

Engineering Specifications – HydroRanger 200

Multi-Functional Level Control System

General

Scope

This section describes the requirements for a multi-functional level controller system. Under this item, the contractor shall furnish and install the multi-functional level controller system, and all associated equipment and accessories as indicated on the plans and as herein specified.

Submittals

The following information shall be included in the submittal for this section:

- Data sheets and catalog literature for system components.
- Interconnection and dimensional drawings.

Basic System Description

The multi-functional level control system (level system) shall employ acoustic echo-ranging technology to determine the distance between the transducer and monitored surface, as a basis for display, output, and digital communication. The level system shall consist of a microprocessor based level controller and an ultrasonic transducer (transducer) for single point operation.

The level controller shall be operator configurable to meet specific application requirements by implementation of available signal processing and process control functions, in any allowable combination.

Level Controller Functions

Signal Processing

The level controller shall:

- Employ an ultrasonic transceiver suitable for providing excitation to, and processing resultant signals from the attached ultrasonic transducer.
- Create a digitized echo profile, and apply patented Sonic Intelligence echo processing techniques to select and verify the echo representing the reflective surface monitored.
- Shall employ Auto False Echo Suppression with the ability to automatically reject signals created by obstructions in the sound wave beam path and determine true material level.
- Calculate the distance between the transducer face and reflective surface based on the echo selected. The calculated distance may be converted to represent: material level, differential level*, average level*, space, material volume, vessel ullage, pumped volume, or head, open channel flow rate, and/or total flow volume. (* Additional transducer required.)
- Compensate temperature-induced variation in the acoustic wave propagation velocity in air. This compensation shall be based on the

signals received from the ultrasonic transducer, and/or a TS-3 temperature sensor, or an operator entered value representing the air temperature of the transmission medium.

- Include a calibration method and/or enable manual operator value entry, to set a fixed acoustic wave propagation velocity for transmission mediums other than air.

Process Control I/O

The level controller shall provide:

- Two analog signal outputs, directly or inversely proportional and scalable to the configured process variable.
- Six relay contact outputs based on the level conversion or other process variable as set by the user configurable relay parameters.
- Two discrete inputs that may be configured to override normal Process Control Functions.
- One analog signal input that may be scaled to a monitored process variable, to be used as a basis for level controller Process Control Functions.

Process Control Functions

The level controller shall provide an assortment of process control functions that may be user implemented in any allowable combination.

Standard Process Control Functions

- 0/4–20 mA output directly / inversely proportional and scalable to:
 - level, space, or distance
 - volume (geometric, piecewise linear, or cubic spline approximation derived)
 - head or flow (exponential, defined flume or weir, or approximation derived)
 - volume rate (derived from change in volume per time interval)
 - dual point average or dual point differential level (two transducers required).
- 0/4-20 mA input configurable to represent level measured by alternate device
- Pre-configured application selections for:
 - duplex wetwell or reservoir pump control by level or rate of change
 - screen rake control
 - general alarms
- Alarms based on on/off setpoints:
 - High, Low, High High, or Low Low level
 - Level in bounds, out of bounds, rate of change
 - Temperature
- Loss of Echo or Cable Fault alarm
- Pump Control - fixed roster, alternating duty assist or back-up, service ratio duty assist or back-up, or FIFO duty assist
- Pump Control Modifiers – pump run-on, pump start and power resumption delays, wall cling reduction, independent pump group rotations, and pump cycle activated flush operation.
- Pump Control Overrides based on discrete inputs such as point level switches or pump fault sensors
- Special Device Control – remote totalizer, flow sampler

- Remote relay state control via communications
- Failsafe operation on measurement loss, including independent mA output and relay operation configuration.

Digital Communications

The level controller shall:

- Store data related to the digitized echo profiles, distance calculation, signal processing functions, process control functions, and system configuration.
- Map stored data to Modbus type read/write and read only registers, as defined by the level controller supplier.
- Provide access to stored data via:
 - RS232 port with RJ-11 connector for use with SIMATIC PDM.
 - RS-485 port with screw terminals for external connection to the RS-485 modem or any compatible RS-485 communications network.
 - SmartLinx port for use with an interchangeable SmartLinx card for direct connection to the corresponding industrial bus protocol.

User Interface

The level controller shall enable user access to read only and read/write enabled data, using any of the following methods:

- Direct or scroll access to data stored in numerical parameters, using the hand programmer and graphic LCD display.
- IBM PC compatible computer access to data and digital echo profiles, using the SIMATIC PDM instrument configuration package.
- HMI, SCADA, PLC, or DCS system access to data stored in Modbus registers via digital communications.

Transducer Functions

Acoustic / Electrical Energy Conversion

The transducer shall employ a piezzo electric driver element to convert the electrical excitation supplied by the level controller, to acoustic energy radiated axially and perpendicular from the transducer face. The piezzo electric driver shall also convert acoustic excitation to an electrical signal for processing by the level controller.

Integral Temperature Sensor

The transducer shall also employ an internal temperature sensor that shall provide a signal to the level controller representing the temperature measured at the transducer face.

System Performance

Conditions

The following system performance specifications pertain to normal industrial applications for which the system is designed; when installed, configured, and calibrated, in accordance to the level controller supplier instructions, based on prior application review and approval.

System Specifications

Range: 0.3 to 15 m (1 to 50') dependent on transducer
Accuracy: 0.25% of range or 6 mm (0.24"), whichever is greater
Resolution: 0.1% of span, or 2 mm (0.08"), whichever is greater
Programming: Primary: Handheld programmer,
Secondary: PC running Dolphin Plus software
Temp. Comp.: Range: -50 to 150°C (-58 to 302°F)
Source: Integral transducer sensor, and/or
TS-3 temperature sensor, or
Programmable fixed temperature
Temp. Error: Sensor: 0.09% of range
Fixed: 0.17% per °C deviation from programmed value

Level Controller Specifications

Power: AC version: 100-230 Vac \pm 15%, 50 / 60 Hz, 36 VA (17W)
DC version: 12-30 Vdc, 20W
Enclosure: Polycarbonate, Indoor/Outdoor
Type 4X / NEMA 4X / IP 65
240mm (9.5") x 175mm (6.9")
1.37 kg (3.02 lb)
Ambient Temp: -20 to 50°C (-5 to 122°F)
Memory: 1MB static RAM with battery backup
512kB flash EPROM
Display: Back lit LCD
Excitation: Transducer: 315V peak, 44 kHz nominal frequency
Differential or average level algorithm (Additional transducer required)
mA O/P: 0-20 mA or 4-20 mA, directly or inversely proportional, scalable and configurable
750 ohm maximum load, isolated
 \pm 0.1% resolution
Relays: All relays rated 5A at 250Vac, non-inductive
4 Form A control relays, 2 Form C alarm relays
Discrete I/P: 2 discrete inputs configurable to override control functions
Logical 0 = < 0.5 Vdc; logical 1 = 10 to 50 Vdc
3 mA maximum draw
mA I/P: 0-20 or 4-20 mA, configurable as level input from another device (availability model dependent)
Comm's: RS-232 running Modbus RTU and ASCII via RJ-11 connector
RS-485 running Modbus RTU and ASCII via terminal block
Industrial bus protocol via SmartLinx card (optional)

Transducer Specifications

Transducer Model Variations

The ultrasonic transducer used with the level controller shall be available in distinct models to suit various application conditions.

Minimum Specifications

Range: 0.6 to 8 meters (2 to 26 feet)
Beamwidth: 12 degrees
Temperature: -20 to 60C (-5 to 140F)
Temp Sensor: Integral
Cable: Length of shielded twisted pair, suitable for temperature rating
Extendable by installer to 365 meters (1200 feet) total length
Approvals: CE compliant, CSA, FM, Cenelec, ATEX

Specification Variation Available by Model (not necessarily in combination)

Range: 0.3 to 15 meters (1 to 50 feet)
Beamwidth: 6 degrees
Temperature: -40 to 145C (-40 to 293F)
Construction: A) Tefzel base and lid with epoxy joint,
2" NPT, BSP, PF2 process connection options.
Flange adapter or submergence hood available.
B) Kynar Flex body with Hypalon face.
1" NPT, (1" BPS available on some models).
Flanges or submergence hood available.
C) Kynar, hermetically sealed,
1" NPT or 1" BPS conduit connection.
Flanges or submergence hood available.
D) Kynar, hermetically sealed,
1" NPT or 1" BPS conduit connection
Teflon faced factory flange

Equipment

Level Controller:

HydroRanger (manufactured by Siemens Milltronics Process Instruments Inc.)
Model 200 with factory configured variations as required to meet signal
processing and process control requirements.

Transducer(s):

Echomax (manufactured by Siemens Milltronics Process Instruments Inc.) Model
XRS-5, XPS-10, XPS-15, XCT-8, XCT-12, or ST-H, as required to meet process
conditions and application requirements.

Additional Equipment:

The following additional equipment shall be available at additional cost.

- A TS-3 temperature sensor for determining the temperature at a location other than that provided by, or in conjunction with, the ultrasonic transducer.
- Infrared hand programmer for local instrument access and configuration.

- SIMATIC PDM instrument configuration package for local or remote instrument access and configuration using an IBM compatible PC.
- SmartLinx communications protocol module for access and configuration via an industrial data communication network.
- RS-485 External Modem Kit for remote access and configuration via leased or land line telemetry.
- Prefabricated mounting brackets for transducer mounting.
- Easy Aimer mounting device for transducer aiming.
- Additional instruction manuals.

Installation:

All equipment shall be installed, configured, interconnected, and commissioned by qualified persons, in accordance with the manufacturers instructions and guidelines, and in compliance with all governing regulations and accepted engineering practices.

Warranty Terms

The manufacturer of the above specified equipment shall guarantee for twelve (12) months from equipment startup or eighteen (18) months from date of shipment, whichever occurs first, that the equipment shall be free from defects in design, workmanship or materials.