ADS® ECHO™

Technical Specification



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Part 1 - Overview

This specification provides technical, functional, and performance specifications for the ADS ECHO™ Level Monitor (level monitor). The level monitor measures water level in sewers, channels, and natural water bodies through integrated level sensors for use in municipal, industrial, water resources, and environmental applications.

Part 2 - Specifications

A. Sensor Interface

The level monitor includes integrated level sensors and an accelerometer.

1. Ultrasonic Level Sensor
    a. The ultrasonic level sensor uses a patented method utilizing the parabolic reflector to focus the ultrasonic beam to an effective beam angle of 4 degrees (°) to measure water level within a manhole channel or other physically restrictive space.
    b. The ultrasonic level sensor has a deadband of 0 in (0 mm) from the bottom of the parabolic reflector.
    c. The ultrasonic level sensor has a range of 0 in (0 mm) from the bottom of the parabolic reflector down to the water level up to a range of 20 feet (6 m).
    d. The ultrasonic level sensor operates at a frequency of 75 kilohertz (kHz).
    e. The ultrasonic level sensor has a resolution of 0.01 in (0.25 mm).
    f. The ultrasonic level sensor has 0 in (0 mm) drift.
    g. The ultrasonic level sensor incorporates a proprietary temperature compensation algorithm for greater measurement accuracy.
2. Pressure Level Sensor
    a. The pressure level sensor is calibrated to the ultrasonic depth sensor until the level monitor detects that the ultrasonic sensor is submerged.
    b. The pressure level sensor has a deadband of 0 in (0 mm) from the bottom of the parabolic reflector.
    c. The pressure level sensor has a range of 0 in (0 mm) from the bottom of the parabolic reflector up to the water level up with a range of 100 inches (2.5 m).
    d. The pressure level sensor has a resolution of 0.01 in (0.25 mm).
3. Accelerometer/Tilt Sensor
    a. The level monitor includes an integrated accelerometer to monitor the orientation of the level monitor and detect movement or installation changes.
    b. The accelerometer is used for tilt alarms, installation confirmation, and diagnostics.

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B. Measurement and Data Processing

The level monitor includes a processor to convert ultrasonic level sensor and pressure level sensor range measurements into flow depth measurements relative to a manhole invert or other similar location.

1. The level monitor reports flow depth data separately for the ultrasonic level sensor and the pressure level sensor.
2. The level monitor reports flow depth as one filtered data entity, using measured data from the ultrasonic level sensor or the pressure level sensor under the appropriate conditions.
3. The level monitor can be configured to provide flow depth in inches (in) in U.S. customary units or in millimeters (mm) in metric units.
4. The level monitor records the date/time for each level measurement, based on a configured sample rate.
5. The level monitor sample rate is configurable to 2, 5, 15, or 30 minutes, or 1, 2, 12, or 24 hours.
6. The level monitor Fast Rate sampling is available in the alarm state is configurable to 2, 5, 15 or 30 minutes, or 1, 2, 12, 24 hours.
7. The level monitor Scan Rate can be configured during normal operation to adjust to the Fast Rate under an alarm state.
8. The level monitor measures internal monitor temperature and reports temperature on demand in diagnostics mode, in daily check-ins, or optionally as a data entity logged at the level monitor sample rate.

C. Level Data Storage

The level monitor includes memory to store level measurements.

1. The level monitor includes sufficient memory to store up to 18 months of up to three data entities recorded at sample rate of 5 minutes.
2. The level monitor includes non-volatile memory to retain recorded measurements in the event of power loss, 8 mb flash and 32 kb of NV FRAM.
3. The level monitor overwrites stored data when the memory is full, overwriting the oldest data first.

D. Electronics and Processing

The level monitor includes an embedded microprocessor-based control system for level measurement, data logging, communications management, and alarm processing.

1. The level monitor incorporates an ARM Cortex-M4 microprocessor.
2. The level monitor includes volatile and non-volatile memory for operation, configuration storage, firmware storage, and measurement data retention.
3. The level monitor includes flash memory that retains configuration settings and recorded data during battery replacement or power loss.
4. The level monitor includes a battery-backed, real-time clock module synchronized with the wireless carrier with an accuracy of ±1 minute/month. Clock synchronization is configured by default but can be disabled, if desired.

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5. The level monitor is compatible with Standard Time and Daylight Saving Time.

E. Communication Interfaces

1. Direct

The level monitor includes a local communication interface to transmit information to and from a laptop computer running the Microsoft Windows Operating System.

a. A direct connection cable is available to communicate with the level monitor via a laptop computer running the Microsoft Windows Operating System and an installed driver.

b. The direct connection cable connects to laptop computer via a Universal Serial Bus (USB) and to the level monitor via a serial interface.

2. Bluetooth®

The level monitor includes an integrated Bluetooth wireless communication interface for local communication via a laptop computer running the Microsoft Windows Operating System.

a. The Bluetooth interface enables local monitor configuration, activation, diagnostics, firmware updates, and data retrieval.

b. The Bluetooth interface eliminates the need for a direct physical communication cable during routine operation.

c. The Bluetooth interface supports secure authenticated communication between the level monitor and authorized user devices.

d. The Bluetooth communication range is up to 8 ft (2.5 m) line-of-sight.

e. The Bluetooth interface requires a Bluetooth dongle to be used with a laptop computer.

f. The Bluetooth interface may be enabled or disabled through software configuration.

3. Wireless

The level monitor includes an integrated wireless modem to transmit data and to communicate remotely with the level monitor.

a. The level monitor includes a cellular modem compatible with LTE-M and NB-IoT.

b. The level monitor includes a cellular modem with fallback to 2G where available.

c. The level monitor includes a cellular modem with an insertable Subscriber Identify Module (SIM) card.

d. The level monitor includes a cellular modem that supports over-the-air (OTA) firmware updates.

e. The level monitor includes an internal ultra-wide band antenna, connected via a Sub Miniature Version A (SMA) connector on the outer enclosure.

f. The level monitor measures communications signal strength and reports signal strength on demand in diagnostics mode, in daily check-ins, or optionally as a data entity logged at the level monitor sample rate.

g. The level monitor includes modem power management capability where the modem can be configured to be always on, always off, or on for a user-specified time span.

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h. A SIM card with a static IP cellular configuration is required for direct remote communication.

i. A SIM card with a dynamic IP cellular configuration supports scheduled data delivery and remote monitoring functions.

F. Modbus

The level monitor supports Modbus communications for integration with Supervisory Control and Data Acquisition (SCADA), distributed control systems (DCS), programmable logic controllers (PLC), and other industrial automation systems. The level monitor functions as a Modbus slave and provides level and diagnostic data through Modbus holding registers.

1. The level monitor supports Modbus Transmission Control Protocol / Internet Protocol (TCP/IP) communications.
2. The level monitor supports communication over a wireless cellular connection.
3. The Modbus slave address is user-configurable from 2 to 247, excluding 58.
4. The level monitor supports a configurable response delay for compatibility with third-party host systems.
5. The level monitor uses Modbus holding registers beginning at Register 40001.
6. Floating-point values are stored using two Modbus holding registers per value.
7. Register values not configured or not available are reported as 0.
8. The level monitor provides the following data through Modbus registers: level, filtered level, internal temperature, alarm states, battery voltage, and wireless signal strength.
9. The level monitor uses TCP Port 2100 for Modbus communications.

G. Data Delivery

The level monitor delivers data to the ADS PRISM™ Cloud software application or a user-configured File Transfer Protocol (FTP) or File Transfer Protocol Secure (FTPS) location.

1. The level monitor includes a normal communication rate and a fast communication rate.
2. The level monitor normal communication rate is configurable at 5 or 15 minutes or 1, 2, 3, 4, 6, 8, 12, or 24 hours.
3. The level monitor fast communication rate is triggered during alarm conditions and is configurable at 5 or 15 minutes or 1, 2, 3, 4, 6, 8, 12, or 24 hours.
4. The level monitor data may be exported from the Cloud software application in comma separated value (.csv) format or excel.
5. The level monitor data are also available programmatically via an Application Programming Interface (API) or delivered to external systems via webhooks.
6. The level monitor supports active or passive FTP modes.

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H. Alarms and Events

The level monitor includes the following alarms that may be enabled or disabled:

1. The level monitor includes a Low Level Alarm. When enabled, this alarm is triggered when the level measured by the level monitor is less than the configured Low Level Threshold.
2. The level monitor includes a Full Pipe Alarm. When enabled, this alarm is triggered when the level measured by the level monitor is greater than or equal to the configured Full Pipe Threshold which equals the configured Pipe Height.
3. The level monitor includes a High Level Alarm. When enabled, this alarm is triggered when the level measured by the level monitor is greater than or equal to the configured High Level Threshold.
4. The level monitor includes a High-High Level Alarm. When enabled, this alarm is triggered when the level measured by the level monitor is greater than or equal to the configured High-High Level Threshold.
5. The level monitor includes an Overflow Alarm. When enabled, this alarm is triggered when the level measured by the level monitor is greater than or equal to the configured Overflow Threshold which equals the configured Manhole Depth.
6. The level monitor includes a Return to Normal Alarm. When enabled, this alarm is triggered when the level measured by the level monitor is returns to its normal/typical depth readings.
7. The level monitor includes a Tilt Alarm. When enabled, this alarm is triggered when the level monitor detects a change in orientation greater than or equal to the configured Tilt Threshold.
8. The level monitor includes a Battery Alarm. When enabled, this alarm is triggered when the level monitor detects a battery voltage less than or equal to the configured Battery Threshold.
9. The level monitor includes configurable alarm averaging and filtering functions to reduce false alarms resulting from transient measurement anomalies.
10. The level monitor can alert up to five email and five SMS recipients directly, when enabled.
11. Notifications, alerts, and alarms delivered via ADS PRISM™ Cloud notifications are unlimited and can be delivered by email, and/or Short Message Service (SMS).
12. Notifications, alerts, and alarms are also available programmatically via an Application Programming Interface (API) or delivered to external systems via webhooks.

I. Configuration and Activation

The level monitor is configured and enabled using the ADS PRISM™ Cloud software application or the ADS Qstart™ XML desktop application. Initial configuration and activation must occur locally via a Bluetooth or serial connection using the ADS Qstart™ XML desktop application.

1. The level monitor can be configured to Check in daily at the desired time.
2. The level monitor can be configured with the desired time zone.
3. The level monitor supports user-defined temperature compensation curves for improved measurement accuracy to match seasonal temperature values to match site conditions and optimize depth calculations year-round.

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J. Diagnostics

The level monitor enables the user to perform general diagnostics and troubleshooting to prevent, detect, isolate, and correct problems.

1. The level monitor reports the battery voltage in diagnostics mode and in daily status notifications.
2. The level monitor reports the wireless signal strength in diagnostics mode and in daily status notifications.
3. The level monitor supports ultrasonic level sensor diagnostic testing.
4. The level monitor supports pressure level sensor diagnostic testing.
5. The level monitor supports tilt sensor diagnostic testing.
6. The level monitor supports firmware upgrades and modem firmware upgrades.

K. Power

The level monitor is designed for low-power operation, supporting long-term deployment using battery power.

1. The level monitor includes a 9-volt (V), 60 amp-hour (Ah) alkaline battery pack as the primary power source. The battery has an estimated 3.5-year service life when configured with a 5-minute sample rate, a 4-hour communication rate, and modem configured Always Off (data and alarm push only mode).
2. The level monitor measures battery voltage and reports battery voltage on demand in diagnostics mode, in daily log files, or optionally as a data entity logged at the level monitor sample rate.
3. The level monitor generates a low battery notification when battery voltage falls below a configured threshold.

L. Environmental and Mechanical

The level monitor is housed in a durable enclosure designed for outdoor applications.

1. The level monitor has a length of 15 inches (380 mm), a width of 6 inches (152 mm) and a height of 17 inches (432 mm).
2. The level monitor has a weight of 11.5 lb (5.21 kg), including battery, excluding mounting hardware.
3. The level monitor outer enclosure is constructed of injection molded, glass-filled polycarbonate.
4. The level monitor outer enclosure provides dust-tight and water-tight protection in accordance with the International Electrotechnical Commission (IEC) IP68.
5. The level monitor is designed to operate in a temperature range of -4 °F to +140 °F (-20 °C to +60 °C).
6. The level monitor is designed to operate in Class I, Division 1, Group C or D Hazardous Locations or Class I, Zone 0, Group IIA or IIB Hazardous Locations.

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Product Dimensions



Part 3 - Accessories

Optional mounting hardware is available for installation and operation of the level monitor, including a mounting bar, wall mounts, antennas, and service tools.

1. The mounting bar is an expandable bar that expands to position the level monitor in a manhole frame or other similar structure. The mounting bar is compatible with manhole frames from 21 in (533.4 mm) to 28 in (711.2 mm) in diameter and includes an integrated bubble level to ensure the bar is properly leveled.
2. Wall mounts are available to mount the level monitor to the wall of a manhole or similar structure. Wall mounts are available in stainless steel or Schedule 80 polyvinyl chloride (PVC) options.
3. ADS offers several antenna options including an antenna for use inside a manhole, an antenna mounted to the manhole cover exterior, and an antenna mounted in the roadway adjacent to a manhole.

ADS ECHO Mounting Hardware Solutions



Stainless Steel Mount | Expandable Bar | PVC Mount

Part 4 - Quality Assurance

The level monitor is manufactured under a Quality Management System certified to ISO 9001:2015 by an accredited certification body.

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Part 5 - Documentation

A product datasheet and product manual are available in digital format.

Part 6 - Support and Warranty

ADS provides technical support via telephone, email, or website inquiries during standard business hours. Warranty details are provided at www.adsenv.com.



Call: 800.633.7246
Email: adssales@idexcorp.com

Part 7 - Compliance & Standards

The level monitor complies with applicable regulatory requirements for radio-enabled equipment. At a minimum, the level monitor meets the following certifications and conformity assessment standards for the following geographic areas:

1. **United States.** The level monitor complies with all applicable Federal Communications Commission (FCC) regulations for intentional radiators under FCC Part 15 and bears a valid FCC Identification (ID).

2. **European Union.** The level monitor complies with the Radio Equipment Directive (RED) 2014/53/EU, the Electromagnetic Compatibility (EMC) Directive, and the Restriction of Hazardous Substances (RoHS) Directive. The level monitor bears the CE mark.

All markings are permanently affixed and legible. The product manual includes appropriate compliance documentation.

Part 8 – Hazardous Area Certifications

The level monitor is suitable for use in Class I, Zone 0, Group IIA hazardous locations and includes intrinsic safety certifications for the following geographic areas:

1. **United States.** The level monitor complies with the National Electrical Code (NEC) and bears a certification mark issued by a Nationally Recognized Testing Laboratory (NRTL).

2. **Canada.** The level monitor complies with the Canadian Electrical Code (CEC) and bears a certification mark issued by a Standards Council of Canada (SCC) accredited certification body.

3. **United Kingdom.** The level monitor complies with the United Kingdom (UK) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations and bears a certification mark issued by a UK Approved Body.

4. **European Union.** The level monitor complies with Atmosphères Explosibles (ATEX) Directive 2014/34/EU and bears a certification mark issued by an EU Notified Body.

5. **Other.** The level monitor complies with the International Electrochemical Commission System for Certification to Standards Relating to Equipment for Use in Explosive Atmospheres (IECEx) Scheme and bears the IECEx Mark License of an IECEx Certified Body.

All markings are permanently affixed and legible. The product manual includes copies of all hazardous area certificates, schedules, and marking information.

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