City of Winnipeg
Olive Wastewater Pumping Station
2015 Upgrades
Bid Opportunity 824-2015

Section 40 90 01
AUTOMATION – FIELD PUSHBUTTONS,
SWITCHES AND INDICATORS
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Part 1   General

1.1   REFERENCES

.1   NEMA 250-2003, Enclosures for Electrical Equipment (1000 Volts Maximum).

.2   Canadian Standards Association (CSA International).

.1   CSA-C22.1-2009, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

1.2   SUBMITTALS

.1   Submit product data in accordance with Section 01 33 00 – Submittal Procedures.

Part 2   Products

2.1   GENERAL

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

.2   External trim materials to be corrosion resistant.

.3   Operating conditions: -40 – 55 degrees C with 5 - 95% RH (non-condensing) unless otherwise specified.

2.2   PUSHBUTTONS – PUSH-PULL/TWIST TO RELEASE

.1   Supply and install enclosed two-position maintained emergency stop operator stations for pumps P-L01, P-L02, and P-L03.

.2   Requirements:

.1   Ingress Protection: NEMA 4X
.2   Contact Life: 1,000,000 cycles
.3   Mechanical Life: 250,000 cycles
.4   Contact Rating: 10 A
.5   Contact Configuration: As shown on the drawings
.6   Illumination: Not required unless otherwise indicated.
.7   Acceptable for hazardous Class I, Zone 2 location.

.3   Acceptable Products:

.1   Allen-Bradley 800H series
.2   Schneider Electric Harmony 9001 K Series
.3   Or approved equal in accordance with B7.

Part 3   **Execution**

3.1   **INSTALLATION**

.1   Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.

.2   Readily accessible to allow for unhindered operation and servicing.

.3   Wall installation:

.1   Located as shown on the drawings.
.2   Securely mounted.

3.2   **IDENTIFICATION**

.1   Identify field devices with lamacoids. Install in a conspicuous location.

END OF SECTION

Part 1 **General**

1.1 **SUMMARY**

    .1 Section Includes:

        .1 Process instrumentation.

1.2 **REFERENCES**

        .1 NEMA 250-2003, Enclosures for Electrical Equipment (1000 Volts Maximum).

    .2 Canadian Standards Association (CSA International).

        .1 CSA-C22.1-2015, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

1.3 **SUBMITTALS**

    .1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 01 33 00 – Submittal Procedures.

    .2 Manufacturer's Instructions:

        .1 Include manufacturer's installation instructions for specified equipment and devices in O&M Manuals.

Part 2 **Products**

2.1 **GENERAL**

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

    .2 External trim materials to be corrosion resistant.

    .3 Operating conditions: 0 - 35°C with 5 - 95% RH (non-condensing) unless otherwise specified.

    .4 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

2.2 **FLOAT SWITCHES, LSH-481 / LSH-L500 / LSHH-L500 / LSH-L523**

    .1 Requirements:

        .1 Suspended mechanical float switch
        .2 Fluid: Wastewater
        .3 Temperature Range: 0 to 50°C
        .4 Output: Form C dry contact
        .5 Protection: IP68
        .6 Approvals: CSA

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.2 Acceptable products:

    .1 Flygt ENM-10 or approved equal in accordance with B7.

2.3 ELECTROMAGNETIC FLOWMETERS

.1 Service:

    .1 Fluid: Raw sewage (wastewater)

    .2 Fluid Temperature: -10°C to 50°C

    .3 Ambient Temperature: 0° to 40°C

    .4 Pressure: 0 to 100 kPa

.2 Accuracy:

    .1 ±0.4% ±1 mm/sec

.3 Sensor Requirements:

    .1 Internal diameter: 203 mm (8")

    .2 Flange material: Carbon Steel

    .3 Flange type: Class 150

    .4 Electrodes: Hastelloy C

    .5 Grounding: Grounding Rings (to be included)

    .6 Area Classification: Unclassified

    .7 Enclosure Rating: NEMA 4X

    .8 Approvals: CSA of equivalent

    .9 All flow tubes shall be hydrostatically tested to 1.5 times their rated pressure.

    .10 Provide epoxy paint coating for the entire flow sensor.

.4 Transmitter Requirements:

    .1 Mounting: Wall (remote from flow sensor)

    .2 Conduit/cable Entry: 12mm (1/2") NPT

    .3 Display Language: English

    .4 Local Display: LCD

    .5 Local Control: Keypad

    .6 SENSORPROM Memory Unit to be included.

    .7 Programming and configuration:

        .1 Fully configurable via transmitter keypad

        .2 Configurable via HART field communicator on 4-20mA output loop (HART field communicator not included)

    .8 Units of Operation:

        .1 Flow rate: l/s

        .2 Flow totalizer: m^3

    .9 Power Supply: 120 Vac

    .10 Output:

        .1 4-20 mA with HART for flow rate

.2   Pulse output for flow totalization

    .11   Enclosure Rating: NEMA 4X

.5   Cable (between flow sensor and transmitter)

    .1   Installation: Conduit

    .2   Purpose: Signal and coil drive

    .3   Length: 30 meters (per flowmeter)

    .4   Gauge: As per manufacturer's recommendations.

.6   Acceptable products:

    .1   Siemens SITRANS F M MAG 3100 P series flow sensor,

    .2   Siemens SITRANS F M MAG 5000 series transmitter,

    .3   Siemens Remote Wall Mount Kit FDK:085U1053,

    .4   Siemens Cable Kit,

    .5   This product was standardized by the City via RFP 449-2014. No alternates or substitutes will be accepted.

.7   Purchase or Quotation:

    .1   All requests for purchase or quotation shall reference RFP 449-2014 to receive standardized pricing that the City has negotiated with the Vendor.

    .2   Contact: Trans-West Company Inc., 126 Bannister Road, Winnipeg, MB

2.4   LEVEL TRANSMITTER, LIT-L500-B

.1   Application: Differential pressure cell for measurement of wet well level via hydrostatic head pressure measurement.

.2   Service:

    .1   Fluid: Wastewater

    .2   Fluid Temperature: -10°C to 50°C

    .3   Sensing range: 0 - 240 inches water (inH_2O)

.3   Sensor/Transmitter:

    .1   Enclosure Material: Die-cast aluminum

    .2   Seal Diaphragm: Stainless Steel,

    .3   Measuring cell filling: Silicone oil,

    .4   Ingress Protection: IP66,

    .5   Power Supply: 10.5 – 45 Vdc (loop powered),

    .6   Output Signal: 2 wire, 4-20 mA with HART,

    .7   Electrical Connection: Screwed gland ½-14 NPT, screw terminals,

    .8   Accuracy: $\leq 0.065\%$

    .9   Display: Included

    .10   Explosion protection: None

.4   Manifold: Block and bleed

    .5   Acceptable Products:

          .1   Siemens SITRANS P DS III,

          .2   This product was standardized by the City via RFP 449-2014. No alternates or substitutes will be accepted.

    .6   Purchase or Quotation:

          .1   All requests for purchase or quotation shall reference RFP 449-2014 to receive standardized pricing that the City has negotiated with the Vendor.

          .2   Contact: Trans-West Company Inc., 126 Bannister Road, Winnipeg, MB.

2.5   **HVAC DUCT TEMPERATURE SENSOR, TE-L600**

    .1   Sensor: 1097 ohms @ 25°C.

    .2   Insertion: 150 mm duct mount with wiring box.

    .3   Operating Range: -40°C to 121°C

    .4   Acceptable Products:

          .1   Honeywell C7031B2005/U

          .2   Or approved equal in accordance with B7.

2.6   **DIFFERENTIAL PRESSURE SWITCH, PDSH-L610**

    .1   Requirements:

.1	Type:	Electro-mechanical
.2	Dry Contact:	SPDT, rated for at least 0.2 Amps at 24VDC
.3	Operating Temperature:	0°C to 35°C
.4	Set Point:	125 Pa (0.5 "w.c), Field adjustable
.5	Pressure Range:	As Required
.6	Enclosure Rating:	NEMA 4 or NEMA 4X
.7	Approvals:	CSA or equivalent
.8	Mounting:	Surface, Duct or Wall

    .2   Acceptable Products:

          .1   United Electric 100 Series

          .2   Or approved equal in accordance with B7.

Part 3   **Execution**

3.1   **INSTALLATION**

    .1   Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

    .2   Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.

.3   Install in a manner to allow easy removal of the transducer and cable assembly for maintenance purposes.

.4   Support field-mounted panels, transmitters and sensors on pipe stands or channel brackets.

.5   Electrical:

.1   Complete installation in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2   Install communication wiring in conduit or utilizing ACIC cabling if shown on the drawings.

.1   Provide complete conduit /cable system to link instrumentation and the control panel(s).

.2   Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems.

.3   Maximum conduit fill not to exceed 40%.

.4   Design drawings do not show conduit layout.

3.2   INSPECTION AND INSTRUCTION

.1   Provide for a factory-trained representative who shall give instructions regarding the installation of the equipment.

.2   The factory-trained representative shall visit the site as required to ensure that the installation work is being performed in a proper and workmanlike manner. Allow for a minimum of one (1) full working day.

.3   The factory-trained representative shall be present to supervise the commissioning, initial operation, and functional testing of the equipment.

3.3   IDENTIFICATION

.1   Identify field devices with lamacoids. Install in a conspicuous location.

3.4   TESTING AND COMMISSIONING

.1   Calibrate and test field devices for accuracy and performance in accordance with Section 40 80 11 - Automation Commissioning.

END OF SECTION

Part 1   **General**

1.1   **SUMMARY**

    .1   Section Includes:

          .1   Process Control Devices including damper actuators.

1.2   **REFERENCES**

    .1   Association (NEMA).

          .1   NEMA 250-2003, Enclosures for Electrical Equipment (1000 Volts Maximum).

    .2   Canadian Standards Association (CSA International).

          .1   CSA-C22.1-2009, Canadian Electrical Code, Part 1, Safety Standard for
                Electrical Installations.

1.3   **SUBMITTALS**

    .1   Submit shop drawings and manufacturer's installation instructions in accordance with
          Section 01 33 00 – Submittal Procedures.

    .2   Manufacturer's Instructions:

          .1   Include manufacturer's installation instructions for specified equipment and
                devices in O&M Manuals.

Part 2   **Products**

2.1   **GENERAL**

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

    .2   External trim materials to be corrosion resistant. Internal parts to be assembled in
          watertight assembly.

    .3   Operating conditions: 0 – 32 degrees C with 5 - 95% RH (non-condensing) unless
          otherwise specified.

    .4   Terminations: use standard conduit box with slot screwdriver compression connector
          block unless otherwise specified.

    .5   Account for hysteresis, relaxation time, maximum and minimum limits in applications of
          sensors and controls.

2.2   **TEMPERATURE CONTROLLER TC-L600**

    .1   General: digital, stand alone, programmable controller

    .2   Power supply: 24 VAC.

.3 Sensor Inputs:

.1 Two (2) 1097 Ohms PTC at 25°C.

.2 Sensed temperature range: -51°C to 132°C.

.4 Relay Outputs: two(2) SPDT, runtime displayed on relays, configurable minimum off time.

.5 Time Clock Scheduler: 2 events per day, selectable for setback, disable, or ignore to control all outputs.

.6 Mounting: Wall

.7 Enclosure: NEMA 4X

.8 Temperature sensor: C7031B2005/U.

.9 Acceptable materials: Honeywell T775U2006 or approved equal in accordance with B7.

2.3   ELECTRONIC MODULATING DAMPER ACTUATORS

.1 Requirements:

.1 Direct mount proportional type.

.2 Spring return type for "fail-safe" in Normally Open or Normally Closed position as indicated.

.3 Torque:
.1 Outdoor Air Damper Actuator: 2 Nm (18 lb-in) minimum.
.2 Mixed/Exhaust Air Damper Actuator: 5 Nm (45 lb-in) minimum.

.4 Damper actuator to drive damper from full open to full closed in less than 150 seconds.

.5 Spring return to drive damper from full open to full closed in less than 25 seconds at normal room temperature.

.6 Angle of Rotation: 90° minimum, adjustable with mechanical stops.

.7 Direction of Rotation: Configurable via switch mounted on the actuator.

.8 Shaft Diameter: 8.0mm to 16.0mm (3/8" to 5/8").

.9 Electrical Connection: 0.9 meter (3 ft), 18 AWG, plenum rated cable.

.10 Overload protection: Required.

.11 Auxiliary Switches: Not required.

.12 Position Feedback: Required, 0-10V output.

.13 Operating range: 0-10 or 2-10 VDC.

.14 Operating Temperature: -30 °C to 50 °C.

.15 Housing: NEMA 2 or IP54 or better.

.16 CSA listing or equivalent.

.17 Acceptable Products:

.1 Outdoor Air Damper Actuator: Belimo TFB24-SR or approved equal in accordance with B7.

.2   Mixed/Exhaust Air Damper Actuator: Belimo AFB24-SR or approved equal in accordance with B7.

2.4   **UNIT HEATER UH-L64 CONTROLLER**

.1   Wall mounted thermostat provided by unit heater manufacturer.

Part 3   **Execution**

3.1   **INSTALLATION**

.1   Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

.2   Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.

.3   Support field-mounted panels, transmitters and sensors on pipe stands or channel brackets.

.4   Electrical:

      .1   Complete installation in accordance with Section 26 05 01 - Common Work Results - Electrical.

      .2   Install wiring in conduit or utilizing ACIC cabling.

           .1   Provide complete conduit /cable system to link control devices with the controlling equipment.

           .2   Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems.

           .3   Maximum conduit fill not to exceed 40%.

           .4   Design drawings do not show conduit layout.

.5   Terminate devices with leads in junction boxes with terminals.

      .1   Wire nuts are not permitted.

      .2   Protect leads in flexible conduit.

3.2   **IDENTIFICATION**

.1   Identify devices with lamacoids. Mount in a conspicuous location.

3.3   **TESTING AND COMMISSIONING**

.1   Calibrate and test control devices for accuracy and performance in accordance with Section 40 80 11 – Automation Commissioning.

3.4   **UNIT HEATER UH-L64 CONTROL**

.1   Temperature controlled by wall mounted thermostat provided by unit heater manufacturer. Mount thermostat in the location shown on the drawings.

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3.5   ELECTRIC DUCT HEATER HCE-L63 CONTROL

.1   Modulating 0-10Vdc signal from Temperature Controller TC-L600.

3.6   TEMPERATURE CONTROLLER TC-L600

.1   Automatic control of electric duct heater with two discharge air setpoints based on occupied/unoccupied status.

.2   Automatic control of outdoor air, mixed air, and exhaust air dampers based on occupied/unoccupied status.

   .1   Occupied

      .1   Digital Input 1: activated from dry contact (by Div. 26) based on room light switch position (ON).
      .2   Setpoint (discharge air temperature): 23°C (adj.).
      .3   MOD 1: 10 V (dampers FV-L600-1, FV-L600-3 fully open, damper FV-L600-2 fully closed).
      .4   MOD 2: modulating 0 – 10 V for heater HCE-L63 control.

   .2   Unoccupied

      .1   Digital Input 1: de-activated from dry contact (by Div. 26) based on room light switch position (OFF).
      .2   Setpoint (discharge air temperature): 5°C (adj.).
      .3   MOD 1: 2 V (dampers FV-L600-1, FV-L600-3 open 5%, damper FV-L600-2 open 95%).
      .4   MOD 2: modulating 0 – 10 V for heater HCE-L63 control.

3.7   MANUFACTURER'S INSTRUCTIONS

.1   Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International).

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

.2 International Electrotechnical Commission (IEC)

.1 IEC 61131, Programmable Controllers

1.2 DEFINITIONS

.1 PLC Programmable Logic Controller

.2 RTU Remote Terminal Unit

1.3 PLC SYSTEM DESCRIPTION

.1 For the purpose of this specification, the terms RTU and PLC will be deemed to be synonymous.

.2 The PLC consists of a controller and an I/O expansion module, mounted in control panel CP-L81.

.3 The City utilizes a remote SCADA system that interfaces with the pumping station control system PLC via cellular and PSTN (telephone) links using the DNP3 protocol.

.4 The Contractor's responsibility on the SCADA system is limited to:

.1 Provision of an interface in the PLC for the SCADA system.

1.4 SYSTEM ARCHITECTURE

.1 Single PLC

.1 Local I/O expansion module.
.2 No remote I/O.
.3 Connected to the following:
.1 MDM01 – Cellular modem (supplied by the City).
.2 MDM02 – PSTN (telephone) modem.

1.5 SOFTWARE OWNERSHIP

.1 The City will fully own all PLC programming logic supplied, and may utilize the software provided for any purpose including:

.1 Modification and revision.
.2 Use at other City facilities.

.2 The City may turn the software over to a 3rd party, for use at any City owned facility.

.3   Provide source code for all custom software and function blocks, or any other software logic utilized in the application.

      .1   Source code for base function blocks provided by the PLC manufacturer are not required.

1.6   DESIGN REQUIREMENTS

.1   Design and implement a complete operating PLC system.

.2   The design is to be based upon the supplied Functional Requirements Specification.

      .1   Utilize a tag naming convention that extends, and does not conflict with the tag scheme utilized in the Functional Requirements Specification.

.3   The PLC is utilized to control wastewater pumping for a municipal application. The consequences of system failure could be significant, and thus a high level of care, attention to detail, and testing is expected.

.4   The PLC software design is to be supervised and approved (sealed) by a Professional Engineer licensed to practice in Manitoba.

.5   Do not assume that the Contractor's internal standards or standard programming methodology will be acceptable for this project. No additional payment will be made for assumptions made regarding standard methods utilized by the Contractor.

.6   The Contract Administrator will review the overall design. Make changes as requested by the Contract Administrator.

1.7   SUBMITTALS

.1   All submittals to be in accordance with Section 01 33 00 – Submittal Procedures.

.2   Stage 1:

      .1   Submit product datasheets

.3   Stage 2:

      .1   Submit a PLC design criteria prior to initiating programming which includes:
            .1   The general PLC program structure.
            .2   The programming languages (ie. ladder, function block) to be utilized
            .3   A sample section of code.
            .4   SCADA interface map.
            .5   Variable naming methodology.

.4   Stage 3:

      .1   Submit a 25% complete submittal, including:
            .1   Software logic printout.
      .2   The primary purpose of this submittal is to ensure that the methodology being utilized is as per requirements prior to the bulk portion of the work being

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completed. At this point, copies of code for similar pieces of equipment should not be completed.

    .5   Stage 4:

        .1   Submit a 99% complete submittal a minimum of 20 Working days prior to the FAT, including:
            .1   Complete software logic printout.
            .2   SCADA interface map.

1.8 O&M MANUALS

    .1   Include the following in the O&M Manuals:

        .1   Product datasheets.

        .2   Hardware and software user manuals.

        .3   Letter stating that the PLC application has been reviewed and approved. The letter is to be signed and sealed by a Professional Engineer licensed to practice in Manitoba.

        .4   SCADA interface map.

        .5   PLC database listing and logic printout.

        .6   CD sleeve with CD containing PLC application program.

Part 2 Products

2.1 PROGRAMMABLE LOGIC CONTROLLER

    .1   Suitable product will be a PLC system produced by a major, international industrial automation vendor.

    .2   Modularity

        .1   The construction of the PLC is to be an integrated processor, power supply, and I/O unit, utilizing additional separated I/O expansion modules that are located adjacent to the main unit on DIN rail.

    .3   Self-Tests, Diagnostics and Failure Modes

        .1   Integrity of controller hardware and software to be constantly monitored by an intrinsic series of continuously running self-tests and diagnostics.
        .2   Immediately report abnormal results as system alarms.
        .3   Have predictable failure mode upon an error. At a minimum, faults are to generate a system alarm.
        .4   Equipment may have the ability to diagnose degradations to performance that may not yet adversely affect operator functions or be a permanent failure. When such conditions are automatically noted, the system is to journal the event in the Historian and have the capability to report such information selectively, as either a system alarm or a message on the programming workstation.

.4   Processors:

.1   Qty 1, 32-bit ARM7-TDMI microcontroller, 32 MHz clock.

.2   Qty 2, Microcontroller co-processors, 20 MHz clock.

.5   Memory:

.1   Flash ROM: 16 MB

.2   CMOS RAM: 4 MB

.3   EEPROM: 4 kB

.6   Integrated Ethernet Port:

.1   Quantity: 1

.2   Speed: 10/100 Mbps

.3   Connection: RJ45 connector

.4   Supported protocols:

      .1   Modbus/TCP

      .2   Modbus RTU in UDP

      .3   Modbus ASCII in UDP

      .4   DNP in TCP

      .5   DNP in UDP

      .6   FTP

.7   Serial Ports:

.1   Type:

      .1   Qty 1, RS-485, Half duplex.

      .2   Qty 1, RS-232 or RS-485 (jumper configurable), Full or Half duplex

      .3   Qty 1, RS-232, Full or Half duplex.

.2   Baud Rates: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 11500

.3   Parity: None, Even, or Odd

.4   Word Length: 7 or 8 bits

.5   Stop Bits: 1 Bit

.6   Supported protocols:

      .1   TeleBUS (compatible with Modbus RTU and Modbus ASCII),

      .2   DF1,

      .3   DNP.

.8   USB Ports:

.1   Qty 1, USB Peripheral

      .1   Connector: Type B connector

      .2   Standard: USB 1.1

      .3   Speed: 12 Mbps (full speed).

.2   Qty 1, USB Host

      .1   Connector: Type A

      .2   Standard: USB 1.1, USB 2.0

    .3 Speed: 12 Mbps (full speed), and 1.5 Mbps (low speed)

    .4 Rating: 5V, 100 mA.

.9 Visual Indicators:

    .1 Power Mode LED,

    .2 Run LED,

    .3 Status LED,

    .4 Forced I/O LED,

    .5 Digital Inputs/Outputs: LED

    .6 Network communication activity

.10 Power Supply:

    .1 Redundancy: Not required.

    .2 Requirements:

      .1 Supply Voltage: 10 to 30V

      .2 Supply Protecting: Integral fuse or breaker.

      .3 Output Voltage: As required.

      .4 Output Current: As required.

      .5 Integrated protection against overloads, short circuits, and overvoltages.

.11 On-board Inputs and Outputs:

    .1 Discrete Inputs (DI):

      .1 Channels: 32

      .2 Voltage: 12/24 Vdc.

      .3 Current sinking.

      .4 Meet IEEE C37.90.1 surge withstand capability.

      .5 Indicating LEDs: Channel status (on/off) for each channel.

    .2 Discrete Outputs (DO):

      .1 Channels: 16

      .2 Type: Form A SPST Relay (dry contact)

      .3 Max switching voltage: 240 Vac

      .4 Isolation:

        .1 Isolated in groups of 4

        .2 Logic to contact: 1500 Vac (1 min.)

        .3 Chassis to contact: 1500 Vac (1 min.)

        .4 Output group to output group: 1500 Vac (1 min.)

      .5 Contact rating:

        .1 3 A, 30 Vdc or 250 Vac (Resistive),

        .2 1000Vac between open contacts,

        .3 12 A maximum per common.

      .6 Max switching load:

        .1 5 A, 30 Vdc (150 W Resistive)

        .2 5 A, 250 Vac (1250 VA Resistive)

          .7   Service Life:

                .1 2×10^7 mechanical

                .2 1×10^5 at 5 A, 30 Vdc or 250 Vac

          .8   Indicating LEDs: Channel status (on/off) for each channel.

      .3   Universal Discrete Inputs/Outputs (DIO):

          .1   Voltage: 24 Vdc

          .2   Inputs: Current sourcing.

          .3   Outputs: Current sourcing.

          .4   Channels: 8

          .5   Indicating LEDs: Channel status (on/off) for each channel.

      .4   Analog Inputs (AI)

          .1   Channels: 14 external + 2 internal

          .2   Type: Single ended

          .3   4-20mA inputs and one 0-32.768V input for battery voltage monitoring.

          .4   Input impedance:

                .1   20 kΩ for 0-10V inputs,

                .2   60 kΩ for 0-32.768V inputs,

                .3   250 Ω for 0-20mA inputs,

          .5   Resolution:

                .1   15 bits over the 0-10V measurement range

                .2   14 bits over the 0-5V measurement and 0-20mA measurement range.

          .6   Accuracy:

                .1   +/- 0.1% at 25 °C.

                .2   +/- 0.2% over temperature range.

          .7   Response time: 100ms typical for 10% to 90% signal change.

      .5   Analog Outputs (AO)

          .1   Channels: 4

          .2   Type: Single ended, 0-20mA

          .3   Maximum load resistance:

                 .1   925 Ω with 24Vdc input voltage

                .2   375 Ω with 12Vdc input voltage

                .3   250 Ω with input voltage at power supply turnoff

          .4   Resolution: 12 bits

          .5   Accuracy:

                .1   +/- 0.15% at 25 °C.

                .2   +/- 0.25% over temperature range.

          .6   Response time: 0.5ms to 2ms for 10% to 90% signal change.

   .12   Expansion I/O Modules:

      .1   Discrete Input Module, 24VDC:

          .1   Channels: 16

.2   Voltage: 24 Vdc.

.3   Current sinking.

.4   Power Requirements: 5V (supplied from controller via ribbon cable)

.5   Indicating LEDs: Channel status (on/off) for each channel.

.6   Mounting: 35mm DIN rail

.13   Required Accessories:

    .1   Include all accessories including cables, terminators, backplanes, memory, batteries, and other components required to make the system operable.

.14   Acceptable Products:

    .1   Schneider Electric SCADAPack 357E (part no. TBUP-EA55-AB20),

    .2   Schneider Electric 5404-24.

    .3   No alternates or substitutes will be accepted.

2.2   PLC PROGRAMMING SOFTWARE

.1   Supply PLC programming software enabling the City to develop, debug, and monitor application programs.

.2   Requirements:

    .1   Operate on Microsoft Windows XP®.

    .2   Menu driven.

    .3   Integrated help functions to assist the user.

    .4   Programming software to be fully compliant with the IEC 61131-3 control languages and include:

        .1   Ladder Logic (LD)

        .2   Function Block Diagram (FBD)

        .3   Sequential Function Chart (SFC)

        .4   Structured Text (ST)

        .5   Instruction List (IL)

    .5   System diagnostics/fault status.

    .6   Program documentation/cross-reference printout.

    .7   Hardware Configuration.

    .8   On-line data changes.

    .9   Input/output forcing.

    .10   Support both on-line and off-line programming.

.3   Program Instruction Set

    .1   Minimum requirements:

        .1   Math Instructions: add, subtract, multiply, divide, square root; ladder logic programming to provide integer and floating point math.

        .2   Comparison Elements: Less Than, Greater Than, Equal to, Less than or Equal to, Greater than or Equal to, Not Equal, Relational Contacts.

.3   Timer and Counter Elements: Counterup, Countdown, Time up, Time down (with accumulator, preset and time-base sub-elements); time base from .01 sec to hours) counter scale factors from X1 to X1000.

.4   Relay Contact Elements: N.O., N.C., Transition on, Transition off, (positive/negative).

.5   Relay Coil Elements: Standard, Latch, Unlatch.

.6   Control Algorithms: PID

.4   PLC Simulator

.1   Provide software to simulate a PLC on a PC.

.5   Licence:

.1   Requirements

.1   Type: Hardware license via USB security key.

.2   I/O variable quantity: Unlimited

.3   User quantity: One (1)

.4   Fully capable of programming all features for PLC supplied.

.5   Licence does not expire.

.6   Acceptable Products:

.1   Schneider Electric Workbench for IEC61131-3.

.2   No alternates or substitutes will be accepted.

2.3   USB MEMORY STICK

.1   Provide a minimum 2GB USB memory stick as part of the Commissioning process, with the following:

.1   Latest application program, with documentation.

.2   PLC hardware user manuals

.3   PLC software user manuals.

.4   HMI hardware user manuals.

.5   HMI software user manuals.

.2   Locate the memory stick in a pocket in the control panel.

2.4   SPARE PARTS

.1   Supply the following spare parts:

.1   One controller (part no. TBUP357-EA55-AB20)

.2   One 24VDC, 16 channel, discrete input module (part no. 5404-24)

.2   Complete set of spare parts to be supplied prior to commissioning.

Part 3   Execution

3.1   HARDWARE INSTALLATION

.1   Install the PLC in Control Panel CP-L81 as per manufacturer instructions and recommendations.

.2   Update the processor and all updatable modules with the latest firmware.

3.2   PLC PROGRAMMING SERVICES

.1   General Requirements:

.1   Program in a manner to make the program easy to follow and maintain.

.2   Insert comments into the program to clarify all items not readily apparent.

.3   Utilize commonly accepted good programming practices.

.4   Utilize function blocks to encapsulate common systems and sections of code.

.5   All field inputs to be checked against range limits. If a field input is outside of its range limits or the data cannot be otherwise propagated because of an equipment fault, the data is to be declared "bad" within the Control System.

.6   All tagnames are to be named and identified using positive logic. Where required, provide comments to clarify the states.

.7   Program PID Control loops to provide bumpless transfer when switching between automatic and manual control modes.

.8   Configure alarms generated in the PLC into two types:

.1   Automatic reset alarms clear upon the alarm condition being removed. Provide logic as required to ensure that fast cycling of the alarm does not occur.

.2   Manual reset alarms require reset from the HMI. Utilize manual reset alarms where the initiating condition would be removed by the action resulting from the alarm. Ensure that manual reset alarms are configured such a a reset signal from the HMI will not clear the alarm, unless the initiating condition is cleared.

.9   For any piece of equipment that has control from the PLC, provide a Manual and Auto control mode selector buttons on the equipment faceplate, and allow for manual control of the equipment from the HMI. Provision of a hardwired local, hand, or manual control mode in the field does not eliminate this requirement.

.2   Provide all required PLC programming as per the Functional Requirements Specification.

3.3   PLC COMMISSIONING SERVICES

.1   Provide all required PLC commissioning services as per Section 40 80 11.

.2   Upon completion of commissioning, load latest software onto USB stick and spare SCADAPack controller. Test spare prior to turning over to City.

END OF SECTION

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CONTROL PANELS
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Part 1 General

1.1   GENERAL REQUIREMENTS

.1   All Control Panels shall be built by a CSA/cUL-approved manufacturer and shall bear the CSA/cUL seal with the manufacturer's file number.

.2   All Control Panels shall be factory assembled and pre-wired. The Control Panel wiring shall be verified at the manufacturer's factory and completely tested before being shipped to the site.

.3   Supply, install, wire and test all components inside the Control Panels according to the specifications herein and the drawings.

1.2   SUBMITTALS

.1   Prior to construction:

.1   Submit product datasheets, and wait for approval, prior to construction of the Control Panels.

.2   Submit stamped red-line mark-ups of the proposed modifications to the control panels. If significant modifications are proposed/required, AutoCAD drawings will be supplied to the Contractor for revision.

.2   Prior to shipment:

.1   Submit electronic pictures of enclosure exterior and interior, including door interior.

.1   Pictures to be of sufficient resolution to read component labels.

.2   As-built drawings:

.1   Submit as-built drawings. Minor changes may be made via red-line mark-ups.

.2   Draft significant changes on AutoCAD drawings.

.3   Do not ship control panel until approval from Contract Administrator is received.

1.3   INSPECTION

.1   A factory inspection of the control panels will be performed at the discretion of the Contract Administrator based upon the pre-shipment submittals.

.2   If requested, demonstrate and test the control panel in presence of the Contract Administrator designated representative.

Part 2   Products

2.1   GENERAL

.1   Construction of the control panels is required, in accordance with the supplied drawings.

.2   Control devices of each category shall be of same type and manufacturer.

2.2   ENCLOSURES

.1   Install lamacoids as per the control panel layout drawings.

.2   All indoor control panels shall be NEMA 12 or as shown on drawings.

.3   All enclosure angles and cut-outs shall be free of dents, gouges or weld marks, and shall present a clean, smooth appearance.

.4   No screws, fittings or other fastenings shall be used on external panel faces, which must be free of any marks, scratches or defaults.

.5   The door is to be a minimum fourteen (14) gauge steel plate, full height and flush with adjacent surfaces.

.6   The exterior of the control panel shall be painted ANSI 61 grey.

.7   The interior of the control panel shall be painted gloss white.

.8   All control panel doors shall be 900 mm (36 inches) wide maximum.

.9   All control panel doors shall open through 180 degrees without restriction.

.10   Enclosure brand shall be Hoffman or an approved equivalent.

2.3   POWER SOURCE

.1   Each power source must be protected by a CSA approved circuit breaker or fuse.

.2   The location of each power source must be clearly shown.

.3   Panels powered by more than 1 electrical source shall display on their door; "Caution: This panel is electrically powered by more than one source".

2.4   COMPONENTS

.1   Unless written approval for use of unapproved components is received from the owner, all electrical materials (e.g., conduit, fittings, wireways, etc.) shall be CSA or cUL approved.

.2   Rails (DIN Rails)

.1   Rails used must be DIN Rail style TS 35mm, slotted.
.2   When used to mount terminals, rails shall be mounted on straight raisers (Rail support / Mounting feet) so as to raise them to the same height as the highest adjacent wiring duct.
.3   Raisers (Rail support / Mounting feet) shall not be used when rail hosts heavy components.

.3   Terminals

.1   Requirements:
.1   Mounting: TS-35 DIN rail.

        .2   Voltage rating:
             .1   600V for general control circuits.
             .2   600V for power circuits.

        .3   Manufacturer: Phoenix Contact or approved equal in accordance with B7.

.2   Terminal blocks shall be designed for the size of the wires to be connected to them. Terminal blocks used for analog, digital, and power cables shall be identified and physically separated from each other.

.3   Each terminal shall bear an identification number on both sides.

.4   Drawings and templates supplied may not detail all hardware components such as labels, stoppers, rail lifters, end plates, separators, etc. The supplier must supply and install such components when required.

.4   Ground Bus Bar

.1   Supply ground bus bar(s) in each control panel as indicated on the drawings.

.2   Requirements:
        .1   Tapped holes with screws.
        .2   Bar to have sufficient connection points for all cables entering the control panel, plus 25% spare.
        .3   Maximum one wire termination per screw.

.5   Pushbutton, Switch and Indicator Light

.1   When required, all control panel pushbuttons, switches and indicator lights shall be at least NEMA 12 (or better)-type devices.

.2   Manufacturer to be Schneider Electric or approved equal in accordance with B7.

.6   Programmable Logic Controllers

.1   As per section 40 94 43.

.7   Annunciator Light Panel

.1   Lights: LED, Full Voltage, 30x30mm, colour as indicated on the drawings, engraved text as indicated on the drawings,

.2   Rating: 24 VDC,

.3   Approvals: CSA,

.4   Manufacturer: IDEC SLC30 series.

.8   General Purpose Relays

.1   Coil Voltage: As per drawings
.2   Indication: LED
.3   Diode: As per drawings
.4   Contact arrangement: As per drawings
.5   Contact Rating: 5A (120 VAC), 5A (24 VDC)
.6   Approvals: CSA
.7   Manufacturer: Omron or approved equal in accordance with B7

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.9 24 VDC Uninterruptible Power Supply

.1 Input: 100-240 Vac

.2 Output: 24 Vdc, 5 A (adjustable 22.5-29.5 Vdc)

.3 Battery: 3.4 Ah

.4 Monitoring outputs: 24 Vdc, Alarm, Battery Mode, Battery Charge

.5 Manufacturer: Phoenix Contact TRIO-UPS/1/AC/24DC/5 (2866611) with QUINT-BAT/24DC/3.4Ah (2866349) or approved equal in accordance with B7.

.10 Cellular Modem:

.1 Supplied by City.

.11 PSTN Modem:

.1 Type: PSTN modem / Ethernet Switch

.2 Protocol: PPP (point-to-point)

.3 Maximum data rate: 56 kbps

.4 Compatibility: V.90, V.34, V.32, V.32 bis, V.22 bis, V.21

.5 Ports:
   .1 Ethernet:
      .1 Quantity: 5
      .2 Speed: 10/100 Mbit (automatic negotiation)
      .3 Connector: RJ45
   .2 Telephone:
      .1 Line (input), Phone (output)
      .2 Connector: RJ11

.6 Supply Voltage: 24 Vdc

.7 Operating temperature: -40 to +75°C

.8 Mounting: 35mm DIN Rail

.9 Approvals: CSA

.10 Model: Phoenix Contact PSI-DATA/FAX-MODEM/RS232 (2708203) or approved equal in accordance with B7.

.12 Grounding

.1 All control panel components shall be adequately grounded in accordance with the component manufacturer, especially control system components.

.2 Firmly bond all panel mounted devices on or within the panels to ground. Provide supplementary bonding conductors for back panels and doors. Attach a separate bonding conductor to all devices that are not firmly fastened to the panels with screws for such devices as case mounted instruments, meters, etc.

.3 Where ground bars are installed on to the rear or side wall of the enclosure, seal screw penetrations to maintain enclosure rating.

.13 Wiring

.1 Panel wiring shall be installed in a near and orderly manner.

.2   All conductors shall be securely fastened to terminals at both ends; no splices are allowed inside the panel.

.3   No more than two (2) conductors may be terminated under each terminal screw. All internal panel conductors shall be connected to the same side of a terminal block, and external conductors to the other side. The only exception is for fused terminals which require connection to the field side for internal wiring.

.4   All wires and cables inside the control panels shall be identified on both ends with non-erasable markers.

.5   Identification shall follow the supplied documents, such as wiring diagrams.

      .1   Label both ends of each wire.

      .2   Utilize machine printed non-slip labels. Wrap-around or self-adhesive markers shall not be permitted.

      .3   Wherever possible wire labels shall be positioned to be read from the panel opening without removal of wire duct covers or other wiring.

.6   Individual conductors or wires exiting a cable shall be identified using non-erasable markers.

.7   The routing of all analog, digital, power, and networking wiring and cabling inside control panels shall be segregated as much as possible by the type of signal they are carrying.

.8   All wires shall be physically protected by wiring ducts with covers. The wiring ducts shall be of sufficient size to be filled to a maximum of 50% when all wires are inside.

.9   All analog twisted pair wiring shall be 18 AWG shielded such as Belden No. 8760, or an approved equivalent. Shield wires exiting the jacket must be covered with a black heat shrink, and the overall cable at the jacket end must also be covered with a heat shrink.

.10   All 24 Vdc or 120 Vac discrete signal wiring shall be 16 AWG TEW stranded conductor.

.11   All 120 Vac power wiring shall be 14 AWG TEW stranded conductor, minimum.

.12   All 24 Vdc power wiring shall be 12 AWG TEW stranded conductor, minimum.

.13   The sizes and colours of wires shall be in accordance with the CSA and the Canadian Electrical Code.

.14   The panel builder shall group and form wiring into a loop when going from a fixed part of the panel to a door such that there is sufficient slack to minimize strand fatigue and breaking. Each end of the loop shall be properly supported.

.15   Ethernet Patch Cords

      .1   Requirements:

         .1   Cat-5e.

         .2   Jacket colour: Blue.

.16   Wiring Duct

      .1   All wires shall be run in narrow slot wiring duct such as such as Panduit or an approved equivalent.

      .2   Wiring Duct shall be installed on both sides of the panel and between the DIN rails.

      .3   Wire or cable, connected to internal device or arriving from external device, shall be uncovered by Wiring Duct for a maximum of 10 cm.

.17   Wire ties shall be non-metallic.

.18   Wiring shall be arranged to be readily accessible for inspection and maintenance.

.19   The wiring arrangement shall not interfere with access to panel-mounted devices or spaces for future equipment.

.14   Overcurrent Protection

.1   Panel-mounted devices and all control circuits shall be protected by appropriately sized fuses or circuit breakers.

Part 3   Execution

3.1   COMPONENT INSTALLATION

.1   Components on the front of the panel shall be identified with an individual permanent nameplate installed in an organized manner. The nameplate must identify the component's function.

.2   Each component inside the control panel shall be identified with a nameplate corresponding to the drawings.

.3   All non-DIN rail mountable devices in the control panel shall be mechanically affixed to the back panel with either tapped or self-tapping screws.

.4   All control devices shall be mounted so that any component can be replaced without removing the sub-panel or other components.

.5   Components and/or auxiliary instruments mounted at the rear of the panel shall be readily accessible and their installation shall not be affected by, or interfere with the removal of any panel instrument.

.6   Nameplates shall be made of lamacoid material with a white background and engraved black letters for internal and external components. Nameplates must resist harsh industrial conditions.

.7   Supply and install all required fuses.

.8   Control devices must be spaced adequately to allow for cooling, replacement, servicing, and wiring access.

.9   Control devices shall be grouped according to voltage and function to reduce electrical noise.

.10   Cutouts for instruments shall be within the tolerances specified by the instrument manufacturer.

.11   If cutouts are specified for future instruments, the cutouts shall be covered by removable steel plates 3 mm (1/8 inch) thick. The cover plates shall be finished and painted with the same paint as applied to the front panel.

.12   If any panel-mounted item is not available for installation before the panel is scheduled for shipment, wiring from the terminal block to the panel location for the item shall be

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completed, wire ends shall be formed exactly to the configurations required, and identifying sleeves shall be applied, ready for connection.

.13 Panel areas designated for future equipment shall be kept clear of stiffening members, rear-mounted equipment, wiring, and all other interferences.

.14 Ample space shall be provided for the entrance of external cables into the panel and for routing the cables to terminating points within the panel.

3.2 IDENTIFICATION

.1 Perform wire and terminal identification using a computerized device. Handwriting is not acceptable.

.2 Label wires and terminals as shown on drawings.

.3 Install label above each terminal block with terminal block name.

3.3 TESTING

.1 Testing of the control panels shall be completed to the greatest extent possible prior to the FAT, and shall include at minimum:

.1 Provide a signed and dated inspection sheet with all tests performed listed on it.

.2 The list of the various test procedures described hereunder is not restrictive, and does not relieve the control panel manufacturer of his responsibility to perform any other work that is not mentioned but requested to verify the good operation of the control panels.

.3 Isolate all instruments and components of the control panels as required to protect them from any damage during tests.

.4 Provide the services of qualified personnel as well as tools and equipment required to perform all tests and inspection of the control panels.

.5 Tests to include:

.1 Power supply functionality

.2 PLC component functionality

.3 Point to point tests of all inputs and outputs

.4 Power terminal voltage verification

.5 Relays and switches functionality

.6 Receptacle functionality

.7 Modem and Ethernet switch functionality

.6 If the panel is modified after tests have been performed, tests shall be repeated.

3.4 SHIPMENT

.1 If any panel-mounted item is not available for installation before the panel is scheduled for shipment, wiring from the terminal block to the panel location for the item shall be completed, wire ends shall be formed exactly to the configurations required, and identifying sleeves shall be applied, ready for connection.

.2   Shipment of any panel having shortages of equipment shall be approved in writing by the owner.

3.5   SPARE COMPONENTS

.1   Supply two spares of each fuse type and rating. Place in a clear plastic bag and attach to the panel door interior

END OF SECTION

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Part 1   General

1.1   MAINTENANCE SERVICES

.1   Not required.

1.2   SUPPORT SERVICES

.1   Duration:

.1   The duration of support services is to extend during the Warranty period (one year past Total Performance)

.2   Requirements:

.1   Provide telephone support for all products supplied (during regular business hours).

.2   Respond to emergency service calls (during regular business hours).

.3   Telephone Support:

.1   Telephone support to utilize service personnel knowledgeable in the products and have the required troubleshooting skills.

.2   No payment will be made for telephone support during the warranty period.

.4   Emergency Service Calls:

.1   Respond to service calls from the City when the system is not functioning correctly.

.2   Qualified control personnel to be available to provide on-site service upon a critical failure, whenever required.

.1   A critical failure is the inability to operate of any critical system supplied by the Vendor.

.2   Critical systems include, but are not limited to:

.1   Communication networks.

.2   PLC system.

.3   HMI systems.

.3   Perform work continuously until system is restored to a reliable operating condition.

.4   Response Time:

.1   The response time to emergency service calls is to be less then four hours.

.5   Record each service call request, when received separately on approved form and include:

.1   Serial number identifying component involved.

.2   Location, date and time call received.

.3   Nature of trouble.

.4   Names of personnel assigned.

.5   Instructions of work to be done.

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   .6 Amount and nature of materials used.

   .7 Time and date work started.

   .8 Time and date of completion.

  .6 Costs:

   .1 If the issue is determined to be due to poor workmanship or defect of the Contractor, no payment will be made to the Contractor.

   .2 If the issue is determined to be due to failure of a physical component supplied, and covered under manufacturer's warranty, the Contractor will be paid for the service call.

   .3 If the issue is determined to be due to an issue outside of the Contractor's responsibility, the Contractor will be paid for the service call.

   .4 Payment will be based upon the rates specified in Form B.

   .5 If the service call is subsequent to Total Performance, submit an invoice, based upon the established rates to the City.

Part 2   **Products**

2.1   **NOT APPLICABLE.**

  .1 Not applicable.

Part 3   **Execution**

3.1   **NOT APPLICABLE.**

  .1 Not applicable.

END OF SECTION