AUTOMATIC TEMPERATURE CONTROL DRAWINGS

JOB NAME: Kehillath Israel
CONTRACTOR: Breen & Sullivan
DRAWING DATE: 8/13/2018
DRAWING TYPE: Controls Drawing

TABLE OF CONTENTS

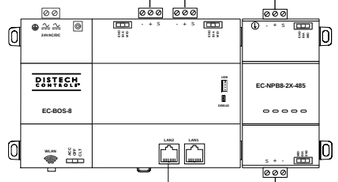
INTERSTATE HVAC CONTROLS
30 VINELAND STREET
BRIGHTON, MA 02135
(617)-782-9000

DISTECH CONTROLS®

Johnson Controls

Network Diagram

SUPERVISOR
MAC: 0



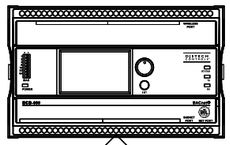
Ethernet LAN

Customer Router

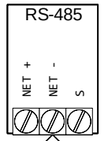
Customer Firewall

Internet Service

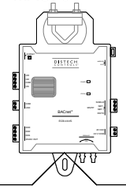
AHU-1
MAC: 4



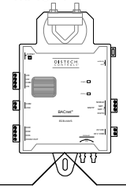
CU-1
MAC: 5



VAV 1-1
MAC: 6

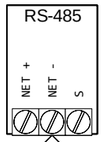


VAV 1-2
MAC: 7

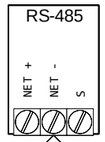


To All VAVs served by AHU-1, Total 21

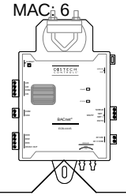
RTU-1
MAC: 4



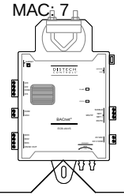
RTU-2
MAC: 5



VAV 2-1
MAC: 6

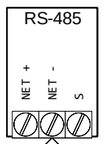


VAV 2-2
MAC: 7

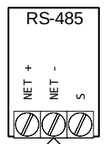


To All VAVs served by RTU-2, Total 4

RTU-3
MAC: 4



RTU-4
MAC: 5



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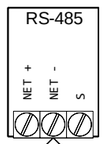
MAC: 6



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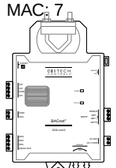
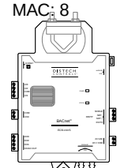
MAC: 7

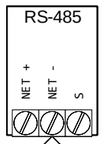


VAV 3-2
MAC: 8

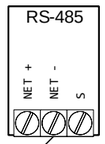


To All VAVs served by RTU-3, Total 14

B-1
MAC: 4



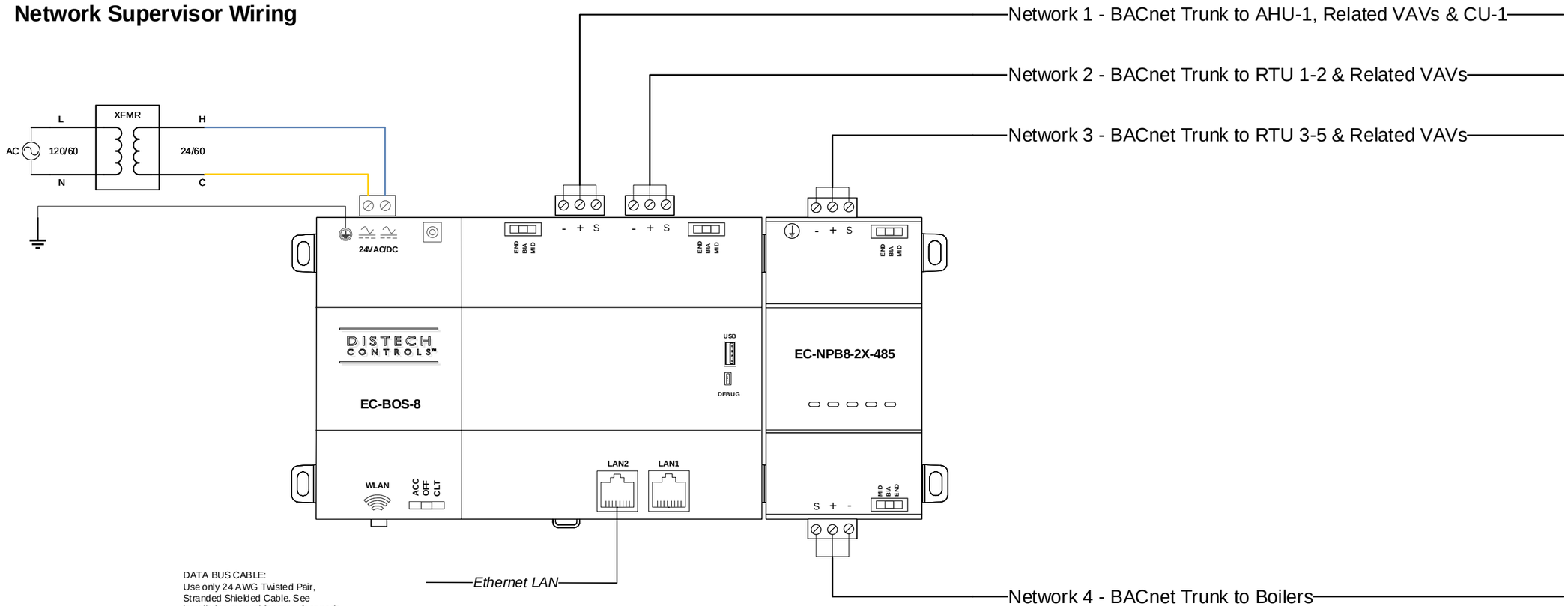
B-2
MAC: 5



INTERSTATE HVAC CONTROLS

PAGE DESCRIPTION	Network Diagram
REVISION	
JOB NAME	Kehillath Israel
REVISED	X
DRAWN BY	Sean
DATE	8/13/2018
PAGE	2 OF 13

Network Supervisor Wiring

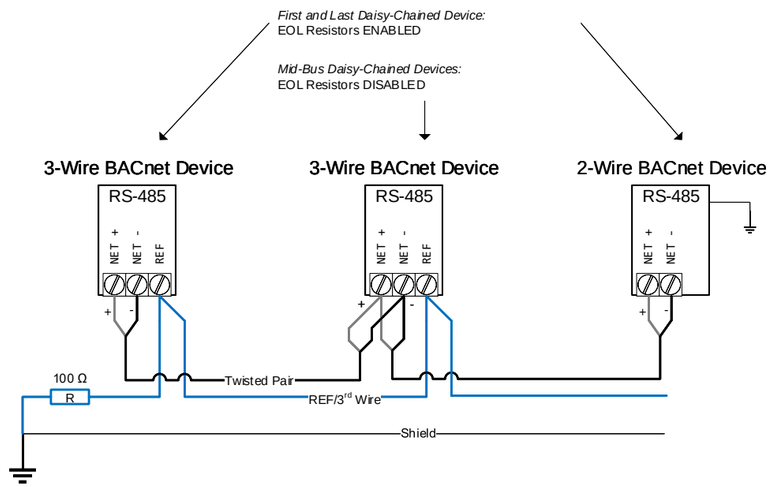


DATA BUS CABLE:
Use only 24 AWG Twisted Pair, Stranded Shielded Cable. See installation manual for manufacturer's specifications

Do Not Splice.

BACnet MS/TP Comm Wiring

Mixed Devices on 3-Conductor Cable with Shield



INSTALLATION NOTES

DATA BUS CABLE

Use 22 or 24 AWG Twisted Pair, Stranded Shielded Cable. 3rd Reference wire may be used with 3-Wire Isolated BACnet devices. See installation manual for manufacturer's specifications

Terminate directly at each device - Do Not Splice.

Daisy Chain Topology must be used.

DATA BUS SHIELDS

Connect shield wires at each device. Isolate last shield wire with electrical tape.

Ground shield wires only at one point – typically at the first device as shown.

END OF LINE RESISTORS

The First and Last devices on a BACnet trunk must have their End-of-Line resistors enabled. See installation manual for instructions on enabling the EOL resistors.

For Devices without an internal EOL resistor, a 120 Ω Resistor may be installed across the + and – RS-485 terminals

2-WIRE & 3-WIRE BACNET DEVICES

3-Wire BACnet Devices have an isolated RS-485 card which requires a 3rd reference wire for communications. Tridium JACEs are 3-wire BACnet devices.

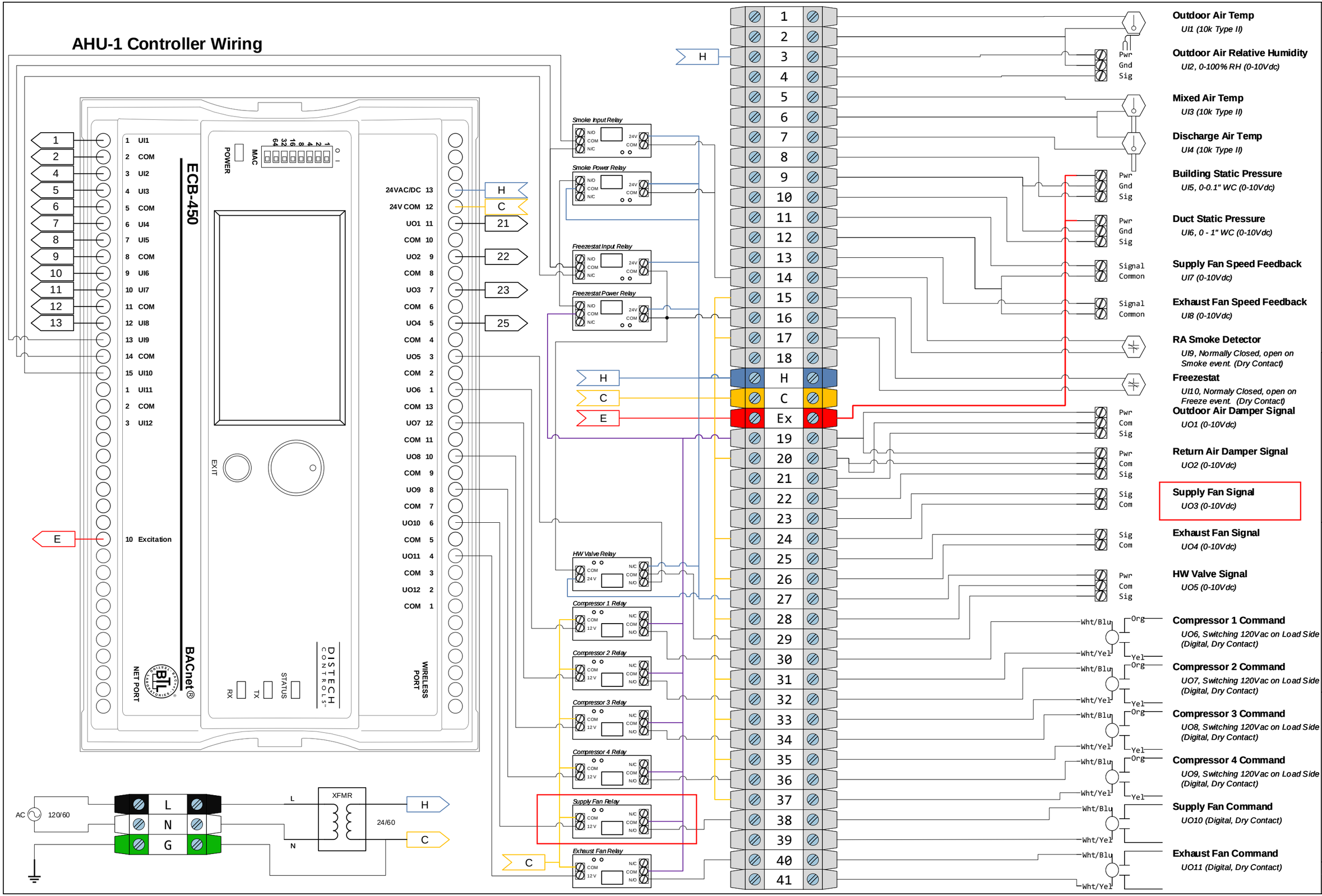
In 2-Wire BACnet devices, the RS-485 card is not isolated from the rest of the controller - the controller's power supply common is used reference. Typically, the power supply common must be grounded on 2-wire BACnet devices. Distech controllers are 2-wire BACnet devices.

REF/3rd Wire must be grounded indirectly, through a 100 Ω Resistor

INTERSTATE HVAC CONTROLS

PAGE DESCRIPTION: Network Supervisor Wiring
REVISION:
JOB NAME: Kehillath Israel
REVISED: X
DRAWN BY: Sean
DATE: 8/13/2018
PAGE: 3 OF 13

AHU-1 Controller Wiring



Outdoor Air Temp
UI1 (10k Type II)

Outdoor Air Relative Humidity
UI2, 0-100% RH (0-10Vdc)

Mixed Air Temp
UI3 (10k Type II)

Discharge Air Temp
UI4 (10k Type II)

Building Static Pressure
UI5, 0-0.1" WC (0-10Vdc)

Duct Static Pressure
UI6, 0 - 1" WC (0-10Vdc)

Supply Fan Speed Feedback
UI7 (0-10Vdc)

Exhaust Fan Speed Feedback
UI8 (0-10Vdc)

RA Smoke Detector
UI9, Normally Closed, open on Smoke event. (Dry Contact)

Freezestat
UI10, Normaly Closed, open on Freeze event. (Dry Contact)

Outdoor Air Damper Signal
UO1 (0-10Vdc)

Return Air Damper Signal
UO2 (0-10Vdc)

Supply Fan Signal
UO3 (0-10Vdc)

Exhaust Fan Signal
UO4 (0-10Vdc)

HW Valve Signal
UO5 (0-10Vdc)

Compressor 1 Command
UO6, Switching 120Vac on Load Side (Digital, Dry Contact)

Compressor 2 Command
UO7, Switching 120Vac on Load Side (Digital, Dry Contact)

Compressor 3 Command
UO8, Switching 120Vac on Load Side (Digital, Dry Contact)

Compressor 4 Command
UO9, Switching 120Vac on Load Side (Digital, Dry Contact)

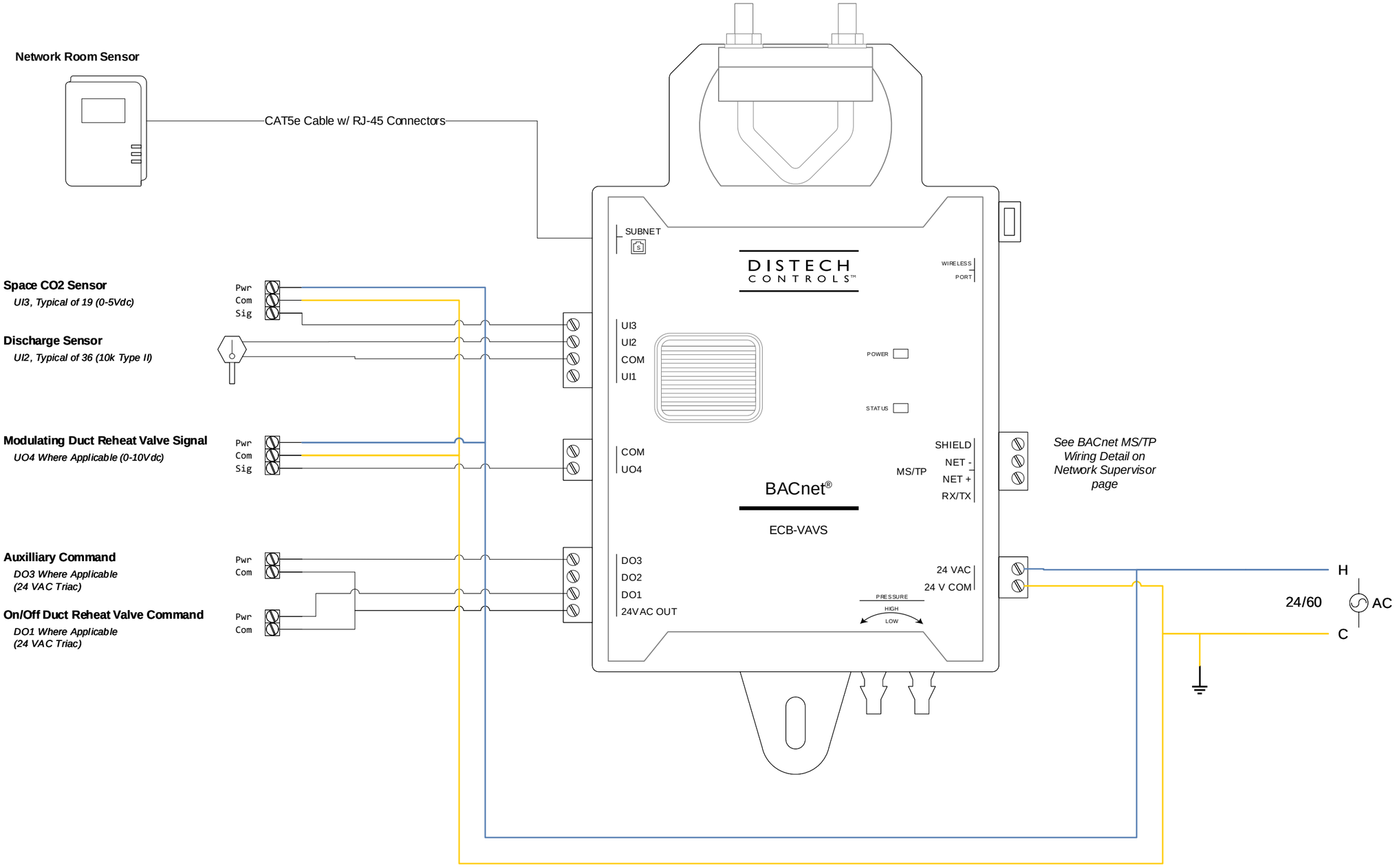
Supply Fan Command
UO10 (Digital, Dry Contact)

Exhaust Fan Command
UO11 (Digital, Dry Contact)

INTERSTATE HVAC CONTROLS

PAGE DESCRIPTION	AHU-1 Controller Wiring
REVISION	
JOB NAME	Kehilath Israel
REVISED	X
DRAWN BY	Sean
DATE	8/13/2018
PAGE	4 OF 13

Typical VAV Wiring *Typical of 36*

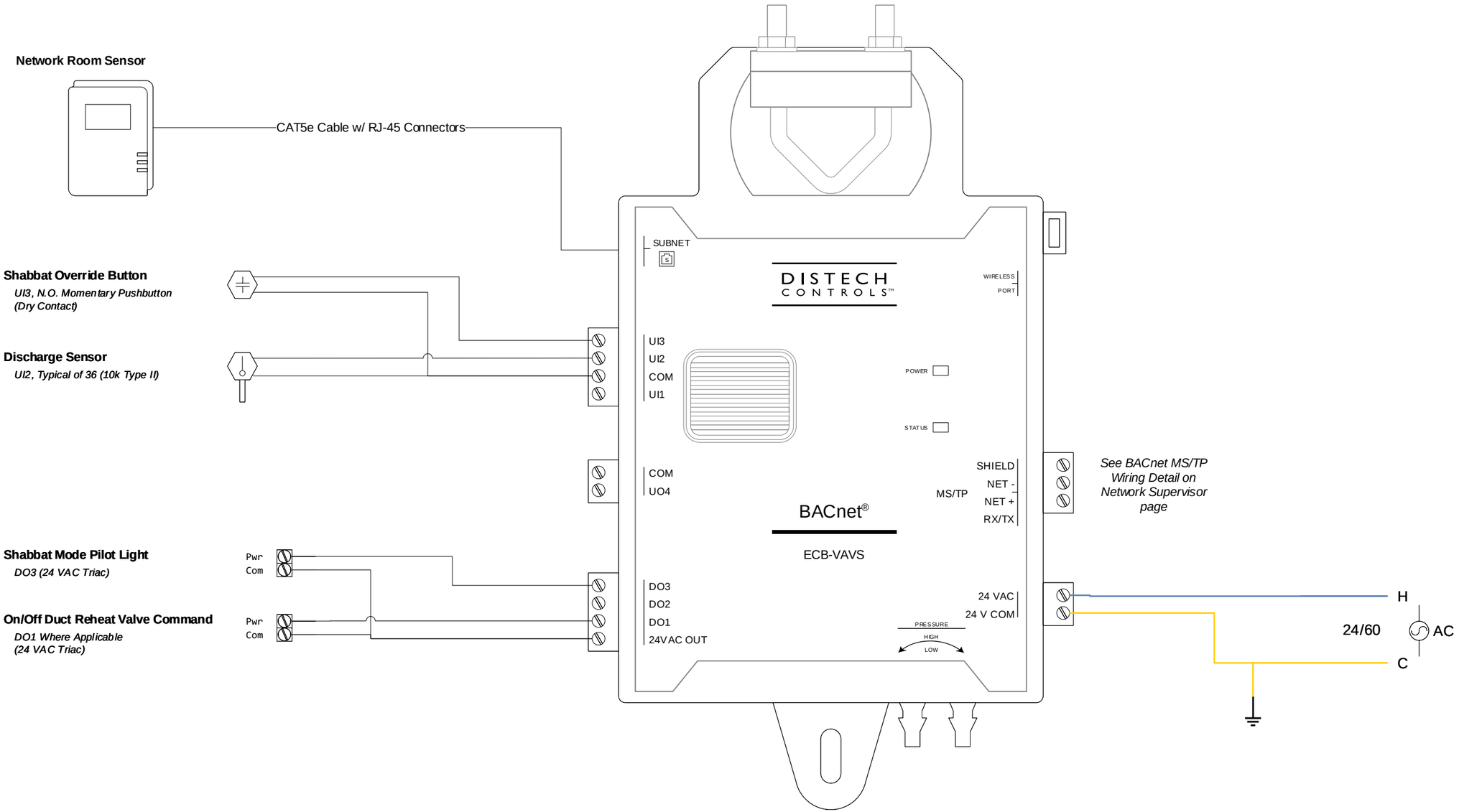


INTERSTATE HVAC CONTROLS

PAGE DESCRIPTION	Typical VAV Wiring
REVISION	
JOB NAME	Kehillath Israel
REVISED	X
DRAWN BY	Sean
DATE	8/13/2018

VAV 1-5 Wiring

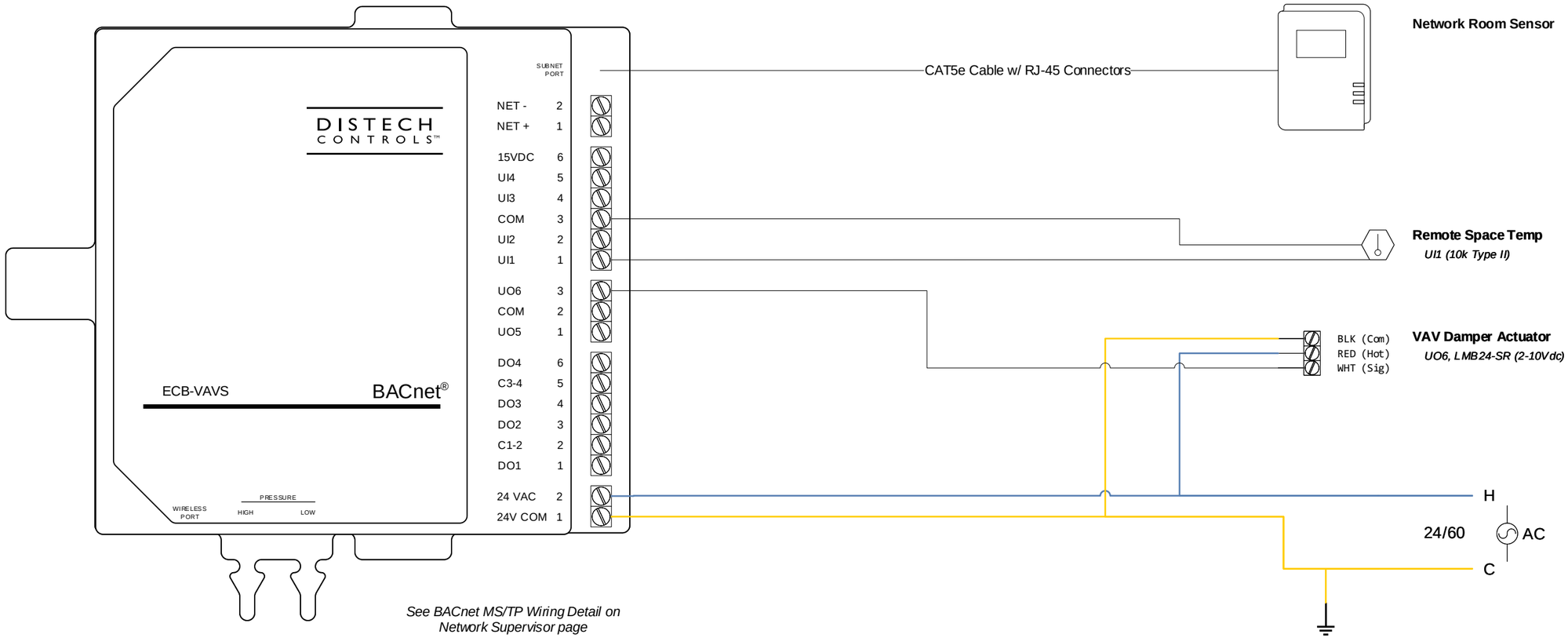
Typical of 1



INTERSTATE HVAC CONTROLS

PAGE DESCRIPTION	VAV 1-5 Wiring
REVISION	
JOB NAME	Kehillath Israel
REVISED	X
DRAWN BY	Sean
DATE	8/13/2018

VAV 2-1 Wiring, Social Hall *Typical of 1*

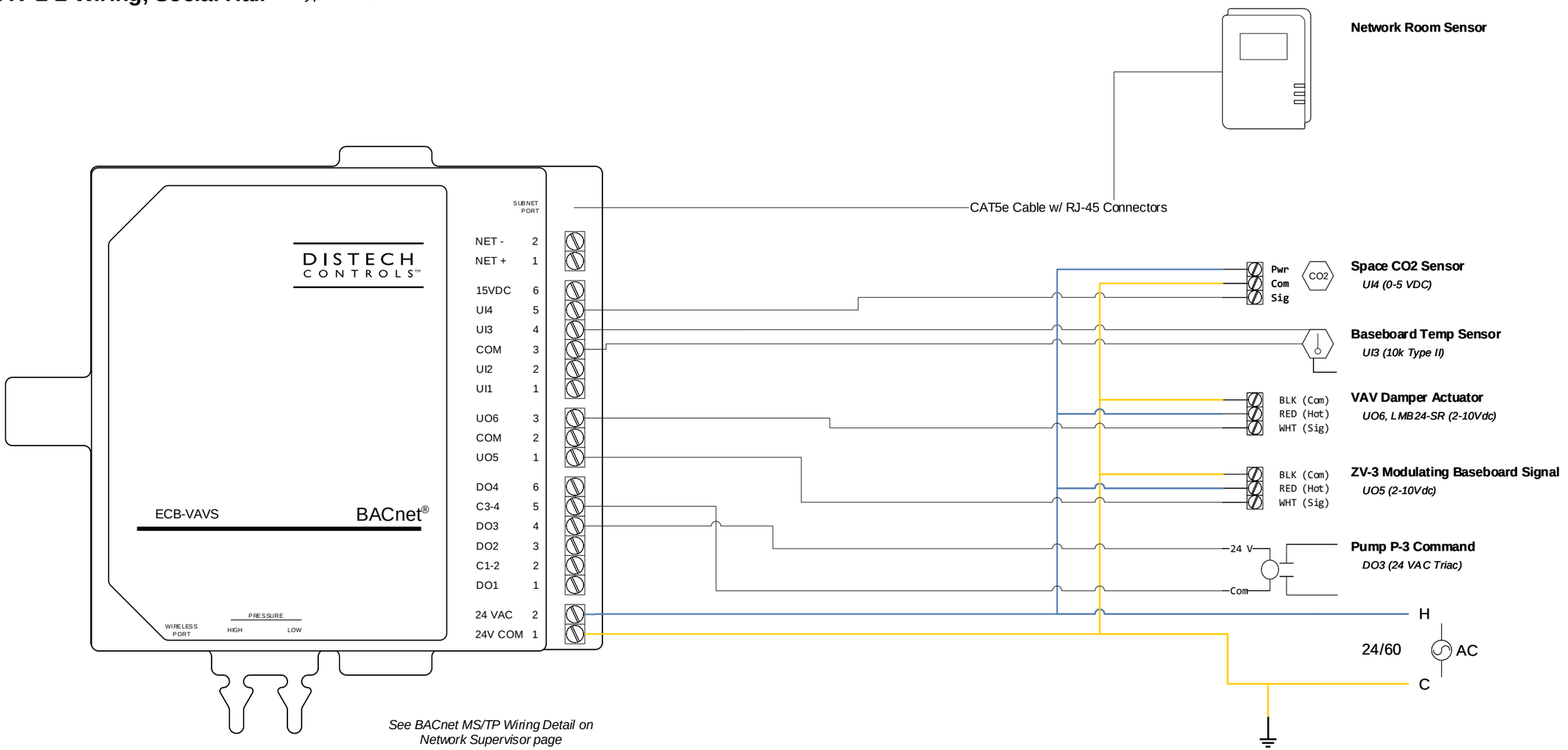


See BACnet MS/TP Wiring Detail on Network Supervisor page

INTERSTATE HVAC CONTROLS

PAGE DESCRIPTION: VAV 2-1 Wiring, Social Hall	REVISION
JOB NAME: Kehilath Israel	REVISED: X
DRAWN BY: Sean	DATE: 8/13/2018
PAGE: 7 OF 13	

VAV 2-2 Wiring, Social Hall *Typical of 1*



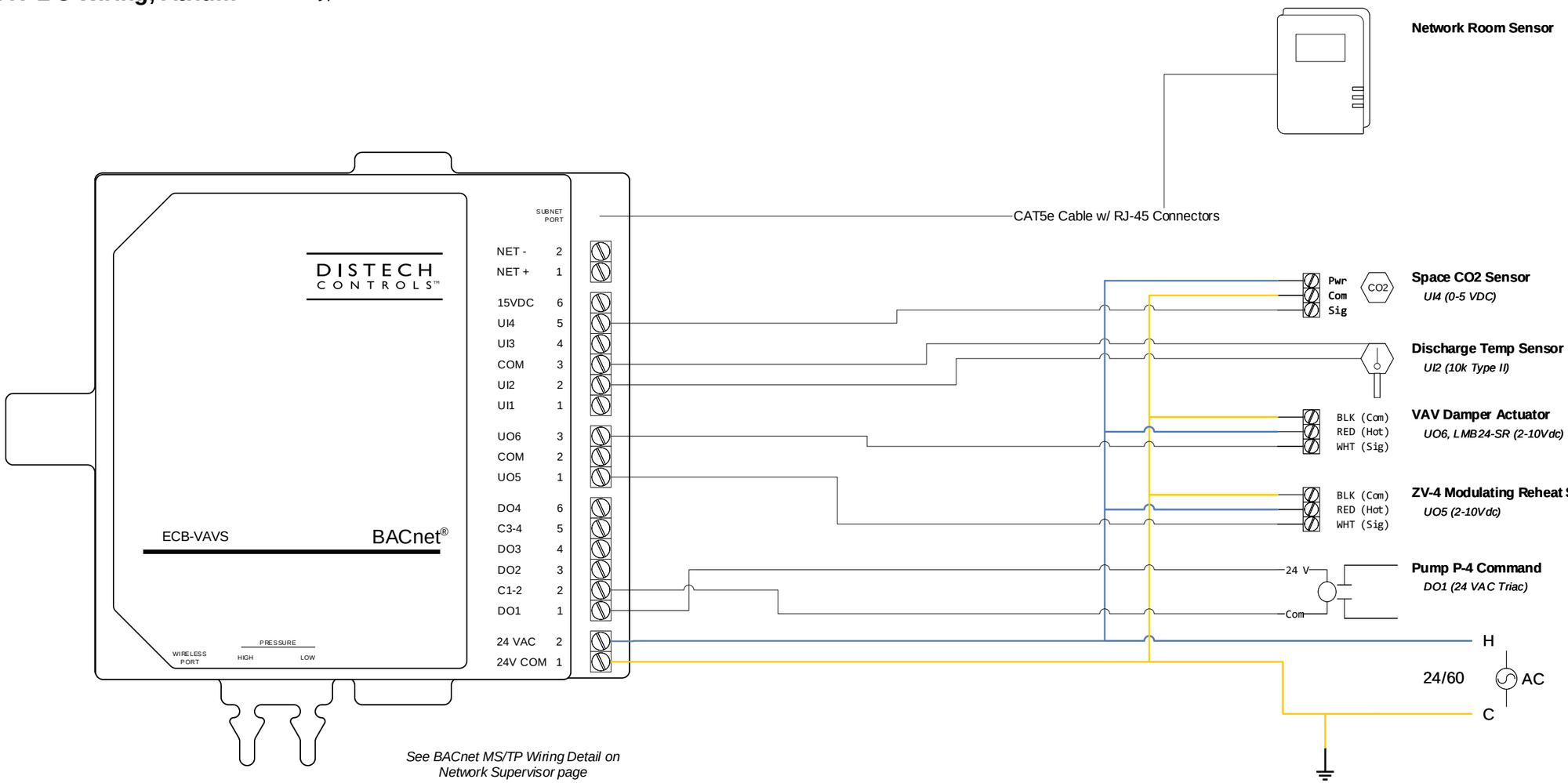
See BACnet MS/TP Wiring Detail on Network Supervisor page

INTERSTATE HVAC CONTROLS

PAGE DESCRIPTION: VAV 2-2 Wiring, Social Hall	REVISION
JOB NAME: Kehilath Israel	REVISED: X
DRAWN BY: Sean	DATE: 8/13/2018

VAV 2-3 Wiring, Atrium

Typical of 1



See BACnet MS/TP Wiring Detail on Network Supervisor page

INTERSTATE HVAC CONTROLS

PAGE DESCRIPTION: VAV 2-3 Wiring, Atrium

REVISION:

JOB NAME: Kehillath Israel

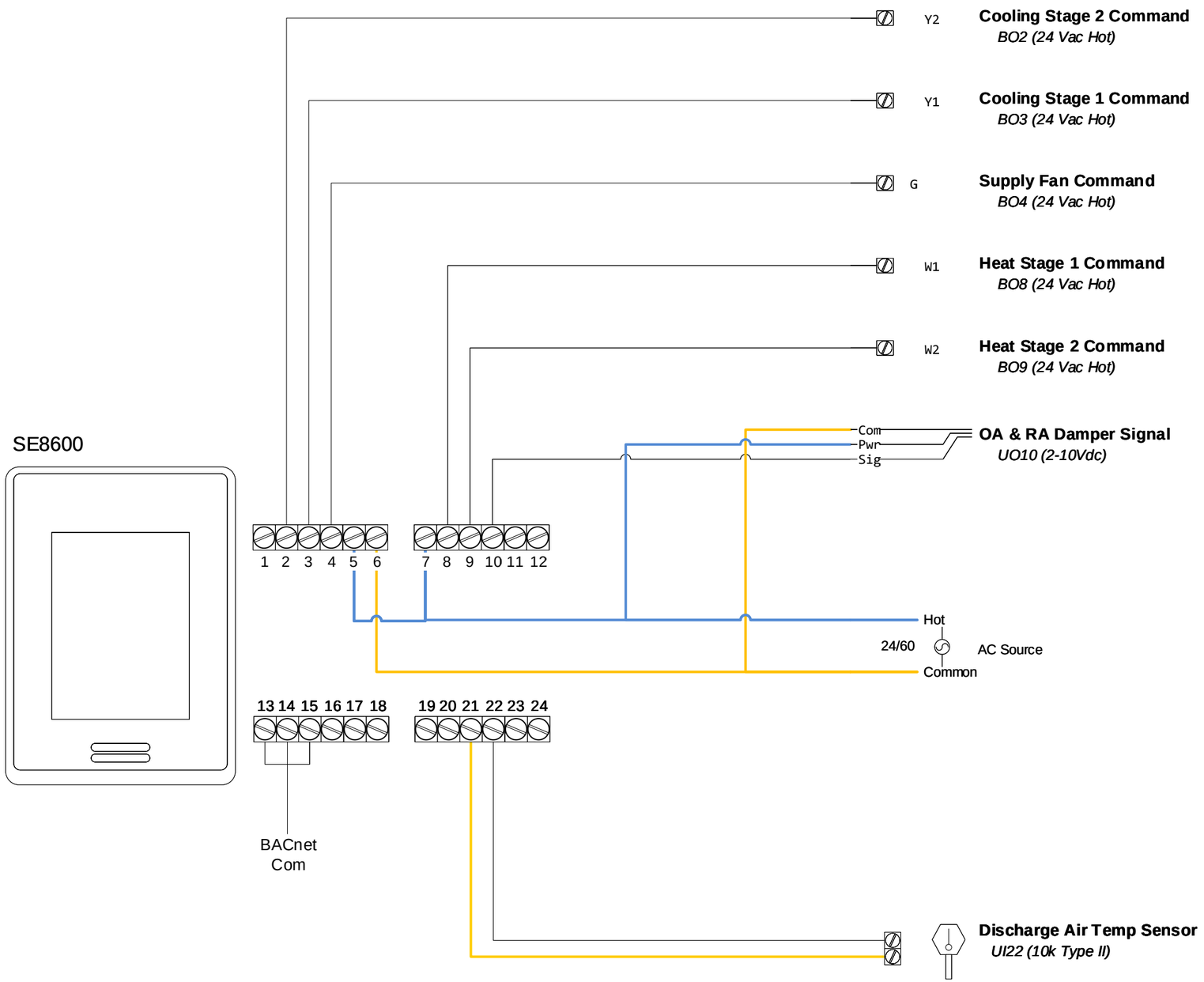
REVISED: X

DRAWN BY: Sean

DATE: 8/13/2018

RTU-4 & 5 Wiring

Typical of 2

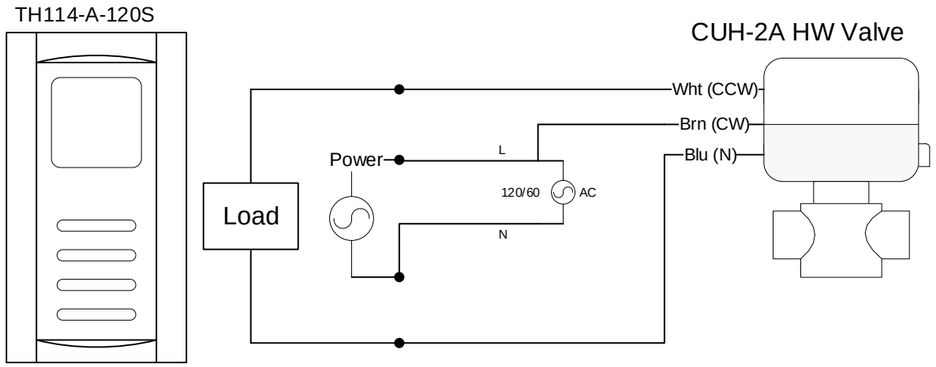


INTERSTATE HVAC CONTROLS

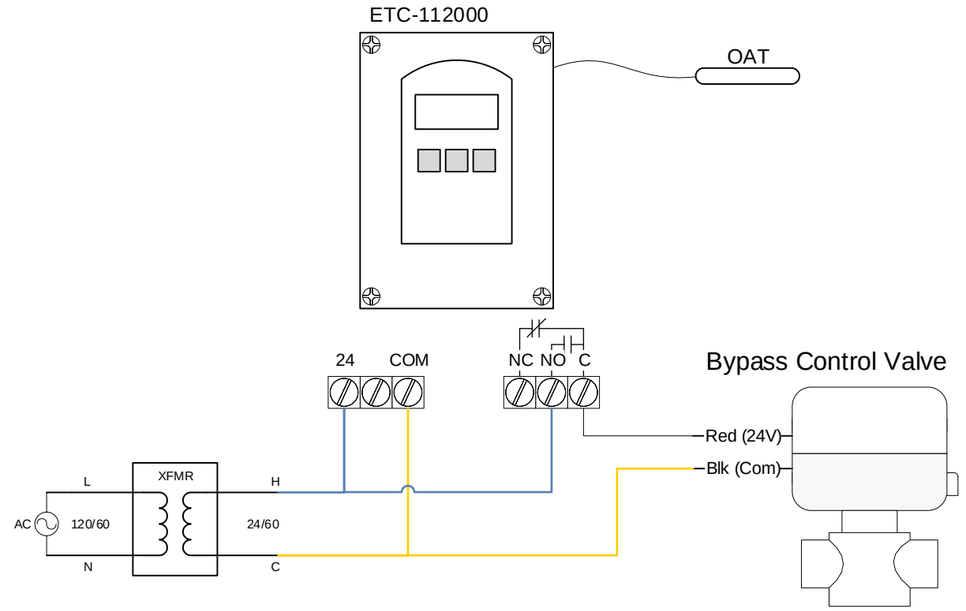
PAGE DESCRIPTION: RTU-4 & 5 Wiring	REVISION
JOB NAME: Kehillath Israel	REVISED: X
DRAWN BY: Sean	DATE: 8/13/2018

Boiler Bypass, CUH-2A, & CUH-3 Wiring

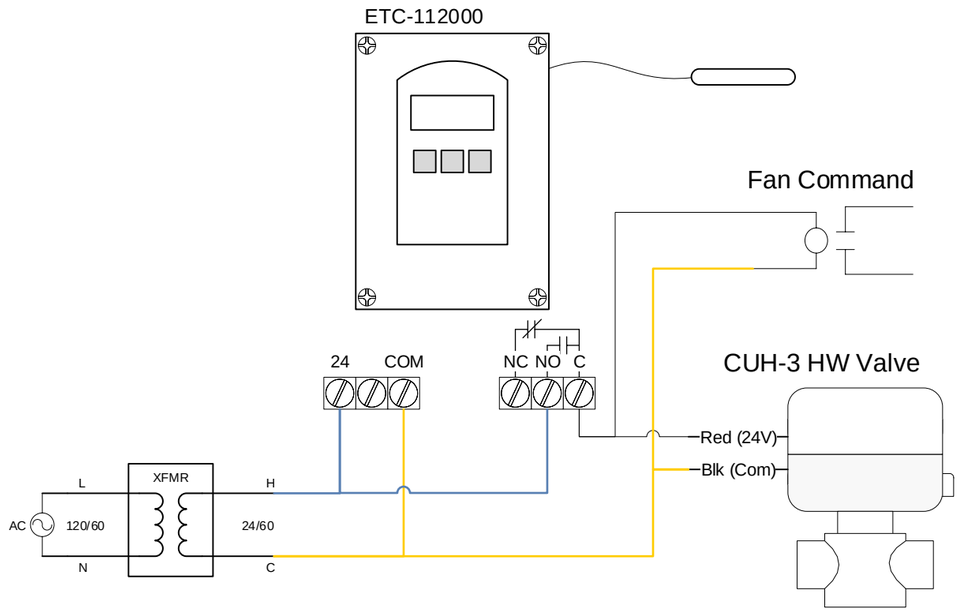
CUH-2A DETAIL



BOILER BYPASS DETAIL



CUH-3 DETAIL



INTERSTATE HVAC CONTROLS

PAGE DESCRIPTION: Boiler Bypass, CUH-2A, & CUH-3 Wiring	REVISION
JOB NAME: Kehilath Israel	REVISED: X
DRAWN BY: Sean	DATE: 8/13/2018

System Sequence

NETWORK SUPERVISOR

The Network Supervisor shall provide an HTML5 based web user-interface for local and remote access. Each user shall have a unique username and password. Access shall be limited or granted to each user as required.

Network Supervisor shall integrate all BACnet devices across several network trunks. The supervisor shall provide scheduling and logic control, including lighting sequences.

GRAPHICS

Spreadsheet reports shall be provided for all VAVs and for all Auxiliary & Lighting control points. Additionally, graphical pages including the indicated points shall be provided as follows:

AHU-1, RTU-1, 2, & 3
- Occupancy status
- Outdoor air temperature and RH
- Supply fan speed
- Duct static pressure and setpoint
- Exhaust fan speed
- Building pressure and setpoint
- Discharge air temperature
- Outside air damper command
- Compressor status (# of compressors running)
- Heat status (stages active or valve position)

RTU-4 & 5
- Occupancy status
- Outdoor air temperature and RH
- Space temperature
- Setpoints
- Cool/heat stages called

VAVS
- Occupancy status
- Space temperature
- CO2 reading
- Setpoint
- Damper position
- Airflow setpoint
- Actual airflow
- Heating valve position & pump status (as applicable)
- Discharge air temperature

BOILERS
- Outdoor temperature
- Boiler status (% fire, entering and leaving water temps) for each boiler.
- Pump status for each pump.
- System temperature setpoint and temperature.
- DHW tank setpoint and temperature.
- Alarms

TRENDS

Supervisor shall trend points as follows:

INTERVAL @ 10 min

Record Count: 52,560 (1 Year)
- All Temp Sensors
- All RH Sensors
- All CO2 Sensors
- All OA Damper Positions
- All VFD Speeds

CHANGE OF VALUE

Record Count: 10,000 (~1 Year)
- All Fan Status
- All Pump Status
- All Compressor Status

Record Count: 500
- All Equipment Error Codes

ALARMS

Supervisor shall annunciate alarms as follows:

CRITICAL ALARMS – Email Alert
- 'Lag' Equipment Failure
- Freezestat Alarm
- Boiler Alarm

NON-CRITICAL ALARMS – Console Only
- 'Lead' Equipment Failure
- Fan Proof Failure
- Room Setpoint Deviation (time delay)
- Low Discharge Temp
- Compressor Failure

VAV SYSTEMS

(AHU-1, RTU-2, RTU-3)

Air Handler supply fan shall run constantly during occupied hours. During unoccupied hours supply fan shall run only in response to heating calls, cooling calls, or zone occupancy overrides. Supply fan speed shall modulate to maintain duct static pressure. Relief/exhaust fan shall run to maintain building pressure setpoint.

When any zone is in cooling mode, Air Handler shall run in cooling mode. When there are no zones in cooling mode, Air Handler shall run in no-cooling mode.

OA Damper shall remain fully closed unless called open by Single Enthalpy Economizer or Demand Controlled Ventilation.

AHU-1 Air Handler Control shall be by DDC controller. RTU-2 & RTU-3 shall run on integral controller with setpoints & modes overwritten by Network Supervisor.

Each VAV terminal shall modulate airflow between min and max heating and cooling setpoints to maintain space temperature setpoints in both occupied and unoccupied mode. On a call for reheat, duct reheat valves shall be modulated or cycled to maintain discharge air temperature setpoint. VAV Reheat shall be disabled whenever OA Temp is above 70°F. On a call for cooling in any zone, the Network Supervisor shall command the related Air Handler into Cooling Mode.

On a ventilation demand in any zone, the zone VAV shall maintain the greater of either the box airflow requirement or the box heating maximum flow setpoint. The Network Supervisor shall submit a ventilation call to the related Air Handler and the OA damper shall modulate open to maintain worst-case zone.

Each VAV terminal shall have a digital output available for side-loop sequence (lighting, etc) control as commanded by either the Network Supervisor or local side-loop logic.

CV SYSTEMS

(RTU-4 & 5)

Fan shall run constantly during occupied hours, and only in response to heating or cooling call during unoccupied hours (Smart Mode). During occupied hours, outside air damper shall remain at minimum unless called open by economizer. Outside air damper shall remain fully closed during unoccupied hours unless called open by economizer. Economizer shall be enabled based on OA Enthalpy as measured at AHU-1 controller, shared over BACnet network. Heating, Cooling and Economizing shall be staged to maintain space temperature setpoint.

SANCTUARY

(RTU-1)

RTU-1 shall be controlled by integral controller. Convectors shall be energized by auxiliary outputs in nearby VAV controllers. If RTU-1 zone temp is below RTU-1 heating setpoint, the convector HW valve shall be commanded open.

SOCIAL HALL

(VAV 2-1 & 2-2)

Social Hall VAVs shall run with the same sequence as a typical VAV except they shall both ventilate in response to the CO2 sensor at VAV 2-2. Additionally, pump P-3 shall be energized when either VAV 2-1 or 2-2 calls for heat or when OAT < 40°F.

ZV-3 shall modulate to maintain the HW supply temp setpoint, reset based on outdoor air temperature between the following points:

During Heat Call
- OAT >= 60°F, SP = 90°F
- OAT <= 60°F, SP = 160°F

No Heat Call
- OAT >= 60°F, SP = 70°F
- OAT >= 60°F, SP = 130°F

ATRIUM

(VAV 2-3)

Atrium VAV shall run with same sequence as a typical VAV except pump P-4 shall be energized whenever there is a call for heat. Valve ZV-4 shall modulate to maintain discharge air setpoint.

HEATING TERMINAL EQUIPMENT

(CUH-1, CUH-2, CUH-2A, CUH-3)

CUH-1 & 2 shall be provided with factory aquastat. Control valves shall be Danfoss self-contained automatic valves with remote sensors. When the SCAV calls for heat and opens, the fan will run once the aquastat senses pipe temperature >100°F.

CUH-2A shall be provided with factory aquastat. Line voltage control valve shall be commanded by Honeywell Aube thermostat. The fan will run once the aquastat senses pipe temperature >100°F.

CUH-3 shall be controlled by RANCO ETC stand-alone temperature controller. On a heat call, the control valve shall be commanded open and the fan shall be energized.

BOILER BYPASS VALVE

Boiler Bypass Valve shall be controlled by RANCO ETC stand-alone temperature controller. On a rise in OAT above 40°F, bypass valve shall be commanded open to maintain minimum flow through boilers.

INTEGRATION

(B-1, B-2, CU-1)

Relevant BACnet points from the boilers and condenser unit shall be integrated to the Network Supervisor for monitoring and adjustment. Point availability and access depend on field device programming.

INTERSTATE HVAC CONTROLS

PAGE DESCRIPTION	System Sequence
REVISION	
JOB NAME	Kehillath Israel
REVISED	X
DRAWN BY	Sean
DATE	8/13/2018

Bill of Materials

SYSTEM	PART NUMBER	QTY	PART DESCRIPTION
SUPERVISOR	CDIDI-BOS8USWIFI	1	Distech JACE 8 Supervisor Controller
	PDIDI-NPB82X485-00	1	2 Port RS-485 Module for JACE 8
	SDITR-NC-8100	1	100 Device Niagara 4 Core license for JACE 8
	SDITR-SMA-BOS8100-1YR-INIT	1	100 Device Initial Software Maintenance Agreementfor JACE 8
	567-452	1	Siemens Controls Enclosure (Assembled w/ accessories)
	TR50VA005	1	Functional Devices 50VA 120/24 Transformer
AHU-1	ECB-450	1	Distech 12 UI, 12 UO Programmable Controller w/ integral LCD
	567-452	1	Siemens Controls Enclosure (Assembled w/ accessories)
	RIBMN24C	2	Functional Devices 24 Vac Track Mount Relay for Interlock
	RIBMN12C	6	Functional Devices 12 Vdc Track Mount Relay for Digital Outputs
	RIBU1C	4	Functional Devices Pilot Relay for Compressor Commands 1-4
	TR50VA005	1	Functional Devices 50VA 120/24 Transformer
	A/RH3-CP-O	1	ACI 10k Type II Temp & Humidity Sensor for Outdoor Air
	A/CP-D-12"-BB	2	ACI 10k Type II Temp Sensor, 12" Duct Probe for Mixed Air & Discharge Air
	A/DLP-001-W-U-N-A-3	1	ACI 0 - 1" Pressure Sensor with Pitot Tube for Duct Static. Pressure ranges field selectable for 0.1, 0.2, 0.5, or 1 inWC
	A/DLP-001-W-U-N-A-0	1	ACI 0 - 0.1" Pressure Sensor with 1/4" Barb Fittings for Building Static. Pressure ranges field selectable for 0.1, 0.2, 0.5, or 1 inWC
	A/R2-PUP	1	ACI Space Pressure Pickup Port
	C-2350VFD	2	Senva VFD Rated Split-Core current sensor for Supply and Exhaust Fan Proof
	A70HA-1C	1	Johnson Manual Reset Freezestat
	D4120 + DST3	1	System Sensor Duct Smoke Detector & Sampling Tube
RTU-4 & 5	SE8600UOB11	2	Bacnet Thermostat
	A/CP-D-8"-BB	2	ACI 10k Type II Temp Sensor, 8" Duct Probe for Discharge Air
VAVs	ECB-VAVS	39	Distech 9-Point Pre-Loaded VAV Controller with 3 UI, 3 DO, & 1 UO
	SMART-VUE-01	39	Distech Communicating Room Sensor w/ Backlit Display
	CO2-VAL	19	Senva Space CO2 Sensor 0-2000 PPM, 4-20mA or 0-5V/0-10V
	A/CP-D-4"-PB	36	ACI 10k Type II Temp Sensor, 4" Duct Probe for Discharge Air
	A/CP-R2	1	ACI 10k Type II Space Temp Sensor, for Social Hall
	A/CP-S-PB	1	ACI 10k Type II Strap-On Temp Sensor, for Social Hall
	RIBU1C	2	Functional Devices Pilot Relay for Atrium & Social Hall Pump Commands
BOILER BYPASS VALVE	ETC112000	1	Ranco Single Stage Digital Temperature Controller, 24 Vac
	TR50VA005	1	Functional Devices 50VA 120/24 Transformer
HEATING TERMINAL EQUIPMENT	013G8042 + 0138252	2	Danfoss RA 2000 Self Contained Automated Valve w/ Remote Sensor, for CUH-1 & 2
	TH114-A-120S	1	Honeywell Aube Line Voltage Thermostat for CUH-2A
	ETC112000	1	Ranco Single Stage Digital Temperature Controller, 24 Vac, for CUH-3
	TR50VA005	1	Functional Devices 50VA 120/24 Transformer for CUH-3
	RIBU1C	1	Functional Devices Pilot Relay for CUH-3 Fan Command

INTERSTATE HVAC CONTROLS

PAGE DESCRIPTION: Bill of Materials
REVISION:
JOB NAME: Kehillath Israel
REVISED: X
DRAWN BY: Sean
DATE: 8/13/2018