Vancouver CoastalHealth

HVAC Standards for Building Automation, Instrumentation & Controls

Rev.1
July 2024

Vancouver CoastalHealth

Contents

1 General Overview

.1 This document serves as a supplement to the contract documents. It is to be used as a guideline to standardize the hardware and software installation for the Building Automation System (BAS).

.2 The contract documents (drawings and specifications) will govern the scope and details of the work.

2 General Requirements

.1 All work shall conform to the requirements of the local codes, regulations, and standards.

.2 In addition, all work shall be done according to VCH standards to achieve a uniform framework.

.3 Deviations from this standard shall seek the approval of VCH (VCH/FMO/HVAC Dept).

3 General Wiring Installation

.1 All controls and network wiring to comply with the following:

.1 All wiring installation to be in emt conduit.

.2 All wires to be continuous runs. No splices are allowed.

.3 All wiring subjected to outdoor environment to be in liquid tight flexible metallic conduit with liquid tight fittings.

.4 All control devices and sensors subjected to outdoor environment to be enclosed in NEMA-4 enclosures.

.5 Fiber cables, if installed alongside with (Information Management/Information Technology Services' (IMITS) fiber infrastructure shall be installed in compliance to IMITS' installation standards (see https://fraserhealth.ca/-/media/Project/FraserHealth/FraserHealth/About-Us/Business-Documents/Communications_Infrastructure_Standards_Specifications.pdf/ for details), otherwise fiber runs must be installed in its own emt conduit.

.2 See Section-11 for additional Network Wiring requirements.

4 Commencement of New and Existing Work

.1 Inform VCH on commencement of work and the areas affected.

.2 Co-ordinate with VCH on any modifications to the existing equipment.

.3 Request for equipment shutdowns to comply with VCH Shutdown Policy.

5 Demolition Work on Obsolete Equipment

.1 Inform and co-ordinate with VCH on any demolition work.

.2 All obsolete devices to be completely removed.

.3 All wires from the field devices to the terminals of the DDC (direct digital controllers) shall be completely removed.

.4 All unnecessary conduits, cable carriers, and electrical boxes shall be completely removed.

.5 All interfacing devices such as transducers, relays, power supplies and wires to be removed from the local panel and the field.

.6 All software related points shall be removed and programs updated.

.7 All DDC controllers to be returned to VCH.

.8 Panel points listing shall be updated accordingly to reflect removed devices.

6 Shop Drawings Submittal

.1 Submit shop drawings to VCH/HVAC/Controls Department for approval.

.2 Shop drawings to include the following:

- Sequence of Operation
- Network schematic
- System schematic of equipment
- DDC Controller types
- Input and Output list
- Sensors, transducers,
- Actuator types
- Valve types
- Specification sheets

7 Hardware Requirements and Installation

.1 General requirements for installation.

1. All devices installed to be easily accessible for replacement or maintenance work.

2. Devices with built-in display shall be mounted for clear visibility and free from obstructions.

3. Where hardware/devices deviate from vendor specific, alternatives must be approved by VCH.

.2 Valves – Hot Water, Chilled Water and Steam.

1. Valves shall be globe valve or characterized ball valve type (Belimo or approved equivalent).

2. Valve actuators shall be modulating.

.3 Pneumatic Air Valves

1. Electro-Pneumatic Transducers (EPT) to be high volume type or equivalent.

2. All air valves (Electro-Pneumatic Transducers and Electric-Pneumatic Solenoids) to be fitted with pressure gauges on the supply and output lines.

.4 Damper Actuators

1. Damper actuators shall be modulating type with spring return for mixing outside, return and exhaust air type application.

2. Damper actuators to have end switches (tilt type) independently mounted on the damper actuator shaft or on the damper blade of each damper section.

.5 Current Sensor/Transducers

1. All amperage reading used for controlling purposes shall be sensed by external current sensor/transducer. Amperage readings from VFD or BACnet controllers shall not be used.

2. Current sensor/transducer to be split core type.

3. Current sensor/transducer to be accurate down to one-tenth of an ampere. Do not use multiple wraps around the current sensor/transducer.

.6 Safety Devices

1. Freeze protection devices may be auto or manual reset. If auto reset is used, then a manual reset of device via software is required for each tripped incident.

2. High- or low-pressure limit devices may be auto or manual reset. If auto reset is used, then a manual reset of device via software is required for each tripped incident.

3. High humidity limit devices may be auto or manual reset. If auto reset is used, then a manual reset of device via software is required for each tripped incident.

.7 Pressure Transducers

1. Differential air pressure transducers to have locally built-in display. Pressure tubing to have T-fittings installed for verification or calibration purposes.

2. Static pressure tips (air) to be used for sensing static pressure readings. Transducers to have locally built-in display. Pressure tubing to have T-fittings installed for verification or calibration purposes.

3. Liquid Pressure Sensors to have locally built-in display. Liquid sensing lines to be copper and fitted with isolation and bleed valves for maintenance. Liquid sensing lines to also have T-fitting with pressure gauges installed on both high and low sides.

.8 Thermostats and Space Sensors

1. Thermostats in main public corridors (outside department boundaries) to be sensor type only, otherwise thermostats must be in clear lockable box.

2. All space sensors (example: temperature, humidity, CO2, motion detectors) shall be installed at locations free from external interferences and barriers.

3. Room thermostats and temperature sensors to be installed at 5ft (1500mm) above finished floor.

.9 Refrigeration Temperature Sensors – Freezers and Fridges.

1. BAS temperature alarm monitoring can be interfaced to refrigeration unit internal alarm module with provided relay contacts. Do not use BACnet data for alarm monitoring.

2. Where actual temperature sensing is required, the temperature sensor is to be used with plastic thermal buffering bottle filled with food grade glycol solution with MSDS labelling. Bottle to be secured to prevent spilling.

8 Primary DDC Controllers

.1 All DDC controllers shall be in hinged enclosures and be accessible. Aluminum electrical boxes are not acceptable.

.2 DDC controllers shall not be located in ceiling space except for dedicated controllers attached directly to damper shaft of VAV boxes.

.3 DDC controllers shall not be subjected to outdoor environment unless they are in a weather proof enclosure with tempered air.

.4 All equipment shall be controlled by external relays/transducers/sensors.

.5 All devices associated to a control loop shall be terminated within the same control panel. (Example – Feedback and Output devices to be terminated and controlled within the same controller)

.6 All new DDC panels shall include minimum 20% spare input and output points.

.7 Acquire control panel addresses from VCH. Do not randomly assign addresses to DDC controllers.

.8 All DDC controllers to be connected to VCH Central UPS power source. Standalone UPS appliances are prohibited.

9 BACnet Controllers from Equipment Vendors

.1 All BACnet controllers shall be BTL (BACnet Testing Laboratories) certified for compatibility.

.2 All BACnet controllers shall be installed and located in the same manner as DDC Controllers - Section-8

.3 BACnet devices are prohibited as a controlling source.

1. DDC Controller must use its own interfacing relay to start/stop the equipment. The DDC Controller shall not WRITE to the BACnet controller to start/stop the equipment.

2. DDC controller must use its own sensing element as feedback for the control loop. The DDC controller shall not retrieve the BACnet data to use it as feedback for the control loop.

.4 BACnet devices may be used for non-critical monitoring purposes only. Examples are:

1. Non-controlling data points for information only.

2. Non critical alarms generated by the BACnet devices.

.5 Acquire BACnet controller addresses from VCH. Do not randomly assign addresses to BACnet controllers.

.6 All BACnet controllers to be connected to VCH Central UPS power source. Standalone UPS appliances are prohibited.

10 BAS Network Integration

.1 For the duration of the project, all new BAS network to be standalone and isolated from the existing BAS network infrastructure.

.2 The new BAS network shall be tested and be free of network errors before integrating into the main BAS infrastructure.

.3 Provide a Network Performance Report (Network Traffic Analysis) that is acceptable to Delta Controls Standard.

.4 Acquire approval from VCH before integrating new networks or new controllers onto existing BAS infrastructure.

11 BAS Network Structured Cabling

.1 Network structured cabling installation to conform to industry standards.

.2 Network cables to be minimum Cat-6.

.3 Network cabling termination:

1. Network Switches - terminate network cables to a patch panel and use patch cords for final termination

2. DDC Control Panels Within Enclosure - terminate network cable to a patch block and use patch cord for final termination.

.4 Allow one spare Ethernet port at each enclosure panel for laptop plugin.

.5 Network cabling shall be labeled at both ends for identification.

12 Network Switches

.1 Network switches to be Allied Telesis. Acquire VCH's approval if others are to be used.

.2 Allow 20% spare capacity for each network switch.

.3 Network switches are prohibited in ceiling spaces.

.4 Network switches to be installed in a hinged enclosure. Aluminum electrical boxes are not acceptable.

.5 All network switches to be connected to VCH Central UPS power source. Standalone UPS appliances are prohibited.

.6 Acquire Network IP addresses from VCH. Do not randomly assign addresses to network appliances.

13 Equipment Interfacing Minimum I/O Points to BAS

.1 Motors:

- Hardware relay to start/stop

- Current transducer to monitor amperage

.2 Variable Speed Drives:
- Drive enable/disable using external relay
- Drive speed output
- Drive speed feedback
- Drive alarm feedback
- Drive motor amperage using external current transducer

.3 AHU - Valve Actuators:
- Analog output signal (0-10vdc) for variable position
- Valve position feedback

.4 AHU – 100% Fresh Air Systems:
- Outdoor air damper to be electrically hardwire interlocked to the SF motor.
- Exhaust air damper to be electrically hardwire interlocked to the EF motor.
- Interlocking end switches for each damper set to be monitored at DDC controller.

.5 AHU - Damper Actuators:

.1 Variable Position:
- Analog signal (0-10vdc) for variable position
- Damper position feedback

.2 Two Position:
- Analog signal (0-10vdc) for 2-position
- Independent Open and Close end switches mounted on damper blade or shaft.
- Where there is more than one bank of dampers, each bank shall have its own damper actuator and its own end switches.

.6 AHU - Isolation Damper Actuators:
- Install actuator for each bank of damper.
- Install independent Open and Close end switches for each bank of damper.

.7 VAV - Damper Actuators:
- Analog signal (0-10vdc) for variable position preferred.
- damper position feedback

.8 VAV - Misc:
- VAV supply air temperature sensor required.
- VAV supply air volumetric sensor required (crossflow type).

.9 Mechanical System Equipment (boilers, chillers, heat pumps, heat exchangers, etc.):
- Controlling of the equipment's components via its BACnet interface is prohibited.
- BACnet data is used only for monitoring.
- Independent sensors to be used for critical monitoring and control loops.
- Independent relays or transducers for controlling.

- All valves to have position indication for physical viewing.
- All valves to have true position feedback to BAS

.10 Critical Alarm Monitoring:

- This includes but not limited to fridges, freezers, oxygen level, water leak detection, sump pit water level, gas detection.
- All alarm wiring to be terminated at main DDC control panels. Do not terminate at subnet control panels.
- All alarm points to be configured as Normally Closed contacts such that when an alarm is generated the relay contact is released Open.

14 Hardware Identification

.1 DDC control panel:

.1 Lamecoid on DDC control panel enclosures. Printed labels are not acceptable. Follow the format as shown.

.2 Printed Label with BACnet address on DDC controllers is acceptable.

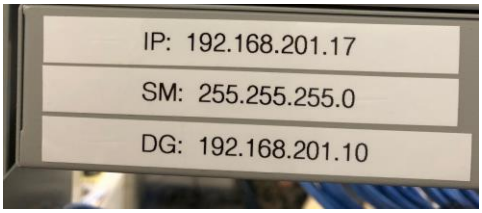
.3 Where new and existing DDC controllers are located in ceiling spaces (example - VAV controllers), labels shall be placed at ceiling. Labels shall indicate controller number.

.2 Thermostats: Affix sticker on the base enclosure, not on the cover plate.

.3 Sensors, transducers, instruments: Use waterproof device tags.

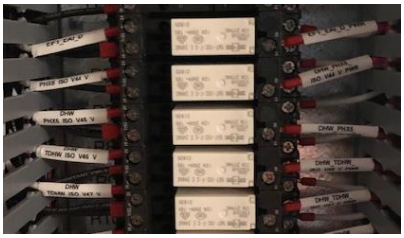
.4 Network Switches: Affixed with labels with the following information

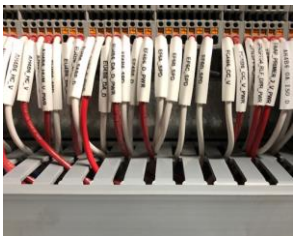
- IP Address
- Submask
- Default Gateway



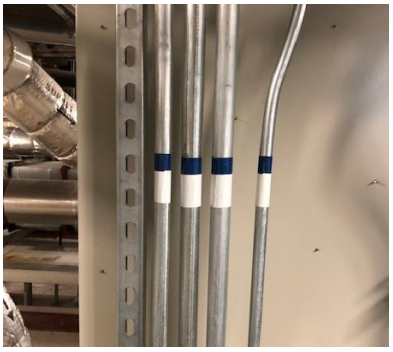
.5 Wiring: Affixed with labels on both ends of wire (including network cables).

- Use machine printed labels.
- Hand written labels are not acceptable



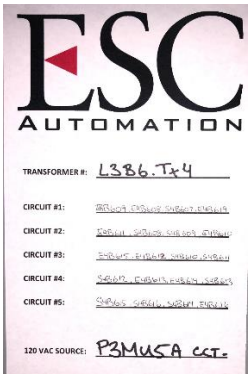


.6 EMT Conduit: Color coding required.



.7 Electrical Boxes: Color coded or company identification.

.8 Power Transformers: Label identifying power source and circuit breaker numbers.



.9 Devices that are installed in non-obvious locations (Example: Outside the boundaries of an AHU) shall be noted in its software object description field.

15 Software Programs

.1 All control loops to be tuned for all conditions.

.2 All software inputs, outputs, and variables to be in the AUTO mode

.3 All inputs to have alarms programmed for device failure or control failure.

.4 All controlling setpoints to have alarms programmed for out-of-setpoint range.

.5 All trend logs to have the following sample rate: 5min interval, 600 samples

.6 All measurements to be in Metric

16 Software Naming Conventions

Descriptors to be in Upper Case and in the following order:

.1 Ahu components: Building_Ahu_Equipment_Point Description

Example: JPS_AH5_SF5_SA_T

.2 Space Sensors: Building_Ahu_VAV_Floor Level_Rm Number_Point

Example: JPS_AH2_VAV114_LEV2 _RM2014_RT_SENS (room sensor)
JPS_AH2_VAV114_LEV2_RM2014_RT_TSTAT (bacstat)

.3 Mechanical components: Building_Primary Equipment_Secondary Equipment_Point

Example: JPS_CH1_PMP1_VFD_C
JPS_HP1_SUP_T
JPS_HEX2_HWS_T

See Appendix for list of typical acronyms. Consult with VCH for additional acronyms.

17 Graphical Representation

.1 Consult with VCH at the design stage of the graphics.

.2 All graphics design must be approved by VCH.

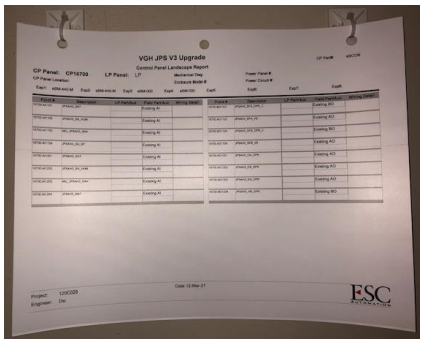
.3 All graphics must match VCH current standard Orcaview graphics or Eviz graphics.

.4 Obtain sample graphics from VCH.

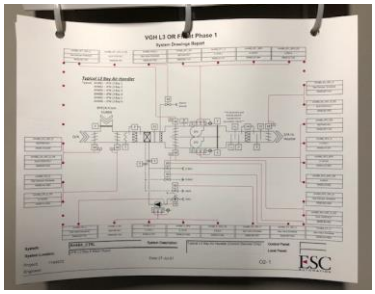
.5 All hardware inputs and outputs on DDC panel must be graphically referenced.

18 Field Equipment Documentation

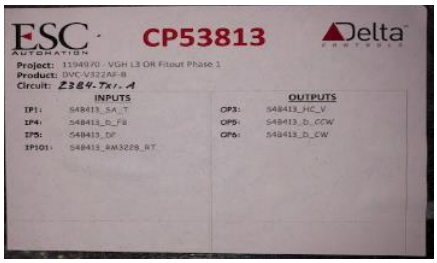
.1 Control Panel Input/Output (I/O's) listings (laminated) to be displayed and mounted on the inside door of the enclosure.



.2 As built drawings and schematics (laminated) for the associated DDC panel to be displayed and mounted on the inside door of the enclosure.



.4 VAV Controllers – I/O listing affixed to vav box.



19 Controls and Instruments Verifications

.1 All inputs to be checked end to end – from panel input terminal to sensor.

.2 All outputs be checked end to end – from panel output terminal to end device.

20 System Commissioning and Calibration

.1 Setup and calibrate all control loops and sensors

.2 Perform all control sequence testing for all modes of operation.

.3 All flow volumes to be calibrated using pitot tube flow traversing or electronic flow-hoods.

21 Pre-Job Completion Requirements

.1 All spare DDC controllers, instrumentation, and control devices to be returned to VCH.

.2 All existing DDC controllers, and thermostats to be returned to VCH.

.3 All graphics should be commissioned and thoroughly checked for accuracy and correct links.

.4 Submit final software graphics for review 10 days in advance before completion of project.

.5 Provide check sheets for the following: See Appendix B for samples.
Controls contractor can make their own check sheets with the following minimum requirements:

.1	Inputs:	- End to end checks (from field device to BAS readings) - Visual confirmation - Calibration as required
.2	Outputs:	- End to end checks (from BAS command to field device) - Visual confirmation - Calibration or adjustment as required.
.3	Volumes:	- Calibration data/factors set/coded into program.

22 Project Completion Requirements

.1 Turnover of equipment shall be fully operational and functional as a complete system.

.2 All DDC points (I/O's) to be commissioned and in the AUTO mode.

.3 All graphics should be commissioned and fully functional.

.4 Provide training as required.

Appendix-A Acronyms

.1 Mechanical Equipment

SF	Supply fan
RF	Return fan
EF	Exhaust fan
BLR	Boiler
HEX	Heat exchanger
HP	Heat pump
PMP	Pump
RAD	Radiation
RHC	Reheat coil
STM	Steam
CH	Chiller
VFD	Variable frequency drive

.2	Outputs:	Relays, transducers, valves,
	C	Control
	EN	Enable
	SPD	Speed
	OA_D	Outdoor air damper
	RA_D	Return air damper
	EA_D	Exhaust air damper
	RLF_D	Relief air damper
	HC_V	Heating coil valve
	HC_P	Heating coil pump
	CC_V	Cooling coil valve
	CC_P	Cooling coil pump
	HUM_V	Humidity valve
	ISO_D	Isolation damper
	ISO_V	Isolation valve
	OVRD	Override
	RESET	Reset
.3	Inputs:	Sensors, devices
	A	Amperage
	OA_T	Outdoor air temperature
	SA_T	Supply air temperature
	MA_T	Mixed air temperature
	PH_T	Pre-heat temperature
	RA_T	Return air temperature
	EA_T	Exhaust air temperature
	HC_T	Heating coil temperature
	HC_SUP_T	Heating coil supply temperature
	HC_RET_T	Heating coil return temperature
	CC_T	Cooling coil temperature
	CC_SUP_T	Cooling coil supply temperature
	CC_RET_T	Cooling coil return temperature
	SA_H	Supply air humidity
	RA_H	Return air humidity
	EA_H	Exhaust air humidity

HD_T	Hot deck temperature
CD_T	Cold deck temperature
RT_SENS	Room temperature
RT_TSTAT	Room thermostat temperature
DP	Differential pressure
VP	Velocity pressure
PRES	Static Pressure
VOL	Volume
FB	Feedback
ES	End switch
CO2	Carbon dioxide reading
FIL	Filter
OP	Open
CL	Close
HWS_T	Hot water supply temperature
HWR_T	Hot water return temperature
RAD_SUP_T	Radiation water supply temperature
RAD_RET_T	Radiation water return temperature
CHWS_T	Chilled water supply temperature
CHWR_T	Chilled water return temperature
CWS_T	Condenser water supply temperature
CWR_T	Condenser water return temperature
SUP_T	Supply water
RET_T	Return water

Appendix-B Check Sheets

Controller: ***CP-15000*** ***Inputs***

Date: ***Dec 1, 2021***

Input #	*Description*	*BAS Reading*	*Test Instrument*	*Visual Inspection*	*Calibrated or Adjusted*	*End to End Check*	*Remarks*
AI-1	SF Amps	15.5 A	15.0 A	---	---	✓	
AI-2	SAT	15.0°C	---	---	---	✓	
BI-2	OAD ENDSW	OPN	---	OPN	✓		

Controller: ***CP-15000*** ***Outputs***

Date: ***Dec 1, 2021***

Output#	*Description*	*BAS*	*Visual Inspection*	*Calibrated or Adjusted*	*End to End Check*	*Remarks*
BO-1	SF_C	ON/OFF	✓	---	✓	
BO-2	SF_ISO_DPR	OPN/CLO	✓	✓	✓	
AO-1	SF_CCV	0/50/100%	✓	---	✓	

Controller: ***CP-15000*** ***Volumes***

Date: ***Dec 1, 2021***

AV#	*Description*	*BAS*	*Test Instrument*	*Correction Factor*	*Entered into PGM*	*Remarks*
AV-10	VAV2_VOL	300 CFM	275 CFM	0.92	✓	