

## SECTION 17000 - CONTROL AND INFORMATION SYSTEM, GENERAL

### PART 1 -- GENERAL

#### 1.01 SCOPE

- A. The Contractor shall provide, through the services of the instrumentation and control system subcontractor, all components, system installation services, as well as all required and specified ancillary services in connection with the Instrumentation, Control and Information System. The System includes all materials, labor, tools, fees, charges and documentation required to furnish, install, test and place in operation a complete and operable instrumentation, control and information system as shown and/or specified. The system shall include all measuring elements, signal converters, transmitters, control panels, cabinets, digital hardware and software, operator interface terminals, signal and data transmission systems, interconnecting wiring, brackets, supports, piping, tubing, valves, mounting hardware, and such accessories as shown, specified, and/or required to provide the functions indicated.
- B. The Contractor shall take note that the Section entitled "Summary of Work" includes specific construction sequencing restrictions that impact the performance of the Work as specified in Division 17. The Contractor shall coordinate sequence requirements between its various Project subcontractors as necessary to meet all requirements as specified in the contract documents.
- C. The general scope of work to be performed under this Division includes, but is not limited to, the following:
1. The Contractor shall retain overall responsibility for the instrumentation and control system as specified herein.
  2. Furnish and install process instrumentation and associated taps, nipples, valves, tubing, and supports as scheduled or shown on the Drawings, unless otherwise noted or supplied by equipment vendors.
  3. Furnish and install control equipment, field panels and associated cabinets and control panels as shown on the drawings and as specified in this Division.
  4. Furnish and install digital control system hardware and software as specified in this Division, including but not limited to:
    - a. One (1) complete ~~Data Flow Systems (DFS)~~ remote terminal unit (RTU) **panel** with Allen-Bradley MicroLogix 1400 and appurtenances **provided by the instrumentation and controls subcontractor**. An **RTU unit with PLC and radio module shall be furnished separately by Data Flow Systems**.
    - b. Radio telemetry antenna, cable, tower and appurtenances.
    - c. Modification of the existing DFS Hyper SCADA Server and workstation to incorporate the new RTU. **Modifications are to be performed by DFS.**
    - d. **Modification of the existing VTSCADA SCADA Server and workstation to incorporate the new RTU.**
    - e. **Refer to Section 17131 and Instrumentation Drawing I-02 for additional requirements.**
  5. Final termination and testing of all instrumentation and control system signal wiring and power supply wiring at equipment furnished under this Division.

6. Furnish and install transient voltage surge suppression systems for all digital equipment, data communications equipment, local control panels, and field instruments provided under this Division, including connections to grounding system(s) provided under Division 16.
  7. Coordinate grounding requirements with the electrical subcontractor for all digital equipment, local control panels, and field instrumentation provided under this Division. Terminate grounding system cables at all equipment provided under this Division.
  8. Provide system testing, calibration, training and startup services as specified herein and as required to make all systems fully operational.
  9. Furnish and install embedded supports, instrument stands, brackets, mounting hardware, piping, tubing, isolation valves and related items required for instrumentation and equipment furnished under Division 17.
  10. The Contractor shall coordinate all work specified herein with related work specified in other Divisions, and shall schedule the work to minimize downtime of equipment and controls as described in the Section entitled "Maintenance of Utility Operations During Construction". The Contractor shall provide temporary equipment and interconnecting cables as described herein and as shown on the Drawings.
- D. It is the intent of the Contract Documents to construct a complete and working installation. Items of equipment or materials that may reasonably be assumed as necessary to accomplish this end shall be supplied whether or not they are specifically stated herein.

#### 1.02 RELATED ITEMS

- A. Field mounted switches, torque switches, limit switches, valve and gate operator position transmitters, sump pump controls and other instrumentation and controls furnished with mechanical or electrical equipment not listed in the instrument schedule shall be furnished, installed, tested and calibrated as specified under other Divisions.
- B. Additional and related work performed under Division 16 includes the following:
  1. Conduit and raceways for all instrumentation and control system signal wiring, grounding systems, special cables and data highway cables.
  2. Instrumentation and control system signal wiring. See termination requirements below.
  4. Install (pull in conduit system) Ethernet data highway network and fiber optic data communications cables.
  5. Furnish and install grounding systems for all digital equipment, local control panels, and field instrumentation provided under Division 17. Grounding systems shall be complete to the equipment provided under Division 17, ready for termination by the instrumentation subcontractor.
  6. Termination of all instrumentation and control system grounding, signal and data communications cables, wiring and surge suppression devices at the equipment end of all equipment furnished under other Divisions of the Specifications. Wiring systems shall be installed complete to the equipment provided under Division 17, ready for termination by the instrumentation subcontractor.
  7. Final wiring and termination to A.C. grounding systems and to A.C. power sources (e.g. panelboards, motor control centers, and other sources of electrical power).

### 1.03 GENERAL INFORMATION AND DESCRIPTION

- A. Where manufacturers are named for a particular item of equipment, it is intended as a guide to acceptable quality and performance and does not exempt such equipment from the requirements of these Specifications or Drawings.
- B. In order to centralize responsibility, it is required that all equipment (including field instrumentation and control system hardware and software) offered under this Division shall be furnished and installed by the instrumentation subcontractor, or under the supervision of the instrumentation subcontractor, who shall assume complete responsibility for proper operation of the instrumentation and control system equipment, including that of coordinating all signals, and furnishing all appurtenant equipment.
- C. The Contractor shall retain total responsibility for the proper detailed design, fabrication, inspection, test, delivery, assembly, installation, activation, checkout, adjustment and operation of the entire instrumentation and control system as well as equipment and controls furnished under other Divisions of the Specifications. The Contractor shall be responsible for the delivery of all detailed drawings, manuals and other documentation required for the complete coordination, installation, activation and operation of mechanical equipment, equipment control panels, local control panels, field instrumentation, control systems and related equipment and/or systems and shall provide for the services of a qualified installation engineer to supervise all activities required to place the completed facility in stable operation under full digital control.
- D. The instrumentation and control system shall be capable of simultaneously implementing all real-time control and information system functions, and servicing all operator service requests as specified, without degrading the data handling and processing capability of any system component. It shall also be possible to simultaneously generate displays on all workstations and print out data on all printers without degradation of system performance.
- E. Control system inputs and outputs are listed in the Input/Output Schedule. This information, together with the control strategy descriptions, process and instrumentation diagrams, and electrical control schematics, describes the real-time monitoring and control functions to be performed. In addition, the system shall provide various man/machine interface and data reporting functions as specified in the software sections of this Specification.
- F. The mechanical, process, and electrical drawings indicate the approximate locations of field instruments, control panels, systems and equipment as well as field-mounted equipment provided by others. The instrumentation subcontractor shall examine the mechanical, process and electrical drawings to determine actual size and locations of process connections and wiring requirements for instrumentation and controls furnished under this Contract. The instrumentation subcontractor shall inspect all equipment, panels, instrumentation, controls and appurtenances either existing or furnished under other Divisions of the Specifications to determine all requirements to interface same with the control and information system. The Contractor shall coordinate the completion of any required modifications with the associated supplier of the item furnished.
- G. The instrumentation subcontractor shall review and approve the size and routing of all instrumentation and control cable and conduit systems furnished by the Electrical Contractor for suitability for use with the associated cable system.
- H. The Contractor shall coordinate the efforts of each supplier to aid in interfacing all systems. This effort shall include, but shall not be limited to, the distribution of approved shop

drawings to the Electrical Contractor and to the instrumentation subcontractor furnishing the equipment under this Division.

- I. The Contractor shall be responsible for providing a signal transmission system free from electrical interference that would be detrimental to the proper functioning of the instrumentation and control system equipment.
- J. The Owner shall have the right of access to the subcontractor's facility and the facilities of its equipment suppliers to inspect materials and parts; witness inspections, tests and work in progress; and examine applicable design documents, records and certifications during any stage of design, fabrication and tests. The instrumentation subcontractor and its equipment suppliers shall furnish office space, supplies and services required for these surveillance activities.
- K. The terms "Instrumentation", "Instrumentation and Control System", and "Instrumentation, Control and Information System" shall hereinafter be defined as all equipment, labor, services and documents necessary to meet the intent of the Specifications.

#### 1.04 INSTRUMENTATION AND CONTROL SYSTEM SUBCONTRACTORS

~~A. Instrumentation and control system subcontractors shall be regularly engaged in the detailed design, fabrication, installation, and startup of instrumentation and control systems for municipal water treatment facilities. Instrumentation and control system subcontractors shall have a minimum of five years of such experience, and shall have completed a minimum of three projects of similar type and size as that specified herein. As used herein, the term "completed" shall mean that a project has been brought to final completion and final payment has been made. Any instrumentation and control system subcontractor that has been subject to litigation or the assessment of liquidated damages for nonperformance on any project within the last five calendar years shall not be acceptable.~~

A. Instrumentation and controls subcontractor shall be one of the following, no exceptions, or substitutions:

- 1. **C.C. Controls**  
Address: 5760 Corporate Way, West Palm Beach, FL 33407  
Phone: 561.293.3976
- 2. **Champion Controls**  
Address: 811 NW 57TH PL, Fort Lauderdale, FL 33309  
Phone: 954.318.3090
- 3. **I&C Consulting Engineers**  
Address: 2900 NW 112 Ave, Suite 19 Doral, FL 33172  
Phone: 786.942.5685

#### 1.05 DEFINITIONS

A. Solid State: Wherever the term solid state is used to describe circuitry or components in the Specifications, it is intended that the circuitry or components shall be of the type that convey electrons by means of solid materials such as crystals or that work on magnetic principles such as ferrite cores. Vacuum tubes, gas tubes, slide wires, mechanical relays, stepping motors or other devices will not be considered as satisfying the requirements for solid state components of circuitry.

- B. Bit or Data Bit: Whenever the terms bit or data bit are used in the Specification, it is intended that one bit shall be equivalent to one binary digit of information. In specifying data transmission rate, the bit rate or data bit rate shall be the number of binary digits transmitted per second and shall not necessarily be equal to either the maximum pulse rate or average pulse rate.
- C. Integrated Circuit: Integrated circuit shall mean the physical realization of a number of circuit elements inseparably associated on or within a continuous body to perform the function of a circuit.
- D. Mean Time Between Failures (MTBF): The MTBF shall be calculated by taking the number of system operating hours logged during an arbitrary period of not less than six months and dividing by the number of failures experienced during this period plus one.
- E. Mean Time to Repair (MTTR): The MTTR shall be calculated by taking the total system down time for repair over an arbitrary period of not less than six months coinciding with that used for calculation of MTBF and dividing by the number of failures causing down time during the period.
- F. Availability: The availability of a non-redundant device or system shall be related to its MTBF and MTTR by the following formula:

$$A = 100 \times (MTBF / (MTBF + MTTR)) \text{ Percent}$$

The availability of a device or system provided with an automatically switched backup device or system shall be determined by the following formula:

$$A = A_2 + 1 - ((1 - A_1) \times (1 - A_1))$$

where:

A1 = availability of non-redundant device or system

A2 = availability of device or system provided with an automatically switched backup device or system

- G. Abbreviations: Specification abbreviations include the following:

- A - Availability
- ADC - Analog to Digital Converter
- AVAIL - Available
- ATA - Advanced Technology Attachment
- BCD - Binary Coded Decimal
- CSMA/CD - Carrier Sense Multiple Access/Collision Detect
- CPU - Central Processing Unit
- CRC - Cyclic Redundancy Check
- CRT - Cathode Ray Tube
- CS - Control Strategy
- DAC - Digital to Analog Converter
- DBMS - Data Base Management System
- DDR - Double Data Rate

DIMM	-	Dual In-line Memory Module
DMA	-	Direct Memory Access
DPDT	-	Double Pole, Double Throw
DVD	-	Digital Video Disc
DVE	-	Digital to Video Electronics
ECC	-	Error Correction Coding
EPROM	-	Erasable Programmable Read Only Memory
FDM	-	Frequency Division Multiplexing
FSK	-	Frequency Shift Keyed
GB	-	Gigabyte
Gbps	-	Gigabits per second
HMI	-	Human Machine Interface
I/O	-	Input/Output
LAN	-	Local Area Network
LCD	-	Liquid Crystal Display
LED	-	Light Emitting Diode
MB	-	Megabyte
Mbps	-	Megabits per second
MCC	-	Motor Control Center
MTBF	-	Mean Time Between Failures
MTTR	-	Mean Time To Repair
OS	-	Operating System
OIT	-	Operator Interface Terminal
PCB	-	Printed Circuit Board
PLC	-	Programmable Logic Controller
RAID	-	Redundant Array of Inexpensive Discs
PROM	-	Programmable Read Only Memory
RAM	-	Random Access Memory
RMSS	-	Root Mean Square Summation
ROM	-	Read Only Memory
RTU	-	Remote Telemetry Unit
SATA	-	Serial ATA
SCADA	-	Supervisory Control and Data Acquisition
SDRAM	-	Synchronous Dynamic Random Access Memory
SIMM	-	Single In-line Memory Module

SPDT	-	Single Pole, Double Throw
TB	-	Terabyte
TDM	-	Time Division Multiplexing
TFT	-	Thin Film Transistor
USB	-	Universal Serial Bus
UPS	-	Uninterruptible Power Supply
WAN	-	Wide Area Network

- H. To minimize the number of characters in words used in textual descriptions on displays, printouts and nameplates, abbreviations may be used subject to Engineer approval. If a specified abbreviation does not exist for a particular word, an abbreviation may be generated using the principles of masking and or vowel deletion. Masking involves retaining the first and last letters in a word and deleting one or more characters (usually vowels) from the interior of the word.

#### 1.06 ENVIRONMENTAL CONDITIONS

- A. Instrumentation equipment and enclosures shall be suitable for ambient conditions specified. All system elements shall operate properly in the presence of telephone lines, power lines, and electrical equipment.
- B. Inside control rooms and climate-controlled electrical rooms, the temperature will normally be 20 to 25 degrees Celsius; relative humidity 40 to 80 percent without condensation and the air will be essentially free of corrosive contaminants and moisture. Appropriate air filtering shall be provided to meet environmental conditions (i.e., for dust).
- C. Other indoor areas may not be air conditioned/heated; temperatures may range between 0 and 40 degrees Celsius with relative humidity between 40 and 95 percent.
- D. Outdoor equipment including instrumentation and panels may be subjected to wind, rain, lightning, and corrosives in the environment, with ambient temperatures from -20 to 40 degrees Celsius and relative humidity from 10 to 100 percent. All supports, brackets and interconnecting hardware shall be aluminum or Type 316 stainless steel as shown on the installation detail drawings.

### PART 2 -- PRODUCTS

#### 2.01 NAMEPLATES

- A. All items of equipment listed in the instrument schedule, control panels, and all items of digital hardware shall be identified with nameplates. Each nameplate shall be located so that it is readable from the normal observation position and is clearly associated with the device or devices it identifies. Nameplates shall be positioned so that removal of the device for maintenance and repair shall not disturb the nameplate. Nameplates shall include the equipment identification number and description. Abbreviations of the description shall be subject to Engineer approval.
- B. Nameplates shall be made of 1/16-inch thick machine engraved laminated phenolic plastic having white numbers and letters not less than 3/16-inch high on a black background.

- C. Nameplates shall be attached to metal equipment by stainless steel screws and to other surfaces by an epoxy-based adhesive that is resistant to oil and moisture. In cases where the label cannot be attached by the above methods, it shall be drilled and attached to the associated device by means of stainless steel wire.

## PART 3 -- EXECUTION

### 3.01 SCHEDULE OF PAYMENT

- A. Payment to the Contractor for Control and Information System materials, equipment, and labor shall be in accordance with the General and Supplementary Conditions. The schedule of values submitted as required by the General and Supplementary Conditions shall reflect a breakdown of the work required for completion of the Control and Information System. The breakdown shall include sufficient detail to permit the Engineer to administer payment for the Control and Information System including, but not necessarily limited to, the following items:
  - 1. Mobilization
  - 2. Shop Drawing Submittals
  - 3. Process Instrumentation
  - 4. Control Panels
  - 5. Programming
  - 6. Process Instrumentation Testing and Startup
  - 7. Control Panel Loop Testing
  - 8. Process Control Strategy Testing and Startup
  - 9. Training
  - 10. Final System Acceptance Testing
  - 11. Final Acceptance
- B. Requests for payment for materials and equipment that are not installed on site, but are required for shop fabrication and testing (e.g., digital hardware), or are properly stored as described in the Contract Documents and herein, shall be accompanied by invoices from the original supplier to the Contractor or instrumentation subcontractor substantiating the cost of the materials or equipment.
- C. No payment for programming shall be paid prior to approval of associated shop drawings. Upon approval of programming shop drawings, up to 50% of programming shall be payable. Upon completion of on-site loop checkout, up to 70% of programming shall be payable. Upon completion of functional tests, up to 90% of programming shall be payable. The remaining 10% shall be payable upon completion of the Final Acceptance Test.
- D. Any balance remaining within the schedule of values for field instruments and other materials installed on the site, or for other materials, for which payment is made by invoice, will be considered due upon completion of the Final Acceptance Test.

### 3.02 CLEANING

- A. The Contractor shall thoroughly clean all soiled surfaces of installed equipment and materials.

- B. Upon completion of the instrumentation and control work, the Contractor shall remove all surplus materials, rubbish, and debris that has accumulated during the construction work. The entire area shall be left neat, clean, and acceptable to the Owner.

3.03 FINAL ACCEPTANCE

- A. Final acceptance of the Instrumentation, Control and Information System will be determined complete by the Engineer, and shall be based upon the following:
  - 4. Receipt of acceptable start up completion and availability reports and other documentation as required by the Contract Documents.
  - 5. Completion of the Availability Demonstration of the System as a whole.
  - 6. Completion of all punch-list items.
- B. Refer to the Section entitled "Project Closeout" for additional requirements.

- END OF SECTION -