AUTOMATIC TEMPERATURE CONTROL SYSTEM REPLACEMENT AT FAIRVIEW ELEMENTARY SCHOOL

5815 Ox Rd
Fairfax Station, VA 22039
(FAIRFAX COUNTY PUBLIC SCHOOLS)

CONTRACT # MMB-085-24

DRAWING INDEX

FAIRFAX COUNTY PUBLIC SCHOOLS

OFFICE OF FACILITIES MANAGEMENT
5025 SIDEBURN ROAD
FAIRFAX, VIRGINIA 22032-2637
TEL.: 703-764-2423

PROJECT TITLE

AUTOMATIC TEMPERATURE CONTROL SYSTEM REPLACEMENT

FAIRVIEW ELEMENTARY SCHOOL

5815 OX ROAD
FAIRFAX STATION, VA 22039

DRAWN SM

CHECKED

DATE 05-16-2024

PROJECT # MMB-085-24

REVISIONS

NO.	DATE	DESCRIPTION

DRAWING TITLE

COVER SHEET

DRAWING NUMBER

CS

GENERAL: THE CONTRACTOR SHALL COMPLETELY REPLACE EXISTING HVAC AUTOMATIC TEMPERATURE CONTROL (ATC) SYSTEM WITH A NEW HVAC AUTOMATIC TEMPERATURE CONTROL SYTEM WITH DDC CONTROLS. THE NEW BUILDING AUTOMATION SYSTEM (BAS) SHALL INCLUDE OPERATING SEQUENCES THAT ARE SPECIFICALLY DESIGNED FOR THIS SITE TO PROVIDE MAXIMUM ENERGY EFFICIENCY AS WELL AS OPTIMUM OCCUPANT COMFORT IN THE MANAGEMENT OF THE BUILDING'S HVAC SYSTEMS. THE BAS WILL ALSO INCLUDE A HIGH QUALITY, USER FRIENDLY GRAPHICAL INTERFACE. THE CONTRACTOR SHALL PROVIDE THE FOLLOWING:

1 - REMOVE ALL EXISTING CONTROL DEVICES INCLUDING ACTUATORS.

2 - REPLACE EXISTING THREE WAY MAIN HOT WATER MIXING VALVE WITH NEW. REPLACE EXISTING ACTUATOR WITH NEW SPRING RETURN ELECTRONIC ACTUATOR. PROVIDE AND INSTALL NEW VARIABLE FREQUENCY DRIVES FOR SPECIFIED PUMPS AND DIFFERENTIAL PRESSURE TRANSMITTER(S) AT THE LOCATION SPECIFIED ON DRAWING M-2.

3 - REPLACE OUTSIDE AIR TEMPERATURE AND HUMIDITY SENSORS WITH NEW. PROVIDE AND INSTALL NEW BAS WATER TEMPERATURE SENSORS FOR CENTRAL PLANT HOT WATER AND CHILLED WATER SYSTEMS AS SHOWN ON THESE DRAWINGS. WELD NEW SENSOR WELL THREAD-O-LETS ON PIPES. EXISTING SENSOR WELLS MAY BE REUSED IF COMPATIBLE AND CLEANED WITH NEW SENSORS. PROVIDE NEW THERMAL GREASE IN EACH WELL.

4 - REPLACE ALL HVAC EQUIPMENT (AHUS, RTUS, MAUS, UVS, FCUS, FTRS) HW & CHW COIL VALVES AND ACTUATORS WITH NEW VALVES AND ELECTRONIC ACTUATORS.

5 - REPLACE ALL HVAC EQUIPMENT (INCLUDING EXHAUST FANS) PNEUMATIC DAMPER ACTUATORS WITH NEW ELECTRONIC ACTUATORS. CLEAN & LUBRICATE ALL UNIT DAMPER LINKAGES INCLUDING BAROMETRIC DAMPERS AND VERIFY PROPER DAMPER OPERATION.

6 - REMOVE ALL EXISTING BAS CONTROLLERS AND RETURN TO FCPS. REMOVE ALL EXISTING CONTROL DEVICES SUCH AS RELAYS, SENSORS, POWER SUPPLIES, TERMINALS, TRANSDUCERS, ETC. AND REPLACE WITH NEW WHERE APPLICABLE. RE-USE OR RETURN TO FCPS UNINTERRUPTIBLE POWER SUPPLIES (UPS).

7 - PROVIDE AND INSTALL A NEW STAND ALONE DDC PROGRAMABLE CONTROLLER FOR EACH OF THE FOLLOWING HVAC SYSTEMS AND EQUIPMENT: CENTRAL HEATING SYSTEM (BOILERS & HW PUMPS), CHILLED WATER SYSTEMS (CHILLERS & CHW PUMPS), EACH AHU, RTU, MAU, UV AND FCU. BAS CONTROLLERS FOR MAJOR EQUIPMENT (BOILERS, CHILLERS, PUMPS, AHUS, RTUS & MAUS) MUST HAVE CONTROL POINT (OUTPUT) OVERRIDE CAPABILITIES. THE BAS SHALL CONTROL ALL EXHAUST FANS, FTRS, CUHS AND UHS SHOWN ON THESE FLOOR PLANS THAT ARE NOT CONTROLLED BY ELECTRONIC THERMOSTATS OR WALL SWITCH. PROVIDE AND INSTALL NEW LINE VOLTAGE THERMOSTATS WITH CONCEALED SETPOINT ADJUST WHERE SHOWN ON FLOOR PLANS.

8 - PROVIDE AND INSTALL MOTOR CURRENT SENSORS AND STATUS RELAYS FOR ALL EF, HW & CHW PUMP MOTORS AND AHU, RTU & MAU AND FC FAN MOTORS FOR THE PURPOSE OF MONITORING AND TRENDING THE RUN STATUS OF THIS EQUIPMENT AS WELL AS ACCUMULATING RUN TIME. THE BAS WILL ALSO MONITOR & TREND THE ALARM AND RUN STATUS POINTS OF THE BOILERS AND CHILLERS.

9 - PROVIDE AND INSTALL NEW RETURN AND SUPPLY AIR TEMPERATURE DUCT SENSORS IN ALL AHUS, RTUS & MAUS. PROVIDE & INSTALL NEW AVERAGING TYPE SENSORS TO MONITOR MIXED AIR FOR ALL AHUS & RTUS. PROVIDE & INSTALL RETURN AIR HUMIDITY DUCT SENSORS WHERE SHOWN ON THESE DRAWINGS. PROVIDE NEW SENSORS TO MONITOR DISCHARGE AIR FOR ALL UVS & FCUS AND MOUNT IN CENTER OF UNIT.

10 - INSTALL NEW 2 POLE FREEZESTATS IN ALL UNITS WITH OUTSIDE AIR INTAKE AND HW OR CHW COILS. ONE POLE FOR THE HARDWIRED SAFETY INTERLOCK SEQUENCE, THE OTHER FOR THE BAS CONTROLLER ALARM INPUT.

11 - REPLACE EXISTING SPACE SENSORS WITH NEW SETPOINT ADJUST TYPE SENSORS. SURFACE MOUNT ON WALL WITHIN A VENTILATED COVER (EXCEPT IN HALLWAYS, BATHROOMS & SHOWERS - USE FLAT WALL PLATE TYPE WITHOUT ADJUSTER) AND INSULATE BEHIND SENSOR. NEW WIRING SHALL BE RUN FROM SENSOR TO CONTROLLER AND BE CONCEALED IN WALLS AND CEILING. PROVIDE CAGE TYPE PROTECTIVE COVERS FOR SENSORS IN GYMS & CAFETERIA, AND KITCHEN. REMOVE ALL EXISTING NIGHT SETBACK SENSORS ASSOCIATED WITH EXISTING BAS.

12 - PROVIDE AND INSTALL NEW OCCUPANCY (MOTION) SENSORS IN SPACES SHOWN ON THESE FLOOR PLANS AND WIRE TO LOCAL BAS CONTROLLERS AS SHOWN ON THESE DRAWINGS. PROVIDE & INSTALL CARBON DIOXIDE (CO2) SENSORS IN SPACES SHOWN ON FLOOR PLAN(S). PROVIDE CAGE TYPE PROTECTIVE COVERS FOR CO2 SENSORS IN GYMS & CAFETERIA. PROGRAM OCCUPANCY SEQUENCE FOR THESE DEVICES AS SPECIFIED HEREIN.

13 - HVAC UNIT NAMES IN PROGRAMS AND ROOM NUMBERS ON GRAPHIC SHALL MATCH UNIT NAMES & ROOM NUMBERS AS SHOWN ON THESE DRAWINGS. ALL SPACE SENSORS SHALL BE LABELED WITH THE HVAC ID NAME OF THE UNIT SERVING THAT AREA. CONTRACTOR SHALL FIELD VERIFY ROOM NUMBERS AND NAMES.

14 - PROVIDE NEW CONTROL CABINETS WITH LATCHING DOOR PANEL (WITHOUT KEY LOCK) FOR NEW BAS CONTROLLERS AND REMOVE ALL UNUSED CONTROL CABINETS. EXPOSED MOUNTING HOLES IN WALL FROM REMOVED CABINETS SHALL BE REFILLED AND NEWLY EXPOSED AREAS SHALL BE PAINTED TO MATCH EXISTING WALL COLOR.

15 - EXISTING CONDUIT TO SENSORS AT AIR HANDLERS AND CENTRAL PLANT MAY BE RE-USED IF IN GOOD CONDITION AND IF SIZED PER NATIONAL ELECTRIC CODE. CONTRACTOR SHALL REPAIR ALL CONDUIT USED FOR CONTROLS INCLUDING CONNECTORS AND COVER PLATES AS NEEDED. ALL NEW CONDUIT FOR POWER WIRING SHALL BE INTERMEDIATE METAL CONDUIT IF LARGER THAN 1" OR ELECTRIC METALIC TUBING IF 1" OR SMALLER. NEW CONDUIT SHALL BE SIZED PER NATIONAL ELECTRIC CODE. FOR POWER WIRING IN THE CENTRAL PLANT, LIQUID-TIGHT GALVANIZED SINGLE STRIP FLEXIBLE METAL CONDUIT MAY BE USED FOR POWER WIRING IN LENGTHS UP TO 24" AND A SEPARATE GREEN GROUND WIRE SHALL BE INSTALLED THROUGH THE FLEXIBLE CONDUIT BACK TO THE SOURCE. FOR NEW CONDUIT TO END DEVICES SUCH AS SENSOR AND ACTUATORS, METAL CLAD (MC) FLEXIBLE CONDUIT IN LENGHTS UP TO 24" MAY BE USED. ALL CONTROL WIRING SHALL BE NEW. WIRING SHALL BE CONTINUOUS FROM CONTROLLER TO INPUT SENSORS AND OUTPUT DEVICES WITHOUT SPLICING OR WIRE NUTS. WIRING TO CONTROL END DEVICES ON MOVING OR VIBRATING EQUIPMENT SHALL BE RUN IN FLEXIBLE METALIC CONDUIT IN LENGTHS UP TO 24".

16 - ALL THE EXPOSED CONTROL WIRING AND POWER WIRING IN OCCUPIED SPACES INCLUDING BUT NOT LIMITED TO CLASSROOMS AND OFFICES SHALL BE RUN IN 700 SERIES WIREMOLD METAL RACEWAYS. THE COLOR OF THE RACEWAY SHALL MATCH THE COLOR OF THE WALL.

17 - ALL NEW VALVES AND PIPING INSULATION DISTURBED DURING THE COURSE OF THIS WORK SHALL BE RE-INSULATED. THE NEW INSULATION SHALL CONFORM TO SECTION 15250.

18 - THE CONTRACTOR SHALL BE RESPONSIBLE FOR DRAINING, REFILLING THE HOT WATER AND CHILLED WATER SYSTEMS, AND BLEEDING AIR OUT OF THE SYSTEMS AFTER REFILL TO PERFORM THIS WORK. CONTRACTOR SHALL BE RESPONSIBLE TO CYCLE HVAC EQUIPMENT FOR THIS PURPOSE.

19 - THE CONTRACTOR SHALL HIRE A CERTIFIED TESTING, ADJUSTING, AND BALANCING (TAB) AGENCY TO PERFORM AIR AND WATER BALANCING OF THE SYSTEMS PER SECTION 01660 OF SPECIFICATIONS. CONTRACTOR SHALL BE RESPONSIBLE FOR DISASSEMBLING AND ASSEMBLING UNITS AS NEEDED TO PERFORM BALANCING. CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIRING PIPE AND AIR DUCT INSULATION DISTURBED DURING THE COURSE OF BALANCING.

20 - CONTRACTOR SHALL INCLUDE AND BEAR THE COST OF ALL THE APPLICABLE SERVER UPGRADES NECESSARY FOR THE ADDITION OF THE SYSTEM INSTALLED PER THIS CONTRACT TO THE SERVER AND FURTHER THE CONTRACTOR SHALL MAKE CERTAIN THAT THE ADDITION OF THE NEW SYSTEM AND ANY ASSOCIATED UPGRADES PROVIDE NO NOTICEABLE DISRUPTION TO SERVICE OR OTHER NEGATIVE IMPACTS ON REMAINING FCPS FACILITIES HOSTED ON THE SERVER

SCOPE OF WORK

ROOFTOP UNIT SCHEDULE

			Total	OA	Cooling		Heating		Outside Air Damper		
Unit #	Rm/Area Served	Zone	CFM	CFM	MBH	ST	MBH/Kw	ST	Control	Min Pos	Other
RTU-1	Administration	1	4000	500	124.0	2	150.0	2	Economizer	13%	Gas heat
RTU-2	Classrooms 224, 225	11	2200	750	72.0	1	20.3	2	Min OA	34%	Electric heat
RTU-3	Classroom 223	12	1500	400	50.5	1	90.0	1	Min OA	27%	Gas heat
RTU-4	Cafeteria/Kitchen	2	6000	1125	187.0	2	N/A	N/A	Economizer	19%	
RTU-5	Classrooms	5	7500	1500	235.0	2	N/A	N/A	Economizer	20%	
RTU-6	Muptipurpose Room	15	2000	500	63.8	1	N/A	N/A	Economizer	25%	
RTU-7	Classroom 222	13	1500	250	49.6	1	13.1	2	Min OA	17%	Electric heat
RTU-8	Classroom 221	14	1500	250	49.6	1	13.1	2	Min OA	17%	Electric heat
RTU-9	SACC	8	1600	450	50.5	1	90.0	2	Min OA	28%	Gas heat
RTU-10	SACC	8	1600	450	50.5	1	90.0	2	Min OA	28%	Gas heat
RTU-11	Art Room 257	10	2000	450	60.5	1	135.0	2	Min OA	23%	Gas heat
RTU-12	Gymnasium	3	4990	1000	155.0	2	250.0	2	Min OA	20%	Gas heat
RTU-13	Gymnasium	3	4990	1000	155.0	2	250.0	2	Min OA	20%	Gas heat
RTU-14	Stage	4	2000	450	60.5	1	135.0	1	Min OA	23%	Gas heat
RTU-15	Art Room 130	9	1500	400	50.5	1	90.0	1	Min OA	27%	Gas heat

AIR HANDLING UNIT SCHEDULE

			Total	OA	Cooling			Outside Air Damper		
Unit #	Rm/Area Served	Zone	CFM	CFM	MBH	GPM	Pipe Runout Size**	Control	Min Pos	Other
AHU-1	Classrooms	6	16350	1875	496.9	100	N/A*	Economizer	11%	
AHU-2	Classrooms	7	16350	1875	496.9	100	N/A*	Economizer	11%	

*Contractor to field verify the data and perform calculations accordingly
**Control valves shall not be sized smaller that two sizes below the pipe runout size

UV/FC SCHEDULE

					CHW Coil			HW Coil		
Unit#	Room Served	Zone	CFM	OA CFM	MBH	GPM	Pipe** Runout Size	MBH	GPM	Pipe** Runout Size
FC-1	Intructional Room 122	6	1750	390	55.0	11.0	N/A	N/A	N/A	N/A
UV-1	Cafeteria	6	1500	200	60.0	12.0	N/A	60.0	8.0	N/A
UV-2	Cafeteria	6	1500	200	60.0	12.0	N/A	60.0	8.0	N/A

*Contractor to field verify the data and perform calculations accordingly
**Control valves shall not be sized smaller that two sizes below the indicated pipe runout size

DHC SCHEDULE

Unit #	Asc'd. VAV	Capacity MBH	GPM	Pipe Runout Size
DHC - 5	VAV-5	30.0	3.0	1"
DHC - 6	VAV-6	30.0	3.0	1"
DHC - 7	VAV-7	30.0	3.0	1"
DHC - 8	VAV-8	30.0	3.0	1"
DHC - 233	VAV-233	30.0	3.0	1"
DHC - 233A	VAV-233A	30.0	3.0	1"

PUMP SCHEDULE

Pump#	Service	GPM	Head Ft.
P-1	Hot Water Pump	350	50
P-2	Hot Water Pump	350	50
P-3	Chilled water	220	50
P-4	Chilled water	220	50

STANDARD ABBREVIATIONS
AHU - Air Handling Unit
BAS - Building Automation System
CFM - Cubic Feet (of Air) Per Minute
CH - Cabinet Heater
CHW - Chilled Water
CU - Control or Cooling Unit (VAV)
CVT - Constant Volume Terminal (VAV)
DP - Differential Pressure (Static)
DHC - Duct Heating Coil
FCPS - Fairfax County Public Schools
FCU - Fan Coil Unit
FTR - Finned Tube Radiator
GPM - Gallons Per Minute
HW - Hot Water
LVT - Line Voltage Thermostat
MAU - Makeup Air Unit
MBH - Thousand BTU Per Hour
NIC - Not Included in Contract
RAHU - Rooftop Air Handling Unit
RTU - Rooftop Unit
UH - Unit Heater
UV - Unit Ventilator
VAV - Variable Air Volume
VFD - Variable Frequency Drive

MECHANICAL EQUIPMENT DATA

EF SCHEDULE

Exh Fan #	Control	Asc'd Unit	Zone
CEF-1	BAS	N/A	6
CEF-2	BAS	N/A	6
CEF-3	BAS	N/A	6
EF-1	BAS	N/A	7
EF-2	BAS	N/A	6
EF-3	BAS	N/A	1
EF-4	BAS	N/A	6
EF-5	BAS	N/A	5
EF-6	BAS	N/A	6
EF-7	BAS	N/A	3
EF-8	LVT	N/A	N/A
EF-9	BAS	N/A	5
EF-10	LVT/Sw	N/A	N/A
EF-11	BAS	N/A	2
EF-12	BAS	N/A	3
EF-13	LVT	N/A	N/A
EF-14	Sw	N/A	N/A
EF-15	LVT	N/A	N/A
EF-16	BAS	N/A	3
WF-1	LVT	N/A	N/A

SCHEDULING, OCCUPANCY, ALARMS & TRENDS

Scheduling:

General: There shall be a Regular & Overtime Occupancy schedule for each zone. There shall be a Holiday schedule that applies to the whole building.

Regular (Weekly) Occupancy schedules shall include an Optimal Start sequence for each zone (see below).

Overtime (Off Hour) Occupancy schedules are for one time events specific to that zone that include a date & time but not an Optimal Start sequence.

Holiday schedules shall override (Off) Zone Regular schedules. Zone Overtime scheduling and the on-site zone override panel will take priority over the Holiday schedule.

Vacation schedule shall override existing Regular Occupancy schedules (exept Admin zone).

A Snow Day button shall be provided on the main graphic to place the school in unoccupied setback in the event it needs to be shut down for one day only. This button should also be available in the system's main server graphic at Sideburn Support Center to override all connected schools. The Zone Override panel on site shall override the Snow Day if needed.

Morning warmup/cooldown: Each BAS control zone will use its own optimal start sequence. The sequence will reference the operator entered scheduled occupied start time, the zone space temperature (or average temps in a zone), the occupied setpoints and outside air conditions. Utilizing this data, the controller shall calculate a pre-occupied start time to activate the necessary HVAC system(s) so that it will bring the zone temp to within at least 1°F of the occupied setpoints prior to the scheduled occupied period. During the pre-occupied startup the associated outside air damper(s), shall be closed and remain so until the scheduled occupied time.
If the space temperature attains occupied setpoints prior to the scheduled start time, the equipment will be placed in the Standby mode until the scheduled Occupied time. This feature shall be programmed however, disabled by the contractor. The owner will enable it as needed via an Optimal start enable/disable accessible point.

Primary Freeze Protection Mode: If the outside air temperature falls below 38°F, the hot water system shall run continously 24/7 to ensure that hot water is constantly available at any time for HVAC systems to maintain night setback temperature setpoints or in case of a freeze protector trip.

Secondary Freeze Protection Mode: If the outside air temperature falls below 20°F, the building shall maintain occupied heating setpoints 24/7 regardless of the occupancy status.

Equipment control modes

Occupied mode: the HVAC equipment shall maintain occupied temperature setpoints. The unit's supply fan shall run continuously and the outside air damper shall be commanded on or opento a set position or position defined by the adjustable zone time schedule.

Unoccupied Mode: The HVAC equipment shall maintainnight setback or night setup temperature setpoints. The unit's supply fan shall be cycled on as needed to maintain these temperature setpoints, otherwise it shall remain off, heating valve shall be open and cooling valve closed. The outdoor air damper shall remain closed. The unoccupied mode shall occur outside the occupied zone time schedule.

Equipment Failure Notification (Alarms):

General: The BAS will be capable of generating alarms via email to a designated FCPS email address and to the central computer (server) monitoring station.

All alarms will be sent to FCPS central monitoring station, displayed in RED on the current screen showing the location (school), specific piece of equipment and nature of failure. This information will also be logged into the server database and time stamped. Any active alarms should also be displayed on their appropriate equipment screen.

Communication Failures: In the event a local controller loses communication (goes OffLine) with the main controller along with the scheduling info it provides, the controlled system shall remain in its current state (active or inactive). If still OffLine after 20 minutes and the controlled system is central heating or cooling, the system will activate. If A/C units, they will be placed in night setback (fan off & OA damper closed), but using occupied setpoints. If the main building controller were to fail, the system server will generate an alarm.

Trend Sampling as Follows: All Digital Points including alarm flags – Log Change Of State (On/Off) or every 10 Minutes if COS is unavailable

Outside Air, Space & Return Air Temperatures, Humidity & Enthalpy – Log Every 20 Minutes

Supply Air, Mixed Air Temps, All Water Sensors & Analog Outputs – Log every 5 Minutes

At least 48 samples for change of state (COS) logging and 96 samples for time stamp logging.

All points shall be continuously logged and capable of being automatically written to a standard computer database. All sample times & quantities shall be adjustable.

GRAPHICS DISPLAY GUIDELINES

General: The graphic selections shall include a Main Floor Plan which shall also serve as the 'Home' page, a Main Menu, Control Zone layouts, Central Plant layout, a Schedule Menu, Zone regular & overtime schedules and Mechanical Systems graphics. This should include an AHU/RTU Menu with links to individual unit graphics, Zone Equipment Data graphics and exhaust fan graphic.

All Zone & Equipment graphics as well as the Home Page shall display the outside air temperature, humidity and enthalpy. All graphics should have links to the Home Page, Main Menu and Central Plant.

The graphics shall be of professional quality and user friendly such that a service technician with basic computer skills can easily navigate the system and extract necessary equipment and environmental data. All data and text displayed shall contrast sharply with its background and be a standard font size for optimal visual clarity.

Every graphic shall display outdoor temperature, humidity, date and time

Trends of the points displayed on the graphic shall be accessible directly from the graphic

The graphics to be organized and displayed as follows:

Home Page: The opening (or Home) page will display the entire school layout outlining all control zones. Each zone will display its appropriate zone number and description (ref Dwg M-2). The Home page will provide links to all Zone Graphic pages, Schedule Menu, Central Plant and Main Menu.

Main Menu: Provide links to Main Floor Plan, Central Plant, Schedule Menu and Equipment Data Menus.

Central Plant: Provide an accurate graphical layout and mechanical flow of the boilers, chiller, cooling towers, pumps, sensors, etc. Graphic(s) will dynamically display all hardwired points and relevant virtual points such as set points, alarm flags, runtime hours, etc.

Equipment Data Menus: Provide menu with links to all AHU, RTU, UV, FCU, ETC. DATA pages.

Equipment Status Charts: Provide equipment status charts for AHU, RTU, UV, FC, EF etc grouped by type of equipment. The following sample information shall be indicated on the pages: Occupancy status, Supply fan status, Space temperature, Supply temperature, Return temperature, and links to Trends. The points displayed will vary depending on the type and configuration of the equipment.

Equipment Graphics: Provide detailed graphic of all AHUs, RTUs, UVs, FCUs etc. Show the proper flow sequence of dampers, coils, fans, sensors, etc. of each unit. Graphics will dynamically display all hardwired points and relevant virtual points such as set points, alarm flags, occupancy status, runtime hours, etc. Provide link back to Equipment Menus.

Schedule Menu: Provide links to Main Schedule and Control Zone Schedules, regular, overtime & holiday/vacation. See scheduling (above).

Zone Data Menu: Provide links to Zone Graphics, Zone Equipment Data Page and Zone Schedules.

Zone Graphics: Every zone # on the Home page shall be linked to a floor plan graphic that will display the various rooms, mechanical system layout and Occupancy status of that zone. This will include a heading at the top of the page stating the zone # and description of that zone. Names of areas (Gym, Admin, etc.) and room numbers will be displayed. Location of HVAC equipment & which areas and/or rooms they serve will be shown.

All space temperatures in that zone will be dynamically displayed. Either the space temps or the room/area background will be displayed as a thermograph with color variations based on temperature to set point comparison.

In addition to the standard links, each zone graphic will include links to its Zone Schedule, Zone Equipment Data Page and any AHUs or RTUs that may be associated with that zone.

Roof Plan: will indicate locations of rooftop equipment such as chillers, RTUs, and exhaust fans.

The graphics package should include a Navigation Tree with links to all graphics. The Navigation Tree should be organized into the Home Page, Main Menu, Schedule Menu, Central Plant and the various control zones. All other graphics will be organized accordingly as sub-folders. Ref. sample Navigation Tree below.

Sample Navigation Tree
– Main Floor Plan (Home)
- Zone 1 Floor Plan
  - (List of all equipment graphics in zone 1)
  - Zone x Floor Plan
  - (List of all equipment graphics in zone x)
- Main Menu (Links to all major graphics)
  - Equipment Status Charts
  - Roof Plan
- Schedule Menu (List all zone schedule links)
  - Main (Bldg) Scheduler
  - Zone 1 Scheduler
  - Zone x Scheduler
- HVAC Equipment Menu
  - Central Plant
  - Boiler System
  - Chiller System
- AHU/RTU Menu (Links to Various AHU/RTUs)
  - AHU-1 Graphic
  - AHU-x Graphic
- UV, FCU & VAV Data Pages
  - Zone 1 Unit Data
  - Zone x Unit Data

FAIRFAX COUNTY PUBLIC SCHOOLS
OFFICE OF FACILITIES MANAGEMENT
5025 SIDEBURN ROAD
FAIRFAX, VIRGINIA 22032-2637
TEL.: 703-764-2423

PROJECT TITLE

AUTOMATIC TEMPERATURE CONTROL SYSTEM REPLACEMENT

FAIRVIEW ELEMENTARY SCHOOL

5815 OX ROAD
FAIRFAX STATION, VA 22039

DRAWN SM

CHECKED

DATE 05-16-2024

PROJECT # MMB-085-24

REVISIONS

NO.	DATE	DESCRIPTION

DRAWING TITLE

ZONED LOWER LEVEL PLAN AND HVAC LAYOUT

DRAWING NUMBER

M-1

VAV BOX SCHEDULE

Unit#	Room Served	Asc'd Unit	Zone	Max CFM	Min CFM
VAV-1	Lobby	AHU-1	6	1100	275
VAV-2	Hallway	AHU-1	6	400	100
VAV-3	Hallway	AHU-2	7	200	50
VAV-4	Lobby	AHU-1	6	500	125
VAV-5	Library Offices	AHU-1	6	1200	300
VAV-6	Library	AHU-1	6	1200	300
VAV-7	Library	AHU-1	6	1200	300
VAV-8	Library	AHU-1	6	1200	300
VAV-9	Lobby	AHU-1	6	800	200
VAV-10	Hallway	AHU-1	6	600	150
VAV-11	Stairwell	AHU-1	6	2000	500
VAV-12	Stairwell	AHU-1	6	2000	500
VAV-13	Instructional Room	AHU-1	6	400	100
VAV-16	Offices	RTU-5	5	1000	400
VAV-14	Hallway	AHU-1	6	400	100
VAV-17	Offices	AHU-1	6	400	100
VAV-100	Classroom 100	AHU-2	7	1200	300
VAV-101	Classroom 101	AHU-2	7	1200	300
VAV-102	Classroom 102	AHU-2	7	1200	300
VAV-103	Classroom 103	AHU-2	7	1200	300
VAV-104	Classroom 104	AHU-2	7	1200	300
VAV-105	Classroom 105	AHU-1	6	1200	300
VAV-106	Classroom 106	AHU-1	6	1200	300
VAV-108	Classrooms 108, 109, 110	AHU-1	6	450	112.5
VAV-111	Intructional Room 111	AHU-1	6	400	100
VAV-113	Office 113	AHU-1	6	400	100
VAV-119	Instructional Room 119	AHU-2	7	600	150
VAV-120	Classroom 120	AHU-2	7	1200	300
VAV-200	Classroom 200	AHU-2	7	1200	300
VAV-201	Classroom 201	AHU-2	7	1200	300
VAV-202	Classroom 202	AHU-2	7	1200	300
VAV-203	Classroom 203	AHU-2	7	1200	300
VAV-204	Classroom 204	AHU-2	7	1200	300
VAV-205	Classroom 205	AHU-1	6	1200	300
VAV-206	Classroom 206	AHU-1	6	1200	300
VAV-207	Classroom 207	AHU-1	6	1200	300
VAV-208	Classroom 208	AHU-1	6	1200	300
VAV-215	Intrsuctional Room 215	AHU-2	7	800	200
VAV-216	Intrsuctional Rooms 216, 217	AHU-2	7	2000	500
VAV-218	Classroom 218	AHU-2	7	1200	300
VAV-219	Classroom 219	AHU-2	7	1200	300
VAV-220	Classroom 220	AHU-2	7	1200	300
VAV-233	Classroom 233	RTU-5	5	1200	300
VAV-233A	Classroom 233	RTU-5	5	1200	300
VAV-251	Classroom 251	RTU-5	5	1000	400
VAV-253	Classroom 253	RTU-5	5	1000	400
VAV-259	Classroom 259	RTU-5	5	1000	400
VAV-259A	Classroom 259	RTU-5	5	1000	400
VAV-261	Classroom 261	RTU-5	5	600	150
VAV-264	Classroom 264	RTU-5	5	1000	400
VAV-264A	Classroom 264	RTU-5	5	1000	400

FTR SCHEDULE

Unit #	Asc'd Unit	Capacity MBH	GPM	Pipe Runout Size
FTR-1	N/A	16.0	1.6	N/A*
FTR-2	N/A	10.0	1.0	N/A*
FTR-3	VAV-4	10.0	1.0	N/A*
FTR-4	VAV-4	10.0	1.0	N/A*
FTR-5	N/A	8.5	0.9	N/A*
FTR-6	N/A	11.0	1.1	N/A*
FTR-7	N/A	12.0	1.2	N/A*
FTR-8	N/A	8.0	0.8	N/A*
FTR-9	N/A	10.0	1.0	N/A*
FTR-10	N/A	4.5	0.5	N/A*
FTR-11	N/A	9.0	0.9	N/A*
FTR-12	N/A	9.3	0.9	N/A*
FTR-13	N/A	3.7	0.4	N/A*
FTR-14	N/A	6.5	0.7	N/A*
FTR-15	N/A	9.3	0.9	N/A*
FTR-16	VAV-16	12.0	1.2	N/A*
FTR-17	N/A	7.4	0.7	N/A*
FTR-18	N/A	19.3	2.0	N/A*
FTR-19	N/A	21.1	2.2	N/A*
FTR-20	N/A	21.1	2.2	N/A*
FTR-21	N/A	19.3	2.0	N/A*
FTR-22	N/A	10.2	1.0	N/A*
FTR-23	N/A	5.6	0.6	N/A*
FTR-24	VAV-9	12.0	1.2	N/A*
FTR-25	VAV-9	12.0	1.2	N/A*
FTR-26	VAV-11, 12	20.0	2.0	N/A*
FTR-27	VAV-11, 12	20.0	2.0	N/A*
FTR-28	N/A	11.0	1.1	N/A*
FTR-29	N/A	9.3	0.9	N/A*
FTR-30	N/A	11.5	1.2	N/A*
FTR-31	N/A	10.0	1.0	N/A*
FTR-32	N/A	17.0	1.7	N/A*
FTR-100	VAV-100	31.0	3.1	N/A*
FTR-101	VAV-101	28.0	2.8	N/A*
FTR-102	VAV-102	28.0	2.8	N/A*
FTR-103	VAV-103	28.0	2.8	N/A*
FTR-104	VAV-104	28.0	2.8	N/A*
FTR-105	VAV-105	28.0	2.8	N/A*
FTR-106	VAV-106	28.0	2.8	N/A*
FTR-108	VAV-108	5.0	0.5	N/A*
FTR-109	VAV-108	5.0	0.5	N/A*
FTR-110	VAV-108	5.0	0.5	N/A*
FTR-111	VAV-111	12.0	1.2	N/A*
FTR-113	VAV-113	11.0	1.1	N/A*
FTR-119	VAV-119	16.0	1.6	N/A*
FTR-120A	VAV-120A	16.0	1.6	N/A*
FTR-120B	VAV-120B	16.0	1.6	N/A*
FTR-122	FC-1	48.0	4.8	N/A*
FTR-200	VAV-200	40.0	4.0	N/A*
FTR-201	VAV-201	31.0	3.1	N/A*
FTR-202	VAV-202	31.0	3.1	N/A*
FTR-203	VAV-203	31.0	3.1	N/A*
FTR-204	VAV-204	31.0	3.1	N/A*
FTR-205	VAV-205	31.0	3.1	N/A*
FTR-206	VAV-206	26.0	2.6	N/A*
FTR-207	VAV-207	26.0	2.6	N/A*
FTR-208	VAV-208	34.0	3.4	N/A*
FTR-215	VAV-215	18.0	1.8	N/A*
FTR-216	VAV-216	18.0	1.8	N/A*
FTR-217	VAV-216	18.0	1.8	N/A*
FTR-218	VAV-218	12.0	1.2	N/A*
FTR-218A	VAV-218	22.0	2.2	N/A*
FTR-219	VAV-219	12.0	1.2	N/A*
FTR-219A	VAV-219	22.0	2.2	N/A*
FTR-220	VAV-220	12.0	1.2	N/A*
FTR-220A	VAV-220	22.0	2.2	N/A*
FTR-221	N/A	39.0	3.9	N/A*
FTR-222	N/A	39.0	3.9	N/A*
FTR-223	N/A	39.0	3.9	N/A*
FTR-224	N/A	39.0	3.9	N/A*
FTR-225	N/A	39.0	3.9	N/A*
FTR-251	VAV-251	48.0	4.8	N/A*
FTR-253	VAV-253	17.4	1.8	N/A*
FTR-253A	VAV-253	17.4	1.8	N/A*
FTR-253B	VAV-253	17.4	1.8	N/A*
FTR-259	VAV-259, 259A	19.3	2.0	N/A*
FTR-259A	VAV-259, 259A	19.3	2.0	N/A*
FTR-261	VAV-261	10.0	1.0	N/A*
FTR-261A	VAV-261	10.0	1.0	N/A*
FTR-264	VAV-264, 264A	17.4	1.8	N/A*
FTR-264A	VAV-264, 264A	17.4	1.8	N/A*
FTR-264B	VAV-264, 264A	17.4	1.8	N/A*
FTR-266	SFB-266, 266A	24.8	2.6	N/A*
FTR-266A	SFB-266, 266A	24.8	2.6	N/A*

*Contractor to field verify the data and perform calculations accordingly
**Control valves shall not be sized smaller that two sizes below the pipe runout size

FAN POWERED CONSTANT VOLUME UNIT SCHEDULE

					Cooling		Heating	
Unit#	Room Served	Asc'd Unit	Zone	Fan CFM	Max CFM	Min CFM	Stages	Kw
SFB-266	Classroom 266	RTU-5	5	800	800	200	2	8
SFB-266A	Classroom 266	RTU-5	5	800	800	200	2	8

MECHANICAL EQUIPMENT DATA

FAIRFAX COUNTY PUBLIC SCHOOLS

OFFICE OF FACILITIES MANAGEMENT
5025 SIDEBURN ROAD
FAIRFAX, VIRGINIA 22032-2637
TEL.: 703-764-2423

PROJECT TITLE

AUTOMATIC TEMPERATURE CONTROL SYSTEM REPLACEMENT

FAIRVIEW ELEMENTARY SCHOOL

5815 OX ROAD
FAIRFAX STATION, VA 22039

DRAWN SM

CHECKED

DATE 05-16-2024

PROJECT # MMB-085-24

REVISIONS

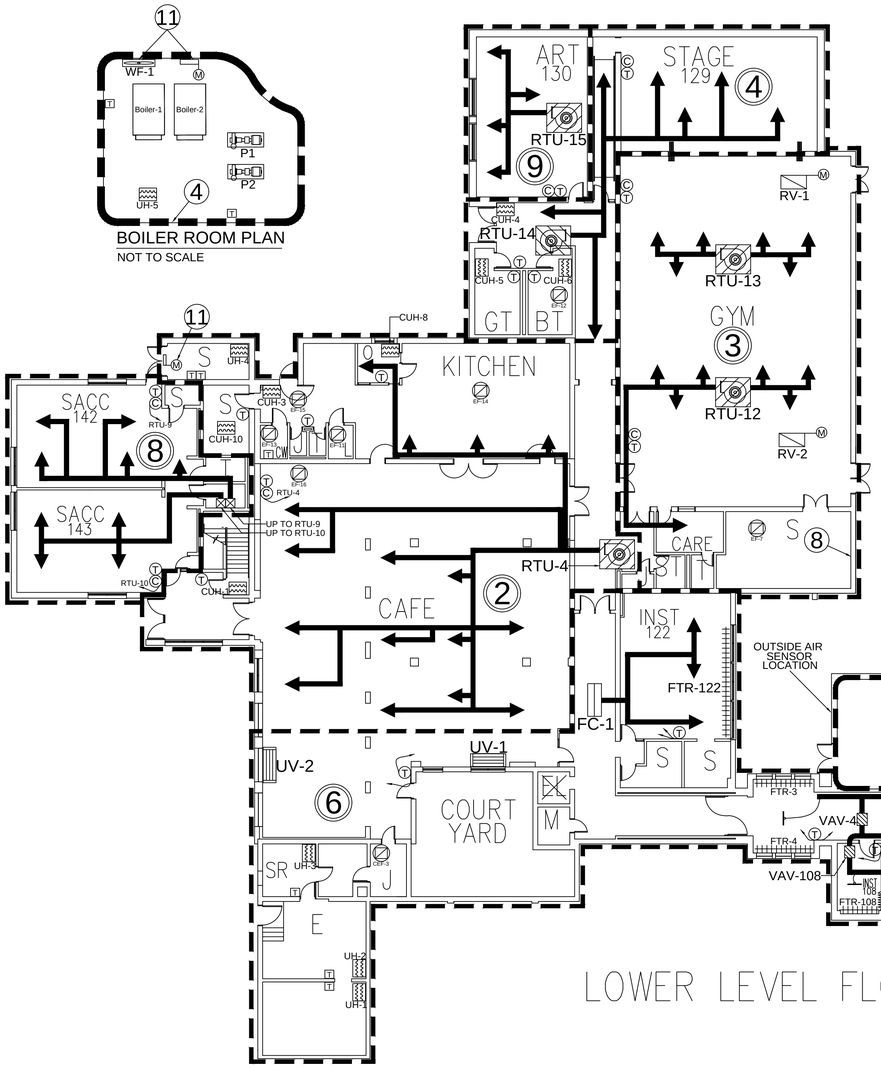
NO.	DATE	DESCRIPTION

DRAWING TITLE

ZONED LOWER LEVEL PLAN AND HVAC LAYOUT

DRAWING NUMBER

M-2



SYMBOLS AND ABBREVIATIONS

- AHU-AIR HANDLING UNIT; RTU - ROOF TOP UNIT
- UV - UNIT VENTILATOR
- FC - FAN COIL UNIT
- PRV - POWER ROOF VENTILATOR; CEF - CEILING EXHAUST FAN
- CUH/UH - CABINET UNIT HEATER/UNIT HEATER
- BAS - BUILDING AUTOMATION SYSTEM
  - (T) SPACE TEMPERATURE SENSOR (BAS)
  - (T) LINE VOLTAGE THERMOSTAT
  - (C) CO2 - CARBON DIOXIDE SENSOR
- (1) ZONE - HVAC CONTROL ZONE NUMBER
- FTR - FINNED TUBE RADIATOR
- RV - RELIEF VENT WITH MOTORIZED DAMPER (M)

Project Notes:

1. For all equipment controlled by LVT and/or or wall switch only, remove existing BAS control relay and complete power circuit. Install new EMT conduit and power conductors from the power source to LVT and the unit as necessary to complete the installation.
2. Install line voltage motor rated on/off switch in parallel with new LVT to control EF-10 on wall in kiln room, install necessary power conductors and conduit; remove existing control relay and complete power circuit
3. For all EFs controlled by BAS: keep existing wall switch in place if applicable.
4. Install control panels for Chilled Water System and Hot Water System at the indicated location.
5. Install control panels for AHUs - 1 and 2 at the indicated location.
6. Install control panels for RTUs - 1, 2, 3, 7, 8 at the indicated location.
7. Install control panels for RTUs - 5, 6, 11 at the indicated location.
8. Install control panels for RTUs - 4, 9, 10, 12, 13, 14, 15 at the indicated location.
9. Connect each RTU and Main Plant Ethernet network controller to a designated FCPS WAN Ethernet port on the drop provided and installed by FCPS adjacent to control panels at the locations indicated herein.
10. Contractor shall make information regarding MAC addresses pertinent to controllers installed within each control panel available within the panel.
11. Interlock motorized outdoor air intake damper with exhaust fan
12. Control relays must be installed for all the major equipment, including main plant, RTUs and AHUs. The control relays' contracts shall be wired to the equipment control terminals, and the coil connected to the corresponding physical output of the BAS controller. The control relays shall be installed inside the HVAC equipment and shall have an LED indicator for ON position. Wiring BAS control outputs directly from the controller to the HVAC equipment control terminal or components without utilizing control relays is prohibited.
13. All the work during the school year shall be performed after school hours. The start time for evening shifts will vary based on a particular school's release time. Contractor's and subcontractor's personnel shall work weekly 5-day 8-hour schedules. The approval of 4-day 10-hour workweek may be requested in writing to the FCPS project manager, but the approval is not guaranteed.

ZONES - AREA SERVED

1 - ADMIN OFFICES
2 - CAFETERIA/KITCHEN
3- GYMNASIUM
4 - STAGE
5 - CLASSROOMS
6 - CLASSROOMS/LIBRARY
7 - CLASSROOMS
8 - SACC
9 - ART ROOM 130
10 - ART ROOM 257
11 - CLASSROOMS 224, 225
12 - CLASSROOM 223
13 - CLASSROOM 222
14 - CLASSROOM 221
15 - MULTIPURPOSE ROOM

EQUIPMENT CONTROLLED BY BAS

- RTU - 1; EF - 3; CUH - 9
- RTU - 4; EF - 11; CUH - 1, 3, 8, 10
- RTU - 12, 13; EF - 7, 12, 16; CUH - 4, 5, 6
- RTU - 14
- RTU - 5; EF- 5, 9; CUH - 2
- AHU - 1; EF - 2, 4, 6; CEF - 1, 2, 3; CUH - 11, 12, 13, 14, 15
- AHU - 2; EF - 7
- RTU - 9, 10
- RTU - 15
- RTU - 11
- RTU - 2
- RTU - 3
- RTU - 6
- RTU - 7
- RTU - 6

MAIN HOT WATER SYSTEM SERVES ZONES 1, 5, 6, 7, 11, 12, 13, 14
ACTIVATE CHILLER-1 FOR ZONES 6, 7

FAIRFAX COUNTY PUBLIC SCHOOLS

OFFICE OF FACILITIES MANAGEMENT
5025 SIDEBURN ROAD
FAIRFAX, VIRGINIA 22032-2637
TEL.: 703-764-2423

PROJECT TITLE

AUTOMATIC TEMPERATURE CONTROL SYSTEM REPLACEMENT

FAIRVIEW ELEMENTARY SCHOOL

5815 OX ROAD
FAIRFAX STATION, VA 22039

DRAWN SM

CHECKED

DATE 05-16-2024

PROJECT # MMB-085-24

REVISIONS

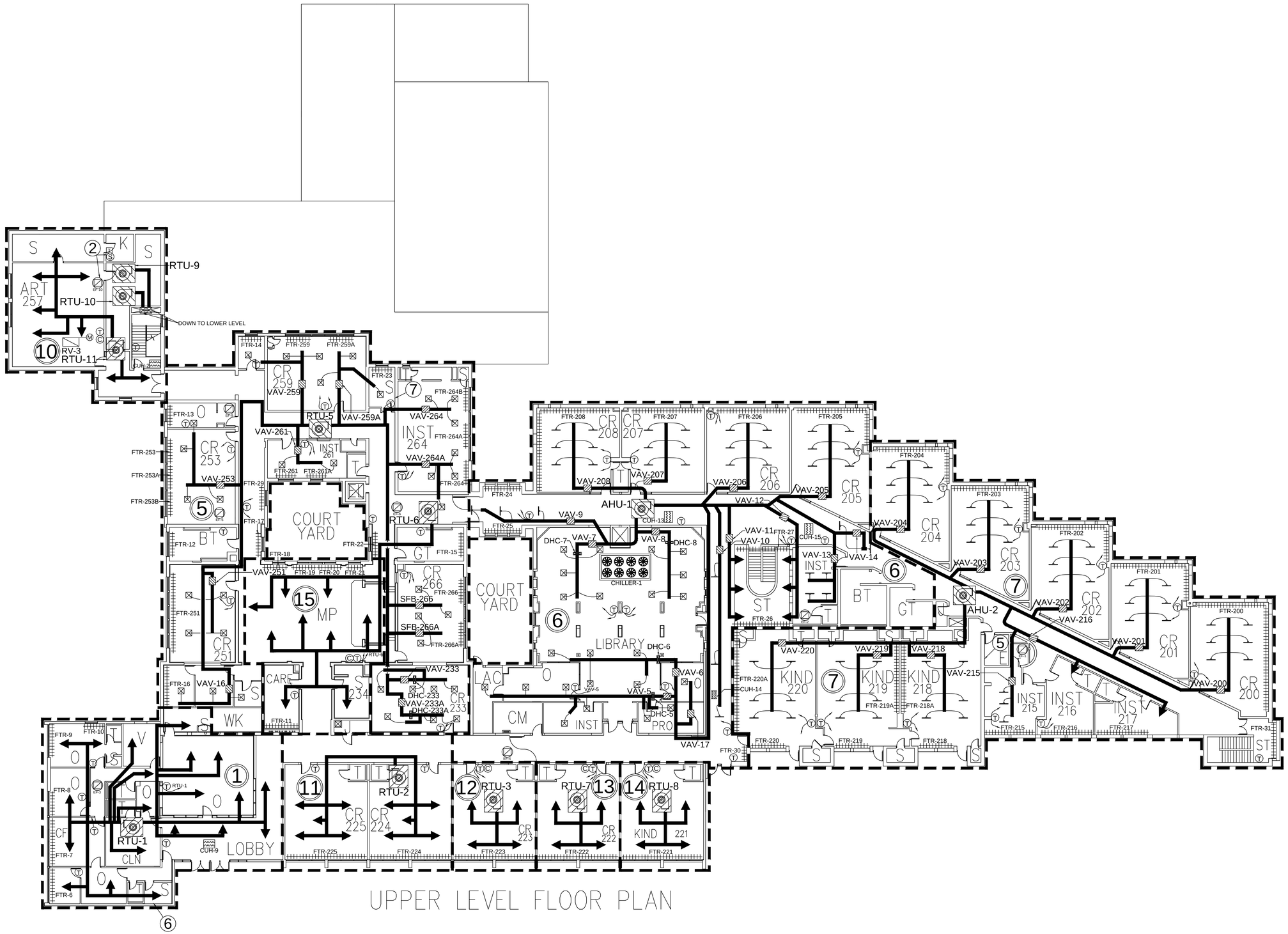
NO.	DATE	DESCRIPTION

DRAWING TITLE

ZONED LOWER LEVEL PLAN AND HVAC LAYOUT

DRAWING NUMBER

M-3



FAIRFAX COUNTY PUBLIC SCHOOLS

OFFICE OF FACILITIES MANAGEMENT
5025 SIDEBURN ROAD
FAIRFAX, VIRGINIA 22032-2637
TEL.: 703-764-2423

PROJECT TITLE

AUTOMATIC TEMPERATURE CONTROL SYSTEM REPLACEMENT

FAIRVIEW ELEMENTARY SCHOOL

5815 OX ROAD
FAIRFAX STATION, VA 22039

DRAWN SM

CHECKED

DATE 05-16-2024

PROJECT # MMB-085-24

REVISIONS

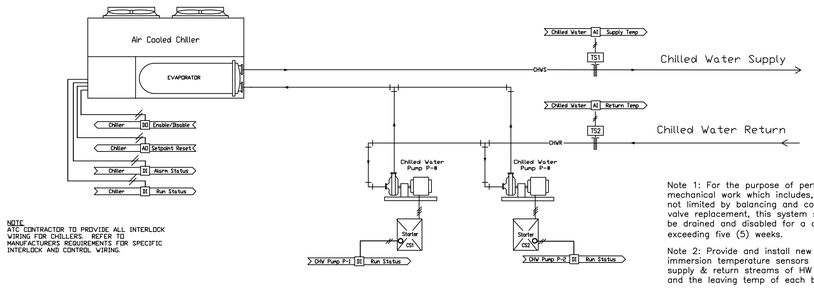
NO.	DATE	DESCRIPTION

DRAWING TITLE

ZONED LOWER LEVEL PLAN AND HVAC LAYOUT

DRAWING NUMBER

M-4



NOTE
ATC CONTRACTOR TO PROVIDE ALL INTERLOCK WIRING FOR CHILLERS. REFER TO MANUFACTURERS REQUIREMENTS FOR SPECIFIC INTERLOCK AND CONTROL WIRING.

Note 1: For the purpose of performing mechanical work which includes, but is not limited by balancing and control valve replacement, this system shall not be drained and disabled for a duration exceeding five (5) weeks.

Note 2: Provide and install new immersion temperature sensors in supply & return streams of HW loop and the leaving temp of each boiler.

Air Cooled Chilled Water System Control Sequence

General: BAS shall control the chilled water system which includes the air cooled Chiller and provide monitoring and diagnostic information for management purposes.

Chilled Water System Enable/Disable:

1) Chilled Water System shall be Enabled when Cooling mode is enabled AND outside air temperature is above 60°F (adj.) (with a 5°F differential (adj.)) AND when the number of cooling requests stays above the setpoint continuously for 5 min (adj.) OR whenever manually enabled by the operator at the operator interface via a graphic icon.

Chiller Start Sequence

1) On a request for the chilled water system to start, BAS shall Enable the chiller

2) BAS shall monitor the Chiller status and the Chiller panel alarm point and if the alarm point is active, generate a "Chiller Failure" alarm message. Also, the BAS shall monitor CHW Supply Temperature and generate an Alarm if it stays above 60°F (adj.) for at least 20 minutes while chiller is enabled.

Chiller Stop Sequence

1) When the Chiller is no longer needed, the BAS shall remove the Enable command and allow it to stop under its own control. The Chiller must remain off for at least 10 minutes (adj.) before being allowed to restart.

Chilled Water Temperature Control

1) The chilled water temperature shall be controlled by the individual chiller controller.

Log Total Runtime Hours for the chiller and for each Pump. The Runtime Hours variables shall be operator resetable.

Chiller System Hardwired Points

Universal Inputs (Sensors):

1. Chiller Run Status
2. CHW Supply Temperature
3. CHW Return Temperature
4. Chiller Alarm Status
5. CHW Pump P1 Status
6. CHW Pump P2 Status

Digital Outputs (Control):

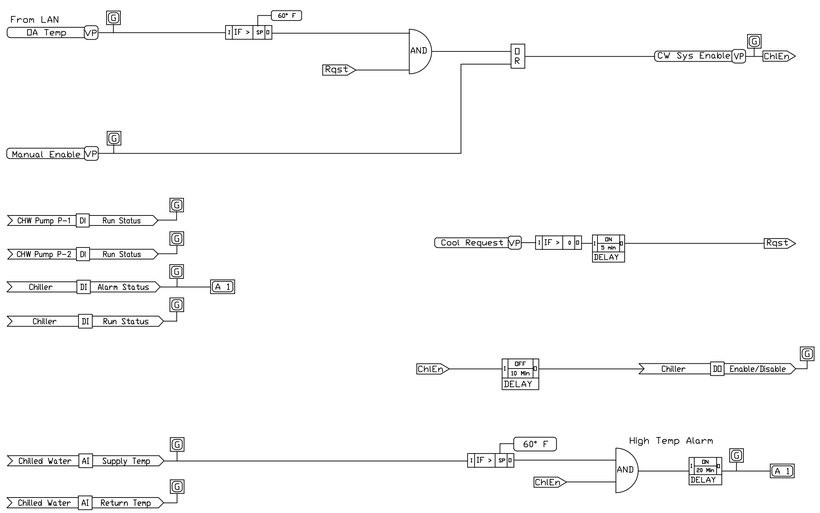
1. Chiller Start/Stop

Virtual Points

Software Flags & Setpoints

1. Chiller System Enable
2. CHW Hi Temp Alarm Setp
3. CHW Hi Temp Alarm Flag
4. CHWP P1 Runtime (Hrs)
5. CHWP P2 Runtime (Hrs)
6. Chiller Runtime Hours
7. Cooling Requests
8. Cooling Requests Setpoint
9. OA Chiller Enable Setpoint

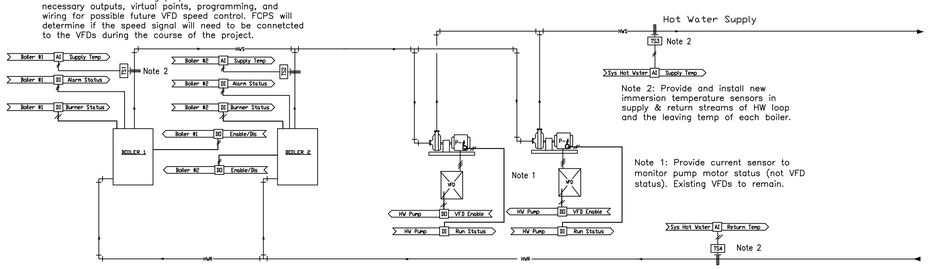
Above Points to be Displayed on CHW System Graphic
All Above Points Shall be Accessible by User
All Above Points Shall be Trended



CHILLER – 1

AIR COOLED CHILLED WATER SYSTEM

Note 1: Provide and install differential pressure transmitter for monitoring purposes. Provide all the necessary outputs, virtual points, programming, and wiring for possible future VFD speed control. FCPS will determine if the speed signal will need to be connetcted to the VFDs during the course of the project.



Central Hot Water Heating System Control Sequence

General: BAS shall control the Central Hot Water Heating System including both Boiler units & both hot water pumps and provide monitoring and diagnostic information for management purposes.

Hot Water System Enable:

1) Hot Water System shall be enabled when Heating mode is enabled AND the outside air temperature is below the Heat Lockout setp of 55°F (adj.) (with a 5°F differential (adj.)) AND the number of heating requests stays above the setpoint continuously for 5 min (adj.).

2) OR whenever Heating mode is enabled AND the outside air temperature is below the continuous 24/7 run setp of 38°F (adj),

3) OR whenever manually overridden locally on site or remotely from FCPS Energy Management central office by an operator with the appropriate password level.

HW Pump Control

1) Lead pump shall run continuously whenever heating is enabled.

2) BAS shall prove operation of the pump. If, after 30 seconds (adj.), the pump fails to start or fails at any time after, the BAS shall generate an alarm and start the lag pump.

3) For start up, in order to prevent thermal shock to the boilers, program the VFD to slowly ramp up to full speed over a period of 5 minutes (adj.).

4) The BAS shall modulate the HW pump VFD via a PID loop to maintain a differential pressure of 10psi (adj.). Adjust the PID loop for smooth modulation to prevent excessive variations in pump speed to maintain setpoint. A separate output start/stop and speed signal from the BAS shall be provided for each pump VFD. A VFD minimum speed of 20Hz shall be programmed into each VFD.

5) The lead pump shall continue to run for 3 min. (adj.) after the heating system has been disabled. The pumps shall remain off for at least three minutes before being allowed to restart.

6) The lead/lag pump sequence shall rotate weekly.

7) Log Total Runtime Hours for each pump by monitoring the pump's run status. The Runtime Hours variables shall be operator ressetable

Boiler Start Sequence

1) Whenever the Central Heating System is Enabled AND on proof of either hot water pump status, the BAS shall enable the boilers to run.

Boiler Stop Sequence

1) When boilers are no longer needed, the BAS shall Disable the boilers and allow them to stop under their own controls

Proof Of Boiler Operation

a) BAS shall prove the operation of the boilers via boiler alarm points. When a boiler is assessed as failed, an alarm shall be enunciated. The following conditions shall result in the assessment that the boiler has failed:

1) Closure of boiler failure input

Hardwired Points

Universal Inputs (Sensors):

1. Boiler #1 Burner Status
2. Boiler #2 Burner Status
3. Boiler #1 Alarm Status
4. Boiler #2 Alarm Status
5. Sys HW Supply Temperature
6. Sys HW Return Temperature
7. HW Pump P1 Run Status
8. HW Pump P2 Run Status
9. Boiler #1 Supply Temp
10. Boiler #2 Supply Temp
11. Outside Air Temperature
12. Outside Air Humidity

Digital Outputs (Control):

1. Boiler #1 Enable
2. Boiler #2 Enable
3. HW Pump P1 Start/Stop
4. HW Pump P2 Start/Stop

Analog Outputs (Control):

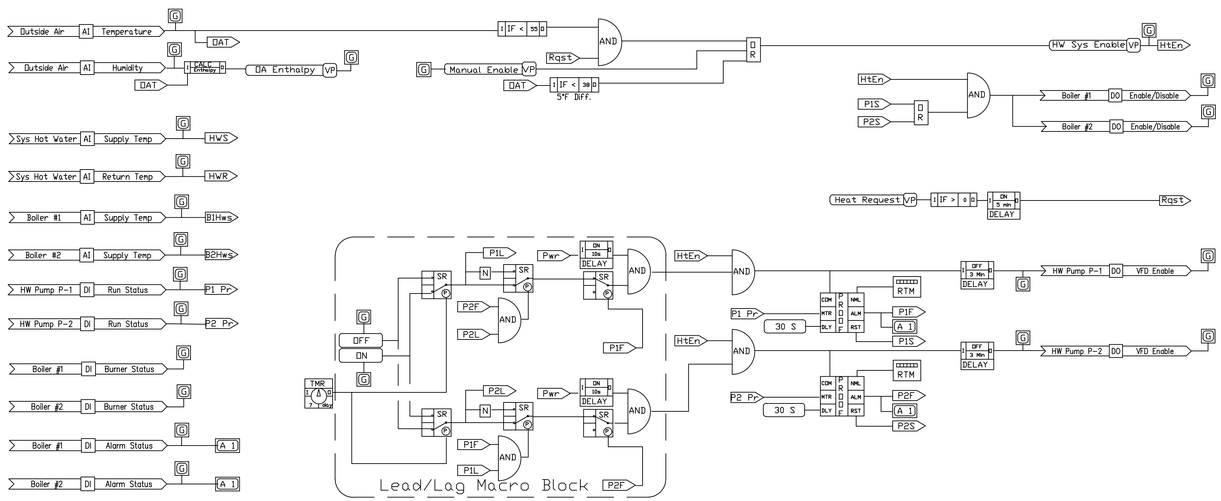
Virtual Points

Program Variables – Binary & Analog

1. Boiler System Enable
2. HW Lead Pump
3. HW Pump P1 Fail Flag
4. HW Pump P2 Fail Flag
5. HW Low Temp Alarm Setp
6. Outside Air Enthalpy (calculated)
7. OA Htg Continuous Run Setp
8. HW Pump P1 Runtime (Hrs)
9. HW Pump P2 Runtime (Hrs)
10. Heating Requests
11. Heating Requests Setpoint

Above Points to be Displayed on HW System Graphic
All Points shall be accessible by user
All Above Points Shall be Trended

FAIL SAFE RELAY: BOLER 1, BOILER 2, AND ALL HOT WATER PUMP ENABLE/DISABLE AT THE EQUIPMENT SHALL BE CONNECTED TO NORMALLY CLOSED TERMINALS OF THE CONTROL RELAYS. THE CONTROL RELAYS' CONTROL POWER SHALL BE WIRED THROUGH A NORMALLY OPEN FAIL SAFE RELAY. THE FAIL SAFE RELAY SHALL BE CONTROLLED BY A NORMALLY OPEN OUTPUT ON THE HOT WATER SYSTEM CONTROLLER. THE FAIL SAFE RELAY SHALL BE CONSTANTLY COMMANDED ON BY THE BAS. BOILERS' AND PUMPS' CONTROL OUTPUTS SHALL BE NORMALLY OPEN.



CENTRAL PLANT HOT WATER HEATING SYSTEM

FAIRFAX COUNTY PUBLIC SCHOOLS

OFFICE OF FACILITIES MANAGEMENT
5025 SIDEBURN ROAD
FAIRFAX, VIRGINIA 22032-2637
TEL.: 703-764-2423

PROJECT TITLE

AUTOMATIC TEMPERATURE CONTROL SYSTEM REPLACEMENT

FAIRVIEW ELEMENTARY SCHOOL

5815 OX ROAD
FAIRFAX STATION, VA 22039

DRAWN SM

CHECKED

DATE 05-16-2024

PROJECT # MMB-085-24

REVISIONS

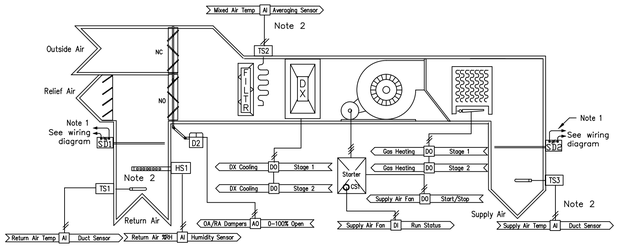
NO.	DATE	DESCRIPTION

DRAWING TITLE

HOT WATER PLANT
CHILLER-1

DRAWING NUMBER

M-5



Note 3: Replace damper actuators with new electronic actuators. Clean & lubricate damper linkage, set minimum position and verify proper operation of dampers.

Note 2: Provide and install new Return & Supply Air temperature & Return Air humidity duct sensors and Mixed Air averaging sensor.

Note 1: Confirm (or rewire) interlock through existing Safety devices to shut down unit Fan(s). Wire associated unit control devices such as actuators & relays to go to their setback (or FAIL) positions whenever the Supply Fan is Off – OA damper closed, DX cooling off, etc.

Provide new wall mounted space sensor with manual setpoint adjust.

RTU w/DX, Gas Heat Economizer Control Sequence

General: This unit shall have its own Control Module and be fully controlled by the BAS. The unit control logic strategies shall include:
a) Scheduled Occupancy
b) Sequenced heating and cooling control
c) Night (unoccupied) setback

Supply Air Fan Control: The BAS shall control the starting and stopping of the supply air fan as follows:

1 – During the scheduled Occupied period the unit fan shall be commanded to run continuously.
2 – BAS shall monitor fan status and generate an alarm if the fan fails to start as commanded after a 30 second delay or fails anytime thereafter. However the request for the failed fan shall remain active until the unit can be serviced. The BAS shall use the fan status to accumulate resettable runtime.
3 – The unit fan shall be commanded Off when:
a) the Occupied period is over AND the unit is not heating or cooling to maintain night Setup/Setback setpoints
4 – Once the Fan is shut down it must remain off for at least 3 minutes (Adj.) prior to being restarted (note: Minimum Off, Not Delay Start).
5 – The unit may be overridden On or Off via operator command from a remote central location or by the BAS controller on site or BAS graphics.

Mixed Air Dampers: BAS shall control OA damper as follows:
1 – When the Unit is de-energized the OA damper shall be commanded to its closed position.
2 – When the Unit is energized to maintain unoccupied setpoints, the damper shall remain closed.
3 – During the occupied period, the OA damper shall be commanded open to its design minimum position (ref. AHU/RTU Data Dwg M-1).
4 – On a call for Cooling and enthalpy conditions allow, the OA damper shall be modulated open as needed to satisfy cooling needs (ref. Economizer section).
5 – The RA and RF dampers shall track the OA damper proportionately.
6 – The OA Damper shall close if the mixed air temperature falls below 48F.

Space Temperature Control: Control space temperature by cycling the heating/cooling on the unit as needed. Three operator adjustable setpoints shall apply. Occupied Cooling (74F), unoccupied setback heating (55F) and unoccupied setup cooling (85F). These three values shall be the only values changed by the operator to adjust space temperatures. The Occupied Heating setpoint shall be the Cooling Setpoint minus 3F.

Heating Section: On a fall in space temperature below the heating setpoint, the BAS shall activate the 1st stage of gas heat. When the temperature rises to the heating setpoint plus 1F the heat shall de-activate. If the space temp falls to 1F below the heating setpoint the BAS shall activate the 2nd stage of gas heat. On a rise in space temp to above the heating setpoint, the 2nd stage heat shall de-activate. There shall be a minimum of five minute intervals between activating and de-activating the heating stages.

Cooling Section: On a rise in space temperature above the cooling setpoint and the outside air temperature is above the DX cooling lockout setpoint (55F OA (adj.)), the BAS shall activate the 1st stage compressor. When the temperature falls one degree below the cooling setpoint the cooling shall be de-activated. If the temperature rises to above 1F of the cooling setpoint the 2nd stage shall be activated. On a fall in space temp to below the cooling setpoint the 2nd stage shall be de-activated. There shall be a minimum of five minute intervals between activating and de-activating the cooling stages.

Economizer Section: On a call for Cooling And if the OA Enthalpy is less than 28 btu/lb (adj) And the OA Enthalpy is less than the unit's RA Enthalpy, the OA damper shall be modulated open to maintain a mixed air temp setpoint of 52F based on the needs of the space but not lower than 48F. First stage compressor shall be disabled while Economizer is on.

Unoccupied Setback: During the Unoccupied period:
1 – Heating and cooling shall be commanded off and the OA damper shall close.
2 – After a two minute delay the supply fan shall be commanded off.
3 – The unit fan, heating and cooling shall be cycled as needed to maintain unoccupied setpoints. Above heat/cool sequences shall apply.

Associated Exhaust Fans: BAS shall command associated Exhaust Fans to run continuously during the Occupied period.

Hardwired Points

Universal Inputs (Sensors):
1. Supply Fan Status
2. Space Temp
3. Setpoint Adjust
4. Supply Air Temperature
5. Return Air Temperature
6. Mixed Air Temperature
7. Return Air Humidity

Digital Outputs (Control):
1. Supply Fan Start/Stop
2. Stage 1 Cooling
3. Stage 2 Cooling
4. Stage 1 Gas Heat
5. Stage 2 Gas Heat

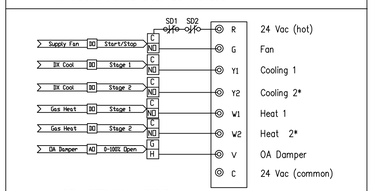
Analog Outputs (Control):
1. OA/RA Dampers

Virtual Points

Software Flags & Setpoints

1. Unit Start Signal
2. Occupied Mode (Sched)
3. Clg Setpoint (74F Adj)
4. Htg Setp (Clg Setp–3)
5. Adjusted Space Setpoint
6. Night Setback (55F Adj)
7. Night Setup (85F Adj)
7. Supply Fan Fail Alarm
8. Heat/Cool Mode
9. Economizer Mode

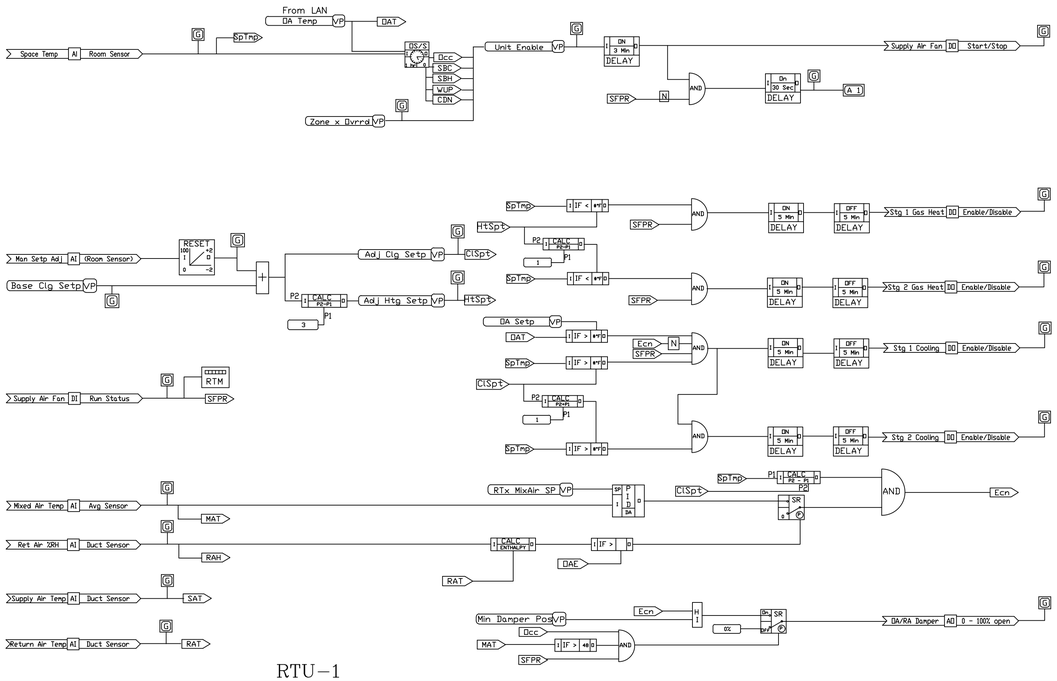
Above Points to be Displayed on RTU Graphic
All Above Points Shall be Accessible by User
All Above Points Shall be Trended



RTU TERMINAL STRIP
Interface board terminal strip by unit manufacturer

* Provide number of stages as required

WIRING DIAGRAMS



RTU–1

ROOFTOP UNIT W /DX CLG/GAS HEAT/ECONOMIZER

RTU w/DX, Gas Heat Min OA & CO2 Control Sequence

General: This unit shall have its own Control Module and be fully controlled by the BAS. The unit control logic strategies shall include:
a) Scheduled Occupancy
b) Sequenced heating and cooling control
c) Outside air intake control based on CO2 levels
d) Night (unoccupied) setback

Supply Air Fan Control: The BAS shall control the starting and stopping of the supply air fan as follows:

1 – During the scheduled Occupied period the unit fan shall be commanded to run continuously.
2 – BAS shall monitor fan status and generate an alarm if the fan fails to start as commanded after a 30 second delay or fails anytime thereafter. However the request for the failed fan shall remain active until the unit can be serviced. The BAS shall use the fan status to accumulate resettable runtime.
3 – The unit fan shall be commanded Off when:
a) the Occupied period is over AND the unit is not heating or cooling to maintain night Setup/Setback setpoints
4 – Once the Fan is shut down it must remain off for at least 3 minutes (Adj.) prior to being restarted (note: Minimum Off, Not Delay Start).
5 – The unit may be overridden On or Off via operator command from a remote central location or by the BAS controller on site or BAS graphics.

Min OA Damper control: BAS shall control OA damper as follows:
1 – When the Unit is de-energized the OA damper shall be commanded to its closed position.
2 – When the Unit is energized to maintain unoccupied setpoints, the damper shall remain closed.
3 – During the occupied period AND when the space CO2 level rises above the setpoint of 500ppm (adj.), the OA damper shall be commanded open to its preset minimum position.
4 – The RA and RF dampers shall track the OA damper proportionately.
5 – The OA Damper shall close if the mixed air temperature falls below 48F.

Space Temperature Control: Control space temperature by cycling the heating/cooling on the unit as needed. Three operator adjustable setpoints shall apply. Occupied Cooling (74F), unoccupied setback heating (55F), and unoccupied setup cooling (85F). These three values shall be the only values changed by the operator to adjust space temperatures. The Occupied Heating setpoint shall be the Cooling Setpoint minus 3F.

Heating Section: On a fall in space temperature below the heating setpoint, the BAS shall activate the 1st stage of gas heat. When the temperature rises to above the heating setpoint plus 1F the heat shall de-activate.

Cooling Section: On a rise in space temperature above the cooling setpoint and the outside air temperature is above the DX cooling lockout setpoint (55F OA (adj.)), the BAS shall activate the 1st stage compressor. When the temperature falls one degree below the cooling setpoint the cooling shall be de-activated.

Unoccupied Setback: During the Unoccupied period:
1 – Heating and cooling shall be commanded off and the OA damper shall close.
2 – After a two minute delay the supply fan shall be commanded off.
3 – The unit fan, heating and cooling shall be cycled as needed to maintain unoccupied setpoints. Above heat/cool sequences shall apply.

Associated Exhaust Fans: BAS shall command associated Exhaust Fans to run continuously during the Occupied period.

Hardwired Points

Universal Inputs (Sensors):
1. Supply Fan Status
2. Space Temp
3. Setpoint Adjust
4. Supply Air Temperature
5. Return Air Temperature
6. Mixed Air Temperature
7. Return Air Humidity
8. CO2 Sensor

Digital Outputs (Control):
1. Supply Fan Start/Stop
2. Stage 1 Cooling
3. Stage 1 Gas Heat
4. OA/RA Dampers

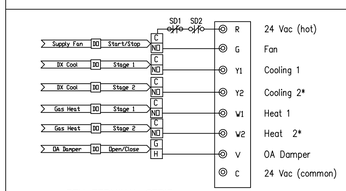
Analog Outputs (Control):

Virtual Points

Software Flags & Setpoints

1. Unit Start Signal
2. Occupied Mode (Sched)
3. Clg Setpoint (74F Adj)
4. Htg Setp (Clg Setp–3)
5. Adjusted Space Setpoint
6. Night Setback (55F Adj)
7. Night Setup (85F Adj)
8. Supply Fan Fail Alarm
9. Damper CO2 Setpoint
10. Heat/Cool Mode

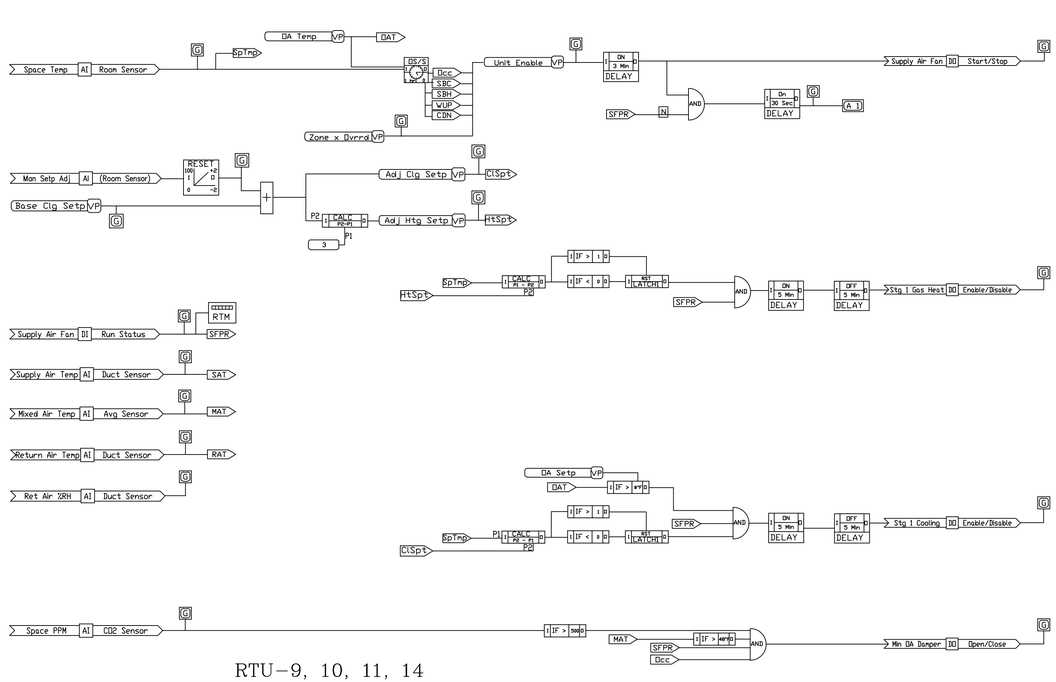
Above Points to be Displayed on RTU Graphic
All Above Points Shall be Accessible by User
All Above Points Shall be Trended



RTU TERMINAL STRIP
Interface board terminal strip by unit manufacturer

* Provide number of stages as required

WIRING DIAGRAMS



RTU–9, 10, 11, 14

ROOFTOP UNIT W /DX CLG/GAS HEAT/MIN OA/CO2

Provide new wall mounted space sensor with manual setpoint adjust.

Provide and install new CO2 sensor near space sensor.

FAIRFAX COUNTY PUBLIC SCHOOLS

OFFICE OF FACILITIES MANAGEMENT
5025 SIDEBURN ROAD
FAIRFAX, VIRGINIA 22032-2637
TEL.: 703-764-2423

PROJECT TITLE

AUTOMATIC TEMPERATURE CONTROL SYSTEM REPLACEMENT

FAIRVIEW ELEMENTARY SCHOOL

5815 OX ROAD
FAIRFAX STATION, VA 22039

DRAWN SM

CHECKED

DATE 05-16-2024

PROJECT # MMB-085-24

REVISIONS

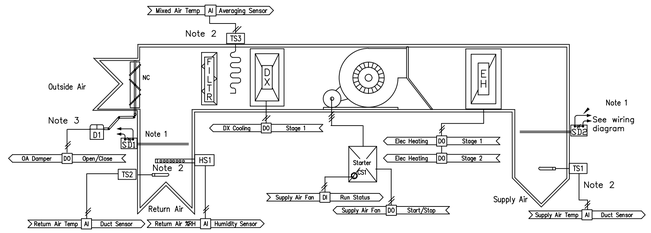
NO.	DATE	DESCRIPTION

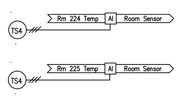
DRAWING TITLE

CONTROL DIAGRAMS
RTU- 1, 9, 10, 11, 14, 15

DRAWING NUMBER

M-6





Note 3: Replace damper actuators with new electronic actuators. Clean & lubricate damper linkage, set minimum position and verify proper operation of dampers.

Note 2: Provide and install new Return & Supply Air temperature & Return Air humidity duct sensors and Mixed Air averaging sensor.

Note 1: Confirm (or rewire) interlock through existing Safety devices to shut down unit Fan(s). Wire associated unit control devices such as actuators & relays to go to their setback (or FAIL) positions whenever the Supply Fan is Off – OA damper closed, DX cooling off & gas heat off.

Note 4: Replace existing HW valve actuator with new.

RTU w/DX, Gas Heat Min OA & CO2 Control Sequence

General: This unit shall have its own Control Module and be fully controlled by the BAS. The unit control logic strategies shall include:
a) Scheduled Occupancy
b) Sequenced heating and cooling control
c) Night (unoccupied) setback

Supply Air Fan Control: The BAS shall control the starting and stopping of the supply air fan as follows:

1 – During the scheduled Occupied period the unit fan shall be commanded to run continuously.
2 – BAS shall monitor fan status and generate an alarm if the fan fails to start as commanded after a 30 second delay or fails anytime thereafter. However the request for the failed fan shall remain active until the unit can be serviced. The BAS shall use the fan status to accumulate resettable runtime.
3 – The unit fan shall be commanded Off when:
a) the Occupied period is over AND the unit is not heating or cooling to maintain night Setup/Setback setpoints
4 – Once the Fan is shut down it must remain off for at least 3 minutes (Adj.) prior to being restarted (note: Minimum Off, Not Delay Start).
5 – The unit may be overridden On or Off via operator command from a remote central location or by the BAS controller on site or BAS graphics.

Mixed Air Dampers: BAS shall control OA damper as follows:
1 – When the Unit is de-energized the OA damper shall be commanded to its closed position.
2 – When the Unit is energized to maintain unoccupied setpoints, the damper shall remain closed.
3 – During the occupied period, the OA damper shall be commanded open to its design minimum position (ref. AHU/RTU Data Dwg M-1).
4 – On a call for Cooling and enthalpy conditions allow, the OA damper shall be modulated open as needed to satisfy cooling needs (ref. Economizer section).
5 – The RA and RF dampers shall track the OA damper proportionately.
6 – The OA Damper shall close if the mixed air temperature falls below 48°F.

Space Temperature Control: Control space temperature by cycling the heating/cooling on the unit as needed. The control temperature shall be averaged between the two space sensors' readings. Three operator adjustable setpoints shall apply. Occupied Cooling (74°F), unoccupied setback heating (55°F), and unoccupied setup cooling (85°F). These three values shall be the only values changed by the operator to adjust space temperatures. The Occupied Heating setpoint shall be the Cooling Setpoint minus 3°F. The Occupied FTR Heating setpoint shall be regular Occupied Heating setpoint minus 1°F (Adj.)

Heating Section: On a fall in space temperature below the heating setpoint, the BAS shall activate the 1st stage of electric heat. When the temperature rises to above the heating setpoint plus 1°F the heat shall de-activate. If the space temp falls to 1°F below the heating setpoint the BAS shall activate the 2nd stage of electric heat. On a rise in space temp to above the heating setpoint the 2nd stage heat shall de-activate. There shall be a minimum of five minute intervals between activating and de-activating the heating stages.

Cooling Section: On a rise in space temperature above the cooling setpoint and the outside air temperature is above the DX cooling lockout setpoint (55°F OA (adj.)), the BAS shall activate the 1st stage compressor. When the temperature falls one degree below the cooling setpoint the cooling shall be de-activated.

Hydronic Heating Control: N.O. FTR valve shall modulate in a PI loop to maintain FTR space temperature heating setpoint as defined above with a 2°F throttling range.

Heating Request: This terminal shall issue a "heating request" as follows"
a) Whenever the heating PI output is at 10% or below
b) Whenever the space temperature falls below the throttling range of the heating PI loop

Unoccupied Setback: During the Unoccupied period:
1 – Heating and cooling shall be commanded off and the OA damper shall close.
2 – After a two minute delay the supply fan shall be commanded off.
3 – The unit fan, heating and cooling shall be cycled as needed to maintain unoccupied setpoints. Above heat/cool sequences shall apply.

Associated Exhaust Fans: BAS shall command associated Exhaust Fans to run continuously during the Occupied period.

Hardwired Points

Universal Inputs (Sensors):

1. Supply Fan Status
2. Supply Air Temperature
3. Return Air Temperature
4. Mixed Air Temperature
5. Return Air Humidity
6. Room 224 Space Temperature
7. Room 225 Space Temperature

Digital Outputs (Control):

1. Supply Fan Start/Stop
2. Stage 1 Cooling
3. Stage 1 Elec Heat
4. Stage 2 Elec Heat
5. OA Damper

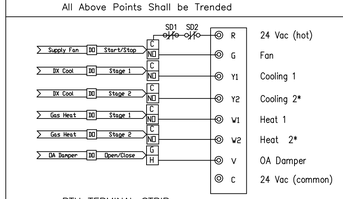
Analog Outputs (Control):
1. FTR Valve

Virtual Points

Software Flags & Setpoints

1. Unit Start Signal
2. Occupied Mode (Sched)
3. Clg Setpoint (74°F Adj)
4. Htg Setp (Clg Setp–3)
5. FTR Htg Setpoint (Htg. Setp–1)
6. Night Setback (55°F Adj)
7. Night Setup (85°F Adj)
8. Supply Fan Fail Alarm
9. Damper CO2 Setpoint
10. Heat/Cool Mode

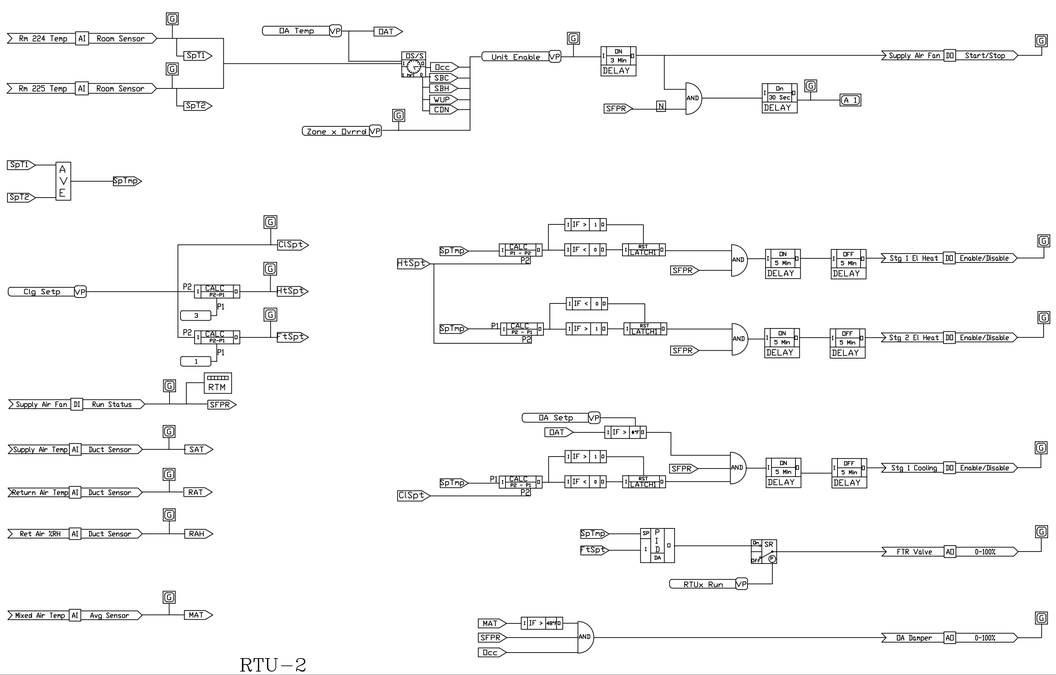
Above Points to be Displayed on RTU Graphic
All Above Points Shall be Accessible by User
All Above Points Shall be Trended



RTU TERMINAL STRIP
Interface board terminal strip by unit manufacturer

* Provide number of stages as required

WIRING DIAGRAMS



RTU–2

ROOFTOP UNIT W /DX CLG/GAS HEAT/MIN OA/CO2

RTU w/DX, Gas Heat Min OA & CO2 Control Sequence

General: This unit shall have its own Control Module and be fully controlled by the BAS. The unit control logic strategies shall include:
a) Scheduled Occupancy
b) Sequenced heating and cooling control
c) Outside air intake control based on CO2 levels
d) Night (unoccupied) setback

Supply Air Fan Control: The BAS shall control the starting and stopping of the supply air fan as follows:

1 – During the scheduled Occupied period the unit fan shall be commanded to run continuously.
2 – BAS shall monitor fan status and generate an alarm if the fan fails to start as commanded after a 30 second delay or fails anytime thereafter. However the request for the failed fan shall remain active until the unit can be serviced. The BAS shall use the fan status to accumulate resettable runtime.
3 – The unit fan shall be commanded Off when:
a) the Occupied period is over AND the unit is not heating or cooling to maintain night Setup/Setback setpoints
4 – Once the Fan is shut down it must remain off for at least 3 minutes (Adj.) prior to being restarted (note: Minimum Off, Not Delay Start).
5 – The unit may be overridden On or Off via operator command from a remote central location or by the BAS controller on site or BAS graphics.

Min OA Damper control: BAS shall control OA damper as follows:
1 – When the Unit is de-energized the OA damper shall be commanded to its closed position.
2 – When the Unit is energized to maintain unoccupied setpoints, the damper shall remain closed.
3 – During the occupied period AND when the space CO2 level rises above the setpoint of 500ppm (adj.), the OA damper shall be commanded open to its preset minimum position.
4 – The RA and RF dampers shall track the OA damper proportionately.
5 – The OA Damper shall close if the mixed air temperature falls below 48°F.

Space Temperature Control: Control space temperature by cycling the heating/cooling on the unit as needed. Three operator adjustable setpoints shall apply. Occupied Cooling (74°F), unoccupied setback heating (55°F), and unoccupied setup cooling (85°F). These three values shall be the only values changed by the operator to adjust space temperatures. The Occupied Heating setpoint shall be the Cooling Setpoint minus 3°F. The Occupied FTR Heating setpoint shall be regular Occupied Heating setpoint minus 1°F (Adj.)

Heating Section: On a fall in space temperature below the heating setpoint, the BAS shall activate the 1st stage of gas heat. When the temperature rises to above the heating setpoint plus 1°F the heat shall de-activate.

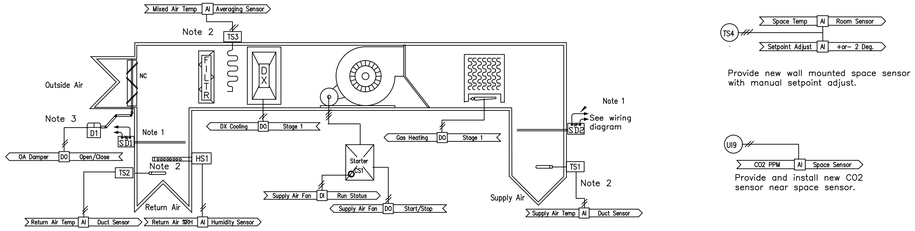
Cooling Section: On a rise in space temperature above the cooling setpoint and the outside air temperature is above the DX cooling lockout setpoint (55°F OA (adj.)), the BAS shall activate the 1st stage compressor. When the temperature falls one degree below the cooling setpoint the cooling shall be de-activated.

Hydronic Heating Control: N.O. FTR valve shall modulate in a PI loop to maintain FTR space temperature heating setpoint as defined above with a 2°F throttling range.

Heating Request: This terminal shall issue a "heating request" as follows"
a) Whenever the heating PI output is at 10% or below
b) Whenever the space temperature falls below the throttling range of the heating PI loop

Unoccupied Setback: During the Unoccupied period:
1 – Heating and cooling shall be commanded off and the OA damper shall close.
2 – After a two minute delay the supply fan shall be commanded off.
3 – The unit fan, heating and cooling shall be cycled as needed to maintain unoccupied setpoints. Above heat/cool sequences shall apply.

Associated Exhaust Fans: BAS shall command associated Exhaust Fans to run continuously during the Occupied period.



Note 3: Replace damper actuators with new electronic actuators. Clean & lubricate damper linkage, set minimum position and verify proper operation of dampers.

Note 2: Provide and install new Return & Supply Air temperature & Return Air humidity duct sensors and Mixed Air averaging sensor.

Note 1: Confirm (or rewire) interlock through existing Safety devices to shut down unit Fan(s). Wire associated unit control devices such as actuators & relays to go to their setback (or FAIL) positions whenever the Supply Fan is Off – OA damper closed, DX cooling off & gas heat off.

Note 4: Replace existing HW valve actuator with new.

Hardwired Points

Universal Inputs (Sensors):

1. Supply Fan Status
2. Space Temp
3. Setpoint Adjust
4. Supply Air Temperature
5. Return Air Temperature
6. Mixed Air Temperature
7. Return Air Humidity
8. CO2 Sensor

Digital Outputs (Control):

1. Supply Fan Start/Stop
2. Stage 1 Cooling
3. Stage 1 Gas Heat
4. OA/RA Dampers

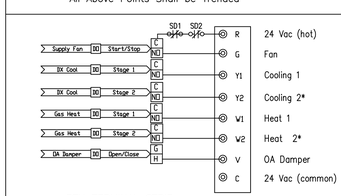
Analog Outputs (Control):
1. FTR Valve

Virtual Points

Software Flags & Setpoints

1. Unit Start Signal
2. Occupied Mode (Sched)
3. Clg Setpoint (74°F Adj)
4. Htg Setp (Clg Setp–3)
5. FTR Htg Setp (Htg. Setp–1)
6. Adjusted Space Setpoint
7. Night Setup (85°F Adj)
8. Supply Fan Fail Alarm
9. Damper CO2 Setpoint
10. Heat/Cool Mode

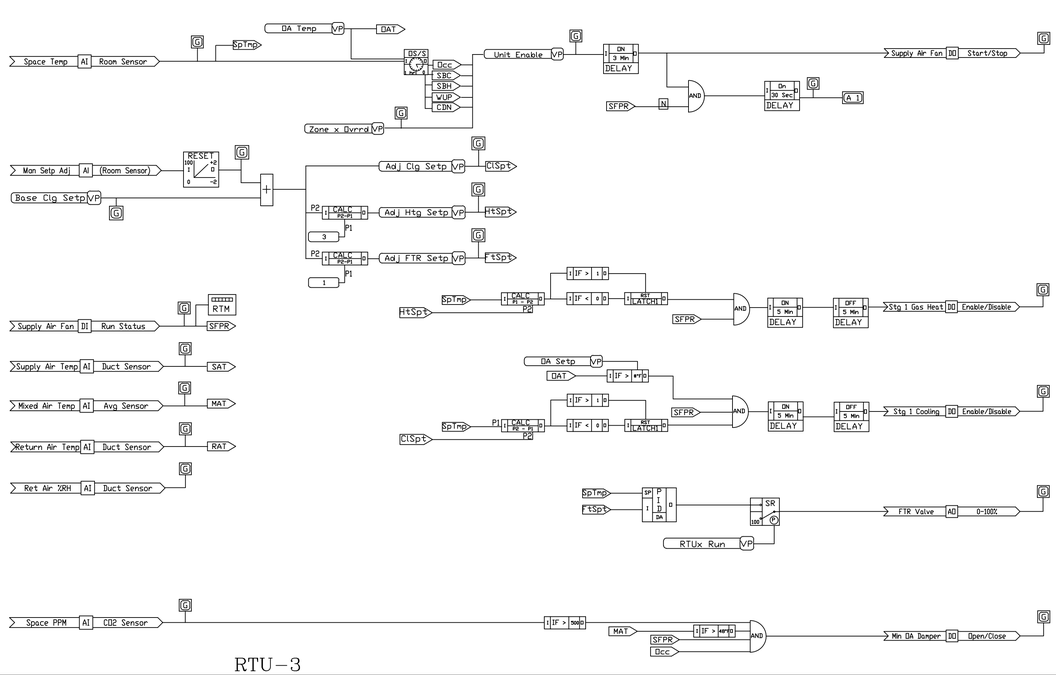
Above Points to be Displayed on RTU Graphic
All Above Points Shall be Accessible by User
All Above Points Shall be Trended



RTU TERMINAL STRIP
Interface board terminal strip by unit manufacturer

* Provide number of stages as required

WIRING DIAGRAMS



RTU–3

ROOFTOP UNIT W /DX CLG/GAS HEAT/MIN OA/CO2

FAIRFAX COUNTY PUBLIC SCHOOLS
OFFICE OF FACILITIES MANAGEMENT
5025 SIDEBURN ROAD
FAIRFAX, VIRGINIA 22032-2637
TEL.: 703-764-2423

PROJECT TITLE

AUTOMATIC TEMPERATURE CONTROL SYSTEM REPLACEMENT

FAIRVIEW ELEMENTARY SCHOOL

5815 OX ROAD
FAIRFAX STATION, VA 22039

DRAWN SM

CHECKED

DATE 05-16-2024

PROJECT # MMB-085-24

REVISIONS

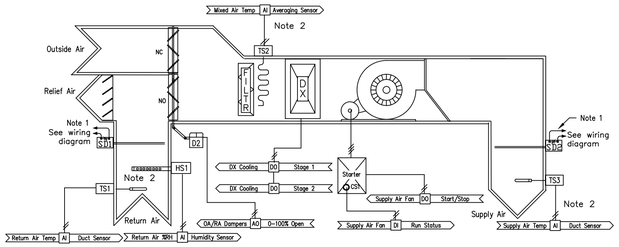
NO.	DATE	DESCRIPTION

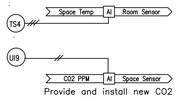
DRAWING TITLE

CONTROL DIAGRAMS
RTU- 2, 3

DRAWING NUMBER

M-7





Provide and install new CO2 sensor near space sensor.

Note 3: Replace damper actuators with new electronic actuators. Clean & lubricate damper linkage, set minimum position and verify proper operation of dampers.

Note 2: Provide and install new Return & Supply Air temperature & Return Air humidity duct sensors and Mixed Air averaging sensor.

Note 1: Confirm (or rewire) interlock through existing Safety devices to shut down unit Fan(s). Wire associated unit control devices such as actuators & relays to go to their setback (or FAIL) positions whenever the Supply Fan is Off – OA damper closed, DX cooling off, etc.

RTU w/DX, Economizer Control Sequence

General: This unit shall have its own Control Module and be fully controlled by the BAS. The unit control logic strategies shall include:
a) Scheduled Occupancy
b) Sequenced heating and cooling control
c) Night (unoccupied) setback

Supply Air Fan Control: The BAS shall control the starting and stopping of the supply air fan as follows:

1 – During the scheduled Occupied period the unit fan shall be commanded to run continuously.
2 – BAS shall monitor fan status and generate an alarm if the fan fails to start as commanded after a 30 second delay or fails anytime thereafter. However the request for the failed fan shall remain active until the unit can be serviced. The BAS shall use the fan status to accumulate resettable runtime.
3 – The unit fan shall be commanded Off when:
a) the Occupied period is over AND the unit is not heating or cooling to maintain night Setup/Setback setpoints
4 – Once the Fan is shut down it must remain off for at least 3 minutes (Adj.) prior to being restarted (note: Minimum Off, Not Delay Start).
5 – The unit may be overridden On or Off via operator command from a remote central location or by the BAS controller on site or BAS graphics.

Mixed Air Dampers: BAS shall control OA damper as follows:
1 – When the Unit is de-energized the OA damper shall be commanded to its closed position.
2 – When the Unit is energized to maintain unoccupied setpoints, the damper shall remain closed.
3 – During the occupied period, the OA damper shall be commanded open to its design minimum position (ref. AHU/RTU Data Dwg M-1).
4 – On a call for Cooling and enthalpy conditions allow, the OA damper shall be modulated open as needed to satisfy cooling needs (ref. Economizer section).
5 – The RA and RF dampers shall track the OA damper proportionately.
6 – The OA Damper shall close if the mixed air temperature falls below 48°F.

Space Temperature Control: Control space temperature by cycling the heating/cooling on the unit as needed. Three operator adjustable setpoints shall apply. Occupied Cooling (74°F), unoccupied setback heating (55°F) and unoccupied setup cooling (85°F). These three values shall be the only values changed by the operator to adjust space temperatures.

Cooling Section: On a rise in space temperature above the cooling setpoint and the outside air temperature is above the DX cooling lockout setpoint (55°F OA (adj.)), the BAS shall activate the 1st stage compressor. When the temperature falls one degree below the cooling setpoint the cooling shall be de-activated. If the temperature rises to above 1°F of the cooling setpoint the 2nd stage shall be activated. On a fall in space temp to below the cooling setpoint the 2nd stage shall be de-activated. There shall be a minimum of five minute intervals between activating and de-activating the cooling stages.

Economizer Section: On a call for Cooling And if the OA Enthalpy is less than 28 btu/lb (adj.) And the OA Enthalpy is less than the unit's RA Enthalpy, the OA damper shall be modulated open to maintain a mixed air temp setpoint of 52°F based on the needs of the space but not lower than 48°F. First stage compressor shall be disabled while Economizer is on.

Unoccupied Setback: During the Unoccupied period:
1 – Heating and cooling shall be commanded off and the OA damper shall close.
2 – After a two minute delay the supply fan shall be commanded off.
3 – The unit fan, heating and cooling shall be cycled as needed to maintain unoccupied setpoints. Above heat/cool sequences shall apply.

Associated Exhaust Fans: BAS shall command associated Exhaust Fans to run continuously during the Occupied period.

Hardwired Points

Universal Inputs (Sensors):

1. Supply Fan Status
2. Supply Air Temperature
3. Return Air Temperature
4. Mixed Air Temperature
5. Return Air Humidity
6. Space Temperature
7. CO2 Sensor

Digital Outputs (Control):

1. Supply Fan Start/Stop
2. Stage 1 Cooling
3. Stage 2 Cooling

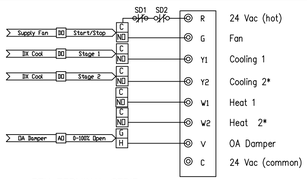
Analog Outputs (Control):
1. OA/RA Dampers

Virtual Points

Software Flags & Setpoints

1. Unit Start Signal
2. Occupied Mode (Sched)
3. Clg Setpoint (74°F Adj)
4. Night Setback (55°F Adj)
5. Night Setup (85°F Adj)
7. Supply Fan Fail Alarm
9. CO2 Min Setpoint
10. CO2 Max Setpoint
11. Economizer Mode

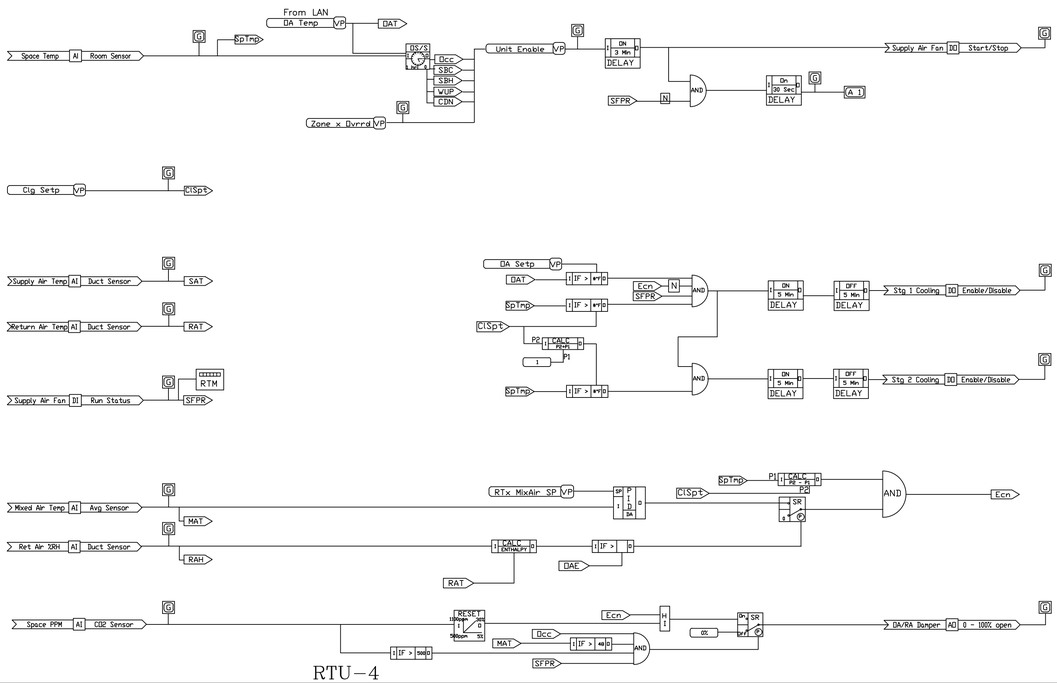
Above Points to be Displayed on RTU Graphic
All Above Points Shall be Accessible by User
All Above Points Shall be Trended



RTU TERMINAL STRIP
Interface board terminal strip by unit manufacturer

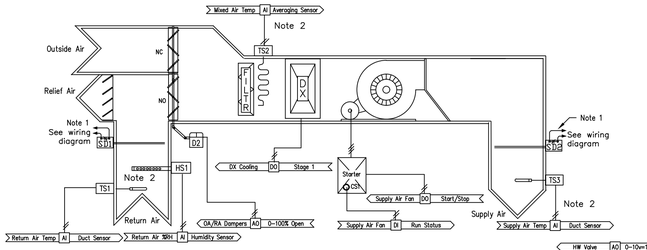
* Provide number of stages as required

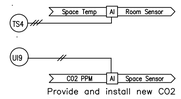
WIRING DIAGRAMS



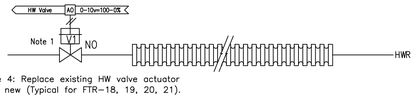
RTU–4

ROOFTOP UNIT W /DX CLG/ECONOMIZER





Provide and install new CO2 sensor near space sensor.



Note 4: Replace existing HW valve actuator with new (Typical for FTR–18, 19, 20, 21).

Note 3: Replace damper actuators with new electronic actuators. Clean & lubricate damper linkage, set minimum position and verify proper operation of dampers.

Note 2: Provide and install new Return & Supply Air temperature & Return Air humidity duct sensors and Mixed Air averaging sensor.

Note 1: Confirm (or rewire) interlock through existing Safety devices to shut down unit Fan(s). Wire associated unit control devices such as actuators & relays to go to their setback (or FAIL) positions whenever the Supply Fan is Off – OA damper closed, DX cooling off, etc.

RTU w/DX, Economizer Control Sequence

General: This unit shall have its own Control Module and be fully controlled by the BAS. The unit control logic strategies shall include:
a) Scheduled Occupancy
b) Sequenced heating and cooling control
c) Night (unoccupied) setback

Supply Air Fan Control: The BAS shall control the starting and stopping of the supply air fan as follows:

1 – During the scheduled Occupied period the unit fan shall be commanded to run continuously.
2 – BAS shall monitor fan status and generate an alarm if the fan fails to start as commanded after a 30 second delay or fails anytime thereafter. However the request for the failed fan shall remain active until the unit can be serviced. The BAS shall use the fan status to accumulate resettable runtime.
3 – The unit fan shall be commanded Off when:
a) the Occupied period is over AND the unit is not heating or cooling to maintain night Setup/Setback setpoints
4 – Once the Fan is shut down it must remain off for at least 3 minutes (Adj.) prior to being restarted (note: Minimum Off, Not Delay Start).
5 – The unit may be overridden On or Off via operator command from a remote central location or by the BAS controller on site or BAS graphics.

Mixed Air Dampers: BAS shall control OA damper as follows:
1 – When the Unit is de-energized the OA damper shall be commanded to its closed position.
2 – When the Unit is energized to maintain unoccupied setpoints, the damper shall remain closed.
3 – During the occupied period, the OA damper shall be commanded open to its design minimum position (ref. AHU/RTU Data Dwg M-1).
4 – On a call for Cooling and enthalpy conditions allow, the OA damper shall be modulated open as needed to satisfy cooling needs (ref. Economizer section).
5 – The RA and RF dampers shall track the OA damper proportionately.
6 – The OA Damper shall close if the mixed air temperature falls below 48°F.

Space Temperature Control: Control space temperature by cycling the heating/cooling on the unit as needed. Three operator adjustable setpoints shall apply. Occupied Cooling (74°F), unoccupied setback heating (55°F), and unoccupied setup cooling (85°F). These three values shall be the only values changed by the operator to adjust space temperatures. The Occupied Heating setpoint shall be the Cooling Setpoint minus 3°F.

Cooling Section: On a rise in space temperature above the cooling setpoint and the outside air temperature is above the DX cooling lockout setpoint (55°F OA (adj.)), the BAS shall activate the 1st stage compressor. When the temperature falls one degree below the cooling setpoint the cooling shall be de-activated.

Hydronic Heating Control: N.O. FTR valve shall modulate in a PI loop to maintain FTR space temperature heating setpoint as defined above with a 2°F throttling range.

Heating Request: This terminal shall issue a "heating request" as follows"
a) Whenever the heating PI output is at 10% or below
b) Whenever the space temperature falls below the throttling range of the heating PI loop

Economizer Section: On a call for Cooling And if the OA Enthalpy is less than 28 btu/lb (adj.) And the OA Enthalpy is less than the unit's RA Enthalpy, the OA damper shall be modulated open to maintain a mixed air temp setpoint of 52°F based on the needs of the space but not lower than 48°F. First stage compressor shall be disabled while Economizer is on.

Unoccupied Setback: During the Unoccupied period:
1 – Heating and cooling shall be commanded off and the OA damper shall close.
2 – After a two minute delay the supply fan shall be commanded off.
3 – The unit fan, heating and cooling shall be cycled as needed to maintain unoccupied setpoints. Above heat/cool sequences shall apply.

Associated Exhaust Fans: BAS shall command associated Exhaust Fans to run continuously during the Occupied period.

Hardwired Points

Universal Inputs (Sensors):

1. Supply Fan Status
2. Space Temp
3. Supply Air Temperature
4. Return Air Temperature
5. Mixed Air Temperature
6. Return Air Humidity
7. CO2 Sensor

Digital Outputs (Control):

1. Supply Fan Start/Stop
2. Stage 1 Cooling

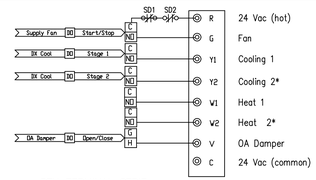
Analog Outputs (Control):
1. OA/RA Dampers
2 FTR Valve (Typical of 4)

Virtual Points

Software Flags & Setpoints

1. Unit Start Signal
2. Occupied Mode (Sched)
3. Clg Setpoint (74°F Adj)
4. Htg Setp (Clg Setp–3)
5. Night Setback (55°F Adj)
6. Night Setup (85°F Adj)
7. Supply Fan Fail Alarm
9. CO2 Min Setpoint
10. CO2 Max Setpoint
11. Economizer Mode

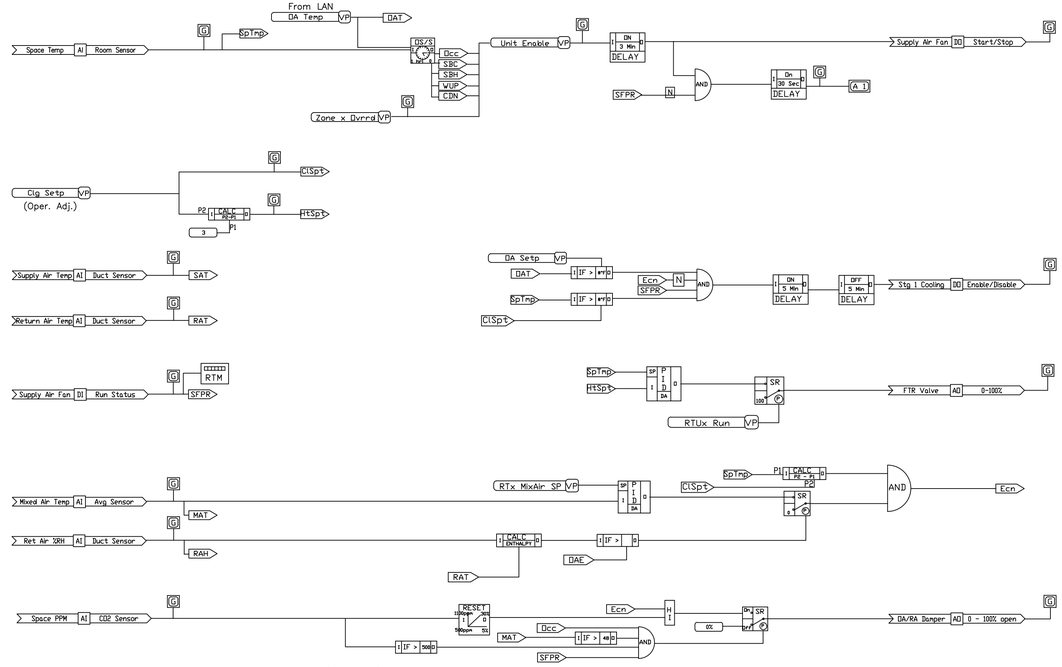
Above Points to be Displayed on RTU Graphic
All Above Points Shall be Accessible by User
All Above Points Shall be Trended



RTU TERMINAL STRIP
Interface board terminal strip by unit manufacturer

* Provide number of stages as required

WIRING DIAGRAMS



RTU–6

ROOFTOP UNIT W /DX CLG/ECONOMIZER

FAIRFAX COUNTY PUBLIC SCHOOLS

OFFICE OF FACILITIES MANAGEMENT
5025 SIDEBURN ROAD
FAIRFAX, VIRGINIA 22032-2637
TEL.: 703-764-2423

PROJECT TITLE

AUTOMATIC TEMPERATURE CONTROL SYSTEM REPLACEMENT

FAIRVIEW ELEMENTARY SCHOOL

5815 OX ROAD
FAIRFAX STATION, VA 22039

DRAWN SM

CHECKED

DATE 05-24-2024

PROJECT # MMB-085-24

REVISIONS

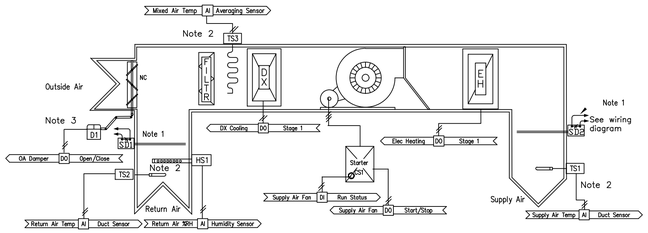
NO.	DATE	DESCRIPTION

DRAWING TITLE

CONTROL DIAGRAMS
RTU- 4, 6

DRAWING NUMBER

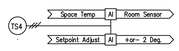
M-8



Note 3: Replace damper actuators with new electronic actuators. Clean & lubricate damper linkage, set minimum position and verify proper operation of dampers.

Note 2: Provide and install new Return & Supply Air temperature & Return Air humidity duct sensors and Mixed Air averaging sensor.

Note 1: Confirm (or rewire) interlock through existing Safety devices to shut down unit Fan(s). Wire associated unit control devices such as actuators & relays to go to their setback (or FAIL) positions whenever the Supply Fan is Off - OA damper closed, DX cooling off & gas heat off.



Provide new wall mounted space sensor with manual setpoint adjust.

Provide and install new CO2 sensor near space sensor.

Note 4: Replace existing HW valve and actuator with new.

RTU w/DX, Gas Heat Min OA & CO2 Control Sequence

General: This unit shall have its own Control Module and be fully controlled by the BAS. The unit control logic strategies shall include:
a) Scheduled Occupancy
b) Sequenced heating and cooling control
c) Outside air intake control based on CO2 levels
d) Night (unoccupied) setback

Supply Air Fan Control: The BAS shall control the starting and stopping of the supply air fan as follows:

1 - During the scheduled Occupied period the unit fan shall be commanded to run continuously.
2 - BAS shall monitor fan status and generate an alarm if the fan fails to start as commanded after a 30 second delay or fails anytime thereafter. However the request for the failed fan shall remain active until the unit can be serviced. The BAS shall use the fan status to accumulate resettable runtime.
3 - The unit fan shall be commanded Off when:
a) the Occupied period is over AND the unit is not heating or cooling to maintain night Setup/Setback setpoints
4 - Once the Fan is shut down it must remain off for at least 3 minutes (Adj.) prior to being restarted (note: Minimum Off, Not Delay Start).
5 - The unit may be overridden On or Off via operator command from a remote central location or by the BAS controller on site or BAS graphics.

Min OA Damper control: BAS shall control OA damper as follows:
1 - When the Unit is de-energized the OA damper shall be commanded to its closed position.
2 - When the Unit is energized to maintain unoccupied setpoints, the damper shall remain closed.
3 - During the occupied period AND when the space CO2 level rises above the setpoint of 500ppm (adj.), the OA damper shall be commanded open to its preset minimum position.
4 - The RA and RF dampers shall track the OA damper proportionately.
5 - The OA Damper shall close if the mixed air temperature falls below 48F.

Space Temperature Control: Control space temperature by cycling the heating/cooling on the unit as needed. Three operator adjustable setpoints shall apply. Occupied Cooling (74F), unoccupied setback heating (55F), and unoccupied setup cooling (85F). These three values shall be the only values changed by the operator to adjust space temperatures. The Occupied Heating setpoint shall be the Cooling Setpoint minus 3F. The Occupied FTR Heating setpoint shall be regular Occupied Heating setpoint minus 1F (Adj.)

Heating Section: On a fall in space temperature below the heating setpoint, the BAS shall activate the 1st stage of electric heat. When the temperature rises to above the heating setpoint plus 1F the heat shall de-activate.

Cooling Section: On a rise in space temperature above the cooling setpoint and the outside air temperature is above the DX cooling lockout setpoint (55F OA (adj.)), the BAS shall activate the 1st stage compressor. When the temperature falls one degree below the cooling setpoint the cooling shall be de-activated.

Hydronic Heating Control: N.O. FTR valve shall modulate in a PI loop to maintain FTR space temperature heating setpoint as defined above with a 2F throttling range.

Heating Request: This terminal shall issue a "heating request" as follows"
a) Whenever the heating PI output is at 10% or below
b) Whenever the space temperature falls below the throttling range of the heating PI loop

Unoccupied Setback: During the Unoccupied period:
1 - Heating and cooling shall be commanded off and the OA damper shall close.
2 - After a two minute delay the supply fan shall be commanded off.
3 - The unit fan, heating and cooling shall be cycled as needed to maintain unoccupied setpoints. Above heat/cool sequences shall apply.

Associated Exhaust Fans: BAS shall command associated Exhaust Fans to run continuously during the Occupied period.

Hardwired Points

Universal Inputs (Sensors):

1. Supply Fan Status
2. Space Temp
3. Setpoint Adjust
4. Supply Air Temperature
5. Return Air Temperature
6. Mixed Air Temperature
7. Return Air Humidity
8. CO2 Sensor

Digital Outputs (Control):

1. Supply Fan Start/Stop
2. Stage 1 Cooling
3. Stage 1 Gas Heat
4. OA/RA Dampers

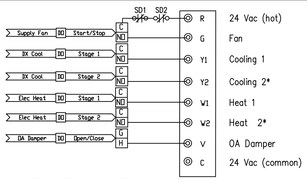
Analog Outputs (Control):
1. FTR Valve

Virtual Points

Software Flags & Setpoints

1. Unit Start Signal
2. Occupied Mode (Sched)
3. Clg Setpoint (74F Adj)
4. Htg Setp (Clg Setp-3)
5. FTR Htg Setp (Htg. Setp-1)
5. Adjusted Space Setpoint
6. Night Setback (55F Adj)
7. Night Setup (85F Adj)
8. Supply Fan Fail Alarm
9. Damper CO2 Setpoint
10. Heat/Cool Mode

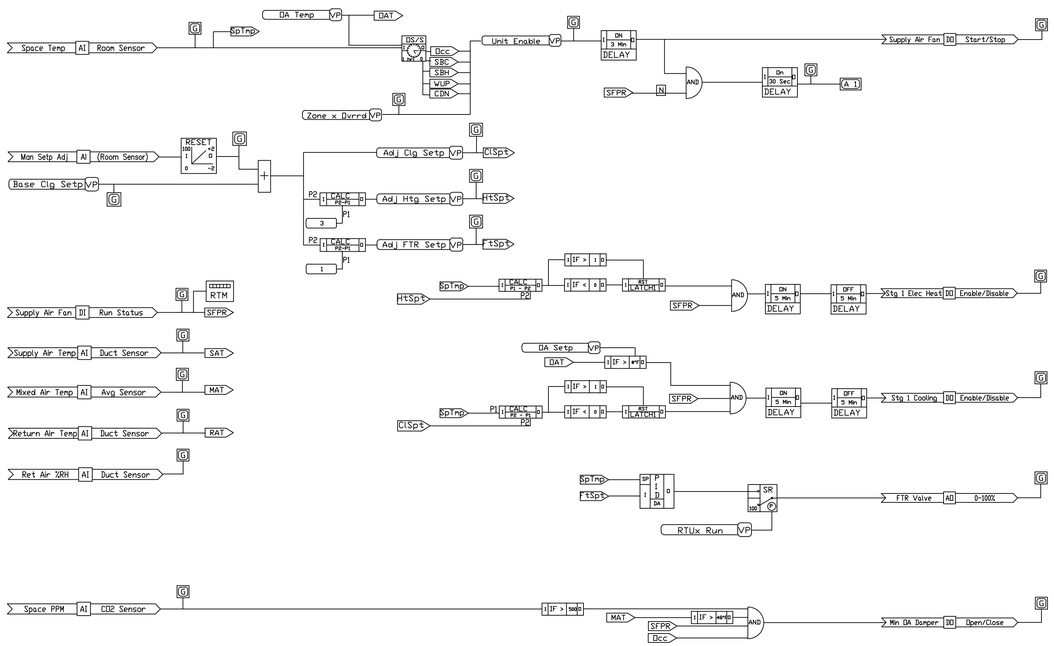
Above Points to be Displayed on RTU Graphic
All Above Points Shall be Accessible by User
All Above Points Shall be Trended



RTU TERMINAL STRIP
Interface board terminal strip by unit manufacturer

* Provide number of stages as required

WIRING DIAGRAMS



RTU-7, 8

ROOFTOP UNIT W /DX CLG/ELECTRIC HEAT/MIN OA/CO2

RTU w/DX, Gas Heat Min OA & CO2 Control Sequence

General: This unit shall have its own Control Module and be fully controlled by the BAS. The unit control logic strategies shall include:
a) Scheduled Occupancy
b) Sequenced heating and cooling control
c) Outside air intake control based on CO2 levels
d) Night (unoccupied) setback

Supply Air Fan Control: The BAS shall control the starting and stopping of the supply air fan as follows:

1 - During the scheduled Occupied period the unit fan shall be commanded to run continuously.
2 - BAS shall monitor fan status and generate an alarm if the fan fails to start as commanded after a 30 second delay or fails anytime thereafter. However the request for the failed fan shall remain active until the unit can be serviced. The BAS shall use the fan status to accumulate resettable runtime.
3 - The unit fan shall be commanded Off when:
a) the Occupied period is over AND the unit is not heating or cooling to maintain night Setup/Setback setpoints
4 - Once the Fan is shut down it must remain off for at least 3 minutes (Adj.) prior to being restarted (note: Minimum Off, Not Delay Start).
5 - The unit may be overridden On or Off via operator command from a remote central location or by the BAS controller on site or BAS graphics.

Min OA Damper control: BAS shall control OA damper as follows:
1 - When the Unit is de-energized the OA damper shall be commanded to its closed position.
2 - When the Unit is energized to maintain unoccupied setpoints, the damper shall remain closed.
3 - During the occupied period AND when the space CO2 level rises above the setpoint of 500ppm (adj.), the OA damper shall be commanded open to its preset minimum position.
4 - The OA Damper shall close if the mixed air temperature falls below 48F.

Space Temperature Control: Control space temperature by cycling the heating/cooling on the unit as needed. Three operator adjustable setpoints shall apply. Occupied Cooling (74F), unoccupied setback heating (55F), and unoccupied setup cooling (85F). These three values shall be the only values changed by the operator to adjust space temperatures. The Occupied Heating setpoint shall be the Cooling Setpoint minus 3F.

Heating Section: On a fall in space temperature below the heating setpoint, the BAS shall activate the 1st stage of gas heat. When the temperature rises to above the heating setpoint plus 1F the heat shall de-activate. If the space temp falls to 1F below the heating setpoint the BAS shall activate the 2nd stage of gas heat. On a rise in space temp to above the heating setpoint the 2nd stage heat shall de-activate. There shall be a minimum of five minute intervals between activating and de-activating the heating stages.

Cooling Section: On a rise in space temperature above the cooling setpoint and the outside air temperature is above the DX cooling lockout setpoint (55F OA (adj.)), the BAS shall activate the 1st stage compressor. When the temperature falls one degree below the cooling setpoint the cooling shall be de-activated. If the temperature rises to above 1F of the cooling setpoint the 2nd stage shall be activated. On a fall in space temp to below the cooling setpoint the 2nd stage shall be de-activated. There shall be a minimum of five minute intervals between activating and de-activating the cooling stages.

Unoccupied Setback: During the Unoccupied period:
1 - Heating and cooling shall be commanded off and the OA damper shall close.
2 - After a two minute delay the supply fan shall be commanded off.
3 - The unit fan, heating and cooling shall be cycled as needed to maintain unoccupied setpoints. Above heat/cool sequences shall apply.

Associated Exhaust Fans: BAS shall command associated Exhaust Fans to run continuously during the Occupied period.

Hardwired Points

Universal Inputs (Sensors):

1. Supply Fan Status
2. Supply Air Temperature
3. Return Air Temperature
4. Mixed Air Temperature
5. Return Air Humidity
6. Space Temperature
7. CO2 Sensor

Digital Outputs (Control):

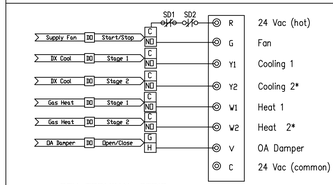
1. Supply Fan Start/Stop
2. Stage 1 Cooling
3. Stage 2 Cooling
4. Stage 1 Gas Heat
5. Stage 2 Gas Heat
6. OA Damper
7. RF Damper

Virtual Points

Software Flags & Setpoints

1. Unit Start Signal
2. Occupied Mode (Sched)
3. Clg Setpoint (74F Adj)
4. Htg Setp (Clg Setp-3)
5. Night Setback (55F Adj)
6. Night Setup (85F Adj)
7. Supply Fan Fail Alarm
8. Damper CO2 Setpoint

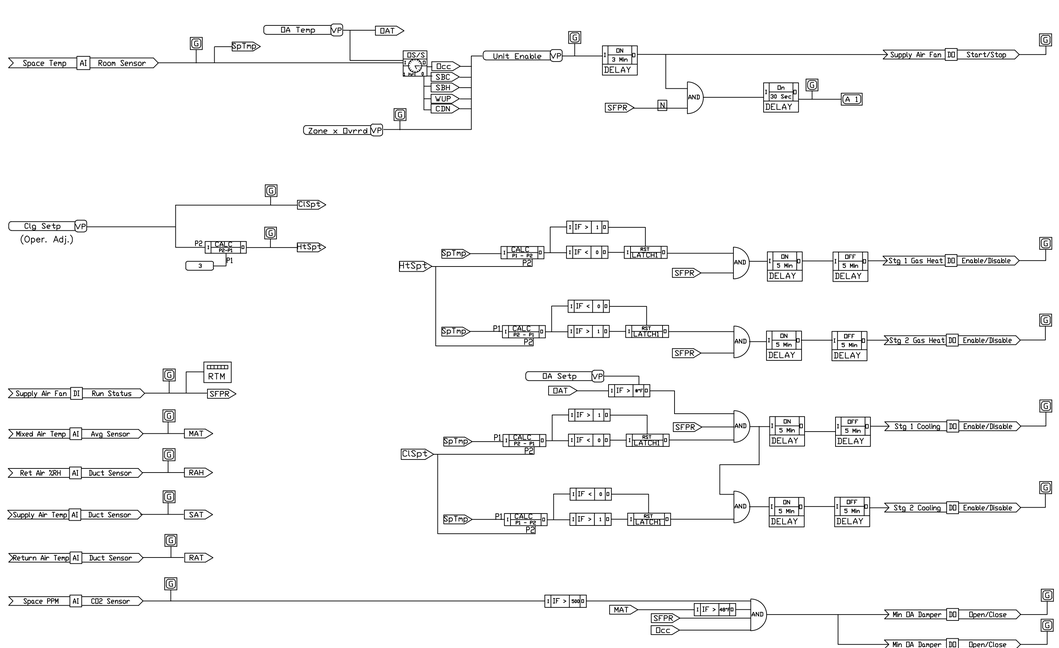
Above Points to be Displayed on RTU Graphic
All Above Points Shall be Accessible by User
All Above Points Shall be Trended



RTU TERMINAL STRIP
Interface board terminal strip by unit manufacturer

* Provide number of stages as required

WIRING DIAGRAMS



RTU-12, 13

ROOFTOP UNIT W /DX CLG/GAS HEAT/MIN OA/CO2

FAIRFAX COUNTY PUBLIC SCHOOLS

OFFICE OF FACILITIES MANAGEMENT
5025 SIDEBURN ROAD
FAIRFAX, VIRGINIA 22032-2637
TEL.: 703-764-2423

PROJECT TITLE

AUTOMATIC TEMPERATURE CONTROL SYSTEM REPLACEMENT

FAIRVIEW ELEMENTARY SCHOOL

5815 OX ROAD
FAIRFAX STATION, VA 22039

DRAWN SM

CHECKED

DATE 05-16-2024

PROJECT # MMB-085-24

REVISIONS

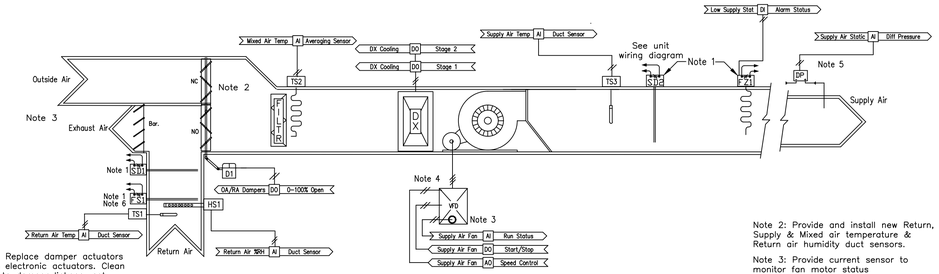
NO.	DATE	DESCRIPTION

DRAWING TITLE

CONTROL DIAGRAMS
RTU- 7, 8, 12, 13

DRAWING NUMBER

M-9



Note 6: Replace damper actuators with new electronic actuators. Clean & lubricate damper linkage, set minimum position and verify proper operation of dampers.

Note 1: Replace Low Supply temperature stat with 2-pole stat and provide status point to BAS controller. Install new stat in the supply air duct if does not exist. Confirm (or rewire) interlock through existing Safety devices to shut down unit Fan(s). Wire associated unit control devices such as actuators & relays to go to their setback (or FAIL) positions whenever the Supply Fan is Off – OA damper closed, DX cooling off, and electric heat off.

Note 2: Provide and install new Return, Supply & Mixed air temperature & Return air humidity duct sensors.

Note 3: Provide current sensor to monitor fan motor status

Note 4: Connect new controls to existing Supply Air fan VFD.

Note 5: Provide and install new duct DP xmtr approx 2/3 distance from fan at the location indicated on floor plans.

VAV RTU w/ DX Cool/Electric Heat

General: This unit shall have its own Control Module and be enabled/disabled by the BAS. The unit control logic strategies shall include:
a) Scheduled Occupancy with Optimum Preoccupancy
b) Night (unoccupied) setback

Supply Air Fan Control: The BAS shall control the starting and stopping of the supply air fan as follows:
1 – The BAS shall calculate an optimum pre-occupied RTU start time based on space temperature, outside air conditions, and availability of the necessary central plant system(s).
2 – During the scheduled Occupied period, the unit fan shall be commanded to run continuously .
3 – BAS shall monitor fan status and generate an alarm if the fan fails to start as commanded after a 30 second delay or fails anytime thereafter. However the request for the failed fan shall remain active until the unit can be serviced. The BAS shall use the fan status to accumulate runtime.
4 – Volume Control: BAS shall modulate system via an analog signal to the Varable Frequency Drive (VFD) so as to maintain a Supply Duct Pressure Setpoint determined per Supply Static Pressure Reset sequence.
5 – The unit fan shall be commanded Off when the Occupied period is over AND the unit is not needed to maintain heating or cooling night Setup/Setback VAV space setpoints
6 – Once the RTU is shut down it must remain off for at least 3 minutes prior to being restarted (note: Minimum Off, Not Delay Start).
7 – The unit may be overridden On or Off via operator command from a remote central location or by the BAS controller on site.

Mixed Air Dampers: BAS shall control OA damper as follows:
1 – When the Unit is de-energized the OA damper shall be commanded to its closed position.
2 – When the Unit is energized during unoccupied period, the damper shall remain closed.
3 – During the occupied period, the OA damper shall be commanded open to its design minimum position (ref. Schedules Dwg M-1).
4 – On a call for Cooling and if enthalpy conditions allow, the OA damper shall be modulated open as needed to satisfy cooling needs (ref. Economizer section).
5 – The RA damper shall track the OA damper proportionately.
6 – The OA Damper shall close if the mixed air temperature falls below 48T.

Supply Static Pressure Reset: Supply static pressure shall be reset between the minimum supply static setpoint of 0.5 WC and optimized maximum supply static setpoint determined by the Testing and Balancing cointracor (both adjustable) using Trim & Response logic per ASHRAE 36–2018. Starting 5 minutes after the fan status indicates the supply fan is ON, the sequence will slowly reduce the the RTU static pressure setpoint by 0.04 WC, but no lower than 0.5 WC every 2 minutes. When more than 2 VAV boxes open to more than 95%, static pressure setpoint will be increased by 0.06 WC for every request, but no more than a maximum of 0.15 WC regardless of the number of requests. The setpoint will continue to increase every 2 minutes up to the maximum setpoint or until all but 2 VAV boxes are satisfied (damper position of <85%). Subsequently, the setpoint will continue to decrease 0.04 WC every 2 minutes. When the outdoor air temperature is below cooling lockout setpoint, Supply static setpoint shall stay equal to the maximum static pressure setpoint.

Space Temperature Control: The space temperatures shall be controlled via individual VAV boxes.

Discharge Air Temperature Control*:
The discharge Air temperature shall be controlled as follows:
a) During the Occupied period, the discharge temperature setpoint shall be reset from 55T to 70T as the average VAV space temperature falls from 74T to 68T with all values being adjustable.
b) If the unit is energized for morning cooldown or setup cooling during the Unoccupied period, the discharge temperature setpoint shall be 55T (Adj.)

Cooling Section: On a rise in discharge air temperature above the calculated discharge air setpoint and if the outside air temperature is above the building chilled water system enable setpoint, the BAS shall activate the 1st stage compressor. When the temperature falls two degrees below the discharge air temperature setpoint, cooling shall be de-activated. If the temperature rises to above 2T of the discharge air setpoint the 2nd stage shall be activated. On a fall in space temp to below the discharge air setpoint the 2nd stage shall be de-activated. There shall be a minimum of five minute intervals between activating and de-activating the cooling stages. During Morning Warmup period or for Unoccupied heating, cooling shall be disabled.

Economizer Section: On a call for Cooling And if the OA Enthalpy is less than 28 btu/lb (adj.) And the OA Enthalpy is less than the unit's RA Enthalpy, the OA damper shall be modulated open to maintain a mixed air temp setpoint of 52T based on the needs of the space but not lower than 48T. First stage compressor shall be disabled while Economizer is on.

Unoccupied Mode:
During the Unoccupied period, the supply fan will be commanded off and the OA damper will close.
During the Unoccupied period, RTU shall be enabled to run for setup cooling if temperature of any space served by RTU rises above its night setup setpoint of 85T (Adj.).

Hardwired Points

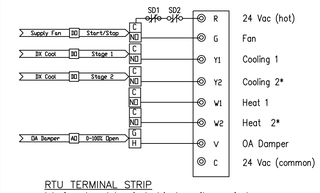
Universal Inputs (Sensors):
1. Supply Fan Status
2. Supply Air Temperature
3. Return Air Temperature
4. Mixed Air Temperature
5. Return Air Humidity
6. Supply Duct Static Pressure
7. Low Supply Temperature Stat

Digital Outputs (Control):
1. Supply Fan Start/Stop
2. Stage 1 Cooling
3. Stage 2 Cooling

Analog Outputs (Control):
1. OA/RA Dampers
2. Fan Speed (VFD) Control

Software Flags & Setpoints
1. Unit Start Signal
2. Occupied Mode (Sched)
3. Active Discharge Air Setpoint
4. Min Discharge Air Setpoint
5. Max Discharge Air Setpoint
6. Return Air Enthalpy
7. VAV Terminals Occupied
8. VAV Cooling Requests
9. VAV Average Space Temp
10. Supply Fan Fail Alarm
11. Active Supply Duct Static Setp
10. Min Supply Duct Static Setp
11. Max Supply Duct Static Setp
12. Morning Cooldown
13. Morning Cooldown Setpoint
14. Economizer Mode

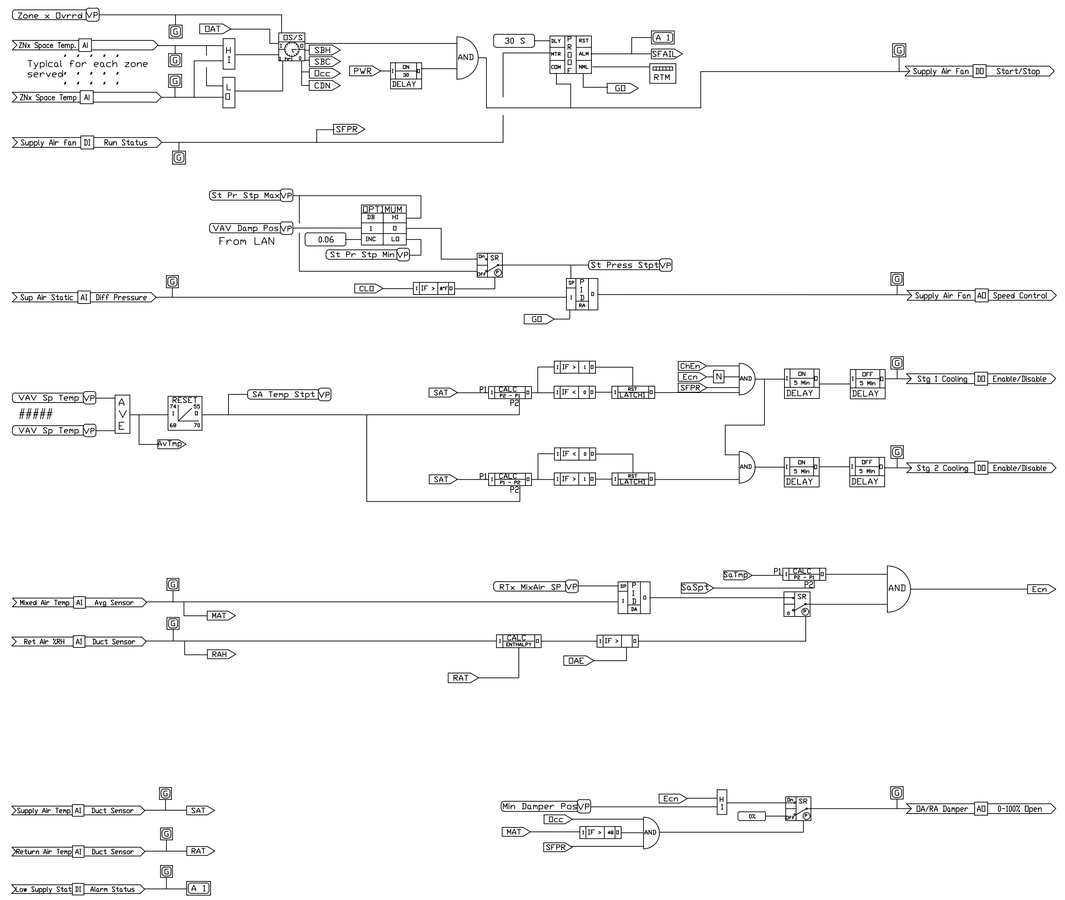
Above Points to be Displayed on RTU Graphic
All Above Points Shall be Accessible by User
All Above Points Shall be Trended



RTU TERMINAL STRIP
Interface board terminal strip by unit manufacturer

* Provide number of stages as required

WIRING DIAGRAMS



RTU – 5

VAV RTU WITH DX COOLING & ECONOMIZER

FAIRFAX COUNTY PUBLIC SCHOOLS

OFFICE OF FACILITIES MANAGEMENT
5025 SIDEBURN ROAD
FAIRFAX, VIRGINIA 22032-2637
TEL.: 703-764-2423

PROJECT TITLE

AUTOMATIC TEMPERATURE CONTROL SYSTEM REPLACEMENT

FAIRVIEW ELEMENTARY SCHOOL

5815 OX ROAD
FAIRFAX STATION, VA 22039

DRAWN SM

CHECKED

DATE 05-24-2024

PROJECT # MMB-085-24

REVISIONS

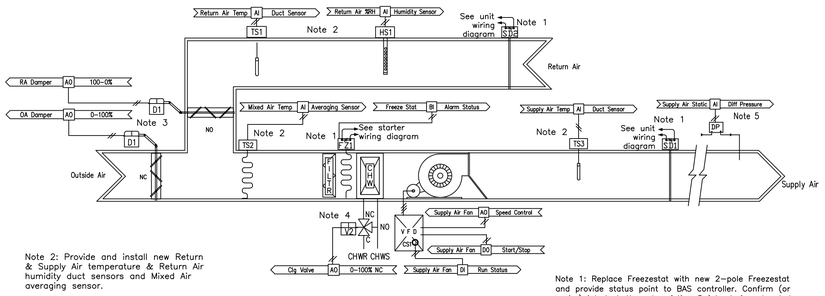
NO.	DATE	DESCRIPTION

DRAWING TITLE

CONTROL DIAGRAMS
RTU- 5

DRAWING NUMBER

M-10



Note 2: Provide and install new Return & Supply Air temperature & Return Air humidity duct sensors and Mixed Air averaging sensor.

Note 3: Replace OA and RA damper actuators. Clean & lubricate damper linkage and verify proper operation of dampers.

Note 4: Replace existing 3-way CHW valve and actuators with new identical Siemens valve & Siemens SKD-62U electronic actuator.

Note 5: Provide and install new duct DP xmtr approx 2/3 distance from fan at the location indicated on floor plans. Existing VFD to remain.

Note 1: Replace Freezestat with new 2-pole Freezestat and provide status point to BAS controller. Confirm (or rewire) interlock through existing Safety devices to shut down unit Fan(s). Wire associated unit control devices such as actuators & relays to go to their setback (or FAIL) positions whenever the Supply Fan is Off – HW valve open to coil, OA damper closed, etc.

Variable Air Volume AHU w/CHW Coils & Economizer Dampers

General: The VAV air handler shall be fully controlled by the BAS.
AHU control logic strategies shall include:
a) Scheduled occupancy with Optimum Preoccupancy
b) Sequenced heating and cooling control
c) Variable Frequency fan speed control
d) Enthalpy comparison outside air economizer control
e) Night (unoccupied) setback

Supply Air Fan Control: The BAS shall control the starting and stopping of the supply air fan as follows:
1 – The BAS shall calculate an optimum pre-occupied RTU start time based on space temperature, outside air conditions, and availability of the necessary central plant system(s).
2 – During the scheduled Occupied period, the unit fan shall be commanded to run continuously .
3 – BAS shall monitor fan status and generate an alarm if the fan fails to start as commanded after a 30 second delay or fails anytime thereafter. However the request for the failed fan shall remain active until the unit can be serviced. The BAS shall use the fan status to accumulate runtime.
4 – Volume Control: BAS shall modulate system via an analog signal to the Variable Frequency Drive (VFD) so as to maintain a Supply Duct Pressure Setpoint determined per Supply Static Pressure Reset sequence.
5 – The unit fan shall be commanded Off when the Occupied period is over AND the unit is not needed to maintain heating or cooling night Setup/Setback VAV space setpoints
6 – Once the RTU is shut down it must remain off for at least 3 minutes prior to being restarted (note: Minimum Off, Not Delay Start).
7 – The unit may be overridden On or Off via operator command from a remote central location or by the BAS controller on site.

Mixed Air Dampers: BAS shall control OA damper as follows:
1 – When the Unit is de-energized the OA damper shall be commanded to its closed position.
2 – When the Unit is energized during unoccupied period, the damper shall remain closed.
3 – During the occupied period, the OA damper shall be commanded open to its design minimum position (ref. Schedules Dwg M-1).
4 – On a call for Cooling and if enthalpy conditions allow, the OA damper shall be modulated open as needed to satisfy cooling needs (ref. Economizer section).
5 – The RA damper shall track the OA damper proportionately.
6 – The OA Damper shall close if the mixed air temperature falls below 48°F.

Supply Static Pressure Reset: Supply static pressure shall be reset between the minimum supply static setpoint of 0.5 WC and optimized maximum supply static setpoint determined by the Testing and Balancing cointracor (both adjustable) using Trim & Response logic per ASHRAE 36-2018. Starting 5 minutes after the fan status indicates the supply fan is ON, the sequence will slowly reduce the the RTU static pressure setpoint by 0.04 WC, but no lower than 0.5 WC every 2 minutes. When more than 2 VAV boxes open to more than 95%, static pressure setpoint will be increased by 0.06 WC for every request, but no more than a maximum of 0.15 WC regardless of the number of requests. The setpoint will continue to increase every 2 minutes up to the maximum setpoint or untill all but 2 VAV boxes are satisfied (damper position of <85%). Subsequently, the setpoint will continue to decrease 0.04 WC every 2 minutes. When the outdoor air temperature is below cooling lockout setpoint, Supply static setopint shall stay equal to the maximum static pressure setpoint.

High Supply Air Duct Static Pressure Alarm: If the supply duct static pressure exceeds 5" WC (Adj.), the system will generate an alarm and disable the supply fan. The supply fan shall stay disabled until the alarm is reset remotely by an operator. The alarm reset point shall be added to the unit's graphic.

Space Temperature Control: The space temperatures shall be controlled via individual VAV boxes.

Discharge Air Temperature Control:
The discharge Air temperature shall be controlled as follows:
a) During the Occupied period, the discharge temperature setpoint shall be reset from 55°F to 80°F as the average VAV space temperature falls from 74°F to 68°F with all values being adjustable.
b) If the unit is energized for morning cooldown, setup cooling, or night purge during the Unoccupied period, the discharge temperature setpoint shall be 55°F (Adj.)

Cooling Section: Chilled water valve shall be modulated in a PID loop to maintain discharge temperature setpoint. Cooling valve shall remain closed if the outside air temperature is below the chilled water system enable setpoint. During Unoccupied period, if the AHU is energized for heating, warm-up, or night purge, the chilled water valve will remain closed.

Requests: This unit shall issue a "request" as follows:
a) A "cool request" shall be issued whenever the cooling PID output is at 30% (Adj.) or above

Economizer Section: On a call for Cooling And if the OA Enthalpy is less than 28 btu/lb (adj.) And the OA Enthalpy is less than the unit's RA Enthalpy, the OA damper shall be modulated open to maintain a mixed air temp setpoint of 52°F based on the needs of the spaces but not lower than 48°F.

Unoccupied Mode:
During the Unoccupied period, the supply fan will be commanded off and the OA damper will close.
During the Unoccupied period, AHU shall be enabled to run for setup cooling if temperature of any space served by AHU rises above its night setup setpoint of 85°F (Adj.).

Low Space Temperature Mode:
During the Occupied mode, if the the average temperature of the spaces controlled by VAVs falls below 63°F (Adj.), the AHU shall switch into Low Temp Mode. In this mode, the AHU Outdoor Air damper shall close. On the rise of the average space temperature above 65°F (Adj.), Low Temp Reheat Mode shall be deactivated and the AHU shall open.

Hardwired Points

Universal Inputs (Sensors):

1. Supply Fan Status
2. Return Air Temperature
3. Supply Air Temperature
4. Mixed Air Temperature
5. Return Air Humidity
6. Duct Static Pressure
7. Freeze Stat

Digital Outputs (Control):

1. Supply Fan Start/Stop
2. Exh Fan/PRV Start/Stop

Analog Outputs (Control):

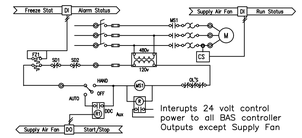
1. Chilled Water Valve
2. Outdoor Air Damper Control
3. Return Air Damper Control
4. Fan Speed (VFD) Control

Virtual Points

Software Flags & Setpoints

1. Unit Start Signal
2. Occupied Mode (Sched)
3. Active Discharge Air Setpoint
4. Min Discharge Air Setpoint
5. Max Discharge Air Setpoint
6. Return Air Enthalpy
7. VAV Terminals Occupied
8. VAV Cooling Requests
9. VAV Average Space Temp
10. Supply Fan Fail Alarm
11. Active Supply Duct Static Setp
12. Min Supply Duct Static Setp
13. Max Supply Duct Static Setp
14. Return Duct Static Setpoint
15. Morning Cooldown
16. Morning Cooldown Setpoint
17. Economizer Mode

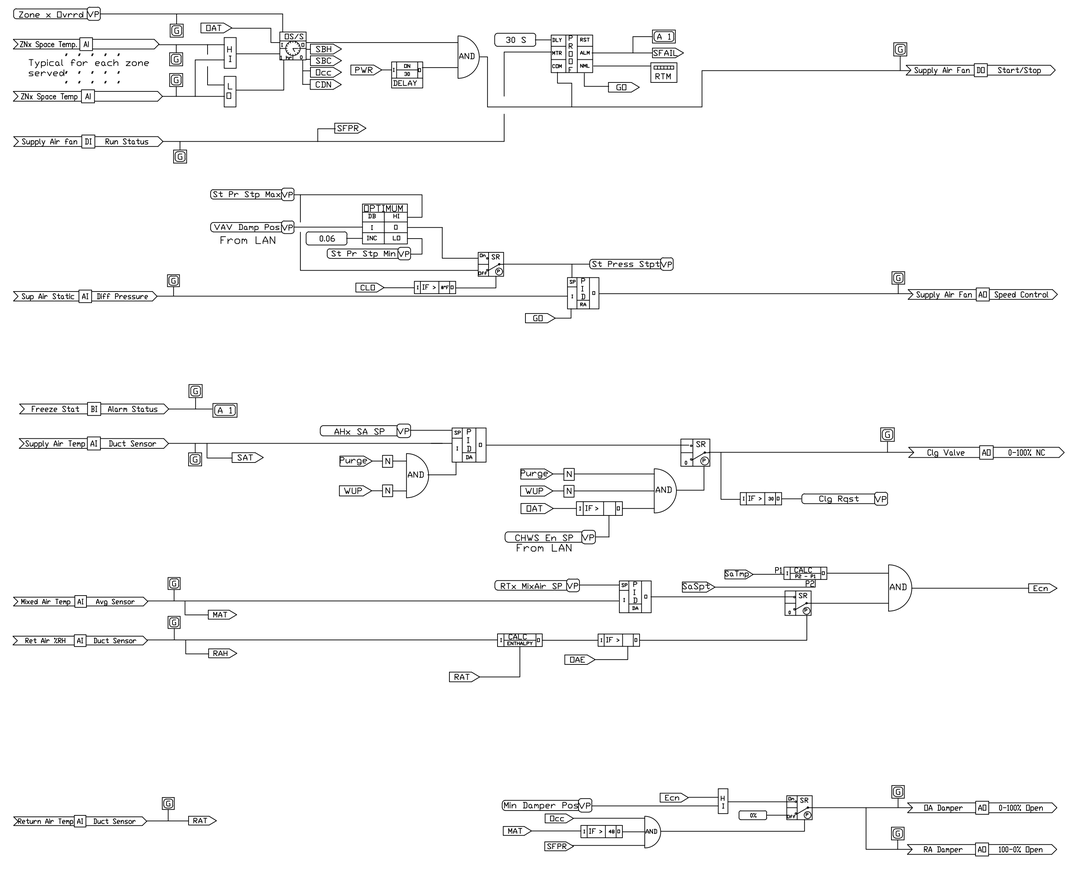
Above Points to be Displayed on AHU Graphic
All Above Points Shall be Accessible by User
All Above Points Shall be Trended



Interupts 24 volt control power to all BAS controller Outputs except Supply Fan

Unit Supply Fan

WIRING DIAGRAMS



AHU – 1, 2

VAV AHU W /CHW COOLING & ECONOMIZER

FAIRFAX COUNTY PUBLIC SCHOOLS

OFFICE OF FACILITIES MANAGEMENT
5025 SIDEBURN ROAD
FAIRFAX, VIRGINIA 22032-2637
TEL.: 703-764-2423

PROJECT TITLE

AUTOMATIC TEMPERATURE CONTROL SYSTEM REPLACEMENT

FAIRVIEW ELEMENTARY SCHOOL

5815 OX ROAD
FAIRFAX STATION, VA 22039

DRAWN SM

CHECKED

DATE 05-16-2024

PROJECT # MMB-085-24

REVISIONS

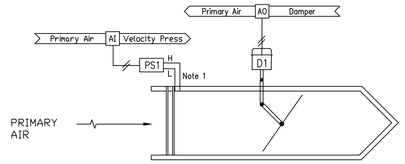
NO.	DATE	DESCRIPTION

DRAWING TITLE

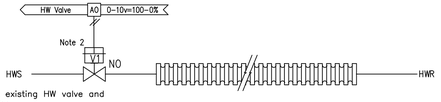
CONTROL DIAGRAMS
AHU- 1, 2

DRAWING NUMBER

M-11

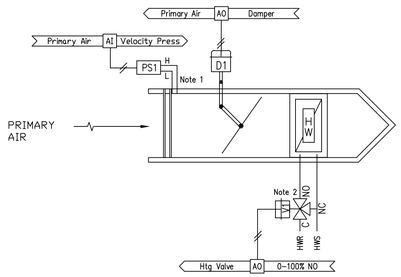


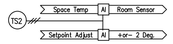
Provide new wall mounted space sensor with manual setpoint adjust.



Note 1: Replace existing velocity sensor with new KELE FXP series velocity sensor or approved equal

Note 2: Replace existing HW valve and actuator with new.





Provide new wall mounted space sensor with manual setpoint adjust.

Note 1: Replace existing velocity sensor with new KELE FXP series velocity sensor or approved equal

Note 2: Replace existing 3-way HW valve and actuator with new normally open to the coil 3-way valve and electronic actuator.

Variable Air Volume Terminal Unit

General: Control shall be pressure independent with minimum and maximum flow setpoints, scheduled occupancy with optimimum preoccupancy, occupancy override. Schedule shall be the same as the parent RTU.

Primary Air Damper: Primary air damper shall modulate in a PI loop to maintain air volume setpoint. Air volume setpoint shall be reset between maximum and minimum volume settings to maintain space temperature cooling setpoint with a 2°F (adj.) reset range. Air volume setpoint shall go to the heating volume setpoint whenever the space temperature falls below the heating space temperature setpoint.

Space Temperature Control: The space temperature shall be controlled by modulating the VAV damper and the hot water coil valve in turn. Two operator adjustable setpoints shall apply, Occupied (74°F adj.) cooling, setback heating (55°F adj.), and setup cooling (85°F adj.). These three values shall be the only values changed by the operator to adjust space temperatures. Occupied space heating setpoint shall be the occupied cooling setpoint minus 3°F (adj.). The actual Occupied setpoints shall be offset +or- 2°F by a manual adjuster on the room sensor.
Night Purge: During night purge cycle, the space cooling setpoint shall be 70°F.

Hydronic Reheat FTR valve shall modulate in a PI loop to maintain space temperature heating setpoint as defined above with a 2°F throttling range. Valve shall be closed whenever the parent RTU is commanded off.
Occupancy Override: When the Occupancy Override timer for the parent AHU or RTU's respective zone is on, the terminal shall be indexed to the Occupied period.
Heating Request: This terminal shall issue a "heating request" as follows"
a) Whenever the heating PI output is at 10% or below
b) Whenever the space temperature falls below the throttling range of the heating PI loop

Hardwired Points

Universal Inputs (Sensors):
1. Primary Air Velocity Press
2. Space Temperature
3. Setpoint Adjust

Digital Outputs (Control):
1. N/A

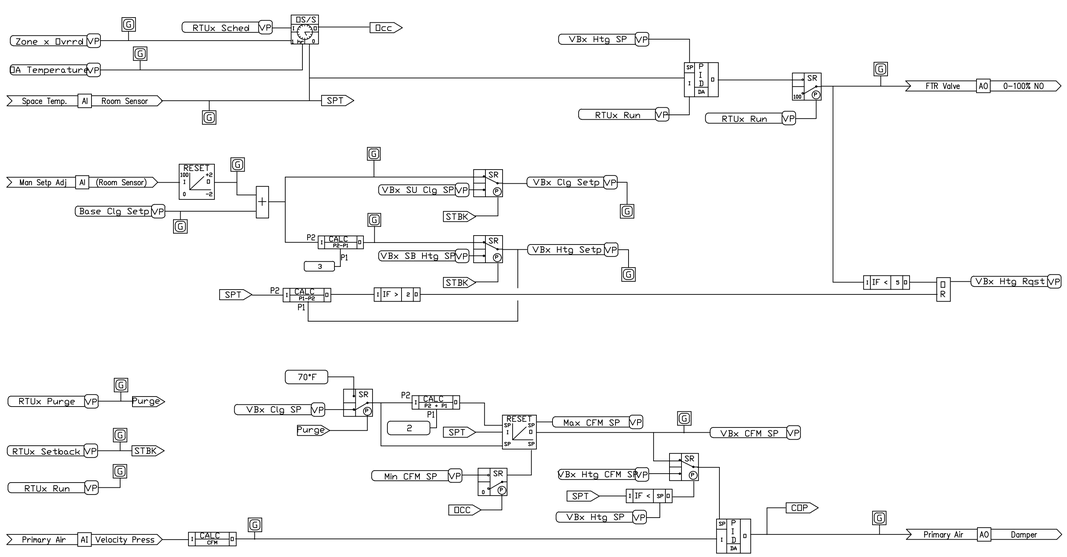
Analog Outputs (Control):
1. Primary Air Damper Control
2. FTR Valve

Virtual Points

Software Flags & Setpoints

1. Scheduled Occupancy
2. Cooling Setpoint
3. Heating Setpoint
4. Adj. Space Setpoint
5. Night Setback (55°F Adj)
6. Night Setup (85°F Adj)
7. Calculated CFM
8. CFM Setpoint
9. Min CFM Setpoint
10. Max CFM Setpoint

Above Points to be Displayed on VAV Graphic
All Above Points Shall be Accessible by User
All Above Points Shall be Trended



VAV UNIT WITH FTR

Variable Air Volume Terminal Unit with Reheat Coil Control

General: Control shall be pressure independent with minimum and maximum flow setpoints, scheduled occupancy with optimimum preoccupancy, occupancy override. Schedule shall be the same as the parent RTU.

Primary Air Damper: Primary air damper shall modulate in a PI loop to maintain air volume setpoint. Air volume setpoint shall be reset between maximum and minimum volume settings to maintain space temperature cooling setpoint with a 2°F (adj.) reset range. Air volume setpoint shall go to the heating volume setpoint whenever the space temperature falls below the heating space temperature setpoint.

Space Temperature Control: The space temperature shall be controlled by modulating the VAV damper and the hot water coil valve in turn. Two operator adjustable setpoints shall apply, Occupied (74°F adj.) cooling, setback heating (55°F adj.), and setup cooling (80°F adj.). These three values shall be the only values changed by the operator to adjust space temperatures. Occupied space heating setpoint shall be the occupied cooling setpoint minus 3°F (adj.). The actual Occupied setpoints shall be offset +or- 2°F by a manual adjuster on the room sensor.
Night Purge: During night purge cycle, the space cooling setpoint shall be 70°F.

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. Valve shall be closed whenever the parent AHU or RTU is commanded off.
Occupancy Override: When the Occupancy Override timer for the parent AHU or RTU's respective zone is on, the terminal shall be indexed to the Occupied period.
Heating Request: This terminal shall issue a "heating request" as follows"
a) Whenever the heating PI output is at 10% or below
b) Whenever the space temperature falls below the throttling range of the heating PI loop

Hardwired Points

Universal Inputs (Sensors):
1. Primary Air Velocity Press
2. Space Temperature
3. Setpoint Adjust

Digital Outputs (Control):
1. N/A

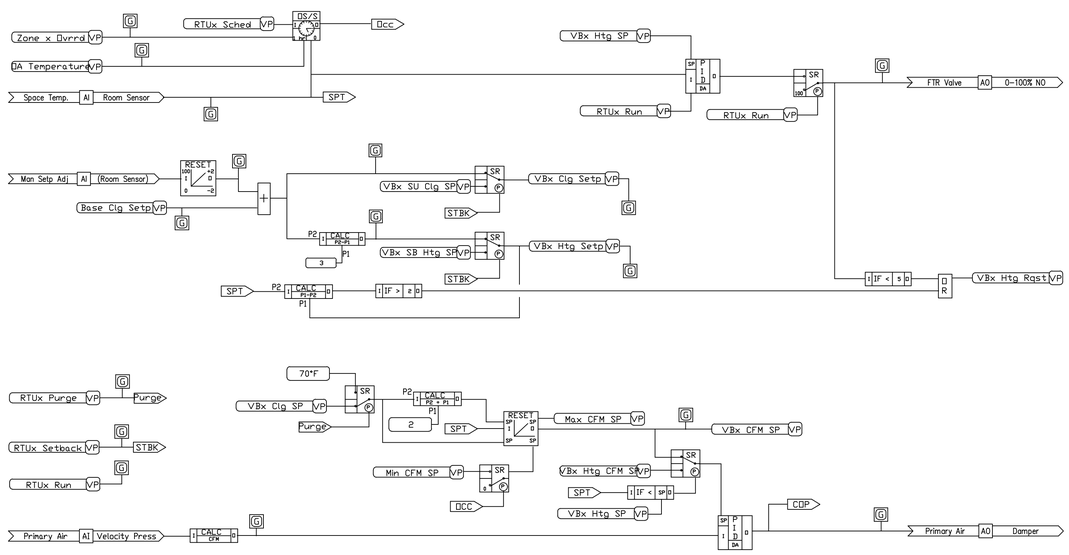
Analog Outputs (Control):
1. Primary Air Damper Control
2. DHC Valve

Virtual Points

Software Flags & Setpoints

1. Scheduled Occupancy
2. Cooling Setpoint
3. Heating Setpoint
4. Adj. Space Setpoint
5. Night Setback (55°F Adj)
6. Night Setup (85°F Adj)
7. Calculated CFM
8. CFM Setpoint
9. Min CFM Setpoint
10. Max CFM Setpoint

Above Points to be Displayed on VAV Graphic
All Above Points Shall be Accessible by User
All Above Points Shall be Trended



VAV UNIT WITH DHC

FAIRFAX COUNTY PUBLIC SCHOOLS

OFFICE OF FACILITIES MANAGEMENT
5025 SIDEBURN ROAD
FAIRFAX, VIRGINIA 22032-2637
TEL.: 703-764-2423

PROJECT TITLE

AUTOMATIC TEMPERATURE CONTROL SYSTEM REPLACEMENT

FAIRVIEW ELEMENTARY SCHOOL

5815 OX ROAD
FAIRFAX STATION, VA 22039

DRAWN SM

CHECKED

DATE 05-16-2024

PROJECT # MMB-085-24

REVISIONS

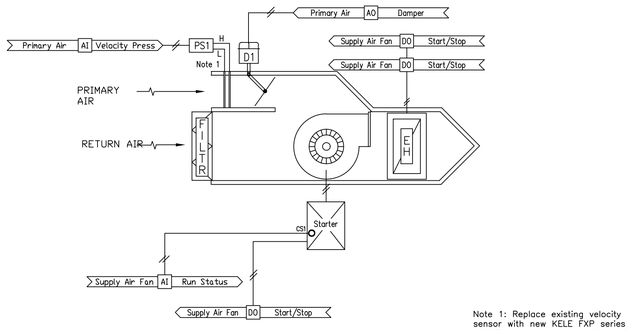
NO.	DATE	DESCRIPTION

DRAWING TITLE

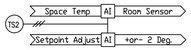
CONTROL DIAGRAMS VAV

DRAWING NUMBER

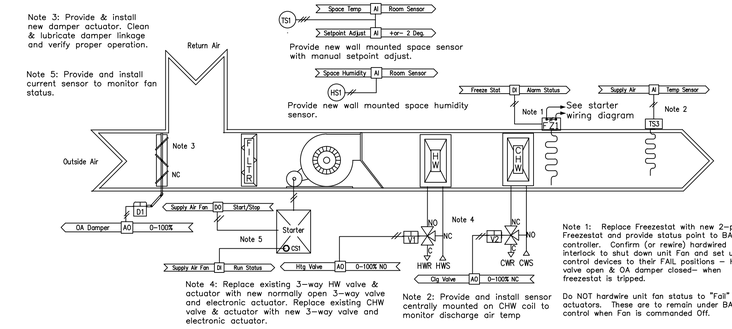
M-12



Note 1: Replace existing velocity sensor with new KELE FXP series velocity sensor or approved equal



Provide new wall mounted space sensor with manual setpoint adjust.



Note 4: Replace existing 3-way HW valve & actuator with new normally open 3-way valve and electronic actuator. Replace existing CHW valve & actuator with new 3-way valve and electronic actuator.

Note 2: Provide and install sensor centrally mounted on CHW coil to monitor discharge air temp

Note 1: Replace Freezestat with new 2-pole Freezestat and provide status point to BAS controller. Confirm (or rewire) hardwired interlock to shut down unit Fan and set unit control devices to their FAIL positions – HW valve open & OA damper closed– when freezestat is tripped.

Do NOT hardwire unit fan status to "Fail" valve actuators. These are to remain under BAS control when Fan is commanded Off.

FAIRFAX COUNTY PUBLIC SCHOOLS

OFFICE OF FACILITIES MANAGEMENT
5025 SIDEBURN ROAD
FAIRFAX, VIRGINIA 22032-2637
TEL.: 703-764-2423

PROJECT TITLE

AUTOMATIC TEMPERATURE CONTROL SYSTEM REPLACEMENT

FAIRVIEW ELEMENTARY SCHOOL

5815 OX ROAD
FAIRFAX STATION, VA 22039

DRAWN SM

CHECKED

DATE 05-16-2024

PROJECT # MMB-085-24

REVISIONS

NO.	DATE	DESCRIPTION

DRAWING TITLE

CONTROL DIAGRAMS
SFB, UV, FCU

DRAWING NUMBER

M-13

Constant Volume Treminal (SFB) Unit Control

General: Control shall be pressure independent with minimum and maximum flow setpoints, scheduled occupancy with optimimum preoccupancy, occupancy override. Schedule shall be the same as the parent RTU.

Unit Fan Control: Unit fan shall be energized and run continuously whenever the parent RTU is energized. During Unoccupied period, the fan shall cycle on if the space temperature rises above its night setup setpoint of 85°F (Adj.)

Primary Air Damper: Primary air damper shall modulate in a PI loop to maintain air volume setpoint. Air volume setpoint shall be reset between maximum and minimum volume settings to maintain space temperature cooling setpoint with a 2°F (adj.) reset range. Air volume setpoint shall remain at minimum volume setting whenever the space temperature is below cooling throttling range.
a) Minimum Volume setpoint shall be as scheduled on the drawings if the parent AHU id energized and shall be set to zero otherwise.

Space Temperature Control: The space temperature shall be controlled by modulating the VAV damper and the hot water coil valve in turn. Two operator adjustable setpoints shall apply, Occupied (74°F adj.) cooling, setback heating (55°F adj.), and setup cooling (85°F adj.). These three values shall be the only values changed by the operator to adjust space temperatures. Occupied space heating setpoint shall be the occupied cooling setpoint minus 3°F (adj.). The actual Occupied setpoints shall be offset +or- 2°F by a manual adjuster on the room sensor.
Night Purge: During night purge cycle, the space cooling setpoint shall be 70°F.

Heating Section: On a fall in space temperature below the heating setpoint AND the fan status proven to be ON, the BAS shall activate the 1st stage of electric heat. When the temperature rises to above the heating setpoint plus 1°F the heat shall de-activate. If the space temp falls to 1°F below the heating setpoint the BAS shall activate the 2nd stage of electric heat. On a rise in space temp to above the heating setpoint the 2nd stage heat shall de-activate. There shall be a minimum of five minute intervals between activating and de-activating the heating stages.

Occupancy Override: When the Occupancy Override timer for the parent RTU's respective zone is on, the terminal shall be indexed to the Occupied period.

Hardwired Points

Universal Inputs (Sensors):

1. Supply Fan Status
2. Primary Air Velocity Press
3. Space Temperature
4. Setpoint Adjust

Digital Outputs (Control):

1. SFB Fan Start/Stop
2. Electric Heat Stage 1
3. Electric Heat Stage 2

Analog Outputs (Control):

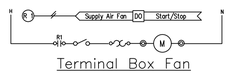
1. Primary Air Damper Control

Virtual Points

Software Flags & Setpoints

1. Scheduled Occupancy
2. Cooling Setpoint
3. Heating Setpoint
4. Adj. Space Setpoint
5. Night Setback (55°F Adj)
6. Night Setup (85°F Adj)
7. Calculated CFM
8. CFM Setpoint
9. Min CFM Setpoint
10. Max CFM Setpoint

Above Points to be Displayed on SFB Graphic
All Above Points Shall be Accessible by User
All Above Points Shall be Trended



Terminal Box Fan

WIRING DIAGRAM

Unit Vent & FCU w/HW/CHW Coils

General: Each unit will have its own Control Module and be fully controlled by the BAS. The unit control logic strategies shall include:
a) Scheduled occupancy
b) Sequenced heating and cooling control
c) Night (unoccupied) Setback
d) Outdoor air intake control based on occupancy

Supply Air Fan: The BAS shall control the starting and stopping of the supply air fan as follows:
1 – The unit fan shall run continuously during the scheduled Occupied period (Or the zone override is active)
2 – BAS shall prove fan operation and use the status indication to accumulate runtime. The BAS shall generate an Alarm if the fan fails to start after a 30 second delay or fails anytime thereafter. However the request for the failed fan shall remain active (as well as the Alarm) until the unit can be serviced and the Alarm is acknowledged.
3 – The unit fan shall be commanded Off when:
a) the Occupied period is over AND the unit is not heating or cooling to maintain night Setup/Setback setpoints.
4 – Once the Fan is shut down it must remain off for at least 2 minutes.
5 – The unit may be overridden On or Off via operator command from a remote central location.

Outside Air Damper BAS shall control the Outside Air (OA) Damper as follows:
1 – When the Unit is de-energized, the OA Damper shall remain in its closed position.
2 – When the Unit is energized for Night Setback, the OA damper shall remain closed.
3 – When the zone is in scheduled Occupied and the supply air temperature is higher than 46°F the BAS shall open the OA Damper to a preset minimum position determined by air balancer.

Space Temperature Control: Control space temperature by modulating the heating & cooling on the Unit as needed. The space temperature setpoints shall be as follows:
Two operator adjustable setpoints shall apply. Occupied Cooling (74°F), setback heating (55°F), and setup cooling (85°F). These values shall be changed by the operator to adjust space temperatures. The Occupied Heating setpoint shall be the Cooling Setpoint minus 3°F. The actual Occupied setpoints shall be offset +or– 2°F by a manual adjuster on the room sensor.

Valve: N.C. cooling and N.O. heating valves shall modulate in a cooling or heating PI loop respectively to maintain applicable space temperature setpoints within a 2°F throttling range. No other control loops except those indicated on the logic diagram shall control the valve. In heating mode, the BAS shall maintain the supply air temperature no less than 46°F.

Unoccupied Setback: During the (scheduled) UnOccupied period the HW Valve shall close. If, during this period, the space temperature falls below the night setback setpoint, the unit fan shall run with the HW valve fully open until the space temp rises to at least 2°F above the NSB setpoint.

Unoccupied Setup: During the (scheduled) Unoccupied period the CHWV shall close. If, during this period, the space temperature rises above the night setup setpoint, the unit fan shall run with the CHW valve fully open until the space temp drops to at least 1°F below the NSU setpoint.

Hardwired Points

Universal Inputs (Sensors):

1. Space Temperature
2. Setpoint Adjust
3. Supply Air Temp
4. Freeze Stat
5. Fan Status
6. Space Humidity

Digital Outputs (Control):

1. Supply Fan Start/Stop

Analog Outputs (Control):

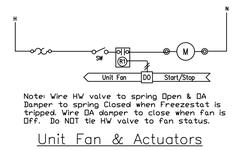
1. Hot Water Valve
2. Chilled Water Valve
3. OA Damper Control

Virtual Points

Software Flags & Setpoints

1. Unit Start Signal
2. Occupied
3. Cooling Setp (74°F Adj)
4. Heating Setp (Clg Setp – 3)
5. Adjusted Space Setpoint
7. Night Setback (55°F Adj)
8. Night Setup (85°F Adj)
9. Heat/Cool Mode

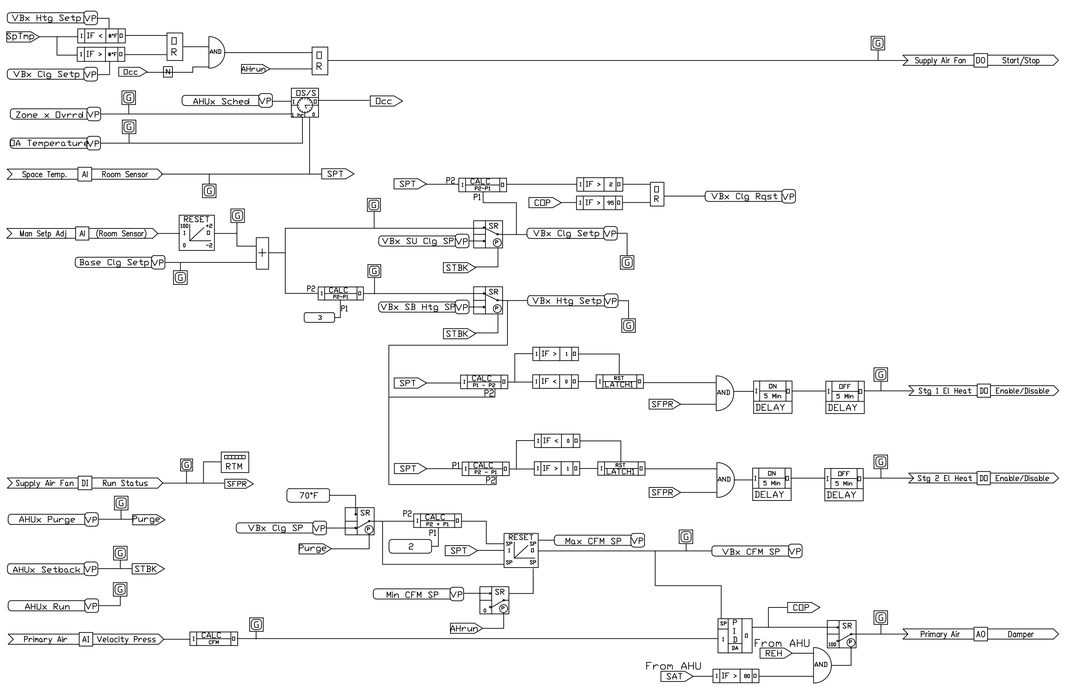
Above Points to be Displayed on Unit Graphic
All Above Points Shall be Accessible by User
All Above Points Shall be Trended



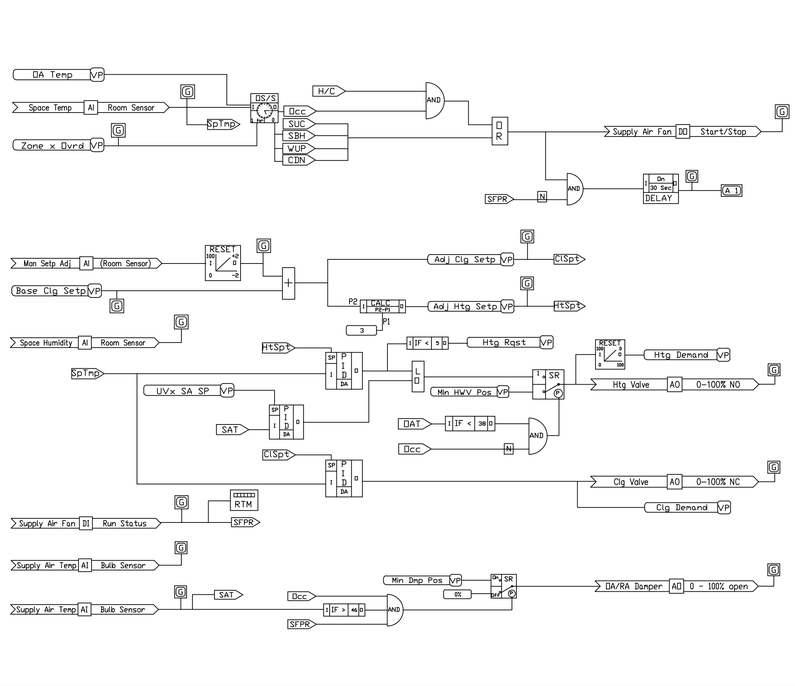
Note: Wire HW valve to spring Open & OA Damper to spring Closed when Freezestat is tripped. Wire OA damper to close when fan is OFF. Do NOT tie HW valve to fan status.

Unit Fan & Actuators

WIRING DIAGRAMS

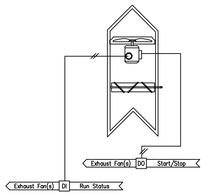


SFB CONSTANT VOLUME TERMINAL WITH ELECTRIC HEAT



UVS & FCU W/ HOT/CHILLED WATER

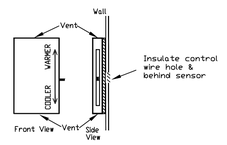
Typical PRV/Exh Fan



Activate exhaust fans to run during Occupied period.

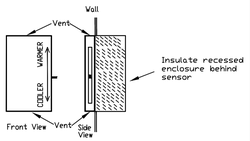
Provide run status for all exhaust fans controlled by BAS

Wall Mounted Vented Cover for Space Sensor

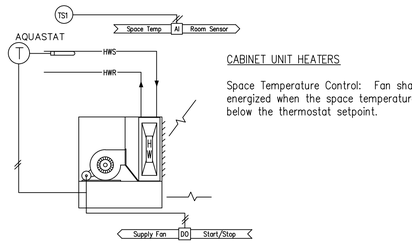


Wall Mounted

Sensor cover should be sufficiently vented to allow room air to freely flow over sensor.



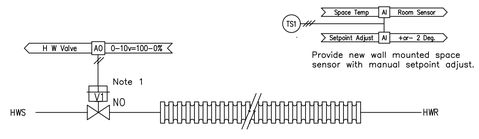
Recessed Enclosure Mounted



CABINET UNIT HEATERS

Space Temperature Control: Fan shall be energized when the space temperature falls below the thermostat setpoint.

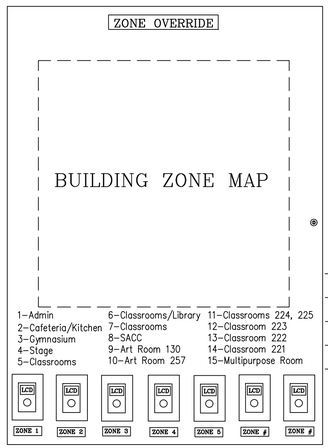
Finned Tube Radiator (FTR)



Space Temperature Control: normally open heating valve shall modulate in a PI loop to maintain space temperature setpoint within a 2°F throttling range.

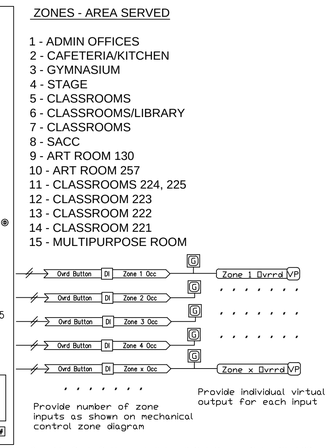
Note 1: Replace existing 2-way HW valve and actuator with new valve and electronic spring return actuator.

ZONE OVERRIDE



ZONES - AREA SERVED

1 - ADMIN OFFICES
2 - CAFETERIA/KITCHEN
3 - GYMNASIUM
4 - STAGE
5 - CLASSROOMS
6 - CLASSROOMS/LIBRARY
7 - CLASSROOMS
8 - SACC
9 - ART ROOM 130
10 - ART ROOM 257
11 - CLASSROOMS 224, 225
12 - CLASSROOM 223
13 - CLASSROOM 222
14 - CLASSROOM 221
15 - MULTIPURPOSE ROOM



OVERRIDE PANEL

General: Provide override panel for manual override of HVAC systems by zone. Location of panel to be determined by FCPS. Panel shall have hinged cover with color coded graphic of building floor plan displaying HVAC control zones and zone descriptions. Face mount momentary contact push buttons along bottom of panel as shown. Provide nameplates designating zones for each override timer.

Override Push Buttons shall be digital time switch with LCD display (Wattstopper TS-400-24), and shall be programmed to provide two hours overtime use when pushed. Zones shall be defined by the Control Zone Diagrams as shown on these control drawings. Upon activation of the zone timer, BAS shall place all HVAC equipment located in the applicable zone into the occupied mode Whenever the override button is pushed while in the active mode, the timer shall be reset to zero and the zone override run request removed.

Reports: The BAS shall log all override data and be made available in a report via operator command.

Global Override Disable Point: Provide an override disable point embedded in the program code which will disable all zone overrides at the same time.

TYPICAL OVERRIDE PANEL

FAIRFAX COUNTY PUBLIC SCHOOLS

OFFICE OF FACILITIES MANAGEMENT
5025 SIDEBURN ROAD
FAIRFAX, VIRGINIA 22032-2637
TEL.: 703-764-2423

PROJECT TITLE

AUTOMATIC TEMPERATURE CONTROL SYSTEM REPLACEMENT

FAIRVIEW ELEMENTARY SCHOOL

5815 OX ROAD
FAIRFAX STATION, VA 22039

DRAWN SM

CHECKED

DATE 05-16-2024

PROJECT # MMB-085-24

REVISIONS

NO.	DATE	DESCRIPTION

DRAWING TITLE

CONTROL DIAGRAMS MISCELLANEOUS

DRAWING NUMBER

M-14

DDC FUNCTION BLOCK LOGIC SYMBOLS

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
POINT NAME AO ADDRESS	OUTPUT POINT - TRANSMITS A VALUE FROM THE FB TO A PHYSICAL OUTPUT CHANNEL ON THE CONTROLLER. DESCRIPTOR - CONTROLLER ADDRESS, POINTNAME AND POINT TYPE AO - ANALOG OUTPUT DO - DIGITAL OUTPUT	SP P I D I D DA	PID CONTROLLER - PROPORTIONAL, INTEGRAL, DERIVATIVE LOOPS USE STANDARD ALGORITHMS TO CALCULATE AN OUTPUT BASED ON A VARIABLE INPUT. PROPORTIONAL IS BASED ON THE DIFFERENCE BETWEEN THE INPUT AND THE SETPOINT. INTEGRAL IS BASED ON THE TIME THE INPUT DEVIATES FROM THE SETPOINT. DERIVATIVE IS BASED ON THE THE RATE THE INPUT IS APPROACHING THE SETPOINT. THE PID CAN BE EITHER DIRECT ACTING (DA) OR REVERSE ACTING (RA). IN A DA PID WHEN THE INPUT INCREASES THE OUTPUT INCREASES. IN A RA PID WHEN THE INPUT INCREASES THE OUTPUT DECREASES.
ADDRESS AI POINT NAME	INPUT POINT - READS A VALUE FROM A PHYSICAL INPUT ON THE CONTROLLER AND CONVERTS FOR USE INSIDE THE FB. DESCRIPTOR - CONTROLLER ADDRESS, POINTNAME AND POINT TYPE AI - ANALOG INPUT DI - DIGITAL INPUT	SP F I T DA PC R E	FLOATING CONTROLLER - OUTPUT WILL INCREASE OR DECREASE INCREMENTALLY AS INPUT DEVIATES FROM SETPOINT. IN A DA CONTROLLER WHEN THE INPUT INCREASES THE OUTPUT INCREASES. IN A RA CONTROLLER WHEN THE INPUT INCREASES THE OUTPUT DECREASES.
POINT-NAME VP	VIRTUAL POINT - ANALOG OR DIGITAL VALUE USED WITHIN A FB OR BROADCAST ACROSS THE LAN.	RESET 100 I 0 100 0 100	RESET CONTROLLER - USER DEFINED OUTPUT VALUE WILL RESET IN A LINEAR RELATIONSHIP BASED ON USER DEFINED INPUT VALUE.
	DIGITAL WIRE - DIGITAL LOGIC CONNECTION BETWEEN FB'S		
	ANALOG WIRE - ANALOG LOGIC CONNECTION BETWEEN FB'S	OFF SR ON R	SWITCHING RELAY - SWITCHES OUTPUT BETWEEN TWO INPUTS WHEN DIGITAL PILOT INPUT IS ON. SWITCH SHOWN IN NORMAL POSITION
CONST	CONSTANT - CONSTANT VALUE INPUTS	OFF DSR I SP2 SP1 ON D	DEADBAND SWITCHING RELAY - DIGITAL OUTPUT CHANGES WHEN INPUT VALUE RISES/FALLS ABOVE/BELOW SETPOINT 1 (SP1). DIGITAL OUTPUT RESTORES TO NORMAL WHEN INPUT RISES/FALLS ABOVE/BELOW SETPOINT 2 (SP2). SWITCH SHOWN IN NORMAL POSITION
G	GRAPHIC INTERFACE - VALUE APPEARS ON GRAPHIC SCREEN	I IF > SP D	LOGICAL IF EXPRESSION - THE OUTPUT IS ON IF THE INPUT MEETS THE CONDITION OF THE SETPOINT.
A##	ALARM & PRIORITY - TRANSMITS AN ALARM AND ALARM PRIORITY TO APPROPRIATE DEVICES.	RAMP CHNG# I # Sec Max 0 MIN	RAMP CONTROLLER - LIMITS THE RATE OF CHANGE OF AN OUTPUT ON AN INCREASE IN VALUE OR A DECREASE IN VALUE. CHNG# - % OF TOTAL MAXIMUM OUTPUT VALUE ALLOWED FOR OUTPUT CHANGE # = TIME IN SECONDS MAX = MAXIMUM OUTPUT VALUE MIN = MINIMUM OUTPUT VALUE
M##	MESSAGE AND NUMBER - TRANSMITS A MESSAGE AND MESSAGE NUMBER TO APPROPRIATE DEVICES.		
	TREND - ESTABLISHES TREND IN CONTROLLER.	TMR I D CLK	TIMER - OUTPUT IS ON FOR A USER SPECIFIED TIME AFTER INPUT CHANGES FROM OFF TO ON
RTM	RUN TIME MONITOR - ACCUMULATES RUNTIME FOR DIGITAL OUTPUT AND CONVERTS TIME TO HOURS.	ATS I D OVRIDE	AUTOMATIC TIME SCHEDULER - INCLUDES SCHEDULES ENTERED INTO CONTROLLER FOR 7 DAY SCHEDULING WITH HOLIDAYS AND OVERRIDE SCHEDULES. INCLUDES OVERRIDE INPUT FOR UNSCHEDULED OVERRIDE. OUTPUTS REFERENCE FLAGS CAN INCLUDE : HEATING SETBACK, COOLING SETBACK, AND UNOCCUPIED
REF#	REFERENCE FLAG - USED AS CONNECTION TO FB'S BY REFERENCE INSTEAD OF WIRES.		
AND	DIGITAL AND GATE- OUTPUT IS ON IF ALL INPUTS ARE TRUE	DS/S I D OVRIDE	OPTIMUM START/STOP TIME SCHEDULER - INCLUDES SCHEDULES ENTERED INTO CONTROLLER FOR 7 DAY SCHEDULING WITH HOLIDAYS AND OVERRIDE SCHEDULES. INCLUDES OPTIMUM START STOP ROUTINE. OUTPUTS REFERENCE FLAGS CAN INCLUDE : WARM-UP, COOL-DOWN, HEATING SETBACK, COOLING SETBACK, AND UNOCCUPIED. INCLUDES OVERRIDE INPUT (OVR) FOR UNSCHEDULED OVERRIDE
OR	DIGITAL OR GATE - OUTPUT IS ON IF ANY INPUT IS TRUE.		
XOR	DIGITAL EXCLUSIVE OR GATE - OUTPUT IS ON IF ONLY ONE INPUT IS TRUE.	I CALC D	CALCULATION BLOCK - OUTPUT IS EQUAL TO CALCULATION USING INPUT(S). EQUATION CAN BE MATHEMATICAL OR A PREDEFINED INDUSTRY STANDARD ALGORITHM (ie. CFM, VELOCITY PRESSURE, ENTHALPY, DEW POINT ETC.)
N	INVERSE (NOT)- IF INPUT = ON, OUTPUT = OFF; CONVERSELY IF INPUT =OFF, OUTPUT =ON	H I	HIGH SELECTOR - SELECTS HIGHER OF INPUT VALUES
RST I LATCH D	LATCH OFF- OUTPUT IS OFF WHENEVER INPUT IS ON. OUTPUT REMAINS OFF UNTIL RESET CHANGES FROM OFF TO ON.	L O	LOW SELECTOR - SELECTS LOWER OF INPUT VALUES
RST I LATCH D	LATCH ON- OUTPUT IS ON WHENEVER INPUT IS ON. OUTPUT REMAINS ON UNTIL RESET CHANGES FROM OFF TO ON.	AVE	AVERAGING BLOCK - MATHEMATICALLY AVERAGES INPUT VALUES.
ON/OFF I # P DELAY	ON/OFF DELAY TIMER- AFTER INPUT IS ON, OUTPUT IS ON/OFF AFTER A PREDETERMINED TIME (#) HAS ELAPSED.	DLY MTR CDM PROOF RST ALM NML	PROOFING MODULE - GENERATES VALUES BASED ON A COMPARISON OF COMMAND AND MONITORING INPUTS. DLY - PROOFING DELAY PERIOD MTR - MONITOR (INPUT FOR PROOF) CDM - COMMAND (INPUT FOR PROOF) RST - RESET (IF LATCHING IS USED) ALM - (ON WHEN MONITOR INPUT IS NOT EQUAL TO COMMAND INPUT) NML - OUTPUT IS ON WHEN MONITOR AND COMMAND INPUTS ARE ON AND NORMAL CONDITIONS ARE MET
CYCLE I # P DELAY	CYCLE DELAY TIMER - WHEN SET TIME HAS ELAPSED, THE FIRST TIME INPUT IS ON, OUTPUT IS ON AND TIMER RESETS. BEFORE SET TIME HAS ELAPSED, OUTPUT IS OFF WHEN INPUT IS OFF. IF INPUT GOES FROM OFF TO ON BEFORE SET TIME HAS ELAPSED, OUTPUT WILL REMAIN OFF.	I TIME AVG. SUM(I(t-x)I(t))/x O	TIME AVERAGE BLOCK - OUTPUT IS EQUAL TO SUM OF INPUTS FROM USER SPECIFIED PREVIOUS TIME PERIOD (OR NUMBER OF SCANS) TO CURRENT TIME (OR SCAN) DIVIDED BY NUMBER OF DISCRETE POINTS IN THE SUMMATION PERIOD. OUTPUT IS A ROLLING TIME BASED AVERAGE OF THE INPUT VALUE.
PWR	POWER FLAG - ON WHEN CONTROLLER IS INITIALLY POWERED ON AND NO PHASE LOSS IS DETECTED	REQUEST NLCK TLCK CLCK NLCK ROTATE A B C D	STAGER BLOCK - OUTPUT IS EQUAL TO SUM OF REQUESTS FROM USER SPECIFIED INPUTS. ROTATION SHALL BE DETERMINED BY USER DEFINED PARAMETERS. EACH INDIVIDUAL OUTPUT CAN BE LOCKED OUT BY USER DEFINED INDIVIDUAL INPUTS. LOCKED OUT OUTPUTS SHALL BE SKIPPED IN ROTATION. (SEE SEQUENCE OF OPERATION FOR DETAILS)
R FF D	FLIP FLOP - CHANGE STATE OF OUTPUT WHEN INPUT CHANGES FROM OFF TO ON. OUTPUT SET TO OFF WHEN RESET (R) GOES CHANGES FROM OFF TO ON		
OPTIMUM DB HI I O INC LO	SETPOINT OPTIMIZATION - RESET OF OUTPUT FROM A MAXIMUM VALUE TO A MINIMUM VALUE BASED ON VALUES OR REQUESTS) DB - DEAD BAND INC - INCREMENT/DECREMENT VALUE HI - MAXIMUM RESET VALUE LO - MINIMUM RESET VALUE		
SP INTVL MX > +100+10 O I S & B _ < -100-10 MN	SAMPLE & BUMP - CHANGE IN OUTPUT (WITH DEFINED MINIMUM & MAXIMUM VALUES) BY A DEFINED AMOUNT WHEN INPUT DEVIATES FROM SETPOINT (SP) BY A DEFINED AMOUNT AT A DEFINED INTERVAL. I - INPUT O - OUTPUT MX - MAXIMUM OUTPUT MN - MINIMUM OUTPUT INTVL - INTERVAL > +IE, +DA - WHEN INPUT RISES ABOVE SETPOINT BY AMOUNT '+IE', OUTPUT IS INCREASED BY AMOUNT '+DA' < -IE, -DA - WHEN INPUT FALLS BELOW SETPOINT BY AMOUNT '-IE', OUTPUT IS REDUCED BY AMOUNT '-DA'		

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 EP1 S	RELAY COILS
TS1	TEMPERATURE SENSOR WITH PIPE WELL		FUSE
HS1	HUMIDITY SENSOR	OL	THERMAL OVERLOAD
TZ1	LOW TEMPERATURE SWITCH (FREEZESTAT)		NORMALLY OPEN AND NORMALLY CLOSED CONTACTS
TS1	HIGH TEMPERATURE SWITCH (FIRESTAT)	HAND AUTO OFF	HAND-OFF-AUTO SELECTOR SWITCH
SD1	SMOKE DETECTOR		WIRING DESIGNATION. (NO. OF HATCHES INDICATES NO. OF CONDUCTORS)
DPS1	DIFFERENTIAL PRESSURE SWITCH		WIRING CONNECTION
FZ1	WATER FLOW SWITCH	ON-OFF	ON-OFF SELECTOR SWITCH
AQ1	DUCT AIR QUALITY SENSOR	TS1	STRAP-ON TEMPERATURE SENSOR
IP1 AO M	CURRENT TO PNEUMATIC TRANSDUCER	T	ROOM TEMPERATURE SENSOR AS SHOWN ON FLOOR PLANS
V1 N.C.	TWO WAY CONTROL VALVE	H	ROOM HUMIDITY SENSOR AS SHOWN ON FLOOR PLANS
V2 C. N.C. N.O.	THREE WAY CONTROL VALVE	DCS	DIGITAL CONTROL STATION
D1	DAMPER ACTUATOR	WI	WAN INTERFACE
WD	WATER DETECTOR	G	PILOT LIGHT (WITH LENS COLOR)
	CURRENT SENSOR	FAR	FIRE ALARM RELAY BY DIV. 16
LS1	LIMIT SWITCH	TDR	TIME DELAY RELAY DELAY ON MAKE OR BREAK
	DPST FREEZESTAT		AIR FLOW MONITORING STATION
R	RELAY - NORMALLY OPEN		

LEGEND	
WIRING DESIGNATIONS	
	NEW WIRING
	WIRING BY OTHERS

FAIRFAX COUNTY PUBLIC SCHOOLS

OFFICE OF FACILITIES MANAGEMENT
5025 SIDEBURN ROAD
FAIRFAX, VIRGINIA 22032-2637
TEL.: 703-764-2423

PROJECT TITLE

AUTOMATIC TEMPERATURE CONTROL SYSTEM REPLACEMENT

FAIRVIEW ELEMENTARY SCHOOL

5815 OX ROAD
FAIRFAX STATION, VA 22039

DRAWN SM

CHECKED

DATE 05-16-2024

PROJECT # MMB-085-24

REVISIONS

NO.	DATE	DESCRIPTION

DRAWING TITLE

STANDARD CONTROL &LOGIC SYMBOLS

DRAWING NUMBER

M-15