



SPECIFICATIONS

These specifications cover an intelligent “Leak Monitoring System” – a leak noise logger with data acquisition via an Automatic Meter Reading (AMR) System that utilizes a high-power, radio frequency meter interface unit (MIU). The leak noise logger data information shall be obtained through a radio frequency device using a compatible data capture system. The system shall be configured as follows:

1. Meter Interface Unit (MIU) - Water

The MIUs must be compact electronic devices which are compatible with both water meters and leak noise loggers. They shall interrogate the leak noise logger and transmit the data to a remote reading device. The same RF MIUs must be capable of being read by a walk-by handheld computer equipped with an RF receiver, a mobile system with an RF receiver mounted in a vehicle, and/or a targeted fixed network data collection system. This shall allow an easy migration between the various methods of data capture without any change to the MIU devices or revisiting the site. The MIUs shall be manufactured for valve box or meter pit deployment and shall be a fully potted, waterproof design suitable for submergence.

Physical/Mechanical Requirements

Pit MIU

- For water valve boxes, the Pit MIU antenna shall be designed to be installed through the industry standard 1-3/4” hole in the pit lid with no degradation of transmission range. The MIU antenna unit will be capable of mounting to various thicknesses of valve box lids.
- The device shall be capable of operating at temperatures of -22°F to 149°F (-30°C to +65°C) and operating humidity of 0 to 100%.
- The range will not be affected when the valve box is flooded.
- The circuit board and the battery will be protected by a potting material that is suitable for submergence.
- The antenna shall be made of a metallic and polymer material to withstand traffic and shall have a dual seal connection to the MIU housing.
- The MIU device must be protected against static discharge without loss of data per IEC 801-2, issue 2.

Operations Specifications

- For reliability and meter reading integrity, the vendor shall be the sole manufacturer of the different components of the AMR system (water meters, RF MIUs, meter reading equipment and meter reading software), and provide a turn-key system offering to the utility.
- For ease of implementation, the radio frequency system shall not require any special licensing, including licenses from the FCC. The system must, therefore, operate in the 902 MHz to 928 MHz unlicensed band.
- The system must be expandable at any time without getting authorization from the FCC.
- No wake-up tone shall be necessary.
- To minimize the potential for RF interference from other devices, the MIU shall transmit using the Frequency-Hopping, Spread-Spectrum technique comprised of alternating pseudo-random frequencies within the 902 MHz to 928 MHz unlicensed band.
- The MIU shall operate within FCC Part 15.247 regulations for devices operating in the 902 MHz to 928 MHz unlicensed band.
- The radio frequency output power shall meet FCC Part 15.247 high-power requirements.
- Power shall be supplied to the MIU by a lithium battery with capacitor. The Vendor shall warrant that any battery provided and installed in the MIUs by the Vendor shall be free of manufacture and design defects for a period of twenty (20) years – the first ten (10) years from the date of shipment from factory without prorating, and the second ten (10) years with prorating, as long as the MIU is working under the environmental and meter reading conditions specified.
- The battery life shall not be affected by outside erroneous wake-up tones (i.e., other water, gas, or electric utilities reading and therefore sending out a wake-up tone).
- The number of radio-based meter reads performed must not affect the battery life.
- The batteries shall be field-replaceable and be designed for a minimum twenty (20) years’ life expectancy.
- The MIU shall not require reprogramming if the battery discharges before it is replaced.
- No MIU programming shall be necessary for installation.
- The MIUs must be capable of reading two networked Neptune encoder registers at one time.
- The MIU shall be compatible with either a water meter encoder or a leak noise logger without the need to program the MIU for such compatibility.

2. Leak Noise Logger Specifications

Technical Specifications and Features

- Leak noise logger diameter no greater than 2.0 inches
- Leak noise logger height including antenna no greater than 4.5 inches
- Internal battery supply shall last at least 10 years
- Lithium-ion replaceable battery
- Enclosure environmental tested to IP-68 tested to a depth of 15 feet
- Leak noise logger shall utilize a Piezo, ceramic high-sensitivity accelerometer with minimum 2 V/g sensitivity
- Sensor frequency range shall be up to 3.8 KHz
- Leak noise logger shall couple to water main with the use of a high-strength, rare-earth magnet (products using flexible tie-down mounting system will not be accepted)
- Leak noise logger magnet must be protected from corrosion by stainless steel diaphragm
- Leak noise logger must be fully flash-programmable to allow for wireless product upgrades without removing logger from its field location
- Internal memory for storage of up to 28 days of acoustic data results
- Simple logger activation via a magnetic field
- Evaluation of Leak/No Leak result executed within the leak noise logger (product that performs the leak analysis at the host software will not be accepted)
- Radio transmission of the leak alert (i.e., leak/no leak result)
- Transmission of a confidence number to determine likelihood of leak
- Leak noise logger includes user-programmable Histogram (AquaLog) feature for leak site investigation
- Each leak noise logger will be shipped with a bar-code label that includes both numeric and bar-coded serial number for mass deployment
- Each leak noise logger should include a deployment hook for easy deployment in a standard valve box
- Each leak noise logger shall utilize a stainless steel sensor assembly

3. Data Collection Devices

3.1 In a Walk-by System

In a walk-by system, the system must give the user the ability to collect metering data in several ways:

- Keyed entry
- Inductive probing
- RF communication: The meter must be attached to an RF meter interface unit (MIU); the handheld must have an RF receiving device (Handheld Interface Unit (HHIU))

The proposed walk-by data collection system must include:

- Handheld data collector device which shall be a combination of a handheld unit and an HHIU and its antenna
- Communication cradles for charging and loading the handheld unit
- Probes for interrogating Neptune and Sensus absolute encoders

3.1.1 Handheld Data Collector Device

3.1.1.1 Basic Functions

The handheld data collection device shall have the capability to collect and store meter readings at any time of the meter reading route by any of the following methods:

- Manual use through the use of an alphanumeric keypad
- Probing of water meters equipped with supported absolute encoders
- Via radio frequency

The unit shall be able to obtain all types of readings on any particular route without requiring:

- Reprogramming of the handheld computer

- Physical change of software contained within the unit while in the field
- Access through special software menus contained within a given route/program

The handheld data collection device must be able to multi-task by collecting data while in keyed entry (manual) meter reading mode.

3.1.1.2 Hardware Requirements

3.1.1.2.1 Processor and PC Compatibility

The handheld data collection device must be PC compatible and run Windows CE.NET 4.2. At minimum, the handheld must operate with an Intel X-Scale PXA255 Processor at 400 MHz.

3.1.1.2.2 Case

- The unit must be able to withstand a minimum six-foot drop to concrete.
- The handheld must meet and exceed MIL-STD 810F standard, method 516.5, procedure IV for drop tests.
- The handheld shall be ergonomically designed to be comfortable for handheld meter reading.

3.1.1.2.3 Display

- The handheld screen must be 3.5" (89mm) QVGA TFT transfective color LCD with backlighting. The size of the display characters must be selectable, allowing the use of larger characters that are easiest to read. The screen must have a minimum of 240 by 320 pixels (a total of 76,800 pixels) and is CGA compatible for both text and graphics.
- The manufacturer's specification on the contrast ratio on the LCD display must be 9:1 at 76° F (25° Celsius) and provide automatic contrast adjustment based on temperature which will give clear readings in extreme temperature. There must also be a manual contrast adjustment feature which will allow the user to adjust the contrast to his or her satisfaction.
- The display must have no degradation when exposed to storage temperatures of -40°C to +70°C (-40°F to 158°F) and operating temperature of -20°C to +50°C (-4°F to +122°F).

3.1.1.2.4 Keyboard

- The keyboard must have independent large keys of silicone rubber with adequate separation for use with gloved hand.
- The keyboard must provide tactile feedback and be fully alphanumeric.
- There must be an audible beep indicating key has been fully depressed; there must also be an auto-repeat function on keys and a rapid response between keying and seeing results on the screen.
- The keyboard must be fully PC compatible and programmable.

3.1.1.2.5 Battery

- The battery capacity must be sufficient for a minimum of 8 hours of meter reading.
- The handheld must come with a power management system designed to conserve power.
- The handheld must come with an integrated intelligent fast charge capability that allows for full charge in 4 hours.
- Rechargeable Lithium Ion batteries shall be made with a technology that does not develop memory effect.
- The back-up battery must be a rechargeable Nickel Metal Hydride battery.

3.1.1.2.6 Memory

The handheld data collection device must include 64MB of DRAM and 128MB FLASH memory.

3.1.1.2.7 Carrying Method

A hand strap must be provided with each unit and must provide ease of use for right- or left-handed operators.

3.1.1.2.8 Size

The handheld data collection device dimensions with RF HHIU must not be larger than:

- Length: 11.75" (298 mm)
- Width: 4.6" (117 mm)
- Height: 3.25" (83 mm)

3.1.1.2.9 Weight

The unit's weight must be less than 2.4 lbs (1089g) with the battery pack installed.

3.1.1.3 Environmental Characteristics

The handheld must include but not be limited to the following:

- The unit must operate in temperature range of -20°C to +50°C (-4°F to +122°F).
- The device shall be water resistant, capable of unlimited exposure to spray or splash (such as rain or snow).
- The device must be protected against an 8kV static discharge without loss of data.
- The unit must be resistant to various chemical products and must be sealed to keep out dust, humidity, and water.
- The device must be shock resistant exceeding IEC 68-2-32 method 1 (a 1-meter drop on concrete).
- The unit must be CE and FCC certified.

3.1.1.4 Software Requirements

3.1.1.4.1 Basic Functions

The handheld software must be easy to use and give the meter reader control over the route in searching for accounts, tagging accounts for later action, entering related notes and manually reading meters.

The handheld software must include entry of meter readings.

In addition, the handheld software shall include but shall not be limited to the following basic features:

- User customizable key assignments
- Allows manual or automatic entry of meter readings, ID numbers and note codes
- Performs high/low test on readings
- Date and time stamped to each reading
- Identifies type of reading — manual keyed, probed or RF MIU
- Must be able to read ARB® I - VI and Sensus ECR® II AND ECR III* (* denotes support for the ECR III encoder when programmed as an ECR II with 6 wheels) encoders via either wireless probed reading or via RF MIU
- Performs unread meter search
- Found meter processing for new accounts
- Forward and reverse walk order allowed
- Data search capability (Display, Notes and ID)
- Auto-Search for automatic reading of encoded meters

- Displays the number of read and unread accounts on demand
- Left-to-right, right-to-left or calculator entry of manual meter readings
- Can capture multiple meter readings from a single ARB VI pad; i.e., two networked ARB VI encoders
- Collect the information for the host to generate reports on leak detection, tamper detection, and backflow conditions when used with Neptune R900® encoder and E-Coder® register

3.1.1.4.2 Sounds

Successful meter readings will be confirmed by an audible tone.

3.1.2 Communications/ Charging Equipment

3.1.2.1 Communication

Communications between the handheld and the PC software must be established using a cradle connected via an Ethernet 10 Base T Cradle with one additional option of an RS232 on Lemo connector, up to 230 kbps full duplex. The handheld must have an embedded Ethernet controller for communication with the cradle. In addition, the following basic features must be included:

- Extensive error checking is provided to assure data integrity during communications between the handheld and the PC.
- A typical route of four to five hundred accounts could be loaded or unloaded in less than one minute and must be able to load up to 5,000 records into a single handheld unit.
- Routes/books can be split at the PC level.
- Once loaded, routes may be individually selected on the handheld.

3.1.2.2 Charging / Communications Cradles

- The charging/communications cradle will be housed in a suitable material that can be wall or tabletop mounted.
- It will have the capability of recharging the handheld unit within 4 hours and also provide the communication port connection to the computer.
- The cradle will hold one handheld at a time and be capable of connecting in a series to accommodate additional units.
- The cradle will be capable of communicating with the host computer at 10 Mbps.
- Multiple handhelds must be able to be connected to the host computer.
- The charging units must carry the Underwriters Laboratory (UL) seal of approval.

3.1.3 Probes

The handheld must be compatible with a wireless probe capable of reading Neptune ARB V, Neptune ProRead™ AutoDetect and Sensus ECR II and ECR III* (*denotes support for the ECR III encoder when programmed as an ECR II with 6 wheels) encoder water meters.

3.1.4 Radio Frequency Capability

The reading system must be capable of being upgraded to radio frequency communications. (Utility) plans to read water meters equipped with radio frequency meter interface units. Only absolute encoder registers from Neptune or Sensus will be acceptable. In the radio read system, the encoder registers will be connected to a MIU that shall provide the radio link from the meter to the handheld interface unit.

The handheld radio frequency adapter must be available as a retrofit kit for existing handheld units.

3.1.4.1 Radio Frequency Reading Function

The function of the handheld in radio frequency mode is to provide (Utility) the capability of reading meters via radio signals. The handheld must be capable of receiving RF readings. All transmissions from supported MIUs will be collected. The reading of any MIU shall be automatically stored in the proper account record without the intervention of the meter reader.

Should any MIU not be able to be read during the route, the software shall support storage of a flag in

the account record, indicating clearly that the MIU could not be read.

When reading the meters in the RF mode, it should not require the meter reader to activate any wake-up tone.

The handheld reading equipment must provide a test mode to verify operation of the MIU. This test mode must be accessible from within the meter reading application as well as accessible from a device main screen (no login required). The test application must be capable of reporting statistics for an individual MIU or displaying all MIUs within range.

3.1.4.2 Handheld Interface Unit (HHIU)

The Handheld Interface Unit must be attached to the handheld to allow radio-frequency communications with water meters that have an RF MIU connected externally. The HHIU must be sealed and secured tightly to the handheld unit by a locking mechanism.

The antenna shall be externally mounted and replaceable.

The HHIU must be Part 15 FCC compliant.

The HHIU must collect the meter readings as well as the ID# of the MIU connected to the meter. The following specifications must be met:

- Radio Characteristics:
 - Receiving Frequency: 910-920 MHz
 - Protocol: data error checking in every received data
- Size and Weight: Physical specifications of the handheld unit with the HHIU must be within the following parameters:
 - Length without antenna: 11.75"
 - Width: 4.6"
 - Height: 3.25"
 - Weight (with battery pack): 2.4 lbs
- Probe Compatibility:
 - Compatibility with Neptune Advantage II Probe, Neptune Pocket ProReader RF, Northrop Grumman Logicon Probe or Sensus AutoGun.
- Environmental Operating Conditions:
 - Operating conditions: -4°F to +122°F (-20°C to +50°C)
 - Storage temperature: -22°F to +158°F (-30°C to +70°C)
 - Designed to withstand shock and vibrations per MIL-STD-810 F, method 516.5, procedure IV
 - Designed to withstand electrostatic discharges per EN61000-4-2
 - Humidity: 5 to 95% (non-condensing)
- Data Collection Device Battery Life:
 - The data collection device batteries must provide enough power to support RF meter reading for a minimum of 8 hours.
- Capabilities:
 - The HHIU must be capable of processing a minimum of 30 meter readings per minute. "Processing" must include accuracy of the message confirmation.
- Retrofit Kit:
 - The HHIU adapter should be available as a retrofit kit for the existing handheld units and should not require the return of the handheld to the supplier.

* HHIU should also be capable of supporting Itron R300® and Itron electric ERT®s in the event the utility utilizes RF electric meters.

3.2 Mobile Data Collection System

The mobile data collection device must be a portable, compact electronic system mountable in any vehicle. It must collect the data broadcast by the MIUs and store it onto a USB Flash Drive to be downloaded to the host computer at the utility office.

The unit shall be easily transportable from vehicle to vehicle or vehicle to office.

3.2.1 Hardware Specifications

The key components of the collection device must consist of a Portable Personal Computer (PPC) and an integrated radio receiver unit packaged in rugged, weatherproof, compact carrying case enclosure.

The mobile data collection device must be easily installed in any vehicle that will drive to the field for meter reading. It must be mounted securely in the passenger seat with a standard seat belt. Through a 12 VDC plug-in power cord, the unit must be powered from the vehicle's power supply (cigarette lighter).

The system must include a magnetic base antenna and the antenna chord as well as all necessary power and communication cables.

For water applications the dimensions must be no longer than the following parameters: 18.5"x15.5"x11.375". The weight shall not be more than 48 lbs.

For water and electric applications with wake-up ERTs, the dimensions must be no larger than the following parameters: 20"x20"x15.25" (50.8x50.8x38.74 cm). The weight shall not be more than 68 lbs.

The system must comply with FCC specification: Part 15.

The PPC must be a ruggedized laptop PC. The system must have flash upgradeable BIOS with advanced power management interface. The keyboard must have a spill-proof membrane and backlight with intensity control and built-in solid state mouse. The display must be transmissive, having a light sensor that automatically adjusts screen intensity per ambient light, a shock/scratch-resistant anti-glare plate and incorporate touch technology. The unit must be enclosed in a hard mount case including an extendable handle and wheels.

Mobile unit should also be capable of supporting Itron R300 and Itron electric bubble-up ERTs, in the event the utility supports electric meters.

3.2.2 Environmental Conditions

The mobile data collection device must work in the following environmental conditions:

- Operating Temperatures: 32°F to +122°F (0°C to +50°C)
- Storage Temperature: -40°F to +185°F (-40°C to +85°C)
- Operating Humidity: 5 to 95% non-condensing relative humidity

3.2.3 Software Requirements

3.2.3.1 Computer Platform

The laptop computer must use Windows XP as a minimum for the platform operating system.

3.2.3.2 Basic Functions

The software must be a dialog-based, intuitive, easy-to-use meter reading application.

After the meter reader starts the reading process, the software must be fully automated to collect the meter reading data received from the radio receiver unit and store it in an Export file which can be used by the host software to update the mainframe route data. The system must utilize a USB flash drive for data storage and transfer.

Self-diagnostic tests must be run upon booting up the laptop or on request to ensure the good functionality of the system, including the collection method.

Unit must be capable of optimizing the memory storage space by filtering out the duplicate readings from the same MIU and keeping only the last reading received.

Each reading record must contain a MIU ID and a time stamp of the reading.

The software must have the option to provide found meter processing for new accounts.

The software must be capable of performing high/low test on readings.

The software interface must allow the user to select a single route to view the route status.

The mobile data collection software unit must allow a manual reading to be entered into the account record.

The software must allow freeform notes to be entered to record conditions in the field that require noting and may require an additional Work Order created to address at a later date.

The software must be capable of displaying meter points and read success and unread accounts via GIS mapping interface. The software must be capable of collecting the following information for the host to generate reports: leak detection, tamper detection and reverse flow conditions (when used with Neptune R900 encoder and E-Coder register).

3.2.4 Performance Requirements

The antenna must be omni-directional and support a gain of 5 dB minimum.

The receiver utilized must operate with a minimum sensitivity of greater than 110 dBm.

The receiver module must process at minimum 72 discreet channels across a 10 MHz bandwidth utilizing a digital signal processor capable of capturing 8 meter readings simultaneously from these channels.

The receiver module must operate with a dynamic range of greater than or equal to 100 dB with a message success rate greater than 50%.

The mobile data collection device must be able to maintain a minimum sustained processing rate of 70 unique meter reading accounts per second.

The mobile data collection device must reject a minimum 45 dB of noise energy above the target message in adjacent channels.

The mobile data collection device must operate effectively at posted speed limits.

4. Additional Requirements

- Successful bidder must provide a list of at least 10 U.S. water utilities that have purchased and installed more than 1,000 leak noise loggers and are currently using the proposed product.
- Successful bidder must provide a list of 10 U.S. water utilities that have purchased and installed more than 10,000 MIUs and are currently using the proposed product.

Neptune engages in ongoing research and development to improve and enhance its products. Therefore, Neptune reserves the right to change product or system specifications without notice.

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