

PART 1 GENERAL

1.1 SUMMARY

- .1 This specification shall define the electrical and mechanical components that make-up the PLC HVAC controls and interface to the NEWPCC DCS system.

1.2 RELATED SECTIONS

- .1 Section 26 33 53 - Static Uninterruptible Power Supply
- .2 Section 27 10 05 - Structured Cabling for Communications Systems
- .3 The City of Winnipeg Standard Construction Specifications Section CW1110 - General Instructions.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.14, Industrial Control Equipment.
 - .2 CSA C22.2 No.158, Terminal Blocks.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with The City of Winnipeg Construction Specifications Section CW1110 - General Instructions.
- .2 Include:
 - .1 Outline sketch showing ratings, dimensions and weights
 - .2 User manual that shall include installation drawings and instructions, a functional description of the equipment with block diagrams, safety precautions, illustrations, step-by-step operating procedures and general maintenance guidelines.
 - .3 Control loop diagrams to City of Winnipeg standards in Autocad format.

1.5 WARRANTY

- .1 The panel manufacturer shall warrant the PLC against defects in materials and workmanship for two (2) years.

1.6 QUALITY ASSURANCE

- .1 All PLC panel equipment and components shall bear a CSA approval.

1.7 CLOSEOUT SUBMITTALS

- .1 Provide data for incorporation into operation and maintenance manual specified in Section 21 05 01 - Common Work Results for Mechanical.
- .2 Operation and Maintenance Manual to include:
 - .1 Technical data:
 - .1 Approved shop drawings;
 - .2 Characteristic curves for automatic circuit breakers and protective devices;
 - .3 Project data;
 - .4 Technical description of components;
 - .5 Parts lists with names and addresses of suppliers.

1.8 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials.

- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

PART 2 Products

2.1 FABRICATION

- .1 All materials and components making up the PLC panel shall be new, of current manufacture and shall not have been in prior service except during factory testing.
- .2 Wiring
 - .1 Wiring practices, materials and coding shall be in accordance with the requirements of the Canadian Electrical Code.
 - .2 All wiring shall be copper.
 - .1 All discrete control circuits shall have a minimum #14 wire gauge.
 - .2 All analog control circuits shall have a minimum #18 wire gauge.
 - .3 All PLC I/O terminals shall be wired out to terminals including spare channels.
 - .4 Internal panel wiring shall be Type TEW Conductor as follows:
 - .1 Cable: to CAN/CSA-C22.2 No.127
 - .2 Conductors: 18 AWG, unless noted otherwise, for PLC/DCS cabinet internal wiring.
 - .3 Insulation: thermoplastic compound, 600V.
 - .4 Suitable for installation in temperatures down to -40 °C and a conductor operating temperature of 105 °C.
- .3 The PLC panel enclosure shall be:
 - .1 NEMA 12 rating if located in a climate controlled electrical or mechanical room.
- .4 Installed I/O shall include a minimum of 20% spare for each I/O type.
- .5 PLC panel shall include the following components:
 - .1 Enclosure light c/w a door activated switch.
 - .2 Convenience receptacle fed from UPS power c/w label indicating "FOR LAPTOP USE ONLY".
 - .3 Fold out shelf suitable for supporting a laptop computer.
 - .4 Drawings holding pouch suitable for 11x17 drawings.
- .6 PLC panel shall have a selector switch from which one of two power sources may be selected to feed the panel.
- .7 All electronic components such as PLC, 24Vdc power supplies, Ethernet switches shall be powered from a clean 120 Vac power source. The only exception to this is the second 24Vdc power supply does not require to be fed from the UPS so that if it is offline for service 24Vdc power is still supplied within the panel.
- .8 In general wire-ways within the PLC panel shall be organized so that they contain only field wiring or panel wiring. In this manner generally field wiring will alternate from the left side of terminals in one row to the right side of the terminals in the adjoining row.
- .9 DIN rails shall be rotated 30 degrees to present the field wiring side of the terminals for easier installation.

2.2 PLC COMPONENTS

- .1 Design shall be based on Schneider Electric's Modicon M340 series PLC platform.
- .2 Telefast wiring modules provided for discrete modules to provide individual channel isolation at desired voltages.

- .3 Processor shall be capable of communications via the Modbus\TCP protocol over an Ethernet network.
- .4 In order to keep a standard set of parts within the City's installations the following I/O modules are approved. Other I/O module part numbers may be considered for approval.
 - .1 Discrete Inputs - BMX DDI 3202K c/w Telemecanique telefast block ABE-7P16F310 with the following relays for channel isolation:
 - .1 ABS-7EC3B2 for 24Vdc circuits.
 - .2 ABS-7EA3F5 for 120Vac circuits.
 - .2 Discrete Outputs - BMX DDO 3202K c/w Telemecanique telefast block ABE-7P16T330 with ABR-7S33 relays.
 - .3 Analog Inputs - BMX AMI 0810
 - .4 Analog Outputs - BMX AMO 0410

2.3 HMI COMPONENTS

- .1 The HMI touch screen panel shall support the following features:
 - .1 10.4" touchscreen that supports SVGA resolutions (800 x 600 pixels).
 - .2 Communications: Modbus\TCP protocol.
 - .3 Operating temperature range: 0 °C to 50 °C
 - .4 Enclosure: IP65, NEMA 4X
- .2 Acceptable Product: Schneider Electric XBTGT5430 or approved equal in accordance with B6.

2.4 ETHERNET SWITCH

- .1 Ethernet switch shall be a managed with the following features:
 - .1 Support Modbus\TCP Industrial Ethernet protocol
 - .2 Support Turbo Ring, Turbo Chain, and RSTP/STP (IEEE 802.1w/D) for network redundancy.
 - .3 Contain a minimum of four (4) 10/100/1000BaseT(X) ports plus five (5) combo 10/100/1000BaseSFP slot Gigabit ports.
 - .4 Contain 2 relay outputs alarm contacts rated 1 A at 24 Vdc.
 - .5 Switch shall be DIN-Rail mountable.
 - .6 Switch shall be designed for industrial networks usage.
 - .7 Approved Product: Moxa EDS-G509 Series switch or approved equal in accordance with B6.

2.5 24 VDC POWER SUPPLY

- .1 Input voltage: 120 Vac at 60 Hz.
- .2 Output voltage: 24 Vdc
- .3 PLC panel contains two 24 Vdc power supplies connected together with diodes for a redundant 24 Vdc power supply.
- .4 Capacity: 100 W minimum, sized to panel load plus 50% spare capacity for each 24 Vdc power supply.
- .5 Output Characteristics:
 - .1 Voltage adjustment range: ±10 %
 - .2 Ripple: 2 % (peak-peak) maximum
 - .3 Temperature influence: 0.05 % / °C maximum with rated load and output voltage at an ambient temperature between 0 °C to 50 °C
- .6 Overload protection: 105 % minimum of rated load current, with automatic reset.
- .7 Ambient temperature operating range: 100 % load output, 0 °C to 50 °C.
- .8 Ambient humidity operating range: 25 % to 85 % minimum
- .9 Dielectric strength: 3000 Vac for 1 minute between all inputs and outputs.
- .10 Undervoltage detection indicator.
- .11 General alarm contact (Form C) rated 1 A at 24 Vdc.

2.6 UNINTERRUPTIBLE POWER SUPPLY (UPS)

- .1 UPS shall be as per Section 26 33 53 - Static Uninterruptible Power Supply.

2.7 TERMINAL BLOCKS

- .1 Terminal blocks shall comply with CSA C22.2 No. 158 - Terminal Blocks.
- .2 Control voltage and discrete I/O, feed through type
 - .1 CSA rated 600 V, 36 A
 - .2 Conductor sizes: #26 through #10 AWG
 - .3 TS 35 DIN Rail mounting
 - .4 Moulding material: Thermoplastic
 - .5 Acceptable Product: Weidmuller SAK 4 or approved equal in accordance with B6.
- .3 Control voltage and discrete I/O, 2-Tier feed through type
 - .1 CSA rated 300 V, 10 A
 - .2 Conductor sizes: #26 through #12 AWG
 - .3 TS 35 DIN Rail mounting
 - .4 Moulding material: Thermoplastic
 - .5 Acceptable Product: Weidmuller WDK 2.5 or approved equal in accordance with B6.
- .4 Terminal, disconnect, fused
 - .1 CSA rated 300 V, 10 A
 - .2 Conductor sizes: #26 through #12 AWG
 - .3 TS 35 DIN Rail mounting
 - .4 5 x 20 mm fuse holder type, level type, hinged
 - .5 Disconnect to include blown fuse indicator.
 - .6 Moulding material: Thermoplastic
 - .7 Acceptable Product: Weidmuller ASK 1EN or approved equal in accordance with B6.
- .5 Terminal 2-tier, disconnect, fused and feed through type
 - .1 CSA rated 300 V, 10 A
 - .2 Conductor sizes: #22 through #12 AWG
 - .3 TS 35 DIN Rail mounting
 - .4 5 x 20 mm fuse holder type, level type, hinged
 - .5 Disconnect to include blown fuse indicator.
 - .6 Moulding material: Thermoplastic
 - .7 Acceptable Product: Weidmuller KDKS1 LD EN or approved equal in accordance with B6.
- .6 Terminal disconnect
 - .1 CSA rated 300 V, 10 A
 - .2 Conductor sizes: #26 through #12 AWG
 - .3 TS 35 DIN Rail mounting
 - .4 Test points
 - .5 Moulding material: Thermoplastic
 - .6 Product: Weidmuller WTR 2.5 STB or approved equal in accordance with B6.
- .7 Circuit breakers on terminal strips
 - .1 Use for power distribution as shown
 - .2 CSA approved, 250 Vac, 65 Vdc
 - .3 Thermal magnetic type
 - .4 Insulation resistance: 100 M Ω at 500 Vdc
 - .5 Current ratings: As indicated on drawings or as required
 - .6 TS 35 DIN Rail mounting
 - .7 Product: Weidmuller Series 4201 circuit breakers or approved equal in accordance with B6.
- .8 Control fuses
 - .1 Where fast acting is specified
 - .1 Current rating as shown

- .2 Product: BUSS GMA or approved equal in accordance with B6.
- .2 Where time delay is specified
 - .1 Current rating as shown
 - .2 Product: BUSS GMD or approved equal in accordance with B6.
- .9 General
 - .1 Use partitions between voltages classes as required. Partition to conform with terminal type.
 - .2 Use end plates to complete strip assembly
 - .3 Apply end anchors to strip
 - .4 Use manufacturers markings tags to identify terminals
 - .5 Where more than one terminal strip is identified in a panel or enclosure, apply label carrier
 - .1 Acceptable Product: Weidmuller SCH T5S or approved equal in accordance with B6.

2.8 PUSHBUTTONS

- .1 Heavy industrial, operator recessed, flush, extended, mushroom type, as indicated. Colour as shown, with 1-NO and 1-NC EEMAC AC600 contacts, labels as indicated. Stop pushbuttons coloured red.
- .2 30.5 mm NEMA type 4
- .3 Acceptable Product: Allen Bradley 800T, Square D 9001 Series or approved equal in accordance with B6.

2.9 SELECTOR SWITCHES

- .1 Maintained, spring return, 2, 3 position as indicated, labelled as indicated, heavy industrial oil tight, standard operators, contact arrangement as indicated, EEMAC AC 600 contacts.
- .2 30.5 mm NEMA type 4
- .3 Acceptable Product: Allen Bradley 800T, Square D 9001 Series or approved equal in accordance with B6.

2.10 INDICATING LIGHTS

- .1 Heavy duty oil tight, full voltage, LED type, lens colour as indicated, supply voltage 120 Vac or 24 Vdc as required, labels as indicated.

2.11 PLC AND HMI PROGRAMMING

- .1 Provide all PLC programming services to program, test and commission the PLC panels to provide functionality as per the control narratives.
- .2 Provide all programming required to facilitate data transfers between the PLC's and Bailey DCS.
- .3 Provide all HMI programming for the PLC HMI's. Allow for review and approval of all HMI screens by the City staff.

2.12 PROGRAMMING SOFTWARE

- .1 None required.

2.13 FIELD CONTROL DEVICES

- .1 General
 - .1 Control devices of each category to be of same type and manufacturer.

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- .2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, shockproof, vibration proof and heat resistant assembly.
 - .3 Operating conditions: 0 - 32 °C with 10 - 90 % RH (non condensing) unless otherwise specified.
 - .4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.
 - .5 Transmitters and sensors to be unaffected by external transmitters including walkie talkies.
 - .6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.
 - .7 Outdoor installations: use weatherproof construction in NEMA 4X enclosures.
 - .8 Range: including temperature, humidity, pressure, as indicated in Control Narratives.
 - .9 All devices shall be CSA certified.
- .2 Temperature Sensors
 - .1 General: to be resistance type to following requirements:
 - .2 RTD's: 100 or 1000 ohm at 0 °C (plus or minus 0.2 ohms) platinum element with strain minimizing construction, 3 integral anchored leadwires. Coefficient of resistivity: 0.00385 ohms/ohm °C.
 - .3 Sensing element: hermetically sealed.
 - .4 Stem and tip construction: type 304 stainless steel.
 - .5 Time constant response: less than 3 seconds to temperature change of 10 °C.
 - .6 Room temperature sensors to be wall mounting, in slotted type covers having brushed stainless steel finish, with guard.
 - .7 Separate mounting base for ease of installation.
 - .8 Stability 0.02 °C drift per year.
 - .3 Temperature Transmitters
 - .1 Requirements:
 - .2 Input circuit: to accept 3 lead, 100 or 1000 ohm at 0 °C, platinum resistance detector type sensors.
 - .3 Power supply: 24 V DC into load of 575 ohms. Power supply effect less than 0.01 °C per volt change.
 - .4 Output signal: 4 - 20 mA into 500 ohm maximum load.
 - .5 Input and output short circuit and open circuit protection.
 - .6 Output variation: less than 0.2 % of full scale for supply voltage variation of plus or minus 10 %.

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- .7 Combined non linearity, repeatability, hysteresis effects: not to exceed plus or minus 0.5 % of full scale output.
 - .8 Maximum current to 100 or 1000 ohm RTD sensor: not to exceed 25 mA.
 - .9 Integral zero and span adjustments.
 - .10 Temperature effects: not to exceed plus or minus 1.0 % of full scale / 50 °C.
 - .11 Long term output drift: not to exceed 0.25 % of full scale / 6 months.
 - .4 Temperature Switches:
 - .1 Requirements:
 - .2 Operate automatically and reset automatically
 - .3 Adjustable setpoint, 0 to 50 °C, with a differential.
 - .4 Accuracy: plus or minus 1 °C.
 - .5 Snap action rating: 24V DC as required. Switch to be DPST for hardwire.
 - .6 Type as follows:
 - .7 Room: for wall mounting on standard electrical box with protective guard as indicated.
 - .5 Temperature Control Valves: 3-way mixing, globe style, brass body, stainless steel stem and brass plug, NPT threaded connections, class 150, size based on maximum pressure drop of 21 kPa, electric actuator, 24Vac, spring fail safe position.
 - .1 Acceptable Product: Honeywell or approved equal in accordance with B6.
 - .6 Damper Actuators: direct coupled, 2-position, self-centered shaft adaptor, fully open and minimum position limit switches, spring return direction filed selectable, torque ratings 125% of breaking torque (minimum, 24V).
 - .1 Acceptable Product: Honeywell or approved equal in accordance with B6.
 - .7 CURRENT SENSING RELAYS
 - .1 Requirements:
 - .2 Suitable to detect belt loss or motor failure.
 - .3 Trip point adjustment, output status LED.
 - .4 Split core for easy mounting.
 - .5 Induced sensor power.
 - .6 Relay contacts: capable of handling 0.5 amps at 120 Vac / 24 Vdc. Output to be NO solid state.
 - .7 Suitable for single or 3 phase monitoring. For 3 Phase applications: provide for discrimination between phases.
 - .8 Adjustable latch level.
 - .8 WIRING
 - .1 In accordance with Section 27 10 05 Structured Cabling for Communication Systems.

- .2 For wiring under 70 volts use FT6 rated wiring where wiring is not run in conduit. Other cases use FT4 wiring.
- .3 Wiring must be continuous without joints.
- .4 Sizes:
 - .1 Field wiring to digital device: #14 AWG minimum.
- .5 Analog input and output: shielded #18 AWG minimum stranded twisted pair.

2.14 SPARE PARTS

- .1 Provide the following spare parts to be turned over to the city
 - .1 One spare I/O module for each I/O module type used.
 - .2 One spare PLC processor
 - .3 One spare power supply
 - .4 One spare telefast block for each type used.
 - .5 Twelve spare relays for each type used within telefast blocks.

PART 3 EXECUTION

3.1 ASSEMBLY

- .1 PLC panel shall be shop assembled by a CSA approved panel shop.
- .2 Test each I/O point up to the point of field termination to ensure all wiring within PLC panel is correct before shipping panels to site.
- .3 Provide panel shop drawings

3.2 INSTALLATION

- .1 Install PLC panels as indicated on drawings.
- .2 Wire and connect instrumentation loops as per loop drawings.
- .3 Provide DVD's with final as-built programming of all PLC's and HMI.
- .4 Install a CAT5e Ethernet cable installed from PLC panel back to the City's DCS controls cabinet in order to provide Modbus\TCP Communications link.
 - .1 CAT5e cable shall be provided as per Section 27 10 05 - Structured Cabling for Communications Systems.
- .5 Turn over all field mounted devices to respective trades for mounting.

3.3 DEMONSTRATION

- .1 Demonstrate complete functioning system to Contract Administrator under all operating scenarios.
- .2 Simulate alarms and warnings to demonstrate functionality of all status points, alarms and warnings.
- .3 Provide both a full summer and winter season control system start-up commissioning services through the warranty period.

END OF SECTION