

Overview

Twenty seven (27) of the stations currently have the same PLC, HMI (see attachment) and operating program with the remainder to be upgraded in the coming year. The SCADA System proposed must be capable of being expanded to handle a minimum of 50 more stations. It is the intention of the City to use this SCADA system for monitoring all the pump stations connected to it for station functions listed in this document, although no remote control is to be used at time of implantation it shall be available through hardware/software installed in the initial installation.

SCADA Stations:

The City of Oak Ridge is requiring two (2) different monitoring stations to be live at all times. The first location will be at the Wastewater Treatment Plant located at 200 Monterey Road. This site will be able to monitor and view each individual pump station's operation and status; this will include any alarms at any location. This site shall also be the location that all poled data (listed in this documentation) is received and sent to the city's asset management program (Infor) via SQL table transfer or CSV files or approved equivalent. The Infor EAM uses a MS-SQL Database server. The data transferred will be used to create work order and track hours of run time for assets. The Water plant located at 1616 Bear Creek Road shall be the second monitoring site. This site shall be a duplicate of the station located at the Wastewater Plant with the exception of the storage and moving of the required CSV files. Both locations shall have multiple user security levels from just monitoring and acknowledging alarms to changing alarm set points on the front end displays.

Pump Stations:

The Pump Stations to be monitored all have the same controls in them. These controls consist of Primary and Back-Up controller. The Primary Controller is the controller that operates all of the functions on a day to day basis. The Back-Up controller is live at all times but only becomes active when there is a high level alarm or when the selector switch is in the Back-Up position.

Each station has two identical pumps in it with one pump being adequate for pumping during normal flow conditions. The second pump is installed giving each station redundant pumping capabilities in case one pump fails or when needed in high flow conditions. The two pumps alternate between pump cycles and on a lead/lag condition.

Each controller at the Pump Stations has its own 10 segment level probe for monitoring the liquid level in the wet well. As the level in the wet well increases consecutive rings on the probes are covered in the liquid media and the relay monitoring it send a contact closure to an input on the PLC to indicate what level the liquid is at.

As stated previously each station has two completely separate controls which standalone from any outside logic or control. The primary controller at each station is a Square D Twido Compact Base (24) 24 VDC Inputs and (16) Outputs with the part number TWDLCD40DRF. This PLC is equipped with a Square D RS485 Module with the part

number TWDNAC485T. The HMI at each station is a Square D 5.7" Color Touchscreen with Ethernet capabilities with the part number XBTGT2330. Each control panel also contains an unmanaged Conexium industrial grade switch manufactured by Square D and has the part number TCSEU053FN0. The Secondary or back-up controller is manufactured by MPE and is their Duplex Controller with the part number 010-120-122P. Communications from this device is provided via a RS232 Serial Port with Modbus Protocol.

Communications

The City of Oak Ridge has chosen Verizon Wireless to be the provider of the wireless communications between the various pumps station and the master station. All proposals submitted shall be based upon this communications network. This decision was based on several factors some of which are:

- Verizon Wireless has coverage at all pump station locations.
- The State of Tennessee (the City of Oak Ridge is included in the contract) has a contract with Verizon Wireless to provide the required service at a substantial savings.
- Verizon Wireless will provide a private VPN through their network.
- Verizon Wireless maintains network.

System Requirements

The City of Oak Ridge is intending that the proposal provided performs at a minimum the following requirements. When equipment is called out or specified in these requirements the City expects these parts to be utilized and any deviation from those parts specified to be clearly called out in the proposal with full explanation of why another part is proposed.

The wastewater pump station will monitored via two (2) independent HMI screens, with one screen being located at the WWTP at 200 Monterey Rd, and the other located at the WTP located at 1616 Bear Creek Rd. Each of these HMI screens shall be a Square D Model XBTGT7340. These HMIs shall monitor all the pump stations in the system with the functions available.

1. Each station in the system shall be polled approximately every 15 minutes. Each time a station is polled the following information will be shown on both HMIs and if applicable logged data shall be transferred to the appropriate database table which is available for extraction from an open database format.
 - Any alarm conditions that are present. An alarm condition at any station shall enable the alarm contact output on each HMI to ring an audible alarm which is provided by the City. An alarm condition shall also have some highly noticeable indication on each screen. Alarm conditions are as follows:

- a. High well level as indicated via the PLC
 - b. High well level as indicated via the MPE Back-up controller
 - c. Low well level as indicated by the PLC
 - d. Pump 1 failure
 - e. Pump 2 failure
 - f. High Temp pump 1
 - g. High Temp pump 2
 - h. Seal failure pump 1
 - i. Seal failure pump 2
 - j. Pump 1 high amp draw
 - k. Pump 1 low amp draw
 - l. Pump 2 high amp draw
 - m. Pump 2 low amp draw
 - n. Loss of phase/phase imbalance/loss of power
 - o. PLC failure
 - p. Pump 1 too many starts per hour (to be predetermined at pump station)
 - q. Pump 2 too many starts per hour (to be predetermined at pump station)
 - Current conditions
 - a. Well level
 - b. Controller status
 - c. Pump 1 status
 - d. Pump 2 status
 - e. Pump 1 run time
 - f. Pump 2 run time
 - g. Pump 1 amp draw
 - h. Pump 2 amp draw
 - i. Pump 1 starts for last hour
 - j. Pump 2 starts per last hour
 - MPE Back-up controller status
 - a. Status active/non-active
 - b. Pump 1 status on/off
 - c. Pump 2 status on/off
 - Each pump station shall have the following data logged and transferred to the system server. These files shall be transmitted in a CSV format and saved in an Excel spreadsheet on a per station/per tag basis.
 - a. Pump 1 cumulative run time (24 hour basis)
 - b. Pump 2 cumulative run time (24 hour basis)
 - c. Pump 1 starts per hour (with totalization for daily total)
 - d. Pump 2 starts per hour (with totalization for daily total)
 - e. Pump 1 average amp draw per 24 hours
 - f. Pump 2 average amp draw per 24 hours
 - g. All alarm conditions recorded.
2. All information shall be able to be viewed at either of HMIs located at either of the two monitoring stations at any time as well as being viewed from Web Gate enabled PCs in the system. This shall be a manual selection of the station the operator chooses to view.

3. Individual stations shall be able to be viewed with all current status displays being shown independently of the polling cycle.
4. The Server for the storing historical data and alerts shall meet the following requirements:
 - a. provide the ability to run on Microsoft Windows Server within 2 versions of the current operating system most recent release
 - b. provide support for Microsoft SQL Server within 2 versions of the current of the most recent release
 - c. please explain security features for the user console interface as well as database security and management

The new SCADA system is anticipated to operate using virtual server architecture that utilizes the existing City local area network to connect the treatment plant SCADA systems together. Currently the City is using VMware and an EMC SAN. If the system does not support a Virtual server please explain the reasons and the requirements. If a system is proposed that is not a Windows based system, please explain the reasons and the requirements.

5. Proposals shall include an explanation of the recommended system and network hardening of server and end points.
6. Explanation of the data backup and archiving, the system shall provide backup capability. In the case of an entire system failure, which replicated throughout all of the system redundancies, the system shall have be capable of being restored from a backup.
7. Patch Management, the vendor shall provide description of the patch management processes and/or services offered for all of the proposed programmable components, and the associated costs. The proposal shall include an explanation of which patch management processes and services are included in the base price and which preprocesses/services are available for additional cost
8. All required networking between the WWTP and the WTP will be coordinated through the City of Oak Ridge Information Services Department. The City currently maintains a private LAN network between the two facilities and intends on this network being available for this data network as well. Parts of the LAN are T-1 lines today, and will be upgraded to Fiber links with 1GB links within the year between these two buildings. The City's server Room is in the middle of these buildings on the T-1 path and Fiber path.
9. All communications to the pump stations shall be accomplished via cellular modem utilizing the Verizon Wireless Network. The cellular modem shall be a Sixnet model SN-6601-BZ. The bid shall call out the price per modem and be listed as an adder. The City of Oak Ridge reserves the right to purchase these modems independently of the contract. All cellular modems will be installed into the existing pump station control panels by City personnel. The City of Oak Ridge will assist the awarded contactor in getting proper accounting and programming

configurations for all of the cellular devices thru Verizon Wireless. The City has confirmed thru Verizon Wireless that they will provide a VPN thru their network for all of the required cellular modems.

10. The awarded integrator shall be responsible for all programing requirements of the PLC's, HMI's, sever and cellular modems to facilitate the operation and maintaining the integrity of the systems thru out the installation. At the conclusion of the project the integrator shall provide all programs, software, manuals and documentation in triplicate for all of the systems either installed or modified to the City of Oak Ridge. The City of Oak Ridge will own all equipment, software and programing at the conclusion of the project.
11. A warranty period of at least one year must be provided on all equipment and programing. Explain the terms of a standard offered warranty, and the differences between warranty types, such as hardware, performance, etc., if any. List and briefly summarize third-party warranties that are expected to be provided as part of this project, and how third-party warranties are administered with regards to the Vendor's warranty.

Proposal Requirements

1. All proposals shall contain the following information:
 - a. A detailed summary of system configuration and system components.
 - b. Itemization of proposed equipment cost, software costs, and programming/integration costs.
 - c. Screen shots of at three (3) proposed system displays.
 - d. Estimation of time to complete project from award of contract to final acceptance.
 - e. Any deviation or exemption from listed specification must be clearly called out in writing.
2. Customer contact list of at least five (5) comparable integration jobs completed.
3. A fee schedule for onsite work after install for the purpose of upgrading, maintaining, and repairing of system.
4. Please explain the SCADA annual maintenance procedures and costs for software and hardware.
5. Please elaborate on any additional licenses or hardware that may be required for the City to procure for this project to work from a third party. Vendor shall include in the proposal the exact method of licensing for the SCADA system and how licensing relates to pricing.
6. Please elaborate on time sync and management of time of controls. The City has a TCP/IP Nclock which can be used as part of this process.
7. Provide information about the failover capabilities to allow redundant database servers, redundant communication paths (Cell and Fiber) and redundant application services to continue providing information to multiple workstation clients during a server failure.
8. Please explain the capabilities and technologies used for any web services that may be used to share data for display or access to controls from a Web browser.
9. The City of Oak Ridge reserves the right to require further documentation and information on proposed system from the selected bidder but before awarding of bid.
10. The City of Oak Ridge reserves the right to require the selected bidder to provide proof of competency in both operation and programming of the selected components of this system.

**ATTACHMENT
for
Pump Station SCADA System RFQ**

City of Oak Ridge, Tennessee

CITY OF OAK RIDGE, TENNESSEE
Product Specifications
for
Pump Station Control Panels

(to be used as reference material for RFQ for SCADA)

2.02 CONTROL REQUIREMENTS

A. Control Scheme

1. The control scheme is to use a primary controller to operate the station as required on a regular basis.
2. The PRIMARY controller shall take care of all the functions needed to operate the station in the proper manor. This controller shall communicate via Ethernet (using MODBUS protocol) all of the current conditions at the pump station as well as any other alarms.
3. The BACKUP controller shall serve as a back-up to the primary control unit in the event the primary fails to operate.
4. Each controller shall utilize a separate level probe for its monitoring of the wet well.
5. The Controller Selector Switch will have 3 positions, PRIMARY-AUTO-BACKUP. When the Controller Selector Switch is set in the AUTO position the PRIMARY controller will control the station and the BACKUP controller will take over control of the station when the liquid level in the wet well reaches a predetermined level.

B. PRIMARY Controller

1. The primary controller shall be a Twido PLC manufactured by the Square-D/Telemecanique (Model specified below).
2. The PRIMARY level probe shall be manufactured by MPE Inc. and be part number LP-97-10-50 or an approved equal.
3. Probe Level Inputs shall utilize a Level Probe Relay manufactured by MPE Inc. and be part number LPR-1.
4. The Twido shall monitor all (10) points on the level probe.
5. The HMI for operator interface at the pump station shall be a Magelis touch screen manufactured by Square-D/Telemecanique (Model specified below).

6. The Twido PLC shall have all the required components' to properly operate, control and monitor all station functions.
7. The Twido shall operate the required pumps to operate as required in a pump down configuration.
8. All required programing shall be done by the panel shop installing the PLC.
9. The Twido shall communicate via Ethernet (using MODBUS protocol) to an external SCADA System.
10. All station functions will be monitored, and transmitted to the SCADA system. These functions are as follows:
 - a. Automatic Lead/Lag operation.
 - b. Automatic alternation of all pumps.
 - c. Monitor and alarm on all pumps fault.
 - d. High and Low level alarms.
 - Wet Well level
 - e. Monitor Modbus communications for pump monitoring devices. Such as:
 - Drive or starter state and faults
 - Motor voltage
 - Running state
 - Amp draw
 - Pump run times
11. The Magelis HMI shall offer the operator the ability perform the following functions:
 - a. Select pump state. Hand, Off, Automatic.
 - b. View liquid level in wet well.
 - c. Change set points for Lead On/Off, Lag On/Off, High Alarm, and Low Alarm.
 - d. View all faults with a running history of all pumps for a period of least 30 days.

C. BACKUP Controller

1. The BACKUP controller will take over pump station control in the event that the PRIMARY controller fails or cannot control the level. This shall happen when either the Twido has a major fault or when the level in the wet well reaches a predetermined set point.
2. The BACKUP controller shall be Duplex Controller part number 010-120-122P manufactured by MPE Inc.
3. The BACKUP level probe shall be manufactured by MPE Inc. and be part number LP-97-10-50 or an approved equal.
4. The BACKUP controller will monitor four (4) points for pump operation and high level alarms.
5. This controller will also have separate HAND-OFF-AUTO switches for pump operation.
6. The BACKUP controller shall be pluggable into a standard 12-pin rectangular socket.

2.03 MONITOR AND ALARM POINTS – PRIMARY CONTROLLER (PLC)

A. TWDLCDE40DRF Modular Base Controller

Discrete Inputs (24 V)

I0	Pump #1 AUTO	I12	Level Probe Point 1
I1	Pump #2 AUTO	I13	Level Probe Point 2
I2	PRIMARY Mode	I14	Level Probe Point 3
I3	BACKUP Mode	I15	Level Probe Point 4
I4	Pump #1 OVERTEMP	I16	Level Probe Point 5
I5	Pump #2 MOISTURE	I17	Level Probe Point 6
I6	Pump #2 OVERTEMP	I18	Level Probe Point 7
I7	Pump #2 MOISTURE	I19	Level Probe Point 8
I8	HIGH Level (Backup)	I20	Level Probe Point 9
I9	Phase Fault Alarm	I21	Level Probe Point 10
I10	Spare	I22	Spare
I11	Spare	I23	Spare

Discrete Outputs (24 V Transistor)

Q0	Spare	Q1	Spare
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Discrete Outputs (Relay)

Q2	Common Alarm	Q9	Spare
Q3	Spare	Q10	Spare
Q4	Spare	Q11	Spare
Q5	Spare	Q12	Spare
Q6	Spare	Q13	Spare
Q7	Spare	Q14	Spare
Q8	Spare	Q15	Spare

2.04 COMPONENTS

- A. The PLC shall be manufactured by Square-D (Telemecanique) (Schneider Electric) as described on the drawings and in this specification. The number and types of cards shall be as listed below.
- B. PLC Equipment shall include, but is NOT limited to the following components.

Item	Qty	Description	Manufacturer	Model #
1	1	TWIDO - Compact Base Controller	Square D Telemecanique	TWDLCDE40DRF
2	1	RS485 – Module	Square D Telemecanique	TWDNAC485T
3	1	24 Volt DC Power Supply	Square D	ABL8RPS24050
4	1	Unmanaged Ethernet Switch	Square D Telemecanique	TCSESU053FN0
5	1	Local HMI	Square D Telemecanique	XBTGT233

2.05 CONTROL PANEL

- A. ENCLOSURE – NEMA 4X-SS (Derated to NEMA 3RX)
1. The enclosure shall be a NEMA 4X rated enclosure manufactured from 304 stainless steel with white polyester powder coating. The enclosure shall be a minimum depth of 8" sized adequately to house all of the components. The door gasket shall be formed in place rubber composition and shall assure a positive weatherproof seal. The door shall open a minimum of 180 degrees. Devices mounted on the external surface of the enclosure shall maintain the NEMA rating on the enclosure. Manufacture is Hoffman or approved equal.
 2. A polished inner aluminum dead front door shall be mounted on a continuous aluminum aircraft type hinge and shall contain cutouts for the protrusion of the circuit breakers and provide protection of personnel from internal live voltages. All control switches, pilot indicator lights, elapsed time meters, duplex receptacle and other operational devices shall be mounted on the external surface of the dead front. The dead front door shall open a minimum of 150 degrees to allow for access to the equipment for maintenance. A 3/4" break shall be formed around the perimeter of the dead front to provide rigidity. Painted steel or other materials are not acceptable.

3. The back plate shall be manufactured of 12 gauge sheet steel and be finished with a primer coat and two (2) coats of baked on white enamel. All hardware mounted to the sub panel shall be accomplished with machine thread tapped holes. Sheet metal screws are not acceptable. All devices shall be permanently identified with engraved legends.
4. The enclosure shall utilize a 3-point latch system, part #L36 from Hoffman or an approve equal.

B. INCOMING POWER – Main/Auxiliary Circuit Breakers

1. A properly sized Service Entrance main circuit breaker shall be supplied in its own section for the bottom fed incoming power supply.
2. In addition to the main breaker, an identical auxiliary power breaker shall be supplied.
3. Both the main breaker and the auxiliary breaker will be Square D “H or J” Frame 611 Series Heavy Duty Breakers.
4. The main breaker and auxiliary power breakers shall be tied together with a mechanical interlock to prevent both breakers from being energized at the same time.
5. Where more than one connection is required on load side of breakers Square D, Class 611 “Power Distribution Connectors of the proper size will used on the load side lugs.

C. AUXILIARY POWER CONNECTION – Power Receptacle

1. The Auxiliary Power Connector shall be a Crouse-Hinds Arktite Heavy Duty Circuit Breaking Receptacle AR Series utilizing a 45 degree angle adapter and spring load receptacle cover.
2. The receptacle shall be a 4 pole configuration rated at a minimum of 200 amps.

D. SURGE PROTECTION – Lightning Arrestor 120V, 230V and 480V

1. Three phase surge protection shall be accomplished by using a Square D SDSA3650 or SDSA3650D (as applicable) Surge Protector.
2. Single phase surge protection shall be accomplished by using an APT D120V1P Surge Protector.
3. The surge protector shall be properly mounted onto the back panel.

E. ALARM SYSTEM – 120 VAC Alarm

1. An alarm system shall be installed that will provide both audible and visual indication of an alarm condition. The audible and visual devices will only activate on a high or low level wet well level, all other alarms will be viewed on control panel display screen.
2. The visual indication of the alarm condition shall be a minimum 160,000 candle power strobe light with red prismatic lens. The alarm light shall be NEMA 4X.
3. The audible indication of the alarm condition shall be an alarm horn with a 90 DB @ 10 Ft sound level.
4. A push button shall be externally mounted on enclosure to silence the audible horn when acknowledging an alarm condition while the strobe light continues to flash until alarm condition is no longer present.
5. A push to test button shall be mounted on the dead front to test both audible and visual alarm devices.

F. CONTROL CIRCUIT BREAKERS

1. All control circuit breakers shall be Square D QOU Miniature Circuit Breakers, Class 720 sized appropriately.
2. Control circuit breakers shall be accessible with the dead front door in the closed position.

G. MOTOR CIRCUIT BREAKERS AND CONTROLLERS

1. For motors 10 HP and smaller:
 - a. All motors at or below 10 hp. shall utilize a Square-D U-Line combination circuit breaker/starter.
 - b. The U-Line motor starter shall contain the circuit breaker, starter, and communication module.
 - c. The U-Line motor starter shall also contain the “TESYS T Motor Management System” which will transmit the data to the control system PLC.
 - d. Regardless of motor size the U-Line power base shall be rated at 32 amps.
 - e. The U-Line combination starter shall be supplied with the following configuration. Listed configuration does not relieve the supplier from providing any additional configuration components in order to

provide a complete and functioning system. The basic components that must be included in the configuration consists of:

- Motor Starter Power Base LUB320
Self-Protected Starter Base WITHOUT screw terminations. (32 amp)
- Advanced Control Unit LUCBxxBL
Advanced, 3-phase, Class 10 Overload Protection with a setting range suitable for the load with a control voltage of 24 Volts DC. This clip-on control unit that provides protection against overloads and short-circuit and alarm and fault differentiation.
- Communication Module LULC031
This module enables the U-Line power base to be connected to the MODBUS Network (RS-485 multi-drop, MODBUS RTU).
- Pre-wired coil connector LU9BN11C
To connect the Communication Module output terminals to the Power Base coil terminals.
- T-Junction VW3A8306TF03
RS-485 Line Terminator VM3A8306RC
These components are required to provide the connection of the RS-485 wiring to the module and termination at the of the MODBUS RS-485 Serial Bus. To be supplied as required to properly connect the RS-485 serial bus between the PLC and motor starters.

2. For motors 11 HP and larger:

- a. All motors 11 Hp and larger shall utilize a Square-D "H or J" frame 611 Series circuit breakers sized for the load.
- b. All motors 11 Hp and larger shall utilize the Square-D ATS22 Series soft-start starters with built by-pass contactor.
- c. All soft-starters will use properly sized line fuses as required.
- d. All Square-D ATS22 Series Starters shall communicate to the PLC via the MODBUS Network (RS-485 multi-drop, MODBUS RTU).
- e. All Square-D ATS22 Series Starters shall provide predictive maintenance information to the control system PLC.

H. PUMP PROTECTION

1. Phase Monitor

- a. A line voltage rated, adjustable phase monitor shall be installed to sense low voltage, loss of power, reversed phasing and loss of a phase. The control circuit shall de-energize upon sensing any of the faults and shall automatically restore service upon return to normal power.
- b. The phase monitor shall be dual voltage and be of an 8-pin and utilize an 8-pin relay base.
- c. The phase monitor relay shall have a 20 second delay to normal after a fault reset.
- d. Manufacture is MPE or approved equal

2. Pump Monitor Relay

- a. One plug in solid state Pump Monitor Relay unit shall be supplied for each pump to monitor the pump for over-temp and leakage.
- b. The unit shall have an 11-pin, round base to mate with a standard 11-pin socket.
- c. The unit shall also be flanged in order to allow dead front door mounting.
- d. The unit shall be powered by 24VAC, 24VDC, or 120VAC.
- e. LED indication shall be provided for power on, over-temp, and leakage conditions. An over-temp reset push-button shall be provided to allow reset of unit.
- f. The sensor input circuitry is to contain both hardware and software filters to provide noise immunity, as well as sensor input short circuit protection.
- g. The Pump Monitor Relay unit shall of a type approved by the pump manufacturer as to not void any pump manufacturer's warranties.
- h. Manufacture is MPE or approved equal

I. CLIMATE CONTROL

Air Vents and Fans

1. Air vents and fans shall be supplied for proper ventilation and maintaining ambient temperature for the installed equipment.
2. All vent openings shall be louvered and screened to prevent entrance of insects into the enclosure.
3. Inlet vent opening shall also have a washable filter to filter out fine dirt and pollen particulates.
4. Ventilation fan shall be controlled by a thermostat that manufactured by Hoffman part number ATEMNO.
5. Both inlet and outlet vent openings shall be covered with an external protective shroud to prevent driving rain from entering the enclosure and inhibit vandalism. The shroud shall be constructed of 304 stainless steel and be powder-coated white to match enclosure.

Air Conditioning

1. Air conditioning will be required on control enclosures that house VFD's. The Owner (City of Oak Ridge) will provide assistance in selection when required.

Heaters and Condensation Control

1. All Control Enclosures shall utilize a Hoffman Unit Heater Model D-AH1001A to control ambient temperature inside of enclosure.

J. CONTROL AND AUXILIARY POWER TRANSFORMER

1. The Control Power and Auxiliary Device transformer shall be a separate transformer located separate from the control panel and is not supplied by the manufacturer of the control panels.
2. The transformer shall be sized for all 120 VAC power within the Control Panel as well as the following additional loads plus a minimum of 20% extra capacity:

Qty	Description	CKT	Load	Comment
1	Sparer	15A	50W	Site Specific
1	Scrubber	20A	1 HP	Site Specific
1	Enclosure Heater	20A	1500W	Site Specific
1	Enclosure Blower	15A	1/3 HP	Site Specific

3. The minimum size of the transformer shall be 5 KVA.
4. Each additional load listed above shall be furnished with a circuit breaker.

5. The transformer shall have primary and secondary circuit breaker installed in the control panel.
6. An isolated multi-tap buss bar shall be provided for the grounded neutral connections of the 120 VAC circuits.
7. The transformer shall NEMA 3RX-SS rated for outdoor service.

K. PUSH BUTTONS, SELECTOR SWITCHES, AND PILOT LIGHTS

1. All required Push Buttons and Selector Switches shall be manufactured by Square-D and will be in the 9001 series.
2. All required Pilot lights shall be LED type manufactured by Square-D and be in the 9001 series.
3. All pilot devices shall be installed with securing notches or mechanical components to prevent rotation of the devices per manufacturer's recommendations.

L. ELAPSED TIME METERS

1. Each pump shall have an elapsed run time meter. These meters shall be manufactured by Redington and be model 710-0016.

M. CONTROL RELAYS

1. All control relays shall be TPDT relays as manufactured by Square-D and be in the 8501 series type K.
2. All control relays shall have pilot lights to indicate state of relay.
3. All Control relays shall be of the tubular type and be pluggable into a standard 11-pin relay socket.

N. UNINTERRUPTABLE POWER SUPPLY (UPS)

1. All control circuits shall be powered by an UPS properly sized to provide back-up power to controls for a period of 12 hours before falling below required voltage.
2. All UPS systems shall be manufactured by APC.

O. ENCLOSURE ACCESSORIES

1. All enclosures will have an internal light installed across the top of the cabinet. The light shall be of the LED type. The light will be controlled by a switch located on the dead front panel.
2. A 15 AMP GFIC type utility receptacle will be installed on the dead front panel.

P. GENERAL PRACTICES

Below are the requirements for the fabrication and assembly of the control panels.

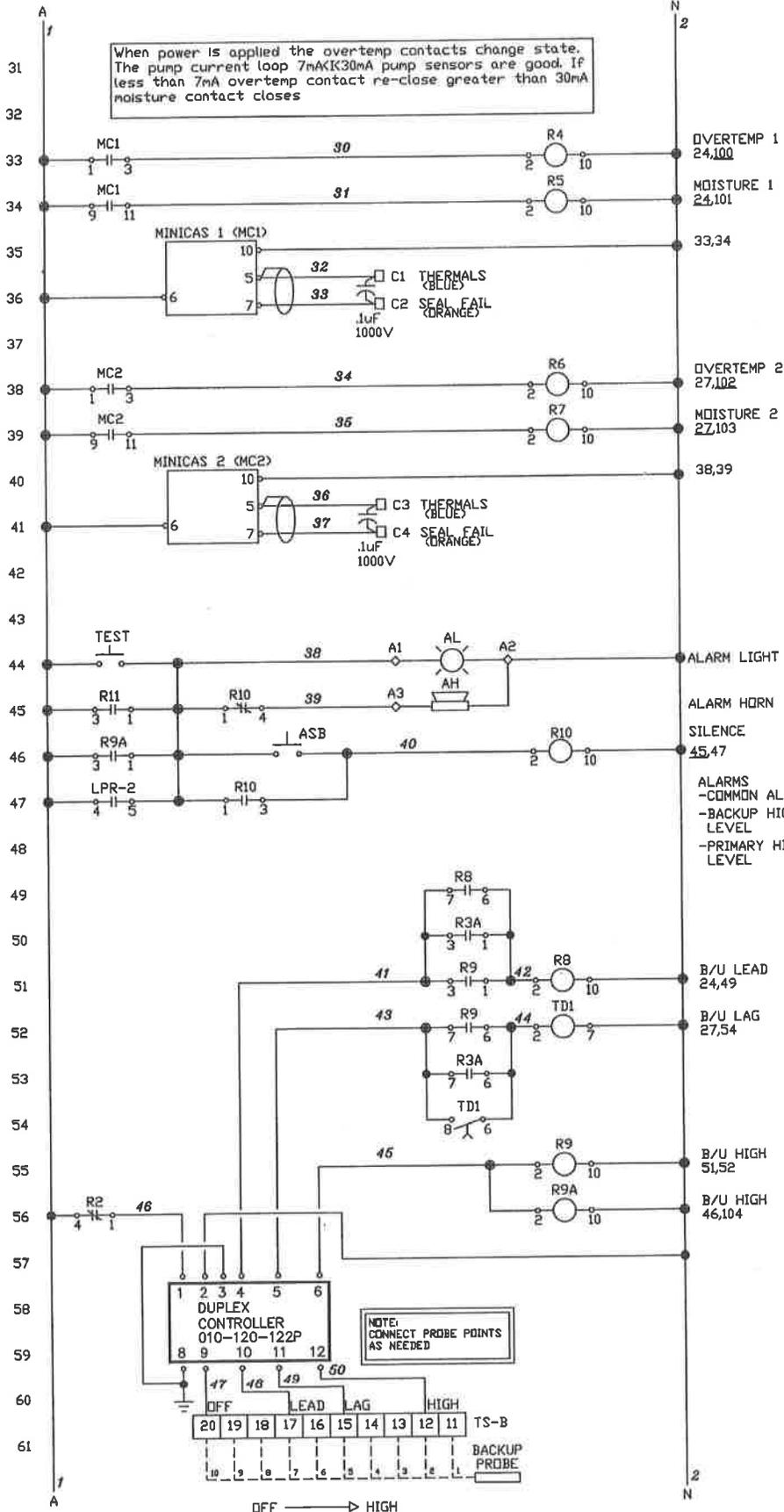
1. All panel components and terminal block line-ups shall be labeled with engraved marking plates.
2. All terminal block points shall be permanently identified with the terminal number.
3. Each end of every wire shall be permanently identified with the wire number.
4. All component, terminal block point, and wire labeling shall match the as-built drawings.
5. A complete set of as-built schematics shall be laminated to inside of outer enclosure door.
6. All of the panel components shall be installed in the panel in accordance with the manufacturer's recommendations and requirements.
7. All control components contained in the control panels shall be mounted on a removable sub-plate.
8. Control circuits shall be wired with a minimum #16 AWG stranded copper wire with MTW or approved equal insulation.
9. Instrumentation wiring shall be wired with single pair #16 AWG twisted shielded wire.
10. Power wiring shall be sized as required for the load.
11. Different voltage level wiring shall not be bundled together or run together. Control voltage 115 VAC wiring must be run separately from 24V control and instrumentation wiring.

City of Oak Ridge, Tennessee

Pump Station Control Panel
Drawings

(SCADA Reference Material)

When power is applied the overtemp contacts change state. The pump current loop 7mA(K)30mA pump sensors are good. If less than 7mA overtemp contact re-close greater than 30mA moisture contact closes

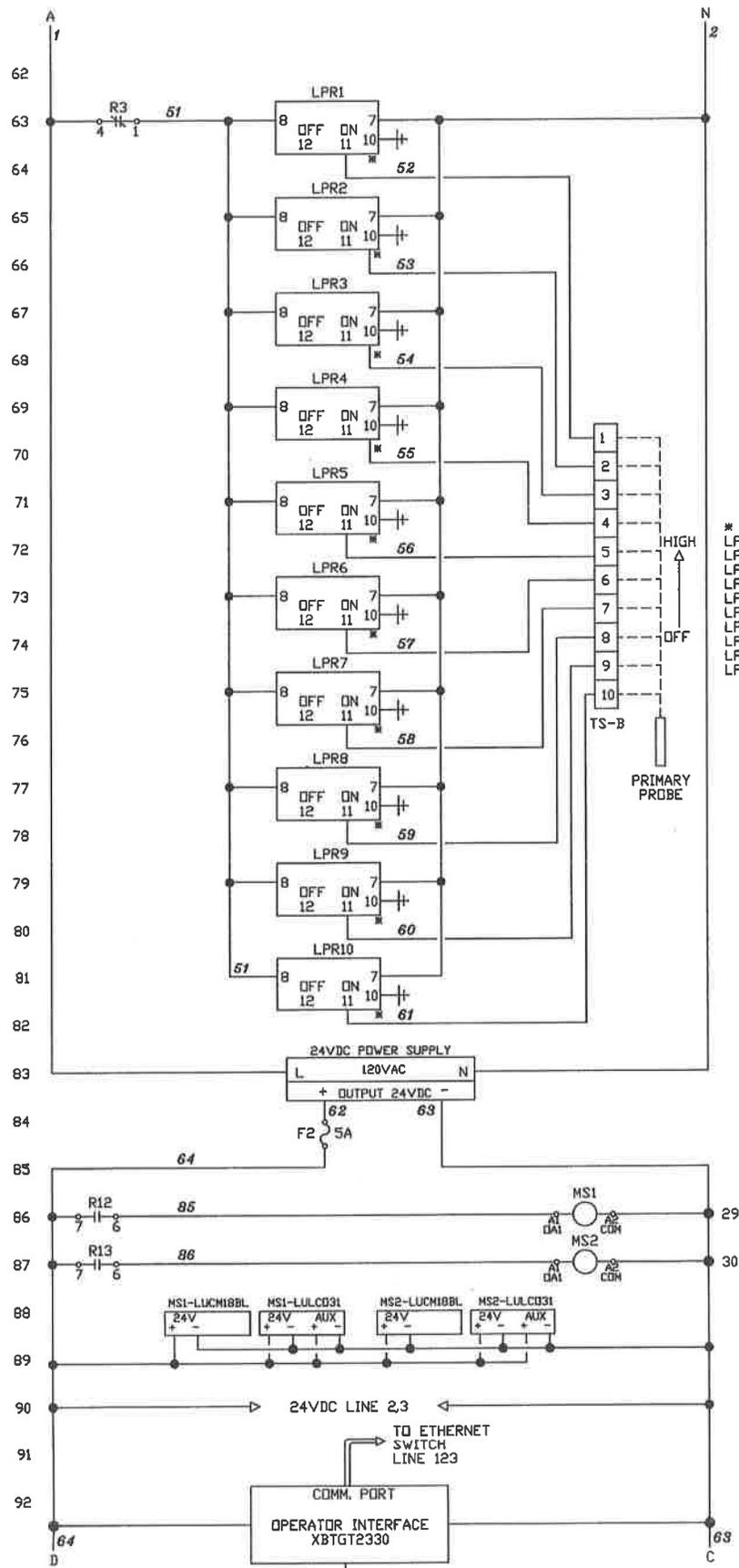


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TRUMBULL, CT 06611

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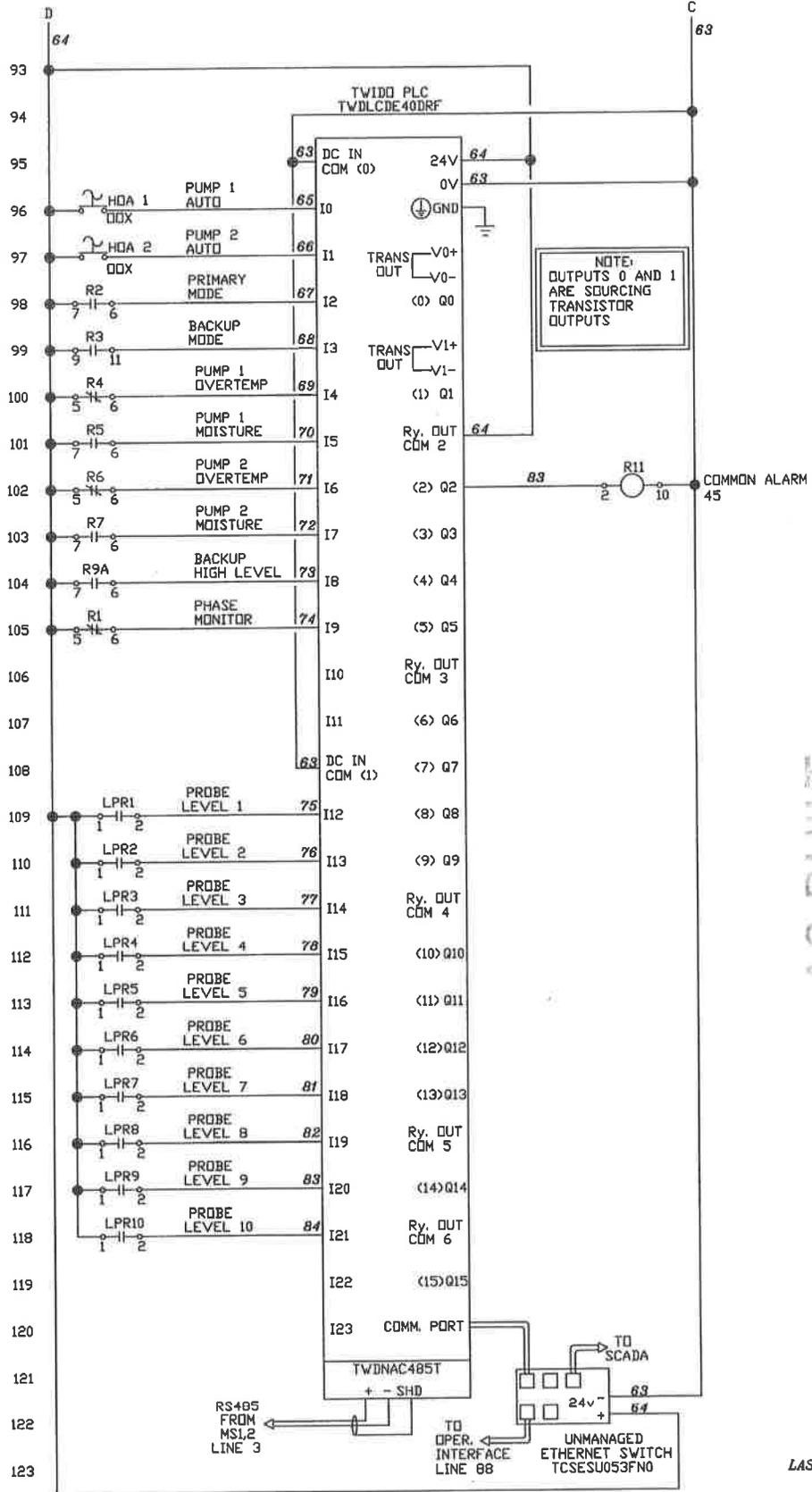
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- LPR2 - 47,110
- LPR3 - 111
- LPR4 - 112
- LPR5 - 113
- LPR6 - 114
- LPR7 - 115
- LPR8 - 116
- LPR9 - 117
- LPR10 - 118

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AS BUILT



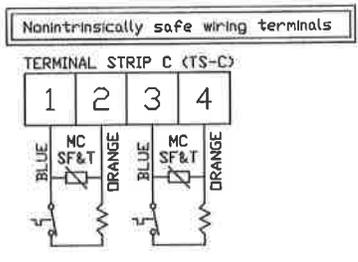
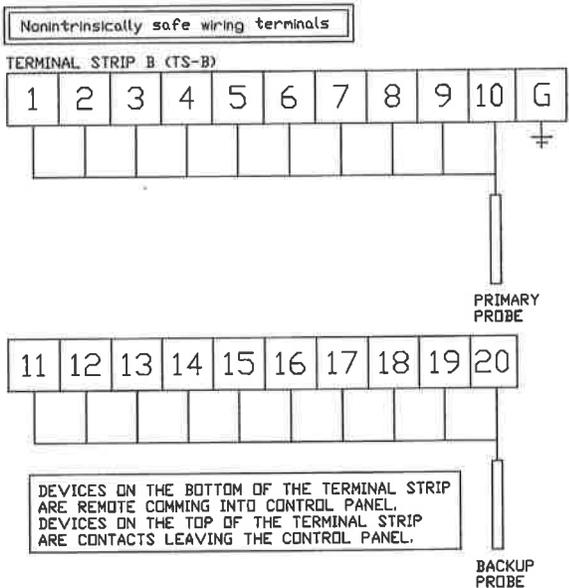
NOTE:
 OUTPUTS 0 AND 1
 ARE SOURCING
 TRANSISTOR
 OUTPUTS

CITY OF OAKRIDGE
 HOME DEPOT L/S
 QUOTE NO. DATE DRAWN BY REVISION
 99553FA 4.6.12 MED

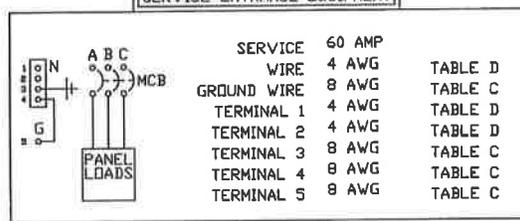
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LAST WIRE #86



SUITABLE ONLY FOR USE AS SERVICE ENTRANCE EQUIPMENT



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CITY OF OAKRIDGE
HOME DEPOT L/S
QUOTE NO. DATE DRAWN BY REVISION
99553FA 4.6.12 MED

CUSTOMER NEDROW & ASSOC.
JOB NAME OAKRIDGE HOME DEPOT L/S
ENCLOSURE UL TYPE RATING: UL TYPE 3R
VOLTAGE 240V PHASE 3 HZ 60
H.P. #1 3 #2 3 #3 X #4 X
F.L.A. 9A 9A X X
TOTAL F.L.A. 38A
SERIAL # 12-0428 DATE 5/31/2012
SCCR: 5 KA SYMMETRICAL RMS, 240 V. MAX.
MANUFACTURED BY:
STA CON INC 2525 S. DBT APOPKA FL 32709

SQD Ground Busbar
PK12GTA, PK12GTA, PK12GTA

Wire Range AWG CU-AL	Torque lb-in.
14-10 CU, 12-10 AL	20
8	25
6-4	35
Two 14 or 12 CU, Two 12 or 10 AL	25

SQD Terminal Block
GRB + GRB

Wire Range AWG CU	Torque lb-in.
(Type GK6) 22-10	11-12
(Type GR6) 22-8	18-20

Panduit Ground Lug
One-Barrel

Wire Range AWG CU	Torque lb-in.
(LAMA2-14-QY) 12-14	15
6-10	40
2-4	50
(LAMA1/0-14-QY) 10-14	35
8	40
4-6	45
2/0-3	50
(LAMA250-56-QY) 2-6	275
250-1	375
(LAMA350-38-QY) 2-6	275
350-1	375
(LAMA600-38-6Y) 600-4	500
Two-Barrel	
(LAM2A1/0-14-6Y) 10-14	35
8	40
4-6	45