

**RTU-2
SEQUENCE OF OPERATION**

RTU-2 (TYPICAL OF 1)

RUN CONDITIONS - REQUESTED:
THE UNIT SHALL RUN WHENEVER:

- ANY ZONE IS OCCUPIED
- OR A DEFINABLE NUMBER OF UNOCCUPIED ZONES NEED HEATING OR COOLING.

FREEZE PROTECTION:

THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A FREEZESTAT STATUS.

HIGH STATIC SHUTDOWN:

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

SUPPLY AIR SMOKE DETECTION:

THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A SUPPLY AIR SMOKE DETECTOR STATUS.

SUPPLY FAN:

THE SUPPLY FAN SHALL RUN ANYTIME THE UNIT IS COMMANDED TO RUN, UNLESS SHUTDOWN ON SAFETIES. TO PREVENT SHORT CYCLING, THE SUPPLY FAN SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME.

ALARMS SHALL BE PROVIDED AS FOLLOWS:

- SUPPLY FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
- SUPPLY FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
- SUPPLY FAN RUNTIME EXCEEDED: STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT (ADJ.).

SUPPLY AIR DUCT STATIC PRESSURE CONTROL:

THE CONTROLLER SHALL MEASURE DUCT STATIC PRESSURE AND SHALL MODULATE THE SUPPLY FAN VFD SPEED TO MAINTAIN A DUCT STATIC PRESSURE SETPOINT OF 1.0 IN H₂O (ADJ.). THE SUPPLY FAN VFD SPEED SHALL NOT DROP BELOW 30% (ADJ.).

ALARMS SHALL BE PROVIDED AS FOLLOWS:

- HIGH SUPPLY AIR STATIC PRESSURE: IF THE SUPPLY AIR STATIC PRESSURE IS 25% (ADJ.) GREATER THAN SETPOINT.
- LOW SUPPLY AIR STATIC PRESSURE: IF THE SUPPLY AIR STATIC PRESSURE IS 25% (ADJ.) LESS THAN SETPOINT.
- SUPPLY FAN VFD FAULT.

SUPPLY AIR TEMPERATURE SETPOINT - OPTIMIZED:

THE CONTROLLER SHALL MONITOR THE SUPPLY AIR TEMPERATURE AND SHALL MAINTAIN A SUPPLY AIR TEMPERATURE SETPOINT RESET BASED ON ZONE COOLING AND HEATING REQUIREMENTS

THE SUPPLY AIR TEMPERATURE SETPOINT SHALL BE RESET FOR COOLING BASED ON ZONE COOLING REQUIREMENTS AS FOLLOWS:

- THE INITIAL SUPPLY AIR TEMPERATURE SETPOINT SHALL BE 55°F (ADJ.).
- AS COOLING DEMAND INCREASES, THE SETPOINT SHALL INCREMENTALLY RESET DOWN TO A MINIMUM OF 53°F (ADJ.).
- AS COOLING DEMAND DECREASES, THE SETPOINT SHALL INCREMENTALLY RESET UP TO A MAXIMUM OF 72°F (ADJ.).

IF MORE ZONES NEED HEATING THAN COOLING, THEN THE SUPPLY AIR TEMPERATURE SETPOINT SHALL BE RESET FOR HEATING AS FOLLOWS:

- THE INITIAL SUPPLY AIR TEMPERATURE SETPOINT SHALL BE 62°F (ADJ.).
- AS HEATING DEMAND INCREASES, THE SETPOINT SHALL INCREMENTALLY RESET UP TO A MAXIMUM OF 85°F (ADJ.).
- AS HEATING DEMAND DECREASES, THE SETPOINT SHALL INCREMENTALLY RESET DOWN TO A MINIMUM OF 72°F (ADJ.).

COOLING STAGES:

THE CONTROLLER SHALL MEASURE THE SUPPLY AIR TEMPERATURE AND STAGE THE COOLING TO MAINTAIN ITS COOLING SETPOINT. TO PREVENT SHORT CYCLING, THERE SHALL BE A USER DEFINABLE (ADJ.) DELAY BETWEEN STAGES, AND EACH STAGE SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME.

THE COOLING SHALL BE ENABLED WHENEVER:

- OUTSIDE AIR TEMPERATURE IS GREATER THAN 60°F (ADJ.).
- AND THE ECONOMIZER (IF PRESENT) IS DISABLED OR FULLY OPEN.
- AND THE SUPPLY FAN STATUS IS ON.
- AND THE HEATING (IF PRESENT) IS NOT ACTIVE.

ALARMS SHALL BE PROVIDED AS FOLLOWS:

- HIGH SUPPLY AIR TEMP: IF THE SUPPLY AIR TEMPERATURE IS 5°F (ADJ.) GREATER THAN SETPOINT.

ELECTRIC HEATING STAGES:

THE CONTROLLER SHALL MEASURE THE SUPPLY AIR TEMPERATURE AND STAGE THE HEATING TO MAINTAIN ITS HEATING SETPOINT. TO PREVENT SHORT CYCLING, THERE SHALL BE A USER DEFINABLE (ADJ.) DELAY BETWEEN STAGES, AND EACH STAGE SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME.

THE HEATING SHALL BE ENABLED WHENEVER:

- OUTSIDE AIR TEMPERATURE IS LESS THAN 65°F (ADJ.).
- AND THE SUPPLY FAN STATUS IS ON.
- AND THE COOLING (IF PRESENT) IS NOT ACTIVE.

THE HEATING STAGES SHALL RUN FOR FREEZE PROTECTION WHENEVER:

- SUPPLY AIR TEMPERATURE DROPS FROM 40° TO 35°F (ADJ.).
- AND THE SUPPLY FAN STATUS IS ON.

ALARMS SHALL BE PROVIDED AS FOLLOWS:

- LOW SUPPLY AIR TEMP: IF THE SUPPLY AIR TEMPERATURE IS 5°F (ADJ.) LESS THAN SETPOINT.

ECONOMIZER:

THE CONTROLLER SHALL MEASURE THE MIXED AIR TEMPERATURE AND MODULATE THE ECONOMIZER DAMPERS IN SEQUENCE TO MAINTAIN A SETPOINT 2°F (ADJ.) LESS THAN THE SUPPLY AIR TEMPERATURE SETPOINT. THE OUTSIDE AIR DAMPERS SHALL MAINTAIN A MINIMUM ADJUSTABLE POSITION OF 20% (ADJ.) OPEN WHENEVER OCCUPIED.

THE ECONOMIZER SHALL BE ENABLED WHENEVER:

- OUTSIDE AIR TEMPERATURE IS LESS THAN 65°F (ADJ.).
- AND THE OUTSIDE AIR ENTHALPY IS LESS THAN 22 BTU/LB (ADJ.).
- AND THE OUTSIDE AIR TEMPERATURE IS LESS THAN THE RETURN AIR TEMPERATURE.
- AND THE OUTSIDE AIR ENTHALPY IS LESS THAN THE RETURN AIR ENTHALPY.
- AND THE SUPPLY FAN STATUS IS ON.

THE ECONOMIZER SHALL CLOSE WHENEVER:

- MIXED AIR TEMPERATURE DROPS FROM 40°F TO 35°F (ADJ.).
- OR THE FREEZESTAT (IF PRESENT) IS ON.
- OR ON LOSS OF SUPPLY FAN STATUS.

THE OUTSIDE AND EXHAUST AIR DAMPERS SHALL CLOSE AND THE RETURN AIR DAMPER SHALL OPEN WHEN THE UNIT IS OFF. IF OPTIMAL START UP IS AVAILABLE THE MIXED AIR DAMPER SHALL OPERATE AS DESCRIBED IN THE OCCUPIED MODE EXCEPT THAT THE OUTSIDE AIR DAMPER SHALL MODULATE TO FULLY CLOSED.

MINIMUM OUTSIDE AIR VENTILATION - CARBON DIOXIDE (CO₂) CONTROL:
WHEN IN THE OCCUPIED MODE, THE CONTROLLER SHALL MONITOR ZONE CO₂ CONCENTRATIONS SERVED BY THIS AIR HANDLING UNIT. THE CONTROLLER SHALL TAKE THE HIGHEST ZONE CO₂ CONCENTRATION AND MODULATE THE OUTSIDE AIR DAMPERS OPEN ON RISING CO₂ CONCENTRATIONS, OVERRIDING NORMAL DAMPER OPERATION TO MAINTAIN A CO₂ SETPOINT OF 750 PPM (ADJ.).

ALARMS SHALL BE PROVIDED AS FOLLOWS:

- HIGH ZONE CARBON DIOXIDE CONCENTRATION: IF THE HIGHEST ZONE CO₂ CONCENTRATION IS GREATER THAN 1000 PPM (ADJ.).

PREFILTER DIFFERENTIAL PRESSURE MONITOR:

THE CONTROLLER SHALL MONITOR THE DIFFERENTIAL PRESSURE ACROSS THE PREFILTER.

ALARMS SHALL BE PROVIDED AS FOLLOWS:

- PREFILTER CHANGE REQUIRED: PREFILTER DIFFERENTIAL PRESSURE EXCEEDS A USER DEFINABLE LIMIT (ADJ.).

MIXED AIR TEMPERATURE:

THE CONTROLLER SHALL MONITOR THE MIXED AIR TEMPERATURE AND USE AS REQUIRED FOR ECONOMIZER CONTROL (IF PRESENT) OR PREHEATING CONTROL (IF PRESENT).

ALARMS SHALL BE PROVIDED AS FOLLOWS:

- HIGH MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS GREATER THAN 90°F (ADJ.).
- LOW MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS LESS THAN 45°F (ADJ.).

RETURN AIR CARBON DIOXIDE (CO₂) CONCENTRATION MONITORING:

THE CONTROLLER SHALL MEASURE THE RETURN AIR CO₂ CONCENTRATION.

ALARMS SHALL BE PROVIDED AS FOLLOWS:

- HIGH RETURN AIR CARBON DIOXIDE CONCENTRATION: IF THE RETURN AIR CO₂ CONCENTRATION IS GREATER THAN 1000 PPM (ADJ.) WHEN IN THE UNIT IS RUNNING.

RETURN AIR HUMIDITY:

THE CONTROLLER SHALL MONITOR THE RETURN AIR HUMIDITY AND USE AS REQUIRED FOR ECONOMIZER CONTROL (IF PRESENT) OR HUMIDITY CONTROL (IF PRESENT).

ALARMS SHALL BE PROVIDED AS FOLLOWS:

- HIGH RETURN AIR HUMIDITY: IF THE RETURN AIR HUMIDITY IS GREATER THAN 70% (ADJ.).
- LOW RETURN AIR HUMIDITY: IF THE RETURN AIR HUMIDITY IS LESS THAN 35% (ADJ.).

RETURN AIR TEMPERATURE:

THE CONTROLLER SHALL MONITOR THE RETURN AIR TEMPERATURE AND USE AS REQUIRED FOR ZONE CONTROL OR ECONOMIZER CONTROL (IF PRESENT).

ALARMS SHALL BE PROVIDED AS FOLLOWS:

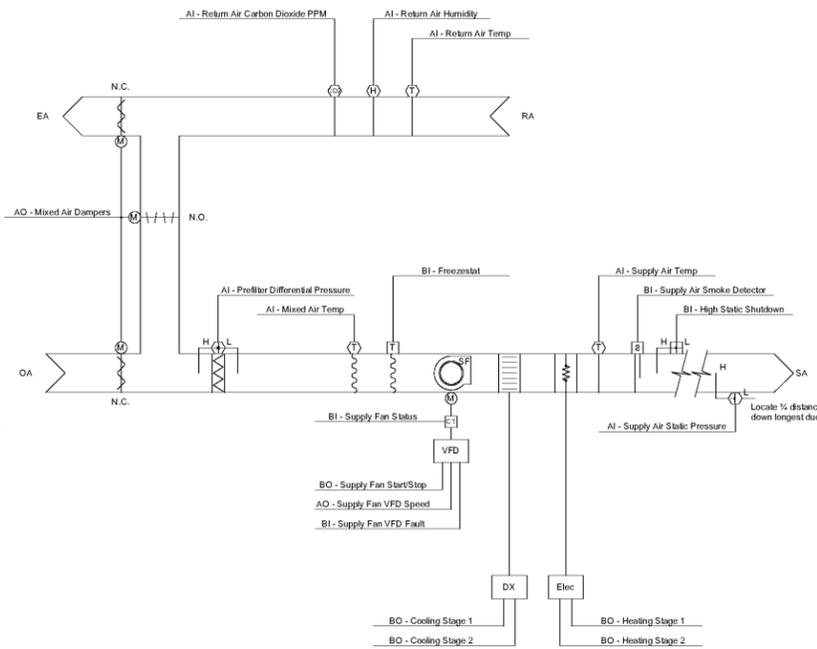
- HIGH RETURN AIR TEMP: IF THE RETURN AIR TEMPERATURE IS GREATER THAN 90°F (ADJ.).
- LOW RETURN AIR TEMP: IF THE RETURN AIR TEMPERATURE IS LESS THAN 45°F (ADJ.).

SUPPLY AIR TEMPERATURE:

THE CONTROLLER SHALL MONITOR THE SUPPLY AIR TEMPERATURE.

ALARMS SHALL BE PROVIDED AS FOLLOWS:

- HIGH SUPPLY AIR TEMP: IF THE SUPPLY AIR TEMPERATURE IS GREATER THAN 90°F (ADJ.).
- LOW SUPPLY AIR TEMP: IF THE SUPPLY AIR TEMPERATURE IS LESS THAN 45°F (ADJ.).



POINT NAME	HARDWARE POINTS					SOFTWARE POINTS					SHOW ON GRAPHIC	
	AI	AO	BI	BO	BV	LOOP	SCHED	TREND	ALARM			
MIX AIR TEMP	X							X		X		
PREFILTER DIFFERENTIAL PRESSURE	X							X		X		
RETURN AIR CARBON DIOXIDE PPM	X							X		X		
RETURN AIR HUMIDITY	X							X		X		
RETURN AIR TEMP	X							X		X		
SUPPLY AIR STATIC PRESSURE	X							X	X	X		
SUPPLY AIR TEMP	X							X		X		
MIXED AIR DAMPERS		X						X		X		
SUPPLY FAN VFD SPEED		X						X		X		
FREEZESTAT			X					X	X	X		
HIGH STATIC SHUTDOWN			X					X	X	X		
SUPPLY AIR SMOKE DETECTOR			X					X	X	X		
SUPPLY FAN STATUS			X					X		X		
SUPPLY FAN VFD FAULT			X					X		X		
COOLING STAGE 1			X					X		X		
COOLING STAGE 2			X					X		X		
HEATING STAGE 1			X					X		X		
HEATING STAGE 2			X					X		X		
SUPPLY FAN START/STOP			X					X		X		
ECONOMIZER MIXED AIR TEMP SETPOINT								X		X		
SUPPLY AIR STATIC PRESSURE SETPOINT				X				X		X		
SUPPLY AIR TEMP SETPOINT			X					X		X		
ZONE CARBON DIOXIDE PPM			X					X		X		
ZONE CARBON DIOXIDE PPM SETPOINT			X					X		X		
COMPRESSOR RUNTIME EXCEEDED									X			
HIGH MIXED AIR TEMP									X			
HIGH RETURN AIR CARBON DIOXIDE CONCENTRATION									X			
HIGH RETURN AIR HUMIDITY									X			
HIGH RETURN AIR TEMP									X			
HIGH SUPPLY AIR TEMP									X			
LOW SUPPLY AIR TEMP									X			
LOW ZONE CARBON DIOXIDE CONCENTRATION									X			
LOW MIXED AIR TEMP									X			
LOW RETURN AIR HUMIDITY									X			
LOW RETURN AIR TEMP									X			
LOW SUPPLY AIR STATIC PRESSURE									X			
LOW SUPPLY AIR TEMP									X			
LOW SUPPLY AIR TEMP									X			
PREFILTER CHANGE REQUIRED									X	X		
SUPPLY FAN FAILURE									X			
SUPPLY FAN IN HAND									X			
SUPPLY FAN RUNTIME EXCEEDED									X			
TOTALS	7	2	5	5	5	0	0	0	23	24	24	
TOTAL HARDWARE (19)												
TOTAL SOFTWARE (62)												

**RTU-3, 5 & 6
SEQUENCE OF OPERATION**

RTU-3, 5 & 6 (TYPICAL OF 3)

RUN CONDITIONS - SCHEDULED:
THE UNIT SHALL RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:

- OCCUPIED MODE: THE UNIT SHALL MAINTAIN
 - A 75°F (ADJ.) COOLING SETPOINT
 - A 70°F (ADJ.) HEATING SETPOINT.
- UNOCCUPIED MODE (NIGHT SETBACK): THE UNIT SHALL MAINTAIN
 - A 65°F (ADJ.) COOLING SETPOINT
 - A 55°F (ADJ.) HEATING SETPOINT.

ALARMS SHALL BE PROVIDED AS FOLLOWS:

- HIGH ZONE TEMP: IF THE ZONE TEMPERATURE IS GREATER THAN THE COOLING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).
- LOW ZONE TEMP: IF THE ZONE TEMPERATURE IS LESS THAN THE HEATING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).

ZONE SETPOINT ADJUST:

THE OCCUPANT SHALL BE ABLE TO ADJUST THE ZONE TEMPERATURE HEATING AND COOLING SETPOINTS AT THE ZONE SENSOR.

ZONE OPTIMAL START:

THE UNIT SHALL USE AN OPTIMAL START ALGORITHM FOR MORNING START-UP. THIS ALGORITHM SHALL MINIMIZE THE UNOCCUPIED WARM-UP OR COOL-DOWN PERIOD WHILE STILL ACHIEVING COMFORT CONDITIONS BY THE START OF SCHEDULED OCCUPIED PERIOD.

ZONE UNOCCUPIED OVERRIDE:

A TIMED LOCAL OVERRIDE CONTROL SHALL ALLOW AN OCCUPANT TO OVERRIDE THE SCHEDULE AND PLACE THE UNIT INTO AN OCCUPIED MODE FOR AN ADJUSTABLE PERIOD OF TIME. AT THE EXPIRATION OF THIS TIME, CONTROL OF THE UNIT SHALL AUTOMATICALLY RETURN TO THE SCHEDULE.

EMERGENCY SHUTDOWN:

THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING AN EMERGENCY SHUTDOWN SIGNAL.

SUPPLY FAN:

THE SUPPLY FAN SHALL RUN ANYTIME THE UNIT IS COMMANDED TO RUN, UNLESS SHUTDOWN ON SAFETIES. TO PREVENT SHORT CYCLING, THE SUPPLY FAN SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME.

ALARMS SHALL BE PROVIDED AS FOLLOWS:

- SUPPLY FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
- SUPPLY FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
- SUPPLY FAN RUNTIME EXCEEDED: STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT (ADJ.).

COOLING STAGE:

THE CONTROLLER SHALL MEASURE THE ZONE TEMPERATURE AND STAGE THE COOLING TO MAINTAIN ITS COOLING SETPOINT. TO PREVENT SHORT CYCLING, THE STAGE SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME.

THE COOLING SHALL BE ENABLED WHENEVER:

- OUTSIDE AIR TEMPERATURE IS GREATER THAN 60°F (ADJ.).
- AND THE ECONOMIZER (IF PRESENT) IS DISABLED OR FULLY OPEN.
- AND THE ZONE TEMPERATURE IS ABOVE COOLING SETPOINT.
- AND THE SUPPLY FAN STATUS IS ON.
- AND THE HEATING IS NOT ACTIVE.

ELECTRIC HEATING STAGE:

THE CONTROLLER SHALL MEASURE THE ZONE TEMPERATURE AND STAGE THE HEATING TO MAINTAIN ITS HEATING SETPOINT. TO PREVENT SHORT CYCLING, THE STAGE SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME.

THE HEATING SHALL BE ENABLED WHENEVER:

- OUTSIDE AIR TEMPERATURE IS LESS THAN 65°F (ADJ.).
- AND THE ZONE TEMPERATURE IS BELOW HEATING SETPOINT.
- AND THE SUPPLY FAN STATUS IS ON.
- AND THE COOLING IS NOT ACTIVE.

MIXED AIR DAMPERS:

THE MIXED AIR DAMPERS SHALL OPEN TO PROVIDE MINIMUM OUTSIDE AIR VENTILATION ANYTIME THE UNIT IS OCCUPIED. THE MIXED AIR DAMPERS SHALL CLOSE 5 SEC (ADJ.) AFTER THE SUPPLY FAN STOPS.

IF OPTIMAL START IS AVAILABLE:

THE OUTSIDE AIR DAMPER SHALL CLOSE AND THE RETURN AIR DAMPER SHALL OPEN.

PREFILTER DIFFERENTIAL PRESSURE MONITOR:

THE CONTROLLER SHALL MONITOR THE DIFFERENTIAL PRESSURE ACROSS THE PREFILTER.

ALARMS SHALL BE PROVIDED AS FOLLOWS:

- PREFILTER CHANGE REQUIRED: PREFILTER DIFFERENTIAL PRESSURE EXCEEDS A USER DEFINABLE LIMIT (ADJ.).

MIXED AIR TEMPERATURE:

THE CONTROLLER SHALL MONITOR THE MIXED AIR TEMPERATURE AND USE AS REQUIRED FOR ECONOMIZER CONTROL (IF PRESENT) OR PREHEATING CONTROL (IF PRESENT).

ALARMS SHALL BE PROVIDED AS FOLLOWS:

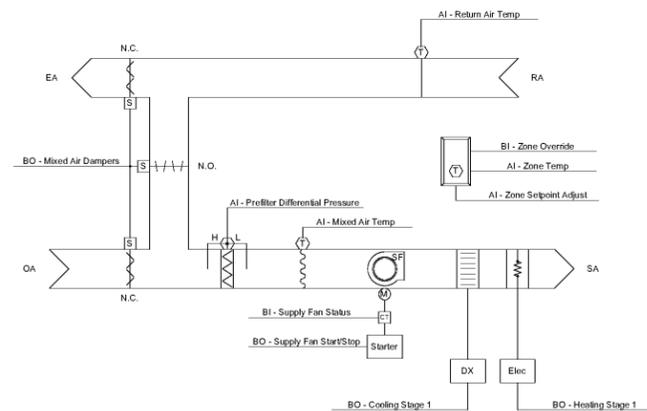
- HIGH MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS GREATER THAN 90°F (ADJ.).
- LOW MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS LESS THAN 45°F (ADJ.).

RETURN AIR TEMPERATURE:

THE CONTROLLER SHALL MONITOR THE RETURN AIR TEMPERATURE AND USE AS REQUIRED FOR ECONOMIZER CONTROL (IF PRESENT).

ALARMS SHALL BE PROVIDED AS FOLLOWS:

- HIGH RETURN AIR TEMP: IF THE RETURN AIR TEMPERATURE IS GREATER THAN 90°F (ADJ.).
- LOW RETURN AIR TEMP: IF THE RETURN AIR TEMPERATURE IS LESS THAN 45°F (ADJ.).



POINT NAME	HARDWARE POINTS					SOFTWARE POINTS					SHOW ON GRAPHIC
	AI	AO	BI	BO	BV	LOOP	SCHED	TREND	ALARM		
MIX AIR TEMP	X							X		X	
PREFILTER DIFFERENTIAL PRESSURE	X							X		X	
RETURN AIR TEMP	X							X		X	
ZONE SETPOINT ADJUST	X							X		X	
ZONE TEMP	X							X		X	
SUPPLY FAN STATUS			X					X		X	
ZONE OVERRIDE	X							X		X	
COOLING STAGE 1			X					X		X	
HEATING STAGE 1			X					X		X	
MIXED AIR DAMPERS			X					X		X	
SUPPLY FAN START/STOP			X					X		X	
COOLING SETPOINT			X					X		X	
HEATING SETPOINT											