SeaChange Modular Building Controls

Standard Controls Specification

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CONTROLS ELECTRIC/ ELECTRONIC

1.1. General

BMS shall comprise Control Modules, software, sensors and instrumentation necessary to meet the intent of this Specification.

The SeaChange Modular controls used shall be supplied by SC Controls Ltd (PO BOX 313, Wadhurst, East Sussex, TN5 6WH Tel 08707 606040, sales@sccontrols.co.uk) and comprise of Seachange range of modular building controls. The system shall be installed and commissioned by an accredited smartpartner.

1.2. Zone Controller

1.2.1. User Controls

A user control interface shall be provided so that users can achieve the primary user control requirements of:

- Setting Required Temperatures
- Setting time schedules
- Override time schedule

These user adjustments must be available through this interface without the requirement for any PC based GUI (Graphic User Interface) to be present on the site.

The user interface(s) shall be able to be located where appropriate in the building to facilitate their convenient use by the appropriate building occupants – normally in an office or at reception – and shall not be restricted to plant room use nor mounted within the control panel.

The user interface shall be wall mounted using a patress box or similar.

The user interface shall employ a two part construction so that network and any other wiring can be installed and terminated without the electronic interface being present. The electronic interface shall require a tool (screwdriver at a minimum) to remove it from its base.

The design of the user interface should be such so as to avoid being intrusive in the user occupied space and should not occupy a foot print of greater than 100 cm2 (10cm x 10 cm).

The user interface must be simple and straight forward for non-technical users. Function selection (temperature, time schedule adjustment, override) must be made using dedicated push buttons that are clearly labelled with their function. Dedicated physical push buttons or touch screen display or soft keys with their function shown on the adjacent display are all acceptable. Cursor controlled systems with navigation buttons or menu driven displays are not acceptable.

1.2.2. Master & Slave Zones

If there is more than one Zone controller, there can be two types of user interface:

- The slave interface shall allow the user to change the Required Temperature and override the time schedule.

- The master interface shall additionally allow the occupation time schedule to be interrogated and modified.

The slave user interface will provide user controls for its local zone.

The slave user interface shall have an LCD display which will normally indicate temperature in the zone and the status of the zone, occupied or non occupied, according to the time schedule and override status.

1.2.3. Override

The time schedule shall be capable of being overridden by a single button action at the slave user interface. This shall have the effect of taking the zone out of occupancy it if were previously within the occupied period until the next scheduled start time.

Outside of occupancy, the override function shall bring the zone into occupancy for a preset time period. This time period will normally be set to one hour but may be set to a different time period if required during commissioning.

1.2.4. Setting Required Temperature

The user shall be able to view and change the Required temperature for the zone from the slave user interface.

The Required Temperature shall be adjustable by the user in 0.5 deg C movements up to the maximum and minimum values which shall initially be 25°C to 15°C but may be altered during commissioning.

When the user adjusts the Required Temperature it shall not be possible to change the Required Temperature by more than 2 deg C at one time. Having made a 2 deg C adjustment a wait period of 2-5 minutes is required before any further adjustment can be made. This is to prevent users making too large a temperature adjustment inadvertently, which would prejudice energy efficiency.

At the beginning of each occupied period, the Required Temperature will reset to its default value and will loose any changes made in the previous period. The default Required Temperature will be 20°C for heating and 24°C for cooling. These parameters shall be adjustable during commissioning.

1.2.5. Time Schedule

In addition to the features of the slave zone user interface described above, the master zone user interface shall be able to interrogate and alter its occupation time schedule. This time schedule will apply to the local zone and to any associated slave time zones.

There shall be no restriction as to the number of master time zones or the number of slave zones that can be associated with each of them except for the restriction of the maximum number of zones overall on the system.

The setting of the time schedule shall be by dedicated push buttons as described above.

The user shall be able to set separate time schedules, for each day of the week with two occupation periods per day. There shall be a copy facility so that if consecutive days are to be set to the same time schedule they can be copied from one day to the other.

There shall be a capability to set Holidays. The time schedule of any occupancy during a holiday period shall be settable in the same manner as the standard 7 day week. The Holiday period shall be set in days and will commence the day after setting. The display on the user interface will indicate when the zone has been set into holiday mode.

It shall be possible to set special time schedules for today and tomorrow which apply only for those days and do not effect the standard 7 day settings.

1.3. Control Modules

The Control Modules shall be of the Distributed Application type, utilising the Echelon LonWorks communication Network, whereby the control application is resident, in a form that cannot be re-programmed or corrupted by the user (ROM,PROM or FLASH) in the control module. The Control Module Resident Application shall be configurable, either via the BMS Central Station or in the field via any LCD based Control Module or laptop computer.

Control Module Network shall be complete with network power supplies, a real time clock, memory, processors and all other items necessary for proper and correct interfacing and operation of the control functions described in this Specification.

All Control Modules shall have peer to peer communications and be able to directly address and communicate with any relevant control module on the control system. All Control Modules shall have a standalone capability such that a failure of the operator's station shall still permit the plant and controls associated with the Control Modules, to continue to operate normally with the Control Modules continuing to communicate with one another.

In the event of transmission failure in the controller communications network, the Control Modules shall continue to operate their own control strategies normally excepting, those which require global information. Either default values or the last sensed value (as appropriate) shall then be assumed for these global parameters.

Control Modules shall be able to provide the operator's station with status information concerning their internal operations. This information shall include, but not be limited to:

- Data transmission and verification.
- Input/output point status and or value (i.e. sensor fault, point forced, etc.).

All necessary interfacing equipment shall be provided so that the Control Modules are fully compatible with all items of plant and equipment.

The Control Modules shall be capable of controlling and/or monitoring the following types of point, as required by the specification.

- Digital Input.
- Analogue Input.
- Pulsed Inputs.
- Digital Output
- Analogue Output.

1.3.1. Digital input

Shall monitor the change of state of a volt free contact.

1.3.2. Pulsed input

Pulses (voltage free contact closures i.e. digital type input) originating typically from flow meters, electrical kWh or kVA meters, etc. and shall be accumulated into registers. A register shall be resettable to zero either by software or operator command. The input must be able to accept pulses up to a frequency of 10Hz with a minimum duration of 50ms.

1.3.3. Digital output

The output signal, a voltage free contact which shall make upon energisation of the output.

1.3.4. Analogue inputs

Analogue to digital conversion (ADC) with a minimum resolution of 1024 counts (10 Bit) over the input range of the sensor. The sensor range shall match the process control range. Any equipment necessary for the conversion of an input signal to the required input level shall be provided.

Each analogue input shall be calibrated (to compensate for non-linear characteristics of input devices, line resistance and similar items) to achieve an accuracy, of the displayed value on the operator's station, as detailed in this Specification for each sensing device. Calibration and scaling data shall be retained in the controller memory. Open or closed circuits on sensor inputs shall be recognised by the controller and may be annunciated as alarms on the user interface or system operator's station(s).

1.3.5. Analogue outputs

Digital to analogue conversion (DAC) shall be performed by the Control Modules with a minimum resolution of 256 counts (8 Bit) over the output range which shall also match the control range of the device and/or system being controlled. Any equipment necessary for the conversion of the output signal to the required process level (i.e. 0-I OV, 2-IOV, 0-2OmA, 4-2OmA etc.) shall be provided.

When not installed inside MCC's the Control Modules shall be enclosed in lightweight wall mounting cabinets. These cabinets shall be constructed to IP 51 Degree of Protection in accordance with DIN 40 050 and comply with the Specification for Type W panels (refer to Motor Control Centres Specification). The cabinets shall be provided with a key-lock, and all cabinet locks shall use the same key numbers.

The Control Modules shall be constructed so that the cabinets and internal terminal strips can be mounted, and electrical termination's made, with all electronics being added at a later date during the testing and commissioning phases.

1.4. Control Modules Displays

1.4.1. Output Display

The status of each output channel will be labelled and displayed on each control module so that maintenance and commissioning staff can clearly see the state of each output channel using an LED or similar.

1.4.2. Input Status

Where the failure of an input signal (e.g. temperature sensor fail) on the control module is detected then the module shall display this on its local status display. A flashing red LED or similar is acceptable.

1.4.3. Module Status

The control module shall have status indication to show that it is on, and that is in a 'healthy' state. If the module is on but an internal failure is detected – program or memory corruption or the like – the module should display this on its status display – and if possible depending on the nature of the failure to shut down its outputs.

1.4.4. Control Error Indication

To aid commissioning and fault diagnosis, each control module shall have a simple control error indication that shows whether the control loop is within a small band of setpoint and if not, whether it is above or below setpoint. A tri-colour LED which shows green when at setpoint, red when below setpoint and yellow when above setpoint would be acceptable.

1.4.5. Manual Override

Each control module shall be fitted with a manual override capability so that the module's outputs can be forced during commissioning and maintenance.

The module shall provide an indication when it is in manual override.

Any PC based GUI connected to the system shall be able to display and set or reset the manual override status of any control module. Hard manual override switches which cannot be remotely set and reset are not acceptable. It is considered sufficient that the manual override can force the outputs to run the plant in full heating or full cooling mode. It is not necessary to be able to modulate the output levels in manual override provided that any software set maximum or minimum limits on temperatures, output levels etc still apply and that all software and hardware based safety interlocks are still active.

1.5. Commissioning

The installation shall be thoroughly tested by the BMS/Controls Trade Contractor to ensure every point and item of plant is being, controlled and/or monitored correctly.

1.6. BMS Control Module Functions/Standard Programs

1.6.1. Power Failure Restoration Or Normal Mode Following A Fire Condition

Unless otherwise detailed in the System Narratives full recovery from either of these conditions shall be fully automatic. All plant shall be sequentially started on a site wide basis, with time delays between the starting. of each item of plant over 5kW.

1.6.2. Manual Start/Stop

Manual start/stop shall be provided for each system and individual item of plant e... pump, fan, etc. When the manual command can be overridden by other signals e.g. fire, frost, etc. the system or item of plant selected for manual start/stop control shall be manually controlled without 'forcing' the output point(s) directly.

1.6.3. Fixed Time Program

The time program shall enable and disable the item(s) of plant specified at specific times for each day of the week. It shall be possible to specify 2 time periods per day.

1.6.4. Optimum Start/Stop

Optimum start and stop programs shall be provided for energy conservation where specified and shall calculate the optimal start and stop times for the HVAC plant, based on occupancy time, measured internal space and outside conditions. The programs shall be suitable for both heating and cooling operation as specified and shall be self-adaptive, i.e. they shall make corrections to the optimization characteristics in accordance with the accuracy of their predictions. The program shall take account of the day of the week, occupancy patterns and holidays.

Unless otherwise detailed in the narratives any optimum start 'boost' condition shall be terminated by either occupancy time being reached or by occupancy temperature being achieved whichever occurs first.

The program shall incorporate facilities for maintaining the internal space temperature of the building or system above a predetermined minimum level, outside occupancy hours.

1.6.5. Rotational Point

This program shall initiate the altering of the control point designation (such as duty/standby and lead/lag) under the following circumstances:

- First on First off
- Least run plant

1.6.6. Demand Based Control

The various zones of the building shall run when determined by the related time schedule and temperature control. The zones and zone plant such as fan coils, chilled ceiling controls, shall transmit appropriate heating and cooling demand to the main plant so that the main plant only runs when there is demand for its service from the zones connected to it. This is to avoid the main heating and cooling plant circulating hot or cold water round the building when there is no requirement and so wasting energy.

1.6.7. Frost Protection Mode

The Boiler Controller shall include a multi-stage frost protection strategy. When the ambient air drops below the frost protection level – preset to 5°C adjustable parameter – then the circulating pumps on the boiler should be activated.

A Frost protection mode signal shall be sent to all other plant controls and relevant plant shall open their valves on all batteries that require frost protection to approx. 50% open. All relevant circulating pumps will run. The Boiler Controller will monitor water temperature and will fire the boilers only if the water temperature falls below the Frost Protection level. The Boilers will continue to fire until the return temperature exceeds its minimum value.

1.6.8. Setpoint behaviour

The users are able to adjust the local setpoint temperature within predetermined limits set at the commissioning time of the system. It will be possible to set up the zone controller to revert its setpoint at midnight to a preset value to ensure that each day the space setpoint starts from the same value.

1.7. Documentation

The documentation of the BMS for the project forms a major part of the contract and consequently only the most professionally prepared and presented documentation will be accepted.

Documentation shall be in accordance with the Preliminaries and the requirements detailed in this section.

Documentation shall consist of two volumes of which 3 copies of each shall be submitted. The two volumes are:

- BMS Project Documentation
- BMS Operator's Manual

Each volume may be submitted in more than one file if its large size will limit its ease of use.

1.7.1. BMS Project Documentation

The BMS project documentation volume will be job specific and therefore is the most important volume of documentation. The following details the sections which must be included in this part of the documentation.

1.7.1.1. Index

1.7.1.2. Schematic Diagrams –

This includes schematic diagrams of the BMS network complete with system numbering and controller locations. It provides a quick understanding- of the network architecture.

1.7.1.3. System Description

- Functional Description - This section describes in detail, the program and hard-wired control sequences associated with the systems. It shall reflect any changes made during the Contract. It shall be written in an easy to understand format
- List of product codes

1.7.1.4. Data Sheets - A data sheet for each item of equipment in the BMS shall be supplied, including all field devices.

1.7.1.5. Interconnect Diagram showing the demands on the system, e.g. Heating demands

1.7.1.6. Print out of Parameter list (InSite report) Configuration parameters for all controllers showing default and project specific settings.

1.7.1.7. Electrical Drawings

1.8. Environment

All equipment detailed in this Specification or other equipment associated with the BMS shall be capable of operation in the following conditions without detriment to the equipment:-

- 0 - 45°C
- 5 - 95% RH (non-condensing).

1.9. Modems/Autodiallers

The system shall be able to support Auto-Dialler Modems (HAYES compatible) either for a fixed or wireless (mobile)line, so that a remote access can be established to the site For maintenance.

1.10. Transient/Spike Protection

All microprocessor based Control Modules and other electronic equipment such as unitary Control Modules, personal computers and peripheral equipment and communications equipment, must be capable of withstanding transient disturbances from the input power supply.

The equipment in the control system shall comply with the latest relevant regulations for CE approval, pertaining to electromagnetic susceptibility and compatibility, and will have suitable protection from electrical noise as generated in Building Services Applications.

1.11. Electromagnetic Compatibility

All components of and the complete Building Management System shall comply with the requirements of BS EN 50 081-1 Generic Emission Standard and BS EN 50 082-1 & 2 Generic Immunity Standard.

In order to avoid corruption of the BMS equipment operation by electrical interference, all wiring shall be installed to minimize coupling of electromagnetic and electrostatic interference on low voltage signals and data wiring.

The preferred method of achieving this shall be by ensuring a physical separation of greater than 50mm between the power supply cables and the signal and data cables. Where mixed wiring is unavoidable braided screen mains cable, dressed close to metalwork, is preferred, but the Tenderer shall clearly specify the methods by which he intends to eliminate any such interference with his signal and data transmission.

The BMS shall be protected from interference by the operation of hand held radio transmitters, radio pagers, mobile phones, etc., within 1 metre of the equipment.