Jefferson County School District, R-1
Support Services

TECHNICAL GUIDELINES

DIVISION 25 – INTEGRATED AUTOMATION

AUGUST 2022

Table of Contents

DIVISION 25 – INTEGRATED AUTOMATION

25 54 00 Instrumentation and Integration Control for Water and Waste Water Treatment Facilities (SCADA) – August 2018.....2

DIVISION 25 – INTEGRATED AUTOMATION

Reference Division 23 for Building Automation for HVAC

25 54 00 Instrumentation and Integration Control for Water and Waste Water Treatment Facilities (SCADA) – August 2018

- This Section is not intended to override mechanical controls in Div 23. The District's Environmental Department water and waste water treatment facilities mechanical systems shall be controlled via an electronic Process Automation System (PAS) interfacing with the existing District Supervisory Control and Data Acquisition (SCADA) system. The PAS shall be provided by one of the following automation equipment/system suppliers:
    1. Allen Bradley
    2. Red Lion
    3. Motorola Orenco
- All commercial grade electronic controllers shall be Modbus compliant. All bidders shall be pre-approved through the District's prequalification process.
- The District's Environmental Department water and waste water treatment facilities shall use two Red Lion ProducTVity Stations.
    1. One station located in the District Monitoring Center and one in the Environmental Department (Operation and Control Centers - OCC) to consolidate and display site status.
    2. Sites shall report to the District's existing Industrial Data Management (IDM) software, GE Historian.
    3. The 2 ProducTVity Stations and the GE Historian will constitute the District's SCADA requirements for this Division when used at our Environmental Department Facilities.
    4. The following are pre-approved SCADA \ Red Lion Installers\Integrators and must have UL 508 Fabrication shop certification and 5 years water and waste water facilities experience:
        a. Timberline Electric
        b. Browns Hill
        c. Champion Technologies
        d. Herbert Instrumentation
- PAS contractor shall furnish, install, wire, guarantee and service the entire PAS. The PAS contractor shall be responsible for the selection, installation, and wiring of all components required for integration into the SCADA. The PAS contractor shall be responsible to update the SCADA system with the latest manufacturer's recommended software and firmware with each project or component addition. The PAS contractor shall be responsible to contract with a District Pre-Approved SCADA Installer\Integrator for PAS integration into the District's SCADA system. PAS contractor shall be responsible for adding new sites, devices, points and events into the District's existing Industrial Data Management (IDM) software.

- Each project shall provide control panels in the quantities and locations necessary to properly access and house all control equipment.
    1. Panels shall be provided with hinged covers and key operated locks.
    2. Panel shall be located in a dry location and accessible from the floor level.
    3. All control panels locations shall be pre-approved by Districts Project Manager.
    4. All control panels shall be located on the project coordination drawings.
    5. The A/E shall indicate all control panel power requirements on the contract drawings.
    6. All control panels shall be fed from a dedicated power source (emergency/UPS if applicable).
    7. All control panels shall have an electrical breaker and an available duplex outlet.
    8. All control panels shall have the appropriate primary and secondary circuit protection.
- Prior to the design of the integration of the PAS into the SCADA, the A/E shall arrange a meeting with the District Project Manager to discuss and resolve the following:
    1. Minimum required control points list and the points monitored and/or controlled by SCADA at the Operations Control Centers (OCC).
    2. Available capacity of existing DDC panels and nodes for connection to SCADA system.
    3. Owner-required ATC/P&ID diagrams. Review of design shall be conducted via a meeting with the District Engineering Department prior to the final bid issue. A/E shall review PAS shop drawing submittals for compliance to the final bid issue design. The District Engineering Department shall approve the PAS shop drawings.
    4. Respective system dynamic information reported back via SCADA to the campus Operations Control Centers (OCC).
        a. For new installations only, a network connection into the building subnet along with IP address, hostname, net mask address and default route address shall be provided by the District. These are required to get the system data from the new location to OCC.
    5. Description of Points:
        a. Provide table(s) listing all points with item number as shown and the following: Environmental Services will provide general terms and nomenclature for equipment to insure consistency from site to site.
        b. Respective control panel card/slot for each control panel and/or data gathering.
        c. Provide for all software points to include but not limited to:
            - Point name.
            - Point function (shall include calculated points and also logical (virtual) points available through a digital interface (not hard- wired).
            - Alarm limits.
            - Engineering Units
            - Device range in engineering units

- Point off normal response
- Prioritize event YELLOW (next business day response) or RED (Immediate response)
- Log only
- Log and Display event in SCADA system
- Log and E-mail event to a distribution list (DL)
- Log and text message to a DL

- The drawings and specifications shall, at a minimum, include the following requirements:
    1. General system description, system architecture, including sequence of operations, point listing, description and type, engineering units, device range, point alarm parameters, control panel locations, sensor locations, etc.
    2. Shop drawing submittal requirements, including the following:
        a. Contractor shall provide as a minimum an individual drawing for each system.
        b. Drawings shall show all system hardware, control panels, field devices, electrical work as well as all PAS work with each drawing containing the following information:
            - Wiring type and method of installation.
            - Point numbers and termination numbering for each control panel.
            - Detailed Bill of Materials with appropriate reference to section where product data is presented.
            - Sequence of operation. Including P&ID (Control) diagrams.
            - Hardwired, Calculated and Logical Point data PAS listing, software addresses following nomenclature in appendix, wiring numbering, control/alarm, set points, and termination locations.
    3. Hardware Product Data
        a. The Contractor shall furnish complete documentation pertaining to hardware and all other equipment supplied including power requirements per control panel and end devices.
        b. Contractor shall document all point connections at the control panels. Include all pertinent wiring, field device, hardware, termination modules and software data. Control panels are to be located by the A/E with final approval coordinated with the District Project Manager.
        c. Contractor shall document all I/O modules and communication cards installed in control panels. Include all pertinent data, including firmware/software versions, switch settings, and calibration data.
    4. Software
        a. Provide the following information pertaining to PAS software:
            - All programs pertinent to project and backup format with software used to create backup.
            - Operating system software on acceptable digital data media.
            - All software, hardware and licenses required to operate, maintain and modify the system controls. The District shall be specified as owner.

- A list of systems requiring graphics. A written narrative shall detail the systems graphics requirements.
- Indicate the PAS software that shall execute at the PAS panel/s independent of the SCADA system, the transmission link to the SCADA system or other PAS panel/s.
- Table of Contents of routines that the Contractor shall use to implement the sequence of operations specified.
- A written narrative shall be detailed and include definitions of each variable and instruction contained in the line code.
- A list of the software points to be used to implement each set-point and control PID tuning parameters, and any other software points used.
- A list of all variables and their meaning.
- A list of the routines provided in each control panel and their storage requirement.
- A written narrative showing the interaction of routines in each control panel including variables being transferred from routine to routine.
- Implementation of energy management routines.
- Wireless System Requirements (not preferred - allowed where approved by District Project Manager only)
- District is currently using GEIP Proficy Historian Analysis to process trends and generate reports.

5. Description of Points:
    a. Provide table(s) listing all points with item number as shown and the following
        - Respective control panel card/slot for each control panel and/or data gathering.
        - Provide for all software points to include but not limited to:
            - Point name.
            - Point function (shall include calculated points and also logical (virtual) points available through a digital interface (not hard- wired).
            - Alarm limits.
            - Engineering Units
            - Device range in engineering units
            - Point off normal response
            - Prioritize event YELLOW (next business day response) or RED (Immediate response)
            - Log only
            - Log and Display event in SCADA system
            - Log and E-mail event to a distribution list
            - Log and text message to a distribution list
6. Field Devices:
    a. Specification data sheets including accuracy, calibration, and servicing information and quantities for all field devices.

b. Tabulated information showing point number, field device, and data sheets reference for all points.
- Drawings of all local control panels including panel face layouts.

7. Electrical Work :
   a. Submit data sheet on each type of wire to be used and its specific job application (e.g. Signal Wiring, Communication, Data Communication, etc.).

- Electrical Work Requirements:
  1. General:
     a. All installations shall also comply with District Division 26 – Electrical.
     b. All installations shall also comply with District Division 27 – Communications.
  2. Signal Wiring:
     a. Per manufacturer's requirements
     b. All signal wiring shall be point to point wiring. No splices, terminal strips, or terminal blocks shall be permitted.
        - Signal wiring shield shall be grounded at control panel end only unless specified by Manufacturer.
  3. Communication Wiring:
     a. All LAN cabling from PAS to SCADA nodes shall be high bandwidth cabling as listed in the District's Division 27 - Communications and shall be installed by a vendor on the District's approved Division 27 Vendor List.
     b. All wiring shall be provided in rigid metal conduit in exterior locations, in mechanical/electrical rooms, and in utility areas up to 8 feet A.F.F. All other interior wiring shall be in electrical metallic tubing (EMT – compression type). All devices and equipment shall be mounted in minimum NEMA 1 enclosures and NEMA 4 for mechanical rooms. All control conduits shall be labeled appropriately as to control voltage. Conduit fill shall not exceed 40% capacity.
     c. Low Voltage Control Wiring (30 VAC or Less):
        - Low voltage control wiring shall be minimum 16 gauge, twisted pair, 100% shielded with PVC over Belden #9316 or equivalent product approved by the District and run in conduit with no splices, separated from any wiring above 30 volts.
        - Any changes in wiring methods or materials must be approved by the District Engineering Department.
- The project specification section shall define the provision for all drivers, gateways, and systems graphics necessary for complete system monitoring and operation.
  1. The project specification section shall identify the minimum system interface and interoperability expected between specific equipment controls and the DDC/PLC for each type of project, as well as the minimum number of graphic displays for each type of system.
  2. Provide as a minimum at least one system graphic for each major system (i.e. AHU, Hot water system, chilled water system) and at least one control graphic and one trend graphic for each system.

- District Campus Operations Control Centers (OCC) – SCADA System:
    1. The SCADA system via interface to PAS systems and other local control systems provides monitoring and control of all Water\Waste water Facilities in the District. The SCADA operators interact with all PAS and local control systems through web browser and Google Chrome using a windows platform. The operator interface package communicates with all of the different local systems and presents information from each in a unified form to the operators. The operators manipulate controlled variables for any local system from the SCADA through an integrator approved by the District Engineering Department
        a. All new systems shall integrate to the SCADA via Modbus protocol.
        b. All PAS or local control system contractors shall include the services of a SCADA system integrator within their bids to complete the systems integration to the SCADA. All SCADA system integrators must be approved by the District Engineering Department.
        c. The SCADA system is a microcomputer-based system that interfaces with different manufacturers' of control hardware distributed throughout the District computers located at various sites and act as clients for sub-groups of control hardware devices. These Operator Workstations are networked to allow data to be accessed from any SCADA node in the District. The computer network uses the existing campus network cables. The various sub-networks are connected to the backbone. Different networking protocols can co-exist on the sub-networks, however only TCP/IP is allowed on the District Network.
        d. The Contractor shall provide the following for the system integrator to develop and install a communication driver for any new control hardware:
            - Complete communication protocol documentation that has a detailed technical description of how the protocol works, format for messages, etc.
            - Technical personnel (by telephone or otherwise) who are knowledgeable about the protocol and able to answer questions.
            - Test hardware or facilities for testing the Communication Interface.
            - Technical personnel on-site at the District during the installation and verification of the Communication Interface.
            - Configuration of the control hardware to facilitate computer configuration.
            - Any special interface card or software that is required.
            - The communication cable between the computer and the control hardware. The Contractor shall ensure that a communication cable from the control hardware to the computer location exists and that it is properly terminated. For example, serial cables may be terminated at the computer end with DB-9 or DB-25 female connectors. The location of the control hardware shall be such that the cable length does not inhibit computer communication.

- Completed data sheets with all of the variables configured on the control hardware.
- The communication protocol shall provide direct access to the control hardware as oppose to an intermediate device such as another computer supplied by the Contractor.

2. It is the responsibility of the system integrator to configure system graphics and control graphics for the new systems. Alarms to be configured into the system are defined in the sequence of operation as well as in the Alarm Standards for SCADA System Interface. Historical trending of all key analog data is to be provided.
    a. All new PAS systems shall include all time-of-day scheduling to ensure that they are not dependent on communications to the SCADA.

- Project Closeout Requirements
    1. Before control and monitoring systems are closed out a point-to-point verification from the field devices to OCC shall take place. The system controls shall be tested at each unit level, terminal units, hydronic systems, etc. Components failed and replaced during the warranty period shall repeat point to point check out.
    2. There shall be a verification test of blackout startup of the system. Also operation under abnormal conditions, such as emergency power, etc.
    3. The contractor shall submit three binders and electronic copies for each project including the following:
        a. P&ID diagram for each system.
        b. Point listing, by system, with variable acronym, software address, point type, and engineering units.
        c. Logic step diagram system.
        d. Wiring diagrams by system including termination nomenclature, location and wiring identification.
        e. Calibration sheet (minimum 3-point calibration) for each device identified in the design as requiring calibration certificates, indicating calibration date and model number. Include equipment calibration certifications for calibration standards.
        f. Final tune-up list of parameters for each PID loop, including a time graph showing response to a disturbance of 15%.
        g. All software, hardware and licenses necessary to operate, maintain, update modify the system. Including a final version of the software operating the building.
        h. Statement indicating all systems graphics are complete and accurate.
    4. Confirmation in writing by the controls contractor that:
        a. All construction Requests for Information (RFIs) are resolved.
        b. All shop drawings, as built and submittals are completed.
        c. All required training is completed.
        d. All Testing, Adjusting and Balancing and commissioning activities are completed.
    5. OCC Graphics Sign-off sheet procedure:

a. Once the controls contractor has completed and confirmed the graphics with Engineering, including a point to point, as well as reviewing them in person at the operator terminal in OCC, the controls contractor shall be responsible for creating a sign-off sheet with project description, District PM listed, and a location for the consultant, Facilities, and commissioning agent to sign off.
b. The sign-off sheet shall be sent to the District Project Manager, and it shall be the District Project Manager's responsibility to obtain the proper signatures from Security, Facilities, Consultant Engineer (if applicable), and the commissioning agent (if applicable). Any deviations identified will be attached to the form and sent back to the controls contractor for the contractor to address.

END SECTION 25 54 00