## Part 1 General

### 1.1 RELATED SECTIONS

.1 Section 25 05 01 - EMCS: General Requirements.

.2 Section 25 05 02 - EMCS: Shop Drawings, Product Data and Review Process.

.3 Section 25 30 02 - EMCS: Field Control Devices.

.4 Section 25 90 01 - EMCS: Site Requirements Applications and Systems Sequences of Operation.

### 1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 C22.2 No.205-M1983 (R2004), Signal Equipment.

.2 Institute of Electrical and Electronics Engineers (IEEE).

.1 IEEE C37.90.1-02, Surge Withstand Capabilities (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus.

.3 Public Works and Government Services Canada (PWGSC)/Real Property Branch/Architectural and Engineering Services.

.1 MD13800-September 2000, Energy Management and Control Systems (EMCS) Design Manual. English: fttp://fttp.pwgsc.gc.ca/rps/docentre/mechanical/me214-e.pdf; ftp://ftp.tech-env.com/pub/EMCS/MD17020EN.pdf

### 1.3 DEFINITIONS

.1 Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.

### 1.4 SYSTEM DESCRIPTION

.1 General: Network of controllers comprising of SDC('s) to be provided as indicated in System Architecture Diagram to support building systems and associated sequence(s) of operations as detailed in these specifications.

.1 Provide sufficient controllers to meet intents and requirements of this section.

.2 Controller quantity, and point contents to be approved by Departmental Representative at time of preliminary design review.

.3 Performance and quality standards of new building controllers must match or exceed current building EMCS controller standards.

.4 New building controllers to be compliant with existing EMCS architecture.

.2 Controllers: stand-alone intelligent Control Units.

.1 Incorporate programmable microprocessor, non-volatile program memory, RAM, power supplies, as required to perform specified functions.

.2 Incorporate communication interface ports for communication to LANs to exchange information with other Controllers.

.3 Capable of interfacing with operator interface device.

.4 Execute its logic and control using primary inputs and outputs connected directly to its onboard input/output field terminations or slave devices, and without need to interact with other controller. Secondary input used for reset such as outdoor air temperature may be located in other Controller(s).

## 1.5 DESIGN REQUIREMENTS

.1 To include:

.1 Scanning of AI and DI connected inputs for detection of change of value and processing detection of alarm conditions.

.2 Perform On-Off digital control of connected points, including resulting required states generated through programmable logic output.

.3 Perform Analog control using programmable logic, (including PID) with adjustable dead bands and deviation alarms.

.4 Control of systems as described in sequence of operations.

.5 Execution of optimization routines as listed in this section.

.2 Failure of a Stand-alone Digital Controller (SDC) shall not affect the EMCS overall operation and shall only affect the data and functions associated with the system in question.

.3 Allow for a total space capacity of at least 20% of each point type distributed. Furthermore, allow for a minimum of 20% spare memory capacity in each SDC for future modifications to the EMCS.

.4 Field Termination and Interface Devices:

.1 To: CSA C22.2 No.205.

.2 Electronically interface sensors and control devices to processor unit.

.3 Include, but not be limited to, following:

.1 Programmed firmware or logic circuits to meet functional and technical requirements.

.2 Power supplies for operation of logics devices and associated field equipment.

.3 Lockable wall cabinet.

.4 Required communications equipment and wiring (if remote units).

.5 Leave controlled system in "fail-safe" mode in event of loss of communication with, or failure of, processor unit.

.6 Input Output interface to accept as minimum AI, AO, DI, DO functions as specified.

.7 Wiring terminations: use conveniently located screw type or spade lug terminals.

.4 AI interface equipment to:

.1 Convert analog signals to digital format with 10 bit analog-to-digital resolution.

.2 Provide for following input signal types and ranges:

.1 4 - 20 mA;

.2 0 - 10 V DC;

.3 100/1000 ohm RTD input;

.3 Meet IEEE C37.90.1 surge withstand capability.

.4 Have common mode signal rejection greater than 60 dB to 60 Hz.

.5 Where required, dropping resistors to be certified precision devices which complement accuracy of sensor and transmitter range specified.

.5 AO interface equipment:

.1 Convert digital data from controller processor to acceptable analog output signals using 8 bit digital-to-analog resolution.

.2 Provide for following output signal types and ranges:

.1 4 - 20 mA.

.2 0 - 10 V DC.

.3 Meet IEEE C37.90.1 surge withstand capability.

.6 DI interface equipment:

.1 Able to reliably detect contact change of sensed field contact and transmit condition to controller.

.2 Meet IEEE C37.90.1 surge withstand capability.

.3 Accept pulsed inputs up to 2 kHz.

.7 DO interface equipment:

.1 Respond to controller processor output, switch respective outputs. Each DO hardware to be capable of switching up to 0.5 amps at 24 V AC.

.2 Switch up to 5 amps at 220 V AC using optional interface relay.

.5 Controllers and associated hardware and software: operate in conditions of 0 degrees C to 44 degrees C and 20 % to 90 % non-condensing RH.

.6 Controllers (SDC): mount in wall mounted cabinet with hinged, keyed-alike locked door.

.1 Provide for conduit entrance from top, bottom or sides of panel.

.7 Cabinets to provide protection from water dripping from above, while allowing sufficient airflow to prevent internal overheating.

.8 Provide surge and low voltage protection for interconnecting wiring connections.

**1.6 SUBMITTALS**

.1 Make submittals in accordance with Section 01 00 10 – General Instructions and Section 25 05 02 - EMCS: Submittals and Review Process.

.1 Submit product data sheets for each product item proposed for this project.

**1.7 MAINTENANCE PROCEDURES**

.1 Provide manufacturers recommended maintenance procedures.

**Part 2 Products**

**2.1 STAND-ALONE DIGITAL CONTROLLER (SDC)**

.1 General:

.1 Primary function is to provide control functions and supervision of typical HVAC systems, hydronic systems and electrical systems.

.2 Installed in proximity of associated electro-mechanical system.

.3 Points integral to one Building System to be resident on only one controller. Refer to points schedule.

.4 Fully programmable, microprocessor based, stand-alone controller for multi task operation and real-time digital control.

.5 Sufficient memory to ensure system's operation and store database including:

.1 Automation regulation processes.

.2 Energy Management applications.

.3 Points history.

.6 All set points, proportional bands, regulation algorithms and system's programmable parameters are memory-resident in the controller to avoid module re-programming after a power failure.

.2 Description:

.1 The Stand-alone Digital Controller (SDC) provides regulation control in stand-alone mode or in network with other SDCs.

.2 Controller includes a power supply, a main module, plug-in electronic circuits for main module, a terminal strip for inputs/outputs connections. Inputs and outputs interface specification as described in this section. Provide for each controller, a connection point for a laptop computer.

.3 Include a communication interface in accordance with the Section 25 10 01-EMCS: Local Area Network (LAN).

.3 Expansion Modules:

.1 Expansion modules can be used to increase the input/output capacity of a controller. Modules can be connected through an expansion bus. To maintain a high degree of performance, the addition of inputs/outputs through expansion modules shall be limited to 75% of the capacity indicated in the manufacturer's technical sheets.

.4 Include uninterruptible clock accurate to plus or minus 5 secs/month, capable of deriving year/month/day/hour/minute/second, with rechargeable batteries for minimum 72 hour operation in event of power failure.

.5 Minimum addressable memory to support at least performance and technical specifications to include but not limited to:

.1 Non-volatile EEPROM to contain operating system, executive, application, sub-routine, other configurations definition software. Tape media not acceptable.

.2 Battery backed (72 hour minimum capacity) RAM (to reduce the need to reload operating data in event of power failure) to contain CDLs, operating data or software that is required to be modifiable from operational standpoint such as schedules, set points, alarm limits, PID constants and CDL and hence modifiable on-line through a remote operator's interface. RAM to be downline loadable from an OWS.

.6 Supports the connection of an operator's terminal for local command entry, instantaneous and historical data display, programs, additions and modifications.

.7 Provides real-time exchange of data with other controllers on the network architecture to achieve stand-alone control of complex electro-mechanical systems.

.8 Provide a rechargeable battery back-up for the SDC power supply to maintain controller's operation in event of power failure. Battery to have a 10 minute minimum capacity.

.9 For SDC I/O capacity, refer to points list.

**2.2 SOFTWARE**

.1 General.

.1 Include as minimum: operating system executive, communications, application programs, operator interface, and systems sequence of operation - CDL's.

.2 Include "firmware" or instructions which are programmed into ROM, EPROM, EEPROM or other non-volatile memory.

.3 Include initial programming of Controllers, for entire system.

.2 Program and data storage.

.1 Store executive programs and site configuration data in ROM, EEPROM or other non-volatile memory.

.2 Maintain CDL and operating data including setpoints, operating constants, alarm limits in battery-backed RAM or EEPROM for display and modification by operator.

.3 Programming languages.

.1 Program Control Description Logic software (CDL) using English like or graphical, high level, general control language.

.2 Structure software in modular fashion to permit simple restructuring of program modules if future software additions or modifications are required. GO TO constructs not allowed unless approved by Departmental Representative.

.4 Pseudo or calculated points.

.1 Software to provide access to value or status in controller or other networked controller in order to define and calculate pseudo point. When current pseudo point value is derived, normal alarm checks must be performed or value used to totalize.

.2 Inputs and outputs for process: include data from controllers to permit development of network-wide control strategies. Processes also to permit operator to use results of one process as input to number of other processes (e.g. cascading).

.5 Control Description Logic (CDL):

.1 Capable of generating on-line project-specific CDLs which are software based, programmed into RAM or EEPROM and backed up to OWS. Owner must have access to these algorithms for modification or to be able to create new ones and to integrate these into CDLs on BC(s) from OWS.

.2 Write CDL in high level language that allows algorithms and interlocking programs to be written simply and clearly. Use parameters entered into system (e.g. setpoints) to determine operation of algorithm. Operator to be able to alter operating parameters on-line from OWS and BC(s) to tune control loops.

.3 Perform changes to CDL on-line.

.4 Control logic to have access to values or status of points available to controller including global or common values, allowing cascading or inter-locking control.

.5 Power Fail Restart: upon detection of power failure system to verify availability of Emergency Power as determined by emergency power transfer switches and analyze controlled equipment to determine its appropriate status under Emergency power conditions and start or stop equipment as defined by I/O Summary. Upon resumption of normal power as determined by emergency power transfer switches, SDC to analyze status of controlled equipment, compare with normal occupancy scheduling, turn equipment on or off as necessary to resume normal operation.

.6 Event and Alarm management: use management by exception concept for Alarm Reporting. This is system wide requirement. This approach will insure that only principal alarms are reported to OWS. Events which occur as direct result of primary event to be suppressed by system and only events which fail to occur to be reported. Such event sequence to be identified in I/O Summary and sequence of operation. Examples of above are, operational temperature alarms limits which are exceeded when main air handler is stopped, or General Fire condition shuts air handlers down, only Fire alarm status shall be reported. Exception is, when air handler which is supposed to stop or start fails to do so under event condition.

.7 Function/Event Totalization: features to provide predefined reports which show daily, weekly, and monthly accumulating totals and which include high rate (time stamped) and low rate (time stamped) and accumulation to date for month.

.1 SDCs to accumulate and store automatically run-time for binary input and output points.

.2 SDC to automatically count events (number of times pump is cycled off and on) daily, weekly or monthly basis.

.3 Totalization routine to have sampling resolution of 1 min or less for analog inputs.

.4 Totalization to provide calculations and storage of accumulations up to 99,999.9 units (eg. kWH, litres, tonnes, etc.).

.5 Store event totalization records with minimum of 9,999,999 events before reset.

.6 User to be able to define warning limit and generate user-specified messages when limit reached.

**2.3 LEVELS OF ADDRESS**

.1 Upon operator's request, EMCS to present status of any single 'point', 'system' or point group, entire 'area', or entire network on printer or OWS as selected by operator.

.1 Display analog values digitally to 1 place of decimals with negative sign as required.

.2 Update displayed analog values and status when new values received.

.3 Flag points in alarm by blinking, reverse video, different colour, bracketed or other means to differentiate from points not in alarm.

.4 Updates to be change-of-value (COV) -driven or if polled not exceeding 2 second intervals.

**2.4 POINT NAME SUPPORT**

.1 Controllers (SDC) to support PWGSC point naming convention as defined in Section 25 05 01 - EMCS: General Requirements.

**Part 3 Execution**

**3.1 LOCATION**

.1 Location of Controllers to be approved by Departmental Representative.

**3.2 INSTALLATION**

.1 Install Controllers in secure locking enclosures as indicated or as directed by Departmental Representative.

.2 Provide emergency power from local 120 V branch circuit panel for equipment.

.3 Install tamper locks on breakers of circuit breaker panel.

.4 Use uninterruptible Power Supply (UPS) and emergency power when equipment must operate in emergency and co-ordinating mode.

**END OF SECTION**