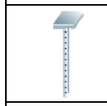
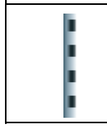
Demo Purposes Only

Tag Descriptions

Tag	Description
OA-RH	Outside Air Humidity Sensor
OA-T	Outside Air Temperature
FLT-Switch	Dirty Filter Switch
MAT	Mixed Air Temperature
CLG-C-T	Cooling Coil Temperature
HTG-DAT-LL	Heating Discharge Air Temp Low Limit
SA-F	Supply Air Flow
SA-T	Supply Air Temperature
RA-RH	Return Air Relative Humidity
SA-RH	Supply Air Relative Humidity
ZN-RH	Zone Relative Humidity
RA-F	Return Air Flow
RA-T	Return Air Temperature
SA-P	Supply Air Pressure
SA-P-HL	Supply Air Pressure High Limit
BLDG-T	Building Temperature
RA-SMK	Return Air Smoke Detector
SA-SMK	Supply Air Smoke Detector
SF-SS	Supply Fan Start/Stop
SF-S	Supply Fan Status
SF-C	Supply Fan Command
EF-SS	Exhaust Fan Start/Stop
EF-S	Exhaust Fan Status
EF-C	Exhaust Fan Command
OA-D-C	Outside Air Damper Command
MA-D-C	Mixed Air Damper Command
DX-V-C	DX Unit Command
HTG-V-C	Heating Valve Command
GEN-S	Generator Status
EUH-SS	Electric Unit Heater Start/Stop
GUH-SS	Gas Unit Heater Start/Stop
PHW-PMP-S	Primary Hot Water Pump Status
PHW-PMP-SS	Primary Hot Water Pump Start/Stop
SHW-PMP-S	Secondary Hot Water Pump Status
SHW-PMP-SS	Secondary Hot Water Pump Start/Stop
BLR-S	Boiler Status
BLR-V-C	Boiler Valve Position
HWR-T	Hot Water Return Temperature
HWS-T	Hot Water Supply Temperature
VAV-VP	VAV Inlet Velocity Pressure
VAV-D-C	VAV Damper Command
DA-T	VAV Discharge Air Temperature
VFD	Variable Frequency Drive

Legend	
Symbol	**Definition**
	Probe Temperature Sensor
	Air Flow Switch
	Serpentine Temperature Element
	Humidity Sensor
	Combination Temp/Humidity Sensor
	Pressure Switch & Transmitter
	Air Flow Station
	Smoke Detector
	Humidifier

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PROJECT:

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PAGE: 2 of 20

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REV	DATE	REVISIONS	INIT

VAV AHU With Economizer

Contractor shall install DDC hardware to perform this sequence of operation and to provide network variable inputs, outputs and alarms as specified. Unless otherwise specified, all modulating control shall be proportional-integral-derivative (PID) control.

Hand-Off-Auto Switches:

Supply fan motor VFD shall accept a fire alarm panel (FAP) signal that takes precedence over all other starter inputs and switches and shall stop the fan. The fan motor starter shall accept an occupant accessible emergency shutoff switch as shown. The suppy fan motor VFD shall have an H-O-A switch:

1) Hand: With the H-O-A switch in hand position, the supply fan shall start and run continuously, subject to safeties.
2) Off: With the H-O-A switch in off position, the supply fan shall stop
3) Auto: With the H-O-A switch in auto position, the supply fan shall run subject to the supply fan start/stop signal and safeties.

Exhaust fan motor starter shall accept a FAP signal that takes precedence over all other starter inputs and switches and shall stop the fan. The exhaust fan motor starter shall have an H-O-A switch:

1) Hand: With the H-O-A switch in hand position, the exhaust fan shall run subject to safeties.
2) Off: With the H-O-A switch in off position, the exhaust fan shall stop
3) Auto: With the H-O-A switch in auto position, the exhaust fan shall run subject to the exhaust fan start/stop signal and safeties.

Occupancy Modes:

The system shall obtain it's occupancy mode input from the system scheduler as speciied. The system shall operate in one of the following modes: Occupied, Unoccupied, Optimum Morning Warm-Up/ Cool-Down.

Proofs and Safeties:

1) The supply fan, exhaust fan and all DDC hardware control loops shall be subject to proofs and safeties. Safeties shall be direct-hardwire interlocked to the fan safety circuit, DDC hardware shall monitor all proofs and safeties and failure of any proof or activation of any safety shall result in all control loops being disabled and the AHU fan being commanded off until reset.

2) Proofs:
   A. Supply Fan Status
   B. Exhaust Fan Status

3) Safeties:
   A. Supply Air Duct Pressure High Limit
   B. Supply Air Smoke
   C. Return Air Smoke
   D. Supply Air Duct High Temp
   E. Emergency Shutdown

4) DDC hardware reset of all proofs and safeties shall be via a local binary push-button (reset) input to the DDC hardware.

System Enable and Loop Enable

1) Occupied Mode: The supply fan shall be enabled and commanded to run. All control loops shall be enabled. The zone temperature control loops for VAV boxes serviced by the AHU shall also be enabled.

2) Unoccupied Mode:
   A. Cooling Season: While the average building temperature is below setpoint (3deg deadband) all control loops shall be disabled and the supply fan shall not run. When building temp increases above setpoint, the supply fan shall be enabled and commanded to run, the supply duct static pressure control, exhaust fan volume control, economizer control and cooling coil control loops shall be enabled. The minimum outside air flow control and heating coil control loops shall be disabled.

   B. Heating Season: While the average building temp is above setpoint all control loops shall be disabled and the supply fan shall not run. When the bldg temp drops below setpoint, the supply fan shall be enabled and commanded to run, the supply duct static pressure control, exhaust fan volume control and heating coil control loops shall be enabled. The minimum outside air flow control, economizer control and cooling coil control loops shall be disabled.

3) Optimum Warm Up/Cool Down: The supply and exhaust fans shall be enabled and commanded to run. The minimum outside air flow control loop shall be disabled and all other control loops shall be enabled. Provide unit with optimum start and optimum stop controls, optimum start and stop setpoints and variables shall be adjustable by the user.

Fan Control:

1) Supply Duct Static Pressure Control: When this loop is enabled the DDC hardware shall modulate the supply fan variable frequency drive unit to maintain the duct static pressure setpoint. The duct static pressure shall be reset according to the "Critical Zone Reset" strategy. The AHU controller shall monitor the position of the VAV boxes' air dampers and slowly adjust the static pressure supply setpoint so that one of the dampers is nearly wide open. The static pressure reset strategy variables shall be user adjustable. When this loop is disabled, the DDC hardware capacity modulation output to the VFD shall be zero percent.

2) Exhaust Air Fan: When this loop is enabled, the fan shall be enabled and run continuously. Exhaust air fan shall not start if the supply air fan does not prove to be running. The exhaust air fan shall stop if any of the safeties in section "C" prove. The exhaust fan speed shall be modulated to ensure the flow differential setpoint is maintained. The exhaust fan shall be off during the unoccupied mode.

DX Cooling Coil Control:

1) When this loop is enabled the DDC hardware shall stage the DX unit to maintain the supply air temp setpoint. When the coil frost prevention sensor senses a frost condition on the cooling coil, the compressors shall be disabled until the sensed temp on the cooling coil increases to 50degF. The system shall otherwise be disabled when the heating coil control loop is enabled.

Heating Coil Control:

1) When this loop is enabled, the DDC hardware shall modulate the gas heating valve to maintain supply air temp setpoint. The heating Coil loop shall be diabled when the cooling coil or economizer loops are enabled.

Minimum Outside Air Flow Control:

1) When this loop is enabled the DDC hardware shall modulate the outside air damper to maintain the minimum OA volumetric flow at setpoint as measured by the airflow measurement array located in the OA duct as shown. Flow setpoint shall be reset using a demand controlled ventilation schedule based on the reset schedule on this sheet, utilizing a proportional control algorithm.

2) OA flow setpoint shall also be reset utilizing the kitchen exhaust hood fan flow inputs. The contoller shall be programmed so that the kitchen exhaust hood flowrate corresponds to the input signal to the DDC per hood. The OA flow setpoint shall be reset to min OA setpoint plus the calculated CFM from C02 reset.

3) These airflows shall be additive (for example: if the OAF-SP has been increased to account for high c02 and the kitchen exhaust hoods are indicating flow, the OAF-SP will be increased to account for both the c02 and the hoods, otherwise, OAF-SP shall equal min OAF-SP)

4) When this loop is disabled, the outside air damper shall be closed.

Economizer Control:

1) When this loop is enabled and the economizer is on as determined by the economizer enable logic, the DDC hardware shall modulate the outside air, Relief and exhaust air dampers to maintain the mixed air temp at setpoint.

2) When this loop is disabled or the economizer is off as determined by the economizer enable logic, the outside air, return air and relief air dampers shall modulate to their minimum positions and the unit shall operate in its time of day mode.

3) Economizer enable logic. The economizer shall be enabled when the outside air enthalpy is less than the return air enthalpy and the OAT is below the high limit temp. The contoller shall also monitor the return air dry bulb and outside air dry bulb temp. The economizer loop shall be disabled upon the mixed air temp falling below the low limit temp. Economizer shall be disabled when heating coil control loop is enabled.

Supply Air Temperature Reset:

1) If the maximum VAV cooling demand is below 85% (Adj) for 5 min (Adj), then the supply air temp setpoint shall be incremented 1degF. If the maximum VAV cooling demand is above 100% (Adj) for 5 min (Adj), then the supply air temp setpoint shall be decremented 1degF (Adj). Maximum reset shall not exceed 65degF (Adj). Minimum reset shall not be less than 61degF (Adj).

Humidification Control:

1) When loop is enabled the DDC hardware shall modulate the humidifier to maintain zone relative humidity at setpoint. When the supply air duct humidity rises above 80% relative humidity, the humidifier valve shall begin to modulate towards closed and shall continue to gradually move towards closed until the supply air duct humidity reaches 90% relative humidity, at which point the humidifier valve shall be fully closed. Humidifier shall only be available when the supply fan is proved on. If the humidifier is operating and the supply fan proof fails, then the humidifier shall be commanded off. When this loop is disabled, the humidifier valve shall be closed.

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AHU Sequence of Operation

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PAGE: 3 of 20

Project #: 154004

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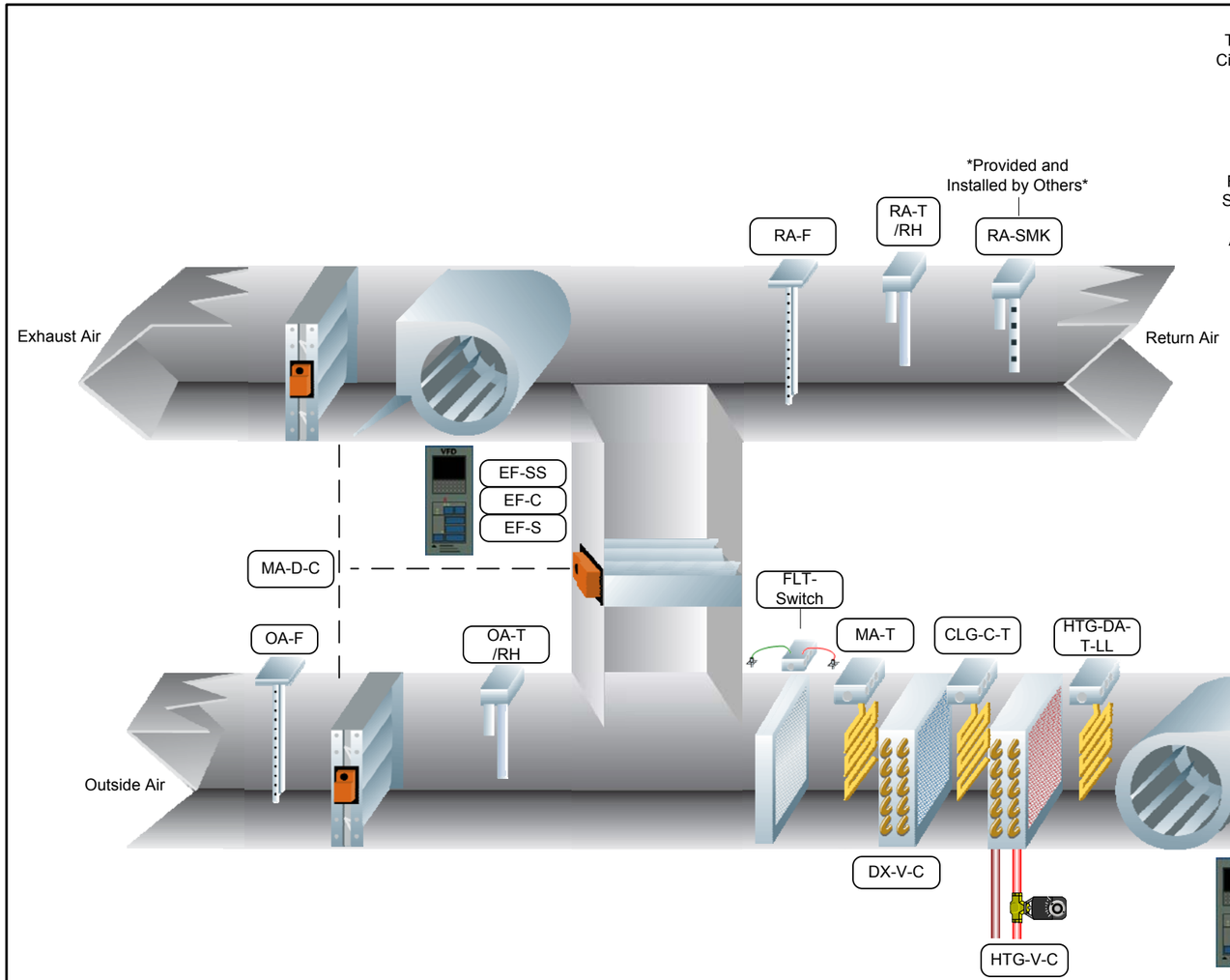
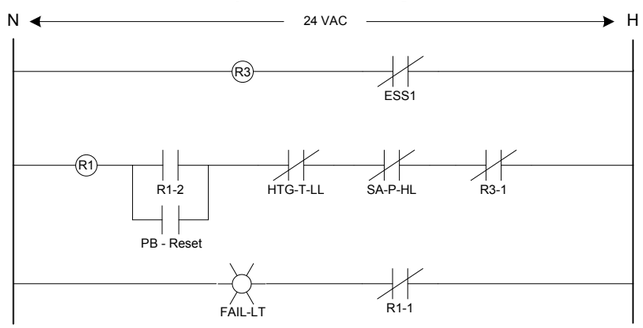


AHU Bill of Material (Typ. 2)

Tag	Model	Manuf.	Description	Qty.	Cut Sheet Page #
OA-T/RH	HU-227-2-VDC-17	Mamac Systems	2% OA Temp/Humidity Sensor	1	P. 28-32
FLT-Switch	AFS-222	Cleveland	Differential Pressure Switch	1	P. 42-43
MAT	TE-AAG-F2434-0	Dwyer	20K 24' Averaging Temp Sensor	1	P. 38
CLG-C-T	TE-AAG-F2434-0	Dwyer	20K 24' Averaging Temp Sensor	1	P. 38
HTG-DAT-LL	DFS-DM20	Dwyer	20' DPDT Low Limit Temp Switch	1	P. 41
SA-F	EAMP	Ruskin	2-10VDC Air Flow Station	1	P. 21-26
SA-T	TE-DFG-F0644-00	Dwyer	20K 6" Duct Probe w/Housing	1	P. 27
RA-RH	HU-224-2-VDC	Mamac Systems	0-10VDC 2% Duct Humidity Sensor	1	P. 33-37
SA-RH	HU-224-2-VDC	Mamac Systems	0-10VDC 2% Duct Humidity Sensor	1	P. 33-37
ZN-RH	HU-225-2-VDC	Mamac Systems	0-10VDC 2% Zone Humidity Sensor	1	P. 33-37
RA-F	EAMP	Ruskin	2-10VDC Air Flow Station	1	P. 21-26
RA-T	TE-DFG-F0644-00	Dwyer	20K 6" Duct Probe w/Housing	1	P. 27
SA-P	616KD-01-TC-V	Dwyer	0-2" w.c. 0-10VDC Pressure Trans.	1	P. 40
SA-P-HL	AFS-222	Cleveland	Differential Pressure Switch	1	P. 42-43
BLDG-T	TR75	Honeywell	Wall-Mount Temp Sensor w/LCD	1	P. 15-18
Hood-#-S	AFS-222	Cleveland	Differential Pressure Switch	1	P. 42-43
VFD	ODE3-120070-1012-01	Invertek Drives	1HP Enclosed 230V 7A VFD	1	P. 92-104

Safety Shutdown Wiring Detail



R1 = Safety Relay
R2 = Fan Enable Relay
R3 = ESS1 Shutdown

R1-1 = Fail Light
R1-2 = Safety Reset Switch
R1-3 = Status to Controller

R2-1 = Fan Enable Cut-Out
R2-2 = VFD Run Cut-Out

R3-1 = ESS1 Safety
R3-2 = Status to Controller

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AHU Flow Diagram

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REV	DATE	REVISIONS	INIT

System Points								LDP and M&C Display				Overrides				Alarms		
Function	Name	Description	Setting (with units)	Range (with units)	nci/CPT name	IO Type	HOA Required	LDP View Required	M&C		SNVT Name	SNVT Type	LDP Override Required	M&C Override Required	SNVT Name	SNVT Type	Alarm Condition (see notes)	Alarm Priority	M&C Routing
									Disp Required	Trend Required									
Proofs & Safeties	SF-S	Supply Fan Status	~	On/Off	~	BI	~	X	X	X	Supply_FanStatus	count	~	~	~	~	Supply Fan Proof Failed	CRIT	MasterAlarmClass
	EF-S	Exhaust Fan Status	~	On/Off	~	BI	~	X	X	X	Exhaust_FanStatus	count	~	~	~	~	Return Fan Proof Failed	CRIT	MasterAlarmClass
	SA-P-HL	Supply Air Pressure Hi Limit	~	Alarm/Normal	SplyFan_HiLimSP	BI	~	~	~	~	Supply_Hi_Limit	Press_p	~	~	~	~	ALM	CRIT	MasterAlarmClass
	ESS1-S	Emergency Shutdown Switch	~	Alarm/Normal	~	BI	~	~	~	~	ESS1	count	~	~	~	~	ALM	CRIT	MasterAlarmClass
	FAP	Fire Alarm Panel Signal	~	Alarm/Normal	~	BI	~	~	~	~	FAP	count	~	~	~	~	ALM	CRIT	MasterAlarmClass
	HTG-DA-T-LL	HTG Coil Discharge Air Low Limit	40°F	Alarm/Normal	nciDATMin_SP	BI	~	~	~	~	HTG_DAT_LL	Temp_P	~	~	~	~	ALM	CRIT	MasterAlarmClass
Start / Stop	SYS-OCC	Occupancy Input (from Schedule)	~	~	~	NVI	~	X	X	~	ScheduleIn_currentState ScheduleIn_nextState	Occupancy	See Notes				~	~	~
	SF-SS	Supply Fan Start/Stop	~	On/Off	~	BO	~	X	X	X	Supply_Fan_SS	count	~	X	SplyFan_SS_Override	count	~	~	~
	EF-SS	Exhaust Fan Start/Stop	~	On/Off	~	BO	~	X	X	X	Ex_Fan_SS	count	~	X	ExFan_SS_Override	count	~	~	~
	Unit Status	CLG/HTG request (see note)	~	HVAC_Cool/HVAC_Heat	~	NVO	~	~	X	~	UnitStatus_mode	HVAC_Status	~	~	~	~	~	~	~
Supply Fan Capacity Control	SA-P	Supply Air Pressure	~	0-5 IWC	~	AI	~	X	X	X	SplyDuct_Press	Press_p	~	~	~	~	SA-P More than ±20% of SA-P-SP	INFO	MasterAlarmClass
	SA-P-SP	Supply Air Pressure Setpoint	0.5 IWC	~	nciSplyFan_PressSP	~	~	X	X	~	~	Press_p	~	X	Sply_Press_Override	press	~	~	~
	SF-C	Supply Fan Command	~	0-100%	~	AO	~	~	X	X	SF_Output	count	~	X	SplyFan_CMD_Override	level_percent	~	~	~
		Supply Fan PID Loop Setings	DB=0.0001 in/w c TR=6.000 in/w c Intg=44Sec	~	nciSplyFan_DB nciSplyFan_IT nciSplyFan_TR	~	~	~	~	~	~	~	~	~	~	~	~	~	~
Exhaust Fan Capacity Control	SA-F	Supply Air Flow	~	0-4000 CFM	~	AI	~	X	X	~	SA_Flow	flow	~	~	~	~	Supply Flow is ±15% of Setpoint	CRIT	MasterAlarmClass
	RA-F	Return Air Flow	~	0-4000 CFM	~	AI	~	X	X	~	RA_Flow	flow	~	~	~	~	~	~	~
	F-DIFF-SP	Flow Difference Setpoint	700 CFM	~	nciFlow DiffSetpoint	~	~	~	X	~	Flow DiffSetpoint	flow	~	X	Flow DiffSP_Override	flow	~	~	~
	EF-C	Exhaust Fan Command	~	0-100%	~	AO	~	~	X	~	ExhaustFanCMD	count	~	X	ExFan_CMD_Override	level_percent	~	~	~
		Exhaust Fan PID Loop Settings	TR=100cfm Intg=0Sec	~	ExhFanTR ExhFanIntg	~	~	~	X	~	~	~	~	~	~	~	~	~	~
Outside Air Control	OA-F	Outside Air Flow	~	0-4000 CFM	~	AI	~	X	X	X	OA_Flow	flow	~	~	~	~	Outside Air Flow is ±15% of Setpoint	CRIT	MasterAlarmClass
	OA-F-SP	Outside Air Flow Setpoint	~	~	nciOA_Flow_SP	~	~	X	X	~	OA_Flow_SP	flow	~	X	OA_Flow SP_Override	flow	~	~	~
	MINOA-F-SP	Min OA Flow Setpoint (CLG/HTG)	660/675 CFM	~	nciMinFlow SP_CLG nciMinFlow SP_HTG	~	~	X	X	~	Min_OA_Flow	flow	~	X	MinFlow_CLG_OR MinFlow_HTG_OR	flow	~	~	~
	HOOD-1-S	Range Hood 1 Fan Status	~	~	~	AI	~	~	X	~	HoodStatus1	u_byte	~	X	~	~	~	~	~
	HOOD-2-S	Range Hood 2 Fan Status	~	~	~	AI	~	~	X	~	HoodStatus2	u_byte	~	X	~	~	~	~	~
	OA-D-C	Min Outside Air Damper Position	~	0-100% Open	~	AO	~	X	X	X	Min_OA_Damper	level_percent	~	X	MinOA_DprOverride	flow	~	~	~
		OA Damper PID Loop Settings	TR=30Δ%, Intg=120Sec, DB=1Sec	~	~	~	~	~	X	~	OAD_PID	level_percent	~	~	~	~	~	~	~
	C02-AHU-1	Carbon Dioxide Level	~	0-2000 PPM	~	AI	~	~	~	~	nviCO2	ppm	~	~	CO2_Override	ppm	~	~	~
		C02 PID Loop Settings	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~
Mixed Air Temperature Control With Economizer	OA-T	Outside Air Temperature	~	-30-130°F	~	AI	~	X	X	X	OutsideTemp	Temp_P	~	~	~	~	~	~	~
	OA-RH	Outside Air Relative Humidity	~	0-100%	~	AI	~	X	X	X	OutsideRH	level_percent	~	X	OA_RH_Override	level_percent	~	~	~
	OA-H	Outside Air Enthalpy	~	~	~	~	~	X	X	~	OA_Enthalpy	Temp_P	~	~	OA_Enth_Override	Temp_P	~	~	~
	RA-T	Return Air Temperature	~	0-100°F	~	AI	~	X	X	X	ReturnTemp	Temp_P	~	~	~	~	~	~	~
	RA-RH	Return Air Relative Humidity	~	0-100%	~	AI	~	X	X	X	RA_RH	level_percent	~	X	RA_RH_Override	level_percent	~	~	~
	RA-H	Return Air Enthalpy	~	~	~	~	~	X	X	~	RA_Enthalpy	Temp_P	~		RA_Enth_Override	Temp_P	~	~	~
	MA-D-C	Mixed Air Damper Command	~	0-100% Open	~	AO	~	X	X	X	MA_D_CMD	level_percent	~	X	MA_D_C Override	level_percent	~	~	~
	MA-T	Mixed Air Temperature	~	-30-130°F	~	AI	~	X	X	X	MixedAirTemp	Temp_P	~		MAT_Override	Temp_P	~	~	~
	MA-T-SP	Mixed Air Temp Setpoint	56°F	~	nciMA_SP	~	~	X	X	~	MAT_SP	Temp_P	~	X	MAT_SP_Override	Temp_P	~	~	~
	ECO-ENA-SP	Economizer Enable Setpoint	26.2 BTU/LB	~	nciEcon_Enable_SP	~	~	X	X	~	Econ_Enab_SP	Temp_P	~	X	EconEnaSP_Override	<___>	~	~	~
	ECO-HL-T	Economizer High Limit Temp	65°F	-30-130°F	nciOAT_HILimit_T	AI	~	X	X	X	EconOAT_HL_T	Temp_P	~	~	EconOAT_HL_Ovrd	Temp_P	~	~	~
		Mixed Air Damper PID Loop Settings	TR=30Δ°F Intg=120s DB=1Δ°F	~	nciEcono_MAT_TR nciEcono_MAT_IT nciEcono_MAT_DB	~	~	~	~	~	MixedAirTempCmd	level_percent	~	~	~	~	~	~	~
Supply Air Temperature	SA-T	Supply Air Temperature	~	-30-130°F	~	AI	~	X	X	X	SupplyTemp	Temp_P	~	~	~	~	SA-T More than ±10°F of Setpoint	INFO	MasterAlarmClass
	SA-T-SP	Supply Air Temp Setpoint	61°F-65°F	~	nciDATMAX_SP nciDATMin_SP	~	~	X	X	~	DAT_SP	Temp_P	~	X	DAT_SP_Override	Temp_P	~	~	~
	DX-V-C	DX Unit Command	~	0-100%	~	AO	~	X	X	X	DX_Output	level_percent	~	X	DX_Out_Override	Temp_P	~	~	~
		DX Unit PID Loop Settings	TR=10Δ°F Intg=120s	~	nciDATSetPts_ClgTR nciDATSetPts_ClgIT	~	~	~	~	~	DATSetPt_ClgPid	level_percent	~	~	~	~	~	~	~
	HTG-V-C	Heating Valve Command	~	0-100% Open	~	AO	~	X	X	X	Htg_Vlv	level_percent	~	X	HTG_Vlv_Override	level_percent	~	~	~
		Heating Valve PID Loop Settings	TR=10Δ°F Intg=120s	~	nciHTGPID_TR nciHTGPID_IT	~	~	~	~	~	Htg_Clg_Pid	level_percent	~	~	~	~	~	~	~
Supply Air Humidification	ZN-RH	Integrated Zone Relative Humidity	~	0-100%	~	AI	~	~	X	X	ZN_RH	level_percent	~	X	ZN_RH_Override	level_percent	~	~	~
	ZN-RH-SP	Zone Relative Humidity Setpoint	30.00%	~	nciZN_RH_SP	~	~	X	X	~	ZN_RH_SP	level_percent	~	X	Zn_RH_SP_Override	level_percent	~	~	~
	SA-RH	Supply Air Relative Humidity	~	0-100%	~	AI	~	~	X	X	SA_RH	level_percent	~	X	SA_RH_Override	level_percent	SA-RH Exceeds 90% or SA-RH-HL	CRIT	MasterAlarmClass
	SA-RH-C	Humidifier Command	~	0-100%	~	AO	~	~	X	X	Humid_CMD	level_percent	~	X	Humid_Cmd_Override	level_percent	~	~	~
		Hum Injection Rate PID Loop Settings	TR=0.1Δ% Intg=300s	~	nciHumid_TR nciHumid_IT	~	~	X	X	X	Humidifier_PID	level_percent	~	X	Humid_PID_Override	level_percent	~	~	~
	SA-RH-HL	Supply Air Humidity Hi Limit Setpoint	95.00%	0-100%	nciSA_RH_HL	~	~	~	X	~	SA_RH_HL	level_percent	~	X	SA_RH_HL_Ovrd	Temp_P	~	CRIT	MasterAlarmClass
	AF-SWITCH	Airflow Switch	~	True/False	~	BI	~	X	X	~	Supply_FanStatus	count	~	~	~	~	~	~	~
Other Points	VAV-MIN-F	VAV-3 Min Flow Setpoint Adjust	~	~	nciVAV3_MinFlow_SP	NVO	~	~	X	X	VAV3_MinFlow_SP	flow	~	X	VAV3MinFlow_Override	flow	~	~	~
	CLG-C-T	Cooling Coil Leaving Air Temp	~	-30-130°F	~	AI	~	~	X	X	Clg_Coil_Temp	Temp_P	~	X	CC_Temp_Override	Temp_P	~	~	~

Notes:

1. The Contractor shall complete the points schedule as specified and as described in the points schedule instructions drawing.
2. Unit manufacturers proofs and safeties: The contractor shall show each proof and safety as a separate row.
3. SYS-OCC: As described in the points schedule instructions, override of SYS-OCC is accomplished through the system scheduler.
4. Alarm conditions marked with an asterisk (*) shall be active only when the system is in occupied mode and has been in occupied mode for more than * = 5 min ** = 30 min.
5. Unit Status: Serves as a monitored point at the M&C software (front-end) and as a heating/cooling request to the boiler, heat exchanger, and/or chiller serving this system.

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AHU System Point Schedule

DATE: March 24, 2017

ENGINEERED BY: MS

DRAWN BY: MS

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Project #: 154004

PAGE: 5 of 20

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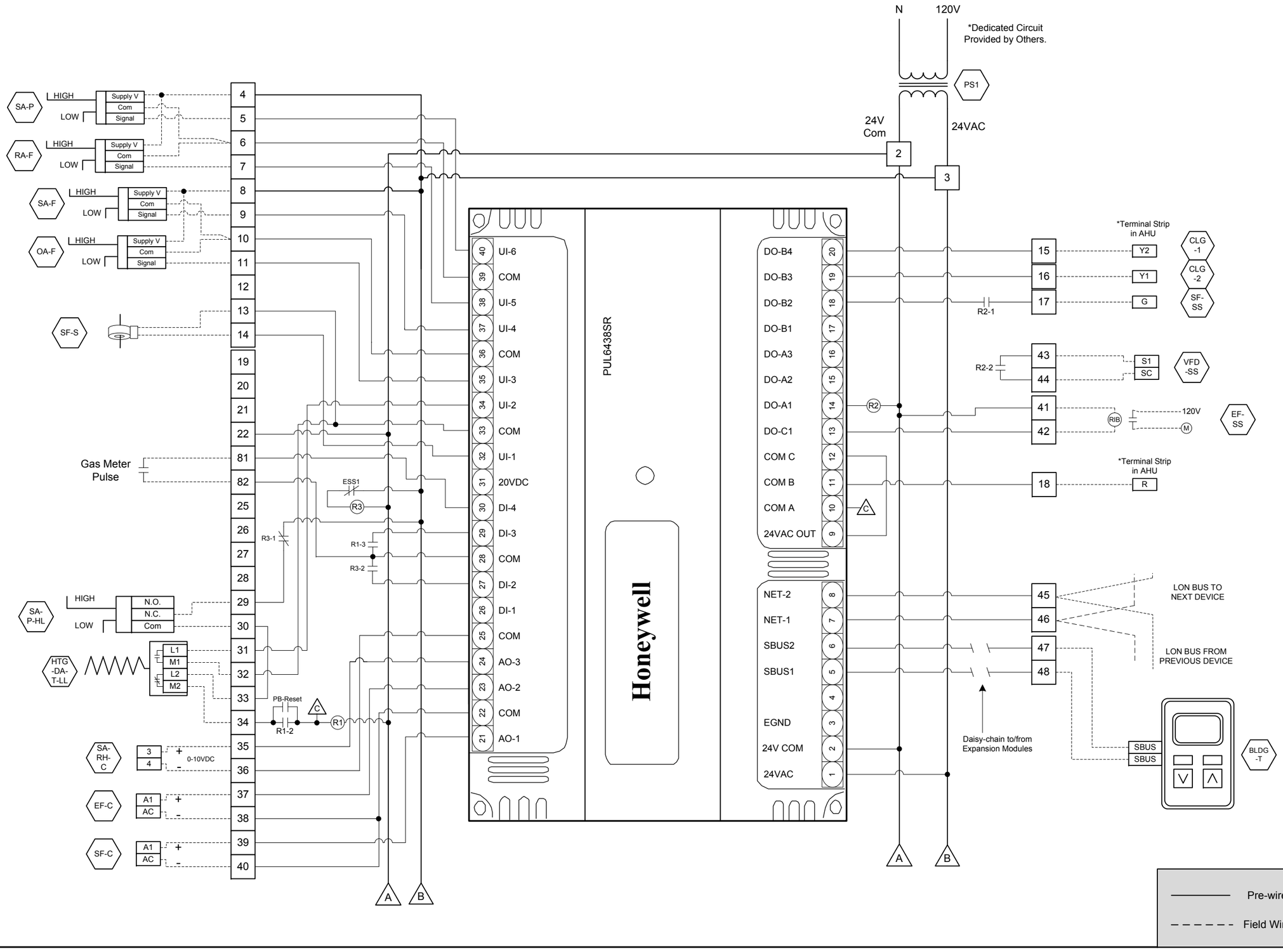

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AHU Wiring Diagram

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Project #: 154004

PAGE: 6 of 20

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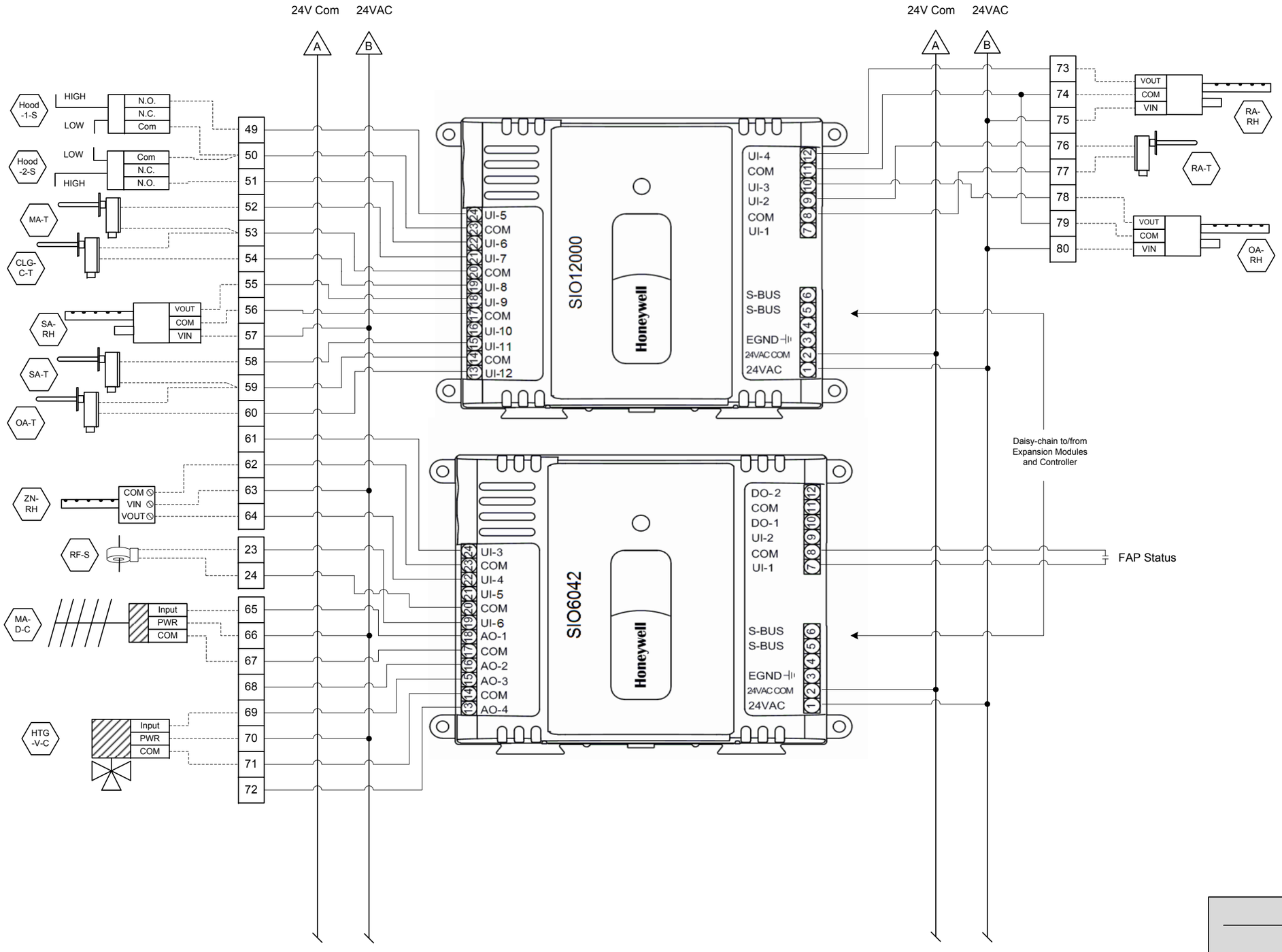

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AHU Expansion Wiring

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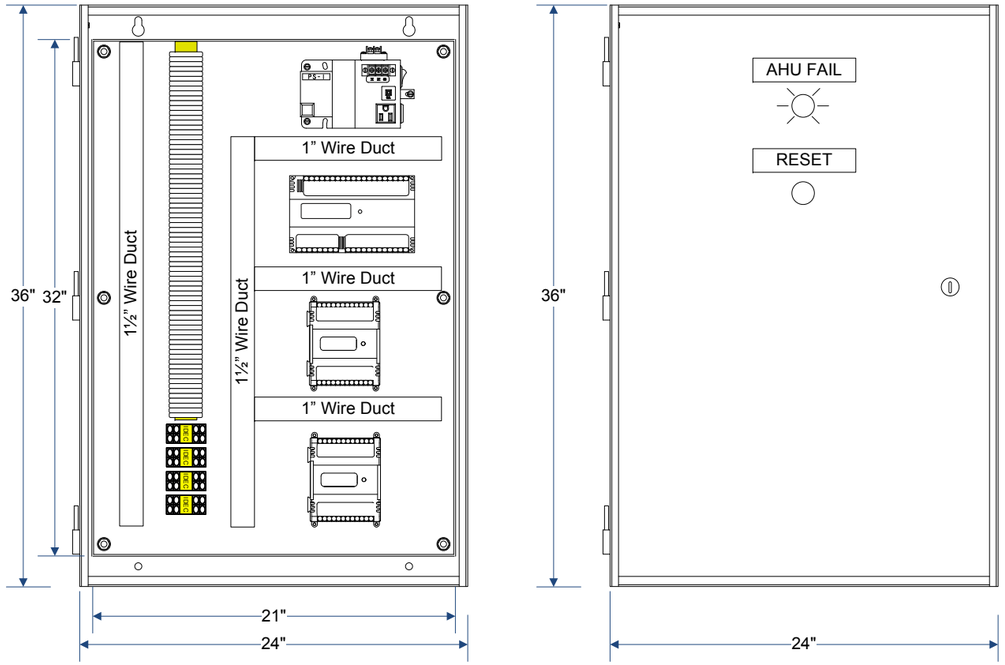

Bill of Material (Typ. 2)

Tag	Model	Manuf.	Description	Qty.	Cut Sheet Page #
ENC	A362408LP	Hoffman	36"x24"x8" NEMA 12 Enclosure	1	P. 69-73
PS1	PSB100AB10	Functional Devices	100VA 120:24VAC Power Supply	1	P. 63
DDC	PUL6438SR	Honeywell	LON Programmable Controller	1	P. 5-11
I/O	SIO12000	Honeywell	12 Input Expansion Module	1	P. 12-14
I/O2	SIO6042	Honeywell	6 Input, 6 Output Expansion Mod.	1	P. 12-14
R1-3	RH2B-ULAC24V	IDEC	24VAC DPDT 10A Relay w/ LED	4	P. 64-68
	SH2B-05	IDEC	10A Relay Base	4	
R4-5	RIBU1C	Functional Devices	10A SPDT 24VAC/DC Coil w/ LED	2	P. 79
	TSH-1015G-1	Automation Direct	1"x1.5" Wire Duct and Cover	1	
	TSH-1515G-1	Automation Direct	1.5"x1.5" Wire Duct and Cover	1	
	DN-R35SAL1-2	Automation Direct	35mm x 10mm DIN Rail	2	
	KN-T12GRY	Konnect-It	100 26-12 AWG Terminal Blocks	1	
	KN-EB3-10	Konnect-It	Terminal Block End Brackets	1	
	KN-ECT6GRY-25	Konnect-It	Terminal Block End Covers	1	
	KN-L5-0	Konnect-It	Terminal Block Marking Tag	1	
	APW299-R-24	Kele	24 VAC Red LED Dome	1	
	MP1-30G10	Kele	Flush-mount Green PB N.O. Contact	1	

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AHU Panel Layout

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PAGE: 8 of 20

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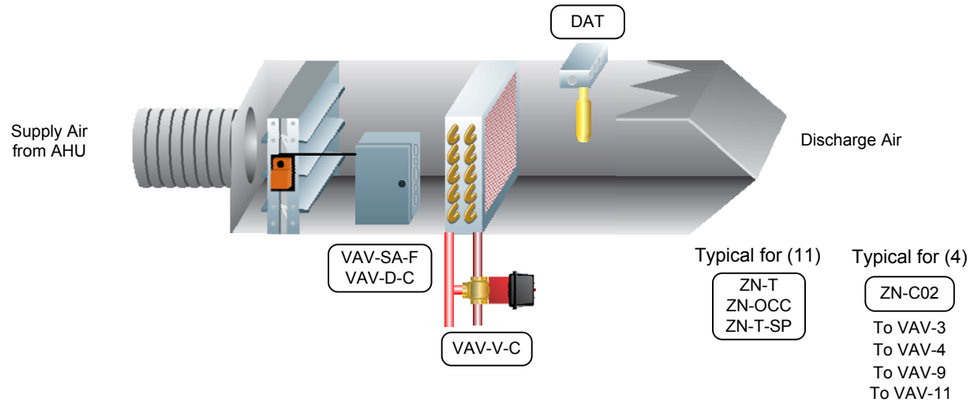

VAV Bill of Material

Tag	Model	Manuf.	Description	Qty.
VAV	PVL4022AS	Honeywell	Lon Programmable VAV Controller	11
DAT	C7041B2005	Honeywell	20K 6" Duct Temperature Sensor	11
ZNT	TR42	Honeywell	Wall Thermostat w/LCD Display	11
ZN-CO2	CDT-2W40-LCD	Dwyer	Wall-Mount CO2 Transmitter w/ Display	4
HWV	G314+LVB24-SR	Belimo	½" 3-way Modulating Valve & Actuator	4
HWV	G315+LVB24-SR	Belimo	½" 3-way Modulating Valve & Actuator	7

Zone Temperature Control – VAV Box with Reheat

Occupancy Modes:
1) Occupied: The VAV box DDC hardware shall be in the occupied mode when the local space occupancy input (ZN-OCC) indicates that the space is occupied or when the input from the system scheduler (SYS-OCC) is occupied.

2) Unoccupied: The VAV box DDC hardware shall be in the unoccupied mode when the local space occupancy input (ZN-OCC) indicates that the space is unoccupied and the input from the system scheduler (SYS-OCC) is unoccupied.

Zone Temperature Control:
1) In the occupied mode, the controller shall sequence the VAV box to maintain the zone temp at setpoint (ZN-T-SP). A setpoint adjustment of ±2°F (WC-ADJ; Adj) shall be permitted to be made via the wall mounted sensor.

2) In the unoccupied mode the VAV box shall be sequenced to maintain the space temp at setpoint (ZN-T-SP-UNOCC).

3) The DDC hardware shall modulate the VAV box damper to maintain VAV box supply air flow (VAV-SA-F) at setpoint as measured by a multi-point flow sensing element at the inlet to the VAV box. Sequencing shall be as shown: upon a rise in zone temp above zone temp setpoint (ZN-T-SP) (Which is 75°F for the cooling season and 68°F for the heating season), subject to the zone temp setpoint deadband as shown. The airflow setpoint shall be adjusted from minimum to maximum flow as shown.

Upon a fall in zone temp below zone temp setpoint, subject to the deadband as shown, the airflow shall be maintained at a fixed air flow setpoint (with a setting independent of the cooling minimum air flow, though these values may be the same) and the heating valve shall modulate towards open. Reheat shall only be available while the boiler is on.

The VAV terminal controller shall issue a heating request (HTG-RQST#), when reheat is required to signal the heating hot water system to run. Request shall only be issued when the VAV's respective AHU is operating.

Occupancy Schedule

	System Default Schedule		Supervisory Monitoring & Control Schedule			# Occ Sensors can Put AHU in Occ Mode
System	Occupied	Unoccupied	Occupied	Unoccupied	Warm-Up	
AHU-1	SU-SA 0000-2400	N/A	SU-SA 0000-2400	N/A	N/A	6
AHU-2	SU-SA 0000-2400	N/A	SU-SA 0000-2400	N/A	N/A	5

VAV Thermostat Schedule

System Service	Terminal Unit Identifier	Area Served	ZN-T (°F) (Summer/Winter)	ZN-T-SP Adjust	Unocc Override Option	Unocc Override Time
AHU-1	VAV-1 ZNT	Chief's Quarters	75° / 68°	± 2° F	Yes	2 Hours
AHU-1	VAV-2 ZNT	Day Room / Staff Entr.	75° / 68°	± 2° F	Yes	2 Hours
AHU-1	VAV-3 ZNT	Kitchen / Dining	75° / 68°	± 2° F	Yes	2 Hours
AHU-1	VAV-4 ZNT	Office 101A & Visitor Entr.	75° / 68°	± 2° F	Yes	2 Hours
AHU-1	VAV-5 ZNT	Offices 101 & Corridor	75° / 68°	± 2° F	Yes	2 Hours
AHU-1	VAV-6 ZNT	Bunk Rm 12 & Mens Toilet Rm	75° / 68°	± 2° F	Yes	2 Hours
AHU-2	VAV-7 ZNT	Bunk Rooms 8, 9, 10 & 11	75° / 68°	± 2° F	Yes	2 Hours
AHU-2	VAV-8 ZNT	Bunk Rooms 1, 2, 3 & 4	75° / 68°	± 2° F	Yes	2 Hours
AHU-2	VAV-9 ZNT	Bunk Rm 7 & Corridor 100SW	75° / 68°	± 2° F	Yes	2 Hours
AHU-2	VAV-10 ZNT	Bunk Rooms 5 & 6	75° / 68°	± 2° F	Yes	2 Hours
AHU-2	VAV-11 ZNT	Corridor 100S	75° / 68°	± 2° F	Yes	2 Hours

VAV HW Valve Schedule

System	Service	Qty.	Part Number	Valve Family	Configuration	Valve Size (in)	Flow (GPM)	Design ΔP (psi)	Valve Coefficient (Cv)	Close-off Rating (psi)	Actuator Control	Basis of Design
VAV-1	Reheat Valve	1.0	G314+LVB24-SR	Globe Valve	3-Way, Modulating	½	1.69	4.0	2.16	50.0	2-10VDC Prop.	Belimo
VAV-2	Reheat Valve	1.0	G314+LVB24-SR	Globe Valve	3-Way, Modulating	½	1.00	4.0	1.60	50.0	2-10VDC Prop.	Belimo
VAV-3	Reheat Valve	1.0	G314+LVB24-SR	Globe Valve	3-Way, Modulating	½	2.04	4.0	1.50	50.0	2-10VDC Prop.	Belimo
VAV-4	Reheat Valve	1.0	G315+LVB24-SR	Globe Valve	3-Way, Modulating	½	2.92	4.0	2.40	50.0	2-10VDC Prop.	Belimo
VAV-5	Reheat Valve	1.0	G315+LVB24-SR	Globe Valve	3-Way, Modulating	½	1.04	4.0	2.27	50.0	2-10VDC Prop.	Belimo
VAV-6	Reheat Valve	1.0	G315+LVB24-SR	Globe Valve	3-Way, Modulating	½	0.99	4.0	2.86	50.0	2-10VDC Prop.	Belimo
VAV-7	Reheat Valve	1.0	G315+LVB24-SR	Globe Valve	3-Way, Modulating	½	1.24	4.0	2.39	50.0	2-10VDC Prop.	Belimo
VAV-8	Reheat Valve	1.0	G315+LVB24-SR	Globe Valve	3-Way, Modulating	½	1.39	4.0	2.73	50.0	2-10VDC Prop.	Belimo
VAV-9	Reheat Valve	1.0	G315+LVB24-SR	Globe Valve	3-Way, Modulating	½	1.04	4.0	2.88	50.0	2-10VDC Prop.	Belimo
VAV-10	Reheat Valve	1.0	G315+LVB24-SR	Globe Valve	3-Way, Modulating	½	3.48	4.0	2.49	50.0	2-10VDC Prop.	Belimo
VAV-11	Reheat Valve	1.0	G314+LVB24-SR	Globe Valve	3-Way, Modulating	½	0.63	4.0	1.75	50.0	2-10VDC Prop.	Belimo

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PAGE TITLE:
VAV Flow, Sequence & Schedules

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Project #: 154004

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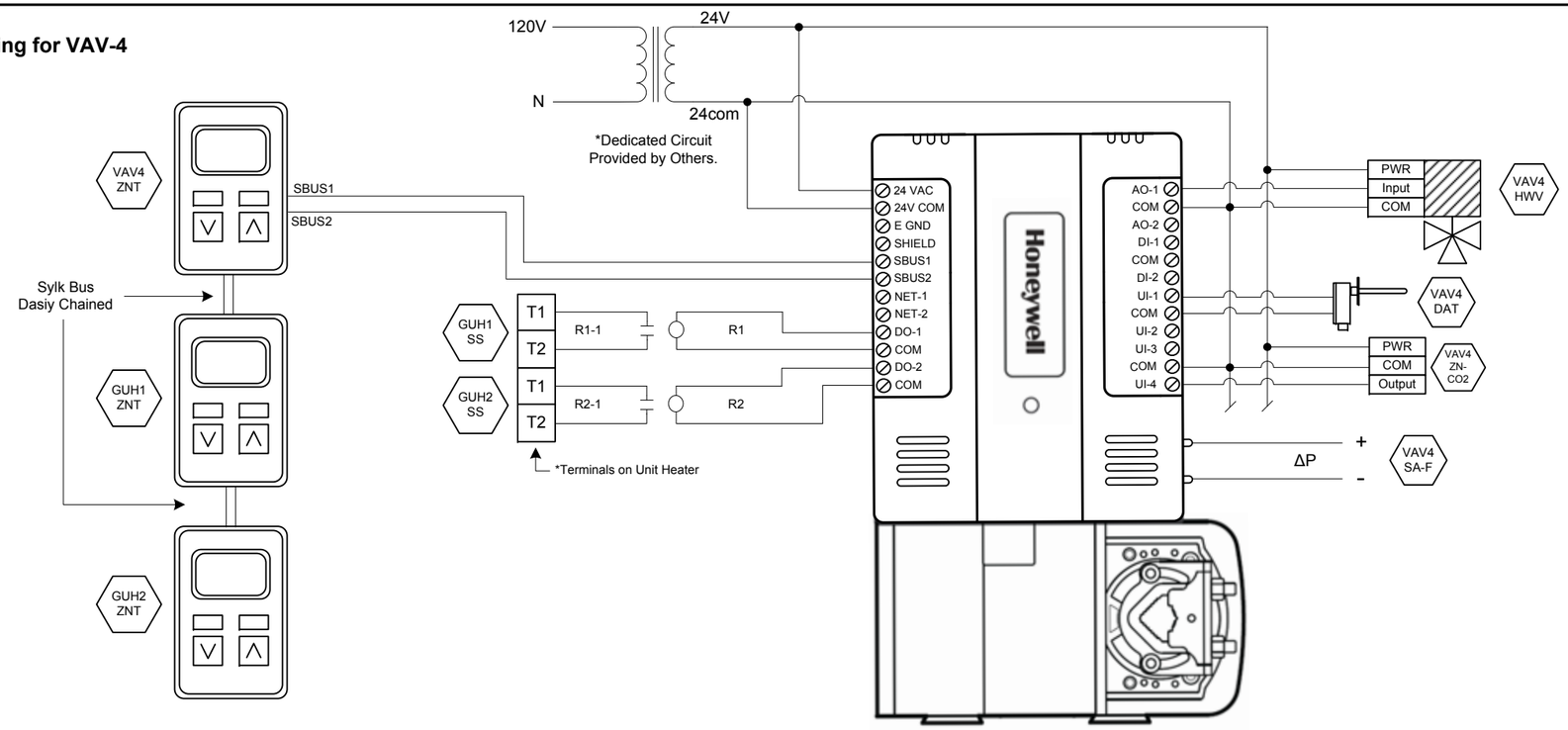
Wiring for VAV-4



System Points							LDP and M&C Display					Overrides				Alarms		
Function	Name	Description	Setting (with units)	Range (with units)	nci/CPT name	IO Type	HOA Required	LDP View Required	M&C Disp Required	M&C Trend Required	SNVT Name	SNVT Type	LDP Override Required	M&C Override Required	SNVT Name	SNVT Type	Alarm Condition (see notes)	Alarm Priority	M&C Routing
Start / Stop	SYS-OCC	Occupancy Input (from system scheduler)	~	Occ/Unocc	nviDlcShed	NVI	~	~	X	~	DlcShed	Switch	See Notes				~	~	~
	EFF-OCC	Effective Occupancy	~	Occ/Unocc	~	~	~	~	~	~	Eff_Occ	Occupancy	~	~	~	~	~	~	~
	ZN-OCC	Zone Occupancy	~	Occ/Unocc	~	BI	~	~	~	~	~	~	~	~	~	~	~	~	~
	GUH-1-SS	Gas Unit Heater 1 Start/Stop	~	On/Off	~	BO	~	X	X	~	GUH_1_SS	Val_ubyte	~	X	GUH_1_Override	Val_ubyte	~	~	~
	GUH-2-SS	Gas Unit Heater 2 Start/Stop	~	On/Off	~	BO	~	X	X	~	GUH_2_SS	Val_ubyte	~	X	GUH_2_Override	Val_ubyte	~	~	~
	UNIT STATUS	Unit Status (see notes)	~	HVAC_Heat/ HVAC_Off	~	NVO	~	~	X	~	EFFHvacMode	HVAC_Status	~	~	~	~	~	~	~
Zone Temp Control	ZN-T	Zone Temperature **	~	32-122°F	~	AI	~	~	X	X	ZN_T	Temp_P	~	~	~	~	** 77°F < ZN-T < 68°F	INFO	MasterAlmClass
	ZN-T-SP/ WC-ADJ	Zone Temperature Setpoint	Occupant Adj ± 2°F	HTG: 68°F CLG: 75°F	nciRoomSetpoint	AI	~	~	X	~	ZN_T_SP	Temp_P	~	X	ZN_T_SP_Override	Temp_P	~	~	~
	ZN-T-SP-UNOCC	Unoccupied Zone Temperature Setpoint	HTG: 63°F CLG: 80°F	~	nciUnocc_ZN_T_SP	~	~	~	~	~	Eff_Unocc_SP	Temp_P	~	X	Unocc_ZN_T_SP	Temp_P	~	~	~
	GUH 1 ZN-T	Zone Temperature	~	32-122°F	~	AI	~	~	X	X	GUH_1_ZNT	Temp_P	~	~	~	~	~	~	~
	GUH 1 ZN-T-SP	Zone Temperature Setpoint	Occupant Adj ± 2°F	HTG: 68°F	nciGUH_1_ZNT_SP	AI	~	~	X	~	GUH_1_ZNT_SP	Temp_P	~	X	GUH_1_ZNT_SP	Temp_P	~	~	~
	GUH 2 ZN-T	Zone Temperature	~	32-122°F	~	AI	~	~	X	X	GUH_2_ZNT	Temp_P	~	~	~	~	~	~	~
	GUH 2 ZN-T-SP	Zone Temperature Setpoint	Occupant Adj ± 2°F	HTG: 68°F	nciGUH_2_ZNT_SP	AI	~	~	X	~	GUH_2_ZNT_SP	Temp_P	~	X	GUH_2_ZNT_SP	Temp_P	~	~	~
	VAV-VP	VAV Inlet Velocity Pressure	~	0-1.5 in.w.c.	~	AI	~	~	X	~	VAV-VP	Press_P	~	~	~	~	~	~	~
	VAV-SA-F	VAV Supply Air Flow	~	0-1240 CFM	~	~	~	~	~	~	BoxFlow	Press_P	~	~	~	~	~	~	~
	VAV-SA-F-SP	VAV Supply Air Flow Setpoint	Reset Sched.	~	nciMinFlow Setpt nciMaxFlow Setpt	~	~	~	X	~	EffFlow Spt	Press_P	~	~	~	~	~	~	~
	VAV-D-C	VAV Damper Command	~	0-100% Open	~	AO	~	~	X	X	VAV-D-C	Level_Percent	~	~	~	~	~	~	~
	HTG-V-C	VAV Reheat Valve Command	~	0-100% Open	~	AO	~	~	X	X	HTG_Valve	Level_Percent	~	~	~	~	~	~	~
		Zone Temperature Setpoint Deadband	3.0 Δ°F	~	nciDlcShiftSpt	~	~	~	~	~	~	~	~	~	~	~	~	~	~
		VAV Damper PID Loop Settings	tr=180s intg=adaptive db=10%	~	nciDpr_tr nciDpr_db	~	~	~	~	~	~	~	~	~	~	~	~	~	~
		VAV Valve PID Loop Settings	tr=3s intg=3100s db=10%	~	nciPidCfgHeat	~	~	~	~	~	~	~	~	~	~	~	~	~	~
Other Points	DA-T	VAV Discharge Air Temperature	~	-40-302°F	~	AI	~	~	X	X	DA_T	Temp_P	~	~	~	~	~	~	~
	ZN-C02	Carbon Dioxide Level	~	0-2000 PPM	~	AI	~	~	~	~	CO2_PPM	SNVT_PPM	~	~	~	~	~	~	~

Notes:

1. The contractor shall complete the points schedule as specified and as described in the points schedule instructions drawing.
2. SYS-OCC: As described in the points schedule instructions, override of SYS-OCC is accomplished through the system scheduler.
3. Alarm conditions marked with a double asterisk (**) shall be active only when the system in in occupied mode and has been in occupied mode for more than 30 minutes.
4. Unit Status: Serves as a monitored point at the M&C software (Front-End) and as a heating/cooling request to the boiler, heat exchanger, and/or chiller serving this system.

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VAV Wiring & Point Schedule

DATE: March 24, 2017

ENGINEERED BY: MS

DRAWN BY: MS

CHECKED BY:

Project #: 154004

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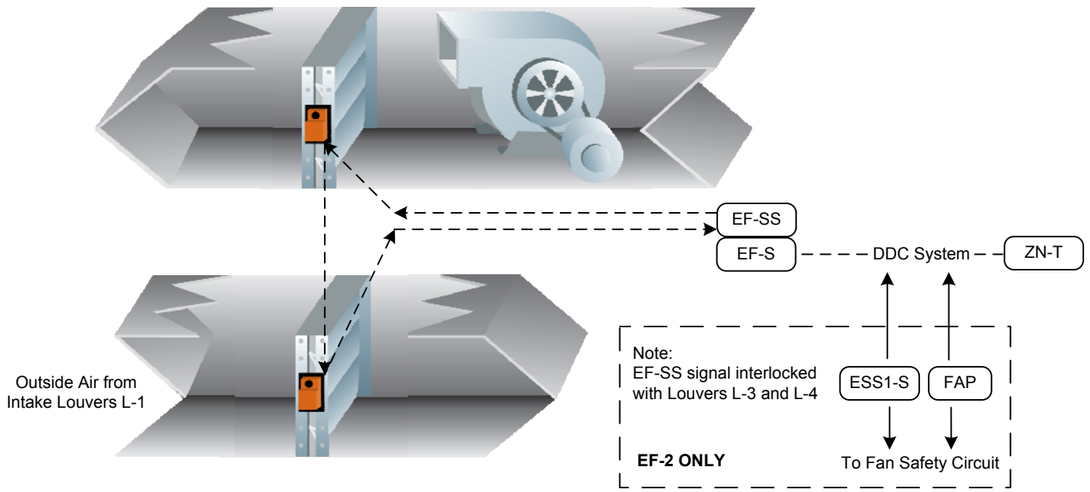
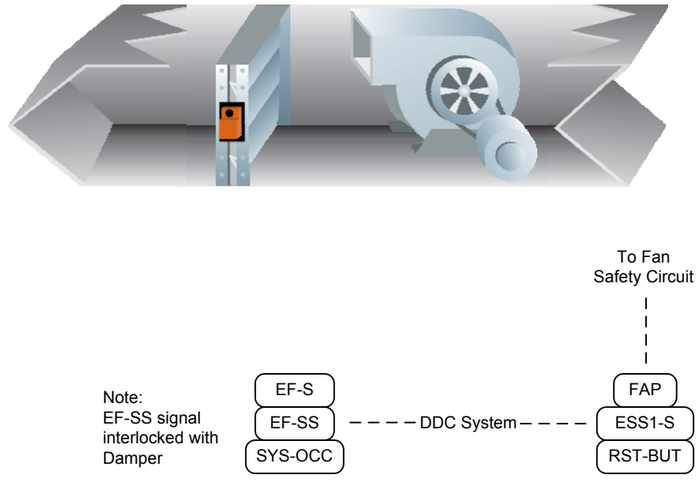
Note: For EF-1 Wiring refer to HWS Expansion Wiring Details

EF-1 & EF-2



Note: For Wiring, Refer to VAV-3 & 7's Wiring Details

EF-3 & EF-4



Exhaust Fan Bill of Material

Tag	Model	Manuf.	Description	Qty.
RIB	RIBTW24SB-LNT3	Functional Devices	LON Communicating Relay	2
ZN-T	A/AN-R2	ACI	10K Type III Zone Thermostat	2
CS	CSP-O-F10-001	Honeywell	Split Core N.O. 1.5A trip Current Switch	5
R1-5	RIBU1C	Functional Devices	10-30VAC/DC SPDT 10A Relay	5

EF-1 & 2 Sequence
Failure of any proof or safety shall result in the system being commanded off and an alarm generated.

The room sensor shall, through the DDC system, turn on the fan for ventilation anytime the zone temperature (ZN-T) is above setpoint (ZN-T-SP; adj). If fan status does not match command, alarm shall be generated.

Provide manual override switch adjacent to temperature sensor (per fan).

EF-1 Note:
Dampers may already be open due to generator operation, install actuators, accessories and controls such that proof of damper position from one system does not interfere with the other.

EF-3 & 4 Sequence
Failure of any proof or safety shall result in the system being commanded off and an alarm generated.The building DDC system shall enable or disable the fan per the occupied/unoccupied schedule:
Occupied: On
Unoccupied: Off

Failure of any proof or safety shall result in the system being commanded off and an alarm being generated.

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Exhaust Fan Flow & Sequence

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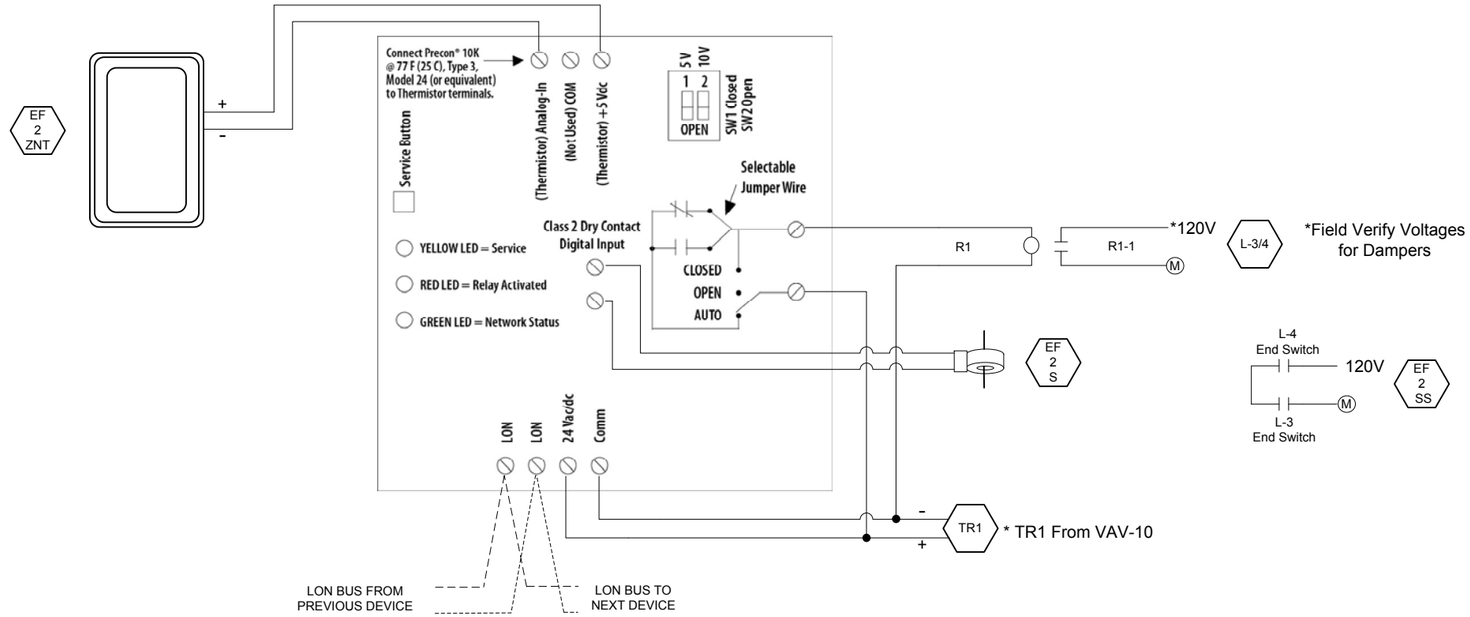
Wiring for Exhaust Fan 2



System Points								LDP and M&C Display					Overrides				Alarms		
Function	Name	Description	Setting (with units)	Range (with units)	nci/CPT name	IO Type	HOA Required	LDP View Required	M&C Disp Required	M&C Trend Required	SNVT Name	SNVT Type	LDP Override Required	M&C Override Required	SNVT Name	SNVT Type	Alarm Condition (see notes)	Alarm Priority	M&C Routing
Proofs & Safeties	EF(1/2)-S	Exhaust Fan Status	~	On/Off	~	BI	~	~	X	X	EF(1/2)_Status	count	~	~	~	~	Exhaust Fan Proof Failed	CRIT	EFAlarmClass
	ESS1-S	Emergency Shutdown Signal	~	Alarm/Normal	~	BI	~	~	~	~	~	~	~	~	~	~	ALM	CRIT	EFAlarmClass
	FAP	Fire Alarm Shutdown Signal	~	Alarm/Normal	~	BI	~	~	~	~	~	~	~	~	~	~	ALM	CRIT	EFAlarmClass
	RST-BUT	System Reset Button (for safeties)	~	~	~	BI	~	~	~	~	~	~	~	~	~	~	~	~	~
Unit Control	ZN-T	Zone Temperature **	~	32-122°F	~	AI	~	~	X	X	ZN_T	Temp_P	~	~	~	~	** ZN-T > 105°F	INFO	EFAlarmClass
	ZN-T-SP	Zone Temperature Setpoint	CLG: 95°F	~	nciZN_T_SP	~	~	~	X	~	ZN_T_SP	Temp_P	~	X	ZN_T_SP_Override	Temp_P	~	~	~
	EF(1/2)-SS	Exhaust Fan Start/Stop	~	On/Off	~	BO	~	~	X	X	EF(1/2)_SS	count	~	X	EF1/2_SS_Override	count	~	~	~

Notes:

1. The contractor shall complete the points schedule as specified and as described in the points schedule instructions drawing.
2. Unit manufacturers proofs and safeties: The contractor shall show each proof and safety as a separate row.
3. Alarm conditions marked with an asterisk (*) shall be active only when the system in occupied mode and has been in occupied mode for more than 5 minutes or 30 minutes if marked with a double asterisk (**).

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Exhaust Fan Wiring & Point Schedule

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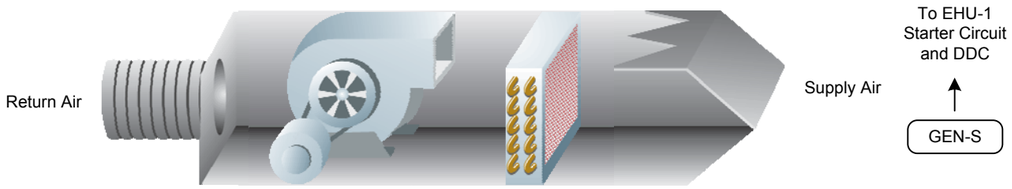
Electric Unit Heaters
(Typ. 4)



Bill of Material

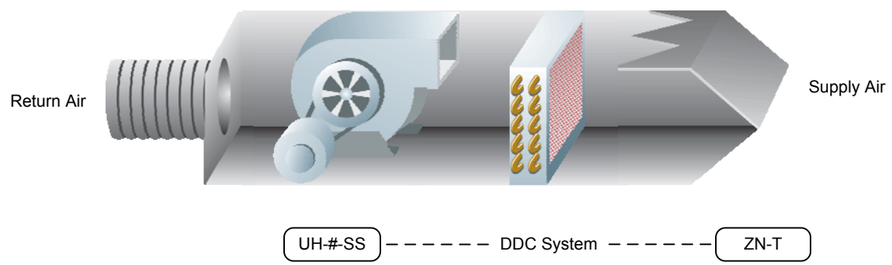
Tag	Model	Manuf.	Description	Qty.
ZN-T	TR-42	Honeywell	Sylk-Bus Wall Mount Thermostat	4
EUH-#-SS	RIBU1C	Functional Devices	10-30VAC/DC SPDT 10A Relay	4

Electric Unit Heater Sequence

When space temp falls below 50°F (adj), the DDC system shall energize the unit heater.

EUH-1 Note:
When emergency generator is in operation the electric unit heater EUH-1 in the generator room shall be de-energized.

Gas Unit Heaters
(Typ. 6)



Bill of Material

Tag	Model	Manuf.	Description	Qty.
ZN-T	TR-42	Honeywell	Sylk-Bus Wall Mount Thermostat	6
UH-#-SS	RIBU1C	Functional Devices	10-30VAC/DC SPDT 10A Relay	6

Gas Fired Unit Heater Sequence

When space temp in garage falls below setpoint (ZN-T-SP), the DDC system shall energize the unit heater.

* For UH Point Schedules refer to corresponding VAV's Point Schedule

ZN-T & Command Wired to I/O on VAV's	
Unit	**VAV-#**
EUH-1	VAV-10
EUH-2	VAV-10
EUH-3	VAV-11
EUH-4	VAV-7
GUH-1	VAV-4
GUH-2	VAV-4
GUH-3	VAV-5
GUH-4	VAV-5
GUH-5	VAV-1
GUH-6	VAV-1

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Unit Heaters & Schedule

DATE: March 24, 2017

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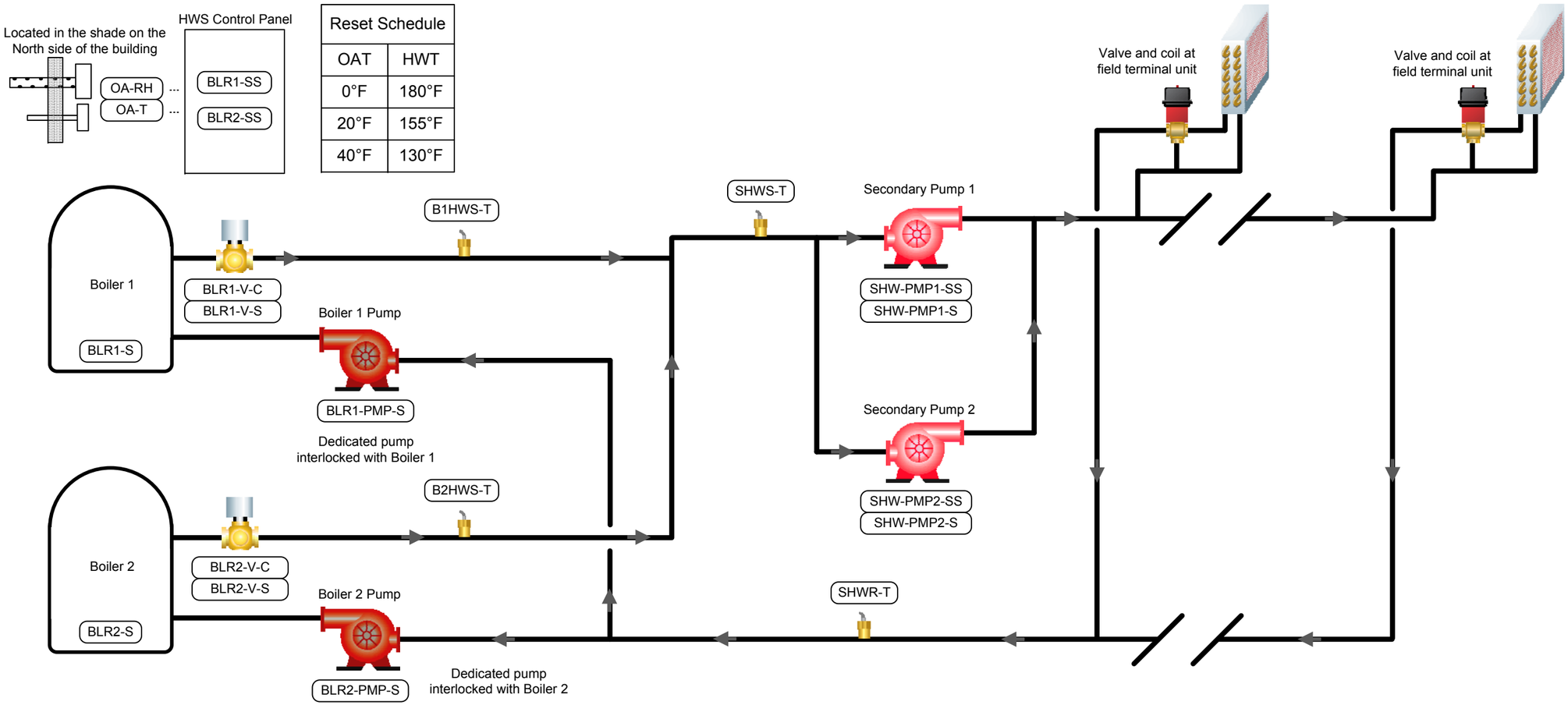

System Enable and Loop Enable:

1) This system will monitor the enabled status of all systems served by this system. If one or more systems served by this system are enabled, this system will be enabled (SYS-ENA). If all systems are served by this system are not enabled, this system will not be enabled.
2) When this system is enabled (SYS-ENA) and the hot water pump is proven “On” the boiler control and hot water control loops will be enabled.

Hand-Off-Auto Switch: The primary hot water pumps’ motor starters will have a H-O-A switch;

1) With the H-O-A switch in the HAND position, the pump will start and run continuously.
2) With the H-O-A switch in the OFF position, the pump will stop.
3) With the H-O-A switch in the AUTO position, the pump will run subject to the hot water pump start/stop command.

Proofs and safeties:

1) The boilers will be subject to the manufacturer’s internal proofs and safeties. DDC hardware will monitor all proofs and safeties as stated below.
2) Proofs:
   a) Primary Hot Water Pump 1 (PHW-PMP1-S)
   b) Primary Hot Water Pump 2 (PHW-PMP2-S)
   c) Boiler 1 (BLR1-S)
   d) Boiler 2 (BLR2-S)
   e) Secondary Hot Water Pump 1 (SHW-PMP1-S)
   f) Secondary Hot Water Pump 2 (SHW-PMP2-S)
3) Safeties none:
DDC hardware reset of all proofs and safeties will be via a local binary push button input to the DDC hardware, via a remote command to the DDC hardware via a SNVT or both. Either method will provide for reset.

Boiler Control:

The DDC controller will alternate between boilers on a weekly basis (adj). When this loop is enabled, the DDC hardware will call for the lead boiler. The lead boiler will start its dedicated boiler pump and when flow is proven, the lead boiler will start. The lead boiler will run subject to the manufacturer’s safeties. Only one boiler will run at a time.

When there is no call for heating, or a boiler is commanded OFF, the boilers’ dedicated pump will continue to run for a delay period subject to the boiler manufacturer’s controls.

If the boiler that is being commanded to run does not prove status ON after 5 min (adj), indicated by temperature rise in the system or feedback signal from the boiler, the boiler will be commanded off and an alarm generated. The DDC will then command the lag boiler to run as described above. If the lag boiler does not prove stats ON after 5 min (adj), indicated by the temperature rise in the system or feedback signal from the boiler, the lag boiler will be commanded off and an alarm generated.

When the loop is disabled, the boilers will be off and their respective pumps will be off. OA Dampers will be closed (Exception: When EF-2 is running D-1 will be open).

Hot Water Temperature Control:

When the loop is enabled, the boiler manufacturer's controls will maintain hot water supply temperature (HWS-T) at setpoint (180°F, adj). The hot water supply temperature setpoint (HWS-T-SP) will be determined from a linear reset schedule as shown. The HWS-TSP will not be less than 130°F. The DDC system will monitor the entering and leaving water temperatures of the boiler.

Secondary Loop Control:

Upon a call for heat, the lag secondary hot water pump will be signaled ON, If the pump does not prove to be running after a user adjustable time delay (SWP-T-D), the pump will be signaled OFF and an alarm generated. The DDC will signal the lag hot water pump to run subject to the same conditions above.

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HWS Flow & Sequence

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System Points								LDP and M&C Display					Overrides				Alarms			
Function	Name	Description	Setting (with units)	Range (with units)	nci/CPT name	IO Type	HOA Required	LDP View Required	M&C		SNVT Name	SNVT Type	LDP Override Required	M&C Override Required	SNVT Name	SNVT Type	Alarm Condition (see notes)	Alarm Priority	M&C Routing
									Disp Required	Trend Required									
Proofs & Safeties	PHW-PMP1-S	Primary Hot Water Pump 1 Status	~	On/Off	~	BI	~	X	X	~	PHWP1_Status	count	X	X	PP1_S_Override	count	Pump PHWP-1 Fail	CRIT	HWSAlarmClass
	PHW-PMP2-S	Primary Hot Water Pump 2 Status	~	On/Off	~	BI	~	X	X	~	PHWP2_Status	count	X	X	PP2_S_Override	count	Pump PHWP-2 Fail	CRIT	HWSAlarmClass
	SHW-PMP1-S	Secondary Hot Water Pump 1 Status	~	On/Off	~	BI	~	X	X	~	SHWP1_Status	count	X	X	SP1_S_Override	count	Pump SHWP-1 Fail	CRIT	HWSAlarmClass
	SHW-PMP2-S	Secondary Hot Water Pump 2 Status	~	On/Off	~	BI	~	X	X	~	SHWP2_Status	count	X	X	SP2_S_Override	count	Pump SHWP-2 Fail	CRIT	HWSAlarmClass
	BLR1-S	Boiler 1 Status	~	On/Off	~	BI	~	X	X	~	BLR1_Status	count	X	X	Blr1_S_Override	count	Boiler 1 Fail	CRIT	HWSAlarmClass
	BLR2-S	Boiler 2 Status	~	On/Off	~	BI	~	X	X	~	BLR2_Status	count	X	X	Blr2_S_Override	count	Boiler 2 Fail	CRIT	HWSAlarmClass
	BLR1-V-S	Boiler 1 Valve Position	~	Open/Close	~	BI	~	X	X	~	BLR1_V_Sts	count	~	~	~	~	Boiler 1 Control Vlv Fails to prove open	CRIT	HWSAlarmClass
	BLR2-V-S	Boiler 2 Valve Position	~	Open/Close	~	BI	~	X	X	~	BLR2_V_Sts	count	~	~	~	~	Boiler 2 Control Vlv Fails to prove open	CRIT	HWSAlarmClass
Start / Stop	SYS-ENA	System Enable	~	Enable/Disable	~	NVI	~	X	X	~	SYS_ENA	count	X	X	SYS_ENA_Override	count	~	~	~
	PHW-PMP1-SS	Primary Hot Water Pump 1 Command	~	Start/Stop	~	BO	~	X	X	~	PHWP1_SS	count	X	X	PP1_SS_Override	count	~	~	~
	PHW-PMP2-SS	Primary Hot Water Pump 2 Command	~	Start/Stop	~	BO	~	X	X	~	PHWP2_SS	count	X	X	PP2_SS_Override	count	~	~	~
	UNIT STATUS	Heating Mode Unit Status (see notes)	~	On/Off	~	NVO	~	X	X	~	Unit_Status	count	X	~	~	~	~	~	~
	SHW-PMP1-SS	Secondary Hot Water Pump 1 Cmd	~	Start/Stop	~	BO	~	X	X	~	SHWP1_SS	count	X	X	SP1_SS_Override	count	~	~	~
	SHW-PMP2-SS	Secondary Hot Water Pump 2 Cmd	~	Start/Stop	~	BO	~	X	X	~	SHWP2_SS	count	X	X	SP2_SS_Override	count	~	~	~
	BLR1-V-C	Boiler 1 Control Valve Command	~	Open/Close	~	BO	~	X	X	~	BLR1_V_C	count	~	~	~	~	~	~	~
	BLR2-V-C	Boiler 2 Control Valve Command	~	Open/Close	~	BO	~	X	X	~	BLR2_V_C	count	~	~	~	~	~	~	~
HW Temp Control	~	Via Boiler Controller	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~
Systems Served	HTG-RQST#	HTG RQST from: VAV-#	~	HVAC_Heat/ HVAC_Off	~	NVI	~	~	X	~	HTG_RQST	count	~	~	~	~	~	~	~
Other Points	HWR-T	Hot Water Return Temperature	~	-40-302°F	~	AI	~	X	X	~	HWR_T	Temp_P	~	~	~	~	~	~	~
	BLR-T-D	Boiler Start Delay	30 sec	0-300 sec	~	~	~	~	X	~	BLR_DelaySec	time	~	X	BLR_Delay_Override	time	~	~	~
	SWP-T-D	Secondary Hot Water Pump Status Delay	30 sec	0-300 sec	~	~	~	~	X	~	SWP_proofDelaySec	time	~	X	SWP_Delay_Override	time	~	~	~
	OA-RH	Outside Air Relative Humidity	~	0-100%	~	AI	~	X	X	~	OA_RH	level_percent	~	X	OA_RH_Override	level_percent	~	~	~
	OA-T	Outside Air Temp Netw ork Variable	~	-40-302°F	~	NVO	~	~	X	~	OA_T	Temp_P	~	X	OA_T_Override	Temp_P	~	~	~
	OA-RH	Outside Air Relative Humidity Netw ork Variable	~	0-100%	~	NVO	~	~	X	~	OA_RH	level_percent	~	X	OA_RH_Override	level_percent	~	~	~
	OA-T	Outside Air Temperature	~	-40-302°F	~	AI	~	~	X	~	OA_T	Temp_P	~	X	OA_T_Override	Temp_P	~	~	~
	PHWS-T	Primary Loop Hot Water Supply Temp	~	-40-302°F	~	AI	~	~	X	~	P_HWS_T	Temp_P	~	X	P_HWS_T_Override	Temp_P	~	~	~
	B1HWS-T	Boiler 1 Hot Water Supply Temp	~	-40-302°F	~	AI	~	~	X	~	BLR1_HWS_T	Temp_P	~	X	BLR1_HWST_Override	Temp_P	~	~	~
	B2HWS-T	Boiler 2 Hot Water Supply Temp	~	-40-302°F	~	AI	~	~	X	~	BLR2_HWS_T	Temp_P	~	X	BLR2_HWST_Override	Temp_P	~	~	~
	SHWR-T	Secondary Loop Hot Water Return Temp	~	-40-302°F	~	AI	~	~	X	~	S_HWR_T	Temp_P	~	X	S_HWRT_Override	Temp_P	~	~	~

Notes:

1. SYS-OCC: As described in the points schedule instructions, override of SYS-OCC is accomplished through the system scheduler.
2. Alarm conditions marked w ith a double asterisk (**) shall be active only w hen the system in in occupied mode and has been in occupied mode for more than 30 minutes.
3. Unit Status: Serves as a monitored point at the M&C softw are (Front-End) and as a heating/cooling request to the boiler, heat exchanger, and/or chiller serving this system.

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HWS Point Schedule

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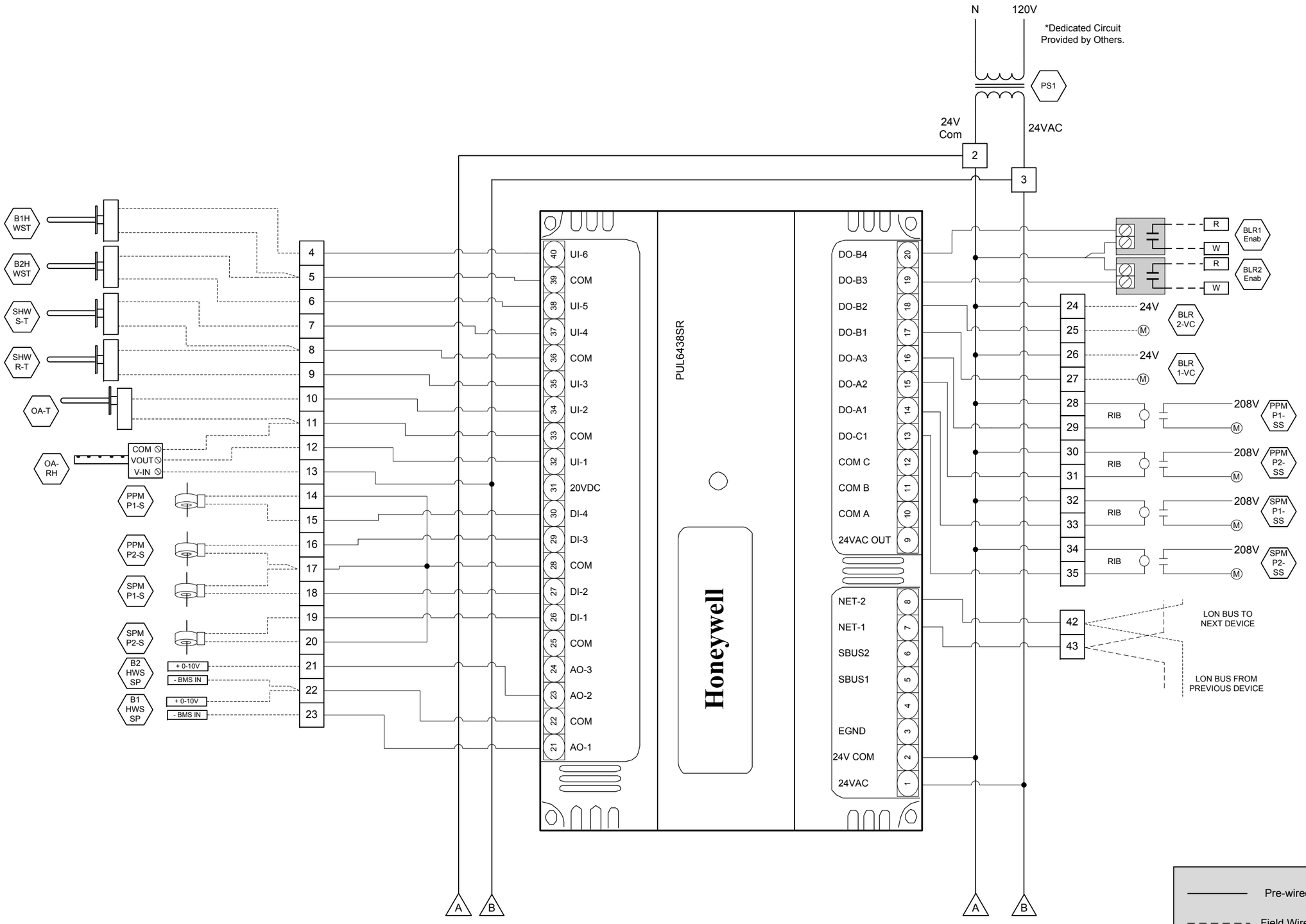

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HWS Wiring Diagram

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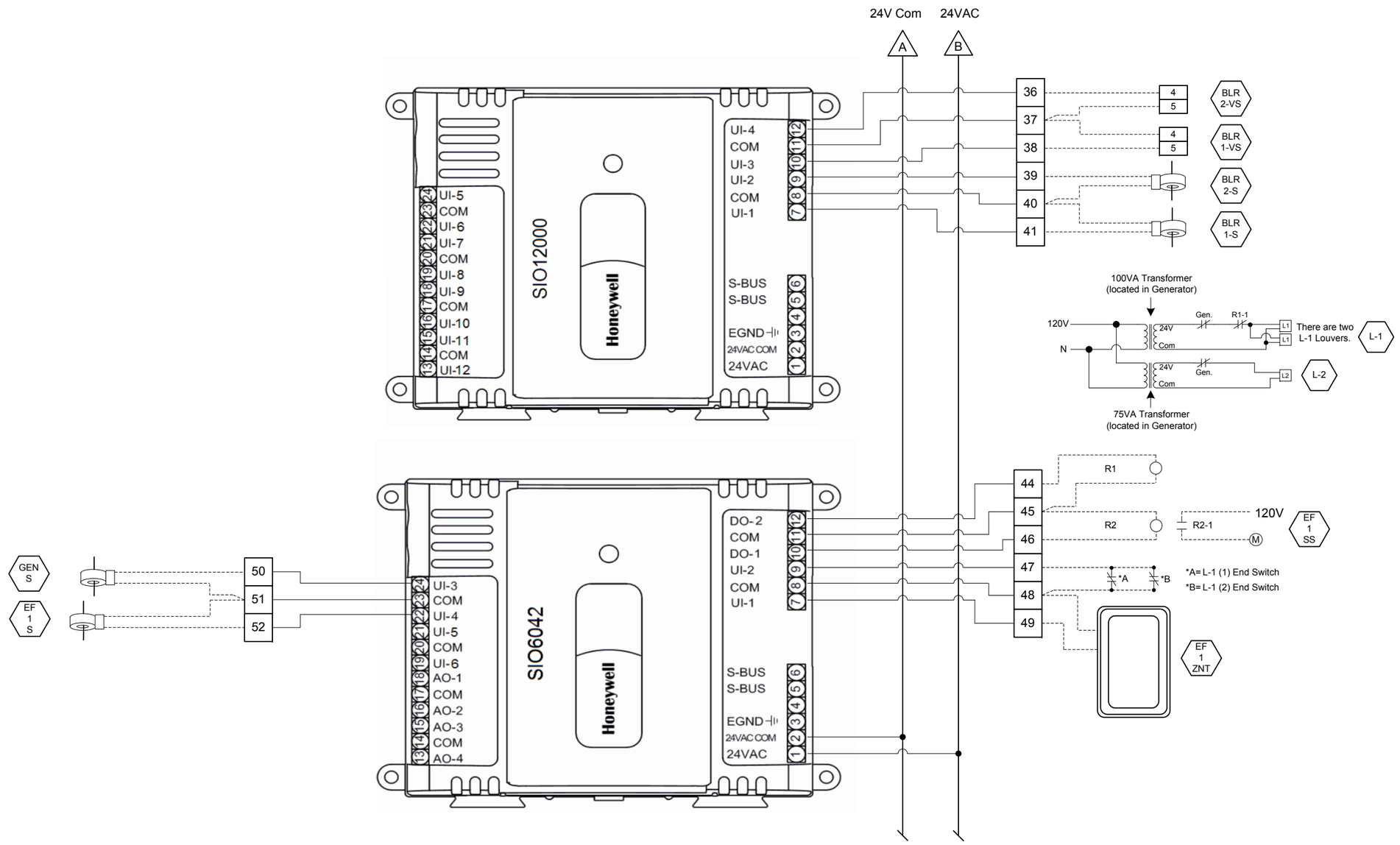

HWS Bill of Material

Tag	Model	Manuf.	Description	Qty.
OA-RH	HU-227-2-VDC	Mamac Systems	0-10VDC 2% OA Humidity Sensor	1
OA-T	TE-OND-F	Dwyer	20K NEMA 4X OA Temp Sensor	1
B1HWS-T	C7041D2001	Honeywell	5" 20K Immersion Sensor	1
B2HWS-T	C7041D2001	Honeywell	5" 20K Immersion Sensor	1
SHWS-T	C7041D2001	Honeywell	5" 20K Immersion Sensor	1
SHWR-T	C7041D2001	Honeywell	5" 20K Immersion Sensor	1
BLR-V-C	VBN2E1PX000	Honeywell	2-Way 1-½" Brass Ball Valve	2
	MS8105A1130	Honeywell	2-Position 24V Valve Actuator	2
	50001774-001/U	Honeywell	5" Thermowell	4
R1-8	RIBU1C	Functional Devices	10A SPDT 24VAC/DC Coil w/ LED	8
CS	CSP-O-F10-001	Honeywell	Split Core N.O. 1.5A trip Current Switch	6
	TR100VA001	Functional Devices	100 VA 120VAC/24VAC Transformer	1
	TR75VA001	Functional Devices	75 VA 120VAC/24VAC Transformer	1

Pre-wired

Field Wired

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HWS Expansion Wiring

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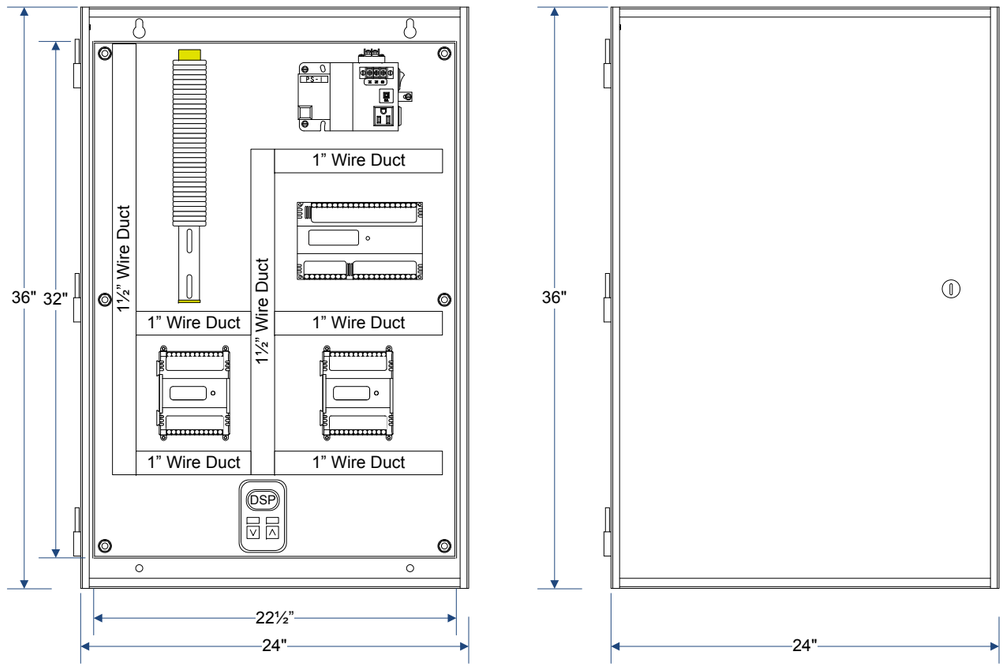

Bill of Material

Tag	Model	Manuf.	Description	Qty.	Cut Sheet Page#
ENC	A362408LP	Hoffman	36"x24"x8" NEMA 12 Enclosure	1	P. 69-73
PS1	PSB100AB10	Functional Devices	100VA 120:24VAC Power Supply	1	P. 63
DDC	PUL6438SR	Honeywell	LON Programmable Controller	1	P. 5-11
I/O	SIO12000	Honeywell	12 Input Expansion Module	1	P. 12-14
I/O2	SIO6042	Honeywell	6 Input, 6 Output Expansion Mod.	1	P. 12-14
DSP	TR75	Honeywell	Wall-Mount Temp Sensor w/LCD	1	P. 15-18
	TSH-1015G-1	Automation Direct	1"x1.5" Wire Duct and Cover	1	
	TSH-1515G-1	Automation Direct	1.5"x1.5" Wire Duct and Cover	1	
	DN-R35SAL1-2	Automation Direct	35mm x 10mm DIN Rail	2	
	KN-T12GRY	Konnect-It	100 26-12 AWG Terminal Blocks	1	
	KN-EB3-10	Konnect-It	Terminal Block End Brackets	1	
	KN-ECT6GRY-25	Konnect-It	Terminal Block End Covers	1	
	KN-L5-0	Konnect-It	Terminal Block Marking Tag	1	

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HWS Panel Layout

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JD_17_116_001_HVAC

LON1 | LAN1 | LAN2 | RS485

MODBUS

147.221.252.19

CAT-6 Ethernet Cable to Media Converter

Power Meter

Humidifier 1

Humidifier 2

AHU-1 Control Panel
(Located in Electrical Room 131)

PUL6438 | SIO6042 | SIO12000

BLDG-T
(Night Stat)

AHU-2 Control Panel
(Located in Electrical Room 131)

PUL6438 | SIO6042 | SIO12000

BLDG-T
(Night Stat)

VAV-11
PVL4022
VAV ZNT

VAV-1
PVL4022
VAV ZNT | GUH5 ZNT | GUH6 ZNT

VAV-2
PVL4022
VAV ZNT

VAV-3
PVL4022
VAV ZNT

VAV-5
PVL4022
VAV ZNT | GUH3 ZNT | GUH4 ZNT

VAV-6
PVL4022
VAV ZNT

VAV-4
PVL4022
VAV ZNT | GUH1 ZNT | GUH2 ZNT

HWS Control Panel
(Located in Mechanical Room 116)

PUL6438 | SIO12000

VAV-10
PVL4022
VAV ZNT | EUH1 ZNT | EUH2 ZNT

VAV-8
PVL4022
VAV ZNT

VAV-9
PVL4022
VAV ZNT

EF-2
RIBTW24SB-LNT3

EF-1
RIBTW24SB-LNT3

VAV-7
PVL4022
VAV ZNT

EOL

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Network Diagram

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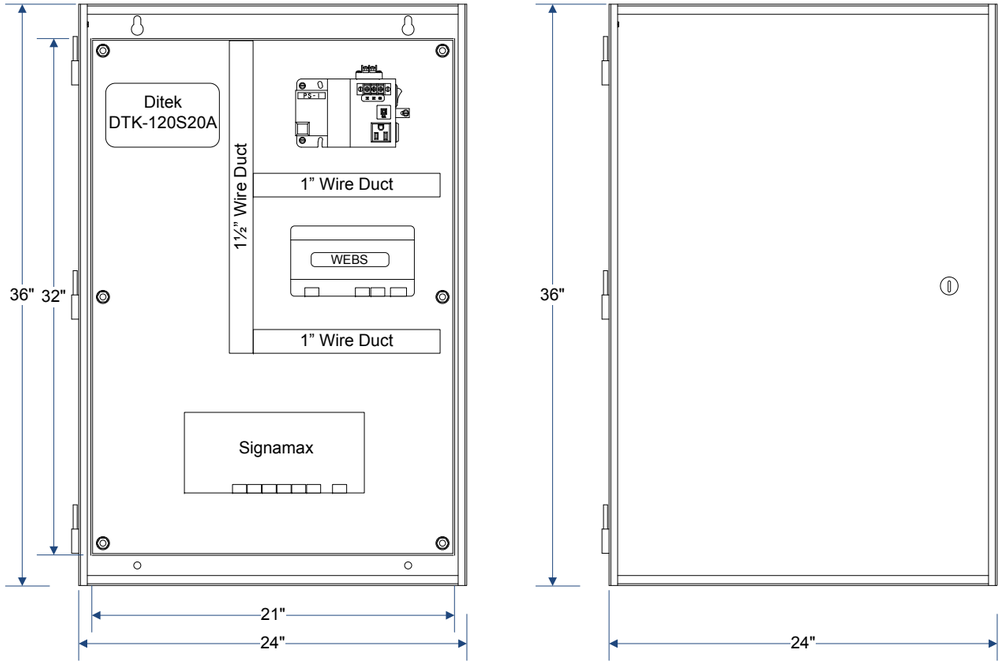

Bill of Material

Tag	Model	Manuf.	Description	Qty.	Reference Page #
PS1	PSB100AB10	Functional Devices	100VA 120:24VAC Power Supply	1	P. 63
JACE	WEB-600E-US-O	Honeywell	Building Management System	1	P. 1-4
	NPB-PWR-H	Honeywell	24VAC/DC Power Supply Module	1	P. 1-4
	NPB-LON	Honeywell	LON Adapter	1	P. 1-4
	NPM-256MB	Honeywell	License for Expanded Memory 256MB	1	P. 1-4
	TSH-1015G-1	Automation Direct	1"x1.5" Wire Duct and Cover	1	
	TSH-1515G-1	Automation Direct	1.5"x1.5" Wire Duct and Cover	1	
	DN-R35SAL1-2	Automation Direct	35mm x 10mm DIN Rail	2	
	065-7111SM	Signamax	7-Port Fiber Switch 10/100BaseT/TX	1	P. 105-108
	DTK-120S20A	Ditek	120V Surge Protector	1	

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JACE Panel Layout

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