

SECTION 16902

MEASURING AND CONTROLLING INSTRUMENTS AND LOOPS

PART 1 - GENERAL

1.1 Summary

A. This Section includes the following

1. Indicators.
2. Controllers.
3. Transducers and function modules.
4. Float Switches.
5. Instrument loops.

1.2 References

1. **American National Standards Institute (ANSI)**
ANSI B16.1 - Cast-Iron Pipe Flanges and Flanged Fittings.
2. **National Electrical Manufacturers Association (NEMA)**
3. As specified in each applicable section, this Division.
4. **National Fire Protection Association**
National Electrical Code, NFPA 70
Standard for Electrical Safety in the Workplace, NFPA 70E
5. **National Electrical Safety Code, IEEE C2.**
6. **Occupational Safety and Health Administration, OSHA.**
7. All electrical and control equipment and material shall bear the recognized Underwriters Laboratories, Inc. (UL) seal of approval. It is Vendor's responsibility to obtain local inspection approval for all non-UL labeled equipment and pay all fees in connection with the same.

1.3 Submittals: Submit as specified in Section 1330.

PART 2 - MATERIALS

2.1 Acceptable Manufacturers

A. Digital Panel Meters

1. Newport Electronics, Inc.
2. Dixon, Inc.
3. Triplett Corp.

B. Controllers

1. Bristol Babcock Incorporated (Bristol).
2. Fischer & Porter Company.
3. The Foxboro Company (Foxboro).
4. Honeywell Process Control Division (Honeywell).
5. Leeds & Northrup Unit of General Signal (Leeds & Northrup).
6. Rosemount Inc. (Rosemount).
7. Taylor Instrument Company Division, Sybron Corporation (Taylor).
8. Great Lakes Instruments

C. Transducers and Function Modules

1. Acromag Inc.
2. Bristol Babcock Incorporated (Bristol).
3. Fischer & Porter Company (Fischer & Porter).
4. The Foxboro Company (Foxboro).

5. Honeywell Process Control Division (Honeywell).
6. Leeds & Northrup Unit of General Signal (Leeds & Northrup).
7. Rochester Instrument Systems (RIS).
8. Rosemount Inc. (Rosemount).
9. Taylor Instrument Company Division, Sybron Corporation (Taylor).
10. Transmation Inc.
11. Great Lakes Instruments

D. Float Switches (High & Low Level Backup)

1. Consolidated Electric Co.
2. Engineer approved equal.

E. Magnetic Flowmeters

1. Brooks Instrument Division, Emerson Electric Company (Brooks).
2. The Foxboro Company (Foxboro).
3. Honeywell Process Control Division (Honeywell).
4. Rosemount Inc. (Rosemount).
5. Great Lakes Instruments.
6. KROHE
7. Toshiba
8. Engineer Approved Equal.

F. Level Controllers

1. U.S. Filter - Model # A1000/157GSC

2. Druck – Model PTX / PMP 1290 with process indicator
3. Engineer Approved Equal

2.2 General

- A. Transmitters shall have an output signal of 4 to 20 mA dc into a minimum load range of 0-600 ohms at 24Vdc.
- B. All analog indicating and recording receivers shall have evenly graduated scales.
- C. Provide all mounting brackets, pipe stands and accessories required to install all field-mounted instruments.
- D. Furnish and install all accessories required for complete and working systems as specified and indicated.

2.3 Indicators

A. Digital Panel Meters

1. 7-segment light emitting diode (LED) display.
2. 0.5-inch high digits, number as specified.
3. Input signal shall be 4-20 mA dc (or BCD from PC output module).
4. Readout shall be in engineering units specified.
5. A/D conversion shall be dual slope integration method.
6. Zero offset and span adjustments shall be factory set as specified and shall be field adjustable.
7. Shall operate from a 120Vac, 60 hertz power supply.
8. Field selectable decimal point.
9. Normal Mode Rejection Ratio shall be 40 db or greater at 60 hertz and Common Mode Rejection Ratio shall be 80 db or greater from dc to 60 hertz.

10. Provide barrier terminal strips for external connections.
11. Furnish with mounting brackets and trim strips.

2.4 Controllers

A. Controllers

1. Control modes as follows: Hand/Off/Auto.
2. **Control Ranges (minimum):**
 - a. Proportional gain: 0.2 to 50.
 - b. Integral (reset): 0.02 to 50 repeats/minute.
3. Provide with anti-reset wind-up control.
4. Provide high and low output signal limiting on automatic control. Limiting set points shall be adjustable from 2 to 22 mA dc.
5. Switching between automatic and manual control shall be bumpless and not require balancing.

B. Electrical Requirements

1. Unit shall operate from a 120Vac power source.
2. Input signals shall be 4-20 mA dc.
3. Input impedance shall be 250 ohms maximum for current inputs.
4. Isolated output signal shall be 4-20 mA dc at 24V into a minimum load range of 0 to 600 ohms. Provide individual isolated signals, for each pump.

2.5 Transducers and Function Modules

- A. Solid-state design.
- B. Housed in a NEMA 1 enclosure designed for surface mounting on control panel interior.

- C. Provide with terminals for external connections.
- D. Designed to operate from a 120Vac power source.
- E. **Signal Transducers**
 - 1. Input/output signal ranges shall be standard 1-5Vdc, 4-20 mA dc, or 3-15 psi as indicated.
 - 2. Provide where required, indicated, or specified to change signal to one compatible with the equipment furnished.

2.6 Float Switches

- A. Rigid, high-density polyurethane tear-drop-shaped float.
- B. Two internal independent mercury switches, one NO and one NC, rated 10 amps at 150Vac, noninductive.
- C. Furnished with necessary length of cable and weight kit for cable suspension.
- D. Model LS, Consolidated Electric Co. or equal.

2.7 Magnetic Flowmeters

- A. Flowmeter system shall consist of a flow element and an indicating transmitter mounted remotely from the meter tube assembly.
- B. System shall be accurate to within (1% of flow rate for velocities between 3 and 30 feet per second.
- C. **Meter Body**
 - 1. 304 stainless steel tube with flanged ends.
 - 2. 150-pound steel with flange that matches the piping provided.
 - 3. Electrodes shall be 316 stainless steel and conical shaped for self-cleaning action.
 - 4. Liner shall be polyurethane.

5. Size as specified in this Section.

D. Transmitter

1. Magnetic flowmeter shall have "DC" excited coils.
2. The transmitter electronics shall be microprocessor based.
3. Shall accept the millivolt input from the meter and provide a (4-20 mA) linear output signal proportional to flow.

E. Accessories

1. Provide a stainless steel grounding ring on the inlet and outlet.

2.8 Level Controllers (Part of Pump Controller)

- A. Level Controller to be a pressure transmitter/ transducer
- B. Transducer cable to be 100 foot long
- C. Output of transmitter to be 4-20 ma
- D. Max. pressure 150 PSIG
- E. Input power – 120Vac, 60 Hz, single phase

2.9 Instrument Loops

A. Pump Station Flow

1. Flow Indicating Transmitter (FIT-1)
 - a. Provide a mag flow meter as specified
 - b. Install the meter and ground it as indicated
 - c. Calibrate the remote transmitter for 0-10,000 gpm.
 - d. Mount remote transmitter on equipment rack, and power it from 120 volt panelboard
 - e. Provide a linear 4-20 mA output signal over the specified range. As indicated, wire the output signal to

the flow indicating controller and than to the PLC and RTU unit

2. Speed Control of Pumps
 - a. Speed control of pumps to be determined by pump controls manufacturer.

PART 3 - EXECUTION

3.1 Installation

A. Panel Mounted Devices: As specified in Section 16901.

B. Field Mounted Devices

1. Install as follows

- a. Mount on floor or wall as required using 2 inch pipe mounts.
- b. Mount plumb and level.
- c. Mount on walls with bottom of box or instrument 4 feet above floor unless indicated otherwise and instrument case spaced at least 1/2-inch away from wall.
- d. Install supports as specified in this Division.
- e. Provide sunshade for all instrument displays located outdoors to prevent UV damage to instrument displays.

2. Connect inputs and outputs as indicated on the manufacturer's shop drawings and as follows:

- a. Transmitters requiring electric power are supplied from the control panels.

3.2 Manufacturer's Field Services: As specified in Section 16900.

3.3 Field Testing

A. Instrument Tests and Adjustments

1. All instruments to be calibrated at factory, where possible, prior to installation.
2. With each system variable transmitter disconnected from its normal source of input signal, apply an input with manometer, instrument potentiometer, or other device and adjust span and zero on all instruments transmitting, receiving, or retransmitting the resulting variable current or voltage signal and on all final control devices. Check instruments and final control devices at several points over the instrument measuring or control device span.
3. Apply manually adjustable time duration or current signals directly to receivers where required to adjust zero and span and to check operation of the instrument over the measuring span.
4. Accurately measure variable current and voltage signals as required to adjust all receivers, transmitters, transducers, and final control devices.
5. With input signals as specified in 1 above, adjust zero and span of each controller; check operation of controller with various set points and system variable inputs; adjust controller proportional band, reset, and rate to conform to instructions from manufacturer's representative and Engineer.
6. Check operation of each instrument with system in actual operation.
7. Readjust controller settings as required to obtain desired control of the associated system variables.

B. Functional Testing of Controls

1. Perform before equipment is placed in service.
2. Include operating control system from each control point.

3. Completely check each annunciated point and equipment alarm.
4. Operate by hand all relays and other system components that cannot be operated in normal manner with plant not in service.
5. Repeat with plant in operation.

PART 4 MEASUREMENT AND PAYMENT

4.1 Measurement

- A. No measurement will be made for this item.

4.2 Payment

- A. Payment will be made at the contract lump sum price bid and shall be considered full payment for providing labor and materials to perform this work.

**** END OF SECTION 16902 ****