SCADA STANDARDS

SUMMARY OF CHANGES

Authorization #8 - Amendments Effective November 5, 2017

Chapter Seven (7)	Section Name	Amendment Description
		1. Put items from 413, 519, and 611 into Chapter as sections were similar except for unit processes. 2. Updated per Polk County direction – much of section provided by Norm. Referenced models of instrumentation where references exist in other sections. 3. Updated Cerlic model as new one has taken over for sludge measurement. 4. Referenced WW-22 series for components in lift station panels. 5. Inserted O&M requirements for specifications previously generated for this purpose.
(NEW)	SCADA Specifications	6. Renamed according to purpose of specification.

SCADA Standards and Specifications

PART 1 - GENERAL UTILITY FACILITY SCADA STANDARDS

1.01 SUMMARY OF SYSTEM

A. These standards provide minimum requirements for the design and construction of County projects. The purpose of this document is to establish conventions and standards used in the selection of instrumentation, hardware, programming, and configuration of control systems to ensure uniformity across all County Utility SCADA systems. The County reserves the right to approve changes based on site specific design requirements.

B. Unless otherwise noted, the latest version of the following standards shall be used for the design and construction of County Utility SCADA Systems.

1. Cisco/Rockwell Converged Plantwide Ethernet (CPwE) Design and Implementation Guide.

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

    a. Standards as applicable for design and implementation.

3. International Society of Automation (ISA):

    a. S5.1, Instrumentation Symbols and Identification.
    b. S5.4, Instrument Loop Diagrams.
    c. S50.1, Compatibility of Analog Signals for Electronic Industrial Process Instruments.
    d. TR20.00.01, Specification Forms for Process Measurement and Control Instruments.
    e. IEC62443 (ISA-99), Industrial Automation and Control System Security.

4. National Electrical Manufacturers Association (NEMA).

    a. Standards as applicable for design and implementation.

5. National Fire Protection Association (NFPA):

    a. 70 – National Electrical Code.
    b. 70E - Standard for Electrical Safety in the Workplace.
    c. 820 – Standard for Fire Protection in Wastewater Treatment and Collection Facilities.

6. National Institute of Standards and Technology:

    a. SP-800 series.

7. Telecommunications Industry Association (TIA); Electronics Industry Association (EIA):

    a. 492, Specifications for Optical Waveguide Fibers.
    b. 568, Commercial Building Telecommunications Cabling Standard.
    c. 569, Commercial Building Standards for Telecommunications Pathways and Spaces.
    d. 607, Commercial Building Grounding and Bonding Requirements for Telecommunications.

8. Underwriters Laboratory, Inc.

    a. 508, Standards for Safety, Industrial Control Equipment.
    b. Component specific standards as applicable.

C. SCADA systems shall be provided to remotely monitor and control County Utility Facilities. The SCADA system shall consist of a Human Machine Interface (HMI) / Supervisory Control and Data Acquisition (SCADA) system, Programmable Automation Controller (PAC), local Historian, CCTV, and instrumentation for a complete control system as identified in this Section.

The HMI application shall provide operators with real time and archived information for monitoring and control of the County Facilities including pump status, tank levels, flow rates, analyzer values, and alarm conditions. The SCADA system architecture shall be based on VTScada; obtain current version information from the County. Server systems shall be virtualized using VMWare vSphere ESXi for larger regional facilities and installed on a single PC for single and dual well water facilities. Each facility will consist of a Primary VTScada server, Historian, and alarm annunciator utilizing a cellular SMS modem. Tag and alarm filtering shall be used to make applications specific for the local facility but part of the County's overall master application. Large regional facilities may also include Secondary SCADA server for redundancy and additional web clients for local control and monitoring clients. Additionally, the County's central VTScada servers shall be configured to poll and store data from each facility and serve as a backup polling server. The location and quantities of HMI and related components shall be designed by the Engineer or Contractor for each specific project.

D. The following documents shall be provided for each facility design and construction project at a minimum:

1. Piping and Instrumentation Diagrams (P&IDs) containing the following minimum information:

    a. Process piping and valves.
    b. Instrumentation.
    c. Motors and motor control equipment.
    d. All I/O shall be clearly labeled on the P&IDs noting whether each point is a Discrete or Analog input or output and all termination locations shall be shown. For Fieldbus or Ethernet I/O, appropriate tables shall be used to list minimum I/O exchange requirements.
    e. Equipment and instrument voltages.
    f. Extents of package systems.
    g. Equipment and instrument tag numbers.

2. Network block diagrams containing the following minimum information:

    a. All network connected components and their physical connections.
    b. All cable types and protocol types clearly defined.
    c. Group all components within their respective enclosures.
    d. Show all patch panels.
    e. All operator interface equipment and display screens.
    f. Power requirements.
    g. Include security system components where applicable.

3. Loop specifications and control descriptions outlining all major process control functions and PLC / HMI programming requirements.

4. Design specifications noting all equipment, workmanship, installation, and testing requirements.

5. Construction Submittals for all components.

6. As-built construction drawings.

7. Testing documentation.

E. Abbreviations:

1. CCTV Closed Circuit Television
2. CPU Central Processing Unit

3. FDT Factory Demonstration Test
4. GUI Graphical User Interface
5. HMI Human-Machine Interface
6. I/O Input and Output
7. IP Internet Protocol
8. LAN Local Area Network
9. O&M Operations and Maintenance
10. PAT Performance Acceptance Test
11. P&ID Piping and Instrumentation Diagram
12. PAC Programmable Automation Controller
13. RTU Remote Terminal Unit
14. SCADA Supervisory Control and Data Acquisition
15. VPN Virtual Private Network

1.02 TAG AND I/O REQUIREMENTS

A. General: Data tags shall be used to provide numerical values, discrete status indications, and text strings for display, and command functions within the SCADA graphics. The iFIX application includes an internal tag database for local storage of data values. Configure the internal tag database with multiple data tag folders to allow for better organization of tag data. Tag data configured within the internal tag database can be mapped to tags within the PLCs, or configured as internal tags. Internal tags are tags whose data value is stored in the iFIX tag database and not linked to external devices.

B. Tag Numbering

SCADA tag numbering shall be as follows for design and implementation for either analog or digital functions:

FAC_UP_TAG_X_Y_Z_BFN

e.g., WWTF4001_10_AIT_001_02_02_PH

FAC Facility or Plant Identifier (8 characters/digits max): Obtain facility identifier from the County for each facility.

UP Unit Process Designator (3 characters max): The SCADA process data shall be organized by unit process (UP) as identified in Chapters 4, 5, and 6 of the Utility Code. For process numbers not identified in the Utility Code, an approved Unit Process Number shall be obtained from the County.

TAG Instrument Tag (4 characters max): This is the instrument or

control loop tag as indicated on the P&IDs or Field Tag. Follow ISA designation from Table 1 in ISA Standard 5.1.

X Loop Number (3 digits max): This is the loop number indicated on the P&IDs and field device tag.

Y Unit Number (2 digits max): Where applicable, use where multiple sets of units are provided for the same control loop.

Z Suffix Number (2 digits max): Where applicable, use where there are multiple instances on the same unit.

BFN Block function or Clarifying Abbreviation (4 characters max): In some cases a block function is required to further identify the block or I/O point, e.g. the tag for a pH controller setpoint would be FAC_UP_TAG_X_Y_Z_PHSP

The following is a listing of example approved Block Function/Clarifying Abbreviation examples and is not all inclusive. Obtain County approval for other necessary descriptions:

A = Alarm Status. Followed by additional descriptor, e.g., H=High, L=Low as required.

CDTF = Current Day Total Flow

ET = Elapsed Time

ETR = Elapsed Time Reset

FA = Fault or Fail

FTC = Fail to Close

FTO = Fail to Open

FTR = Fail to Run

FTS = Fail to Stop

LEAD = Lead operation

MCL = Manual Close

MOP = Manual Open

MSSP = Manual Speed Set Point

MRUN= Manual Run

MSTP = Manual Stop

OFS = Out of Service

OPND = Opened

OVL = Overload

PH = pH

PHSP = pH Set Point

RST = Reset

S = Speed

SP = Set Point

Z = Position

ZSP = Position Set Point

C. Tag Database

1. All signals connected to PAC I/O modules shall be transmitted to the local server and operator interfaces via Ethernet connection. Display variables on appropriate HMI displays. Display status for discrete variables such as ON/OFF/FAIL status for motors and OPEN/CLOSE/FAIL status for valves. Display value, and totalizer value when appropriate, for analog variables such as process variables, Set points, drive speeds, and valve positions. To prevent clutter and to ease operation, some displayed variables will not normally appear on displays but will be accessible through easily identifiable point-and-click targets. Runtime and totalizer counters are an example of variables that might not normally appear and displayed on appropriate graphic screens and operator interfaces. Display shall be in engineering units. High and low alarms for analog signals shall be displayed on the appropriate graphic screens. In general all analog process variables shall be trended. Specific analog signals shall also be transmitter to the local digital chart recorder for secondary display and logging.

2. All alarms shall be displayed with time and date stamp and logged in the historian.

3. At intervals appropriate for the variable being trended, place the current value of analog variable, along with a time and date stamp, into a historical trend file for that variable. Display the trend on selectable HMI screens with appropriate scaling and units.

4. All pumps, trains, blowers, and miscellaneous equipment RUN times shall be calculated and updated in the PAC system and transmitted to local and remote operator interfaces.

5. All timer settings, set points, and miscellaneous adjustments will be determined during application software development or plant startup. All settings and adjustments shall be easily made through the local or remote operator interface.

6. Provide bumpless transfer for all Manual to Auto and Auto to Manual transitions as follows:

    a. Manual to Auto

        i. Maintain current operating status on transition. If Auto mode calls device to stop then stop or maintain stop and if Auto mode calls device to run then run or maintain run.
        ii. For modulating devices, maintain the last control variable output. Allow automatic control to commence from the last manual value.

    b. Auto to Manual

        i. Maintain last operational status from Auto. If running then maintain running and if stopped them maintain stopped.
        ii. Maintain last control variable output for modulating and adjustable variable devices.

7. Provide nuisance alarm suppression by conditioning alarm signals. For example disable all but selected alarms when power is off, and include startup delays, momentary excursion delays, and contact bounce delays. Suppress dysfunctional alarms during and immediately following power outages. Suppress alarms such as low flow or low pressure in situations when equipment is turned off or not running. Suppress alarms when operational set points or controller outputs are below low flow alarms.

8. Coordinate critical alarms requiring remote notification with the County during construction. Configure remote notification software to notify County personnel of critical alarms. Coordinate contact information and alarm message with County during construction.

9. Typical elements that should be monitored and controlled are noted in Chapters 4, 5, and 6 for different County Facilities. It is the

responsibility of the design engineer to determine additional monitoring and control functions required to support specific Facility processes for a given project.

PART 2 - HARDWARE AND INTEGRATION

2.01 GENERAL REQUIREMENTS

A. Provide equipment compatible with the County's existing central SCADA system to ensure proper communications and data transfer. Components listed in this section are based on the latest manufacturer's models and specifications at the time the standard was developed. Provide the manufacturer's equivalent state of the art model at the time of construction for each item specified.

B. Use products of a single manufacturer of the same series device to achieve standardization.

C. Provide nameplates and service legends for all panels and components and provide stainless steel tags for all field devices.

D. All components used shall be UL listed or recognized for their intended use and bear the appropriate UL mark.

E. Number and tag each wire with machine printed heat shrink wire tags. Numbers shall match panel drawings and include field device tag number where applicable.

F. Grounding:

1. Ground all devices and instrumentation in accordance with manufacturer's instructions, the National Electrical Code, and IEEE 142-2007 Recommended Practice for Grounding of Industrial and Commercial Power Systems.

2. Furnish separate copper bus bars for signal and shield ground connections.

3. Furnish and install door grounding kit for enclosures.

4. Ground all DIN Rail.

5. Ground surge suppressors with the shortest possible ground conductor length.

6. Ground bus bars at a single ground point.

7. All grounding systems shall be tested by the 3-point fall of potential test in accordance with ANSI/IEEE Standard 81, or approved equivalent testing, and documented. Documentation shall include all test apparatus information and provide results in both tabular and graphical formats.

2.02 PANEL CONSTRUCTION

A. Design and Fabricate all control panels in accordance with UL 508A. All panels shall bear the UL listing mark for enclosures stating "Listed Enclosed Industrial Control Panel" per UL 508A.

B. Assemble and test all controls panels at the factory. Notify County of factory testing a minimum of 2 weeks in advance (in County) and 4 weeks in advance (outside County) to allow County the opportunity to witness testing.

C. All wiring in panels shall be in duct type wireway or a flexible protective sleeve where wireway is not practical. All wire shall be terminated to terminal block. The use of wirenuts or similar connections are prohibited.

D. All panel components shall be rated for the maximum expected temperature of the control enclosure. Provide calculations showing that all components meet the maximum expected control panel temperature including solar heat gains. Appropriate cooling methods shall be provided as required.

E. All outdoor panels shall be NEMA 4X white painted 304 Stainless Steel. All indoor panels shall be NEMA 4X 304 Stainless Steel for process areas or NEMA 12 painted steel for non-process areas. All panels shall be provided with the appropriate quantity of corrosion-inhibiting vapor capsules.

F. Lighting: Door switched LED lighting with protective lighting cover operating at 24Vdc.

G. Receptacles: DIN Rail mounted as manufactured by Allen-Bradley, Weidmuller, or Phoenix Contact.

H. All enclosures shall be equipped with Lockable 3-point latching system that maintains enclosure NEMA rating without the use of clamps.

I. Manufacturers:

1. Hoffman.

2. Rittal.

3. Hammond.

J. Control Panel General Equipment; select all exact component types as required for application:

1. Circuit Breakers:

a. UL 489 Listed.
b. DIN Rail Mounting.
c. Manufacturers:

i. Schneider Electric/Square D; Multi 9 Series.
ii. Allen-Bradley; 1489-A series.
iii. Weidmuller.
iv. Phoenix Contact.

2. Terminal Block:

a. Screw Compression Clamp.
b. Single level.
c. Provide 20 percent spare installed terminal block.
d. Rated for minus 55 to 110 degree C.
e. DIN Rail Mounting.
f. Label all terminal block with appropriate numbers.
g. Rated 600Vac.
h. Manufacturers:

i. Schneider Electric/Square D.
ii. Allen-Bradley.
iii. Weidmuller.
iv. Phoenix Contact.

3. Control Relays:

a. Plug-in socket type.
b. Rail Mounted.
c. LED Indicator.
d. Push-to-test type.
e. Rated for minus 25 to 40 degree C.

f. Provide hold-down clips.
g. Manufacturers:

i. Schneider Electric/Square D.
ii. Allen-Bradley.
iii. Weidmuller.
iv. Phoenix Contact.

4. Enclosure Surge Suppression:

a. IP 20 DIN Rail Mounted.
b. Pluggable surge device with base socket.
c. Grounded via DIN Rail.
d. LED indication where available.
e. UL 1449 Listed.
f. Provide surge suppression for:

i. Incoming power connections.
ii. Analog signal lines.
iii. Communication signal lines.

a. Manufacturers:

i. Phoenix Contact.
ii. Weidmuller.
iii. Citel.
iv. Emerson/Edco.

5. Outdoor Surge Suppression:

a. NEMA 4X Enclosure.
b. UL 1449 Listed.
c. LED Indication where available.
d. Provide surge suppression for all field 2,3,and 4-wire instrumentation.
e. Manufacturers:

i. Phoenix Contact.
ii. Weidmuller.
iii. Emerson/Edco.

6. Power Supplies:

a. IP20 DIN Rail Mounted.
b. Provide separate power supplies to power panel components and field devices.
c. UL 508 Listed.
d. Manufacturers:

i. Schneider-Electric
ii. Allen-Bradley.
iii. Weidmuller.
iv. Phoenix Contact.

7. Uninterruptible Power Supply (UPS):

a. 24Vdc Input/Output UPS with separately mounted battery.
b. UL508 Listed.
c. Minimum Backup Runtime: 10 minutes.
d. DIN Rail Mounted.
e. Manufacturers:

i. Phoenix Contact.
ii. Weidmuller.
iii. PULS.

2.03 NETWORK COMMUNICATIONS

A. General:

1. Digital communications between controllers, operator workstations, and smart field components (such as intelligent MCCs, Generators, Automatic Transfer switches, and packaged control systems) shall be via Ethernet. The Ethernet protocol utilized shall be compatible with the facility PLC system without the need for converter modules or specialized third party communications equipment.

2. Design networks for fault tolerance and for management utilizing SNMP. All general in plant networks shall be a Gigabit Ethernet fiber optic ring topology utilizing a proprietary ring protocol or using RSTP with appropriate portfast port designations to allow for fast recovery following a link failure. Configure all ports to match speed and negotiation of connected equipment.

3. Design of network systems shall include IP address and VLAN assignments coordinated with the County and existing County

infrastructure. ACL rules and required TCP/IP ports shall be determined to ensure proper communications and security between facilities.

4. Facilities shall communicate across the County Wide Area Network (WAN) via County radio communications, Digital Cellular, or Metro-Ethernet connections. Coordinate required communications for each specific site with the County.

5. Network components specified shall be based on the state of the art during design and construction. Contractor shall provide the latest state of the art hardware available during the submittal process, and shall upgrade features as necessary to meet functional requirements. Network components listed outline minimum requirements for each component.

6. Provide surge suppression for network connected equipment located in vulnerable locations such as connections between buildings or near AC power lines. Provide adequate separation or shielding between communications cabling and other types of cable systems that could interfere with communications.

7. The following outlines the minimum requirements for facility network systems:

    a. IP Address and VLAN assignment and configuration for all network connected components.
    b. Network switch, router, and firewall configuration for in-facility and County WAN communications including VPNs and QoS.
    c. Fault tolerant and high availability design and implementation.
    d. Network management including incorporation into the County SCADA network management software.

B. Network Hardware Components:

1. Select network components to meet requirements for each facility for proper communications and security in accordance with Industry Standards. The following components outline general components to be used within the SCADA system. Additional types of components may be required such as layer 3 switches and routers and should be selected as required utilizing manufacturers similar to the below listed.

2. Industrial Network Media Converter:

a. Function: Convert fiber optic Ethernet signal 100BASE-FX to copper 10/100BASE TX. Used to extend connections from a local managed switch where copper connections are impractical.
b. Support Fiber Optic Type Specified.
c. Fiber Optic Connector: SC or LC.
d. Power: 24Vdc.
e. IP 20 enclosure.
f. Temperature rating: 0 to 60 degrees C.
g. UL 508 Listed.
h. DIN Rail mounted.
i. Manufacturers:

    i. N-Tron.
    ii. Hirschmann.
    iii. Schneider-Electric.

3. Industrial Network Layer 2 Switch, Ethernet, DIN Rail:

    a. Function: Network communications between PLCs, Ethernet connected field components, and HMIs within a facility.
    b. Minimum of 2 Gigabit SFP ports and 6 RJ-45 ports. Select SFP modules as required. Provide ports as required including a minimum of 2 spare ports.
    c. Support 10/100/1000 BASE-TX and Gigabit fiber Ethernet for backbone communications.
    d. Layer 2 software.
    e. Supports SNMP, IEEE 802.1D, IEEE 802.1Q, Multicast IGMP, IEEE 802.3x.
    f. Proprietary ring structure and RSTP capabilities.
    g. Power: 24Vdc.
    h. IP 20 Enclosure.
    i. Temperature rating: 0 to 60 degrees C.
    j. UL 508 Listed.
    k. DIN Rail Mounted.
    l. Manufacturers:

        i. N-Tron 700 Series.
        ii. Hirschmann RS20 series.
        iii. Schneider-Electric.

4. Industrial Network Layer 2 Switch, Ethernet, Rackmount:

a. Function: Network communication backbone switch for process control located in 19-inch rack used for process control communications within a facility.
b. Provide network switching for a minimum of 24 ports within a single chassis.
c. Minimum of 2 Gigabit SFP ports and 22 RJ-45 ports. Select SFP modules as required. Provide ports as required including a minimum of 2 spare ports.
d. Support 10/100/1000 BASE-TX and Gigabit fiber Ethernet for backbone communications.
e. Layer 2 software.
f. Supports SNMP, IEEE 802.1D, IEEE 802.1Q, Multicast IGMP, IEEE 802.3x.
g. Proprietary ring structure and RSTP capabilities.
h. Power: 120Vac.
i. IP 20 Enclosure.
j. Temperature rating: 0 to 60 degrees C.
k. UL 60950 Listed.
l. 19-inch rack mounted.
m. Manufacturers:

    i. N-Tron 7000 Series.
    ii. Hirschmann Mach 1000 series.
    iii. Cisco IE 3010

5. Workgroup Switch, Ethernet, Rackmount:

    a. Function: Network communication switch for communications outside of the process control system or between facilities.
    b. Provide network switching for a minimum of 24 ports within a single chassis.
    c. Minimum of 2 Gigabit SFP ports and 22 RJ-45 ports. Select SFP modules as required. Provide ports as required including a minimum of 2 spare ports.
    d. Support 10/100/1000 BASE-TX and Gigabit fiber Ethernet for backbone communications.
    e. Layer 2 software.
    f. Supports SNMP, IEEE 802.1D, IEEE 802.1Q, Multicast IGMP, IEEE 802.3x.
    g. RSTP, Link Aggregation capabilities.
    h. Stackable.

i. Power: 120Vac.
j. IP 20 Enclosure.
k. Temperature rating: 0 to 50 degrees C.
l. UL 60950 Listed.
m. 19-inch rack mounted.
n. Manufacturers:

i. Cisco 2960 series.
ii. Dell.
iii. HP.

2.04 2RADIO COMMUNICATIONS

A. General: Coordinate with County for communications connection between facility and the County wide area network where required. Work with the County to determine radio communications infrastructure necessary for communications for each facility. County will provide information on required components for each specific site.

B. Coordinate and test all installations with the County Radio Group.

2.05 STRUCTURED CABLING

A. General: Provide structured cabling system for each facility as required to support communications at the facility. Structured cabling systems include all copper and fiber optic communications cabling as well as network equipment enclosures, racks, and patching equipment.

B. Floor Mounted Rack Enclosures:

1. Racks Type: ANSI EIA 19-inch, 45U tall with required depth supported on both sides by vertical wire management system. Securely anchor racks to the floor with manufacturer's anchor kit.

2. Material: Black powder coated Aluminum with steel EIA rails.

3. Doors: Front and back double hinged, lockable, vented door assemblies.

4. Cabling Sections: Aluminum rack cabling section, including formed assembly, lockable cable rings and assembly hardware.

5. 19-inch EIA rack mountable shelves for supporting equipment as required.

6. Provide nameplate for each rack with appropriate name/tag number.

7. Provide air flow baffles between racks to increase air movement.

8. Provide cable management cage to accommodate front to back rack wiring. Provide hooks and rings for cable management. Use Velcro cable ties to secure cables.

9. Provide vertical PDUs for racks to support all equipment plus spare.

10. Provide electrical surge protective devices and grounding for component protection.

11. Manufacturers:

    a. Ortronics.
    b. Hoffman.
    c. Dell.

C. Wall Mounted Rack Enclosures:

1. Racks Type: ANSI EIA 19-inch, minimum 12U tall with overall height and depth as required.

2. Material: Black powder coated Aluminum with steel EIA rails.

3. Doors: Four side access with solid front door. Double hinged to allow front and rear access to equipment.

4. 120Vac fan assembly.

5. Cabling Sections: Aluminum rack cabling section, including formed assembly, lockable cable rings and assembly hardware.

6. 19-inch EIA rack mountable shelves for supporting equipment as required.

7. Provide nameplate for each rack with appropriate name/tag number.

8. Provide cable management accessories. Use Velcro cable ties to secure cables.

9. Provide vertical PDUs for racks to support all equipment plus spare.

10. Provide electrical surge protective devices and grounding for component protection.

11. Manufacturers:

    a. Ortronics.
    b. Hoffman.

D. Rack Mounted UPS Systems:

1. Function: Provides backup power and power regulation for rack-mounted server and network components and peripherals.

2. Mounting: Suitable for 19-inch rack mounting or floor mounting required.

3. Size: As required for connected load, 1.5 kVA minimum. Coordinate feeder breaker size.

4. Backup: Minimum 10 minutes at full load.

5. Warranty: 1 year.

6. UL Listed.

7. UPS Technology: Line Interactive.

8. Surge Suppression: Manufacturer Standard.

9. 1 RJ-45 Ethernet, monitoring. Integrate into the SCADA system.

10. Software: Manufacturer standard software installed on servers and workstations to provide "soft shutdown" of computer hardware.

11. Provide power cables as required.

12. Provide in a redundant or an N+1 configuration to ensure loss of a single UPS will not create a full system failure.

13. Manufacturers:

    a. APC.
    b. Powerware.
    c. Liebert.

E. Category 6/5e Communication Cabling:

1. Provide CAT 6/5e cables for Ethernet communications as required. Provide with appropriate RJ-45 connectors that securely mate into associated equipment and jacks.

2. Provide cables meeting flame propagation test requirements of UL 723.

3. Provide plenum/riser listed cables as required.

4. Provide cables in accordance with ANSI/TIA/EIA-568-B.2 6/5e and ETL verified.

5. Provide cables conforming to applicable UL/NEC ratings. CMR, CMX-Outdoor rated.

6. Shielding:

7. MCCs/VFDs or other high noise installations: Shielded.

8. All other locations: Unshielded.

9. Sunlight and Oil Resistant PVC or PVDF outer jacket.

10. Insulation: FEP – Fluorinated Ethylene Propylene.

11. Maximum Operating Voltage: 300 or 600 Vrms as required by installation.

12. Manufacturer:

    a. Belden DataTuff.
    b. Approved equal.

F. Fiber Optic Cabling:

1. Comply with TIA/EIA 568.

2. Rating: UL Listed OFNR, minimum and OFNP where required.

3. Fiber:

    a. Multimode: 50/125 micron, OM3, multimode. Laser optimized for gigabit performance.
    b. Singlemode: 9/125 micron.

4. Type:

    a. Direct equipment connections: Breakout, tight-buffered.
    b. All other installations: Distribution, gel free, loose tube or tight-buffered.

5. Fiber Count

    a. 4 fibers per breakout cable, minimum.
    b. 12 fibers per distribution cable, minimum.

6. All Dielectric Construction: No electrically conductive components in fiber optic cable are allowed.

7. Helically Wound: Buffered fibers helically wound; approximately 5 turns per meter.

8. Distribution Strength Member: Fiberglass epoxy rod, aramid fiber, kevlar.

9. Protective Covering:

    a. UV, Water, and Fungus resistant.
    b. PVC or Fluoropolymer.

10. Continuous and free from holes, splices, blisters, and other imperfections.

11. Minimum Bend Radius:

    a. Short term Under Tension: 20 times cable diameter.
    b. Long term Without Tension: 15 times cable diameter.

12. Manufacturer:

    a. Corning.
    b. Optical Cable Corporation.

G. Fiber Optic Connectors:

1. Provide in accordance with requirements of TIA/EIA 568.

2. Pull Strength: 0.2 N minimum.

3. Ferrule: Ceramic with factory-polished fiber stub.

4. Durability: Sustain minimum 500 mating cycles without violating other requirements.

5. Ferrules: Free floating low loss ceramic.

6. Polarizing key on duplex connector systems.

7. Attenuation: Maximum of 0.5 dB per connector pair.

8. Connector Type: SC for multimode and LC for singlemode or as required to match component mating connector.

9. Manufacturers:

    a. Corning.
    b. Ortronics.
    c. Approved Equal.

H. KVM Console:

1. Function: Provides local viewing and control of Rackmounted servers.

2. Integrated rackmount Keyboard, LCD Monitor, and mouse.

3. Provide console KVM, installation kit, and required cables for a completely function console KVM system.

4. 19-inch rack mountable.

5. 1 U mounting height.

6. Display:

    a. Wide Screen: 17-inch TFT LCD, 16:9, minimum.
    b. Resolution: 1920 x 1080, minimum.
    c. Support resolutions down to 640 x 480.
    d. Contrast Ratio: 500:1 minimum.
    e. Brightness: 250 cd/m2.
    f. Viewing Angle: 140 x 120 degrees (H x V).
    g. 16 million colors.

7. Keyboard/Mouse:

    a. Notebook type with number pad.

b. Touchpad mouse.

8. Interfaces: 8 ports, minimum.

9. Warranty: 3 years.

10. Manufacturer:

    a. StarTech.
    b. Samsung.
    c. Approved Equal.

I. Cable Management:

1. Provide Cable management documentation for a telecommunications, fiber optic, data communications, network and telephone circuits and components provided for each facility. As a minimum include the following:

    a. All Field cabling, and cable routing
    b. Fiber Optic Patch Panel Layouts.
    c. All network connected devices.
    d. All jacks and outlets.
    e. Develop a cable and fiber numbering system based on Facility and source and destination. Use this numbering system and include detailed cable and connection schedule.

2.06 INSTRUMENTATION

A. The CONTRACTOR shall purchase and install instrumentation equipment as standardized below. The equipment aligns with what Polk County Utilities currently utilizes. Exact models shall be determined during design. Reference Sections 450-B, 516, 550-C, and 650-B to confirm specific modifications to general items noted below:

1. Liquid Level

    a. Differential Pressure (Preferred for ground storage tanks)

        i. Rosemount
        ii. Siemens
        iii. Foxboro

    b. Radar (Preferred for chemical tanks and digesters)

i. Vega
ii. Siemens

c. Ultrasonic

i. Siemens SITRAN LU
ii. Endress Hauser FMU95 S

d. Submersible

i. Endress and Hauser
ii. Keller

2. Pressure Indicating and Differential Transmitters

a. Rosemount
b. Siemens
c. Foxboro

3. Pressure Switches

a. Ashcroft B-Series
b. Ametek
c. Wika

4. Pressure Gauges

a. Ashcroft
b. Ametek
c. Wika

5. Flow Meters

a. Insertion electromagnetic flow meters are the preferred choice for clean low turbidity water applications and clamp-on ultrasonic type are preferred for dirty water applications where suitable. Full bore electromagnetic flow tubes shall be used for all other applications including chemical feed lines.
b. Electromagnetic

i. Foxboro
ii. Siemens
iii. ABB

c. Ultrasonic – see Section 516 for specific requirements

i. GE AT868
ii. Siemens

d. Insertion Electromagnetic

i. McCrommeter FPI

6. Chemical Metering Pumps

a. Prominent

7. Chlorine Analyzers

a. ProMinent Dulcometer

8. pH Element

a. ProMinent – pH sensor for use with Dulcometer

9. Dissolved Oxygen

a. Insite IG
b. Rosemount
c. Hach LDO

10. Oxidation Reduction Potential

a. Insite IG
b. Rosemount
c. Hach

11. Turbidity Sensor

a. Swann Analytical.

12. Motor Operated Valves

a. Beck Actuators
b. Auma Actuators

13. Total Suspended Solids (High and Low) and NTU

a. InsiteIG

b. Hach Solitax

14. Sludge Blanket Monitor

    a. Cerlic CBX

PART 3 - PAC REQUIREMENTS

3.01 GENERAL REQUIREMENTS

A. Provide equipment compatible with the County's existing central SCADA system to ensure proper communications and data transfer.

B. Provide all PAC system components, cables, and additional ancillary equipment required for a completely functional PAC system.

C. Facility-Based PAC systems shall be based on the following:

1. Process Control and Monitoring: Modicon M340.

2. Remote I/O Systems Advantys STB.

D. Remote/RTU-Based PAC systems shall be based on the following:

1. Scheider Electric Modicon M340 PACs.

2. Reference latest WW-22 Series Drawings, and WW-22-6, for Standard components in Lift Station Control Panels.

E. PAC I/O

1. New unit processes shall have decentralized I/O to limit long runs of buried copper communication. Fiber optic Ethernet communications shall be used to extend communications to distributed processors and remote I/O systems.

2. Provide each PAC with a minimum of 20 percent (minimum 2 points) installed spare I/O, of each I/O type, including the necessary terminal block, interposing relays, and surge protection. Pre-wire all I/O to field terminal blocks. Spare I/O is in addition to I/O provided for planned future additions.

3. Provide at least 20% and a minimum of 2 spare slots in each PAC chassis to accommodate future I/O cards. If the number of spare slots required exceeds the PAC chassis capacity then provide subpanel space

and wireway to accommodate a future chassis. Provide empty DIN rail space required to accommodate future terminal block to support the spare slots.

4. Use separate I/O modules for parallel controlled equipment such as multiple high service pumps. Pumps should be split across multiple I/O cards such that the failure of a single I/O card does not impact the operation of all pumps.

5. Provide interposing relays for all discrete inputs and outputs.

6. Provide all PAC system components, cables, and additional ancillary equipment required for a completely functional PAC system.

F. PAC I/O

1. Provide PAC I/O layout similar to other County lift station control panels for similarity between I/O wiring and PAC I/O addressing in the PAC program.

2. Provide each PAC with a minimum of 20 percent (minimum 2 points) installed spare I/O, of each I/O type, including the necessary terminal block, interposing relays, and surge protection. Pre-wire all I/O to field terminal blocks. Spare I/O is in addition to I/O provided for planned future additions such as planned future pumps or odor control.

3. Provide at least 20% and a minimum of 2 spare slots in each PAC chassis to accommodate future I/O cards. If the number of spare slots required exceeds the PAC chassis capacity, provide subpanel space and wireway to accommodate a future chassis. Provide empty DIN rail space required to accommodate the future terminal block to support the spare slots.

4. Use separate I/O modules for parallel controlled equipment such as multiple pumps where feasible. Pumps should be split across multiple I/O cards such that the failure of a single I/O card does not impact the operation of all pumps.

5. Provide interposing relays for all discrete outputs.

G. PAC Requirements:

1. Provide complete microprocessor-based programmable device plug-in power supply, communications, and I/O modules for process control

and monitoring. Provide all components as necessary for a complete system.

2. Chassis:

    a. Type: Modicon M340, BMX series.
    b. Number of Slots: Sufficient for the number of modules required, including spares, plus the required number of empty slots, minimum of 8. Provide expansion bases as required.
    c. Provide cover on empty slots.

3. Processor Modules (CPU):

    a. Type: Modicon M340, BMXP342020.
    b. Supports 1024 discrete and 256 analog I/O.
    c. Supports up to 4 racks.
    d. USB and Modbus communication ports, minimum.
    e. Memory: 2 Mbyte internal RAM with supplied compact flash memory card for backup of programs, minimum.

4. Power Supply Modules:

    a. Type: Modicon M340, BMXCPS2010.
    b. Input Voltage: 24V dc.
    c. Quantity: One for each processor chassis and one for each expansion I/O chassis. Include sufficient capacity to power future expansion of all spare (empty) chassis slots.

5. Network Communications Modules:

    a. Type: Ethernet and Fast Ethernet, 100 Mbps.
    b. Communications Module: Modicon M340, BMXNOE100.

        i. Memory: Supplied Flash Memory Card.
        ii. Configure to scan motor controller I/O and backup motor controller and overload device settings.

6. RTU Modules:

    a. Type: DNP3 Ethernet and Serial.
    b. Communications Module: Modicon M340, BMXNOR200H

        i. Memory: Supplied Flash Memory Card.

ii. Configure DNP3 settings and thresholds for appropriate scan and data transmission intervals.

7. Discrete Input, ac (DI):

   a. Voltage: 24Vdc.
   b. Points per Modules: 16, isolated.
   c. Modicon M340, BMXDDI1602.

8. Discrete Output (DO):

   a. Relay Output, 2A.
   b. Points per Module: 8.
   c. Modicon M340, BMXDRA0805.

9. Analog Input (AI):

   a. Signal: 4 to 20 mA at 24V dc.
   b. Analog Input Points per Module: 8, isolated.
   c. Modicon M340, BMXAMI0810.

10. Analog Output (AO):

    a. Signal: 4 to 20 mA at 24V dc.
    b. Analog Output Points per Module: 4, isolated.
    c. Modicon M340, BMXAMO0410.

PART 4 - SCADA HARDWARE AND SOFTWARE REQUIREMENTS

4.01 GENERAL REQUIREMENTS

A. Provide equipment compatible with the County's existing central SCADA system to ensure proper communications and data transfer.

B. SCADA controls shall be integrated utilizing VTScada with the licenses for the latest version supplied as part of the construction effort. CONTRACTOR must verify and utilize the VTScada version(s) currently in use by PCU prior to integrating PLC/SCADA system.

C. VTScada licenses must be provided with sufficient tags for at least 30% spare tags.

D. Coordinate all network addressing for components with the County.

E. Install seperate SCADA software on separate virtual machines to reduce hardware requirements but maintaining a clean configuration for each server and application to allow for simple migration, backup, and recovery utilizing the County's VM backup system.

4.02 HARDWARE REQUIREMENTS

A. The following hardware specifications indicate minimum quality and components at the time the standard was adopted. Provide manufacturer's latest state of the art model capable of providing high performance operation of the SCADA system and meeting the intent of the minimum requirements listed below. Select exact opinions to exceed the minimum requirements of all software installed on a given machine.

B. SCADA server hardware and OS (Primary and Backup where applicable)

1. Provided by the County with Windows OS and VMWare

C. Large Screen Flat Panel Displays

1. Note: Component specified herein is based on the state of the art during code approval. Provide the latest state of the art hardware available during the submittal process, and upgrade features as necessary. The following specifications outline minimum requirements for each Wall Display.

2. Function: Provide viewing of multiple source inputs.

3. Mounting: Wall mounting with swingout wall mount and cable management.

4. Screen Size: 42 inch, Widescreen (16:9), minimum.

5. Resolution: 1920 x 1080 pixels native.

6. Contrast Ratio: 8,000,000: 1, minimum.

7. LED Backlight.

8. Audio: Stereo (2-channel) audio speakers.

9. Power: 120VAC.

10. Energy Star Compliant.

11. Interface Ports:

    a. Ethernet RJ-45.
    b. (4) HDMI.
    c. (1) PC Input, D-sub.
    d. USB Port.
    e. Component Input.
    f. Composite Input.
    g. RF Input.

12. Manufacturers:

    a. Samsung.
    b. Vizio.
    c. Sharp-Aquos.
    d. Approved Equal.

D. Flat Panel Displays

1. Note: Component specified herein is based on the state of the art during code adoption. Provide the latest state of the art hardware available during the submittal process, and upgrade features as necessary. The following specifications outline minimum requirements for each Display.

2. Function: Provide viewing of SCADA client.

3. Mounting: Wall or base mounting as required for desktop mounting.

4. Screen Size: 27 inch, Widescreen (16:9), minimum.

5. Resolution: 1920 x 1080 pixels native.

6. Brightness: 350 cd/m^2

7. Contrast Ratio: 2,000,000: 1, dynamic, minimum.

8. Backlight: LED.

9. Power: 120VAC.

10. Energy Star Compliant.

11. Interface Ports:

a. VGA.
b. DVI-D (HDCP).
c. HDMI.
d. USB Port.

12. 3-year warranty.

13. Manufacturers:

    a. Dell.
    b. Hewlett-Packard (HP).
    c. Samsung.
    d. Approved Equal.

4.03 SOFTWARE REQUIREMENTS

A. General: Coordinate with County all software requirements. Any licenses purchased shall be transferred to the County.

PART 5 - GRAPHIC AND PROGRAMMING STANDARDS

5.01 GENERAL REQUIREMENTS

A. See Sections 413, 519, and 611 for specific screens and general visual presentation.

PART 6 - SUBMITTALS AND O&M MANUALS

6.01 GENERAL REQUIREMENTS

A. Operation and Maintenance (O&M) Manuals:

1. Content and Format:

    a. Complete sets of separately bound O&M manuals.
    b. Sufficient detail to allow operation, removal, installation, adjustment, calibration, maintenance and purchasing replacements for each component.
    c. Final versions of Legend and Abbreviation Lists.

2. Submission Requirements: As a minimum provide for the following submittals.

    a. Preliminary O&M Manuals.

b. Final O&M Manuals.

3. Include Manufacturer's O&M literature for each component, electrical device, and mechanical device included. Organize the literature by the component identification numbers. The material shall address the following, as a minimum:

   a. Operations procedures.
   b. Installation requirements and procedures.
   c. Maintenance requirements and procedures.
   d. Troubleshooting procedures.
   e. Calibration procedures.
   f. Internal schematic and wiring diagrams.
   g. Component Calibration Sheets from ORT.
   h. List of spares, expendables, test equipment, and tools provided.

PART 7 - TESTING REQUIREMENTS

7.01 GENERAL REQUIREMENTS

A. CONTRACTOR to perform testing on integrated systems at key stages in the process. At a minimum, Operational Readiness Testing (ORT) and Performance Acceptance Testing (PAT) shall be performed. Factory Testing and Staging Testing may be added at COUNTY or ENGINEER discretion. Minimum testing requirements shall be as follows:

1. Operational Readiness Test (ORT): Prior to startup test period and PAT, inspect, test, and document that entire Process Instrumentation and Control System (PICS) is ready for operation.

   a. Loop/Component Inspections and Tests:

      i. Check PICS for proper installation, calibration, and adjustment on a loop-by-loop and component-by-component basis.
      ii. Provide space on forms for signoff by PICS subcontractor.
      iii. Use loop status report to organize and track inspection, adjustment, and calibration of each loop and include the following:

         a) Project name.
         b) Loop number.
         c) Tag number for each component.
         d) Checkoffs/Signoffs for Each Component:

1) Tag/identification.
2) Installation.
3) Termination wiring.
4) Calibration/adjustment

e) Checkoffs/Signoffs for the Loop
1) Field Device Signals Transmitted to the PLCs are Operational: Received/sent, processed, adjusted.

iv. Component calibration sheet for each active field component (except simple hand switches, lights, gauges, and similar items) include the following:

a) Project name.
b) Loop number.
c) Component tag number or PLC register address.
d) Component code number for field device elements.
e) Manufacturer for field device elements.
f) Model number/serial number for field device elements.
g) Summary of Functional Requirements, for Example:
1) Indicators and recorders, scale and chart ranges.
2) Transmitters/converters, input and output ranges.
3) Computing elements' function.
4) Controllers, action(direct/reverse) and control modes (P&ID).
5) Switching elements, unit range, differential (fixed/adjustable), reset (auto/manual).
h) Calibrations, for Example, but not Limited to:
1) Analog Devices: Actual inputs and outputs at 0,10, 50, and 100 percent of span, rising and falling.
2) Other Field Devices: Actual trip points and reset points.
3) Controllers: Mode settings (P&ID).
4) Actual inputs or outputs of 0, 10, 50, and 100 percent of span, rising and falling.
5) Space for comments.
i) Maintain loop status reports, valve adjustment sheets, and component calibration sheets at site and make them available to Engineer at all times.
j) Test and calibrate all fiber optic data links. Document that the dB links are within specified limits and the data communication is error free at specified baud rates.
k) These inspections and tests will be spot checked by Engineer.

l) Engineer reviews loop status sheets and component calibration sheets and spot-check their entries periodically, and upon completion of ORT. Correct deficiencies found.

2. Performance Acceptance Tests (PAT):

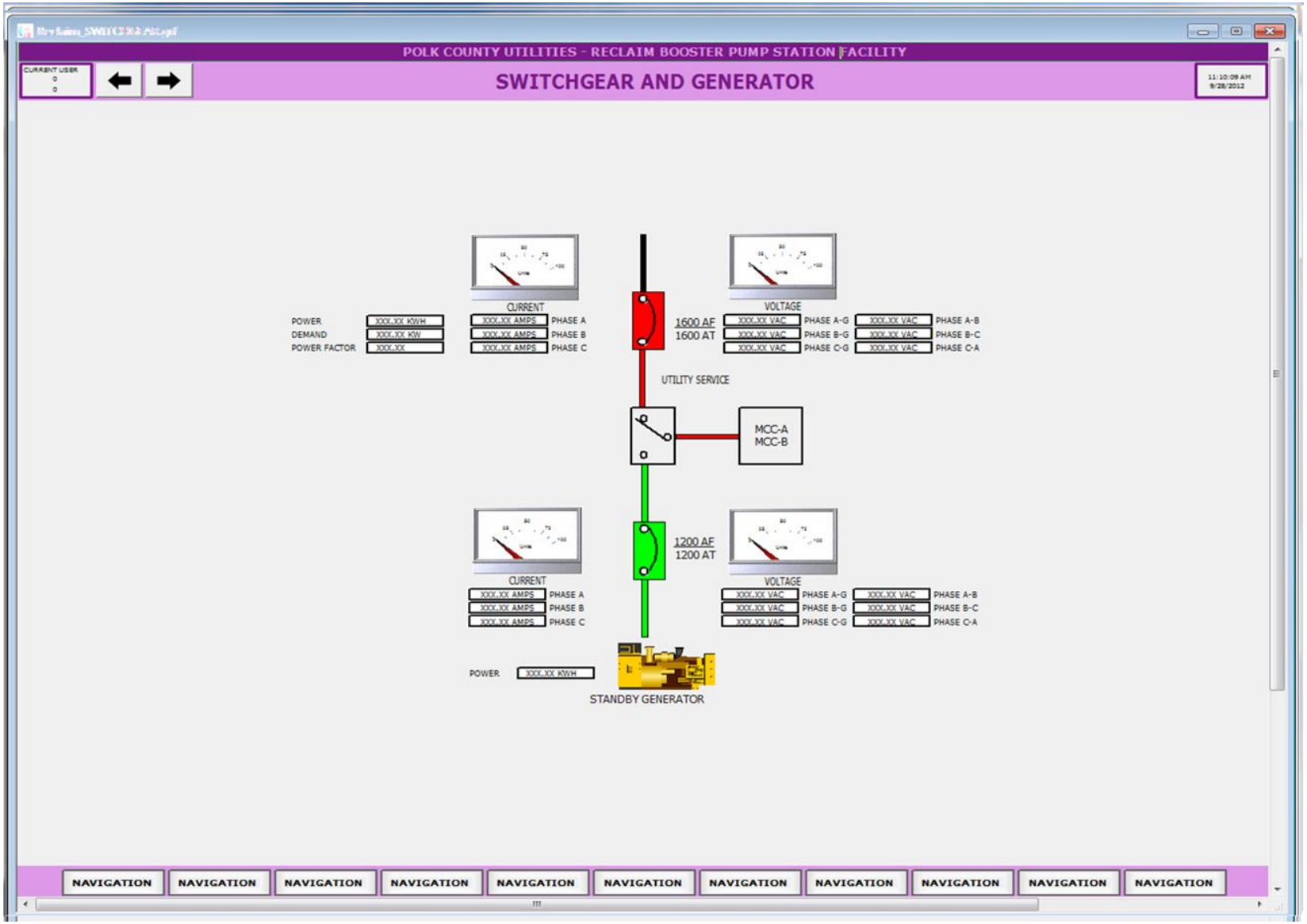
a. Once ORT has been completed and facility has been started up, perform a witnessed PAT on complete PICS to demonstrate that it is operating as required by the Contract Documents. Demonstrate each required function on a paragraph-by-paragraph, loop-by-loop, and site-by-site basis.
b. Loop-specific and non-loop-specific tests same as required for Factory Testing except that entire installed PICS tested using actual process variables and all functions demonstrated.
c. Perform local and manual tests for each loop before proceeding to remote and automatic modes.
d. Where possible, verify test results using visual confirmation of process equipment and actual process variable. Unless otherwise directed, exercise and observe devices supplied by others, as needed to verify correct signals to and from such devices and to confirm overall system functionality. Test verification by means of disconnecting wires or measuring signal levels is acceptable only where direct operation of plant equipment is not possible.
e. Provide updated versions of the following documentation available to Engineer at site, both before and during tests.

i. One copy of submittals applicable to the equipment to be tested.
ii. One copy of the Drawings and Specifications together with addenda and applicable change orders.
iii. Make one copy of all O&M manuals.

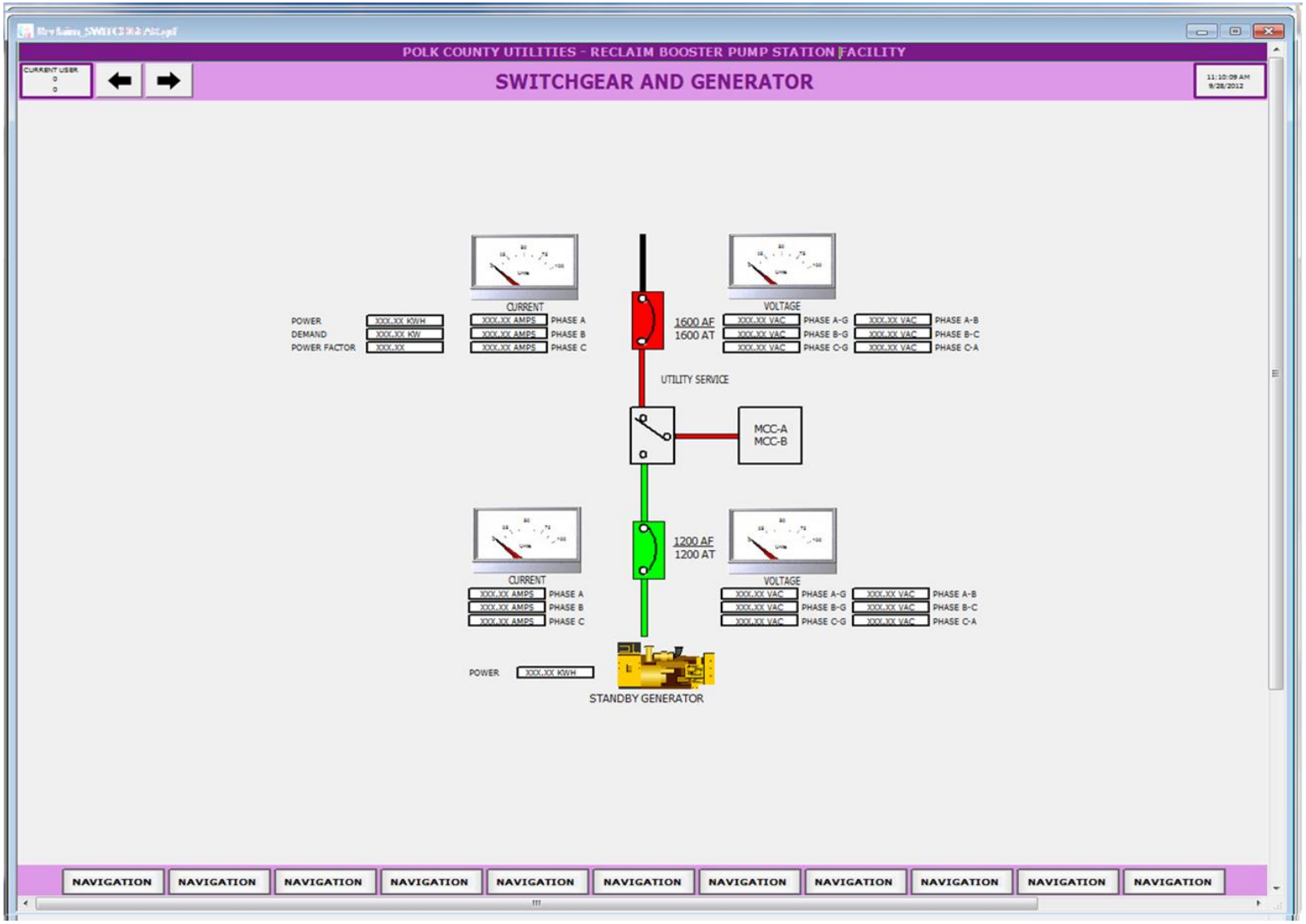
f. Specialty Equipment: For certain components or systems provided under this section but not manufactured by PICS Subcontractor, provide services of qualified manufacturer's representative during installation, startup, demonstration testing, and County training. Refer to Article Onsite Services in PICS Subsystems for specific requirements.

g. Instruments shall be tested at 0 percent, 25 percent, 50 percent, 75 percent, and 100 percent of scale through wired and wireless communications to the PLC and to the HMI insofar as is practical and not to put effluent quality at risk.

SCADA STANDARDS



SCADA STANDARDS



SCADA STANDARDS