



.1 General

- .1 The control system shall be fully electric / electronic except for remaining existing pneumatic controls. Special applications may require pneumatic activation.
- .2 All controls work shall be done by one of the following Reliable Controls Corporation representatives:
 - .1 Foster Air Conditioning Ltd.
 - .2 Houle Electric Ltd.
 - .3 Kerr Controls Inc.
- .3 All products used shall be manufactured by Reliable Controls Corporation or where they do not manufacture required products the products used shall be as recommended by Reliable Controls Corporation for incorporation into their controls system.
- .4 All work shall be consistent with the latest University of Victoria standards for controls systems including all hardware, software and graphics. The specified controls contractors are expected to be fully conversant with those standards and shall allow for all measures required for the specified work to meet those standards
- .5 Provide modifications to the control system complete with all necessary components and connections to achieve the specified functions.
- .6 Include for any required expansion of the existing DDC system to accommodate the required additional control inputs and outputs. All new outputs shall each have an integral HOA toggle switch.
- .7 New controls panels shall be the MACH Series controllers designed and built by Reliable Computer Systems. New controllers shall have a minimum 10% spare points. Controllers must be capable of communicating with RCP protocol on both main and sub network as well as BACnet.
- .8 The control system and all controllers and hardware shall be BACnet Testing Laboratories (BTL) certified.
- .9 All control panels and components (except valves, dampers and sensors) shall be located in the mechanical rooms or in service rooms or spaces as acceptable to Facilities Management.
- .10 Program a trend log and, where appropriate, totalization for each point.
- .11 The Mechanical Consultant shall coordinate with the Electrical Consultant which systems shall be hard-wired under the electrical documents to shut down in the event of detection of a fire.

.2 Existing Controls

- .1 Most of the older buildings have pneumatic controls but almost all have a central DDC system that was retrofitted in the 1990's. When these buildings are renovated, replace the local pneumatic controls within the renovation area and provide all new controls within the renovation area with compatible electronic sensors, actuators and control valves controlled by the DDC system. Provide additional control panel capacity as required for the controls. Note the requirement for new controls outputs to have an HOA switch on each output. Modify the controls sequence to suit. Update the controls graphics to include all new and modified controls.
- .2 Remove all reasonably accessible redundant pneumatic tubing and all redundant pneumatic controls components and tightly cap all remaining pneumatic tubing ends.
- .3 Remove all reasonably accessible redundant controls conduit, wiring and equipment.



- .4 The long term objective is to eliminate the pneumatic controls except where required for special applications.

.3 Alarms

- .1 Software alarms shall be identified as regular or critical. Critical alarms shall be connected from the DDC system to the campus alarm system for monitoring and response by Campus Traffic and Security.

.4 Identification

- .1 Label and identify all panels and points with a numbering system consistent with UVic's DDC network numbering system.
- .2 Identify all controls with symbols relating directly to the control diagram. Use plasticized tags, engraved brass, aluminum, metalphoto or laminated plastic labels and secure them to, or adjacent to, the control devices with key chains.
- .3 Identify all junction box covers with control company label. Paint junction box covers to UVic standard colour.
- .4 Identify with colour bands, all conduits at all junction and pullboxes, at both sides of wall and floors and at not more than 7.5 m [25 ft] intervals along the length. Identification bands to be sprayed on and not less than 100 mm [4"] wide. Bands shall be colour to UVic standard.
- .5 Use colour coded conductors, white for neutral.
- .6 All manual switches, unless they come with standard nameplates, shall be labelled with engraved plastic laminate nameplates to clearly indicate the service. Wording on nameplates shall be subject to approval by Facility Management.
- .7 Identify all DDC panels and associated devices with symbols relating directly to the control diagram. Provide plastic labels for each input and output point with the following information:
 - .1 Point descriptor.
 - .2 Point type and channel number.
 - .3 Corresponding DDC panel number.
- .8 Mount an input/output layout sheet within each DDC panel. This sheet shall include the name of the points connected to each controller.

.2 Graphics and points acceptance procedures

- .1 A copy of each graphical screen page both new and modified existing shall be signed off and dated by the Controls Contractor and Facility Management's representative. Any changes shall be noted. This signed set shall be left on site as the "Record Drawings".
- .2 A summary print out of each group of point types for each panel shall be printed after commissioning and calibration. Each sheet shall be signed by the Controls Contractor's commissioning person, and Facility Management's representative.
- .3 If any changes are noted during spot checks they shall be manually written on the original print out with the date and signature of person noting changes.

.3 Testing and Commissioning

- .1 The Controls Contractor shall comprehensively commission and test all components and functions of the controls system and provide documentation to verify.
- .2 Consider whether the system warrants a comprehensive seven day test.



.4 Demonstration to Owner

- .1 The Controls Contractor shall demonstrate to Facility Management's designated personnel the adjustment, operation and maintenance, including pertinent safety requirements, of the controls equipment and system provided to the satisfaction of Facility Management's representative.

.5 Electrical Components, Wiring and Conduit

- .1 Carrier System:
 - .1 All wiring for 24 volts or less in mechanical service spaces, in stud walls or where exposed to view shall be run in EMT conduit except wiring to all operators and to all sensors subject to vibration shall be run in flexible metallic conduit for the final 900 mm [3 feet].
 - .2 Provide conduit for all wiring between the fire alarm panel and the DDC panels.
 - .3 All wiring for over 24 volts shall be run in EMT conduit.
 - .4 Provide steel fittings with nylon throats for all conduit connections.
- .2 Wire:
 - .1 Line voltage power or switched power wiring - #12 gauge copper wire minimum.
 - .2 Line voltage control wiring - #14 gauge copper wire, length not to exceed 50 meters; #12 gauge copper wire, lengths exceeding 50 meters.
 - .3 Low voltage - wire as directed by applicable electrical codes and requirements but minimum #20 gauge.
- .3 Cable: Data transmission cable shall be minimum Cat. 5e cable.

.6 Temperature Sensors

- .1 Room temperature sensors in staff areas (non-student, non-public areas) - two-wire type with up/down temperature adjust.
- .2 Room temperature sensors in student or public areas – no user interface input.

.7 Control Valves and actuators

- .1 Standard of acceptance: Belimo ball valve, B200 series with stainless steel ball and characterizing disc in the inlet of 2-way valves and in the control ports of 3-way valves.
- .2 Consider whether spring return or fail to last controlled position is desired for each valve.
- .3 Acceptable Products: Johnson Controls, Honeywell

.8 Control Dampers

- .1 Low leakage type with blade and frame seals.
- .2 Blades shall be horizontal in vertical mounted dampers.
- .3 Acceptable Products: Ruskin CD-36, TAMCO Series 1000 (T.A.Morrison), Johnson Controls, Honeywell.
- .4 Control valves on campus heating mains shall be selected to operate continuously at 121°C (250°F).

.9 Control Damper Actuators

- .1 Electric/Electronic Damper Actuators:
 - .1 Actuators shall be direct coupled.
 - .2 Spring return.
 - .3 Acceptable Products: Belimo.



.10 Standby Power

- .1 Consider whether the controls system should be on standby/emergency power, or UPS when central applications are controlled or the equipment being controlled is on emergency power. Consider the impact of power transfer to the control system and whether a UPS system is appropriate.

.11 Controls Points

- .1 Provide current sensors for all motor-driven equipment except small fan-coils, unit heaters, force flow heaters, washroom exhaust fans for individual washrooms, and other minor, non-critical equipment.
- .2 Monitor supply air temperature downstream of every VAV box with a heating coil.
- .3 Determine in advance with Facilities Management whether every office should have its own independent temperature control or if offices are to be grouped under a single temperature control.
- .4 Monitor the building incoming domestic water pressure before the premise backflow prevention and after the building prv.
- .5 Provide pressure differential monitoring across major air filter banks.
- .6 Provide differential pressure or current sensors across pumps.
- .7 Provide an independent output for each of the return air damper, the outdoor air damper and the relief damper on mixed air systems.
- .8 Monitor all equipment remote alarm contacts.
- .9 For variable frequency drives provide output to control ON/OFF and speed and monitor ON/OFF status, run speed, alarm contact
- .10 Provide ON/OFF control for all motor-driven equipment unless manually operated.
- .11 Provide control and operating schedule for DHW recirc pumps.
- .12 Provide hard wired low-temperature shutdown (freeze protection) for air handling systems and monitor its status.
- .13 Generally provide control of all mechanical equipment but not to override or replace integral equipment controls and safeties (e.g. boiler enable/disable but not burner ON/OFF).
- .14 Monitor the temperature of any electrically freeze-protected piping or equipment.
- .15 Monitor the status of regular/emergency/standby electrical power.
- .16 Monitor status of automated glycol make-up systems and glycol tank level alarm.
- .17 Monitor closed pipe systems pressure at or hydraulically near the expansion tank.
- .18 Monitor DHW temperature. Where DHW heating is by heating water, control the heating.
- .19 Monitor the pneumatic controls air pressure.
- .20 Monitor campus heating mains water temperature to and from the building heat exchanger and monitor the flow to it to provide energy monitoring and totalization. Consider use of manufactured energy monitoring equipment.
- .21 Provide a campus mains two-way control valve in the return from the building heat exchanger.
- .22 Provide a small control valve (c_v between 1.5 and 2.0) between the campus mains supply and return pipes (prevent thermal shock if main valve closes for extended period).



- .23 Provide temperature monitoring of the building heating mains and of each individually pumped heating circuit.
- .24 Provide alternating control of duty and standby equipment.
- .25 Monitor all mass and energy meters provided with contacts for remote monitoring.