

POUDRE HIGH SCHOOL RENOVATIONS

AS-BUILT

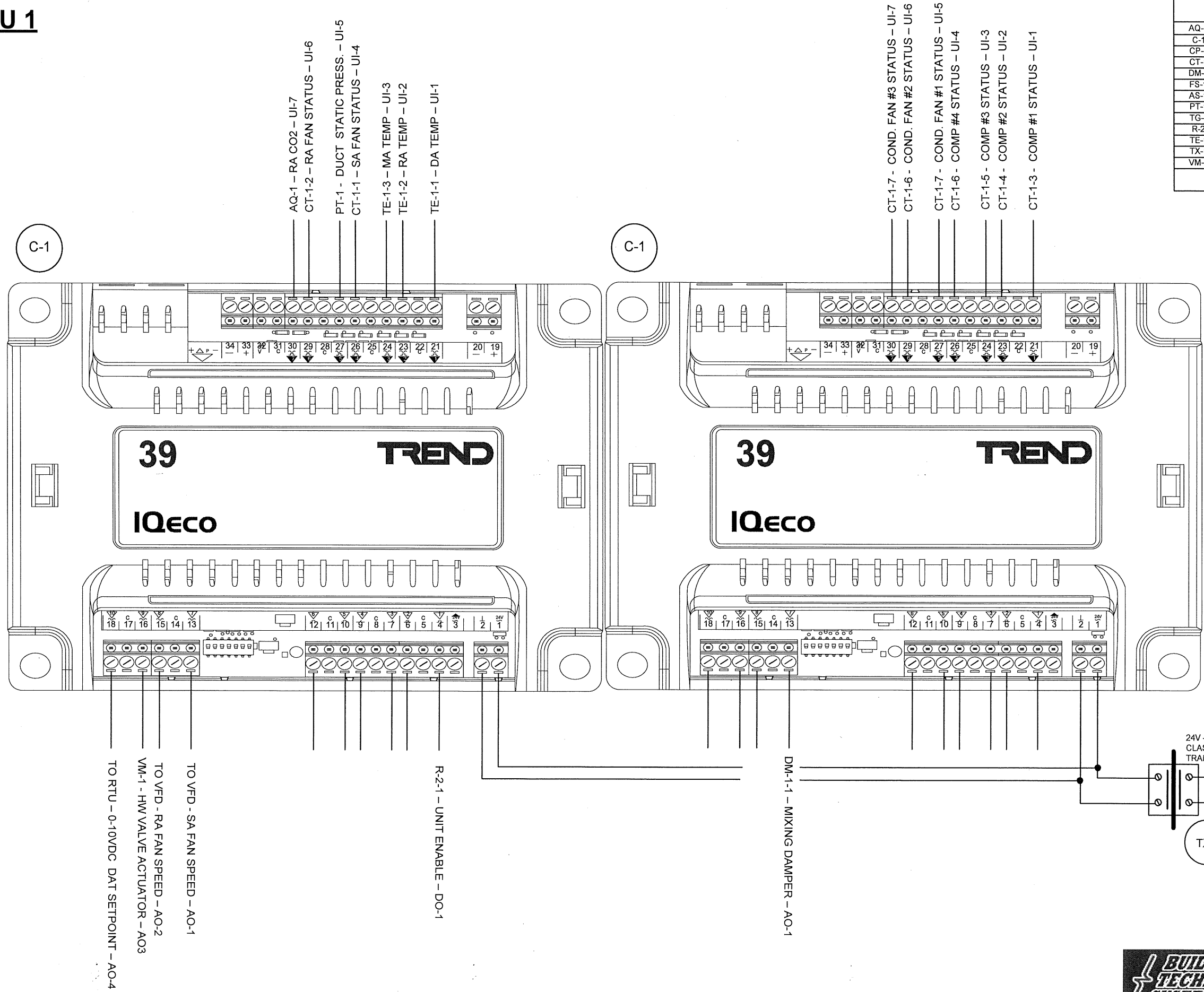
201 IMPALA DRIVE
FORT COLLINS, COLORADO

TEMPERATURE CONTROL DRAWINGS

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RTU 1



BILL OF MATERIALS	
AQ-1	DUCT MOUNTED CO2 SENSOR
C-1	RTU CONTROLLER IQeco 39
CP-1	CONTROL PANEL
CT-1	CURRENT RELAY, SPLIT CORE
DM-1	DAMPER MOTOR
FS-1	FREEZE STAT, AUTO RESET
AS-1	DUCT HIGH LIMIT AIR SWITCH (MANUAL RESET)
PT-1	DUCT PRESSURE TRANSDUCER
TG-1	THERMOSTAT GUARD
R-2	CONTROL RELAY 24vac
TE-1	DUCT MOUNTED TEMPERATURE SENSOR
TX-1	CONTROL TRANSFORMER 100va
VM-1	HOT WATER VALVE ACTUATOR

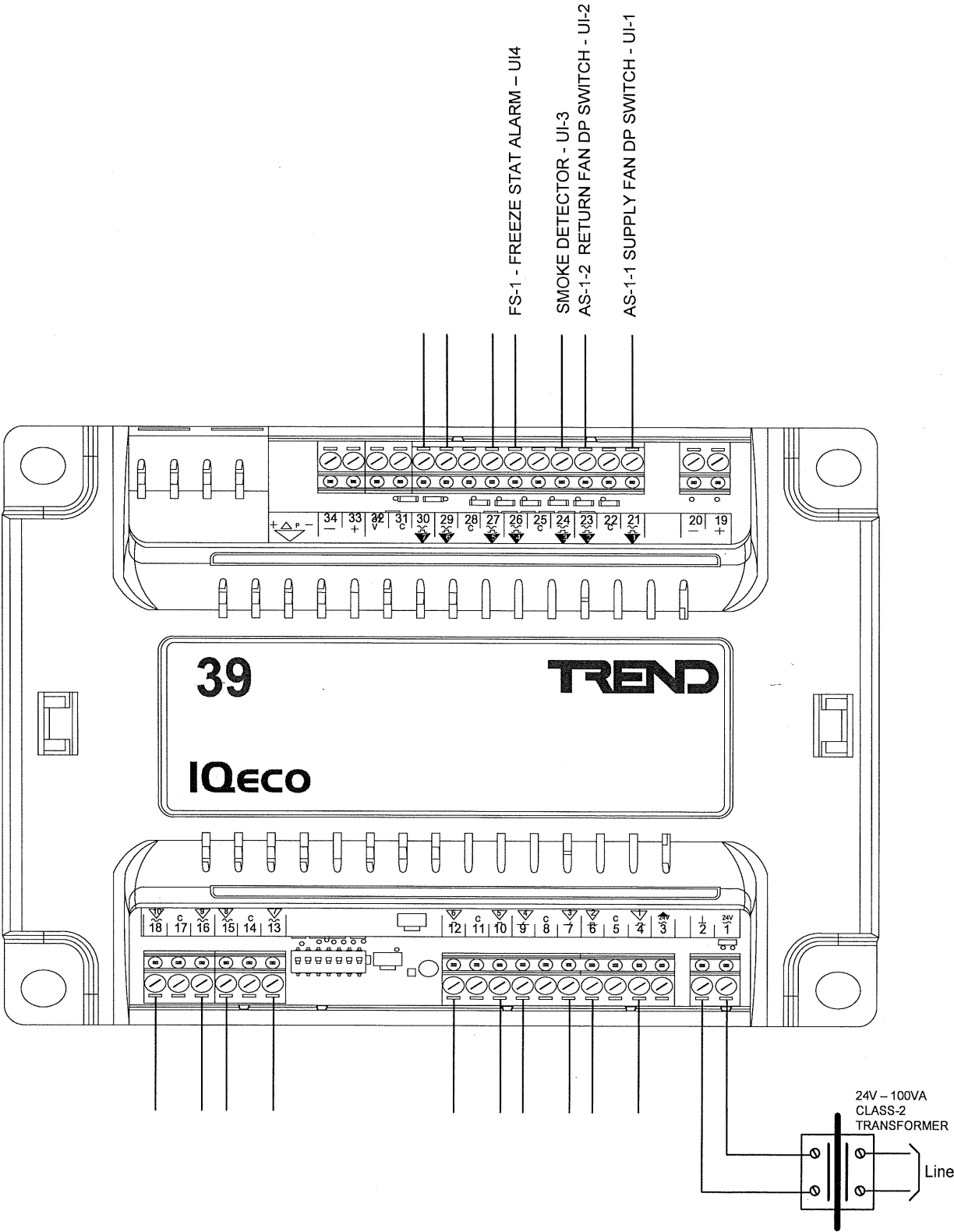
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RTU CONTROLLER IQeco 39	
POUDRE HIGH SCHOOL RENOVATIONS	
Building Technology Systems 1270 S. Lipan DENVER CO. 80223 (303)744.2235 Fax 744.0037	
Drawing No. 2	Drawn by: JASON BROOS 4/10/12

RTU 1

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BILL OF MATERIALS

AQ-1	DUCT MOUNTED CO2 SENSOR
AS-1	CONTROL PANEL
C-1	RTU CONTROLLER IQeco 39
CP-1	CONTROL PANEL
CT-1	CURRENT RELAY, SPLIT CORE
DM-1	DAMPER MOTOR
FS-1	FREEZE STAT, AUTO RESET
HL-1	DUCT HIGH STATIC AIR SWITCH
PT-1	DUCT PRESSURE TRANSDUCER
PT-2	ROOM PRESSURE TRANSDUCER
R-2	CONTROL RELAY 24vac
TE-1	DUCT MOUNTED TEMPERATURE SENSOR
TX-1	CONTROL TRANSFORMER 100va
VM-1	HOT WATER VALVE ACTUATOR

RTU CONTROLLER
IQeco 39

POUDRE HIGH SCHOOL
RENOVATIONS

Building Technology Systems
1270 S. Lipan
DENVER CO. 80223
(303)744.2235 Fax 744.0037

Drawing No.

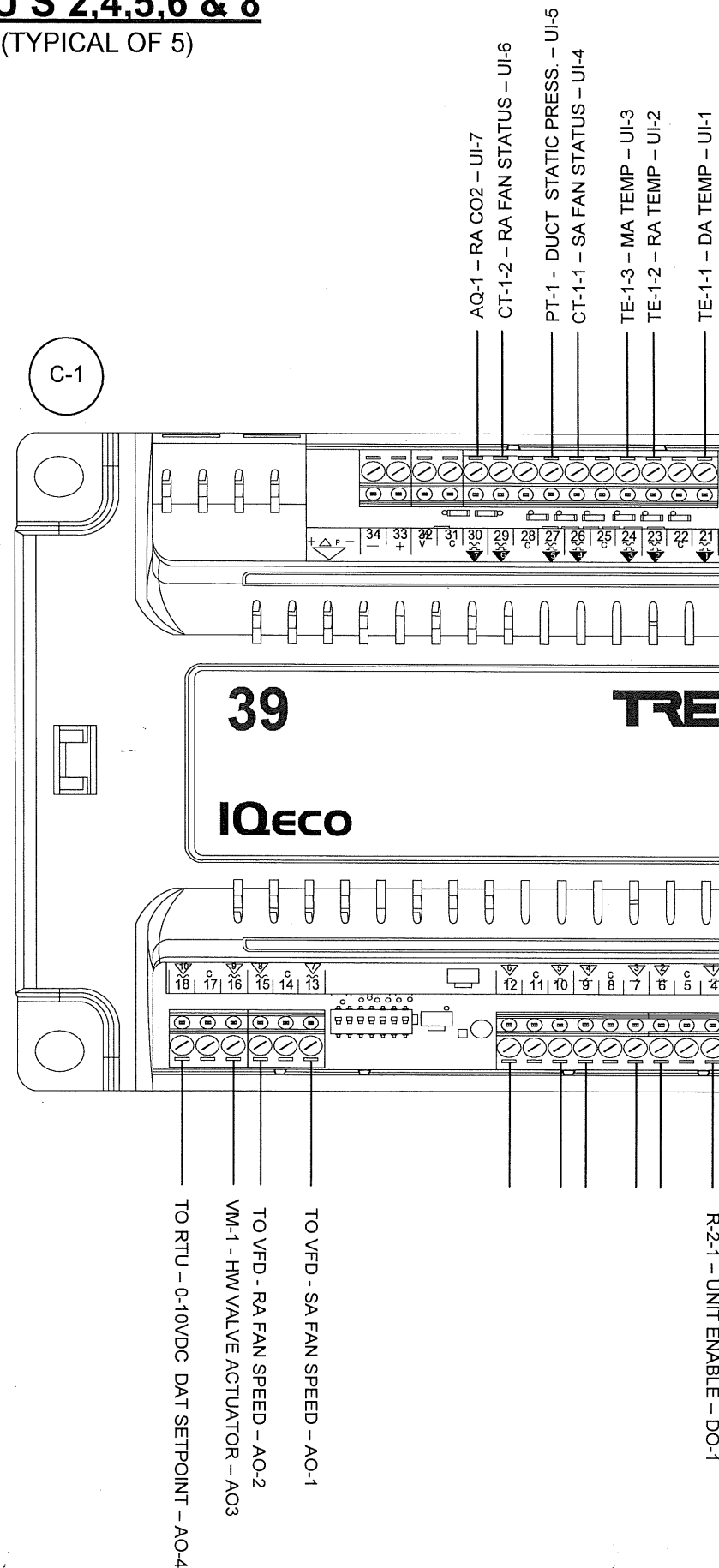
3

Drawn by:
JASON BROOS

4/10/12



RTU'S 2,4,5,6 & 8 (TYPICAL OF 5)



BILL OF MATERIALS	
AQ-1	DUCT MOUNTED CO2 SENSOR
C-1	RTU CONTROLLER IQeco 39
CP-1	CONTROL PANEL
CT-1	CURRENT RELAY, SPLIT CORE
DM-1	DAMPER MOTOR
FS-1	FREEZE STAT, AUTO RESET
AS-1	DUCT HIGH LIMIT AIR SWITCH (MANUAL RESET)
PT-1	DUCT PRESSURE TRANSDUCER
TG-1	THERMOSTAT GUARD
R-2	CONTROL RELAY 24vac
TE-1	DUCT MOUNTED TEMPERATURE SENSOR
TX-1	CONTROL TRANSFORMER 100va
VM-1	HOT WATER VALVE ACTUATOR

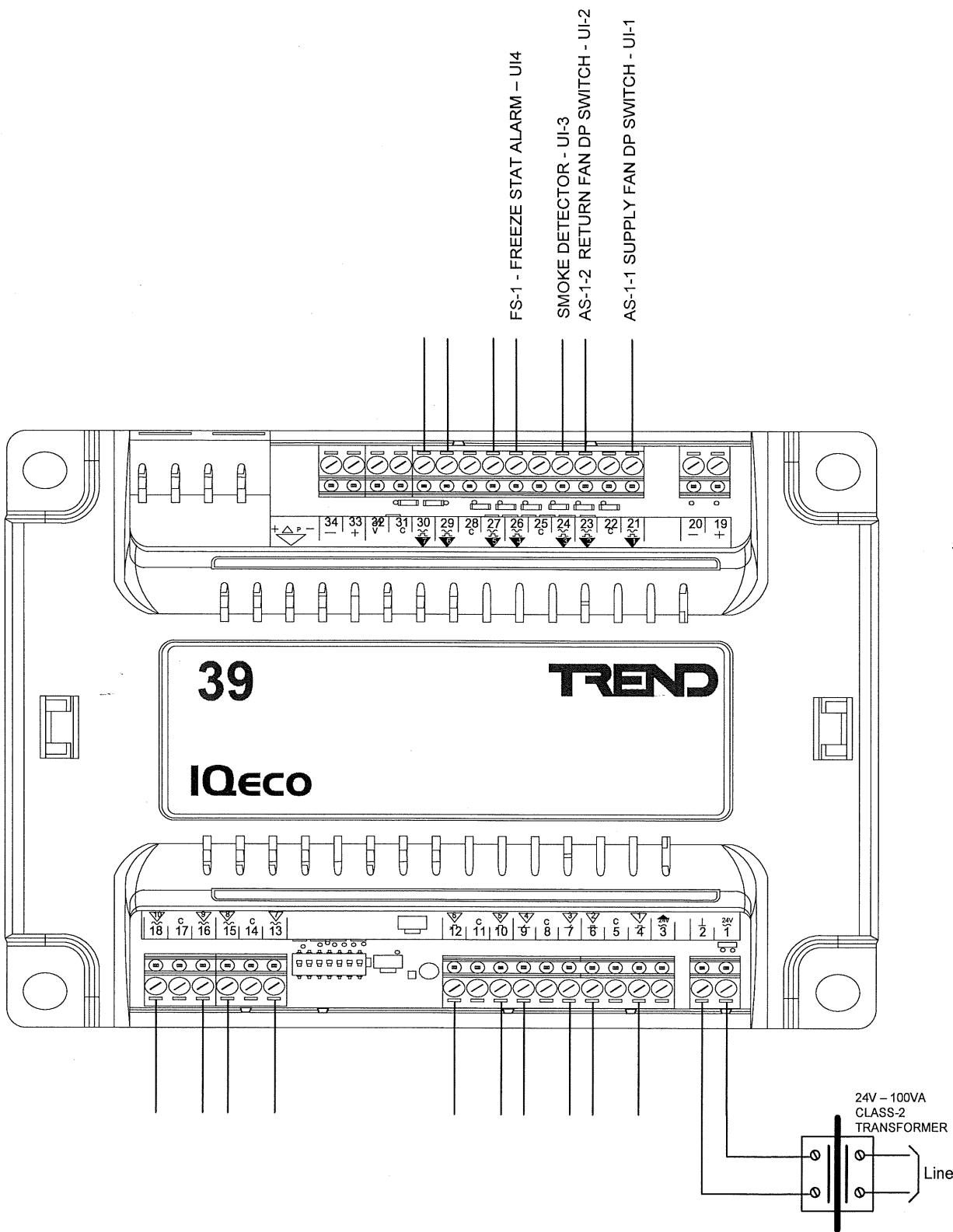
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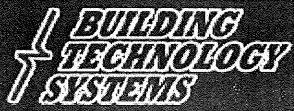
RTU'S 2,4,5,6 & 8
(TYPICAL OF 5)

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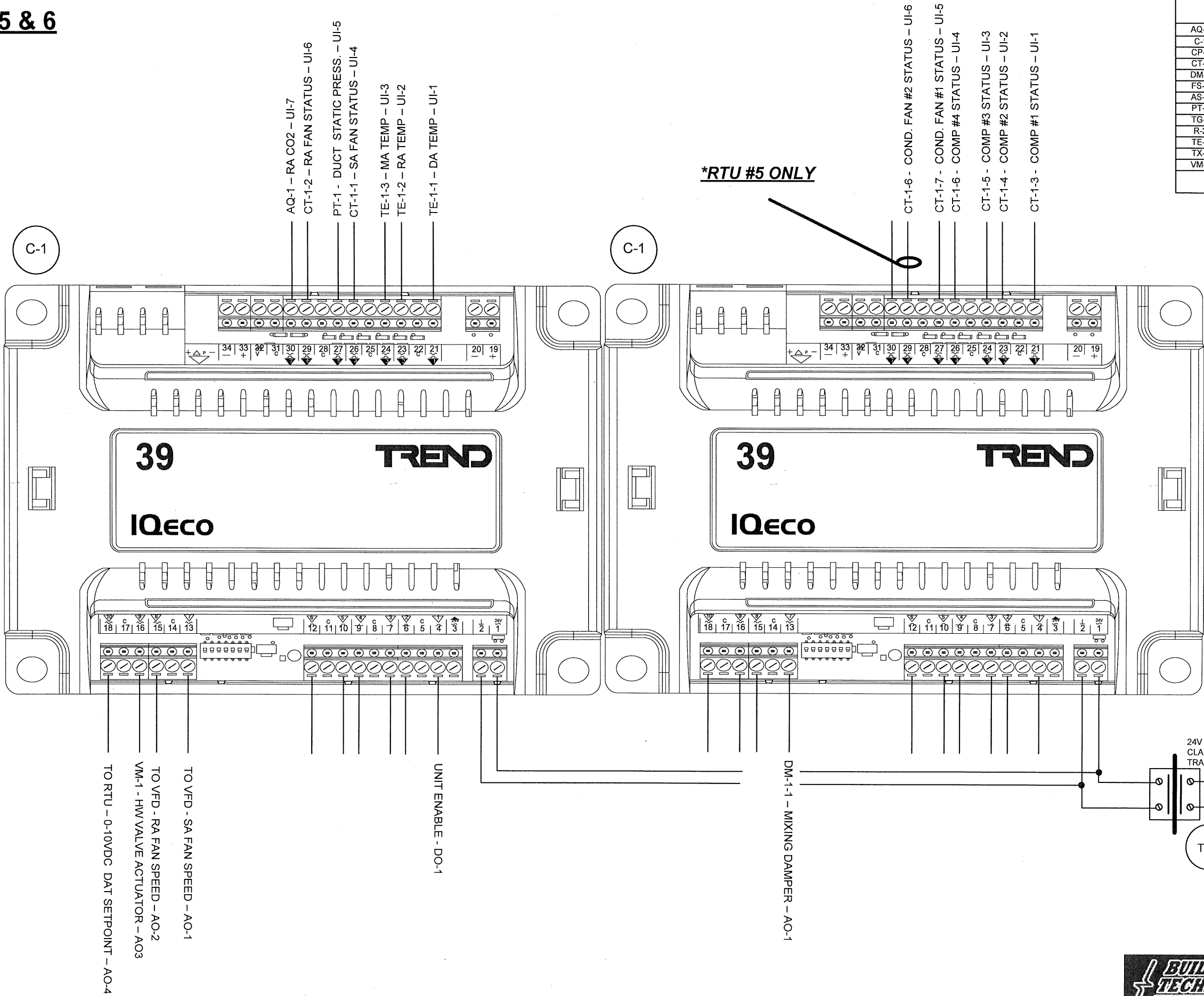
BILL OF MATERIALS	
AQ-1	DUCT MOUNTED CO2 SENSOR
AS-1	CONTROL PANEL
C-1	RTU CONTROLLER IQeco 39
CP-1	CONTROL PANEL
CT-1	CURRENT RELAY, SPLIT CORE
DM-1	DAMPER MOTOR
FS-1	FREEZE STAT, AUTO RESET
HL-1	DUCT HIGH STATIC AIR SWITCH
PT-1	DUCT PRESSURE TRANSDUCER
PT-2	ROOM PRESSURE TRANSDUCER
R-2	CONTROL RELAY 24vac
TE-1	DUCT MOUNTED TEMPERATURE SENSOR
TX-1	CONTROL TRANSFORMER 100va
VM-1	HOT WATER VALVE ACTUATOR

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RTU 5 & 6

BILL OF MATERIALS	
AQ-1	DUCT MOUNTED CO2 SENSOR
C-1	RTU CONTROLLER IQeco 39
CP-1	CONTROL PANEL
CT-1	CURRENT RELAY, SPLIT CORE
DM-1	DAMPER MOTOR
FS-1	FREEZE STAT, AUTO RESET
AS-1	DUCT HIGH LIMIT AIR SWITCH (MANUAL RESET)
PT-1	DUCT PRESSURE TRANSDUCER
TG-1	THERMOSTAT GUARD
R-2	CONTROL RELAY 24vac
TE-1	DUCT MOUNTED TEMPERATURE SENSOR
TX-1	CONTROL TRANSFORMER 100va
VM-1	HOT WATER VALVE ACTUATOR



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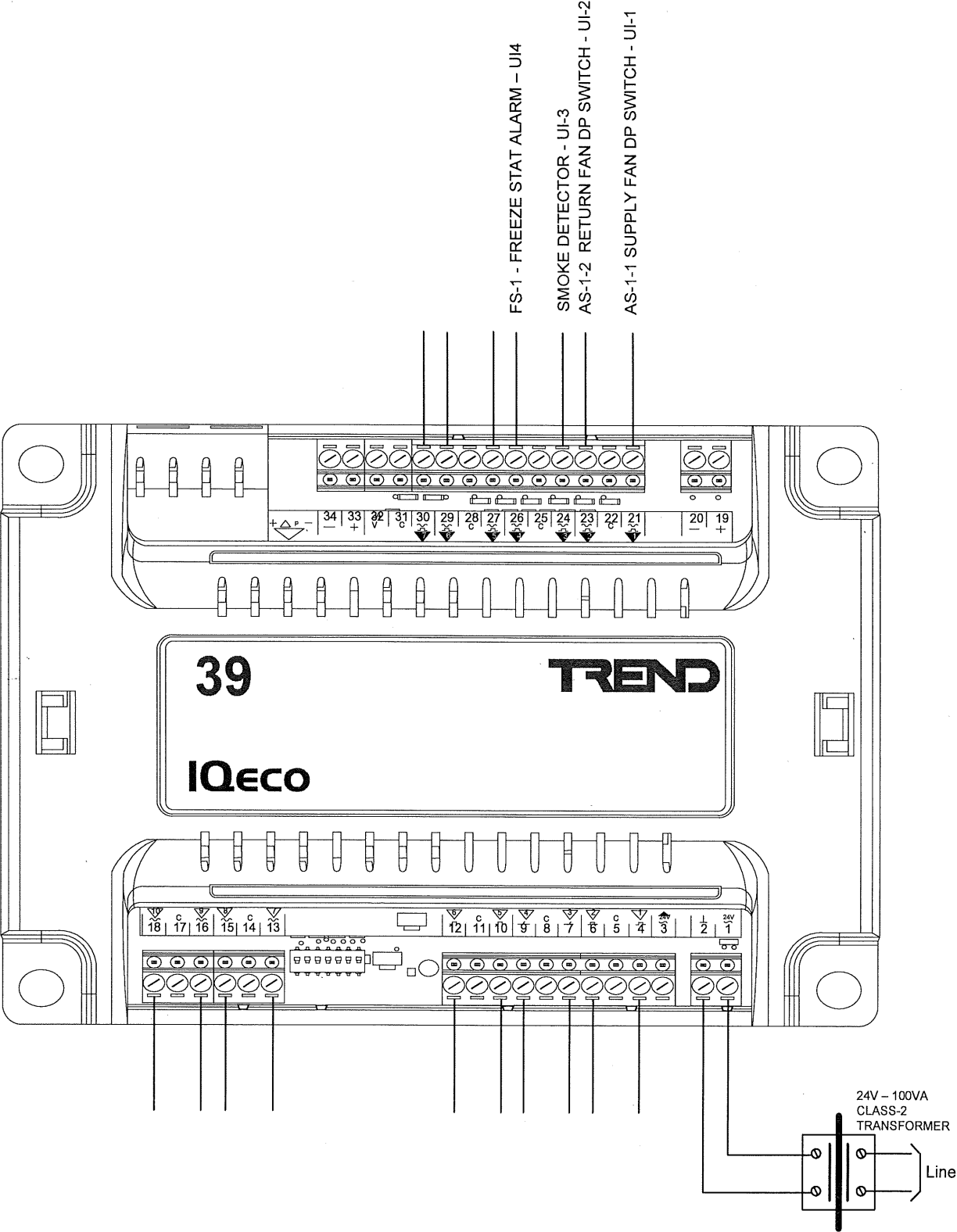


RTU CONTROLLER IQeco 39	
POUDRE HIGH SCHOOL RENOVATIONS	
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Drawing No. 6	Drawn by: JASON BROOS 4/10/12

RTU 5 & 6

BILL OF MATERIALS	
AQ-1	DUCT MOUNTED CO2 SENSOR
AS-1	CONTROL PANEL
C-1	RTU CONTROLLER IQeco 39
CP-1	CONTROL PANEL
CT-1	CURRENT RELAY, SPLIT CORE
DM-1	DAMPER MOTOR
FS-1	FREEZE STAT, AUTO RESET
HL-1	DUCT HIGH STATIC AIR SWITCH
PT-1	DUCT PRESSURE TRANSDUCER
PT-2	ROOM PRESSURE TRANSDUCER
R-2	CONTROL RELAY 24vac
TE-1	DUCT MOUNTED TEMPERATURE SENSOR
TX-1	CONTROL TRANSFORMER 100va
VM-1	HOT WATER VALVE ACTUATOR

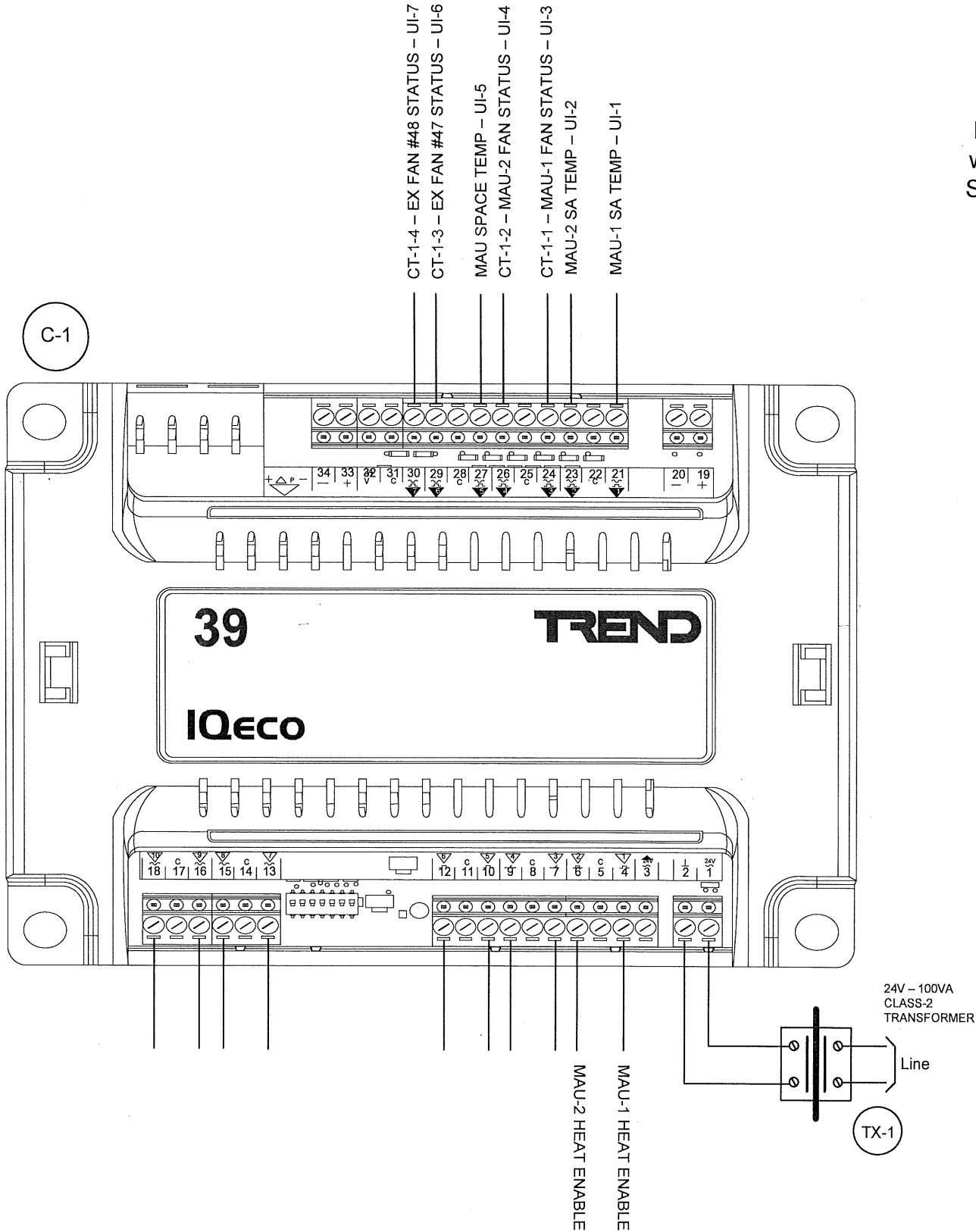
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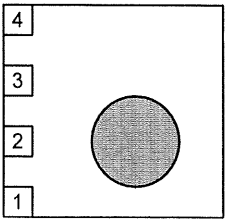
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POUDRE HIGH SCHOOL RENOVATIONS	
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MAU-1 &2 w/ ExFan-47, 48 & 49

(TYPICAL OF 2)

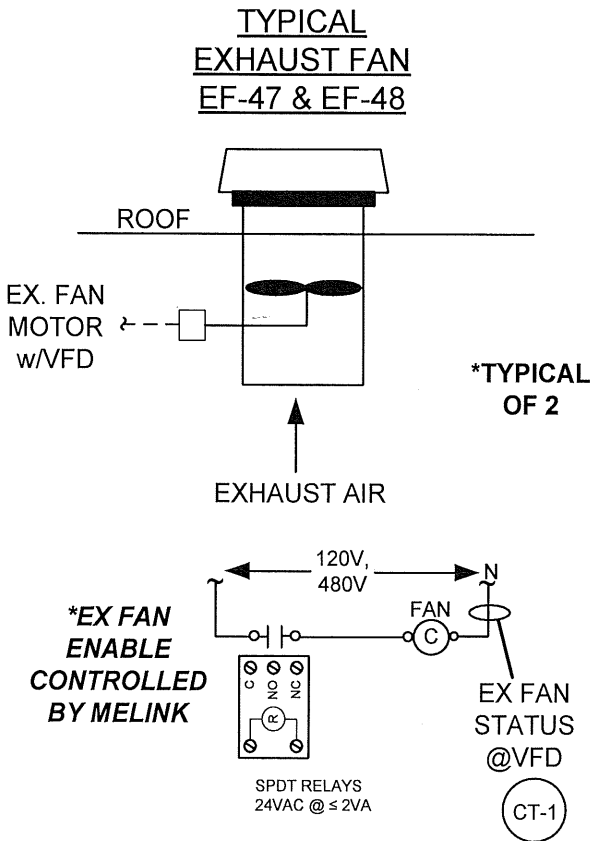


WALL
MODULE
w/ SPACE
SETPOINT



SPACE MOUNTED T-STAT

BILL OF MATERIALS	
C-1	RTU CONTROLLER IQeco 39
CP-1	CONTROL PANEL
CT-1	CURRENT RELAY, SPLIT CORE
DM-1	DAMPER MOTOR
R-2	CONTROL RELAY 24vac
TE-1	DUCT MOUNTED TEMPERATURE SENSOR
TX-1	CONTROL TRANSFORMER 100va



MAU-1 & 2 w/ExFans 47 &48

POUDRE HIGH SCHOOL
RENOVATIONS

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Drawing No.

8

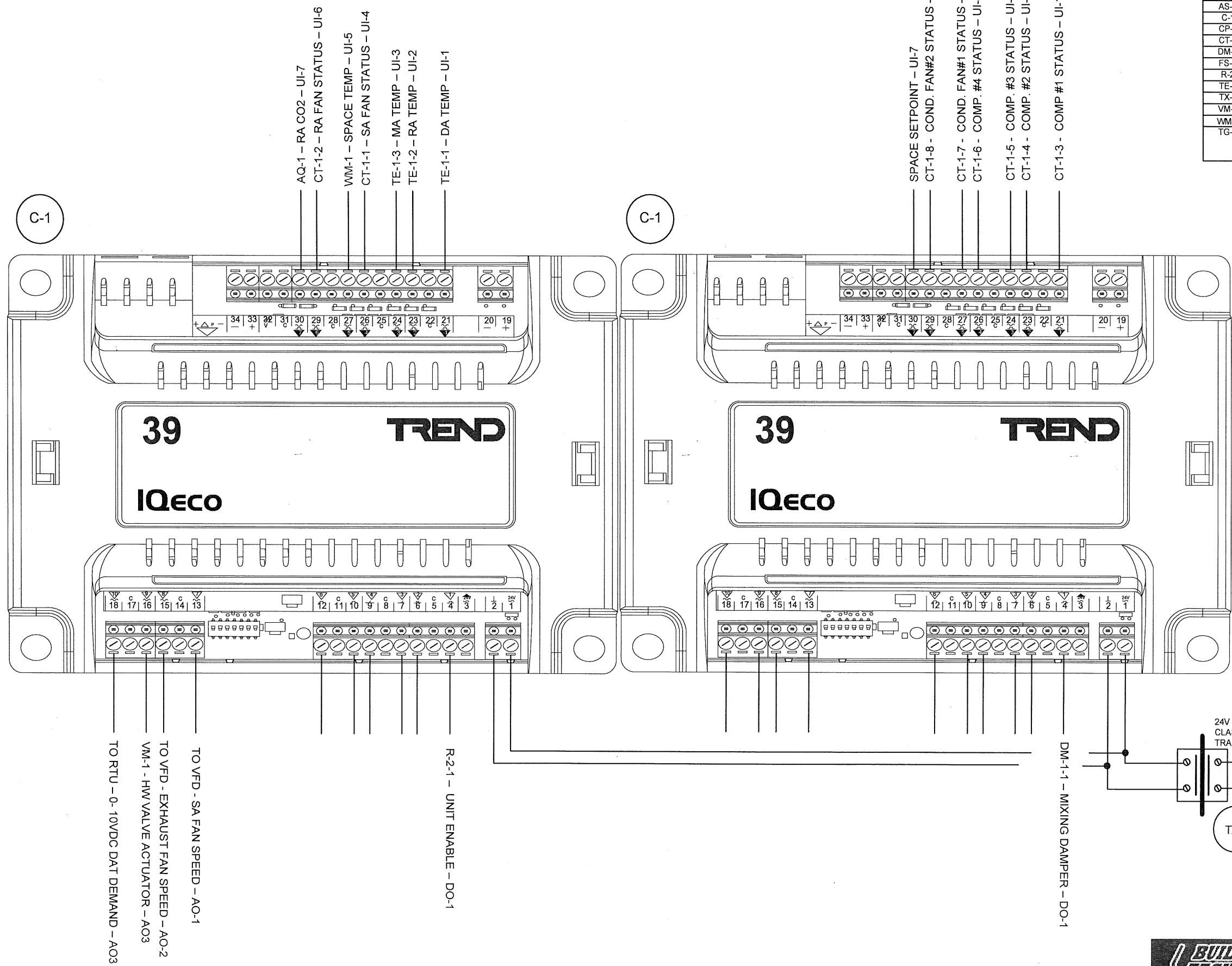
Drawn by:
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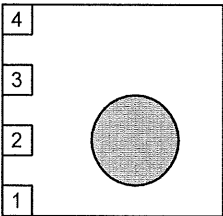


RTU's 3 & 7

BILL OF MATERIALS	
AQ-1	DUCT MOUNTED CO2 SENSOR
AS-1	AIR DIFF. PRESSURE SWITCH
C-1	RTU CONTROLLER IQeco 39
CP-1	CONTROL PANEL
CT-1	CURRENT RELAY, SPLIT CORE
DM-1	DAMPER MOTOR
FS-1	FREEZE STAT, AUTO RESET
R-2	CONTROL RELAY 24vac
TE-1	DUCT MOUNTED TEMPERATURE SENSOR
TX-1	CONTROL TRANSFORMER 100va
VM-1	HOT WATER VALVE ACTUATOR
WM-1	TREND WALL MODULE w/ SETPOINT
TG-1	THERMOSTAT GUARD



WALL
MODULE
w/ SPACE
SETPOINT



*COORDINATE FIELD LOCATION

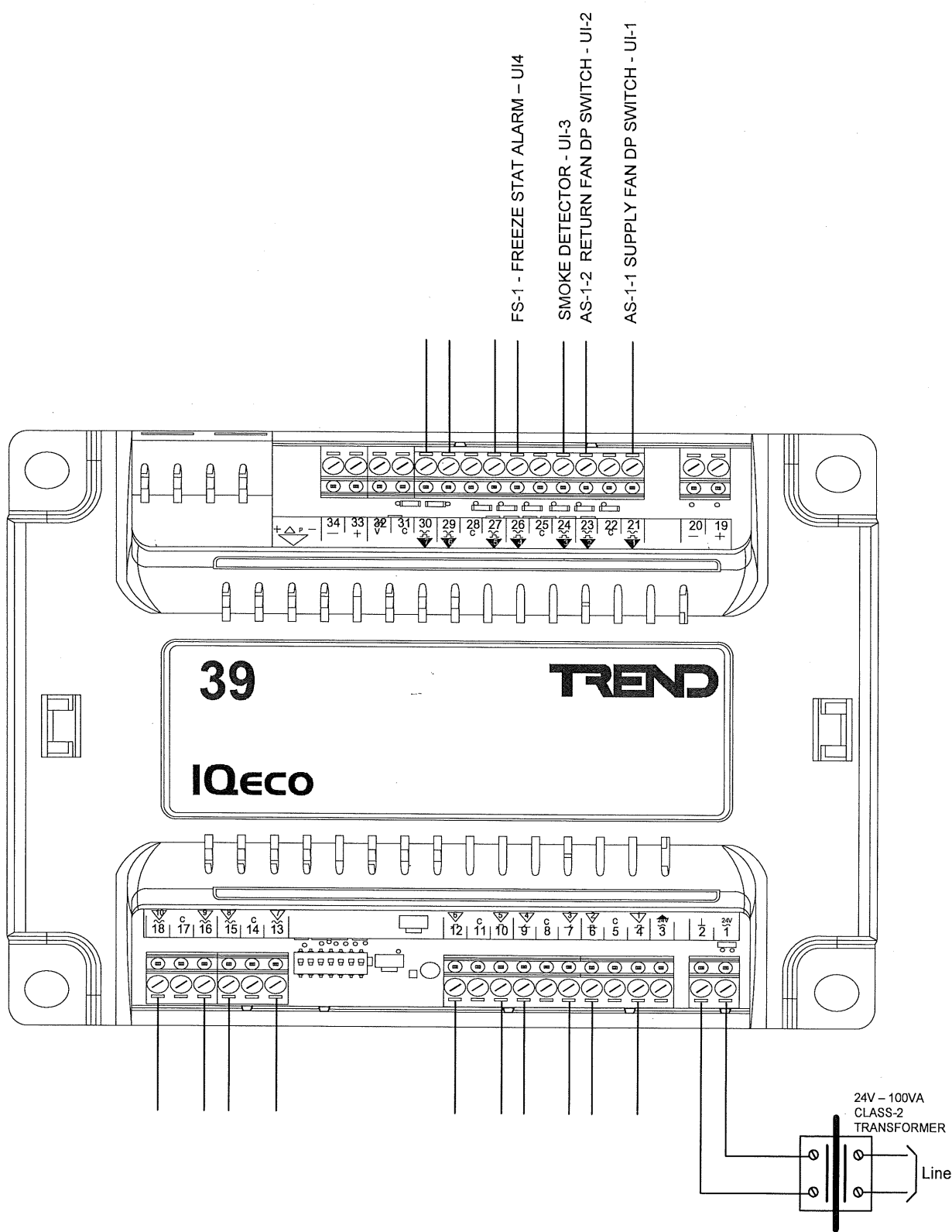
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RTU 3, CONTROLLER IQeco 39	
POUDRE HIGH SCHOOL RENOVATIONS	
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RTU 3 & 7
Cont.

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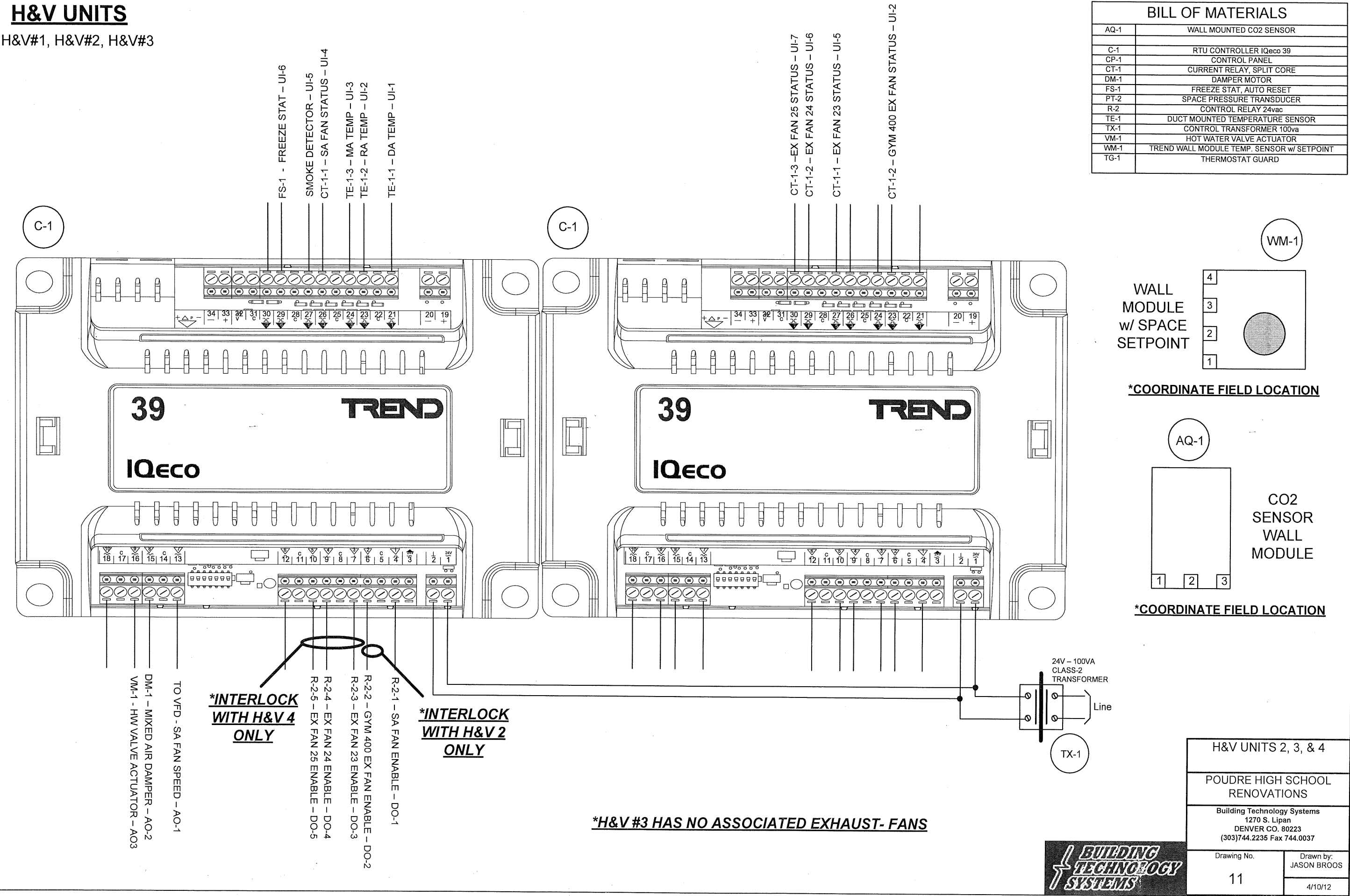
BILL OF MATERIALS	
AQ-1	DUCT MOUNTED CO2 SENSOR
AS-1	CONTROL PANEL
C-1	RTU CONTROLLER IQeco 39
CP-1	CONTROL PANEL
CT-1	CURRENT RELAY, SPLIT CORE
DM-1	DAMPER MOTOR
FS-1	FREEZE STAT, AUTO RESET
HL-1	DUCT HIGH STATIC AIR SWITCH
PT-1	DUCT PRESSURE TRANSDUCER
PT-2	ROOM PRESSURE TRANSDUCER
R-2	CONTROL RELAY 24vac
TE-1	DUCT MOUNTED TEMPERATURE SENSOR
TX-1	CONTROL TRANSFORMER 100va
VM-1	HOT WATER VALVE ACTUATOR

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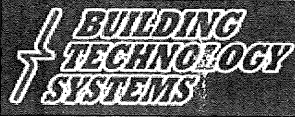
H&V UNITS

H&V#1, H&V#2, H&V#3



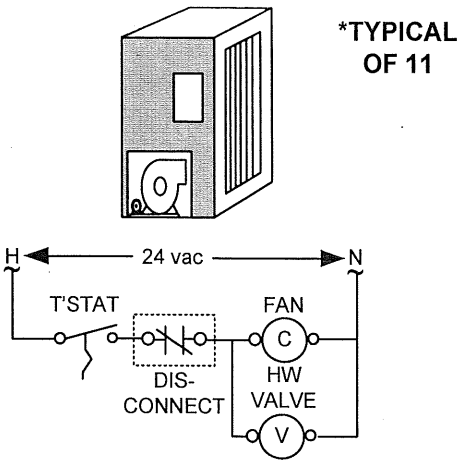
BILL OF MATERIALS	
AQ-1	WALL MOUNTED CO2 SENSOR
C-1	RTU CONTROLLER IQeco 39
CP-1	CONTROL PANEL
CT-1	CURRENT RELAY, SPLIT CORE
DM-1	DAMPER MOTOR
FS-1	FREEZE STAT, AUTO RESET
PT-2	SPACE PRESSURE TRANSDUCER
R-2	CONTROL RELAY 24vac
TE-1	DUCT MOUNTED TEMPERATURE SENSOR
TX-1	CONTROL TRANSFORMER 100va
VM-1	HOT WATER VALVE ACTUATOR
WM-1	TREND WALL MODULE TEMP. SENSOR w/ SETPOINT
TG-1	THERMOSTAT GUARD

H&V UNITS 2, 3, & 4	
POUDRE HIGH SCHOOL RENOVATIONS	
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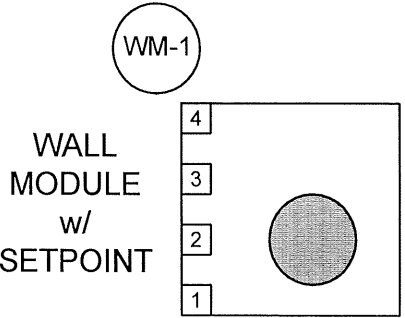
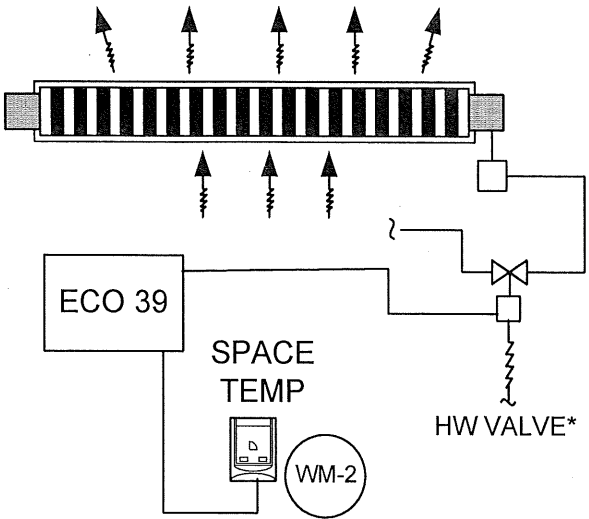


**VAV & MISC.
EQUIPMENT DETAIL**

CABINET UNIT HEATER*



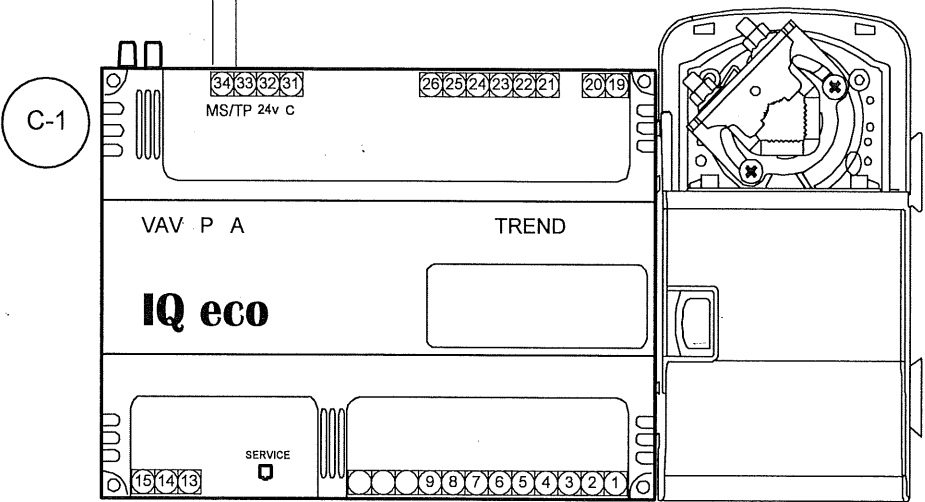
**BASEBOARD HEATING
CONTROLLED BY VAV**
***TYPICAL OF 6**



COMMUNICATION FROM PREVIOUS CONTROLLER

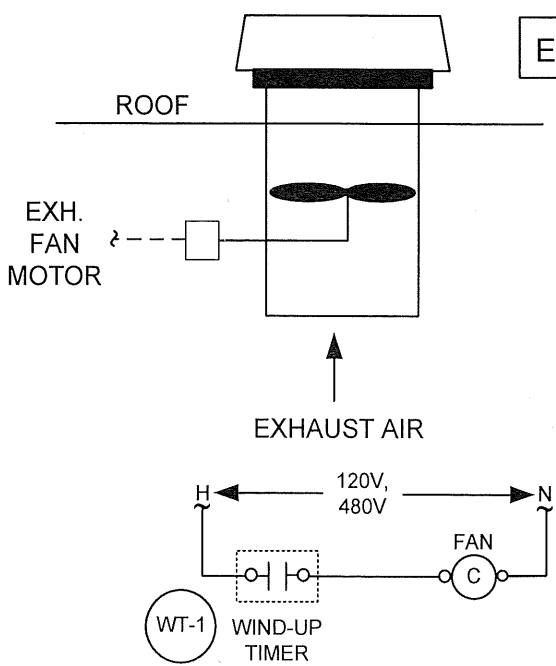
BacNET COMM

TO NEXT CONTROLLER

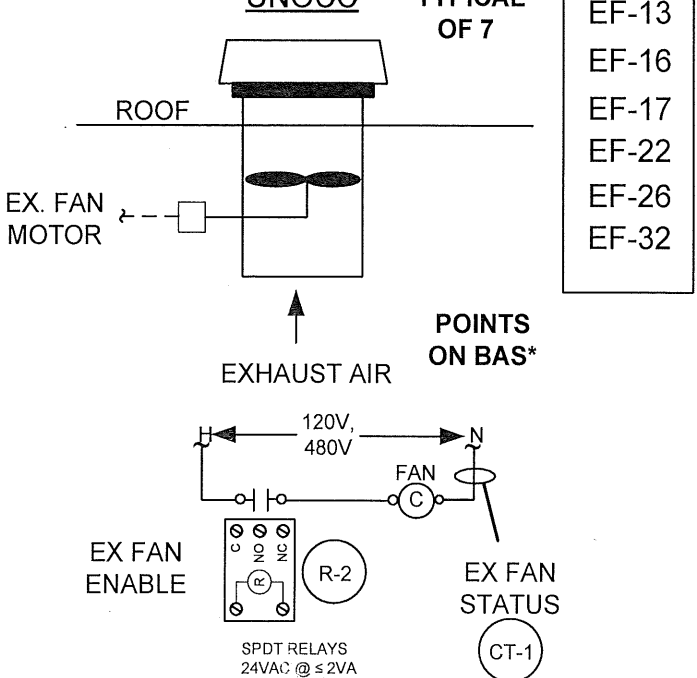


BILL OF MATERIALS	
CT-1	CURRENT RELAY, SPLIT CORE
DM-1	DAMPER MOTOR
R-2	CONTROL RELAY 24vac
TE-1	DUCT MOUNTED TEMPERATURE SENSOR
TX-1	CONTROL TRANSFORMER 100va
VM-1	HOT WATER VALVE ACTUATOR
WM-1	TREND WALL MODULE w/SETPOINT
TH-2	LINE VOLTAGE T-STAT

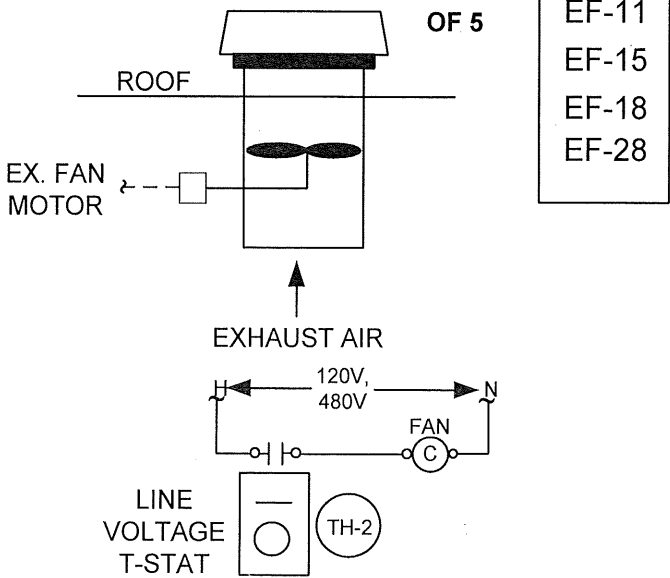
**TYPICAL EXHAUST
FAN w/ WIND-UP
TIMER**
***TYPICAL OF 1**



**TYPICAL
EXHAUST FAN
DDC, OCC/
UNOCC**
***TYPICAL OF 7**



**TYPICAL
EXHAUST FAN
LINE VOLTAGE
T-STAT**
***TYPICAL OF 5**



VAV & MISC. WIRING

**POUDRE HIGH SCHOOL
RENOVATIONS**

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Drawing No. 12

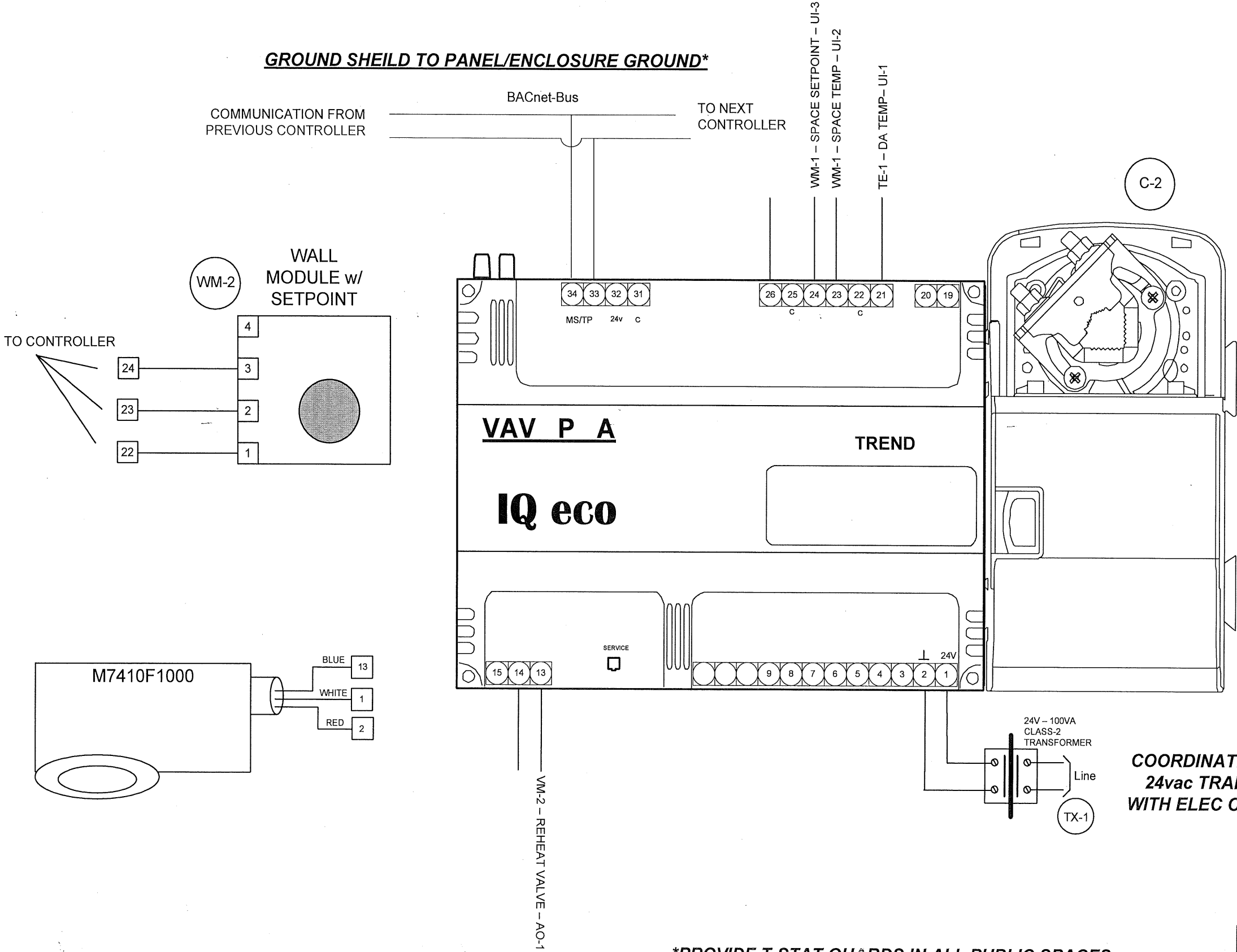
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4/10/12

**BUILDING
TECHNOLOGY
SYSTEMS**

VAV WIRING DETAIL
(TYPICAL OF 69)

BILL OF MATERIALS	
C-2	VAV CONTROLLER (VAV-P-A)
TE-1	DUCT MOUNTED TEMPERATURE SENSOR
TX-1	CONTROL TRANSFORMER 100va
VM-1	HOT WATER VALVE ACTUATOR
WM-2	TREND WALL MODULE w/SETPOINT
TG-1	THERMOSTAT GUARD



COORDINATE POWER TO
24vac TRANSFORMER
WITH ELEC CONTRACTOR

***PROVIDE T-STAT GUARDS IN ALL PUBLIC SPACES**

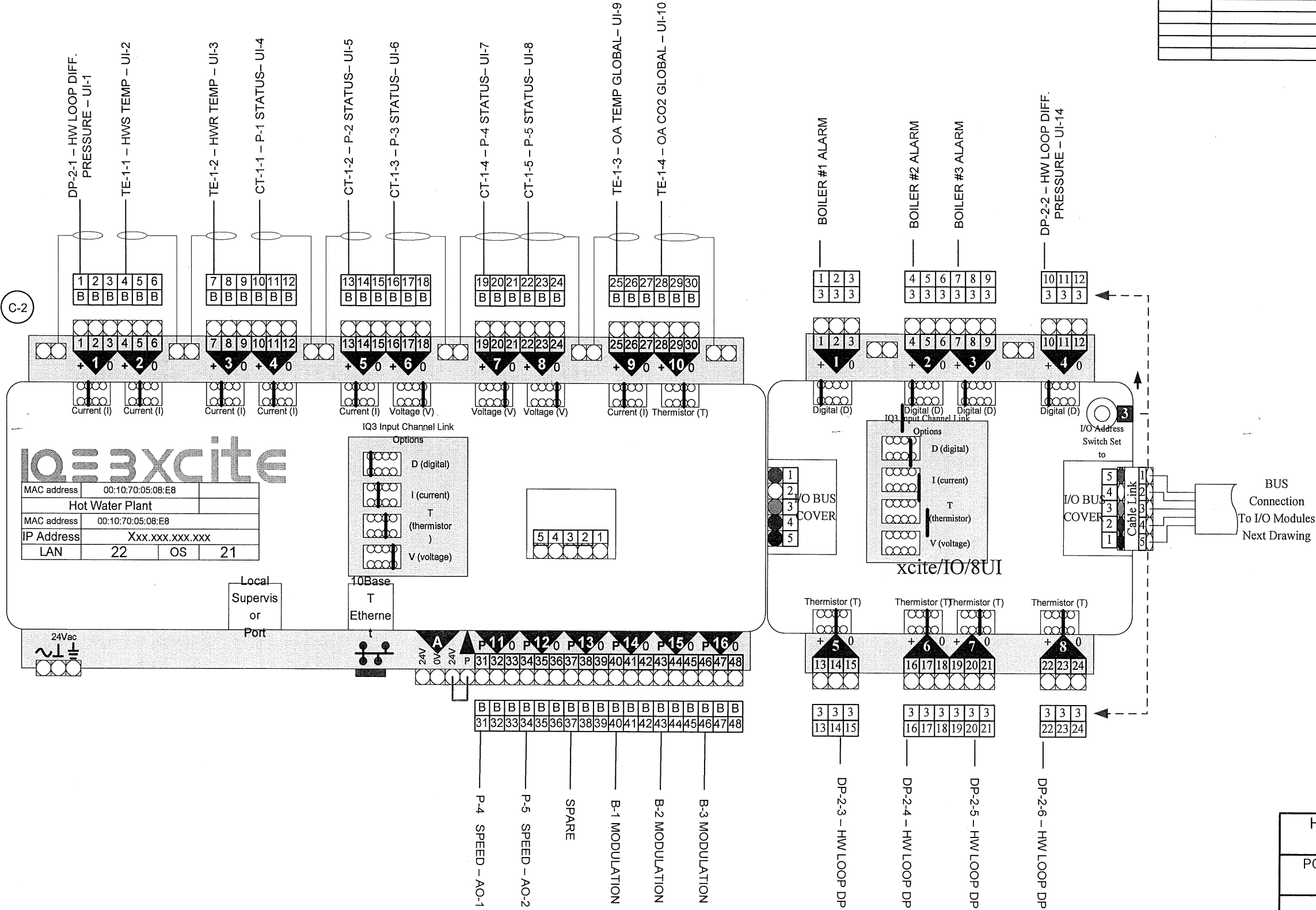


VAV WIRING DETAIL VAV-P-A IQeco	
BLEVINS MIDDLE SCHOOL MAJOR RENOVATIONS	
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**HOT WATER PLANT
WIRING DETAIL**

***HOT WATER OA TEMP SETPOINT FULLY
ADJUSTABLE THROUGH SOFTWARE**

BILL OF MATERIALS	
C-2	IQ3 EXCITE
R-2	CONTROL RELAY W/OVERRIDE
TX-1	CONTROL TRANSFORMER 100va
TE-1	HOT WATER TEMP PIPE SENSOR
CT-1	CURRENT RELAY SPLIT-CORE



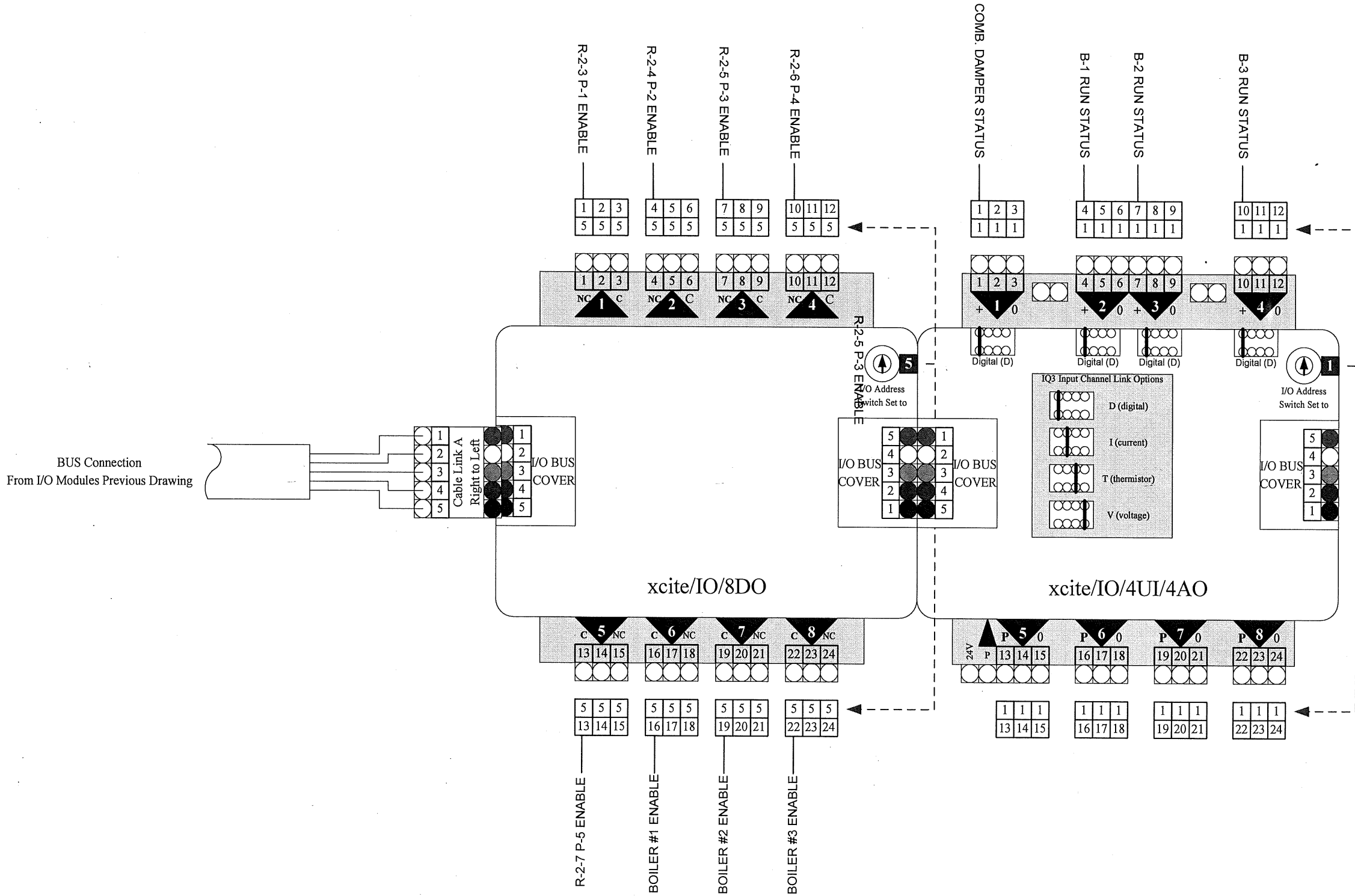
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HOT WATER PLANT WIRING DETAIL	
POUDRE HIGH SCHOOL RENOVATIONS	
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**HOT WATER PLANT
WIRING DETAIL P.2**

BILL OF MATERIALS	
C-2	IQ3 EXCITE
R-2	CONTROL RELAY W/OVERRIDE
TX-1	CONTROL TRANSFORMER 100va
TE-1	HOT WATER TEMP PIPE SENSOR
CT-1	CURRENT RELAY SPLIT-CORE



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HOT WATER PLANT WIRING DETAIL	
POUDRE HIGH SCHOOL RENOVATIONS	
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SEQUENCE OF OPERATION

HOT WATER PLANT

(B-1, B-2, B-3 w/ P-1 ,P-2, P-3)

SEQUENCE OF OPERATION - CENTRAL HOT WATER
THE SYSTEM CONSIST OF THREE CONDENSING BOILERS WITH ASSOCIATED CIRCULATING PUMPS, AND TWO EXISTING SECONDARY LOOP HOT WATER SUPPLY PUMPS. REFER TO BOILER ROOM FLOOR PLANS AND MECHANICAL DIAGRAM SHEET FOR EXISTING PIPING AND EQUIPMENT CONNECTIONS.
BAS CONTROL PANEL SHALL ACTIVATE
AND CONTROL BOILER STAGING AND ASSOCIATED PRIMARY CIRCULATING PUMPS.
BAS SHALL CONTROL EXISTING SECONDARY PUMPS.
ENABLING:
HOT WATER GENERATION SHALL BE ENABLED BY THE BAS UPON A FALL IN OUTDOOR AIR TEMPERATURE BELOW HOT WATER GENERATION SETPOINT (INITIALLY SET TO 60 DEG F ADJUSTABLE).
LOOP PRESSURE CONTROL:
ONCE ENABLED, HOT WATER LOOP DIFFERENTIAL PRESSURE SHALL BE MAINTAINED AT SETPOINT, 10 PSI INITIAL (ADJUSTABLE, TO BE CONFIRMED WITH BALANCING CONTRACTOR AND COMMISSIONING PROCESS) BY FIRST STARTING THE LEAD HOT WATER PUMP AND MODULATING THE ASSOCIATED VFD. DUE TO MULTIPLE PIPING LOOPS IN THIS BUILDING, MULTIPLE DPT SENSORS WILL BE REQUIRED, WORST CASE DPT SENSOR SHALL CONTROL PUMP SPEED. WHEN LEAD HOT WATER PUMP IS AT 100% AND LOOP PRESSURE IS 2 PSI BELOW SETPOINT FOR MORE THAN 15 MINUTES THE LAG PUMP SHALL BE STAGED ON AT 60% AND THE LEAD PUMP SHALL REDUCE TO 60%. PUMPS SHALL THEN STAGE UP AND DOWN IN CONCERT TO MAINTAIN LOOP PRESSURE. WHEN BOTH PUMPS ARE BELOW 40% THE LAG PUMP SHALL STAGE OFF. THE LEAD AND LAG POSITIONS OF HOT WATER PUMPS ARE TO ALTERNATE WEEKLY. ALL PARAMETERS SHALL BE ADJUSTABLE.
TEMPERATURE CONTROL:
SHOULD HOT WATER SUPPLY TEMPERATURE FALL BELOW SETPOINT PLUS DIFFERENTIAL INITIATE OPERATION. LEAD BOILER AND ASSOCIATED BOILER CIRCULATING PUMP SHALL BE ENERGIZED. BAS SHALL ENERGIZE PUMP. BOILER CONTROLLER SHALL SEND SIGNAL TO BAS FOR SECOND AND THIRD PUMP TO BE ENERGIZED. HOT WATER PUMP SHALL INITIATE FIRST, AND AFTER A 2 MINUTE (ADJUSTABLE) DELAY UPON PROOF OF FLOW ENABLE LEAD HOT WATER BOILER. BOILERS HAVE A 5:1 TURNDOWN. BOILERS SHALL INITIATE AT 20% FIRE.
WHEN LEAD BOILER IS AT 40% FIRE THEN ADDITIONAL BOILER SHALL BE STAGED ON. THE SECOND BOILER AND ASSOCIATED BOILER CIRCULATING PUMP SHALL BE ENERGIZED TO PROVIDE ADDITIONAL HEAT TO MAINTAIN HOT WATER SUPPLY TEMPERATURE AT SETPOINT. HOT WATER PUMP SHALL INITIATE FIRST, AND AFTER A 2 MINUTE (ADJUSTABLE) DELAY UPON PROOF OF FLOW ENABLE HOT WATER BOILER. BOILER CONTROL PANEL SHALL MODULATE FIRING RATE OF BOTH BOILERS TO PROVIDE OPTIMUM EFFICIENCY AND STAGE THIRD BOILER IN THE SAME FASHION AS THE SECOND BOILER IF HEATING WATER SETPOINT IS STILL NOT MET WITH TWO BOILERS AT 40% FIRE. THE BOILER CONTROL PANEL SHALL THEN OPTIMIZE THE FIRING RATE OF ALL THREE BOILERS TO PROVIDE OPTIMUM EFFICIENCY BY STAGING THEM UP 20% AT A TIME. WHEN HOT WATER SUPPLY TEMPERATURE EXCEEDS HOT WATER SUPPLY TEMPERATURE SETPOINT BY 5 DEGREES, THEN FIRING RATE STAGES SHALL BE REDUCED TO MAINTAIN HOT WATER SUPPLY TEMPERATURE SETPOINT. THE LEAD AND LAG POSITIONS FOR BOILERS ARE TO ALTERNATE WEEKLY.
BAS SHALL SEND A RESET SIGNAL TO BOILER CONTROL PANEL. HOT WATER TEMPERATURE SETPOINT IS TO BE RESET FROM 110 DEG (ADJUSTABLE) TO 140 DEG F (ADJUSTABLE) AS OUTSIDE AIR TEMPERATURE FALLS FROM 60 DEG F (ADJUSTABLE) TO 20 DEG F (ADJUSTABLE).
FREEZE PROTECTION MODE:
IF DURING UNOCCUPIED HOURS THE OAT IS BELOW 40 DEGREES THE LEAD SECONDARY LOOP PUMP SHALL ENERGIZE AT MINIMUM SPEED AND MODULATE TO MAINTAIN DPT SETPOINT.
FEATURES:
SHOULD ANY PUMP STATUS NOT MATCH PUMP COMMAND, GENERATE AN ALARM TO THE BAS.
SHOULD HOT WATER SUPPLY TEMPERATURE FALL 10 OR MORE DEGREES AWAY FROM SETPOINT WHILE HOT WATER SYSTEM IS ENABLED, GENERATE AN ALARM THROUGH TO THE BAS.

VAV BOX w/ REHEAT

DESCRIPTION - CONSIST OF A PRESSURE INDEPENDENT VARIABLE AIR VOLUME BOX COMPLETE WITH
MOTORIZED DAMPER, HOT WATER REHEAT COIL, FLOATING POINT OR PROPORTIONAL CONTROL VALVE, AND AIR FLOW PRESSURE TRANSDUCER. THE RETROFIT SYSTEMS CONSIST OF A SLIDE-IN RETROFIT VARIABLE AIR VOLUME BOX COMPLETE WITH
MOTORIZED DAMPER AND AIRFLOW PRESSURE TRANSDUCER. DUCT HEATING COILS TO RECEIVE NEW FLOATING POINT OR PROPORTIONAL CONTROL VALVE. SEQUENCES FOR EACH TYPE OF TERMINAL UNIT ARE SIMILAR.
SCHEDULING - OCCUPIED/UNOCCUPIED SCHEDULING APPLIES TO THESE SYSTEMS. SCHEDULES TO BE DETERMINED BY OWNER AND SHALL BE AVAILABLE THROUGH THE OPERATOR WORKSTATION INTERFACE.
SCHEDULING CONTROLS SPACE SETPOINT TEMPERATURE. DURING OCCUPIED MODE, TERMINAL UNIT SHALL MAINTAIN SPACE TEMPERATURE AT SETPOINT DICTATED BY SPACE MOUNTED THERMOSTAT (I.E. 68-72°F HEATING, 74-78°F COOLING). DURING UNOCCUPIED MODE, TERMINAL UNIT SHALL MAINTAIN SPACE TEMPERATURE AT SETBACK TEMPERATURE SETPOINT (I.E. 60°F HEATING, N/A COOLING)
TERMINAL BOX SHALL BE GO FULL OPEN ON A CALL FOR NIGHT SETBACK HEATING DURING UNOCCUPIED PERIODS, ONCE SETBACK TEMPERATURE IS MET, DAMPER SHALL CLOSE.
CONTROL - THE AIRFLOW PRESSURE TRANSDUCER SHALL INDICATE TO THE UNIT MOUNTED DDC CONTROLLER MEASURED AIRFLOW. THE DDC CONTROLLER SHALL MODULATE THE VAV BOX DAMPER TO MAINTAIN AIRFLOW AT SETPOINT. AIRFLOW SETPOINT AND REHEAT VALVE SHALL BE MODULATED BASED ON SPACE TEMPERATURE DEVIATION FROM SETPOINT PER THE SAMPLE RESET SCHEDULES BELOW INDICATING DEADBAND, HEATING AND COOLING RAMP-UP RANGES, AND MINIMUM AIRFLOWS.
NOTES:
1. THE GRAPHICS ARE PROVIDED FOR REFERENCE ONLY.
2. EACH TERMINAL BOX IS UNIQUE AND MAY HAVE REQ'MTS THAT VARY FROM THOSE DEPICTED ABOVE.
3. INCLUDE LOGIC TO OPERATE REHEAT VALVE AND AIRFLOW RATE IN CONCERT TO MAINTAIN DISCHARGE AIR TEMPERATURE AT SETPOINT WHEN IN HEATING MODE (I.E. 90°F MAX AT -2°F AND GREATER DEVIATION FROM SETPOINT)
4. REFER TO EQUIPMENT SCHEDULES FOR INITIAL AIR DELIVERY (CFM) SETTINGS FOR HEATING, MINIMUM COOLING, AND COOLING MODES OF OPERATION.
THE SPACE MOUNTED TEMPERATURE SENSOR SHALL INCORPORATE A WARMER/COOLER ADJUSTMENT ALLOWING ZONE OCCUPANTS TO BIAS THE SPACE TEMPERATURE SETPOINT BY A FIXED AMOUNT IN EITHER DIRECTION.
FEATURES -
1. COOPERATION WITH MORNING WARMUP IN RESPECTIVE AHU SEQUENCES.
2. SPACE TEMPERATURE SHALL BE TRENDED HOURLY.
3. GENERATE AN ALARM SHOULD DISCHARGE AIR TEMPERATURE STRAY FROM DISCHARGE AIR TEMPERATURE SETPOINT BY 5 DEG OR MORE.
4. HOURLY TREND ITEMS INDICATED IN THE POINTS LIST TO BE TRENDED. STORE DATA FOR 1 YEAR PRIOR TO PURGING.

PACKAGED VAV RTU

(RTU-1, 2, 4, 5, 6, 8)

THE SYSTEM CONSIST OF A BUILT UP AIR HANDLING UNIT COMPLETE WITH MIXING BOX, FILTER SECTION, HOT WATER COIL, DX COOLING COIL, AIR COOLED CONDENSING SECTION, SUPPLY FAN, RETURN FAN, AND VARIABLE FREQUENCY DRIVES. DAMPERS ON EA, RA, AND OA TO BE BY UNIT MANUFACTURER. PACKAGED COOLING CONTROLS TO BE BY MANUFACTURER. MANUFACTURER AND CONTROLS CONTRACTOR SHALL COORDINATE TO REPORT STATUS AND ALARMS OF PACKAGED COOLING CONTROLS TO BAS. ACTUATORS FOR DAMPERS, SENSORS AND ALL OTHER DEVICES TO BE SUPPLIED BY TEMPERATURE CONTROLS CONTRACTOR. DEVICES AND WIRING TO BE INSTALLED IN FIELD BY TEMPERATURE CONTROLS CONTRACTOR. COMPRESSOR AND CONDENSER FAN COUNT WILL VARY WITH EACH UNIT. CONTROLS CONTRACTOR TO COORDINATE WITH SUCCESSFUL MANUFACTURER FOR EXACT COUNT.
SCHEDULING:
THE AIR HANDLING UNIT SHALL BE SCHEDULE THROUGH THE OPERATOR WORKSTATION INTERFACE. WHEN SCHEDULED TO BE IN OCCUPIED MODE, BOTH FANS SHALL OPERATE AND CONTROLLED DEVICES SHALL POSITION WITH RESPECT TO THEIR PI CONTROL LOOP.
UNOCCUPIED MODE: FANS SHALL SHUT OFF RETURN DAMPER FULL OPEN, RELIEF AND OUTSIDE AIR DAMPERS CLOSED, HOT WATER VALVE OPEN TO COIL. UNIT SHALL CYCLE TO MEET NIGHT SETBACK TEMPERATURE. UNIT SHALL RUN UNTIL THE COLDEST ZONE HAS REACHED 65 DEG F.
OCCUPIED / UNOCCUPIED SCHEDULE TBD BY OWNER.
MORNING WARM-UP: MORNING WARM-UP SHALL BE BASED ON OPTIMUM START PROGRAMMING. SUPPLY FAN VFD SHALL CONTROL OFF STATIC PRESSURE. ALL VAV BOXES SHALL GO FULL OPEN. VAV BOX HEATING CONTROL VALVE SHALL BE OPEN. AIR HANDLING UNIT SHALL SUPPLY 70% (ADJ) AIR TO VAV BOXES. OA DAMPER SHALL BE CLOSED, RA DAMPER SHALL BE OPEN. AS EACH VAV BOX ZONE REACHES OCCUPIED SETPOINT THE VAV BOX HEATING COIL SHALL CLOSE AND THE VAV BOX AIRFLOW SHALL GO TO MINIMUM POSITION. MORNING WARMUP DISABLE/ENABLE SHALL BE ON GRAPHICS. TIME OF MORNING LIMIT SHALL ALSO BE ON GRAPHICS.
OCCUPIED MODE: RETURN FAN SHALL START AT MINIMUM VFD SPEED. UPON PROOF OF OPERATION FOR ONE MINUTE(ADJUSTABLE) THE SUPPLY FAN SHALL START. IF ANY ZONE TEMPERATURE IS BELOW THE OCCUPIED HEATING SETPOINT THEN OPTIMUM START MORNING WARM-UP CYCLE ABOVE SHALL APPLY. IF MORNING WARM-UP IS NOT REQUIRED THE UNIT SHALL GO TO OCCUPIED CYCLE.
MIXED AIR CONTROL:
WHEN OUTSIDE AIR TEMPERATURE FALLS BELOW DISCHARGE AIR SETPOINT BY 2 DEGREES, MIXING DAMPERS SHALL MODULATE TO MAINTAIN DISCHARGE AIR TEMPERATURE AT SETPOINT. MINIMUM OUTSIDE AIR DAMPER POSITION SHALL NOT BE ALLOWED TO GO BELOW 10% AIRFLOW, DAMPER POSITION TO BE COORDINATED WITH TAB CONTRACTOR DURING COMMISSIONING. CARBON DIOXIDE LEVELS SHALL BE MONITORED TO MODULATE OUTSIDE AIR DAMPERS TO MAINTAIN CARBON DIOXIDE LEVELS AT SETPOINT (500 PPM ABOVE THE OUTDOOR REFERENCE POINT). A SENSOR SHALL BE LOCATED IN RETURN DUCT MAIN. IF THE CO2 SENSOR IN THE RETURN DUCT MAIN IS ABOVE THE CO2 LEVEL SETPOINT, THE OUTSIDE AIR DAMPER SHALL MODULATE OPEN TO MAINTAIN CO2 LEVEL SETPOINT. CONTROL CONTRACTOR SHALL COORDINATE WITH MECHANICAL CONTRACTOR FOR INSTALL LOCATION THAT ALLOWS ACCESS FOR MAINTENANCE AND REPLACEMENT.

CO2 RESET SCHEDULE:
OA DAMPER POSITION SHALL BE RESET BASED ON THE FOLLOWING SCHEDULE. 100 PPM ABOVE OA REFERENCE CO2 LEVEL OA DAMPERS SHALL BE AT 10% OPEN. 500 PPM ABOVE OA REFERENCE CO2 LEVEL OA DAMPERS SHALL BE OPEN TO MINIMUM OUTDOOR AIR LISTED IN EQUIPMENT SCHEDULES. CONTROLS CONTRACTOR, TAB CONTRACTOR AND COMMISSIONING AGENT TO VERIFY THIS DAMPER POSITION IN FIELD.
DISCHARGE AIR CONTROL:
ECONOMIZER MODE SHALL BE ENABLED WHENEVER OAT IS 2 DEGREES LESS THAN RAT. WHEN OAT EXCEEDS RAT, UNIT SHALL GO TO MINIMUM OA BASED ON CO2 SENSOR. WHEN ECONOMIZER MODE(100% OUTSIDE AIR) IS NO LONGER ABLE TO MAINTAIN DISCHARGE AIR TEMPERATURE(DAT) SETPOINT; THEN DX COOLING STAGE ONE THROUGH FOUR (OR MAX # OF COMPRESSORS) SHALL BE SEQUENCED TO MAINTAIN DAT SETPOINT. IF THE OA DAMPERS ARE IN MINIMUM POSITION AND THE MIXED AIR TEMPERATURE IS BELOW DAT SETPOINT THE HOT WATER CONTROL VALVE SHALL MODULATE TO MAINTAIN DAT SETPOINT.
DISCHARGE AIR TEMPERATURE RESET TO VARY FROM 55 TO 65 DEGREES (ADJUSTABLE)SHALL BE RESET BASED ON POLLING OF VAV BOXES ASSOCIATED WITH THAT RTU AND INCREASING SUPPLY AIR TEMPERATURE UNTIL AT LEAST ONE VAV BOX IS OPENED TO 95% FAN CONTROL:
THE SUPPLY FAN VFD SHALL BE MODULATED TO MAINTAIN DUCT STATIC PRESSURE AT SETPOINT, INITIAL SETPOINT 0.75"(ADJUSTABLE) (+/- .05"). STATIC PRESSURE SHALL BE RESET BASED ON VAV BOX WITH THE MOST COOLING OR HEATING DEMAND (ZONE AT 3 DEGREES ABOVE OR BELOW SETPOINT SHALL BE 100% OPEN VAV BOX). RECOMMENDED MINIMUM STATIC PRESSURE IS 0.5" (ADJUSTABLE). VERIFY DURING COMMISSIONING PROCESS. DISCHARGE AIR RESET SHALL BE DONE PRIOR TO STATIC PRESSURE RESET.
RETURN FAN CONTROL:
RETURN FAN SHALL TRACK SUPPLY FAN BY A DIFFERENTIAL TO PROVIDE A SLIGHTLY POSITIVE (0.01-0.05") MIXING BOX PRESSURE. TAB CONTRACTOR, CONTROL CONTRACTOR AND COMMISSIONING AGENT TO CREATE A TRACKING CURVE BASED ON SUPPLY FAN SPEED OF 50-100% TO MAINTAIN POSITIVE MIXING BOX THROUGHOUT RANGE.
DEMAND LIMITING CONTROL: TEMPERATURE CONTROLS CONTRACTOR TO INSTALL LOAD MANAGEMENT SWITCH AVAILABLE FROM FORT COLLINS UTILITIES FOR COINCIDENT PEAK DEMAND CONTROL. UPON RECEIVING A SIGNAL FOR PEAK DEMAND CONTROL THE DX COOLING SHALL BE LOCKED OUT. FREEZE PROTECTION: WHEN OA TEMP IS BELOW 40 DEGREES IN UNOCCUPIED MODE THE HEATING VALVE SHALL MODULATE TO MAINTAIN MAT AT 55 DEGREES.
FEATURES:
DISCHARGE AIR TEMPERATURE SHALL BE TRENDED GENERATE AN ALARM SHOULD DISCHARGE AIR TEMPERATURE STRAY FROM DISCHARGE AIR TEMPERATURE SETPOINT BY 5 DEG OR MORE. GENERATE AN ALARM SHOULD FAN STATUS NOT MATCH FAN COMMAND. GENERATE AN ALARM AND OPEN HEATING VALVE TO 100% SHOULD FREEZE STAT TRIP AND DAMPERS SHALL GO TO UNOCCUPIED MODE POSITION. GENERATE AN ALARM SHOULD SMOKE DETECTOR TRIP AND SHUT UNIT DOWN, VALVES AND DAMPERS SHALL GO TO UNOCCUPIED MODE.

SEQUENCE OF OPERATIONS

POUDRE HIGH SCHOOL RENOVATIONS

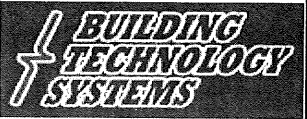
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16

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4/10/12



SEQUENCE OF OPERATION

SINGLE ZONE VAV

(AHU-3 & 7 w/ExFans)

SEQUENCE OF OPERATION - VAV SINGLE ZONE PACKAGED ROOF TOP UNIT. THE SYSTEM CONSIST OF A ROOF TOP UNIT (RTU) COMPLETE WITH VFD SUPPLY FAN, VFD POWER EXHAUST FAN/RETURN FAN, DIGITAL SCROLL COMPRESSOR OR MULTIPLE COMPRESSORS, AND HOT WATER COIL.

SCHEDULING: THE BUILDING SCHEDULING SHALL OCCUR THROUGH THE OPERATOR WORKSTATION INTERFACE AT THE GLOBAL CONTROLLER.

CONTROL RTU SHALL INCLUDE PACKAGED COMPRESSOR CONTROLS FOR COOLING DAT CONTROL FROM FACTORY. ENABLE SIGNAL AND DAT RESET SIGNAL TO BE SENT FROM BUILDING BAS TO FACTORY COMPRESSOR CONTROLS. RTU FACTORY DX COOLING CONTROL SHALL REPORT CONDENSER FAN STATUS, COMPRESSOR STATUS AND ALARM CONDITION BACK TO BAS. DAMPERS SHALL BE FURNISHED AND INSTALLED BY RTU MANUFACTURER. ALSO INCLUDE TERMINAL STRIP FOR FIELD INSTALLED CONTROLS. TCC SHALL PROVIDE CONTROL VALVES, ACTUATORS, SENSORS AND ALL CONTROL WIRING AND INSTALL IN FIELD TO ACHIEVE SEQUENCE AND POINTS LIST AS OUTLINED.

OCCUPIED MODE:

MIXED AIR CONTROL: WHEN OUTSIDE AIR TEMPERATURE FALLS BELOW DISCHARGE AIR SETPOINT BY 2 DEGREES, MIXING DAMPERS SHALL MODULATE TO MAINTAIN DISCHARGE AIR TEMPERATURE AT SETPOINT. MINIMUM OUTSIDE AIR DAMPER POSITION SHALL NOT BE ALLOWED TO GO BELOW 10% AIRFLOW. DAMPER POSITION TO BE COORDINATED WITH TAB CONTRACTOR DURING COMMISSIONING. RA CARBON DIOXIDE LEVELS SHALL BE MONITORED TO MODULATE OUTSIDE AIR DAMPERS TO MAINTAIN CARBON DIOXIDE LEVELS AT SETPOINT (500 PPM ABOVE THE OUTDOOR REFERENCE POINT). A SENSOR SHALL BE LOCATED IN RETURN DUCT MAIN WHEN THE OUTSIDE AIR TEMPERATURE IS GREATER THAN DISCHARGE AIR TEMPERATURE SETPOINT, THE OUTSIDE AIR DAMPERS SHALL BE OPEN 100% UNTIL OA TEMPERATURE IS WITHIN 2 DEGREES OF RA TEMPERATURE. CO2 RESET SCHEDULE:

OA DAMPER POSITION SHALL BE RESET BASED ON THE FOLLOWING SCHEDULE. 100 PPM ABOVE OA REFERENCE CO2 LEVEL OA DAMPERS SHALL BE AT 10% OPEN. 500 PPM ABOVE OA REFERENCE CO2 LEVEL OA DAMPERS SHALL BE OPEN TO MINIMUM OUTDOOR AIR LISTED IN EQUIPMENT SCHEDULES. CONTROLS CONTRACTOR, TAB CONTRACTOR AND COMMISSIONING AGENT TO VERIFY THIS DAMPER POSITION IN FIELD.

DISCHARGE AIR CONTROL: ECONOMIZER MODE SHALL BE ENABLED WHENEVER OAT IS 2 DEGREES LESS THAN RAT. WHEN OAT EXCEEDS RAT, UNIT SHALL GO TO MINIMUM OA BASED ON CO2 SENSOR. WHEN ECONOMIZER MODE(100% OUTSIDE AIR) IS NO LONGER ABLE TO MAINTAIN DISCHARGE AIR TEMPERATURE(DAT) SETPOINT, THE DX COOLING SHALL STAGE ON TO MAINTAIN DAT SETPOINT. IF THE OA DAMPERS ARE IN MINIMUM POSITION AND THE MIXED AIR TEMPERATURE IS BELOW DAT SETPOINT THE HOT WATER CONTROL VALVE SHALL MODULATE TO MAINTAIN DAT SETPOINT.

DISCHARGE AIR TEMPERATURE SHALL BE 55 DEGREES. MODULATE SUPPLY FAN VFD TO MAINTAIN SPACE TEMPERATURE SETPOINT. VFD SHALL NOT GO BELOW 50%. IF VFD IS AT 50% AND SPACE TEMPERATURE IS BELOW SETPOINT, DISCHARGE AIR TEMPERATURE SHALL BE RESET UPWARD.

DISCHARGE AIR TO BE RESET FROM 55 TO 85 DEGREES BASED ON SPACE SENSOR DEVIATION FROM SETPOINT. IF DAT IS AT 85 DEGREES FOR 15 MIN AND SPACE IS STILL BELOW SETPOINT, SUPPLY VFD SHALL INCREASE SPEED TO MEET SETPOINT.

RETURN FAN CONTROL:

RETURN FAN SHALL TRACK SUPPLY FAN BY A DIFFERENTIAL TO PROVIDE A SLIGHTLY POSITIVE (0.01-0.05") MIXING BOX PRESSURE. TAB CONTRACTOR, CONTROL CONTRACTOR AND COMMISSIONING AGENT TO CREATE A TRACKING CURVE BASED ON SUPPLY FAN SPEED OF 50-100% TO MAINTAIN POSITIVE MIXING BOX THROUGHOUT RANGE.

UNOCCUPIED MODE: SUPPLY FAN SHALL ENERGIZE 100%, HEATING VALVE SHALL MODULATE TO ACHIEVE NIGHT SETBACK SETPOINT. OUTSIDE AIR DAMPERS SHALL BE CLOSED, RETURN AIR DAMPERS SHALL BE OPEN. WHEN OAT IS BELOW 40 DEGREES THE HEATING VALVE SHALL MODUALTE TO MAINTAIN MAT AT 55 DEGREES.

MORNING WARM-UP: SUPPLY FAN SHALL ENERGIZE 100% AND HEATING VALVE SHALL OPEN. OPTIMUM START PROGRAMMING SHALL BE PROVIDED.

FEATURES:

SPACE TEMPERATURE SHALL BE TRENDED HOURLY
ALARM SHALL ANY STATUS NOT MATCH COMMAND
ALARM IF DISCHARGE AIR TEMPERATURE STRAYS MORE THAN 5 DEGREES FROM SETPOINT

ALARM IF SPACE TEMPERATURE STRAYS MORE THAN 5 DEGREES FROM SETPOINT
SHUTDOWN SUPPLY FAN IF SUPPLY SMOKE DETECTOR IS ACTIVATED

KITCHEN MAU & EF UNIT

(MAU-1 & 2)

DESCRIPTION - MAKEUP AIR HANDLING UNIT AND EXHAUST FAN COMPLETE WITH FILTER SECTION, INDIRECT FIRED GAS FURNACE, VARIABLE VOLUME EXHAUST FAN AND VARIABLE VOLUME SUPPLY FAN. DAMPERS, MODULATING GAS CONTROL VALVES, AND THEIR ACTUATORS SHALL BE FACTORY PROVIDED. VFDS, SENSORS FOR HOOD HEAT AND PARTICULATES AND SPACE THERMOSTAT SHALL BE BY MELINK INTELLI-HOOD. REFER TO MELINK SPECIFICATION FOR SCOPE REQUIRED OF TEMPERATURE CONTROLS CONTRACTOR.

A SEPARATE MELINK INTELLI-HOOD SYSTEM SHALL BE PROVIDED FOR EACH HOOD; THE RELOCATED TYPE I HOOD AND THE NEW TYPE II HOOD. TYPE I HOOD SHALL HAVE HEAT AND OPTIC SENSORS INSTALLED IN EXISTING HOOD. TYPE II HOOD SHALL HAVE HEAT SENSOR INSTALLED IN NEW HOOD.

BOTH FACTORY CONTROLLER AND MELINK INTELLI-HOOD SHALL BE CAPABLE OF COMMUNICATING TO THE BAS. SCHEDULING - THIS UNIT IS NOT SCHEDULED AND SHALL BE INTERLOCKED WITH THE KITCHEN HOOD EXHAUST SYSTEM TO PROVIDE CONDITIONED MAKE UP AIR WHENEVER THE KITCHEN HOOD EXHAUST SYSTEM IS OPERATING. OA DAMPERS SHALL OPEN WHEN EXHAUST FAN IS ACTIVATED. OA DAMPERS SHALL BE CLOSED WHEN EXHAUST FAN IS DE-ENERGIZED. EXHAUST FAN SHALL BE ENERGIZED BY HEAT AND/OR OPTIC SENSORS.

DISCHARGE AIR CONTROL: PROVIDE A WALL MOUNTED KITCHEN TEMPERATURE SENSOR FROM MELINK FOR SPACE TEMPERATURE AND DISCHARGE AIR SETPOINT CONTROL. MELINK CONTROLLER SHALL SEND SIGNAL TO MUA FACTORY CONTROLLER TO RESET DISCHARGE AIR TEMPERATURE BETWEEN 55 AND 85 DEGREES. FACTORY CONTROLLER SHALL MODULATE GAS VALVE TO MAINTAIN DAT SETPOINT.

FAN SPEED CONTROL: MELINK SHALL VARY FAN SPEED BETWEEN 50% AND 100% DEPENDING ON HEAT AND OPTIC SENSOR REQUIREMENTS.

MELINK SHALL REPORT FAN STATUS AND ANY ALARM CONDITION BACK TO BAS

MELINK SHALL INTEGRATE WITH THE EXISTING, RELOCATED FIRE SUPPRESSION SYSTEM FOR TYPE I HOOD TO TURN MAKEUP AIR UNIT OFF AND ACTIVATE EXHAUST TO 100% UPON FIRE DETECTION.

MUA FACTORY CONTROLS SHALL REPORT FREEZESTAT BACK TO BAS AND SHALL BE CAPABLE OF HAVING AUTOMATIC RESET ON FREEZESTAT FROM THE BAS. TEMPERATURE CONTROL CONTRACTOR SHALL CONNECT TO FACTORY INSTALLED DPT FOR DIRTY FILTER ALARM.

FEATURES -

1. GENERATE AN ALARM SHOULD DISCHARGE AIR TEMPERATURE STRAY BELOW DISCHARGE AIR TEMPERATURE SETPOINT BY 5 DEG OR MORE FOR LONGER THAN 5 MINUTES SHUT UNIT DOWN.
2. GENERATE AN ALARM SHOULD ANY FAN STATUS NOT MATCH FAN COMMAND.
3. GENERATE AN ALARM SHOULD FREEZE STAT TRIP CLOSE OA DAMPER.
4. IN THE EVENT OF A FIRE AT THE HOOD, THE FIRE SUPPRESSION SHALL ACTIVATE.
5. GENERATE ALARMS AS INDICATED IN THE POINTS LIST AND IN THE SEQUENCE OF CONTROL ABOVE.

DESCRIPTION - THE SYSTEM CONSISTS OF AN EXISTING AIR HANDLING UNIT COMPLETE WITH MIXING BOX, FILTER SECTION, HOT WATER COIL, AND SUPPLY FAN TO BE PROVIDED WITH NEW MOTOR AND VARIABLE FREQUENCY DRIVE. A SEPARATE EXHAUST FAN SERVES BUILDING PRESSURE RELIEF. CONTRACTOR TO VERIFY ALL EXISTING EXHAUST FANS WITHIN PROJECT ARE CONTROLLED AND NOTIFY ENGINEER IMMEDIATELY IF UNCONTROLLED FANS ARE FOUND. DAMPERS, CONTROL VALVES, AND THEIR ACTUATORS, AS WELL AS ALL OTHER CONTROLS REQUIRED SHALL BE NEW EQUIPMENT FURNISHED AND INSTALLED BY THE TEMPERATURE CONTROLS CONTRACTOR.

SCHEDULING - OCCUPIED/UNOCCUPIED SCHEDULING APPLIES TO THESE SYSTEMS. SCHEDULES TO BE DETERMINED BY OWNER AND SHALL BE AVAILABLE THROUGH THE OPERATOR WORKSTATION INTERFACE.

SCHEDULING CONTROLS SPACE SETPOINT TEMPERATURE. DURING OCCUPIED MODE, AHU SHALL MAINTAIN SPACE TEMPERATURE AT SETPOINT DICTATED BY SPACE MOUNTED THERMOSTAT (I.E. 68-72°F HEATING, 76-80°F COOLING). DURING UNOCCUPIED MODE, AHU SHALL MAINTAIN SPACE TEMPERATURE AT SETBACK TEMPERATURE SETPOINT (I.E. 60°F HEATING, N/A COOLING UNLESS MORNING COOL-DOWN IS ENABLED, FURTHER DESCRIPTION BELOW) OCCUPIED/UNOCCUPIED SCHEDULING ALSO CONTROLS VENTILATION. WHEN SCHEDULED IN THE OCCUPIED MODE, SUPPLY FAN SHALL OPERATE AND CONTROLLED DEVICES SHALL POSITION WITH RESPECT TO THEIR PI CONTROL LOOP. WHEN SCHEDULED IN THE UNOCCUPIED MODE, FANS SHALL BE SHUT-OFF, RETURN DAMPER FULL OPEN, OUTSIDE AIR DAMPERS CLOSED, AND HEATING WATER VALVE SHALL BE 100% OPEN. SUPPLY FAN SHALL BE PERMITTED TO OPERATE ON DEMAND FOR HEATING.

MORNING WARM-UP: MORNING WARM-UP SHALL BE BASED ON OPTIMUM START PROGRAMMING. SUPPLY FAN VFD SHALL CONTROL OFF STATIC PRESSURE. ALL VAV BOXES SHALL GO FULL OPEN. VAV BOX HEATING CONTROL VALVE SHALL BE OPEN. AIR HANDLING UNIT SHALL SUPPLY 70% (ADJ) AIR TO VAV BOXES. OA DAMPER SHALL BE CLOSED, RA DAMPER SHALL BE OPEN. AS EACH VAV BOX ZONE REACHES OCCUPIED SETPOINT THE VAV BOX HEATING COIL SHALL CLOSE AND THE VAV BOX AIRFLOW SHALL GO TO MINIMUM POSITION. MORNING WARMUP DISABLE/ENABLE SHALL BE ON GRAPHICS. TIME OF MORNING LIMIT SHALL ALSO BE ON GRAPHICS. MORNING WARM-UP: MORNING WARM-UP SHALL BE BASED ON OPTIMUM START PROGRAMMING DURING MORNING WARM-UP, SUPPLY FAN VFD SHALL BE AT MAXIMUM SPEED (AS DETERMINED BY BALANCE CONTRACTOR). AIR HANDLING UNIT SHALL SUPPLY 85°F (ADJ) AIR. OSA DAMPER SHALL BE CLOSED, RA DAMPER SHALL BE OPEN. ZONE REACHES OCCUPIED SETPOINT, THE AHU HEATING COIL CONTROL VALVE SHALL CLOSE AND THE AHU FAN SPEED SHALL GO TO MINIMUM. MORNING WARMUP DISABLE/ENABLE SHALL BE ON GRAPHICS. TIME OF MORNING LIMIT SHALL ALSO BE ON GRAPHICS.

MORNING COOLDOWN: SHALL BE BASED UPON TREND DATA COLLECTED OVER THE PREVIOUS 7 DAYS (ADJ) TO DETERMINE WHETHER OR NOT MORNING COOLDOWN IS WARRANTED. MORNING COOLDOWN SHALL BE DEEMED WARRANTED IF:

1. DEMAND FOR COOLING OCCURRED ON THE MAJORITY OF THE DAYS IN PREVIOUS PERIOD POLLED.
2. -OR- DAILY MAXIMUM OUTSIDE AIR TEMPERATURE EXCEEDED SPACE TEMPERATURE SETPOINT FOR A MAJORITY OF THE DAYS THE IN PREVIOUS PERIOD POLLED.

WHEN DEEMED WARRANTED, MORNING COOLDOWN SHALL BE EXECUTED IN LIEU OF MORNING WARM-UP ROUTINE. THE MORNING COOLDOWN ROUTINE SHALL BE SCHEDULED TO OCCUR PRIOR TO OCCUPANCY. PROVIDE ADJUSTABLE DURATION TO PERMIT BUILDING OPERATOR TO TUNE TIME PERIOD REQUIRED TO FULLY EXECUTE COOLDOWN EXERCISE PRIOR TO OCCUPANCY. DURING MORNING COOLDOWN, HEATING WATER VALVE SHALL BE CLOSED AND BAS SHALL MODULATE MIXING BOX POSITION TO ACHIEVE COOLING DISCHARGE AIR TEMPERATURE. SUPPLY FAN SHALL STOP AND OSA DAMPER SHALL SHUT ONCE THE SPACE TEMPERATURE REACHES THE MORNING COOLDOWN SETPOINT (USER ADJ 60°F TO 68°F).MORNING COOLDOWN DISABLE/ENABLE SHALL BE ON GRAPHICS.

MIXED AIR CONTROL: MIXING BOX CONTROL IS CONTROLLED BY MULTIPLE CONTROL LOOPS- BCS SHALL HIGH SELECT CONTROL POSITION AMONGST THE FOLLOWING LOOPS:

OCCUPIED/UNOCCUPIED: DAMPER CLOSED DURING UNOCCUPIED AND OPEN TO MINIMUM POSITION DURING OCCUPIED. MINIMUM OUTSIDE AIR POSITIONS SHALL NOT BE LESS THAN 10% OSA DURING OCCUPIED PERIODS.

MIXED AIR TEMPERATURE CONTROL LOOP: WHEN OUTSIDE AIR TEMPERATURE FALLS BELOW DISCHARGE AIR SETPOINT BY 2 DEGREE, MIXING DAMPERS SHALL MODULATE TO MAINTAIN DISCHARGE AIR TEMPERATURE AT SETPOINT. DEMAND CONTROLLED VENTILATION LOOP: CARBON DIOXIDE LEVEL SHALL BE MONITORED TO MODULATE OUTSIDE AIR DAMPERS TO MAINTAIN CARBON DIOXIDE LEVELS AT SETPOINT (500 PPM ABOVE THE OUTDOOR REFERENCE POINT).

ECONOMIZER CONTROL LOOP: OPEN OUTSIDE AIR DAMPER, CLOSE RETURN AIR DAMPER. DURING ECONOMIZER MODE. COOLING IS VIA ECONOMIZER MODE ONLY, DISABLE ECONOMIZER COOLING WHEN OUTSIDE AIR TEMPERATURES ARE GREATER THAN INDOOR SPACE TEMPERATURE SETPOINT.

DISCHARGE AIR TEMPERATURE (DAT) CONTROL: DAT SETPOINT SHALL BE 85°F FOR HEATING AND 55°F FOR COOLING. MODULATE MIXING BOX POSITION TO MAINTAIN DAT AT SETPOINT DURING ECONOMIZER COOLING. IF THE OSA DAMPERS ARE AT MINIMUM POSITION (OR COMMANDED FURTHER OPEN BY DCV LOGIC) AND THE MIXED AIR TEMPERATURE IS BELOW DAT SETPOINT, MODULATE HEATING WATER VALVE TO MAINTAIN DAT AT SETPOINT.

FAN CONTROL:

THE SUPPLY FAN VFD SHALL BE MODULATED BASED ON SPACE TEMPERATURE DEVIATION FROM SETPOINT PER THE RESET SCHEDULE BELOW INDICATING DEADBAND, HEATING AND COOLING RAMP-UP RANGES, AND MINIMUM SPEED..

RELIEF SYSTEMS CONTROL: THE BUILDING RELIEF SYSTEMS SHALL BE CONTROLLED BASED ON SPACE PRESSURE REFERENCED AGAINST OUTSIDE AIR PRESSURE. VALUES INDICATED BELOW ARE DIFFERENTIAL PRESSURES BETWEEN THE TWO MEASUREMENTS.

EXISTING H&V-2: EXISTING EXHAUST FAN IS LOCATED IN THE TRIANGULAR STRUCTURE UP HIGH IN THE ORIGINAL 1962 GYM, GYMNASIUM 400. ACCORDING TO PSD MAINTENANCE PERSONNEL IT IS ON NORTH SIDE OF THE GYM NEAR GRIDS 18-19. FAN SHALL BE INTERLOCKED TO RUN WHEN H&V-2 OA DAMPER IS 100% OPEN. UPDATE (E) PNEUMATICS TO DDC CONTROL. COORDINATE WITH PSD FOR ACCESS TO FAN.

EXISTING H&V-4: UNIT SERVES AUDITORIUM. THREE NEW EXHAUST FANS ARE BEING INSTALLED, EF-23, 24, AND 25. THESE SHALL STAGE ON IN CORRELATION WITH OA DAMPER POSITION CONTROLS CONTRACTOR, TAB CONTRACTOR AND COMMISSIONING AGENT TO DETERMINE STAGING VERSUS POSITION IN FIELD. LEAD EF SHALL ROTATE WEEKLY.

EXISTING H&V-3: SERVING COMMONS AREA. DESIGN TEAM WAS UNABLE TO VERIFY AN EXISTING RELIEF HOOD OR EXHAUST FAN ASSOCIATED WITH THIS UNIT.

H&V-3 AND H&V-4 COMBINATION. CONTROL DAMPERS AND INDUSTRIAL LEVEL BACKDRAFT DAMPERS ARE TO BE INSTALLED IN H&V-3 AND H&V-4 TO COMBINE THEIR SUPPLY DUCTS TO PROVIDE MORE AIRFLOW TO THE AUDITORIUM DURING PERFORMANCES. PERFORMANCE TIMES ARE TO BE ABLE TO BE SCHEDULED THROUGH THE BAS INTERFACE. WHEN "PERFORMANCE" MODE IS SCHEDULED THE UNITS DAT SETPOINT, SUPPLY FAN VFD SPEED AND OA DAMPER MODULATION SHALL WORK IN CONCERT BASED ON H&V-4 RESPONDING TO AUDITORIUM FEEDBACK. CONTROL DAMPER IN DUCT CONNECTION SHALL OPEN TO ALLOW H&V-3 SUPPLY TO FLOW INTO H&V-4 SUPPLY. CONTROL DAMPER IN H&V-3 SUPPLY SHALL CLOSE.

FEATURES -

1. DISCHARGE AIR TEMPERATURE SHALL BE TRENDED HOURLY.
2. GENERATE AN ALARM SHOULD DISCHARGE AIR TEMPERATURE STRAY BELOW DISCHARGE AIR TEMPERATURE SETPOINT BY 5 DEG OR MORE.
3. GENERATE AN ALARM SHOULD ANY FAN STATUS NOT MATCH FAN COMMAND.
4. GENERATE AN ALARM AND OPEN HEATING VALVE TO 100% SHOULD FREEZE STAT TRIP AND DAMPERS SHALL GO TO UNOCCUPIED MODE POSITION.
5. GENERATE AN ALARM SHOULD SMOKE DETECTOR TRIP AND SHUT UNIT DOWN, VALVES AND DAMPERS SHALL GO TO UNOCCUPIED MODE.
6. HOURLY TREND ITEMS INDICATED IN THE POINTS LIST TO BE TRENDED. STORE DATA FOR 1 YEAR PRIOR TO PURGING.
7. GENERATE ALARMS AS INDICATED IN THE POINTS LIST AND IN THE SEQUENCE OF CONTROL ABOVE.

SEQUENCE OF OPERATIONS P.2

POUDRE HIGH SCHOOL RENOVATIONS

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4/10/12



SEQUENCE OF OPERATION

100% OA AHU w/ ERV

100% OA INDOOR AIR HANDLING UNIT WITH ENERGY RECOVERY VENTILATOR
THE SYSTEM CONSIST OF AN INDOOR AIR HANDLING UNIT COMPLETE WITH SUPPLY FAN, RETURN FAN, ENERGY RECOVERY HEAT PIPE, ECONOMIZER, HYDRONIC HEATING COILS, PRE FILTER AND FINAL FILTER. CONTROLS SHALL BE FIELD INSTALLED BY TCC, WITH THE EXCEPTION OF ERV MANUFACTURER PROVIDED FACTORY HEAT PIPE CONTROLLER. ERV MANUFACTURER SHALL PROVIDE AN INTERFACE TO TEMPERATURE CONTROLS CONTROL CONTRACTOR TO ALLOW FULL COMMUNICATION OF POINTS BETWEEN HEAT PIPE CONTROLLER AND BAS. COORDINATION BETWEEN TEMPERATURE CONTROLS CONTRACTOR AND ERV MANUFACTURER IS IMPERATIVE.
SCHEDULING:
SCHEDULING SHALL BE PER OWNER.
DISCHARGE AIR CONTROL:
DISCHARGE AIR TEMPERATURE IS TO BE MAINTAINED AT SETPOINT BY TILTING THE HEAT PIPE AND MODULATING THE HOT WATER CONTROL VALVE. DISCHARGE AIR SETPOINT SHALL VARY BASED ON POLLING OF THE REHEAT COIL ZONES SERVED BY THIS UNIT. IF MAJORITY OF ZONES ARE ABOVE SETPOINT DAT SHALL BE 60 DEGREES (ADJUSTABLE), AS MAJORITY OF ZONES REACH SETPOINT THE DAT RESET UP TO 70 DEGREES (ADJUSTABLE). IF MAJORITY OF ZONES ARE BELOW SETPOINT, DAT SHALL BE 85 DEGREES (ADJUSTABLE), AS MAJORITY OF ZONES REACH SETPOINT DAT SHALL RESET DOWN TO 75 DEGREES (ADJUSTABLE), BAS SHALL SEND FACTORY HEAT PIPE CONTROLLER DAT RESET SIGNAL.
FEATURES:
GENERATE AN ALARM SHOULD DISCHARGE AIR TEMPERATURE STRAY BELOW DISCHARGE AIR TEMPERATURE SETPOINT BY 10 DEG OR MORE.
GENERATE AN ALARM SHOULD FAN STATUS NOT MATCH FAN COMMAND. GENERATE AN ALARM AND OPEN HEATING VALVE TO 100% SHOULD FREEZE STAT TRIP. GENERATE AN ALARM SHOULD SMOKE DETECTOR TRIP AND SHUT UNIT DOWN.
HEAT EXCHANGER FROST PROTECTION:
FACTORY HEAT PIPE CONTROLLER SHALL TILT HEAT PIPE TO PREVENT FROST BUILD UP ON THE HEAT EXCHANGER.

DOMESTIC HOT WATER PUMP OCC/UNOCC

SEQUENCE OF OPERATION:
KITCHEN DOMESTIC HOT WATER CIRCULATION PUMP: EXISTING IN WATER HEATER CLOSET WHERE NEW WH-1 SHALL BE INSTALLED. REFER TO FLOOR PLANS
SCHEDULING:
THE PUMP SHALL BE SCHEDULED THROUGH THE BAS SYSTEM TO RUN DURING OCCUPIED MODE AND BE OFF IN UNOCCUPIED MODE. COORDINATE WITH OWNER FOR KITCHEN STAFF OCCUPANCY HOURS AND DAYS

EX-FAN's w/ T-STAT CONTROL

SEQUENCE PERTAINS TO THE FOLLOWING EXHAUST FANS, WHICH ARE NOT INTENDED TO BE ON THE DDC SYSTEM:
EXH FANS SERVING ELECTRICAL ROOM
EXHAUST FANS SHALL BE CONTROLLED BY INDIVIDUAL SPACE MOUNTED COOLING THERMOSTAT SET AT 80°F (ADJ). UPON A RISE IN SPACE TEMPERATURE ABOVE SETPOINT PLUS DIFFERENTIAL, EXHAUST FANS SHALL ENABLE. CONVERSELY, UPON A DECREASE IN SPACE TEMPERATURE BELOW SETPOINT PLUS DIFFERENTIAL, EXHAUST FANS SHALL DISABLE.

EXHAUST FAN OCCUPIED/ UNOCCUPIED CONTROL

DURING OCCUPIED HOURS, FAN SHALL ENABLE. CONVERSELY, DURING UNOCCUPIED HOURS, FAN SHALL DISABLE.
SHOULD FAN STATUS NOT MATCH FAN COMMAND, SEND AN ALARM THROUGH THE WEB INTERFACE.
OCCUPIED/UNOCCUPIED HOURS SHALL BE INDICATED BY THE DDC SYSTEM

CUH's & UH's

UPON A DROP IN TEMPERATURE BELOW SETPOINT PLUS DIFFERENTIAL, FAN SHALL ENERGIZE AND HEATING WATER CONTROL VALVE SHALL OPEN. CONVERSELY, UPON A RISE IN TEMPERATURE ABOVE SETPOINT PLUS DIFFERENTIAL, FAN SHALL BE DE-ENERGIZED AND HEATING WATER CONTROL VALVE SHALL CLOSE.
CABINET UNIT HEATERS AND UNIT HEATERS ARE NOT INTENDED TO BE ON THE DDC SYSTEM.

BASEBOARD HEATING CONTROL

UPON A DROP IN SPACE TEMPERATURE BELOW ZONE THERMOSTAT SETPOINT PLUS DIFFERENTIAL, MODULATE OPEN HEATING WATER CONTROL VALVE BASED ON DEVIATION FROM SETPOINT. CONVERSELY, UPON A DROP IN TEMPERATURE BELOW SETPOINT PLUS DIFFERENTIAL, CONTROL VALVE SHALL CLOSE.
IN ZONES WITH BASEBOARD AND VAV HEATING, THE BASEBOARD VALVE SHALL MODULATE IN CONCERT WITH THE VAV HEATING VALVE.
FEATURES-SPACE TEMPERATURE TRENDED HOURLY



SEQUENCE OF OPERATIONS P.3	
POUDRE HIGH SCHOOL RENOVATIONS	
Building Technology Systems 1270 S. Lipan DENVER CO. 80223 (303)744.2235 Fax 744.0037	
Drawing No. 18	Drawn by: JASON BROOS 4/10/12

IQ3xcite / BINC
First Floor Tel-Net Closet

LAN Addr : 9
VCNC Addr 1: 1
VCNC Addr 2: 4

IP Addr : TO BE PROVIDED
Subnet : 255.255.255.0
VCNC Port Addr : 10001, 10004
MAC Addr : 00:10:70:xx:yy:zz

BACnet Network: 9
Device Instance: 9009
MAC Addr: 9

LAN #9 BUS LAYOUT

(CONTINUED ON NEXT PAGE)

Ethernet Cable
10BaseT /
100BaseTX
Cat.5 (typical)

Linksys Model SD208
8-port 10/100 Switch.
Located in Tel-Net Closet

963S/CD/3USER
Located in the Tel-Net Closet

IP Addr : 192.168.100.1
Subnet : 255.255.255.0
Default Router :

Ethernet LAN

RTU-3 RTU-3

9060 9061
9 60 9 61

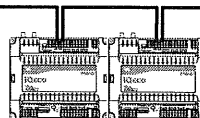
V2-01
9034
9 34

V2-02
9035
9 35

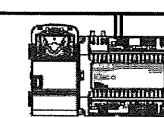
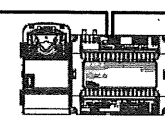
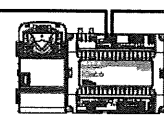
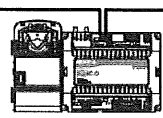
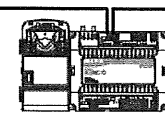
V2-03
9036
9 36

V2-07
9037
9 37

V2-06
9038
9 38



IQeco-39 IQeco-39



Terminating Resistor
See note #2 below
right

V2-05
9012
9 12

V2-04
9013
9 13

RTU-2 RTU-2 RTU-2
9063 9064 9065
9 63 9 64 9 65

V1-09
9016
9 16

V1-08
9017
9 17

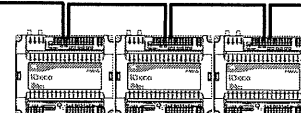
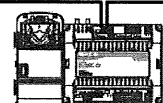
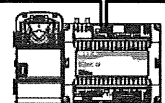
V1-07
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9 18

V1-06
9019
9 19

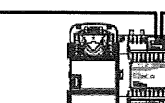
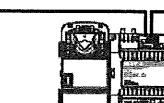
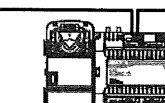
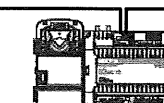
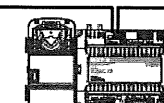
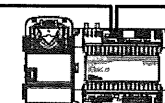
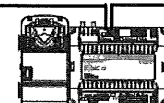
V1-12
9020
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V1-11
9021
9 21

V1-05
9022
9 22



IQeco-39 IQeco-39 IQeco-39



V4-07
9033
9 33

V4-06
9032
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V4-09
9031
9 31

V4-08
9030
9 30

V1-01
9029
9 29

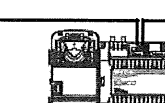
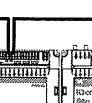
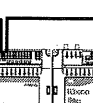
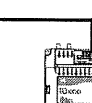
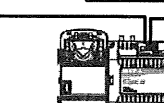
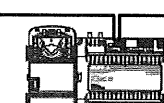
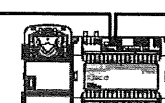
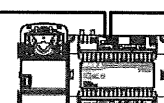
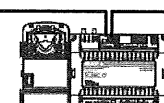
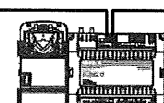
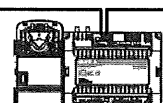
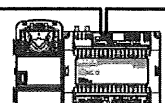
V1-02
9028
9 28

V1-10
9027
9 27

V1-03
9015
9 15

RTU-1 RTU-1 RTU-1
9068 9069 9070
9 68 9 69 9 70

V1-04
9023
9 23



IQeco-39 IQeco-39 IQeco-39

Continued on next page ---->

MS/TP Cable
See note #1

BACnet
Device
Instance

DEVICE
NET MAC

BACnet & Trend
Network
Number

Network
MAC
Address

Control System Network Riser Detail
Not To Scale

Note #1
24 AWG, 2 conductor shielded plenum rated cable
Impedance rating: 100 ohms
Connect-Air Int'l p/n: W241P-2000FBRSP

Note #2
Precision resistors rated 80 ~ 130 ohm, 1/4watt, +/-1%
Installed resistors to match the impedance rating of the installed MS/TP cable.

**BUILDING
TECHNOLOGY
SYSTEMS**

SYSTEM ARCHITECTURE

POUDRE HIGH SCHOOL

Building Technology Systems
1270 S. Lipan
DENVER CO. 80223
(303)744.2235 Fax 744.0037

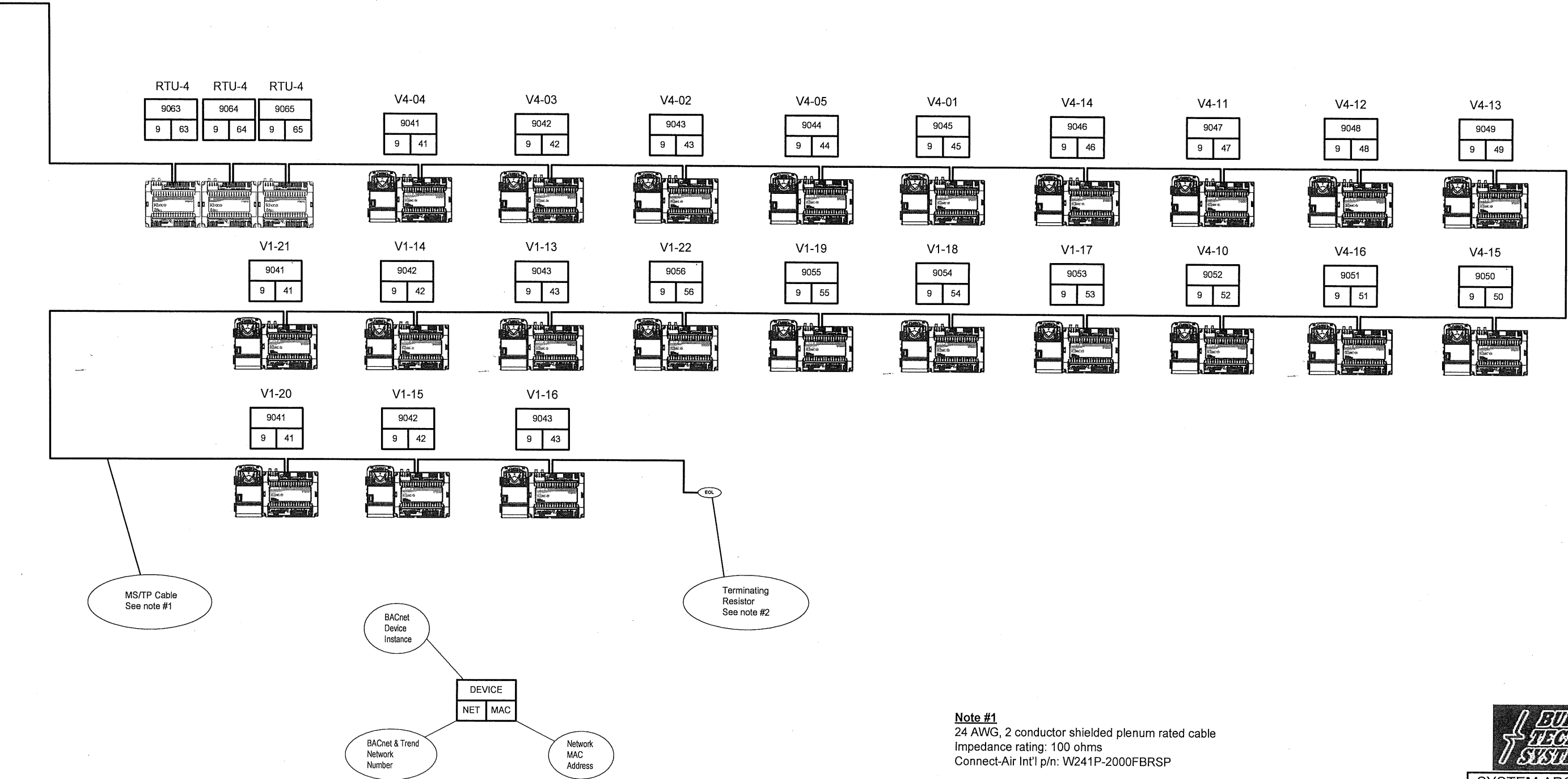
Drawing No.

19


Drawn by:
Jason Broos

05/09/2012

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Control System Network Riser Detail
Not To Scale



SYSTEM ARCHITECTURE

POUDRE HIGH SCHOOL

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1270 S. Lipan
DENVER CO. 80223
(303)744.2235 Fax 744.0037

Drawing No.	Drawn by:
20	Jason Broos
	05/09/2012

IQ3xcite / BINC
First Floor Tel-Net Closet

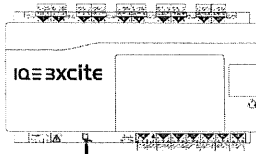
LAN #11 BUS LAYOUT

LAN Addr : 11
CNC Addr 1: 1
CNC Addr 2: 4

IP Addr : TO BE PROVIDED
Subnet : 255.255.255.0
VCNC Port Addr : 10001,
10004
MAC Addr : 00:10:70:xx:yy:zz

BACnet Network: 12
Device Instance: 9012
MAC Addr: 12

IQ3xcite/96/UL/24



Hot Water Plant

LAN Addr : 11
Node Addr : 11
VCNC Addr : 101

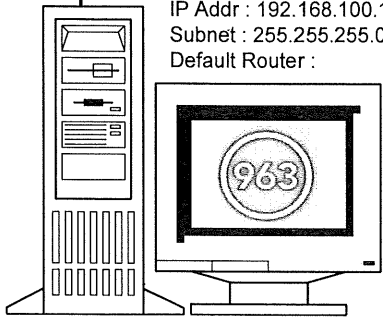
IP Addr : TO BE PROVIDED
Subnet : 255.255.255.0
VCNC Port Addr : 10101
MAC Addr : 00:10:70:xx:yy:zz

Ethernet Cable
10BaseT /
100BaseTX
Cat 5 (typical)

Linksys Model SD208
8-port 10/100 Switch
Located in Tel-Net Closet

963S/CD/3USER
Located in the Tel-Net Closet

IP Addr : 192.168.100.1
Subnet : 255.255.255.0
Default Router :



Ethernet LAN

RTU-5 RTU-5 RTU-5

11060	11061	11062
11	60	11
61	11	62

RTU-6 RTU-6 RTU-6

11063	11064	11065
11	63	11
64	11	65

RTU-7 RTU-7

11066	11067
11	66
11	67

RTU-8 RTU-8 RTU-8

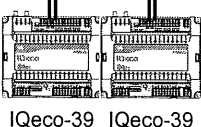
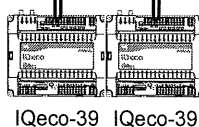
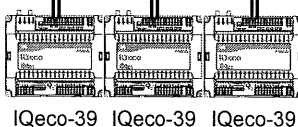
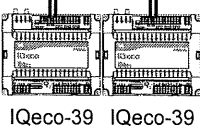
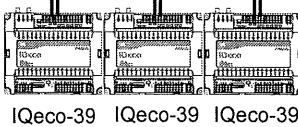
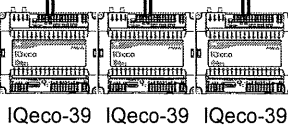
11068	11069	11070
11	68	11
69	11	70

MAU-1 MAU-1

11071	11072
11	71
11	72

MAU-2 MAU-2

11073	11074
11	73
11	74



Terminating Resistor
See note #2 below
right

V5-01

11012
11
12

V5-02

11013
11
13

V5-03

11014
11
14

V5-04

11015
11
15

V5-05

11016
11
16

V5-06

11017
11
17

V6-01

11018
11
18

V6-02

11019
11
19

V6-03

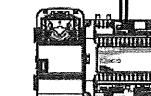
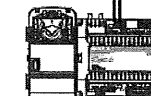
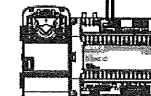
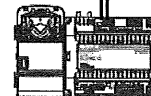
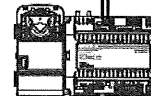
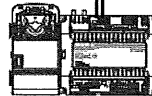
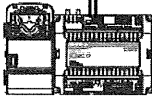
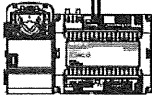
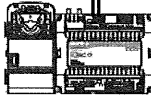
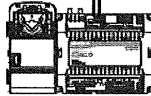
11020
11
20

V6-04

11021
11
21

V6-05

11022
11
22



V8-10

11033
11
33

V8-09

11032
11
32

V8-08

11031
11
31

V8-07

11030
11
30

V8-06

11029
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V8-05

11028
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V8-04

11027
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V8-03

11026
11
26

V8-02

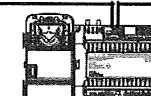
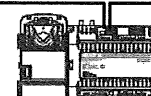
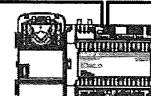
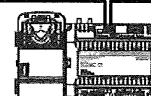
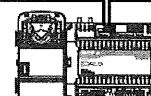
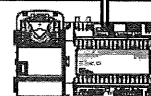
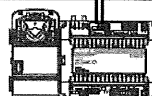
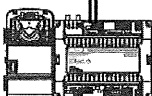
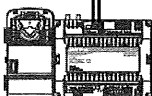
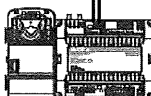
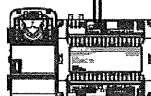
11025
11
25

V8-01

11024
11
24

V6-06

11023
11
23



V8-11

11034
11
34

H&V-1 H&V-1

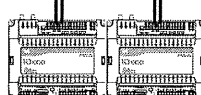
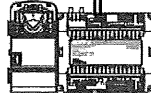
11072	11073
11	72
11	73

H&V-2 H&V-2

11074	11075
11	74
11	75

H&V-3 H&V-3

11076	11077
11	76
11	77



IQeco-39 IQeco-39

IQeco-39 IQeco-39

IQeco-39 IQeco-39

Terminating Resistor
See Note #2

MS/TP Cable
See note #1

BACnet
Device
Instance

DEVICE
NET MAC

BACnet & Trend
Network
Number

Network
MAC
Address

Note #1
24 AWG, 2 conductor shielded plenum rated cable
Impedance rating: 100 ohms
Connect-Air Int'l p/n: W241P-2000FBRSP

Note #2
Precision resistors rated 80 ~ 130 ohm, 1/4 watt, +/-1%
Installed resistors to match the impedance rating of the installed MS/TP cable.

Control System Network Riser Detail

Not To Scale

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SYSTEM ARCHITECTURE

POUDRE HIGH SCHOOL

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Drawing No.

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Drawn by:
Jason Broos

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