MIAMI-DADE COUNTY
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS (DTPW)

ADDENDUM No. 10
April 10, 2025

PROJECT: Biscayne Shores Pump Station Retrofit Nos. 109 and 110 and MIC Stormwater Pump Station Trash Rack Repair
Project No. 20230197-R

BID DUE DATE: May 21, 2025; 02:00 P.M.

FROM: Miami-Dade County DTPW
Capital Improvements Division
111 NW First Street, 14th Floor
Miami, FL 33128
305.375.2930

TO: Prospective Bidders and Interested Parties

This Addendum forms part of the project solicitation documents and will be incorporated into the Contract Documents, as applicable. Insofar as the Original Contract Documents, Drawings and Specifications are inconsistent, this Addendum shall govern. Please acknowledge receipt of this Addendum, at the time of bid submittal to Miami-Dade County, in the space provided on the "Acknowledgement of Addenda Form" provided with the project solicitation documents. Failure to acknowledge receipt of all addenda may be cause for disqualification.

CHANGES TO PROCUREMENT REQUIREMENTS:

A. Change Bid Due Date from Wednesday, April 16, 2025, to Wednesday, May 21, 2025. Time and place remain unchanged.

CHANGES TO THE SPECIAL PROVISIONS:

A. Add to the Appendix "B" Technical Specifications the following Specifications Sections (Attached):

- SECTION 13600 General Instrumentation and Control
- SECTION 13620 Instrument Panel and Enclosure Construction
- SECTION 16630 Remote Terminal Units- Annotations
- SECTION 16660 Radio Telemetry System - Annotations
- SECTION 16661 Radio Telemetry System Testing - Annotations
- SECTION 16232 Diesel Generator Sets

ADDENDUM No. 10
April 8, 2025

CHANGES TO ENGINEERING DRAWINGS:

A. The following details and/or attachments not included in the original Plans have been added to the Plans per Addendum No. 10 (Attached)

- The existing control panel schematic – BISCAYNE SHORES -109 and 110 Electrical Plans.
- Process & Instrumentation Drawing -MD-PWD SCADA Local Pump-Control RECv3. This drawing identifies the origins and purpose of both control devices and instrumentation. It shows the RTU I/O List. It includes*:*
  GENSET & ATS.
  Pump-Control Panel.
  RTU/SCADA.
  Enhanced Wetwell Level instrumentation
  Canal Level instrumentation. Only for canal sites.

- Overview of Local controller and RTU integration – MD-PWD SCADA Local Pump Control REC v2.
- MD-DTPW Stormwater SPEC illustrating a sample RTU assembly- 2024 Stormwater RTU Panel.
- Sample RTU I-O list

END OF ADDENDUM NO. 10

Tiondra Wright
Chief, Capital Improvements Division
Department of Transportation and Public Works (DTPW)

TW:er

c: Elva Reyes, DTPW
Katherine Fernandez, DTPW
Liza Herrera, P.E., DTPW
Daryl Hildoer, P.E., DTPW
Caesar Suarez, SBD
Clerk of the Board
Project File

SECTION 13600 - GENERAL INSTRUMENTATION AND CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

A. This specification covers the technical requirements for the fabrication, installation, engineering, wiring, adjustment, testing, start-up, commissioning, and training for the instrumentation and control (I & C) systems required for work as identified on the plans.

B. The instrumentation and control systems shall include all work and materials necessary to perform the control functions as illustrated on the process and instrumentation diagrams and as specified in the entire Division 13600 of these Specifications.

C. The Systems Integrator shall be responsible for providing and coordination of systems specified in the following:

1. Division 13: Field Mounted Instruments
2. Division 13: Level Instruments
3. Division 13: Instrument Panel and Enclosure Construction
4. Division 13: Remote Terminal Units
5. Division 13: Radio Telemetry System
6. Division 13: Radio Telemetry System Field Testing
7. Division 16: Instrumentation Wiring and Installation

8. The Systems Integrator shall be responsible for coordinating and integrating existing systems as identified on the data sheets.

1.2 SCOPE OF WORK

A. This project includes adding a radio based telemetry system and other modifications to an existing storm water control facility. Scope of work for each location is identified on the individual site scope of work sections.

B. Work at the central SCADA facility in the SPCC Building, 111 NW 1st Street, Miami, FL., is limited to verification of signals received from and sent to the remote site as described in Division 13, Radio Telemetry System Field Testing.

1.3 QUALITY ASSURANCE

A. All work and materials specified herein shall be furnished by a single Systems Integrator (SI). The SI shall be an experienced and reputable

firm, which has been engaged in the business of providing instrumentation and control systems for water and wastewater treatment facilities for at least two years.

B. Drawings and specifications shown are intended to convey information required for a complete functioning system for the purposes specified. The Systems Integrator shall be responsible for all details which may be necessary to properly install, adjust, and place in operation a complete and working system.

C. In order to achieve standardization in appearance, operation, maintenance, and spare parts, similar equipment provided under this contract shall be the end products of a single manufacturer.

D. The Systems Integrator shall provide all materials and work necessary for a complete and functioning telemetry system and shall have full coordination responsibility for the electrical, mechanical, and structural work as specified herein and as shown on the drawings.

E. Codes, specifications, and standards referred to by number or title shall form a part of this specification to the extent required by the references thereto.

1.4 PRE-CONSTRUCTION SUBMITTALS

A. Submittals shall be as specified in the Division 01 - General Requirements.

B. Submit the following:

1. Project schedule, which shall represent the Contractor's and System Integrator's best projections of when activities listed below will occur. Project schedules shall be updated at the Engineer's request, when major changes in the schedule occur. The activities shall include, but not be limited to, the following:

    a. Coordination and loop review meetings
    b. Shop drawing submittals for each group of equipment
    c. Shop drawing approvals for each group of equipment
    d. Coordination meetings
    e. Equipment manufacturing
    f. Equipment delivery
    g. Equipment installation
    h. System testing and calibration
    i. Operational testing

j. Functional testing
k. As-built submittals
l. Operation and Maintenance Manual submittals
m. Operator training

2. Manufacturer's certification of compliance with the referenced specifications and standards.
3. Certified copies of reports of factory tests specified herein and required by the referenced standards.
4. Shop drawings, indicating performance and physical data of the equipment specified herein.
5. Manufacturer's installation instructions.
6. Provide mounting details for field mounted equipment.
7. Manufacturer's operation and maintenance instructions.
8. If available, video-audio cassette tapes produced by the equipment manufacturer which contain demonstrations of operation and maintenance procedures for the equipment specified herein.

C. Physical requirements of submittals shall be as follows:

1. Submittals shall be submitted in three-ring binders.
2. Submittals shall be organized and divided into logical division by means of tagged manilla dividers. Each type of equipment shall be given a separate division.
3. Provide index sheets for the submittals.
4. Drawings shall be 8-1/2 by 11 inches minimum. Drawings larger than 11 by 17 inches shall be folded and put into a three-hole plastic pocket.
5. All text material shall at minimum be typewritten. Handwritten material is not acceptable.
6. All submittals shall be clear and legible. Illegible submittals will be rejected and returned immediately.

D. Shop drawings shall include, but not be limited to, the following:

1. Instrument index, which shall include instrument tag numbers, instrument description and instrument calibrated ranges.
2. Typewritten specification sheets, which shall include manufacturer's names and complete catalog numbers.
3. Detailed calculations as applicable, which shall include, but not be limited to, the following:

a. Power supply sizing calculations
b. Thermal loading (heat dissipation) calculations

4. Instrument cut sheets and catalog information, which shall contain equipment specifications, dimensions, wiring and piping drawings, and installation and mounting details.
5. Loop drawings, which shall contain, but not be limited to, the following information:

    a. Loop numbers and instrument tag numbers
    b. Individual loop component locations
    c. Actual equipment wiring terminal designations, point to point wiring, and cable shield terminations
    d. Wire type, size and identification number
    e. Signal types (e.g., 120 Volt AC, 4-20 Ma DC, pulse frequency, 3-15 psig, etc.)
    f. Contact orientations (e.g., normally open, normally closed, etc.)
    g. Equipment grounding requirements
    h. Sources of loop power, or power supply identifications
    i. Signal boosters, interposing relays and shunt resistors
    j. For each loop, present a tabular summary of the following:

        (1) Load impedance capability of each transmitting instrument output
        (2) Input impedance of each receiving instrument
        (3) Calculated loop wiring impedance, based on wire sizes and lengths
        (4) Total loop impedance
        (5) Reserve output capacity

6. Instrument panel layout drawings, which shall include, but not be limited to, the following:

    a. Bill of materials
    b. Front panel layout drawings to scale.
    c. Internal panel layout drawings to scale.
    d. Internal wiring diagrams, including wire type, size and identification number
    e. Terminal block layout drawings
    f. Nameplate lists
    g. Color schedules and samples

7. Elementary control diagrams
8. Interconnection diagrams showing wire numbers, conduit numbers, terminal numbers for the various equipment items, etc. as indicated on the Drawings.
9. Provide flow charts, text pseudo-code, and other materials as needed to demonstrate understanding of the requirements of this

project. Include such items as handling and scaling of analog inputs, alarm functions, etc. Pseudo-code is defined as a generic (non-RTU specific) detailed listing of how the programming shall be performed. Generic ladder logic diagrams with explanatory comments may also be used.

10. Other descriptive information that will assist the Engineer with approval.

1.5 RECORD DRAWINGS SUBMITTALS

A. Record drawings (as-builts) submittals shall be as specified in the Division 01, General Requirements.

B. The record drawings submittals shall consist of, but not be limited to, the following:

1. Submit to the Engineer one set of corrected contract documents. The original contract documents shall be marked to reflect 'as-built' conditions. Corrections shall be made in red.
2. Submit to the Engineer one set of corrected loop description. The original loop description shall be marked to reflect 'as-built' conditions. Corrections shall be made in red.
3. Submit one set to the Engineer and one set to the Owner printer outputs of the final configuration or programs of all programmable microprocessor-based equipment.
4. Where applicable, submit to the Owner standard compact disc storage devices of all programmable microprocessor based equipment.
5. Where applicable, submit to the Owner two sets of preconfigured Read Only Memory Modules, such as EEPROMS or UVPROMS, of all programmable microprocessor based equipment. Each memory module shall be submitted in an anti-static zippered poly-bag, which shall be clearly labeled and identified.

1.6 STANDARD EQUIPMENT AND INSTALLATION

A. In order to maintain standards within the plant, the following standard equipment and installation shall be strictly followed:

1. Remote Telemetry Unit (RTU) System: Emerson Bristol®,

   a. ControlWave® Micro for sites with utility supplied power.
   b. ControlWave® ExpressPAC for solar supplied sites
   c. All RTU panels to be manufactured and supplied by Emerson Bristol®

2. Radios: MDS model #9710A.
3. No substitutions

1.7 OPERATION AND MAINTENANCE MANUALS

A. The Systems Integrator shall prepare and furnish Operation and Maintenance Manuals of the system, which shall be submitted to the Engineer prior to operator training described below. Number of copies of the Operation and Maintenance Manuals submitted to the Engineer shall be five, or as described under Division 01, General Requirements, whichever is greater.

B. The Operation and Maintenance Manuals shall include, but not be limited to, the following:

1. Approved shop drawings amended by approved change orders and as-built conditions.
2. Manufacturer supplied operating and installation manuals.
3. Detailed procedures and instructions on the operation, removal, installation, adjustment, calibration, and maintenance of each component provided under this contract.
4. As-built control panel and enclosure drawings, including termination drawings, RTU input/output (I/O) wiring diagrams, and panel bill of materials.
5. List of recommended spare parts, which shall include complete catalog numbers.
6. List of local or the nearest manufacturer approved repair and service centers.

1.8 RTU - SCADA COORDINATION

A. An existing ‘master’ SCADA system running OpenEnterprise™ software is located at the SPCC Building, 111 NW 1st Street in Miami, FL.

Modifications to this system for the new equipment shall be by Emerson except as noted. Emerson personnel to contact:

1. Rafael Jacomino, Tel: 305-278-7994, mobile: 786-302-1110
2. Roger Labrecque, Tel: 860-945-2271

B. Coordinate with Owner for setting up data tables and register blocks for information transfer. All data shall be transferred in as few contiguous blocks as possible.

1.9 OPERATOR APPLICATION TRAINING

A. The System Integrator shall provide application operation and maintenance training of the Owner's personnel. This training shall include but not be limited to the following:

1. The review of the Operation and Maintenance Manuals prepared and furnished by the System Integrator.
2. The review of 'as-built' panel layout drawings and wiring diagrams.
3. Hands-on training in the operation of each instrument and each loop.
4. Hands-on training in the maintenance, removal and reinstallation of each instrument and each loop.
5. Hands-on training in the programming or configuration of all programmable microprocessor based instruments. This does not include the RTU system. Training for this equipment is covered under Division 13, Remote Terminal Units.

B. For bidding purposes, the System Integrator shall include a minimum training period of **one (1) day**, eight hours per day.

C. The System Integrator shall bear all expenses associated with the operator training activities, including labor, transportation, and material costs.

1.10 WARRANTY

A. The instrumentation and control system shall be guaranteed for a period of one year, regardless of manufacturer's standard warranties. The warranty period shall begin after Engineer's approval of the completed and working system.

B. During the warranty period, furnish, install, and adjust replacements for any defective units or components at no additional cost to the Owner. Items normally consumed in service are accepted.

C. The Contractor shall bear all costs associated with the warranty work, including labor, transportation and material costs.

D. During the 12-month period, the Contractor shall respond to a warranty service call within 24-hour notice.

PART 2 - PROCESS DESCRIPTION

2.1 GENERAL

A. Part 2 of this specification covers the general requirements for Stormwater Pump Station Control Improvements.

B. Modify existing equipment panels to monitor status values, obtain motor load data, and other features as indicated. High density interposing relays shall be used to separate field wiring from RTU wiring for all discrete inputs and outputs unless noted otherwise.

2.2 CONTINUOUS PROCESS SIGNAL STATUS

A. If the process signal is a 4-20 mA current signal and it falls below 4 mA, or rises above 20 mA, an instrument failure alarm annunciation shall be generated.

B. If the transmitting instrument is provided with transmitter failure contacts, the instrument failure shall be monitored and alarmed.

C. Each process signal shall be provided with at least 4 adjustable control set points:

High High (or very high),
High,
Low,
Low Low (or very low),

2.3 ALARMS

A. Submit a listing of all alarms and events that the RTU system will monitor or generate for review with the Owner and Engineer.

B. Provide ENABLE and DISABLE commands for each alarm and display ENABLED and DISABLED status on the appropriate screens for each. Provide a time delay, 0 to 99 seconds, individually set for each alarm.

PART 3 - EXECUTION

3.1 GENERAL

A. The System Integrator shall provide all materials and work necessary for a complete and functioning Instrumentation & Control (I & C) telemetry system and shall have full coordination responsibility of the electrical, mechanical, and structural work as specified herein and as shown on the drawings. The System Integrator shall ensure that the instrumentation and control system work is properly interfaced with equipment and other work furnished under other divisions of these contract documents.

B. The System Integrator shall install, make final connections to, adjust, test, and start-up the complete instrumentation and control system utilizing the technical services and advice of the system supplier.

3.2 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Materials and equipment shall be delivered to the job site at a maximum of ten days prior to installation and not before.

B. All instruments containing electronics components shall be stored off the ground in weather tight enclosures. They shall be kept dry at all times. All plug-in equipment which can be removed from panels without the necessity of disconnecting any wire terminations shall be removed from its panel before shipping. They shall be transported in separate shipping containers.

C. All equipment covered by this specification shall be shipped in a thoroughly clean condition, free from sand, oil, grit or grease (except where required for lubrication), weld splatter, or other foreign materials. All panel openings shall be capped.

3.3 INSTALLATION

A. Provide sufficient space around the equipment for maintenance and removal.

B. Cover front panels, gages and indicators during construction for protection from weld and paint splatter.

C. Unless otherwise impractical, all indicating instruments shall be mounted with their indicators located at eye level (5 feet to 6 feet).

D. Unless otherwise impractical, support instruments independent of process piping.

3.4 EQUIPMENT IDENTIFICATION AND TAG NUMBERS

A. All apparatus, control equipment, and instruments, both panel and field mounted, shall be plainly identified, using the following methods:

1. Pipe-mounted instruments shall be provided with embossed stainless steel tags, which shall be attached to the instruments by means of stainless steel wire.
2. Wall, plate, or panel mounted instruments shall be provided with engraved laminated plastic tags, which shall be mounted above, or below the instruments. The plastic tags shall be mounted at eye level, and shall be visible from a minimum distance of 20 feet. Lettering shall be black on white background.

B. Tag numbers and engraved or embossed text shall be as shown on the Drawings, or as approved by the Engineer during shop drawing approval.

C. Tag numbers shall conform to the current International Society of Automation (ISA) Standards, which shall consist of a multi-letter prefix, followed by a loop number. Tag numbers shall be as assigned in the instrument list and as indicated on the drawings.

D. Submit listing of all nameplates showing text, character size, colors, etc. to Owner for approval. See attached guide sheet.

3.5 TESTING AND CALIBRATION

A. Test all analog loop zeroes and spans by disconnecting wiring at each transmitter and substituting an Engineer-approved 4-20 mA generator in its place. The receiving instruments shall display the correct value based on the simulated 4-20 mA signals.

B. Test all discrete points by placing jumpers across normally open contact inputs, by physically disconnecting wiring on normally closed contact inputs, or by activating the device’s contacts. These procedures shall be done at the location of the initiating contacts.

C. Provide instrument and loop calibration records as required by each section.

3.6 COMMISSIONING

A. This activity shall consist of two sequential performance tests. Each test shall be witnessed by representatives of the Contractor, the Systems Integrator, the Engineer:

1. Operational Test: The objective of this test shall be to demonstrate that the I & C system is ready for final operation. The I & C system shall be checked for proper installation, adjustment, and calibration on a loop-by-loop basis to verify that it is ready to function as specified. All continuous elements and systems shall be calibrated using the three-point calibration method.
2. Functional Test: The objective of this test is to demonstrate that all control panel functions are operating and complying with the specified performance requirement and the control panel is ready for use by the Owner.

B. The proposed format and documentation of these tests shall be submitted to the Engineer for review and comment prior to commencement of this activity.

3.7 ACCEPTANCE

A. System acceptance shall be defined as that point in time when the following requirements have been fulfilled:

1. All submittals and documentation have been submitted, reviewed and approved by the Engineer.
2. All commissioning activities associated with the Instrumentation and Control systems have been completed.
3. All punch list items have been corrected.
4. All training activities have been satisfactorily completed.

3.8 ATTACHMENTS

A. Nameplate Submittal Form, Attachment “A”

END OF SECTION 13600

NAMEPLATE SUBMITTAL:

NUMBER: _____ (XX-NNNN)
(XX: IC = FOR INSTRUMENTATION & CONTROL, EL = ELECTRICAL, PR = PROCESS, ETC. NNNN = 0001 TO 9999)

BASE: BLACK: __ , WHITE: __ , OTHER: _____

TEXT: BLACK: __ , WHITE: __ , OTHER: _____

FONT: _____ SERIF: ___ , SANS-SERIF: ___

MATERIAL / TYPE OF NAMEPLATE: _____

LINE	SIZE	DESCRIPTION
1	____	_____
2	____	_____
3	____	_____
4	____	_____
5	____	_____
6	____	_____
7	____	_____
8	____	_____

LOCATION: _____

NUMBER: _____ (XX-NNNN)
(XX: IC = FOR INSTRUMENTATION & CONTROL, EL = ELECTRICAL, PR = PROCESS, ETC. NNNN = 0001 TO 9999)

BASE: BLACK: __ , WHITE: __ , OTHER: _____

TEXT: BLACK: __ , WHITE: __ , OTHER: _____

FONT: _____ SERIF: ___ , SANS-SERIF: ___

MATERIAL / TYPE OF NAMEPLATE: _____

LINE	SIZE	DESCRIPTION
1	____	_____
2	____	_____
3	____	_____
4	____	_____
5	____	_____
6	____	_____
7	____	_____
8	____	_____

LOCATION: _____

SECTION 13620 - INSTRUMENT PANEL AND ENCLOSURE CONSTRUCTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This specification covers the technical requirements for the fabrication, engineering, wiring and installation for instrument and control panels, remote telemetry unit (RTU) panels, and enclosures for the:

Miami Dade County Public Works Telemetry Systems
Miami, Florida

B. The instrument and control panels shall be as shown on the drawings.

1.2 SUBMITTALS

A. Submittals shall be as specified in the following specification sections:

1. Division 01: General Requirements
2. Division 13: General Instrumentation and Control

1.3 QUALITY ASSURANCE

Comply with the applicable provision of the following codes and standards:

Underwriters Laboratory (UL)
Electrical Testing Laboratory (ETL)
National Electrical Code (NEC)
National Fire Protection Association (NFPA) 79, *Electrical Standard for Industrial Machinery*
Instrumentation Society of America (ISA)

PART 2 - PRODUCTS

2.1 GENERAL

A. The instrument panels and enclosures shall be as follows:

1. Panels and enclosures located in dry, clean, non-corrosive environments (office areas) shall be rated NEMA 1 and provided with cooling fans and louvers.
2. Panels and enclosures located in environmentally controlled (heated and ventilated) rooms shall be rated NEMA 12 and provided with cooling fans and louvers.
3. General instrumentation and control panels located outdoors, in wet and damp areas, and in corrosive areas shall be rated NEMA 4X.
4. Provide heating, ventilation, and cooling units (air-to-air heat exchangers) as required.
5. All devices such as relays, sockets, power supplies, etc. shall use finger-safe design whenever available. Provide guards for all other terminations if a finger-safe design is not available.

B. NEMA 12 enclosures shall be painted electro-statically, prior to equipment installation:

1. Paint color shall be as selected by the Owner.
2. The Contractor shall submit color selection with the panel shop drawing submittals.
3. Freestanding enclosures shall be provided with cable bases, which shall also be painted electro-statically with a second accent color.
4. The enclosure surfaces shall be given a phosphatizing treatment inside and outside.
5. Inside surfaces shall be finished with two coats of white enamel paint.
6. The outside surfaces shall be finished with two coats of semi-gloss enamel paint, which shall be applied electro-statically.

C. Conduit knock-outs on the enclosure shall be made prior to installation of any equipment within the enclosure. The size and the number of conduit knock-outs shall be as required. Provide water tight conduit hubs for all NEMA 4X enclosures. Double locknuts are not acceptable.

D. All enclosures exposed to weather conditions shall be provided with shields to protect the enclosure from direct exposure from the sun and from rain. Depth of shield shall be nominally twice the depth of the panel.

E. Top conduit entries into panels are prohibited unless approved by the Engineer in advance. Route conduits into sides or bottom of panel to eliminate condensation and metal shavings due to drilling or punching holes from dropping onto electrical components.

F. Manufacturers

1. Hoffman
2. Rittal
3. Weigman
4. Fibox,
5. Or equal

2.2 PANEL CONSTRUCTION

A. General

1. Stiffening members shall be provided for strength and stiffness as required.
2. Seamless welded construction shall be used throughout. All exposed seams shall be continuously welded and ground smooth.
3. Lifting rings shall be provided for panels in excess of 100 pounds.
4. Subpanels shall be provided as required, with mounting designed for easy removal. The subpanels shall be finished with two coats of white enamel paint.
5. Print pockets shall be attached to the interior side of each door.
6. Hinges shall be stainless steel.

B. NEMA 12 Enclosures

1. NEMA 12 enclosures shall be fabricated from 12 gauge cold rolled sheet steel or better.
2. Doors shall be of the flush type construction with hinge and gasketing.
3. Doors shall be equipped with three-point latching mechanism and door locks.
4. Corrosion inhibitors shall be furnished for corrosion control inside the panel.

C. NEMA 4X Enclosures

1. NEMA 4X enclosures shall be fabricated from 14 gauge (minimum) stainless steel, FRP, or aluminum.
2. Stainless steel shall be type 316L where available.
3. Enclosure door shall be provided with neoprene gasket, which shall be attached to the enclosure with oil-resistant adhesive, and held in place with stainless steel retaining strips.
4. Door clamps shall be provided on three sides of the enclosure door. Clamps shall be quarter-turn or similar tool-less means.
5. A hasp and staple shall be provided for padlocking.
6. Panel heaters, corrosion inhibitors and breather drains shall be furnished for condensation and corrosion control inside the panel. Panel heaters shall be of the forced air types provided with integral thermostat control, Hoffman type D-AH, or equal.

D. PANEL GROUNDING

1. Where noted or specified, provide a ground bus tied to the facility grounding system.
2. Ground busbars shall be of nickel-plated copper, rated for at least 100 amperes.
3. The busbar shall be provided with two (2) screw clamp terminal blocks, which shall be capable of accepting conductors up to #2 AWG.
4. The busbar shall be provided with a minimum of fourteen (14) screw clamp terminal blocks, which shall be capable of accepting conductors up to #4 AWG. Blocks shall be Penn-Union Type N70, Ilsco type IL-D-167, or equal.

2.3 PANEL WIRING

A. Wiring within the enclosure shall be continuous and shall be terminated only at terminal blocks or equipment terminals.

B. Not more than two wires shall be terminated at any terminal.

C. Wiring splices and wire nuts will not be permitted within the enclosure.

D. Wiring within the enclosure shall be protected as follows:

1. In general, all wiring within the enclosure shall be put in plastic slotted wiring ducts. Wiring ducts shall be sized to include 100% (percent) spare wiring.
2. Wiring outside of the ducts shall be restrained by means of plastic ties.

3. Wiring passing a door hinge shall be grouped and wrapped in a protective wire harness.
4. Provide abrasion protections for any wire bundles passing through holes or across sheet metal edges.

E. In general, wiring within the enclosures shall be as follows:

1. Control wiring within the enclosure shall be #18 AWG stranded, type MTW, or equal.
2. Wiring for long distance DC signals shall be #18 AWG stranded, type THHN/THWN, or multi-conductor control cable as noted.
3. Wiring for 4-20 mA DC analog signals shall be #18 AWG twisted shielded pairs.

F. Low voltage, milli-amp, and milli-volt cables shall meet the following criteria:

1. U.L. Listed Subject 1277
2. Pass IEEE 383 or UL 1581 Flame Test
3. OSHA Acceptable
4. Pass UL VW-1 Flame Test
5. #18 AWG conductors, 7 strand, bare copper
6. #20 AWG, 7 strand tinned copper drain wire
7. 100% aluminum/polyester foil shield
8. 600 volt 90°C rated insulation
9. Each conductor shall be color coded.
10. Each cable shall be numbered.
11. Comply with NEC articles #318, #340, and #501 for power limited tray cable (PLTC)
12. Nominal 2" lay
13. PVC insulation, with ripcord and nylon jacket
14. Suitable for use in wet locations
15. The manufacturer of the cables shall be an ISO 9001 certified facility.

    a. Manhattan type MICS
    b. Belden type #1120A
    c. Okonite Okoseal-N type P-OS
    d. or equal

G. In general, wiring within the enclosure shall follow the following color convention to comply with NFPA 79 (1994), part 16:

1. Neutral conductors shall be white.
2. Line, load, and control conductors shall be black.
3. Grounding conductors shall be green.

4. Foreign voltage control conductors shall be yellow or orange.
5. Low voltage (below 50 volts) AC conductors shall be red.
6. Low voltage neutral (grounded) conductors shall be white with a red stripe.
7. DC control conductors shall be blue.
8. DC (+) power conductors shall be blue with a white stripe or purple.
9. DC (-) (grounded) power conductors shall be white with a blue stripe.
10. Wiring within multi-conductor cables shall be color coded.

H. Notes:

1. Foreign voltage means all control circuits that may remain energized when the main disconnecting means is in the OFF position. Interlocking conductors shall be yellow or orange throughout the entire circuit, including wiring in the control panel and the external field wiring.
2. Colored stripes on the grounded (neutral) conductors shall be as permitted by NEC #200-6(d) and #210-5(a). Conductors shall meet the requirements of these articles.

I. AC and DC wiring shall be separated from each other. Where AC and DC wire runs parallel, the minimum separation between them shall be 4 inches. Where AC and DC wire runs cross, they shall cross at 90°. Provide separate wire channels for AC and DC wiring.

J. Equipment and signal ground wiring, as well as Neutral wiring shall not be daisy-chained. They shall each be terminated at isolated, bused terminal blocks.

K. Each conductor end shall be terminated at a terminal block or at an equipment wiring terminal. Each terminal block shall have a unique identification number. The terminal blocks shall be arranged and numbered in consecutive order, based on standard alpha-numeric order.

L. Terminal blocks within each enclosure shall be grouped as follows:

1. 120 Volts AC power, through 5 Ampere fused terminal blocks
2. 120 Volts AC control wiring terminal blocks
3. AC isolated Neutral Busbar terminations
4. 24 Volts DC power Busbar terminations
5. 24 Volts DC control wiring terminal blocks for discrete signals
6. 24 Volts DC Common Busbar terminations
7. Analog signal wiring terminal blocks (for 4-20 mA DC signals)
8. Isolated Grounding Busbar terminations

M. Provide 25% spare terminal blocks, (a minimum of 6), for each type used in each enclosure.

2.4 TERMINAL BLOCKS

A. Terminal blocks within enclosures shall be of the high density modular types, constructed of nylon material, suitable for mounting on standard DIN rails. Termination type shall be tubular screw with serrated pressure plate. The terminal block system shall be manufactured by Phoenix Contact, or approved equal.

B. All current carrying parts (metal bodies) shall be made of nickel/tin-plated copper.

C. Ground terminals shall be color coded in accordance with international standard, which shall be yellow/green.

D. Matching jumper bridges shall be color coded to the wiring colors.

E. Panel 120 volt power distribution fused terminal blocks shall be provided with disconnect lever puller mechanism and illuminated indication.

1. Fuses shall be standard 1/4" by 1-1/4", and shall be sized as shown on the drawings.
2. The terminal blocks shall be able to accept up to number 8 AWG conductor.
3. Terminal blocks shall be rated for 15 amps at 250 VAC.
4. They shall be Phoenix Contact type UK 6.3-HESiLA-250.

F. Terminal blocks for discrete inputs and outputs that are not connected to interposing relays shall be two-level types:

1. Both levels shall be of the feed through types
2. Terminals shall be rated for up to 20 Amperes at 300 Volts AC, and shall be able to accept up to #12 AWG stranded conductor.
3. They shall be Phoenix Contact type UKKB-3.

G. Terminal blocks for analog inputs and outputs are not connected to surge suppressors shall be three-level types:

1. The top and center terminations shall be feed through types
2. The bottom termination shall be grounded through the railing.
3. They shall be rated for up to 10 Amperes at 300 Volts AC, and shall be able to accept up to #12 AWG stranded conductor.
4. They shall be Phoenix Contact type SLKK-5.

H. Terminal blocks for foreign voltage "hot" conductors shall be single level disconnecting type.

1. Blocks shall be orange or yellow to match control wiring per Part 2.4.F.
2. Shall be rated for 10 amps at 300 volts AC.
3. Shall be lever type with clear indication of open-close status.
4. Shall accept #22 to #12 AWG conductors.
5. Blocks shall be Phoenix Contact.

I. Provide power distribution terminal blocks as required for incoming service distribution as required. Terminals shall be rated for 600 volts and have number of connections points and wire sizes as required. Blocks shall be Square D Class 9080 type LB, Penn-Union type ADB, or equal.

2.5 PANEL ACCESSORIES

A. Each enclosure shall be provided with internal panel fluorescent lights, which shall be provided with and actuated through a door light switch. The lights shall turn on automatically when the enclosure door is opened and turn off automatically when the enclosure door is closed. The panel lights shall be strategically placed to provide maximum possible illumination coverage of the panel/enclosure interior.

B. The enclosure vendor shall be responsible for all interposing relays which may be necessary to interface all field-mounted equipment with the programmable controller system, to provide a complete functional system.

C. Provide air-to-air heat exchangers where required for NEMA 12 and NEMA 4X panels. Size units to provide a minimum of 125% of the required cooling. Units shall be as manufactured by Kooltronic, Melcor, Noren Products, or equal.

2.6 SIGNAL ISOLATION AND PROTECTION

A. The enclosure vendor shall be responsible for all analog signal boosters, barriers, and isolators which may be necessary to interface all field mounted equipment with the programmable controller system, to provide a complete functional system.

B. Signal Isolators

1. Current to current isolators shall be provided for all analog inputs and outputs, including spares, as shown on the Drawings and as specified herein.
2. Power to the isolators shall be 115 Volts AC, 60 Hertz, 24 VDC, or as indicated.
3. Isolators shall take a single field analog input signal and provide single or dual analog outputs as required or as noted on the Drawings. Inputs shall be 4 - 20 mA DC. Outputs shall be 4 - 20 mA DC isolated, into at least 800 Ohms.
4. Where indicated on the Drawings, provide a NEMA 4X stainless steel enclosure for the unit, ON/OFF switch and surge suppressor.
5. Units shall be high density DIN rail mounted.
6. Manufacturers shall be an ISO 9000 facility. Isolators shall be as manufactured by:

    a. Phoenix Contact type Mini-MCR-SL
    b. Weidmüller Micro-Analog D.C. / D.C.
    c. Action Instruments
    d. Arizona Gear Manufacturing (AGM)
    e. Moore Industries
    f. Or equal.

2.7 SIGNALING DEVICES

A. Provide all audible and visual signaling devices as shown on the Drawings and as specified herein.

B. Audible Signal Devices:

1. Where noted on the Drawings, enclosures shall be provided with audible alarm signaling devices.
2. Low volume devices as manufactured by Sonalert, or equal, shall be used only where specified.

3. High volume devices shall be as manufactured by Patlite, Edwards, Federal Signal, Benjamin, or equal. The unit shall incorporate the following:

    a. Flush panel mounting.
    b. Weather resistant
    c. Internal gain control for output adjustment (80 dBA maximum at 15 feet)
    d. UL listed
    e. Operating Voltage: 120 Volts AC

D. Visual Signaling Devices

1. Provide single visual signaling devices as indicated on the Drawings.
2. Devices shall be rated NEMA 4X and suitable for outdoor use.
3. Operating voltage shall be as required for the panel.
4. Lights shall be both continuous (acknowledged) and flashing (unacknowledged).
5. Devices shall be as manufactured by Patlite, Edwards, Federal Signal, Benjamin, or equal.

2.8 PILOT AND CONTROL DEVICES

A. Pilot Devices: Pushbuttons, selector switches, and indicating lights shall be rated heavy duty; and oiltight, or watertight and corrosion resistant as required. All units shall be furnished with standard size legend plates with legends as indicated on Drawings.

B. Selector switches shall have the number of positions, switching arrangement, number and type of contact blocks indicated on the Drawings.

C. Contact blocks shall have a minimum continuous current rating of 10 amperes at 240 volts ac. Contact blocks shall have screw type connection terminals.

D. Pilot device shall be 22 mm or 30.5 mm size unless noted otherwise. They shall be as manufactured by:

1. Square D Class 9001, Type K.
2. Allen-Bradley Bulletin 800H or 800T.
3. General Electric type CR104P.
4. Eaton-Cutler/Hammer type 10250T or E34
5. Or equal.

E. Control relays shall be plug-in type with sockets and hold-in clips. Sockets shall have screw terminals. Contacts shall be silver-cadmium, rated 10 amperes at 240 volts AC. Relays shall have four pole, double throw contacts (4PDT). Relays shall have a manual operator and pilot light. Coil voltages shall be 120 VAC, or as noted on the Drawings. Relays shall be as manufactured by Allen-Bradley Bulletin 700 Type HF, Square D type R, Struthers-Dunn 219 Series, or equal.

F. Timing relays shall be solid state, plug-in type with screw terminal sockets. Each relay shall have 5 adjustable timing ranges, switch selectable, and 4 timing modes minimum, switch selectable. Timing ranges shall allow from 0.05 seconds to 999 minutes timing. Timing modes shall be ON delay, OFF delay, ONE SHOT, and REPEAT CYCLE. Output contacts shall be DPDT, rated 10 amps at 240 VAC. Timing setting shall be by thumbwheel switches. Coil voltages shall be 120 VAC, or as noted on the Drawings. Timing relays shall be Square D type JCK70, or Allen-Bradley type 700HR.

2.9 INTERPOSING RELAYS

A. Provide interposing relays for all RTU field inputs and outputs. Purpose is to provide isolation between the RTU and the field equipment, and to allow use of high density RTU I/O modules. Interposing relays are not required for the panel mounted devices.

B. All relays shall be high density, DIN rail mounted type with coils, contacts, and voltage ratings as required. All contacts shall be rated 5 amps at 120 volts minimum. All relays shall have an LED "ON" indicator. “Ice-cube” style or machine tool type relays are not acceptable. Field input relays shall have 120 VAC coils, output relays shall have 24 volt coils, or as required.

C. Relays shall be used to isolate field inputs, logic functions, etc. from the wiring to the RTU. Relays shall also be used for control of field devices. Contacts shall be SPDT. Relays shall be Phoenix Contact RTU-Relays type RTU-RSx.

D. For direct control of field devices where heavy duty contacts are required, provide relays with SPDT contacts, rated 12 amps minimum at 250 VAC. Phoenix Contact RTU-Relay High Current. If required, provide the high inrush versions of these units for controlling the field devices. These types shall be used for controlling solenoid valves, fractional horsepower motors, etc.

2.10 EQUIPMENT IDENTIFICATION AND WIRE TAGGING

A. All equipment and wiring identifications shall conform to and be compatible with the Owner's current labeling system, and shall be completed prior to final payment of this work. It is the responsibility of the Contractor to coordinate with the Owner's Engineer, to obtain from him or her all labeling standards and documentation.

B. All control wiring shall be identified by means of computer-generated, heat shrink type wire marker. Wire numbers shall be as shown on the drawings.

C. Each component mounted within the enclosure shall be provided with equipment identification. Equipment and device nameplates or identification shall be of engraved laminated plastic, with black lettering on white background. Nameplates shall be as listed herein or as shown on the drawings.

D. The enclosure vendor shall be responsible for providing and sizing all instrument loop power supplies. The instrument loop power supplies shall be sized to include at least 100% spare capacity. The enclosure vendor shall submit power supply load calculations with the panel shop drawings.

E. For front mounted indicators, the nameplate shall include the appropriate scale range, i.e. 0 to 8 MGD, 0 to 12 feet. Also include tag number, process name, and other data as required. Review all nameplates with Owner.

2.11 REGULATED POWER SUPPLY

A. When DC power supply is required for RTU discrete inputs, and 2-wire analog loops, provide at least two redundant 24 Volt DC regulated power supplies.

B. The power supply shall be sized to include 100% spare capacity.

C. Power supply manufacturers:

1. Phoenix Contact,
2. SOLA,
3. Or equal.

2.14 SURGE SUPPRESSION

A. Provide transient voltage surge suppression (TVSS) for incoming power and digital (serial) inputs and outputs, including spares. Discrete I/O do

not require TVSS protection since each one passes through an interposing relay. Analog I/O signals at the control panels do not require TVSS protection since each one passes through a signal isolator.

B. The protectors shall be designed to protect all typical 4-20 mA DC field mounted transmitters from damaging transients induced by lighting or heavy electrical equipment.

C. Specifications

1. Construction

a. Type “A” housing: Stainless steel 1/2" pipe nipple
b. Type “B” housing: Mounted within the field instrument or in a separate NEMA 4X or 7 enclosure.
c. Type “C” – DIN rail mounted for high density applications.
d. Type “A” and “B”: Epoxy filled unit suitable for all environments
e. Temperature Limits: -40°F to +200°F.
f. Relative Humidity: 100%

2. Electrical

a. Input/Output: Two-wire 4-20 mA DC, from a 10.5 to 55 Volt DC external power supply
b. Conduit entry for pipe nipple style: One or two 1/2-inch NPT connections with leads as required.
c. Maximum loop resistance added: 44 ohms
d. Surge life: 500A, 10x1000µs, 400 minimum
e. DC Clamping voltages - 45VDC max. loop supply, 70V L-L or L-G.
f. Impulse Clamping Levels - 28VDC max loop supply, L-L 70V Max, or L-G 120V Max.

D. ACCEPTABLE MANUFACTURERS

1. The manufacturer of the instruments shall be an ISO 9001 certified facility.
2. As manufactured by:

a. Innovative Technology, Inc. model OEM-D
b. Rosemount Model 470A
c. Joslyn Electronic Systems Corp., Model 1669
d. SPS Model MTL378
e. Phoenix Contact model TERMITRAB (Type C mounting)

f. CITEL DL-24 (panel type)
g. Or equal

PART 3 - EXECUTION

3.1. GENERAL

A. Touch up all nicks, scratches, etc. with materials as recommended by the enclosure manufacturer.

B. Comply with the appropriate items of Section 13600 - Part 3, as required.

C. Provide 1 copy of panel drawings with each panel. Put in 3 ring binder with all pages inside of archival quality sheet protectors to protect them from dust, dirt, and other wear and tear.

D. Clean panel thoroughly inside and out. All wireways shall have covers installed, filters shall be clean, lamps and heaters shall be in good working order. All spare wiring shall be neatly coiled at bottom of panel and identified.

3.2. INSTALLATION

A. All panels shall be installed level and plumb.

B. Install panels facing north where practical. Top of panel shall be between 60 inches and 72 inches above finished floor / grade unless noted otherwise.

C. Provide sun / rain shields for panels as specified.

3.3. TOOLS AND SPARE PARTS

A. Pilot and Control Devices

1. Provide 1 spare LED display unit of each color.

B. Terminal Blocks

1. Provide 10 spare terminal blocks of each type for each panel.

C. Interposing Relays

1. Provide 10 spare base modules of each type for each panel.
2. Provide 20 spare relay modules of each type for each panel.

D. Panel Accessories

1. Provide 1 can of touch-up paint, 4 oz. size, for each panel.
2. Provide 1 replacement fluorescent lamp for each panel.
3. Provide 1 set of corrosion inhibitors for each panel.

E. Signal Isolators, TVSS, fuses, power supply

1. Provide spare signal isolators, minimum 1 of each type per panel.
2. Provide spare fuses, minimum 3 of each type and size.

F. Provide complete listing of all spare parts showing catalog numbers. Include name, address, and contact numbers of distributors. Include copy of listing in binder that remains with panel.

G. Turn over to Owner and obtain receipts for all items.

END OF SECTION 13620

SECTION 13630 – REMOTE TERMINAL UNITS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. General: Work under this Section is subject to the requirements of the Contract Documents.

B. This specification covers the technical requirements for the fabrication, installation, engineering, wiring, adjustment, testing, start-up, commissioning, and training for the remote terminal unit (RTU) required for:

Miami – Dade County Public Works Telemetry System
Miami, Florida

C. The RTU shall be provided complete, including all hardware, system cabling, network cabling, and installation which may be necessary for a complete and working system.

D. The programming of the RTUs shall be covered under this contract.

1.2 RELATED WORK

A. Division 13: General Instrumentation and Control

B. Division 13: Instrument Panel and Enclosure Construction.

C. Division 16: Grounding

D. Division 16: Wires and Cables

1.3 QUALITY ASSURANCE

A. Electrical Component Standards: Components and installation shall comply with the latest edition of NFPA 70, National Electrical Code (NEC).

B. All work and materials of the remote terminal unit (RTU) systems shall be furnished by Emerson Process Management.

C. Drawings and specifications shown are intended to convey information required for a complete control system for the purposes specified. The

System Integrator shall be responsible for all details (such as load resistors, surge protectors, signal isolators, interposing relays, etc.), which may be necessary to properly install, adjust, and place in operation a complete and working system.

D. The System Integrator and the Contractor shall be responsible for all coordination between the RTU systems and the field mounted process equipment and instrumentation.

E. Installation shall be in strict compliance with the equipment manufacturer's instructions. The System Integrator shall assume full responsibility for additional costs which may result from unauthorized deviation from these specifications and from the equipment manufacturer's instructions.

1.4 SUBMITTALS

A. Submittals shall comply with the Contract Documents. Shop drawings shall be submitted complete, in a single submittal. Partial submittals will be returned unchecked. Exceptions can only be made with prior approval from the Engineer.

B. Submit shop drawings in the following sequence:

1. Submit for approval: system hardware configuration block diagrams, equipment cut-sheets, and instruction bulletin for each type used.

C. After system hardware configuration is reviewed, submit the following:

1. Panel/enclosure shop drawings, which shall include front elevation, internal panel elevation, conduit hole penetrations, and panel bill of material. Each item of panel mounted equipment shall be shown.
2. Panel wiring diagrams, which shall show input/output wiring and terminations, and panel power wiring and terminations.
3. Detailed calculations, including power supply sizing calculation.
4. Other descriptive information that will assist the Engineer with approval of the shop drawings.

5. Submit the RTU system and the operator interface system technical manuals and instruction bulletins, which shall include but not be limited to the following items:

   a. Complete system overview
   b. Programming instructions
   c. Installation and start-up instructions
   d. Trouble shooting instructions
   e. Specifications of the various I/O devices
   f. Specifications of the various programming devices

1.5 EQUIPMENT IDENTIFICATION AND TAG NUMBERS

All apparatus, control equipment and instruments, both panel and field mounted, shall be identified by engraved laminated labels. Description on the labels and methods of attachment shall be as approved by the Owner / Engineer during shop drawing approval. Labels shall be in accordance with Division 16 – Electrical Identification.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. RTU System: Emerson Bristol®,

1. ControlWave-Micro or FB3000 for sites with utility supplied power.
2. ControlWave-Micro or FB3000 for solar-powered sites

B. All RTU panels to be manufactured and supplied by Emerson Bristol®.

2.2 GENERAL

A. See Division 13 General Instrumentation and Controls for the Process Control Description.

B. All input and output modules, racks, power supplies, etc. shall be by one RTU manufacturer.

C. Racks or housings shall accept any mixture of inputs, outputs, communication cards, etc. as required. Dedicated racks for any I/O type are not acceptable.

D. All input and output circuits shall be optically isolated from the RTU.

E. Provide removable terminal strips to allow replacement of modules without disturbing panel wiring. Use wiring harnesses where available for connecting the I/O modules to the interposing relays.

F. LED indicators shall show status of each I/O to aid in troubleshooting.

G. Provide power supplies as required to operate and protect all I/O modules, communication cards, processors, remote I/O adapters, etc. as required.

H. The equipment manufacturer shall provide remote-access and phone support to the Owner for a period of 1 year from the date of system delivery.

2.3 OVERVIEW

A. The controller shall be an industrial-grade, microprocessor-based unit capable of accepting inputs from discrete (single point), analog, and high speed pulse data sources.

B. The controller shall execute user-entered logic instructions from memory and perform output functions as required by the logic instructions to discrete, analog, parallel, and serial data outputs.

C. The central processor unit (CPU) shall not require the use of external storage devices (i.e., disk drives) to execute user programs.

D. The controller shall be fully modular in design and have a pin-and-socket connector for easy field upgrades or card placement.

2.4 CENTRAL PROCESSOR UNIT (CPU)

A. The central processing unit shall be a single printed circuit board assembly utilizing surface mount technology.

B. The CPU shall plug directly into the I/O base and have integral wiring to the base, power supply, and the local I/O system.

C. The unit will have indicators on the front bezel that monitor the controller operation, the battery (if required), the status and the CPU's mode of operation.

D. Shall include integral communication ports: Two(2) Ethernet, two(2) RS232, and two(2) RS485 ports.

2.5 MEMORY

A. The standard user program storage medium shall consist of flash EPROMs. The flash EPROM shall store the RTU program plus all program documentation including symbols and ladder rung comments. All symbols and ladder rung comments must remain resident in the RTU memory.

B. The CPU and associated memory shall be incorporated into the same printed circuit board assembly.

C. Under normal operating conditions, the RAM or storage medium shall retain setpoint values for no less than six months in the event of power failure. Under normal operating conditions, the FLAHS or storage medium shall retain a program for 5 years in the event of power failure.

D. Main program memory size of 4 Mbytes minimum, with word lengths of 32 bits. Unit shall include an additional memory for data storage. The RTU must be able to store the program, plus all symbols and comments for the program.

2.6 COMMUNICATIONS

A. Protocols: RTU shall natively communicate through ModBus, DF1, BSAP, HART, and/or **DNP3** SCADA Telemetry protocols. BSAP and/or DNP3 shall also provide complete access to RTU configuration and diagnostics.

B. Sampling: RTU shall provide polled, report-on-exception (alarms/events), and report-by-exception (RBE) data-acquisition of SCADA signals.

C. Media: RTU shall have built-in connections to Ethernet (RJ45), RS232 (D9), and RS485 (D9). RTU shall provide additional ports if needed by application or instrumentation.

2.7 PROGRAM EXECUTION

A. Memory scan time shall be less than 0.1 milliseconds per 1000 Boolean instructions. The entire ladder logic program shall be completed once each scan. Each scan cycle shall allocate time to update all I/O, execute the program, communicate with special function I/O modules and execute specific task request.

B. The processor shall be equipped with no less than 16,384 internal relay equivalents and shall be capable of employing Master Control Relays to perform program control functions.

C. The processor shall contain no less than 65,536 variable memory registers, and each register shall be capable of storing 32-bit floating-point decimal values. Variable memory shall be have non-volatile backup.

2.8 TIMERS AND COUNTERS

A. The controller shall have the capability of up to 4096 counters and 4096 timers. Each counter can store 32-bit floating-point values, and each timer shall be capable of storing double-integer values (milliseconds).

~~B. Timers shall have a selectable time base of 1 millisecond of 1/10th (0.10) second. There shall be one instruction that counts (up or down) between zero and 32,767.~~

2.9 INPUTS AND OUTPUTS

A. The system shall have the capacity to accommodate no less than 96 inputs or outputs in increments of four, eight, or sixteen points within rack limitations. Modules and their rack assemblies shall contain all circuitry for interfacing inputs and outputs to the controller.

B. The I/O assemblies will provide mounting slots for the processor, power supply and I/O modules. The following standard I/O modules shall be utilized.

1. Discrete Inputs: 24 VDC, 16 point.
2. Discrete Outputs: 24 VDC, 16 point
3. Analog Inputs: 8 channel, isolated, accept 4-20 mA DC or 1-5 VDC input signals. Each channel pair shall be configurable.
4. Analog Outputs: 4 channel, isolated, individually configurable as 4-20 mA DC or 1-5 VDC.

C. Provide interposing relays for all discrete inputs and outputs. See Div 13 Instrument Panel and Enclosure Construction sub-part Interposing Relays. Provide pre-wired cable assemblies where available for connecting the inputs and outputs to the interposing relays

D. Provide signal isolation for all analog inputs and outputs. See specification “Instrument Panel and Enclosure Construction” sub-part “Signal Isolation and Protection”. Provide pre-wired cable assemblies where available for connecting the inputs and outputs to the isolators

2.9 RATINGS

A. Electrical

1. Input power supplied by a power supply module
2. Input Voltage Requirements: +5 VDC

B. Environmental

1. Operating Temperature: -40°C to 75°C (-40°F to 167 °F)
2. Storage Temperature: -40°C to 85°C (-40°F to 185°F)
3. Relative Humidity: IEC68-2-3; 5-95% non-condensing
4. Vibration: 1g over 10 to 150 — 0.5g over 150 to 200 Hz
5. Noise Immunity: NEMA (ICS-304) and EN 61326-1:2013

2.10 STANDARDS AND REGULATORY AGENCY APPROVALS

A. The CPU and associated racks, power supplies and I/O modules shall have major approvals include:

1. UL Listing
2. CSA Certification

2.11 RELAY LADDER INSTRUCTIONS

A. There shall exist, instructions which will skip any number of ladder logic rungs to a specified rung. There shall also exist, an end program instruction to skip all unprogrammed lines in memory.

B. There shall exist, discrete and motor alarm timer instructions which shall use a feedback loop to confirm control action occurrence. In the event control actions to not occur in the desired time, an alarm bit shall be set.

C. The RTU and its software shall provide all five programming languages standard as referenced by the PLC IEC 61131-3 standard.

D. Ladder logic documentation shall consist of one comment block for each output coil and a synonym for each contact or output coil. The I/O documentation shall display on a case-by-case basis what type module is in each slot and the synonym for each I/O point. All documentation shall be able to be printed out for reference (variable and constant memory documentation, program title), and stored in the RTU memory.

E. Ladder Logic Labeling

1. All inputs shall be labeled with a description that indicates its function when the input is "true", "energized", or "on". For

example, "Sump Level GE 12 in." instead of "Sump Low Level". All descriptions shall be expressed in a positive fashion, i.e., "Shearpin Limit Switch OK", instead of "Shearpin Limit Switch Not Tripped".

2. Ladder logic contacts and coils shall be labeled in a similar fashion. Modify labels accordingly for normally closed contacts. Example, a normally open contact indicating "Sump Level GE 12 in." should become "Sump Level LT 12 in" for a normally closed contact.

F. The system logic shall be structured into logical code blocks to facilitate future code revision and troubleshooting.

2.12 POWER SUPPLY AND BATTERIES

A. Input power shall be 10.7 to 30 VDC from power supplies as specified in Division 13, Instrument Panel and Enclosure Construction.

B. Provide diagnostic indication (LED) and alarm for memory backup battery.

C. Provide capability for redundant configurations utilizing second or third power supply in critical areas of plant as specified. Provide failure detection.

2.13 SOFTWARE

A. Transfer all software licenses and service to the Engineer

PART 3 - EXECUTION

3.1 SYSTEM INSTALLATION

A. The Contractor shall provide all materials and work necessary for a complete and functioning RTU system and shall have full coordination responsibility of the electrical, instrumentation and control, variable speed drives, mechanical, and structural work as specified in these specifications and/or shown on the drawings.

B. The Contractor shall ensure that RTU system work is properly interfaced with equipment and other work not furnished by the system provider.

C. The Contractor shall install, make final connections to, adjust, test, and start-up the complete RTU system utilizing the technical services of the system provider.

3.2 COMMISSIONING

A. This activity shall consist of two sequential performance tests:

1. Operational test
2. Functional test

B. The proposed format and documentation of these tests shall be submitted to the Engineer for review and comment prior to commencement of this activity.

C. Each test shall be witnessed by representatives of the RTU system provider, the Contractor, the Engineer and the Owner.

D. The objective of the Operational Test shall be to demonstrate that the RTU system is ready for final operation. The system shall be checked for proper installation, adjustment, and calibration on a loop-by-loop basis to verify that it is ready to function as specified.

E. The objective of the Functional Test is to demonstrate that the RTU systems are operating properly and are in compliance with the specified performance requirement, and that the system is ready for use by the Engineer.

3.3 ACCEPTANCE

A. Upon the successful completion of commissioning and training activities, the RTU system provider may request formal acceptance of the system.

B. All plans, cd`s, documentation, etc. to be given to the Engineer. Obtain receipt for same.

C. Assist Engineer with transferring licensing of all software.

D. Back-up and restore all programs and data after system is on-line. Train Engineer in procedure.

3.4 SPARE PARTS

A. Provide the following spare parts.

1. Provide 1 spare input/output cards of each type.

B. Deliver all spare parts to the Engineer. Obtain receipt for same.

END OF SECTION 13630

SECTION 13660 - **RADIO TELEMETRY SYSTEM**

PART 1 - GENERAL

1.1 DESCRIPTION

A. This specification section covers the technical requirements for the Radio Telemetry System as described in Division 13, "General Instrumentation and Control", and as shown on the Drawings.

B. It is the intent of these specifications that all components necessary for a complete and functioning system shall be included. This includes but is not limited to the following: programming of all radios, maintenance software, mounting brackets, grounding systems, 120 VAC power surge suppressors, lighting arresters, poles, directional antennas, 12/24 VDC power supplies, enclosures, etc.

C. The field radio path survey shall be complete before purchasing of radio and antenna equipment for that site.

1.2 SUBMITTALS

A. Submittals shall be as specified in the following specification sections:

B. Division 01: General Requirements

C. Division 13: General Instrumentation and Control

D. Submit agenda for all coordination meetings at least one week in advance. Prepare and distribute meeting minutes within two weeks following each coordination meeting.

E. Submit product brochures and installation guidelines on all radios, antennas, cables, grounding kits, mounting hardware, surge suppressors, diagnostic software, management software, etc.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 70 "National Electrical Code (NEC)", latest edition, for components and installation.

B. Listing and Labeling: Provide products specified in this section that are listed and labeled as defined in NEC article #100.

C. Comply with all Federal Communications Commission (FCC) requirements for a licensed 5-watt data telemetry radio system.

D. Comply with all Federal Communications Commission (FCC) requirements for an unlicensed 1-watt spread spectrum data telemetry radio system.

E. The radio manufacturer shall be certified as an ISO 9001 approved facility. A certificate of ISO 9001 registration shall be included with the bid documents.

F. Company performing installation work shall have a minimum of 2 years experience in wireless communications for SCADA systems.

1.4 DEFINITIONS

A. Bridge: A device for connecting different types of physical media networks, i.e. coaxial cable to twisted pair cable. Protocols are the same on both networks.

B. Router: A managed Ethernet type switch that isolates traffic from one network to another. It provides network address translation (NAT) and may serve as firewall.

C. Master / Access Point (AP): The transceiver in the network that provides synchronization information to one or more remote units.

D. Latency: The delay expressed in milliseconds between when data is received at the input port of one radio and it appears at the output port of another radio.

E. Slave / Remote: A transceiver in a network that communicates with an associated AP or master radio.

1.5 GUARANTEE

A. The radio vendor shall guarantee in writing that if it is contracted to plan, design, and deploy the wireless network: The radio network shall meet or exceed all promised levels of performance and functionality including accurate, complete coverage, signal strength, and data throughput.

1.6 SERVICES PROVIDED BY OWNER

A. Person designated as Engineer liaison. This person shall serve as the point of contact for the contractor and vendors.

B. Copy of On-Site Radio Survey that includes the latitude and longitude in decimal format for all master, repeater and remote locations.

C. Assistance in identifying other facilities, buildings, poles, etc. that can be used as master / repeater locations.

D. Soils report prepared by a local testing firm.

PART 2 - PRODUCTS

2.1 FIELD RADIO SURVEY

A. The field radio survey will be provided.

2.2 MANUFACTURERS

A. The radio manufacturer must be certified as an ISO 9001 approved facility. A certificate of ISO 9001 registration must be included with the bid documents.

B. Radio Equipment

1. Microwave Data Systems (MDS), #9710A
2. No substitutions will be allowed.

C. Antennas

1. MDS Clearwave
2. Dataradio
3. Maxrad
4. Andrew
5. PCTEL
6. Or approved equal

D. Cables

1. Andrew Company, Heliax types FSJ and VXL
2. Times Microwave Systems, type LMR-400, LMR-600, LMR-1200

E. Antenna Cable Surge Arrestors

1. Polyphaser
2. Phoenix Contact type CoaxTRAB
3. Or approved equal

2.3 LICENSED LOW SPEED DATA RADIOS

A. General

1. Integrated wireless modem hardware shall be supplied which complies with applicable Federal Communications Commission (FCC) or National Telecommunications and Information Administration (NTIA) requirements for FCC Part 15. The radio

and the modem must be packaged together and internally interfaced with each other.

2. Wireless modems shall operate within the 800 to 960 MHz frequency band.
3. On-line, non-intrusive RF network diagnostic monitoring shall be provided as a standard feature in the system architecture.
4. Wireless modem hardware of a 'packetized' design may not be used. Units shall be data transparent to allow for a minimum amount of data transmission latency, and to limit data transmission overhead thus to allowing the wireless modem to obtain the data rates specified.
5. The wireless modem hardware must be protocol transparent and independent. It must support 7 or 8 data bits, 1 or 2 stop bits, even, odd, or no parity in any combination. Communication port speeds shall be 9600 bps.
6. Units shall operate in a Master / Remote configuration.
7. Front panel mounted LED indicators shall be available for status monitoring. RUN/POWER, CS/SYN, RX/TX, AND RD/TD.
8. Separate data ports must be provided for both application data and for on-line, non-intrusive diagnostic monitoring.
9. Field configurable as 'Master' or 'Remote'.

B. Physical / Environmental

1. Shall operate on 10 to 16 VDC nominal
2. Operating temperature range: -30^{O} C to $+60^{O}$ C.
3. Rated for Class 1 Division 2 environments
4. Humidity: Less than 95% non-condensing
5. Standard

C. Transmitters

1. RF output power of at least 5 watt (30 dBm) and must be adjustable down to 0.1 watt (20 dBm) and any level in between in 0.5 dB increments.
2. Frequency Stability: 1.5 ppm between -30 to +60 Celsius
3. RTS-CTS Delay for RTS Mode: 0 to 255 ms.
4. RF Output Impedance: 50 ohms.

D. Receivers

1. Type: Dual conversion, superheterodyne
2. Sensitivity (at antenna input port): -110 dBm with 1×10^{-6} BER
3. Conducted Spurious: Per FCC Part 15
4. Frequency Stability: 1.5 ppm from -30 to +60 Celsius.
5. RF Input Impedance: 50 ohms.

E. Diagnostics

1. The wireless modem shall be capable of passing both on-line, non-intrusive system diagnostic capability, as well as off-line diagnostic capability with loop-back testing.
2. On-line diagnostics shall originate at each remote site and will be compiled at the master station. Each remote site with each transmission of data generates diagnostics.
3. Diagnostics shall support an OPC driver and deliver data in an I/O tagged format.
4. Diagnostics reported to the central polling location shall include the following parameters:

    a. A unique ID number.
    b. Receive signal strength in dBm for local and remote units.
    c. Temperature.
    d. Power supply voltage.
    e. Forward and reflected RF power.
    f. A receive quality based on the last 15 data blocks received. This information must be communicated seamlessly over the air with RTU data, during the polling cycle.

5. Off-line intrusive diagnostics must also be supported that provide for the active and immediate querying of remote units, independent of the system polling cycle.
6. Off-line diagnostics must provide the following additional functionality:

    a. Retrieving statistics of operation from any particular remote site.
    b. Sampling of the last 10 stations heard in the network by the remote unit.
    c. Cause the remote unit to send a ‘fox’ type message over the air.

7. The following off-line diagnostic parameters must be made available over the air, from a remote unit(s):

    a. Remote transmitter B+ voltage.
    b. Analog supply voltage.
    c. Transmitter and receiver voltages.
    d. Temperature.
    e. Forward and reflected RF power.

8. Diagnostic data must be digital in nature and may not use DTMF (Dual Tone Modulated Frequency) encoding for reasons of

security, for the off-line diagnostic capability can disrupt wireless data network operations.

9. The equipment vendor must supply off-line diagnostic software as is available from the wireless modem manufacturer.
10. Support for on-line diagnostics must be written into and supported as an integral function of the system control/polling software.

    a. The wireless system control software must provide alarm capability. Alarms are to be issued on the control system CRT when unusual RF network diagnostic values are received at the control point.
    b. The wireless system control software must log diagnostic data to hard disk for later review. Diagnostic data from at least the previous fourteen days must be retained on computer hard disk.
    c. A catalog of diagnostic data, which reflects system start-up values, must be retained for later review.
    d. Diagnostic parameters must be examined weekly by the control software to detect any significant system operational trends.

11. Diagnostics shall include the capability to acquire spectrum usage analysis from both the local unit and a specified or series of specified remote units. This spectrum analysis information shall be a part of the programming software. The tool shall reflect the Received Signal Strength Indication (RSSI) in dBm, the channel associated with the RSSI indication, and a dynamically placed noise floor indication based on a user selected dBm indication. Information will be available as a dynamic graphic presentation.
12. The programming software shall have the capability to display the number of synchronization counts on a per-band/per-channel basis. This information shall be accessible from both the local unit and a specified remote unit (or remotes). All information shall be available as a dynamic graphic presentation.
13. **Master-Station Radio shall provide Terminal-Server connections to SCADA Server. This connection will provide:**

    a. **Redundant encapsulated serial transmissions through two Ethernet connections to the SCADA Server.**
    b. **Radio Diagnostics using the GE-MDS PulseNET management software running in the SCADA Server.**

2.4 CABLES

A. Cables shall be installed in strict accordance with manufacturer's recommendations and industry practices. Cables shall be supported every 10 feet maximum.

B. Antenna cables shall be low loss foam filled type. Cable loss shall not exceed 2 dB for the length installed. Cables shall have 900 MHz attenuation not exceeding the following:

1. 4.0 dB per 100 feet for distances up to 50 feet.
2. 2.0 dB per 100 feet for distances between 50 and 100 feet
3. 1.0 dB per 100 feet for distances greater than 100 feet.

C. Antenna cable shall only be cut with the special cutting tool recommended by the cable manufacturer. After installation, each antenna cable shall be tested with a Time Domain Reflectometer. There shall be no reflections other than from the cable ends.

D. At all points where a cable enters/exits a conduit and is exposed to the weather, the entry shall be shaped and positioned so as to minimize the danger of water intrusion. Any unused entry space shall be filled to further prevent any water from following the cables into the conduit.

E. Antenna cables shall be outdoor type 50 ohm Heliax type as manufactured by Andrew Company, (types FSJ4 or VXL), Times Microwave LMR-400-DB, or equal. All connectors shall be by the same manufacturer as the cable.

F. All connectors shall be corrosion resistant, designed for outdoor installations. Provide "O" ring seals on all connections.

G. Provide heat shrink type covers or similar to seal all outdoor connectors against moisture and corrosion.

2.5 ANTENNAS

A. REMOTE SITES

1. Frequency Range: 902-928 MHz
2. Gain: 6 dB minimum to 15 dB maximum
3. Lightning Protection: Direct ground protection.
4. Front-to-Back Ratio: 20 dB, minimum.
5. Connector: Flexible extension TNC with neoprene housing to appropriate connector type of antenna cable. Nominal cable length of 72" for radios.
6. Mounting Hardware: Heavy duty weatherproof clamp suitable for direct mount to 2 inch pipe, or as required..
7. Antenna Hardware Kits: All the aforementioned items should be supplied from the equipment provider in a complete, easy to use kit that provides all the necessary items to properly connect the wireless modem to the antenna.

B. Units shall include gold anodized aluminum radiator components, gold plated connector, solid aluminum mounting clamp, and stainless steel hardware.

C. Antennas shall be factory tuned to the radio frequencies being used. Coordinate with radio manufacturer for tuning to the frequencies being used for this project. Verify before ordering.

D. Provide all masts, lightning suppressors, and any other apparatus required to assemble a complete, operable, and reliable fixed wireless data system.

2.6 SOFTWARE

A. Provide three (3) copies of radio management software. Software shall include three (3) years of product support and upgrades. Software shall be MDS NETview MS.

PART 3 - EXECUTION

3.1 GENERAL

A. All radios, antenas, cables, etc. shall be installed in strict accordance with the manufacturer's instructions.

B. All units shall be programmed with all necessary information for proper operation.

3.2 GROUNDING

Provide grounding for all systems as shown on the Drawings and as recommended by the radio systems vendor.

3.3 OPERATIONS

A. Install all antennas, cables, and other equipment as required for a complete system. Place system into operation and tune for optimum operation.

B. Document radio paths showing data throughput, dB losses, fade margins, etc.

C. Instruct Owner in basic operations and troubleshooting of the system.

3.4 FINAL REPORT

A. Submit final report of radio system design. This shall include the following:

1. Site listing with GPS coordinates and elevations. Include street addresses where available.
2. Station radio numbers
3. System block diagram showing signal routing,
4. Antenna details: type, mounting arrangement, heights, gain, aiming, etc.
5. Serial numbers of all radio equipment
6. Radiated power at all sites
7. RSSI, BER data, and other signal parameters.

B. Take a minimum of ten (10) digital photographs of each site after all work is complete. Pictures shall show new and old equipment, general area, access, locations of the new panels and antenna supports, etc. Organize by putting each site into a folder with site name, e.g. Arch Creek Estates 1. At end of project provide two copies of all pictures on CD-ROM or DVD. These are to serve as the post-construction references.

END OF SECTION 13660

SECTION 13661 - RADIO TELEMETRY SYSTEM **FIELD TESTING**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Field testing requirements for the Telemetry System.

B. Items specified in this section shall conform to general requirements of Division 13, General Instrumentation and Controls.

1.2 SUBMITTALS

A. In addition to submittal requirements of Division 13, General Instrumentation and Controls, provide completed test documentation and sign-off sheets and punch list forms.

B. Submit documentation in accordance with Division 13, General Instrumentation and Controls.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - PREPARATION

3.1 FIELD TESTING AND DEMONSTRATIONS

A. General

1. Field testing is intended to check installation of the Telemetry System in addition to provide a diagnostic check of associated field equipment and wiring.
2. Install RTU programming and provide any configuration required to establish communications with the Master-Station Radio in the SPCC Building, 111 NW 1st Street, Miami, FL.
3. Testing shall begin after Remote Terminal Panel (RTU) is installed and all terminations are complete.

B. Operational Acceptance Test

1. The objective of these tests is to demonstrate that the Telemetry System is ready for operation.
2. The Telemetry System shall be checked for proper installation, adjustment, and calibration on a loop-by-loop basis to verify that it is ready to function as specified.

3. Run hardware diagnostics.
4. Testing of all input and output (I/O) signals by activation or injection of signal at field device.
5. Discrete input signals:

    a. For all equipment RUNNING signals, test by on - off operation of equipment. If operation of equipment is deemed inadvisable by Owner or System Integrator due to potential process upset, inaccessibility of generating device, hazard to personnel, or other factors, test by jumpering of motor starter auxiliary contact or other source of run signal.
    b. For all alarm or status signals, test by activation of device generating alarm or status signal. If generation of signal is deemed inadvisable by Owner or System Integrator due to potential process upset, inaccessibility of generating device, hazard to personnel, or other factors, test by jumpering of contact at nearest accessible location to generating device.
    c. For signals designated as spare, test by jumpering of signal at RTU panel field termination point.
    d. Demonstrate change of state in local RTU data table.
    e. Demonstrate change of state at "Master" site.

6. Analog input signals:

    a. Verify impedance capabilities of transmitting device has not been exceeded by installation of the RTU.
    b. Disconnect transmitting device and inject 4, 12, and 20 mA D.C. signals into loop.
    c. Demonstrate proper response to various signals in RTU data table.
    d. Demonstrate proper response to various signals at "Master" site for that area.
    e. For signals designated as spare, test by injection of signal at RTU panel field termination point.

7. Discrete output signals:

    a. Manipulate RTU data table or use forces to test response of all discrete output signals.
    b. Manipulate signals at "Master" site for that area to force all discrete output signals ON and OFF.
    c. Verify proper response of other devices in loop to signals.
    d. For signals designated as spare, test by checking signal at RTU panel field termination point.

8. Analog output signals:

    a. Verify impedance capabilities of analog output is not exceeded.
    b. Generate 4, 12, and 20 mA D.C. signals through RTU data table for all analog outputs at “Master” site for that area.
    c. Verify proper response of other devices in analog loop to various signals. Verify proper loop current through measurement.
    d. For signals designated as spare, test by measuring of signal at RTU panel field termination point across a 250 ohm resistor or similar.

C. Documentation

1. Prepare field testing, sign-off document. Document shall include following as a minimum:
2. Project description and number.
3. Company name for System integrator, Owner, and Engineer.
4. Include separate line for each I/O point to be tested.
5. Include area for handwritten notes of any corrections required.

D. Problem field devices or wiring.

1. Provide written documentation of any problems encountered with Owner’s field devices or wiring during testing.
2. Correction of such problems are not considered part of this project.

E. Alarm displays shall be tested for all analog and digital alarm points.

F. All historical data collection, trending, computation, totalization and reporting functions shall be checked and tested to confirm proper operation and accuracy of data.

G. Any defects or problems found with the Telemetry System or documentation shall be corrected by Contractor and then retested or resubmitted to demonstrate proper operation.

3.2 PROVING DEMONSTRATION

A. Before substantial completion will be considered for any site, all site system functions, including but not limited to RTU and radio, shall be run and fully operational for a continuous 48 hours period.

B. Contractor shall notify Engineer before each 48 hours test is conducted and shall document any failure that occurs during the test.

C. Sites that experience any component failure shall be retested until successful completion. Contractor shall submit documentation of each test.

3.3 OPERATION DEMONSTRATION

A. The Operation Demonstration (OD) shall be defined as all Telemetry System components supplied under this contract, in addition to all components modified or connected to this Telemetry System. The OD is intended to demonstrate the operation of the Telemetry System for each site.

B. OD shall begin following completion of the field testing and the 48-hour Proving Demonstration.

C. OD shall continue until a time frame has been achieved wherein the Telemetry System (both hardware and software) availability meets or exceeds 99.7 percent for 30 consecutive days and no system failures have occurred that result in starting the OD over again. During the OD, the Telemetry System shall be available to Owner's operating personnel for use in normal operation of the facilities.

D. The conditions listed below shall constitute system failures that are considered critical to the operability and maintainability of the system. The OD shall be terminated if one or more of these conditions occur. Following correction of the problem, a new 30 consecutive day OD shall begin.

1. Failure to repair a hardware or software problem within 72 consecutive hours from the time of notification of a system failure.
2. Recurrent type hardware or software problems, if the same type of problem occurs three times or more.
3. Software problem causing a RTU processor to halt execution.

E. The following conditions shall constitute a system failure in determining the system availability based on the equation specified below.

1. Failure of one or more input/output modules.
2. Failures of any type affecting four or more input/output points simultaneously.
3. Failure of a RTU power supply.
4. The system availability shall be calculated based on the following equation:

$$A = \frac{MTBF}{MTBF + MTTR} \times 100 \text{ percent}$$

A = system availability in percent
MTBF= mean (average) time interval between consecutive system failures
MTTR = mean (average) time required to repair system failures

5. Time between failures shall be the period between the time that a reported system failure has been corrected and the time of subsequent notification of the Contractor that another system failure has occurred in terms of operating hours.
6. Time to repair shall be the period between the time that the Contractor is notified of a system failure and the time that the system has been restored to proper operation in terms of operating hours.
7. Time to repair shall be the period between the time that the Contractor is notified of a system failure and the time that the system has been restored to proper operation in terms of hours, minus an allowance for the following dead times which shall not be counted as part of the time to repair period.
8. Actual travel time for service personnel to get to the to the plant site up to a maximum of 6 hours from the time the Contractor is notified of a system failure.
9. Time for receipt of spare parts to the plant site once requested up to a maximum of 24 hours. No work shall be done on the system while waiting for delivery of spare parts.
10. Completion of a 30 consecutive day period without any restarts of the OD and with a system availability in excess of 99.7 percent shall constitute acceptance of the Radio Telemetry System.

F. All parts and maintenance materials required to repair the system prior to completion of the OD shall be supplied by Contractor at no additional cost to the Owner. If parts are obtained from the required plant spare parts inventory, they shall be replaced to provide a full complement of parts as specified.

G. An instrumentation and control system Malfunction/Repair Reporting Form shall be completed by Engineer to document failures, to record Contractor notification, arrival and repair times and Contractor repair actions. Format of the form shall be developed and agreed upon prior to the start of the OD.

END OF SECTION 13661

SECTION 16232 – DIESEL GENERATOR SETS

Part 1. GENERAL

1.01 Scope

A. Provide complete factory assembled generator set equipment with digital (microprocessor-based) electronic generator set controls, digital governor, and digital voltage regulator.

B. Provide factory test, startup by a supplier authorized by the equipment manufacturer(s), and on-site testing of the system.

C. The generator set manufacturer shall warrant all equipment provided under this section, whether or not is manufactured by the generator set manufacturer, so that there is one source for warranty and product service. Technicians specifically trained and certified by the manufacturer to support the product and employed by the generator set supplier shall service the generator sets.

D. The generator set supplier shall be responsible for complete compliance to all specification requirements for both the generator set and the paralleling equipment.

E. Prototype testing, factory testing, and site tests.

1.02 Codes and Standards

A. The generator set installation and on-site testing shall conform to the requirements of the following codes and standards, as applicable. The generator set shall include necessary features to meet the requirements of these standards.

1. ANSI S1.13-1971—Measurement of Sound Pressure Levels in Air
2. CSA 282, 1989 Emergency Electrical Power Supply for Buildings
3. IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
4. NFPA 30 – Flammable and Combustible Liquids
5. NFPA 37 – Standard For the Installation and Use of Stationary Combustion Engines and Gas Turbines
6. NFPA 70 – National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
7. NFPA 99 – Essential Electrical Systems for Health Care Facilities
8. NFPA 110 – Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1prototype tests required by this standard shall have been performed on a complete and functional unit, component level type tests will not substitute for this requirement.

B. The generator set and supplied accessories shall meet the requirements of the following standards:

1. NEMA MG1-1998 part 32. Alternator shall comply with the requirements of this standard.
2. UL142 – Sub-base Tanks

3. UL1236 – Battery Chargers
4. UL2200. The generator set shall be listed to UL2200 or submit to an independent third party certification process to verify compliance as installed..

C. The control system for the generator set shall comply with the following requirements.

1. CSA C22.2, No. 14 – M91 Industrial Control Equipment.
2. EN50082-2, Electromagnetic Compatibility – Generic Immunity Requirements, Part 2: Industrial.
3. EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.
4. FCC Part 15, Subpart B.
5. IEC8528 part 4. Control Systems for Generator Sets
6. IEC Std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions.

D. The generator set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.03 Related Sections

A. Automatic Transfer Switches see section (16416)

1.04 Acceptable Manufacturers

Only approved bidders shall supply equipment provided under this contract. Equipment specifications for this project are based on microprocessor-based generator sets manufactured by Cummins Power Generation. Equipment by other suppliers that meets the requirement of this specification must be approved by the Engineer before acceptance if submitted not less than 2 weeks before scheduled bid date. Proposals must include a line by line compliance statement based on this specification.

1.05 Submittals

A. Shop drawings:

1. Outline drawings of assembly.
2. One line diagrams and wiring diagrams for assembly and components.
3. Interconnection wiring diagrams
4. Submit names, experience level, training certifications, and locations for technicians that will be responsible for servicing equipment at this site.

B. Product data:

1. Technical data on all major components. Technical data must include an alternator thermal damage curve, description and operating characteristics of the alternator protection device, and an alternator reactive capability curve. Alternator data demonstrating compliance to section___.
2. Certification of the emissions performance of the generator set engine by the engine manufacturer.
3. Seismic certification, as required.

C. Project information:

1. Test reports and certifications.
2. Factory test procedures.

D. Contract closeout information:

1. Operating and maintenance data.

1.06 Qualifications

A. The generation set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

B. The manufacturer of this equipment shall have produced similar equipment for a minimum period of ten years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.07 Regulatory Requirements

A. The generator set shall be UL2200 listed and labeled

B. The generator set overcurrent protection shall be UL listed as a utility grade protective device.

C. The generator set engine shall comply will all applicable emissions standards at the date of installation.

1.08 Warranty

A. The manufacturer shall warrant the material and workmanship of the generator set for a minimum of five (5) year's from registered commissioning and start-up, or eighteen (66) months from date of shipment.

B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc. shall be allowed during the minimum noted warranty period described in paragraph A above.

Part 2. PRODUCTS

2.01 Generator set

A. Ratings

1. The generator set shall operate at 1800 rpm and at a voltage of: (see drawings) Volts AC, Three phase, 4-wire, 60 hertz.
2. The complete generator set shall be rated per ISO8528 at (see drawings) kW at 0.8 PF[1], Standby Duty rating, based on site conditions of: Altitude 200 feet, ambient temperatures of 40 degrees C, based on temperature measured at the control for indoor installations, and measured at the air inlet closest to the alternator for outdoor equipment.
3. The generator set rating shall be based on emergency/standby service and marked as such per NFPA110.

B. Performance

1. Voltage regulation shall not exceed one percent for any constant load between no load and rated load for both parallel and non-parallel applications. Random voltage variation with any steady load from no load to full load shall not exceed plus or minus 0.5 percent.
2. Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.25%.
3. The diesel engine-generator set shall be capable of single step load pick up of 100% nameplate kW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.
4. Motor starting capability shall be a minimum of 366kVA. The generator set shall be capable of sustaining a minimum of 90% of rated no load voltage with the specified kVA load at near zero power factor applied to the generator set.
5. The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic, and no 3rd order harmonics or their multiples. Telephone influence factor shall be less than 40.
6. The generator set shall be certified by the engine manufacturer to be suitable for use at the installed location and rating, and shall meet all applicable exhaust emission requirements at the time of commissioning.
7. The generator set, complete with sound attenuated enclosure, shall be tested by the generator set manufacturer per ANSI S1.13. Data documenting performance shall be provided with submittal documentation.

C. Construction

1. The engine-generator set shall be mounted on a heavy-duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails.
2. All switches, lamps, and meters in the control system shall be oil-tight and dust-tight. There shall be no exposed points in the control (with the door open) that operate in excess of 50 volts.
3. All outdoor equipment shall be enclosed with corrosion-protected materials. Steel components used in enclosures shall be powder coated and baked, and shall provide fade and corrosion resistance in compliance to Dry film thickness shall be shd3363 of 2H+all a minimum of 1.8 Mils, gloss at 60degrees per ASTMD523 of 80+/- 10, pencil hardness per ASTM D3363

D. Connections

1. The generator set load connections shall be composed of silver or tin plated copper bus bars, drilled to accept mechanical or compression terminations of the number and type as shown on the drawings. Sufficient lug space shall be provided for use with cables of the number and size as shown on the drawings.
2. Power connections to auxiliary devices shall be made at the devices, with required protection located at a wall-mounted common distribution panel.
3. Generator set control interfaces to other system components shall be made on a common,

permanently labeled terminal block assembly.

2.02 Engine and Engine Equipment

A. The engine shall be diesel, 4 cycle, radiator and fan cooled. Minimum displacement shall be __ liters, with __[2]cylinders. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories. Two cycle engines are not acceptable. Engine accessories and features shall include:

B. An electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate and excitation as appropriate to the state of the generator set. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed, and operating in various isochronous or parallel states.

C. Skid-mounted radiator and cooling system rated for full load operation in 50 degrees C ambient as measured at the generator air inlet, based on 0.5 in H_2O external static head. Radiator shall be sized based on a core temperature which is 10C higher than the rated operation temperature, or prototype tested to verify cooling performance of the engine/radiator/fan operation in a controlled environment. Radiator shall be provided with a duct adapter flange. The cooling system shall be filled with a 50/50-ethylene glycol/water mixture by the equipment manufacturer. Rotating parts shall be guarded against accidental contact.

D. Electric starters capable of three complete cranking cycles without overheating.

E. Positive displacement, mechanical, full pressure, lubrication oil pump.

F. Full flow lubrication oil filters with replaceable spin-on canister elements and dipstick oil level indicator.

G. An engine driven, mechanical, positive displacement fuel pump. Fuel filter with replaceable spin-on canister element. Fuel cooler, suitable for operation of the generator set at full rated load in the ambient temperature specified shall be provided if required for operation due to the design of the engine and the installation.

H. Replaceable dry element air cleaner with restriction indicator.

I. Flexible supply and return fuel lines.

J. Engine mounted battery charging alternator, 35-ampere minimum, and solid-state voltage regulator.

K. Coolant heater

1. Engine mounted, thermostatically controlled, coolant heater(s) for each engine. Heater voltage shall be as shown on the project drawings. The coolant heater shall be UL499 listed and labeled.

2. The coolant heater shall be installed on the engine with SAEJ20 compliant materials. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run

exceeds 12 inches. The coolant heater installation shall be specifically designed to provide proper venting of the system. The coolant heaters shall be installed using isolation valves to isolate the heater for replacement of the heater element. The design shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.

3. The coolant heater shall be provided with a 24VDC thermostat, installed at the engine thermostat housing. An AC power connection shall be provided for a single AC power connection to the coolant heater system.
4. The coolant heater(s) shall be sized as recommended by the engine manufacturer to warm the engine to a minimum of 40C in a 15C ambient, in compliance with NFPA110 requirements, as a minimum, or the temperature required for starting and load pickup requirements of this specification.

L. Provide vibration isolators, spring/pad type, quantity as recommended by the generator set manufacturer. Isolators shall include seismic restraints if required by site location.

M. Starting and Control Batteries shall be lead acid type, 24 volt DC, sized as recommended by the engine manufacturer for compliance to NFPA110 starting requirements, complete with battery cables and connectors.

N. Provide exhaust silencer(s) for each engine of size and type as recommended by the generator set manufacturer and approved by the engine manufacturer. The mufflers shall be critical grade. Exhaust system shall be installed according to the engine manufacturer's recommendations and applicable codes and standards.

O. Provide a fully regulated, constant voltage, current limited, multi-rate battery charger(s) for each generator set. The chargers shall be designed for heavy-duty industrial service, primarily to quickly recharge and maintain batteries that start internal combustion engines. Charger shall be rated a minimum of 12 amps, and be capable of operating in parallel with another like charger for reliability and added charging capacity.

1. Charger shall provide 4 distinct charge states: "dead battery", "bulk charge", "absorption", and "float". Charge rate shall be temperature compensated to provide proper charging in ambient conditions from –20 to +55C.
2. Provider LED indication of general charger condition, including charging, fault, and equalize. Provide a 2 line LCD display to indicate charge rate, battery voltage, faults, and provide for charger set up. Charger shall provide relay contacts for fault conditions as required by NFPA110.
3. The charger shall operate properly during fault conditions, including battery disconnection while charging, reversed battery polarity connections, and shorted battery.

4. The charger shall be compliant to the same RFI/EMI and voltage surge performance as are specified for the genset control.

P. GENERATOR ENCLOSURE:

1. A weatherproof type enclosure shall be provided to house the engine/generator and accessories. The enclosure is to be in complete compliance with the National Electrical Code (NEC), and the National Fire Protection Association (NFPA) with regard to clearances around electrical equipment specified herein. The enclosure shall conform to the following construction and design criteria as set forth. Substitutions must be submitted in writing to the engineer and be accepted as an approved equal prior to bid date.
2. -Rigidity wind test equal to 150 MPH
3. -Roof load equal to 50 lbs. per sq. ft.
4. -Rain test equal to 4" per hour
5. -Florida Department of Community Affairs Modular Building Insignia
6. -Large Missile Impact Resistant per FBC 1626.2 Testing Requirements with Approval Numbers.
7. Enclosure shall consist of a roof, two (2) sidewalls, two (2) end walls, and be manufactured of formed aluminum components. The enclosure is to be provided with a means for securely attaching the entire structure to the base/fuel tank as specified within.
8. Roof, sidewalls and end walls shall be of formed 0.090" marine grade aluminum. The roof is to be bolted to both side and end walls to form a complete weather and wind resistance assembly.
9. A minimum clearance of 20” shall be allowed for walkway space between the generator frame and interior sidewalls. A minimum walkway clearance of 30” shall be allowed between the generator end frame and the interior rear wall of the enclosure. The radiator front face shall be sealed to the front wall utilizing and 2” minimum rubber gasket material to minimize recirculation of radiator air discharge and prevent the transmission of vibration from the packaged generator set to the enclosure.
10. Wall framing shall be incorporated in the panels by forming an open back box structure. Skin material shall be minimum thickness .090” marine grade aluminum. Enclosure shall have a baked on powder-coat finish for maximum corrosion resistance. Exterior skin panels shall be integral to the wall structure and not separate pieces riveted onto framing members. Wall panels shall be no wider than 36” each and shall be removable without the use of special tools. Wall and roof panels shall be designed so that field replacement can be accomplished without disassembly of the entire structure if damage should occur.
11. A minimum of sixteen colors shall be available for enclosure exterior. Standard enclosure exterior color is WHITE unless otherwise specified.
12. Roof assembly shall be peaked to aid in rainwater runoff. Cambered roof designs and roofs with thicknesses of less than 0.090” nominally shall not be considered. Roof

Q. Sub-Base Fuel Tank

1. 1. Provide a UL142 listed sub-base fuel tank capacity as listed on plans, the tank shall be UL listed, made of aluminized steel with welded construction, and pressure tested to 3 PSI. The tank shall comply with all state and local requirements
2. Double walled construction with rupture basin

3. Mechanical Fuel Level Gauge (Visible at Fill Point)
4. 2" Fuel Fill Cap
5. Normal and Emergency Vents Per UL-142
6. Low Fuel Level Alarm Switch Set @ 40% Remaining Level Wired to Control Panel Terminal Strip
7. Leak Detection Switch Wired to Control Panel Terminal Strip
8. Supply and Return Connections
9. Cable Stub Up Opening Under Circuit Breaker
10. Generator Mounting Pads
11. 2 Lifting Points per Side (4 Total) for Lifting Generator Set, Enclosure and Tank (Empty)
12. Exterior Painted Industrial Enamel
13. State of Florida DEP package

2.03 Low Voltage AC Alternator

A. The AC alternator shall be; synchronous, four pole, 2/3 pitch, brushless, revolving field, drip-proof construction, single prelubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. The alternator design shall prevent shaft current from flowing and eliminate the need for insulated bearings. All insulation system components shall meet NEMA MG1 requirements for Class H insulation systems. Actual temperature rise measured by resistance method at full load shall not exceed 1058C[3] in a 408C ambient.

B. The alternator shall be capable of delivering rated output (kVA) at rated frequency and power factor, at any voltage up to 5 percent above or below rated voltage.

C. The alternator shall be supplied with an dedicated, independent power source for the voltage regulation system, which provides sufficient excitation for the alternator to supply 300% of rated output current for 10 seconds.

D. The subtransient reactance of the alternator shall not exceed 12 percent, based on the standby rating of the generator set.

E. Provide an anti-condensation heater for the alternator for generator sets installed outdoors or in unheated environments.

2.04 Generator set Control. The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, and protection and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification.

The control shall be mounted on the generator set. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.

The generator set mounted control shall include the following features and functions:

A. Control Switches

1. Mode Select Switch. The mode select switch shall initiate the following control modes. When in the RUN or Manual position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
2. EMERGENCY STOP switch. Switch shall be Red "mushroom-head" push-button. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting. The switch shall include a lockout provision for use in safely disabling the generator set for necessary service.
3. RESET switch. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
4. PANEL LAMP switch. Operating the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is operated, or after the switch is operated a second time.
5. Voltage and Frequency Adjustment. The genset mounted control shall include digital raise/lower switches for adjustment of voltage and frequency.

B. Generator Set AC Output Metering. The generator set shall be provided with a metering set including the following features and functions:

a) Analog voltmeter, ammeter, frequency meter, and kilowatt (KW) meter. Voltmeter and ammeter shall display all three phases. Ammeter and KW meter scales shall be color coded in the following fashion: readings from 0-90% of generator set standby rating: green; readings from 90-100% of standby rating: amber; readings in excess of 100%: red.

b) Digital metering set, 0.5% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three phase voltages (line to neutral or line to line) simultaneously.

c) Both analog and digital metering are required. The analog and digital metering equipment shall be driven by a single microprocessor, to provide consistent readings and performance.

C. Generator Set Alarm and Status Display.

1. The generator set shall be provided with alarm and status indicating lamps to indicate non-automatic generator status, and existing warning and shutdown conditions. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. The generator set control shall indicate the existence of all alarm, shutdown, and status conditions associated with the generator set, including all paralleling control functions and the engine ECM on an alphanumerical display on the genset. The following alarm, shutdown, and status conditions are required, as a minimum:

low oil pressure (alarm)
low oil pressure (shutdown)
oil pressure sender failure (alarm)
low coolant temperature (alarm)

high coolant temperature (alarm)
high coolant temperature (shutdown)
engine temperature sender failure (alarm)
low coolant level (alarm or shutdown--selectable)
fail to crank (shutdown)
fail to start/overcrank (shutdown)
overspeed (shutdown)
low DC voltage (alarm)
high DC voltage (alarm)
weak battery (alarm)
low fuel-daytank (alarm)
high AC voltage (shutdown)
low AC voltage (shutdown)
under frequency (shutdown)
over current (warning)
over current (shutdown)
short circuit (shutdown)
ground fault (alarm)
over load (alarm)
emergency stop (shutdown)

2. Provisions shall be made for indication of four customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above specified conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.

D. Engine Status Monitoring

1. The following information shall be available from a digital status panel on the generator set control :

engine oil pressure (psi or kPA)
engine coolant temperature (degrees F or C)
engine speed (rpm)
number of hours of operation (hours)
number of start attempts
battery voltage (DC volts)

2. The control system shall also incorporate a data logging and display provision to allow logging of a minimum of the last 20 warning or shutdown indications on the generator set, the time of the last fault of each type, and the number of faults of each type, and total time of operation at various loads as a percent of the standby rating of the generator set.

E. Engine Control Functions

1. The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15-second rest period between cranking periods.

2. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall

include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting. The governor control shall be suitable for use in paralleling applications without component changes.

3. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.
4. The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

F. Alternator Control Functions:

1. The generator set shall include an automatic microprocessor-based voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The voltage regulation system shall be based on a full wave rectified input, pulse-width modulated output design. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level. Rotary potentiometers for system adjustments are not acceptable.
2. Controls shall be provided to monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.
3. Controls shall be provided to individually monitor all three phases of the output current for 1, 2, or 3-phase short circuit conditions. The control/protection system shall monitor the current level and voltage. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (short circuit shutdown).
4. Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.
5. An AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.
6. A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 8VDC or more than 16VDC. During engine cranking (starter engaged), the low voltage limit shall be disabled, and if DC voltage drops to less than 14.4 volts

for more than two seconds a "weak battery" alarm shall be initiated.

G. The generator set shall be provided with a network communication module to allow real time communication with the generator set control by remote devices. The control shall communicate all engine and alternator data; alarm, shutdown and status conditions; and allow starting and stopping of the generator set via the network in both test and emergency modes.

H. The generator set shall be provided with a utility grade protective relay, designed to provide thermal overload protection for the alternator, and performance certified for that purpose by a 3rd party testing organization. The supplier shall submit time overcurrent characteristic curves and thermal damage curve for the alternator, demonstrating the effectiveness of the protection provided. Relay shall be installed to allow shutdown of the generator excitation system on an alternator overload condition, with the engine operating for a cool-down period before shutdown. The relay shall not include an instantaneous trip function.

I. Control Interfaces for Remote Monitoring:

1. No field connections for control devices shall be made in the AC power output enclosure. Provide the following features in the control system:
2. Form "C" dry contact set rated 2A @ 30VDC to indicate existence of any alarm or shutdown condition on the generator set.
3. One set of contacts rated 2A @ 30VDC to indicate generator set is ready to load. The contacts shall operate when voltage and frequency are greater than 90% of rated condition.
4. A fused 10 amp switched 12VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit whenever the generator set is running.
5. A fused 20 amp 12VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit at all times from the engine starting/control batteries.
6. The control shall be provided with a direct serial communication link for the communication network interface as described elsewhere in this specification and shown on the drawings.

Part 3. OTHER REQUIREMENTS

3.01 Prototype Testing (submit evidence of prototype testing; manufacturer's certificate etc.)

3.02 Factory Testing

A. The generator set manufacturer shall perform a complete operational test on the generator set prior to shipping from the factory. A certified test report shall be provided. All testing shall be performed with calibrated metering.

B. Generator set factory tests on the equipment shall be performed at rated load and rated power factor. Generator sets that have not been factory tested at rated power factor will not be acceptable. Tests shall include:

C. Run at full load, maximum power, voltage regulation, transient and steady-state governing, single step load pickup, and function of safety shutdowns, complete test report shall be made available to the owner.

3.03 Installation

A. Equipment shall be installed by the contractor in accordance with final submittals and contract

documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.

B. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.

C. Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer's instructions and seismic requirements of the site.

D. Equipment shall be initially started and operated by representatives of the manufacturer. All protective settings shall be adjusted as instructed by the consulting engineer.

E. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to initial operation and final testing of the system.

F. On completion of the installation by the electrical contractor, the generator set supplier shall conduct a site evaluation to verify that the equipment is installed per manufacturer's recommended practice.

3.04 On-Site Acceptance Test:

A. The complete installation shall be tested to verify compliance with the performance requirements of this specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests. The generator set manufacturer shall provide a site test specification covering the entire system. Tests shall include:

B. Prior to start of active testing, all field connections for wiring, power conductors, and bus bar connections shall be checked for proper tightening torque.

C. Installation acceptance tests to be conducted on-site shall include a "cold start" test, a two hour full load (resistive) test, and a one step rated load pickup test in accordance with NFPA 110. Provide a resistive load bank and make temporary connections for full load test, if necessary.

D. Perform a power failure test on the entire installed system. This test shall be conducted by opening the power supply from the utility service, and observing proper operation of the system for at least 2 hours. Coordinate timing and obtain approval for start of test with site personnel.

E. The generator set supplier shall issue a test report documenting the results of testing, and including a complete list of all settings in the control system.

3.05 Training

A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 4 hours in duration and the class size shall be limited to 5 persons. Training date shall be

coordinated with the facility owner.

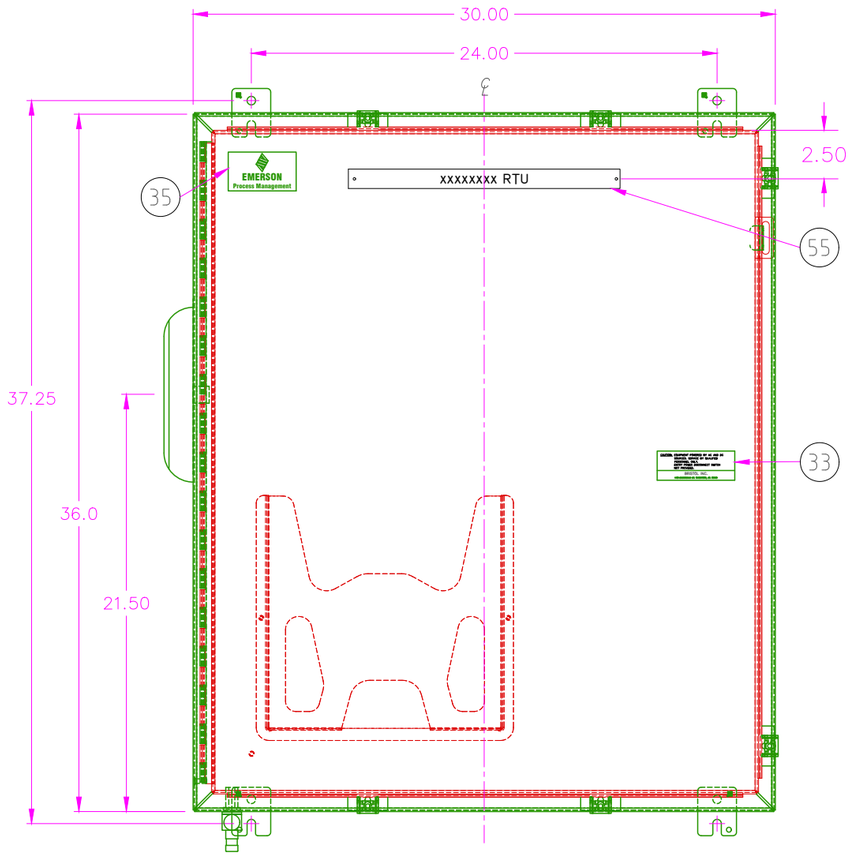
3.06 Service and support

A. The generator set supplier shall maintain service parts inventory for the entire power system at a central location which is accessible to the service. The manufacturer of the generator set shall maintain a central parts inventory to support the supplier, covering all the major components of the power system, including engines, alternators, control systems, paralleling electronics, and power transfer equipment.

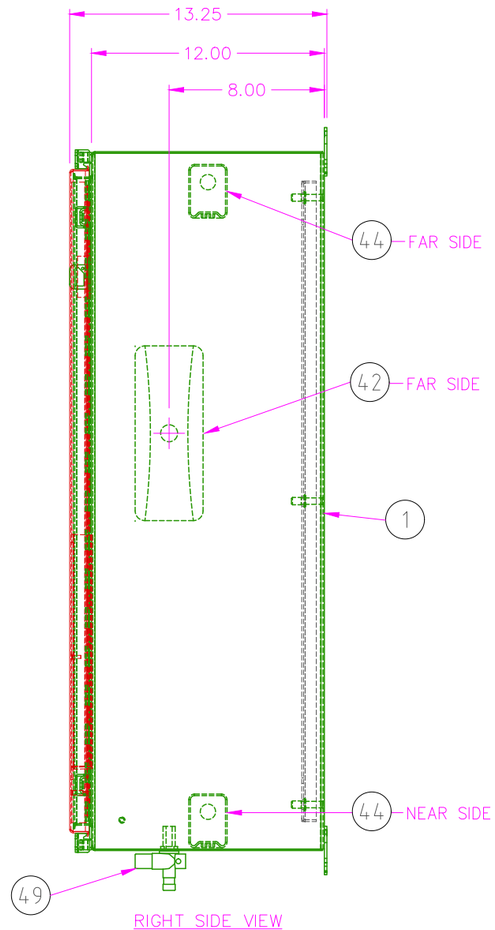
B. The generator set shall be serviced by a local service organization that is trained and factory certified in generator set service. The supplier shall maintain an inventory of critical power system replacement parts in the local service location. Service vehicles shall be stocked with critical replacement parts. The service organization shall be physically located within 50 miles of the site.

END OF SECTION 16232

Details Added by Addendum No. 10



FRONT VIEW



RIGHT SIDE VIEW

BOTTOM VIEW

BILL OF MATERIAL

ITEM NO.	QTY.	BBI PART NO.	DESCRIPTION	REF P/N'S
1	1	·	ENCLOSURE, SS NEMA 4X, 36"H X 30"W X 12"D	BBI SYS 15-2070489-EM-1
2	1	·	PANEL, 33"H x 27"W	HOFFMAN A36P30
3	REF	·	TERMINAL ASSEMBLY, POWER	BBI SYS 15-2070489-TA-1
4	REF	·	TERMINAL ASSEMBLY, I/O	BBI SYS 15-2070489-TA-2
5	REF	·	WIRING DIAGRAM	BBI SYS 15-2070489-W-1
6	1	3CH08C	FB3000 CHASSIS, 8 SLOT	.
7	1	3PWBLK	FB3000 POWER SUPPLY 12-24V	.
8	1	3CPU16	FB3000 2 RS232, 1 RS485 CPU & PM	.
9	1	3MIX12	FB3000 I/O MIX & PM	.
10	2	N/A	FB3000 16-POINT DI & PM	.
11	1	·	.	.
12	1	·	.	.
13	1	396581-06-4	FB3000 COMM EXP RS232/RS485 & PM	.
14	·	·	.	.
15	1	·	DIN RAIL, 14.0"LG	IBOCO OMEGA 3F
16	1	·	.	.
17	1	·	POWER SUPPLY, QUINT 100-240AC/24DC/5A	PHOENIX 2904600
18	1	·	UPS CONTROL UNIT QUINT 24DC/24DC/5A	PHOENIX 2906994
19	·	·	.	.
20	1	·	GFI ASSEMBLY	PHOENIX 5600462
21	1	398038-00-7	GROUND BAR	.
22	1	374962-01-4	ELECTRICAL GROUND LABEL	SEATON 59443
23	1	·	WIRE ASSEMBLY, CWM TO GROUND LUG	BBI SYS WA-143
24	1	·	WIREWAY, 3.0"x 4.0"x 78" LG.	IBOCO T1-3040G
25	A/R	SYS-05001	RIVET WIREWAY DUCT	IBOCO DUCTFIX-R6
26	1	·	WIREWAY, 1.5"x 4.0"x 78" LG.	IBOCO T1-1540G
27	A/R	SYS-06063	SCREW, SEMS #10-32 x 3/8"LG, SS	.
28	A/R	SYS-06062	SCREW, SEMS #8-32 x 1/2"LG, SS	.
29	A/R	SYS-06057	FLAT WASHER #10 SS	.
30	·	·	.	.
31	·	·	.	.
32	·	·	.	.
33	1	·	UL LABEL KIT	BBI SYS UL_LABELKIT
34	1	395683-01-7	LABEL, INDENTIFICATION ASSEMBLY	BBI SYS CUSTOM_LBL1
35	1	398042-00-4	LOGO PLATE, EMERSON	BBI SYS LOGOPLATE_LBL-3
36	A/R	SYS-03101	END CLAMP, CLIPFIX 35	PHOENIX 3022218
37	·	·	.	.
38	1	·	QUINT-13AH BATTERY	PHOENIX 2320416
39	·	·	.	.
40	·	·	.	.
41	·	·	.	.
42	1	·	BROADBAND GLOBAL LTE MINO ANTENNA	LLP202-2C2C-WTH-18
43	1	·	DIGI Transport WR31 4G Radio	DIGI WR31
44	2	·	VENT ASSEMBLY	STAHLIN BV4XKIT
45	1	·	RADIO (SUPPLIED & INSTALLED BY OTHERS)	MDS SD9
46	1	·	BRACKET, RADIO MOUNTING	BBI SYS BKTRAD07
47	1	396786-04-9	CABLE, COAX, RADIO TO POLYPHASER, TNC TO N	BBI SYS CA-1561
48	1	396789-02-1	CABLE ASS'Y, RS232, RADIO TO CWM, 30"LG	MICROENCCA007
49	1	·	SURGE SUPPRESSOR, CN-LAMDA/4-2.25-BB	PHOENIX 2801057
50	1	396117-01-5	SOLDERLESS GROUND LUG (ILSCO, TA6S (4-14))	.
51	3	SYS-03150	GROUND TERMINAL BLOCK, USLKG 5	PHOENIX 0441504
52	2	SYS-03547	TERMINAL MARKER, ZB6-CMS: SO '⏚'	PHOENIX 7006107
53	·	·	.	.
54	1	·	WIREWAY, 2.25"x 4.0"x 78" LG.	IBOCO T1-2240G
55	REF		NAMEPLATE	BBI SYS 15-2070489-N-1

DWG PACKAGE
SHEET 1 OF 7

EMERSON.
Process Management
Power and Water Solutions
200 Beta Drive Pittsburgh Pa 15238
877-826-8514
Remote Automation Solutions
1100 Buckingham St., Watertown, CT. 06795
860-945-2200

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES:
.0 = ±.015
.00 = ±.01
.000=±.005
( ) = REF
ANGLES= ±1°

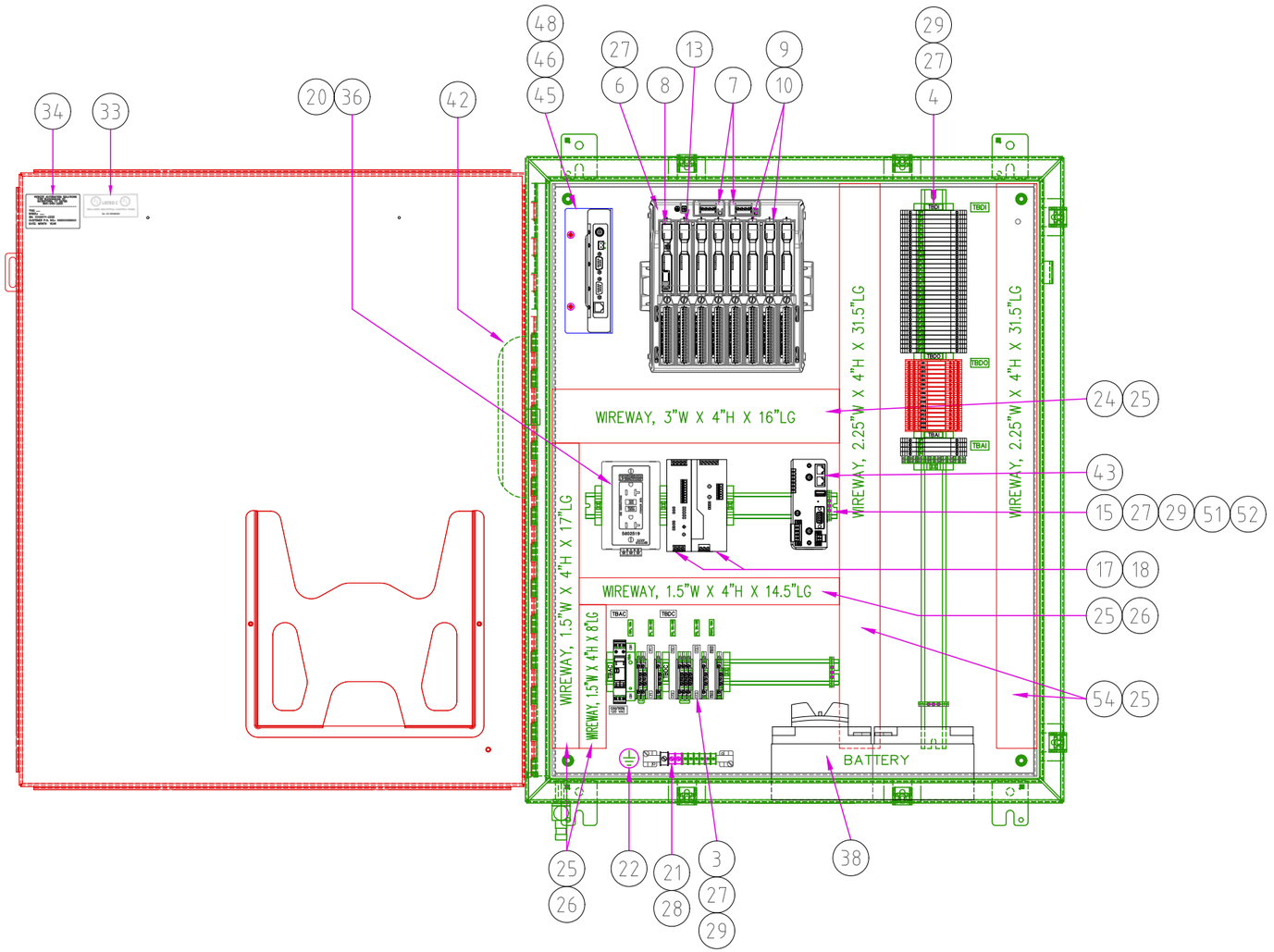
REV.	DESCRIPTION	DATE	BY	PE	APV'D
A					
A	DRAFT				

PROJECT NO. PWS: #######
RAS: .
TITLE: RTU ENCLOSURE ASSEMBLY
CUSTOMER:

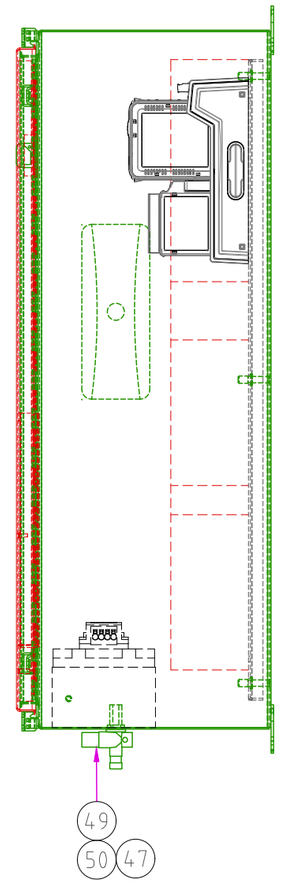
DRN. BY	DATE	PROJ. ENG.	CAD P/N	SCALE
			#######A011	1/4
DWG. NO.		APV'D. BY	CAD SHT.	REV.
20-#######-A-11			1 OF 2	A

ACADR2000

Details Added by Addendum No. 10



FRONT VIEW



RIGHT SIDE VIEW

DWG PACKAGE
SHEET 2 OF 7

PROPRIETARY DATA

THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION OF EMERSON PROCESS MANAGEMENT. IT IS TRANSMITTED TO YOU IN CONFIDENCE AND TRUST, AND IS TO BE RETURNED UPON REQUEST. ITS CONTENTS MAY NOT BE DISCLOSED IN WHOLE OR IN PART TO OTHERS OR USED FOR OTHER THAN THE PURPOSE FOR WHICH TRANSMITTED WITHOUT THE PRIOR WRITTEN PERMISSION OF EMERSON PROCESS MANAGEMENT.

EMERSON.
Process Management

Power and Water Solutions
200 Beta Drive Pittsburgh Pa 15238
877-826-8514

Remote Automation Solutions
1100 Buckingham St., Watertown, CT. 06795
860-945-2200

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES:
.0 = ±.015
.00 = ±.01
.000=±.005
( ) = REF
ANGLES= ±1°

REV.	DESCRIPTION	DATE	BY	PE	APV'D
A					

PROJECT NO. PWS: #######
RAS: .

TITLE: RTU ENCLOSURE ASSEMBLY

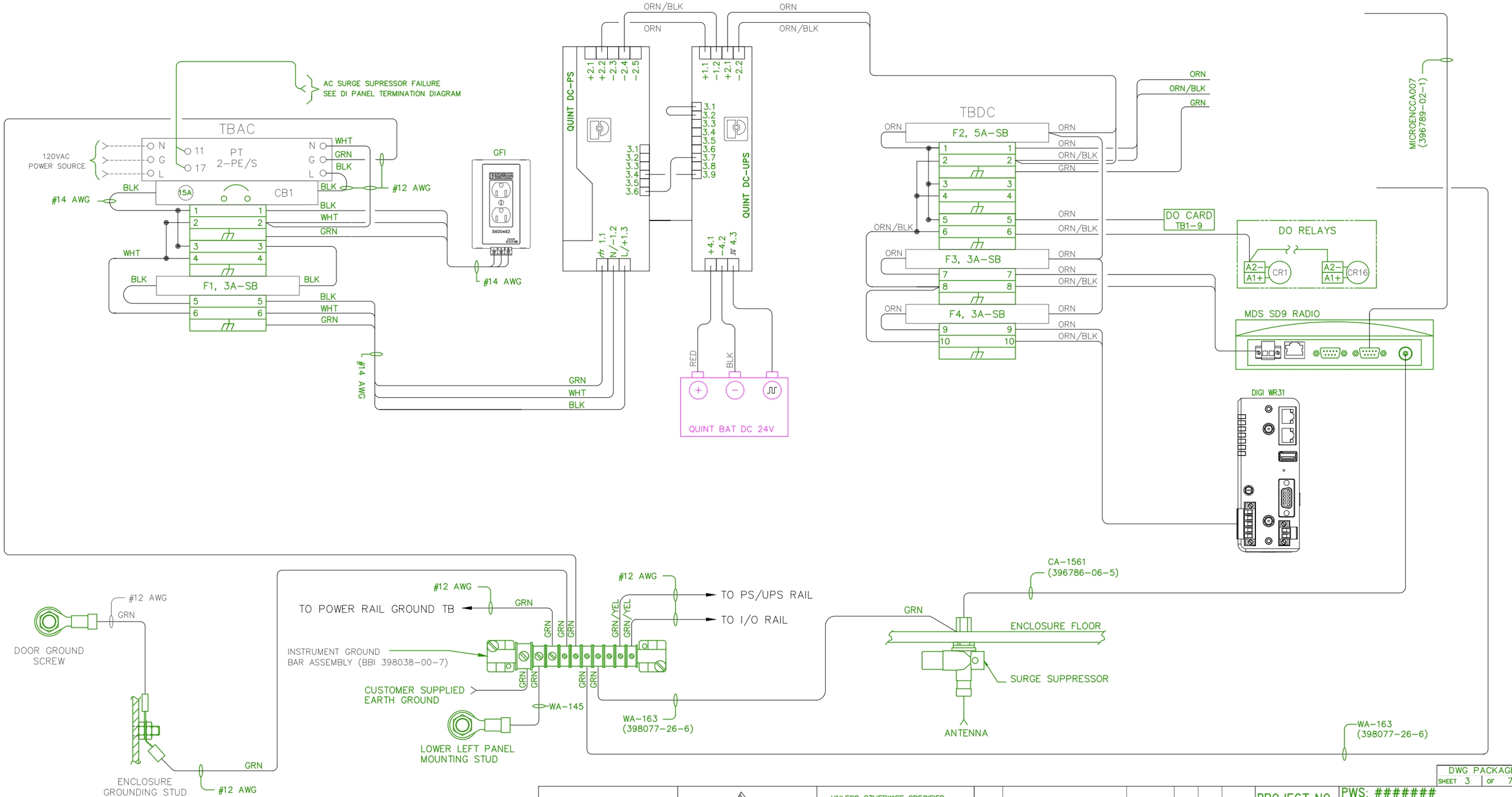
CUSTOMER:

DRN. BY	DATE	PROJ. ENG.	CAD P/N	SCALE
			#######A012	1/4

DWG. NO.	APV'D. BY	CAD SHT.	REV.
20-#######-A-12		2 OF 2	A

ACADR2000

Details Added by Addendum No. 10



NOTES:
1) ALL AC WIRING TO BE #14 AWG TYPE 1007 UNLESS OTHERWISE SPECIFIED.
2) ALL DC WIRING TO BE #16 TYPE 1007 UNLESS OTHERWISE SPECIFIED.

EMERSON.
Process Management

Power and Water Solutions
200 Beta Drive Pittsburgh Pa 15238
877-826-8514

Remote Automation Solutions
1100 Buckingham St., Watertown, CT. 06795
860-945-2200

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES

TOLERANCES:
.0 = ±.015
.00 = ±.01
.000=±.005
( ) = REF
ANGLES= ±1°

REV.	DESCRIPTION	DATE	BY	PE	APV'D
A					

DWG PACKAGE
SHEET 3 OF 7

PROJECT NO. PWS: #######
RAS: .

TITLE: POWER WIRING
RTU PS

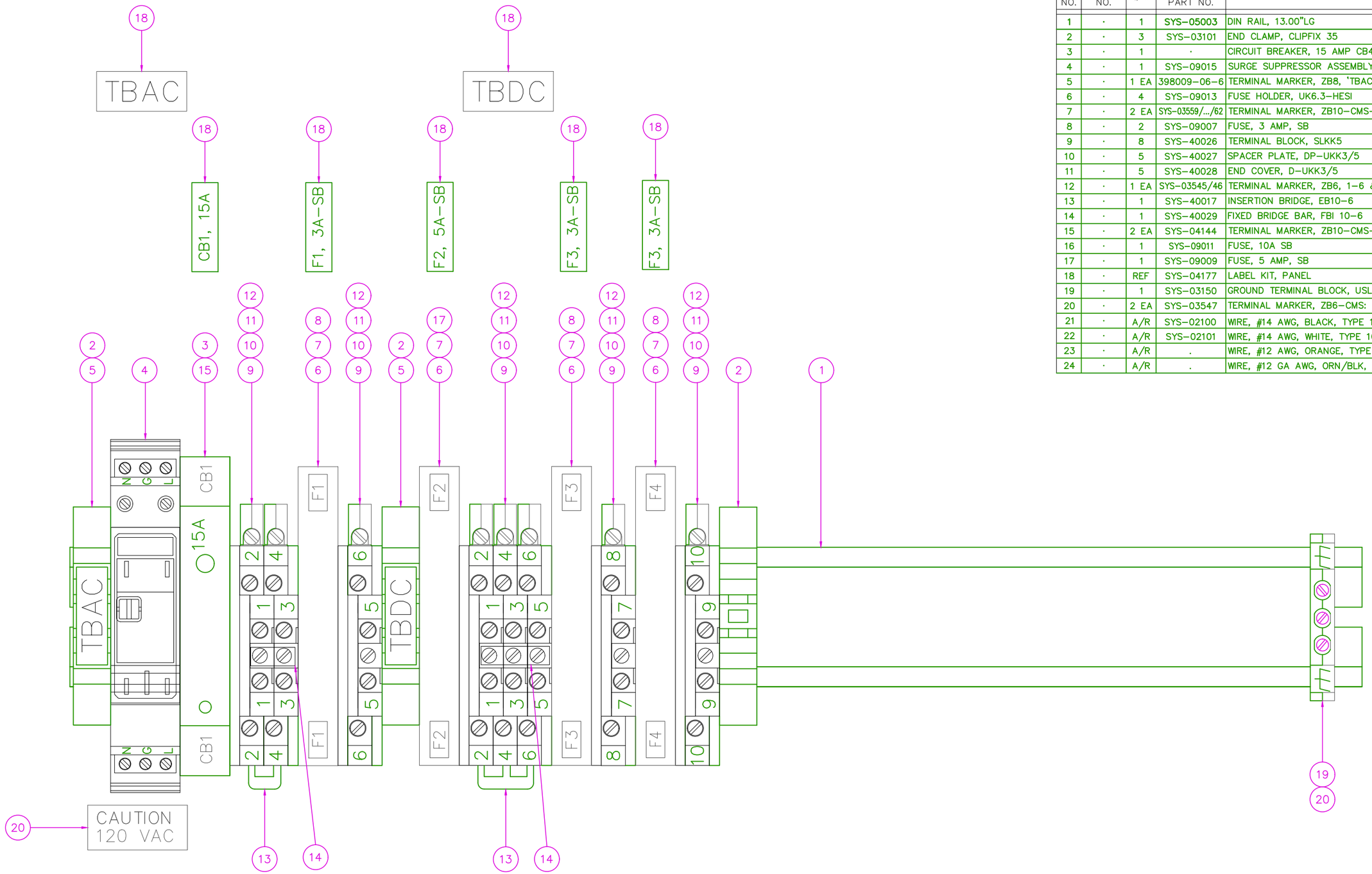
CUSTOMER:

DRN. BY	DATE	PROJ. ENG.	CAD P/N	SCALE
			#######W011	NONE

DWG. NO.	APV'D. BY	CAD SHT.	REV.
20-#######-W-11		1 OF 1	A

ACADR2000

Details Added by Addendum No. 10



BILL OF MATERIAL

ITEM NO.	TAG NO.	QTY	BBI PART NO.	DESCRIPTION	
1	·	1	SYS-05003	DIN RAIL, 13.00"LG	IBOCO OMEGA 3F
2	·	3	SYS-03101	END CLAMP, CLIPFIX 35	PHOENIX 3022218
3	·	1	·	CIRCUIT BREAKER, 15 AMP CB4200, TS35,15.0A	WEIDMULLER 9102003500
4	·	1	SYS-09015	SURGE SUPPRESSOR ASSEMBLY, BBI SYS SSA-002	PHOENIX 5603672
5	·	1 EA	398009-06-6	TERMINAL MARKER, ZB8, 'TBAC', 'TBDC'	PHOENIX 1052002
6	·	4	SYS-09013	FUSE HOLDER, UK6.3-HESI	PHOENIX 3004171
7	·	2 EA	SYS-03559/.../62	TERMINAL MARKER, ZB10-CMS-SO,'F1' THRU 'F3' & 'BAT'	PHOENIX 1050525
8	·	2	SYS-09007	FUSE, 3 AMP, SB	BUSSMAN MDL-3
9	·	8	SYS-40026	TERMINAL BLOCK, SLKK5	PHOENIX 0461018
10	·	5	SYS-40027	SPACER PLATE, DP-UKK3/5	PHOENIX 2770794
11	·	5	SYS-40028	END COVER, D-UKK3/5	PHOENIX 2770024
12	·	1 EA	SYS-03545/46	TERMINAL MARKER, ZB6, 1-6 & 1-10	PHOENIX 7005239-1/2
13	·	1	SYS-40017	INSERTION BRIDGE, EB10-6	PHOENIX 0201139
14	·	1	SYS-40029	FIXED BRIDGE BAR, FBI 10-6	PHOENIX 0203250
15	·	2 EA	SYS-04144	TERMINAL MARKER, ZB10-CMS-SO 'CB1',	PHOENIX 1050525
16	·	1	SYS-09011	FUSE, 10A SB	BUSSMAN MDL-10
17	·	1	SYS-09009	FUSE, 5 AMP, SB	BUSSMAN MDL-5
18	·	REF	SYS-04177	LABEL KIT, PANEL	BBI SYS LBLKIT01
19	·	1	SYS-03150	GROUND TERMINAL BLOCK, USLKG 5	PHOENIX 0441504
20	·	2 EA	SYS-03547	TERMINAL MARKER, ZB6-CMS: SO '⏚'	PHOENIX 7006107
21	·	A/R	SYS-02100	WIRE, #14 AWG, BLACK, TYPE 1007	BELDEN 9989
22	·	A/R	SYS-02101	WIRE, #14 AWG, WHITE, TYPE 1007	BELDEN 9989
23	·	A/R	.	WIRE, #12 AWG, ORANGE, TYPE 1007	BELDEN 9916
24	·	A/R	.	WIRE, #12 GA AWG, ORN/BLK, TYPE 1007	BELDEN 9916

NOTES:

1- ⏚ SYMBOL SHOWN FOR WIRING REFERENCE ONLY.

EMERSON. Process Management

Power and Water Solutions
200 Beta Drive Pittsburgh Pa 15238
877-826-8514

Remote Automation Solutions
1100 Buckingham St., Watertown, CT. 06795
860-945-2200

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES:

.0 = ±.015
.00 = ±.01
.000 = ±.005
( ) = REF
ANGLES = ±1°

REV.	DESCRIPTION	DATE	BY	PE	APV'D
A					

DWG PACKAGE
SHEET 4 OF 7

PROJECT NO. PWS: #######
RAS: .

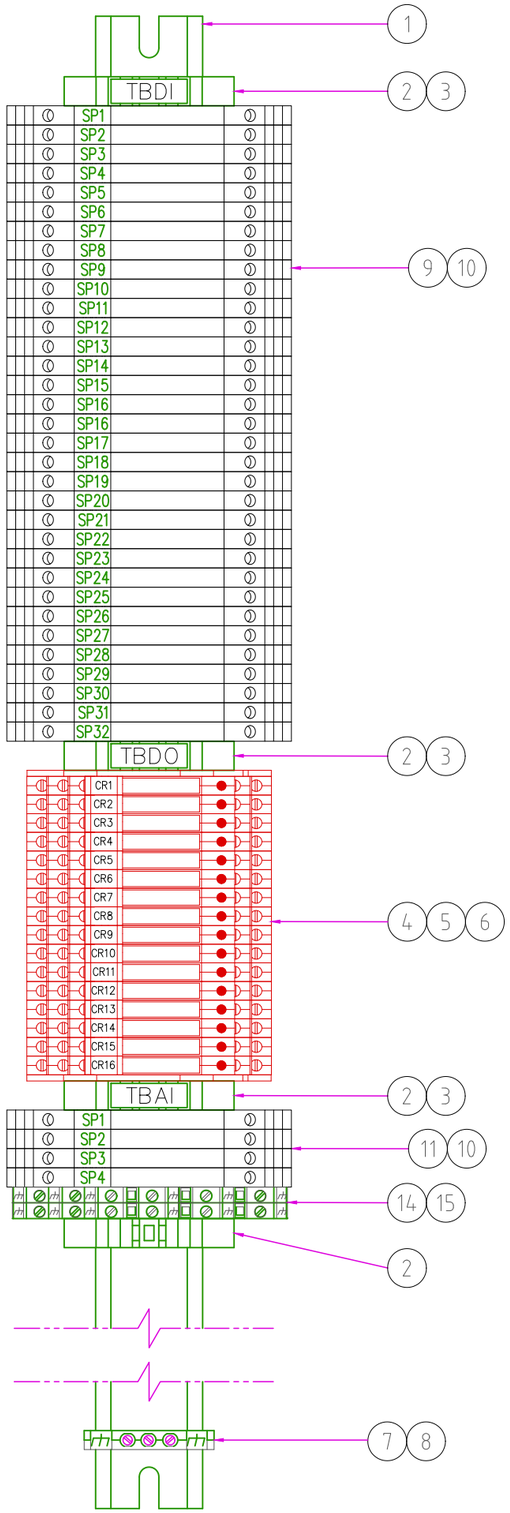
TITLE: TERMINAL ASSEMBLY, POWER

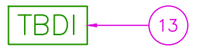
CUSTOMER: #######

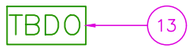
DRN. BY	DATE	PROJ. ENG.	CAD P/N	SCALE
			#######TA011	2/1
DWG. NO.		APV'D. BY	CAD SHT.	REV.
20-#######-TA-11			1 OF 1	A

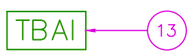
ACADR2000

Details Added by Addendum No. 10









BILL OF MATERIAL

ITEM NO.	TAG NO.	QTY	BBI PART NO.	DESCRIPTION
1		1	SYS-05003	DIN RAIL, 31.50"LG IBOCO OMEGA 3F
2		4	SYS-03101	END CLAMP, CLIPFIX 35 PHOENIX 3022218
3		1 EA		TERMINAL MARKER, ZB8, 'TBAI, TBDI, TBDO' PHOENIX 1052002
4		1 EA		TERMINAL MARKER, VERT, UC-TM6, CR1-CR16 PHOENIX 0818085
5		16		PLC-RSC24DC/21-24 VDC PHOENIX 2966171
6		2		SEPARATING PLATE PHOENIX 2966841
7		1	SYS-03150	GROUND TERMINAL BLOCK, USLKG 5 PHOENIX 0441504
8		2 EA	398009-06-6	TERMINAL MARKER, UC-TM6, ZB6: "⏚" PHOENIX 0818085
9		32	·	SURGE PROTECTION DEVICE - LIT 4X1-24 FOR DI PHOENIX 2804649
10		2	·	TERMINAL MARKER, UC-TM6, SP1-SP16 & SP1-SP4 PHOENIX 0818085
11		4	·	SURGE PROTECTION DEVICE - LIT 4X1-24 FOR AI PHOENIX 2804649
12		·	·	. .
13		REF	SYS-04177	LABEL KIT, PANEL BBI SYS LBLKIT01
14		2		TERMINAL BLOCK,MULTI-LEVEL-UT 2,5-3PE PHOENIX 3214275
15		6 EA		TERMINAL MARKER, ZB5-ZB 5 :UNBEDRUCKT SO " "⏚ PHOENIX 1050004
16				

EMERSON.
Process Management

Power and Water Solutions
200 Beta Drive Pittsburgh Pa 15238
877-826-8514

Remote Automation Solutions
1100 Buckingham St., Watertown, CT. 06795
860-945-2200

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES:
.0 = ±.015
.00 = ±.01
.000=±.005
( ) = REF
ANGLES= ±1°

REV.	DESCRIPTION	DATE	BY	PE	APV'D

DWG PACKAGE
SHEET 5 OF 7

PROJECT NO. PWS: #######
RAS: .

TITLE: TERMINAL ASSEMBLY, I/O

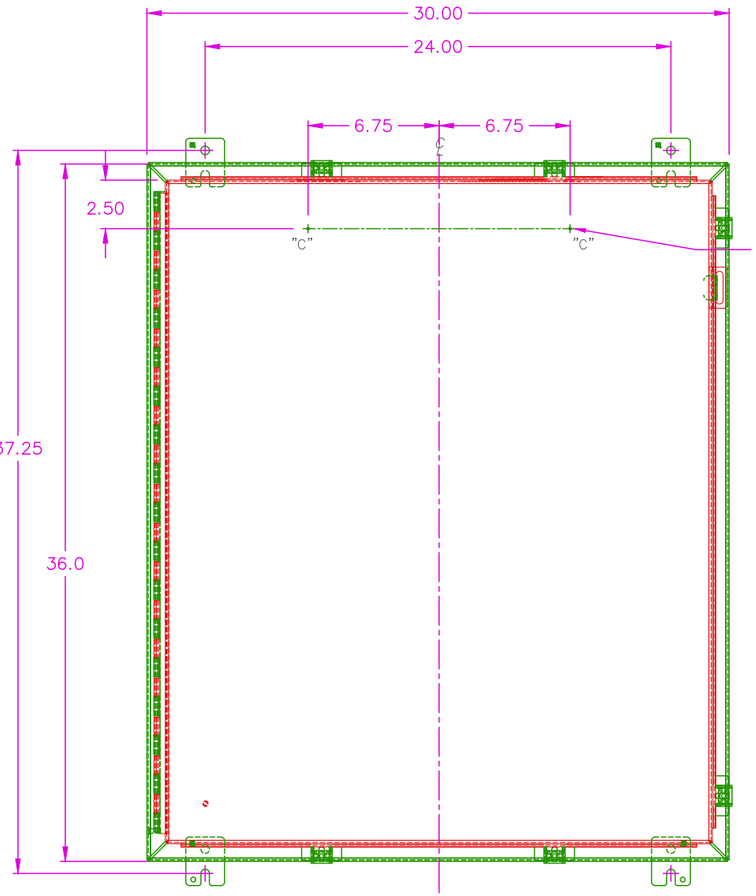
CUSTOMER:

DRN. BY	DATE	PROJ. ENG.	CAD P/N	SCALE
			#######TA021	1/1
DWG. NO.		APV'D. BY	CAD SHT.	REV.
20-#######-TA-21			1 OF 1	A

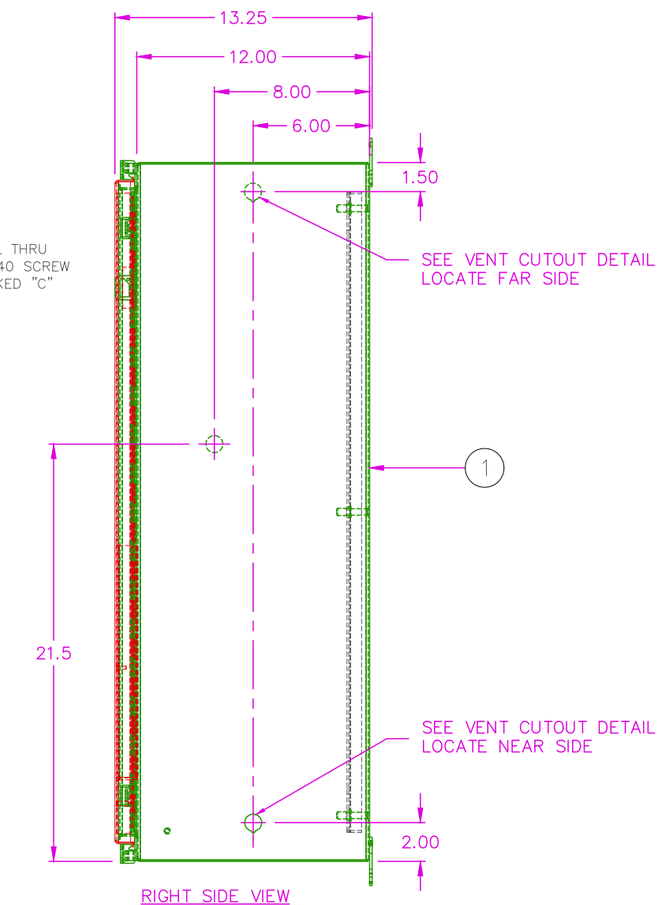
ACADR2000

Details Added by Addendum No. 10

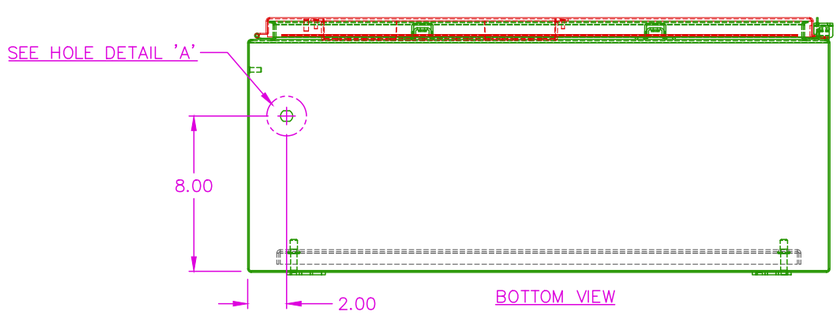
BILL OF MATERIAL				
ITEM NO.	QTY.	BBI PART NO.	DESCRIPTION	REF P/N'S
1	1	-	ENCLOSURE, SS NEMA 4X, 36"H X 30"W X 12"D	HOFFMAN A36H3012SSLP



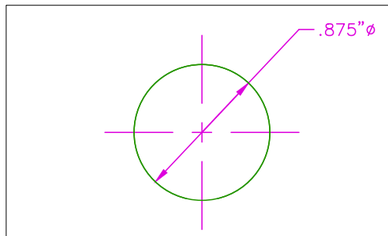
FRONT VIEW



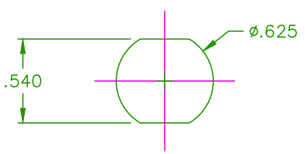
RIGHT SIDE VIEW



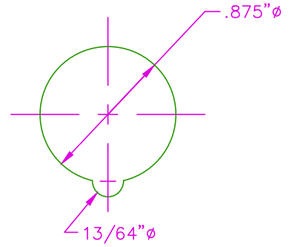
BOTTOM VIEW



MIMO ANTENNA DETAIL
(SCALE: 2=1)



HOLE DETAIL "A"
SURGE ARRESTOR (1) PLACE
SCALE: 2/1



VENT CUTOUT DETAIL
(SCALE: 2=1)

NOTES:
1) ALL MODS TO BE MACHINED ON CNC ROUTER
2) REMOVE ALL SHARP EDGES & BURRS

EMERSON.
Process Management

Power and Water Solutions
200 Beta Drive Pittsburgh Pa 15238
877-826-8514

Remote Automation Solutions
1100 Buckingham St., Watertown, CT. 06795
860-945-2200

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES:
.0 = ±.015
.00 = ±.01
.000=±.005
( ) = REF
ANGLES= ±1°

REV.	DESCRIPTION	DATE	BY	PE	APV'D

DWG PACKAGE
SHEET 6 OF 7

PROJECT NO. PWS: #######
RAS: .

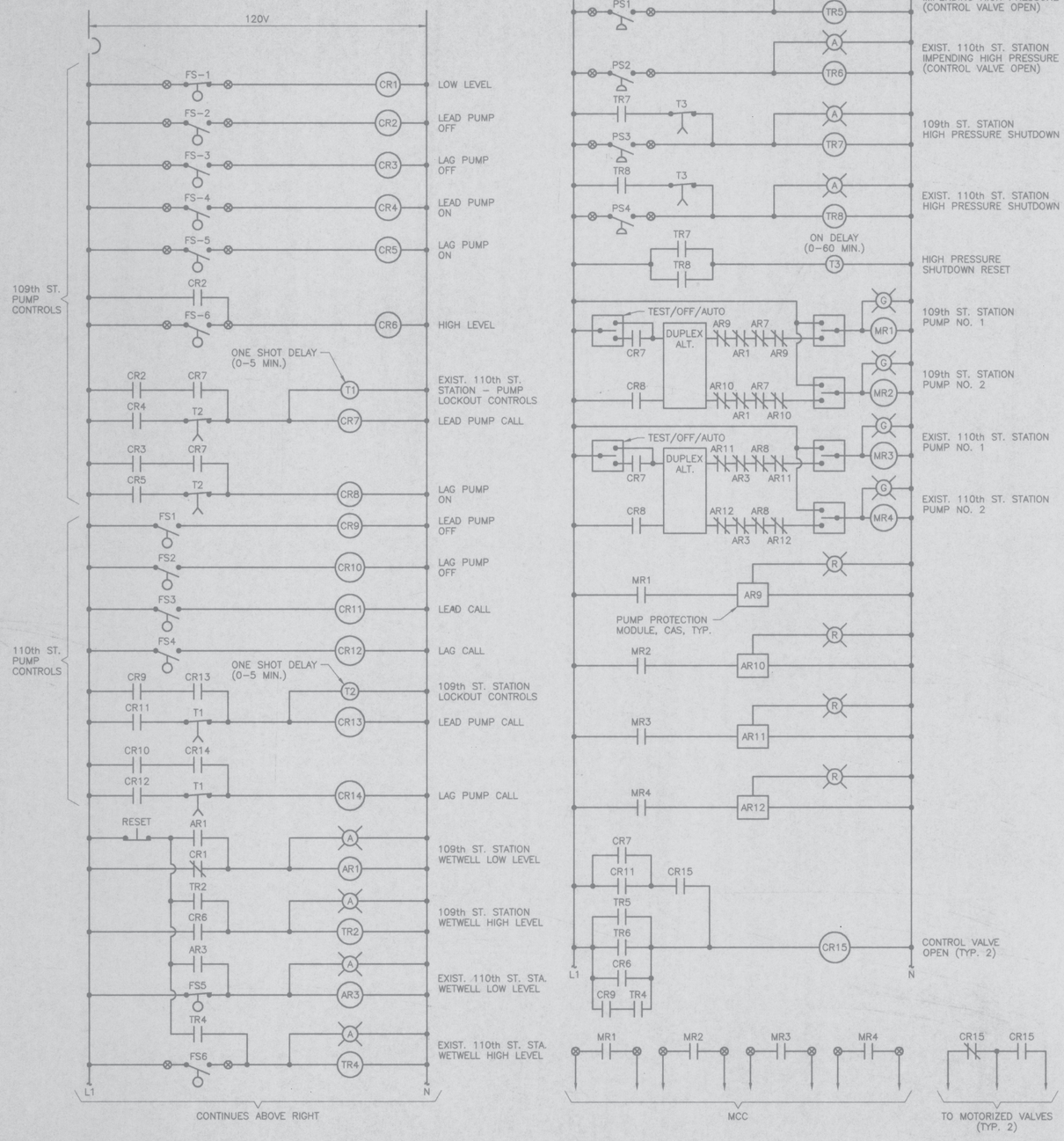
TITLE: ENCLOSURE

CUSTOMER:

DRN. BY	DATE	PROJ. ENG.	CAD P/N	SCALE
			#######EM011	1/1
DWG. NO. 20-#######-EM-11		APV'D. BY	CAD SHT. 1 OF 1	REV. A

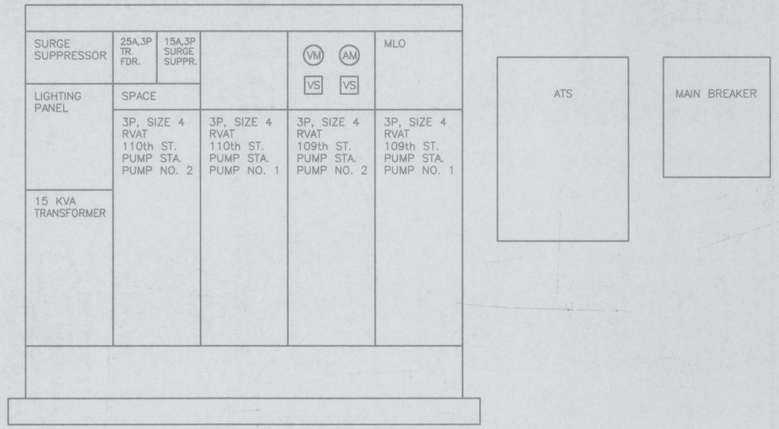
ACADR2000

Details Added by Addendum No. 10



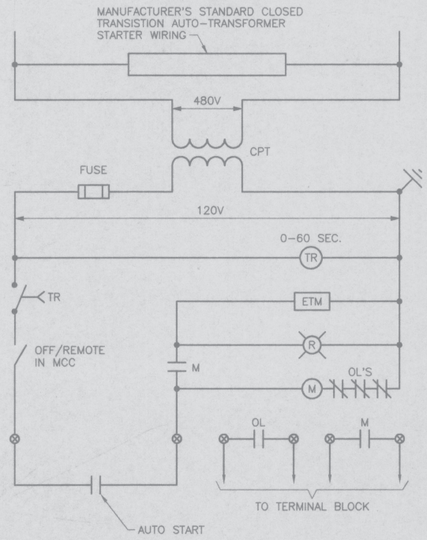
PUMP CONTROL PANEL

NOTE:
SEE DIVISION 11215 FOR ADDITIONAL CONTROL REQUIREMENTS.



MCC FRONT VIEW

N.T.S.



TYP. PUMP STARTER

REVISION | DATE

WILLIAMS, HATFIELD & STONER, INC.
ENGINEERS • PLANNERS • SURVEYORS • ENVIRONMENTAL SCIENTISTS
CORAL GABLES, FLORIDA

BISCAYNE SHORES - PHASE II & PHASE III
STORMWATER IMPROVEMENT PLANS
PHASE II 109th ST. P.S. ELEMETARY DIAGRAMS

Date	1/5/96
Drawn	TRH
Checked	SEB
Manager	SEB
Dwg Name	BSCELM2.DWG

PROJECT No.
4066.00

SHEET No.
E-4

ELECTRICAL - MECHANICAL INSTRUMENTATION
2101 N. ANDREWS AVE., SUITE 100
FORT LAUDERDALE, FLORIDA 33311
PHONE: (954) 564-3111
FAX: (954) 564-3040

Details Added by Addendum No. 10

MIAMI-DADE COUNTY PUBLIC WORKS DEPARTMENT

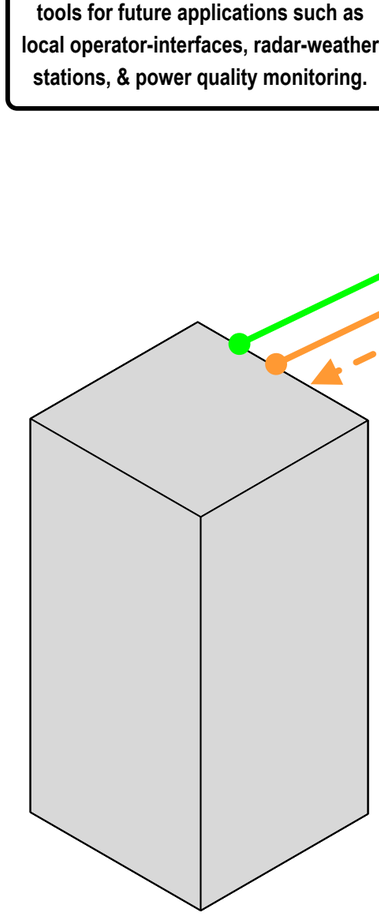
SAMPLE PUMP STATION

RTU INPUT/OUTPUT LIST

RTU MIC PUMP STATION	SIGNAL	RACK	CARD	POINT	POINT		DIGITAL ALARM	ANALOG ALARMS									
DESCRIPTION	TYPE	NUM	SLOT	NUM	CONN		TYPE:PRTY	HIDB	LODB	LOLO:PRTY	LO:PRTY	HI:PRTY	HIHI:PRTY	ZERO	SPAN	UNITS	SIGNAL NAME
WET WELL LEVEL	8-AI	1	7	1										0		FT	WWELL LVL IN
	8-AI	1	7	2										0			
	8-AI	1	7	3										0			
CONTROL PANEL TEMPERATURE	8-AI	1	7	4										0		DegF	RTU TEMP IN
Fuel Tank Level	*8-AI*	*1*	*7*	*5*										*0*		*in*	*FUEL LVL IN*
	8-AI	1	7	6										0			
	8-AI	1	7	7										0			
	8-AI	1	7	8										0			
AC FAIL ALARM	16-DI	1	4	1													AC FAIL IN
BATTERY LOW ALARM	16-DI	1	4	2													BATT STAT IN
AC SURGE FAIL ALARM	16-DI	1	4	3													ACSURGE FAIL IN
CONTROL PANEL INTRUSION ALARM	16-DI	1	4	4													INTR ALARM1 IN
PUMP #1 MOTOR RUN STATUS	16-DI	1	4	5													PUMP1 STAT I
PUMP #2 MOTOR RUN STATUS	16-DI	1	4	6													PUMP2 STAT I
PUMP #1 OVERLOAD	16-DI	1	4	7													PUMP1 OVRL IN
PUMP #2 OVERLOAD	16-DI	1	4	8													PUMP2 OVRL IN
PUMP #1 SEAL FAIL	16-DI	1	4	9													PUMP1 SEAL IN
PUMP #2 SEAL FAIL	16-DI	1	4	10													PUMP2 SEAL IN
PUMP #1 IN BYPASS	16-DI	1	4	11													PUMP1 DISABL IN
PUMP #2 IN BYPASS	16-DI	1	4	12													PUMP2 DISABL IN
PUMP #1 IN AUTO	16-DI	1	4	13													PUMP1 BYP IN
PUMP #2 IN AUTO	16-DI	1	4	14													PUMP2 BYP IN
PUMP #1 IN MANUAL	16-DI	1	4	15													PUMP1 HAND IN
PUMP #2 IN MANUAL	16-DI	1	4	16													PUMP2 HAND IN
RAIN GAGE PULSE	16-DI	1	5	1													RAINGGE PULSE IN
STATION ON FPL UTILITY POWER	16-DI	1	5	2													TRSWTCH FPL IN
GENERATOR RUN STATUS	16-DI	1	5	3													GEN STAT IN
GENERATOR OIL PRESSURE LOW	16-DI	1	5	4													GEN LPS IN
GENERATOR TEMPERATURE HIGH	16-DI	1	5	5													GEN HTS IN
FUEL TANK INTRUSION ALARM	16-DI	1	5	6													INTR ALARM2 IN
FUEL TANK LOW LEVEL	16-DI	1	5	7													GEN FUELLO IN
FUEL TANK LEAK ALARM	16-DI	1	5	8													GEN FUELLK IN
WETWELL HIGH LEVEL ALARM	16-DI	1	5	9													WWELL HILVL IN
AC PHASE MONITOR	16-DI	1	5	10													AC PHASE IN
PUMP #1 FAILURE	16-DI	1	5	11													PUMP1 FAULT IN
PUMP #2 FAILURE	16-DI	1	5	12													PUMP2 FAULT IN
PUMP #1 OVERHEATING	16-DI	1	5	13													PUMP1 OVRTMP IN
PUMP #2 OVERHEATING	16-DI	1	5	14													PUMP2 OVRTMP IN
PUMP #1 LOCAL HOA IN OFF	16-DI	1	5	15													PUMP1 OFF IN
PUMP #2 LOCAL HOA IN OFF	16-DI	1	5	16													PUMP2 OFF IN
PUMP #1 RUN COMMAND	16-DO	1	6	1													PUMP1 START OUT
PUMP #2 RUN COMMAND	16-DO	1	6	2													PUMP2 START OUT
	16-DO	1	6	3													
	16-DO	1	6	4													
WetWell High Level Alarm	16-DO	1	6	5													LIGHT HILVL OUT
WetWell High Level Alarm	16-DO	1	6	6													HORN HILVL OUT
Generator RTU Start/Stop Command	16-DO	1	6	7													GEN START OUT
AUTOMATIC TRANSFER SWITCH COMMAN	16-DO	1	6	8													TRSWTCH START OUT
PUMP #1 SOFTSTART RESET	16-DO	1	6	9													SOFTSTR1 ALARM RST
PUMP #2 SOFTSTART RESET	16-DO	1	6	10													SOFTSTR2 ALARM RST
	16-DO	1	6	11													
	16-DO	1	6	12													
	16-DO	1	6	13													
	16-DO	1	6	14													
	16-DO	1	6	15													
	16-DO	1	6	16													

Details Added by Addendum No. 10

Expanded SCADA Integration provides tools for future applications such as local operator-interfaces, radar-weather stations, & power quality monitoring.



Pump Starter/VFD Panel

Existing

120VAC Power

Two(2) Pump Run Relays

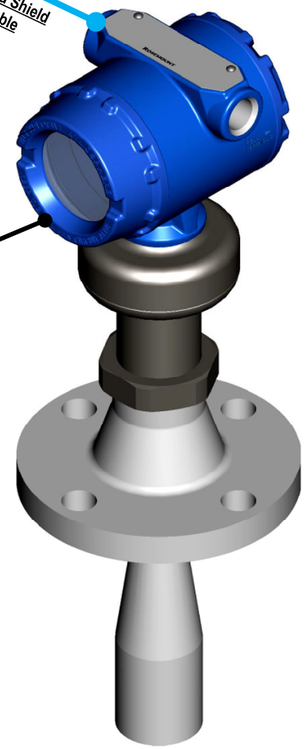
Read-only Data-link to VFD or SoftStarters (when available)

Data-link to Pump Local-Controller monitoring both settings & level measurement

One(1) Belden 9842 Cable

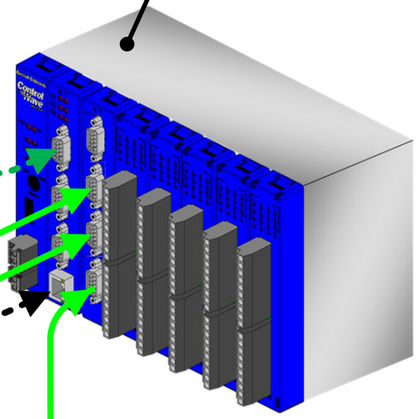
WetWell Level Signal

One(1) Twisted Shield 4~20mA Cable



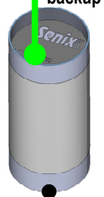
SD9 5W Radio

DigiTransport LTE Radio



Existing

Data-link to SCADA backup level measurement



SCADA/RTU Device (CW-Micro):
- Equipped with expanded serial-ports for isolated & direct connection to FVDs, Pump Local-Controller, backup WetWell level sensor, & SCADA radio.
- Will monitor Pump Local-Controller settings & local-control WetWell level.
- SCADA operators can change Pump Local-Controller settings.

Backup Pump-Controller (Precision Digital PD6000-6R4):
- Ready for 120VAC power. Independent of RTU/SCADA power.
- Designed for level-control applications, with built-in pump-control schemes.
- 4~20mA analog input signal. Four pump-control relay outputs.
- LED Level readout along with 4 pump start/stop LEDs.
- Four front navigation buttons. Configurable through standard USB port & configuration software.
- ModBus integration ready for RTU monitoring of local-control settings. ModBus RS485 breakout-module needed (PDA-1485).
- Panel-mount design with standard removable terminal-strips.

Local-Control Non-Contact WetWell Level (Rosemount 5408):
- Radar non-contact technology to avoid interference with SCADA Ultrasonic WetWell LVL instrument.
- Most accurate & reliable non-contact level measurement.
- Impervious to high-condensation buildup.
- Capable of turbulent or foaming applications.
- Can work in narrow 3" diameter stilling-wells, or without a stilling-well.
- Available with either flanged, 2" NPT, or bracket installation options.
- Free Emerson 'Radar-Master' graphical configuration software (MS-Windows).
- Minimum 1ft distance from tank-wall installation.
- LCD display for quick access to measurement & diagnostics.
- Antenna & cone assembly use 316SS material.
- Built-in 7-day historian for event diagnostics.
- Stilling-well not needed.

SCADA-Control Non-Contact WetWell Level (Senix TF30):
- Ultrasonic non-contact technology to avoid interference with Local-Control Radar WetWell LVL instrument.
- Backup measurement already proven in multiple MD-PWD installations.
- All-in-one NEMA-4X (316SS) housing for sensor & transmitter, with potted cable connections.
- Simple ModBus RS485 for direct connection to SCADA; no 4~20mA needed.
- Capable of 24 or 12 VDC power for either regular utility-power, or solar low-power applications.
- Simple 2" NPT mount installation.
- Free 'SenixVIEW' graphical configuration software (MS-Windows).
- Stilling-well not needed.

SCADA (Ethernet)

SCADA (RS232)

ModBus (RS485)

Analog Signal (4~20mA)

Power (120VAC)

Relay Outputs (120VAC)

MIAMI-DADE COUNTY

EMERSON

SCADA Integration of Backup Pump-Controller

AUTHOR: Rafael N. Jacomino

ISSUED: 4/24/2024

SIZE	FSCM NO	DWG Name	REV
B		Overview of Pump Local-Controller & SCADA integration including non-contact WetWell Level instrumentation.	3

SCALE N/A

SHEET 1 OF 1

NOTES:

1) Backup Pump-Controller (Precision Digital PD6000-6R4):
- Ready for 120VAC power. Independent of RTU/SCADA power.
- Designed for level-control applications; built-in pump-control (4 total).
- 4~20mA analog input signal. Four pump-control relay outputs.
- LED Level readout along with 4 pump start/stop LEDs.
- Four front navigation buttons. Configurable through standard USB port..
- ModBus integration ready for RTU monitoring of local-control settings.
- Needs ModBus RS485 breakout-module needed (PDA-1485).
- Panel-mount design with standard removable terminal-strips.

2) Local-Control Non-Contact WetWell Level (Rosemount 5408):
- Radar technology avoid interference with Ultrasonic WetWell LVL.
- Most accurate & reliable non-contact level measurement.
- Impervious to high-condensation buildup.
- Capable of turbulent or foaming applications.
- Can work in narrow 3" diameter stilling-wells, or without a stilling-well.
- Available with either flanged, 2" NPT, or bracket installation options.
- Free Emerson 'Radar-Master' graphical configuration software.
- Minimum 1ft distance from tank-wall installation.
- LCD display for quick access to measurement & diagnostics.
- Antenna & cone assembly use 316SS material.
- Stilling-well not needed.

3) SCADA-Control Non-Contact WetWell Level (Senix TF30):
- Ultrasonic technology to avoid interference with Radar WetWell LVL.
- Backup measurement already proven in multiple MD-PWD installations.
- All-in-one NEMA-4X housing for sensor/transmitter with potted cable.
- Simple ModBus RS485 for direct connection to SCADA; no 4~20mA needed.
- Capable of 24 or 12 VDC power; utility-power, or solar power ready.
- Simple 2" NPT mount installation.
- Free 'SenixVIEW' graphical configuration software.
- Minimum 3ft distance from vessel installation.
- Stilling-well not needed.

4) Pump-Speed SoftStarter or VFD Device. One per pump.

SYMBOLS:

Relay (Rx)

PLC Connection or Signal

Instrument

Device

Level Transmitter (xxx L)

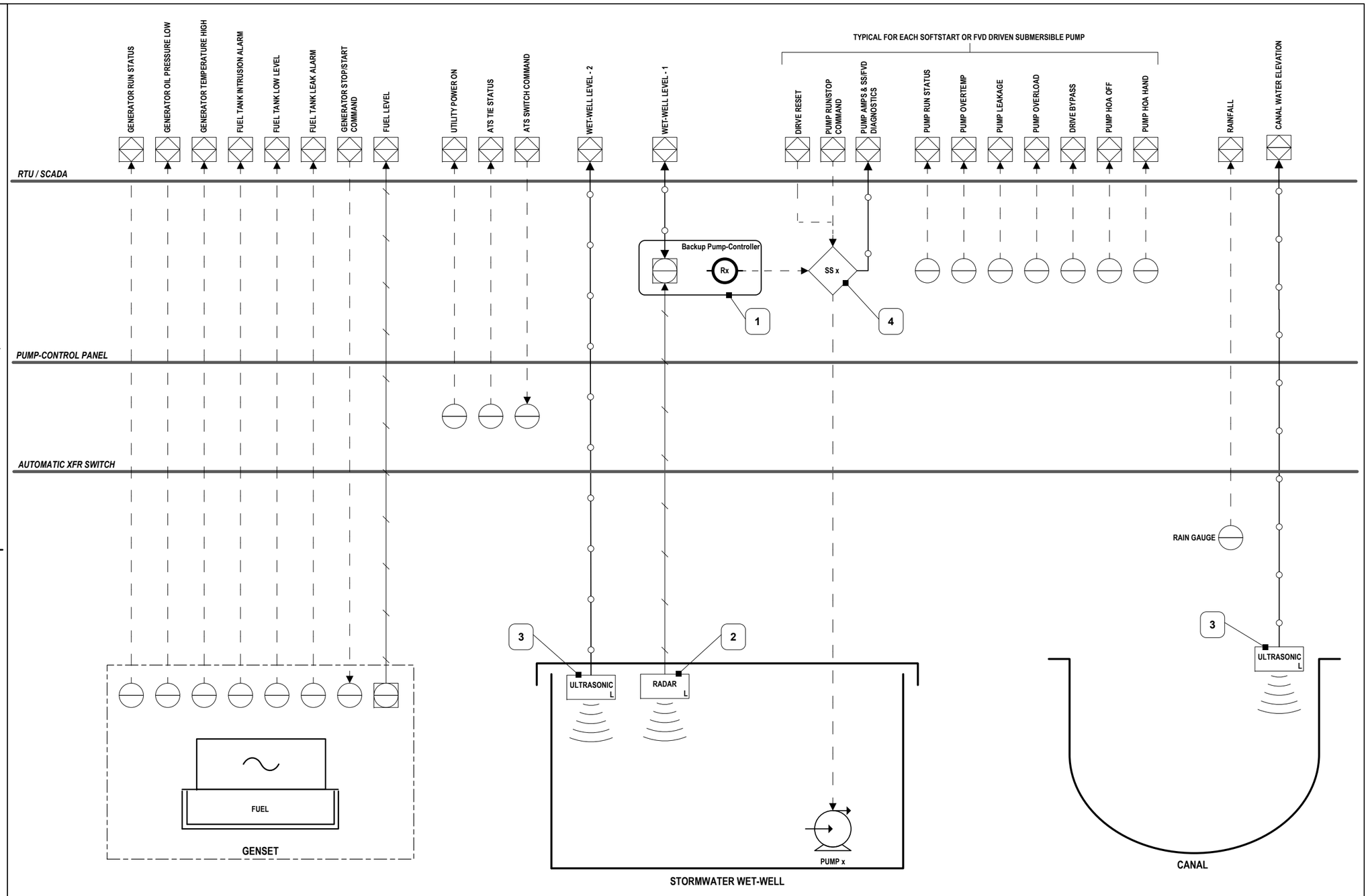
Analog Signal

ModBus Read

ModBus Read/Write

Analog Signal

Discrete Signal



MIAMI-DADE COUNTY / EMERSON	**Stormwater PS SCADA Signals P&ID**	SIZE **B**	FSCM NO	DWG Name: Pump Control & Integration with MD-DTPW RTU and SCADA Systems. Including backup-controller, non-contact radar level, ultrasonic level, and RTU hardware.	REV 3
	AUTHOR **Rafael N. Jacomino**				
	ISSUED **4/24/2024**	SCALE N/A		SHEET 2 OF 2	