RMLD CS™

Remote Methane Leak Detector Complete Solution

OPERATOR MANUAL

HEATH CONSULTANTS

Your Safety...Our Commitment

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Overview

The HEATH Remote Methane Leak Detector - Complete Solution (RMLD-CS) is a highly advanced technology, capable of detecting methane leaks from a remote distance. This technology makes it possible to detect leaks without having to walk the full length of the pipe line, thus creating safer surveys in areas that may be difficult to reach such as busy roadways, yards with dogs, fenced off areas, and other hard to access places.

The RMLD-CS employs the same technology as the RMLD, known as Tunable Diode Laser Absorption Spectroscopy (TDLAS). As the laser passes through the gas plume, the methane absorbs a portion of the light, which the instrument then detects. Based on the local meteorological conditions, a given amount of gas escaping from the ground will produce a plume that varies in size and uniformity of concentration levels. The plume, by nature, is variable and dependent on the soil conditions, temperature, wind, and leak rate.

The RMLD-CS operates under a variety of field conditions including a wide temperature range, light rain and fog. Its rugged design will stand up to normal field use and operating conditions. Its sensitivity or range is not affected by reasonable amounts of dust on the instrument's window.

The RMLD-CS includes many new features which reduce costs and improve usage. These advanced features include, but are not limited to:

User Interface	Light Weight
Internal Data Logging	Rechargeable and Replaceable Battery
WiFi	Dual Charger
GPS	Mobile App Support
Bluetooth BLE	Vest Support
Color Camera	Ergonomic Housing
Color Display	

Proprietary Notice

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Heath Consultants Incorporated operates under a continual product improvement program and reserves the right to make improvements and / or changes without prior notification.

This manual supersedes all previous manuals for this instrument.

Warnings & Definitions

Safety and Warning Information

It is essential that users of this instrument read, understand and follow the instructions for operation and maintenance. The precautions contained in this manual insure that the instrument is used in a proper and safe manner.

 **DANGER**

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

 **WARNING**

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

 **CAUTION**

Indicates a hazardous situation, which if not avoided, could result in minor or moderate injury.

DANGER: Do not use the device in an explosive environment.
DANGER: To reduce the risk of ignition of a flammable or explosive atmosphere, batteries must be recharged only in a location known to be non-hazardous.
WARNING: Read and understand this manual fully before use.
WARNING: Follow the manual instructions and testing methods.
WARNING: The visible green Spotter laser is a Class IIIa (3R) laser product. Do not stare into beam or view directly with optical instruments.
WARNING: Avoid direct eye exposure to the laser and do not point in the direction of others. Visible and Invisible Lasers are deployed by this instrument.
WARNING: Substitution of components may impair intrinsic safety. No user serviceable components contained within this instrument.

CAUTION: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.
CAUTION: No attempt should be made to repair the instrument. Should the instrument not work properly, or indicate a fault or warning, refer to the troubleshooting section of this manual.

Definitions

Beam Skip: Occurs when the IR beam jumps between a near object and a far away object. This may cause a false detection. This can also occur on highly reflective surfaces (windows, water, ice, etc).

Control Module: The portion of the RMLD-CS with the keypad and display that clips onto a harness.

Dark Zone: An area not being scanned due to an obstruction. This may be an elevation change, the side of a building, behind a curb, etc.

DMD (Digital Methane Detection): An advanced detection mode which, when activated, will only alert the operator when there is a probable detection of methane.

Footprint: The surface area covered by the IR beam, increasing with distance. At 100 ft., this area is 22” in diameter when shined against a vertical wall.

Infrared (IR): A wavelength of light just outside the range of the visible spectrum.

Laser Calibration Drift: A normal characteristic of tunable diode lasers is that the wavelength calibration can drift slowly overtime. The RMLD-CS has a built in Self-Test/Calibration feature to automatically maintain proper calibration.

ppm-m (Parts Per Million Meter): The product of the methane concentration times the width of the plume.

Real Time: A mode that will emit a variable (continuous) Geiger beep rate relative to the concentration of gas.

Spotter Laser: The green, blinking laser which guides the operator as to the location of the IR beam. This laser can be activated through the button located on the keypad.

Tunable Diode Laser Absorption Spectroscopy: A method of gas detection that utilizes a laser that, when shined through a cloud of methane, will be partially absorbed by the gas which can be measured for gas concentration.

Symbols Used

	Caution

	Information
	Consult Instructions for use
IP54	Ingress protection
	Do not dispose of this product in the unsorted municipal waste stream. Dispose of this product according to local regulations.
	Measurement Laser Radiation: Class I Visible (Green) Laser Radiation: Class IIIa (3R) Do not stare into beam. Avoid direct eye exposure.

Specifications

Detection Method	Tunable Diode Laser Absorption Spectropscopy (TDLAS)
Measurement Range	0 to 99,999 ppm-m
Sensitivity	5 ppm-m at distances from 0 to 100 ft (30m)
Intrinsic Safety	IECEx 60079-1,-11; ATEX, UL913 (PENDING)
Detection Distance	100 ft (30m) nominal. Actual distance may vary due to background type and conditions.
Beam Size	Conical in shape with a 22” diameter at 100 ft (55cm at 30m)
Detection Alarm Modes	**Digital Methane Detection (DMD)**: Audible tone when detection threshold exceeded Adjustable Detection Alarm Level 1 to 999. **Real Time (RT)**:Continuous audio beep relative to concentration.
System Fault Warning	Unique audible pitch and indication on the display.
Self Test	Built-in Self Test function verifies operation and adjusts laser wavelength for maximum sensitivity. Test gas cell integrated within carrying case.
Compliance	EMC (EN61000-6-2, EN6100-6-4) Radio Equipment Directive (2014/53/EU) ETSI EN 301 489-1 v2.2.0 EN 61326-1:2013 47 CFR Part 15 & ICES-003
Laser Eye Safety	IR Laser: Class I Green Spotter Laser : Class IIIa (3R) Do not stare into beam or view directly with optical instrument
Communications	Bluetooth 4.2 BLE, WiFi, USB Dual Mode
Display	3.5" LCD
Operating Temperature	0° to +122° F (-17° to 50° C)
Humidity	5 to 95% RH, non-condensing
Instrument Protection	IP54 (water splash and dust resistant)
Instrument Weight	3 lbs (approx)

Carry Case	21" x 17.5" x 9.5"
Battery	Removable, rechargeable Li Ion pack, 10.8 VDC 2.6Ah
Battery Run Time	8 hours at 32 F (approx)
Battery Charger	External, 110-240 VAC, 50/60 Hz Universal
Charge Time	2-3 hours full charge (approx)
Charging Indicator	Integrated into Dual Battery Charger

RMLD-CS Instrument and Accessories

Complete Kit Assembly - HPN 105301
(Includes Carry Case, Instrument, Test Cell, Carry Strap, Battery Charger, Battery Pack, USB Cable)

Instrument - HPN105354

This is the primary component of the RMLD-CS. In addition to the gas detection capability, it contains the user interface, data logging interface, battery, power connector.

Carrying Case - HPN 105355

The carrying case provides protection for the instrument during storage and/or transportation.It also has a built in cal cell for calibration. The instrument should be kept in the case while not in use.

Battery Pack - HPN 105384

1 rechargeable Li-Ion battery is supplied with unit. The RMLD-CS has an removable, rechargeable Lithium-ion battery that provides the main power to the instrument. This battery is designed to provide up to eight (8) hours of operating time when fully charged. The battery must be recharged between uses to assure no interruption in use.

Battery Charger - HPN 105358

The battery charger is provided to recharge the instrument's battery after use. It has 2 slots for dual battery charging. The charger is a universal 100 - 240 VAC, ~ 1.6A 50-60 Hz with charger indicator on the front of the housing. While charging the light will blink green, once a full charge is reached the light will turn solid green.

Vest - HPN 105357 and HPN 105406

The RMLD-CS has an optional accessory type 2 class R vest. It has many pockets for equipment placement. The pocket on the back can hold a pad for your notes/maps or a water pack.

Sizes: M/L and L/XXL

Strap - HPN 105516

Designed to minimize instrument weight and reduce fatigue during use.

USB Cable

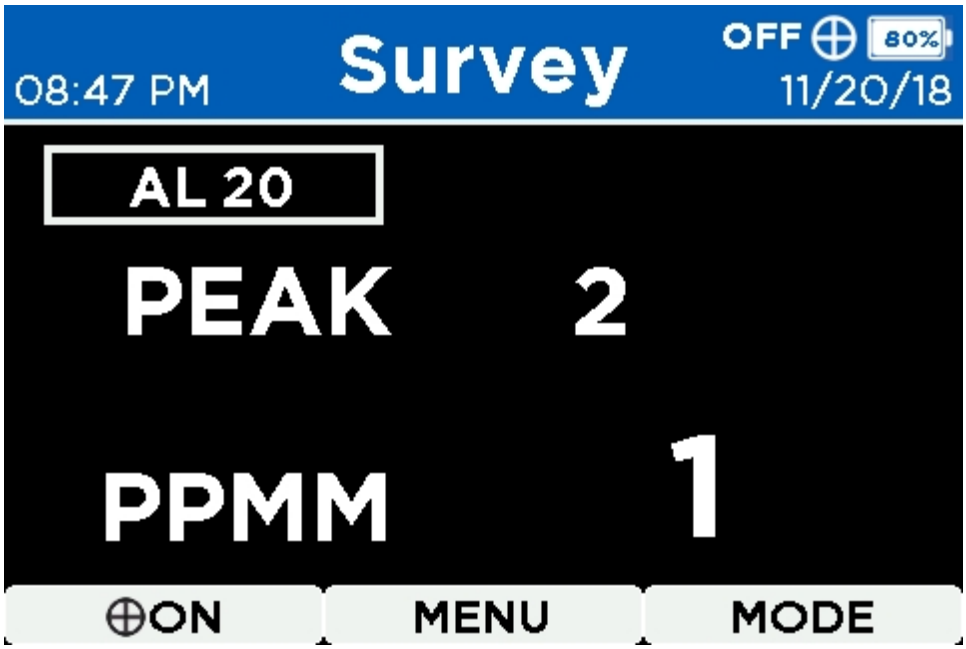
The USB2 A to micro cable is for downloading data from instrument to computer.

Battery, Charger and Charging Procedure

Battery Pack

The RMLD-CS has a removable, rechargeable Li-Ion battery that provides the main power to the instrument. This battery is designed to provide up to 8 hours of operating time when fully charged. The battery must be recharged between use to assure no interruption in use.

The display features a remaining battery capacity (in percent) indicator in the top right of the screen.



Dual Bay Battery Charger

The dual bay battery charger supplied with the instrument has the ability to charge two batteries simultaneously. An integrated metal bracket is included on the bottom of the charger to allow for wall mount or fixed mounting options. For wall mounted or mobile applications, HEATH recommends securing the battery to the charger using the captive screws attached to the battery pack.

The RMLD-CS is provided with a universal AC battery supply. The plug of the charger can be changed to fit the type of receptacle used in your location.

Charging Procedure

DANGER: To reduce the risk of ignition of a flammable or explosive atmosphere, the battery must be recharged only in a location known to be non-hazardous.

WARNING: Only use the HEATH supplied RMLD-CS battery charger to recharge the unit. Use of any other charger may cause severe damage to the battery or electrical circuits.

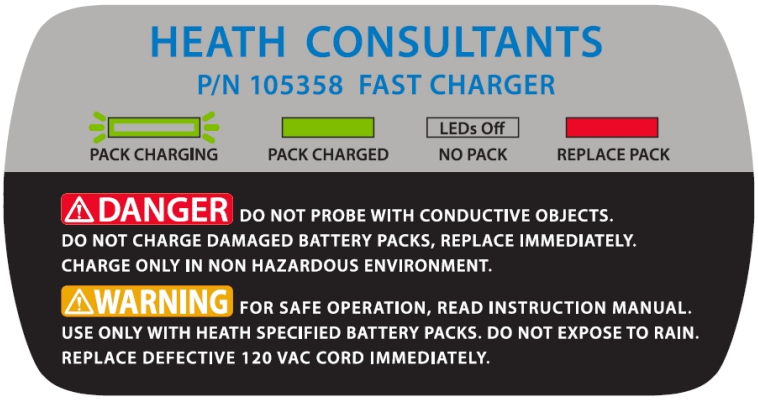
CAUTION: To prevent damage to the battery or electrical circuits, always plug the charger into a surge-protected outlet.

NOTE :The prolonged storage of battery inside or outside the instrument can lead to battery chemistry being irreversibly damaged leading to permanent failure of the battery. When storing the instrument or the battery for more than a month, charge the battery to 40-50% and store at room temperature of about 60-70º F.

To charge the battery, perform the following procedure:

1. Turn instrument OFF.
2. Unscrew the two captive screws located on the bottom of battery pack. Remove from instrument.

3. Insert the battery into the charger, ensuring it is all the way down.
    a. Optional: Fasten captive screws into charger housing to prevent battery from dislodging.
    b. LED panel will illuminate to show the status of the battery charging.
4. Charging Modes (The charger station displays charging legend):
    a. Flashing Green – Battery pack charging
    b. Solid Green - Battery pack fully charged
    c. No light – Battery not present or not connected properly
    d. Red – Fault, replace battery pack
        i. Position battery into the other bay, if still red, then try another battery.
        ii. If the light is still red send to repair or replace.



5. Once the battery is fully charged, power up the instrument and verify the battery capacity on the screen displays it is charged.

NOTE: Full charge time is approximately 2-3 hours.

NOTE: To obtain full battery capacity, charge the battery when the ambient temperature is above 50º F (10º C).

Operating the RMLD-CS

Turning on the Instrument

To turn on the instrument, Press and Hold the middle button for 3 seconds.

To turn off the instrument, Press and Hold the middle button for 3 seconds.

Working with the Menu Items

Instrument Self Test

The RMLD-CS has a built-in function to perform a Self-Test of the laser wavelength. The self-test feature should be performed daily before survey to ensure that the instrument is operational. A Self-Test log file is recorded and stored on the RMLD-CS instrument.

NOTE: No yearly factory calibration required unless instrument fails the self-test (repeatedly) or presents other problems.

NOTE: The self-test takes approximately one to three minutes to perform.

To perform the Self-Test and Calibration, the following procedure should be followed:

1. Turn on the instrument and allow instrument to successfully boot up.
2. Press the **MENU** button and select the **SELF-TEST** option.
3. The screen will display and guide the next steps for the operator to follow within 10 seconds (enough time for the steps).
4. Place the instrument in its designated area in the carrying case, making sure it is all the way in place and flat.
5. Status of test will be present on the display and by audible tones.
    a. A continuous one beep every second means the instrument passed the self-test.
    b. If the instrument fails, two beeps every second will play and operator should repeat self-test.
    c. If instrument fails on a third attempt, contact Heath Consultants Factory Service.

What if the instrument failed the Self-Test?

Most often, the causes are due to the instrument not being properly positioned in the case, the case was moved during the test, the laser wavelength has drifted, or the battery level is too low to perform the test. Ensure sufficient battery charge before attempting self-test procedure. Make sure the instrument is in its proper position, all the way down, and flat. After rechecking the above, repeat the Self-Test procedure above.

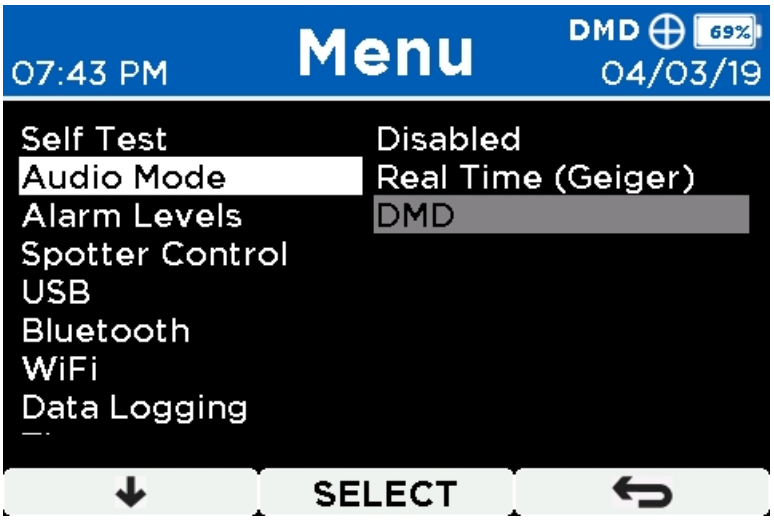
CAUTION: Should the instrument not pass after several attempts, do not use the instrument for survey work until the problem is corrected. Contact HEATH for further assistance.

NOTE: Laser wavelength drift is a normal characteristic of the RMLD-CS. Normally the rate of drift is low and will not affect the Self-Test if performed on a regular basis. Survey work conducted with an instrument which has drifted and was not self-tested may need to be redone. If instrument is not able to successfully perform a self-test after three attempts, contact HEATH for assistance.

Audio Modes

DMD (Digital Methane Detection)

The Digital Methane Detection (DMD) mode is a highly sophisticated detection algorithm that greatly enhances the use of the RMLD-CS. In most situations, the operator should survey with the DMD mode turned on. To turn on the DMD mode, press the MENU button, select AUDIO MODE, then select DMD.



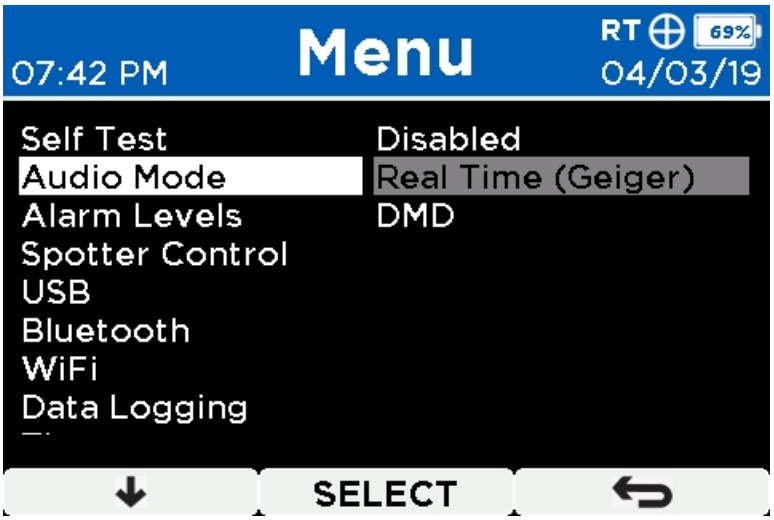
While using the DMD, no sound will be heard until a detection of methane occurs.

The DMD will indicate detection when the ppm-m exceeds the average background plus Alarm Detection Threshold level, or when the reading is excessive. While the low light warning is sounding, the RMLD-CS may still be able to detect very large gas concentrations, indicated by frequent, fast beeps.

The Alarm Detection Threshold controls the sensitivity of the DMD. The operator can adjust the Alarm Detection Threshold. Your company's survey procedure may require the use of a specific value or procedure to set it. Set the Alarm Detection Threshold such that the false detection rate is low, while not too high that leaks are missed.

Real Time (Geiger)

The Real Time mode of the RMLD-CS plays a variable (continuous) beep that is relative to the instantaneous concentration level. The faster the unit beeps, the higher the methane concentration level. Note that the beep frequency increases as you scan at a further distance due to the ambient amount of methane in the air.



The Real Time mode is most effective when used up close to help verify a low level detection or to help isolate the highest gas concentration.

To verify a low level leak the following procedure should be used:

1. Stand back about 10 feet from the leak with the wind to your back if possible.
2. Sweep the laser back and forth across the leak while maintaining a constant distance.
3. Listen for a consistent increase in beep frequency as the beam sweeps through the leak. Very small leaks will have just a slight increase in beeps.

To isolate the spot with the highest concentration, the following procedure should be used:

1. Stand back about 10 feet from the leak with the wind to your back if possible.
2. Sweep the laser starting from the up-wind side, in and around the leak area.
3. Listen for the fastest beep frequency.
4. Change your angle slightly and re-scan the leak zone.
5. If the location with the fastest beeping is consistent, then the location of the leak is at that spot.
6. If the beeps are not consistent then keep working the area. The gas plume may be drifting around causing inconsistent readings. In some cases, the gas plume may be large enough that localization is not very accurate.

Audio Warning Indications

A low pitch beep will indicate a warning due to an infrared laser low light level condition or instrument fault. The warning will also be displayed indicating that the light level is too low or if over saturation of the signal occurs.

If low light, the operator needs to move in closer to get in range.

If over saturation, the operator should back up from the target or point the device at a less reflective surface.

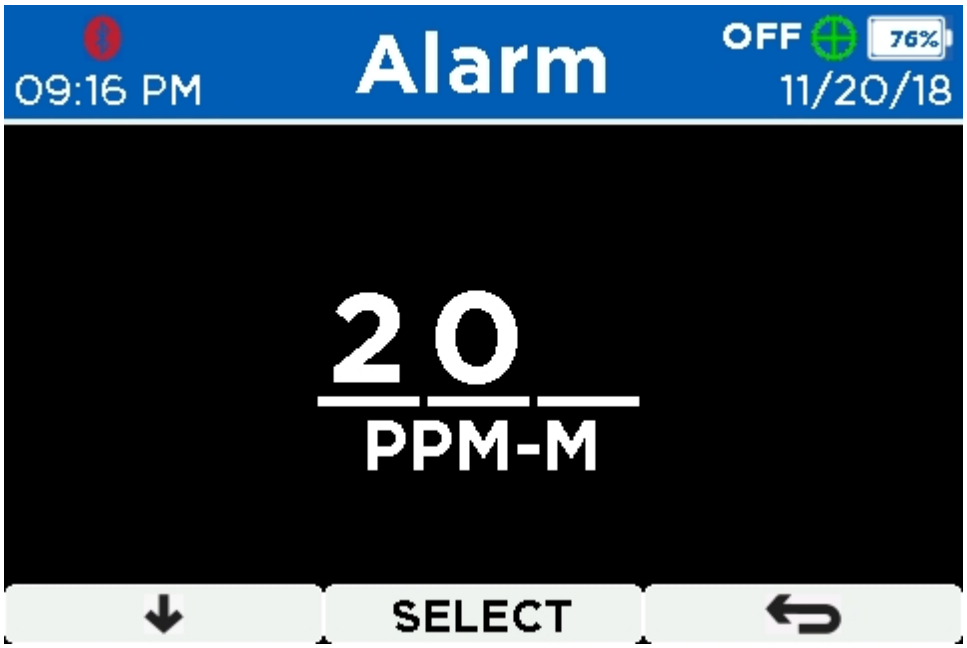
Should the warning(s) persist, it could be due to a fault in the instrument. Check the display and follow the instructions in the troubleshooting guideline.

Alarm Levels

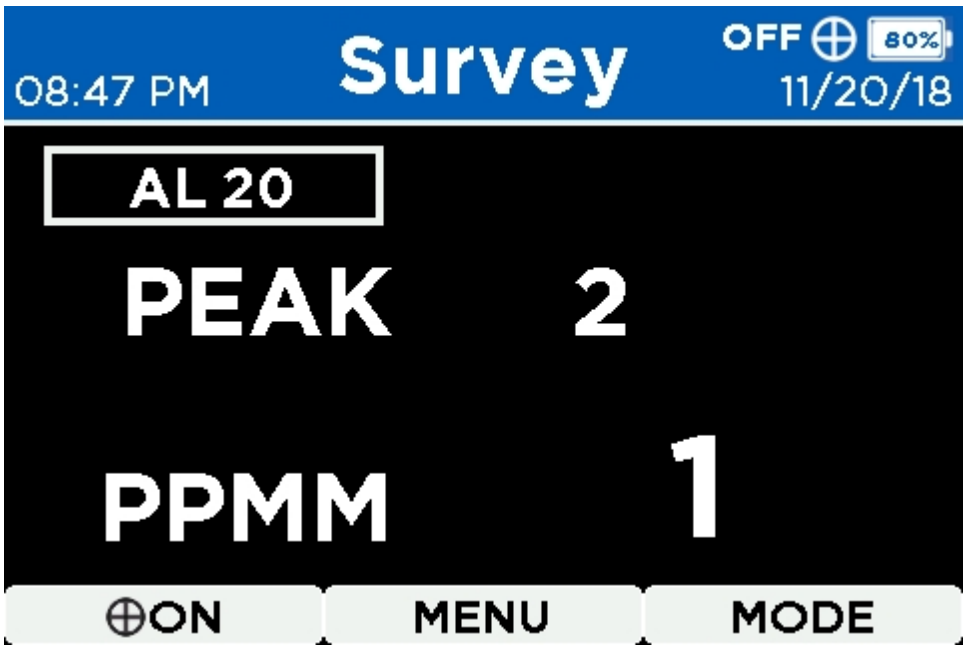
To change the Alarm Detection Threshold, press the MENU button, scroll down and select ALARM LEVELS. Press the down arrow button to increase or decrease the threshold and SELECT to move the placeholder.

NOTE: The higher the threshold setting is, the higher the concentration of methane will be needed to alarm.

Press the back arrow button to return to the menu.



The alarm level setting is shown on the display within a rectangle (AL 20).



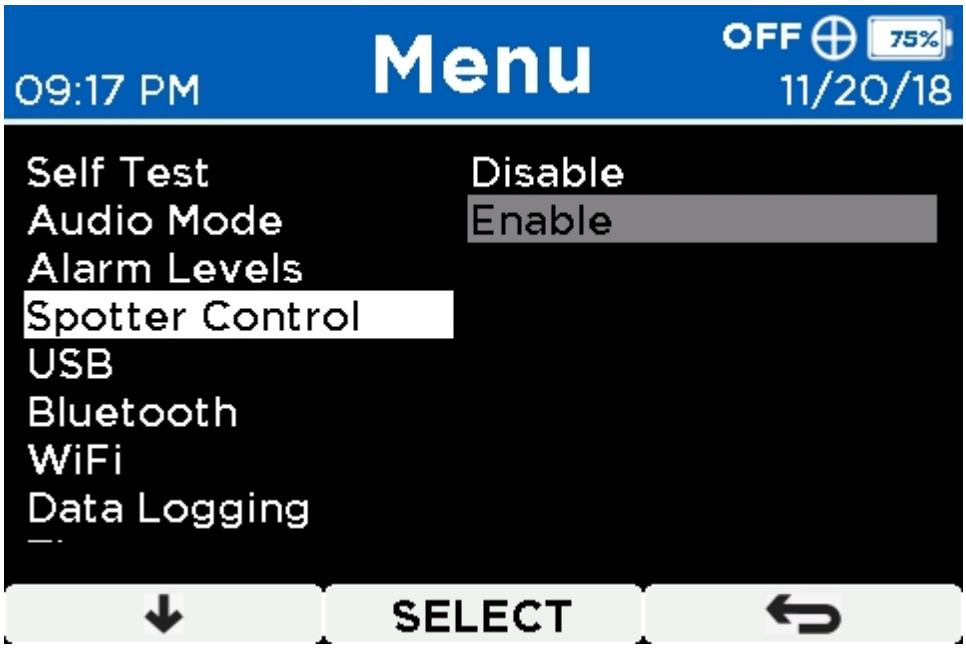
Spotter Control

The green spotter laser in under the control of the operator and is on for one minute when the spotter "ON" button has been pressed and when enabled. The green spotter laser will automatically shut off after one minute, requiring the user to press the "ON" button again for use. While using the green spotter laser, be careful to not point it towards people's eyes or causing vehicle drivers to be distracted.

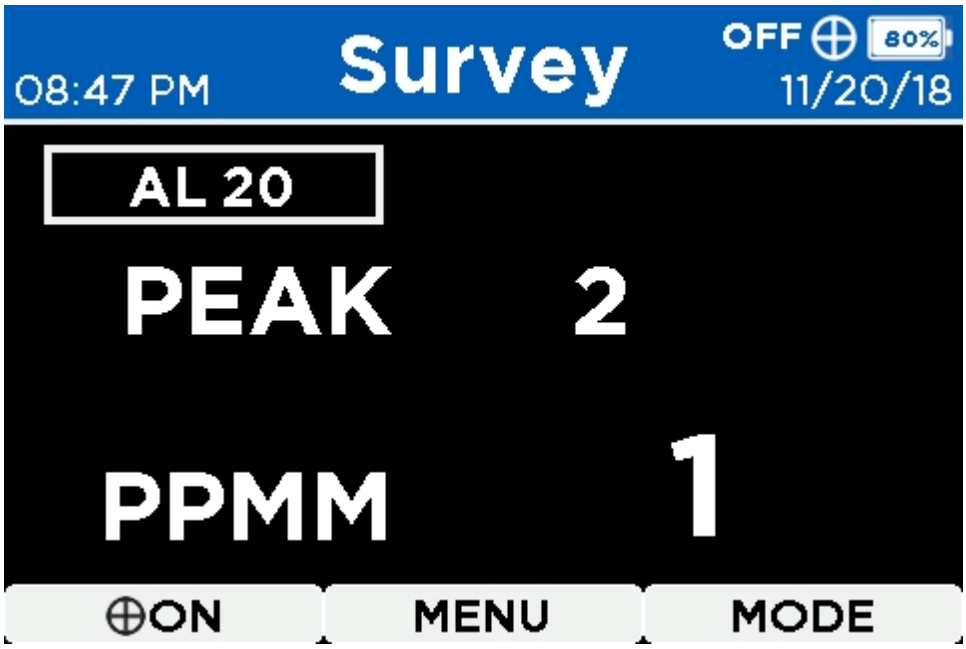
WARNING: The visible green spotter laser is a Class IIIa (3R) laser product. Do not stare into beam or view directly with optical instruments.

To use the spotter laser, the user must first verify the laser is ENABLED in the MENU.

1. To do this, select MENU, scroll down to SPOTTER CONTROL, then select ENABLE.



2. The spotter icon will now be visible in the top menu bar. When the spotter laser is turned ON, the icon will change from white to green (ON).



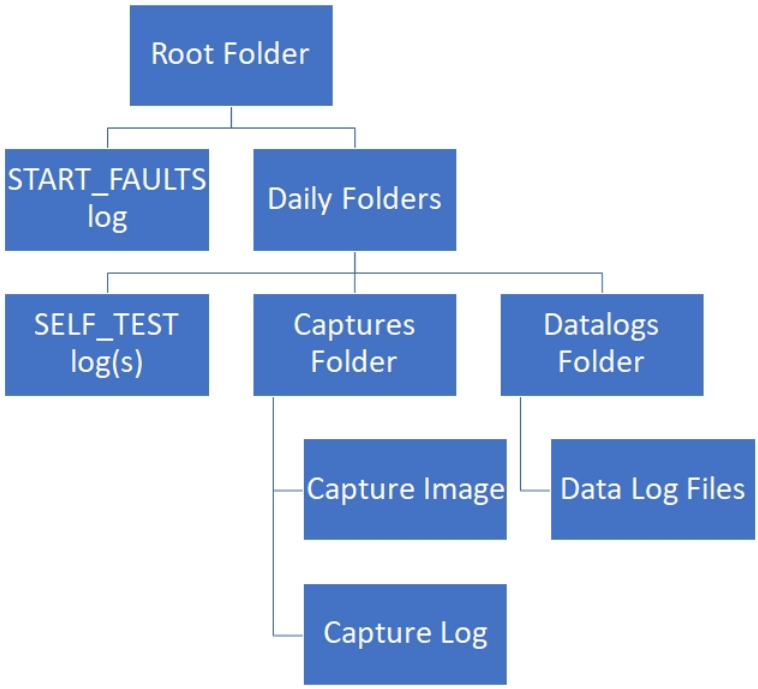
3. The left menu button will now display the spotter ON option. Pressing the left button (on/off) will activate the spotter for 1 minute.

USB File Transfer

To access recorded/ captured data, plug in the provided USB cord into the instrument while powered on and to the operator's PC. The USB mode in the MENU must be set to "Mass Storage Device" for PC recognition and file logging operations.

NOTE: Recognition of RMLD-CS may take some time on first plug in as the required drivers are installed. **Please allow time for this initial process to complete.**

A file explorer window should open automatically when the device is ready for access. The basic file and folder structure is shown below.



Daily Folders: Will be created in the *YYMMDD* format
Self Test Logs: Will be created in the format, *hhmmss-SELF_TEST.txt*
Data Logs: Will be created in the format, *YYMMDD-hhmmss_'USER'_Datalog.txt*

NOTE: 'USER' will be replaced by the operator profile being used during operation

Bluetooth

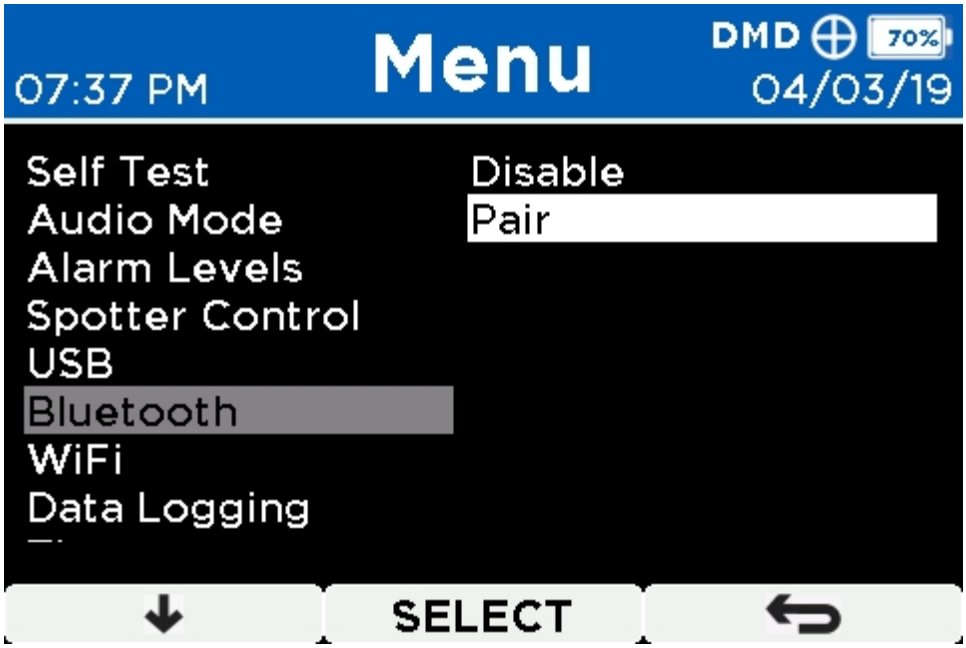
The Bluetooth feature within the RMLD-CS allows operators to connect with their apple/android/pc devices through specific applications. The instrument sends out real time warnings, errors, and data (instrument readings).

To enable the Bluetooth feature, the instrument must be paired with a Bluetooth (BLE) capable device. To pair with a Bluetooth capable device:

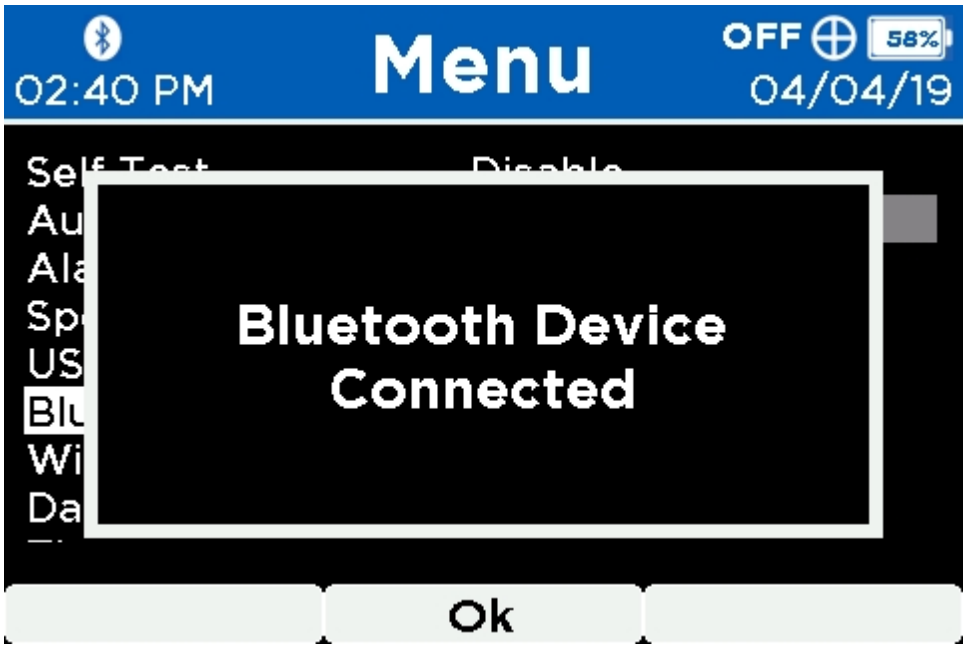
- Press MENU and scroll down to BLUETOOTH. Select and then select PAIR. The Bluetooth connection "RMLD CS" is now broadcasting for discovery.

For instructions and recommendations on how to connect and view data, please contact HEATH for additional information.

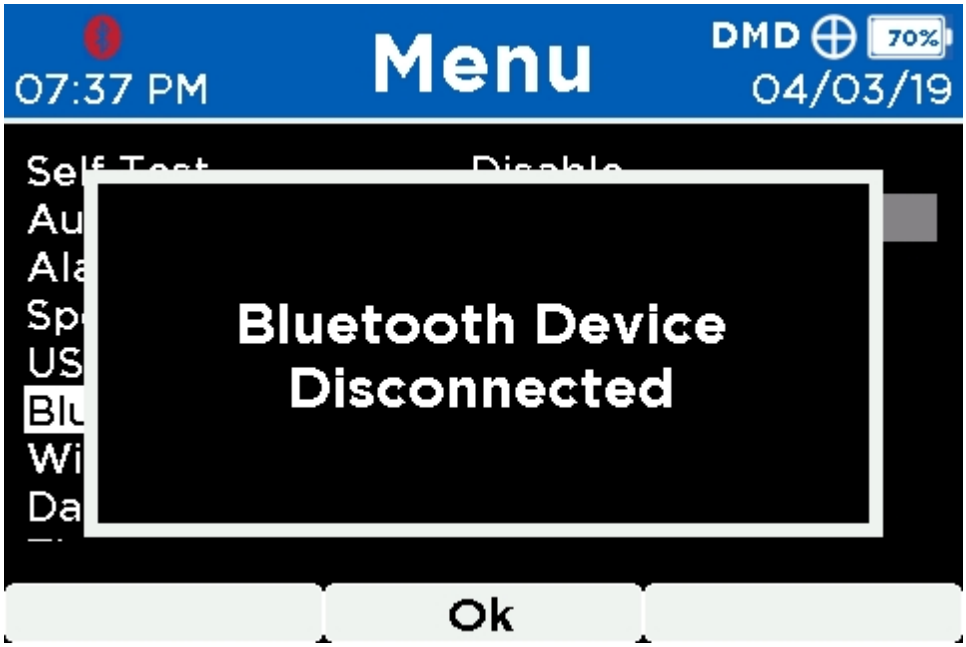
NOTE: Some devices may not be able to discover the RMLD-CS using the default Bluetooth connection manager on the operator's device. The operator must first install a compatible Bluetooth terminal application on their device for successful pairing.



A white Bluetooth icon will be present in the status bar of the display screen once a successful pairing has completed.



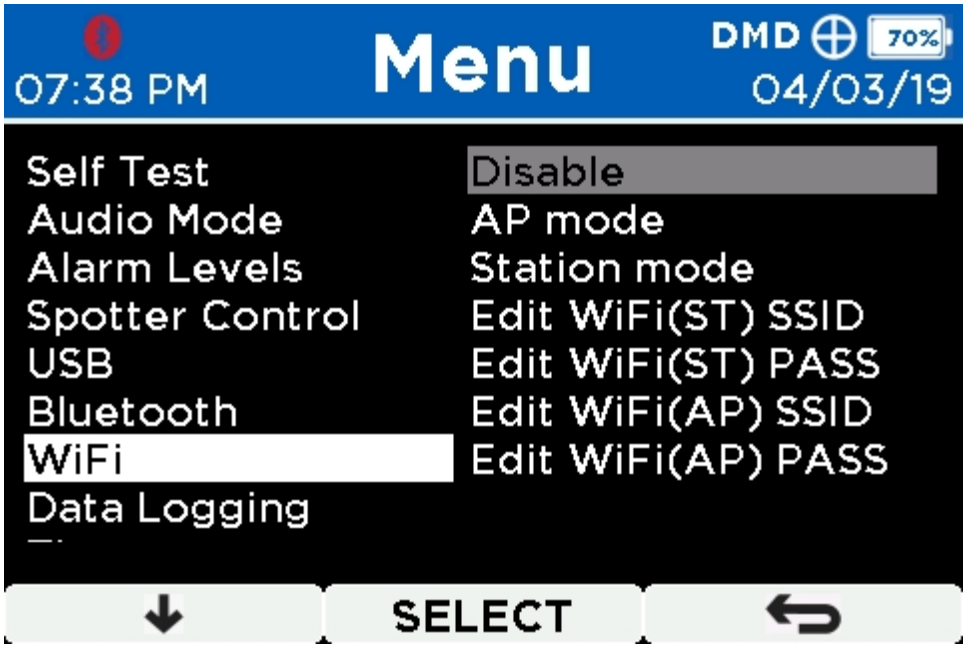
The Bluetooth icon will turn red and a pop up window will be displayed when the connection is lost or not present.

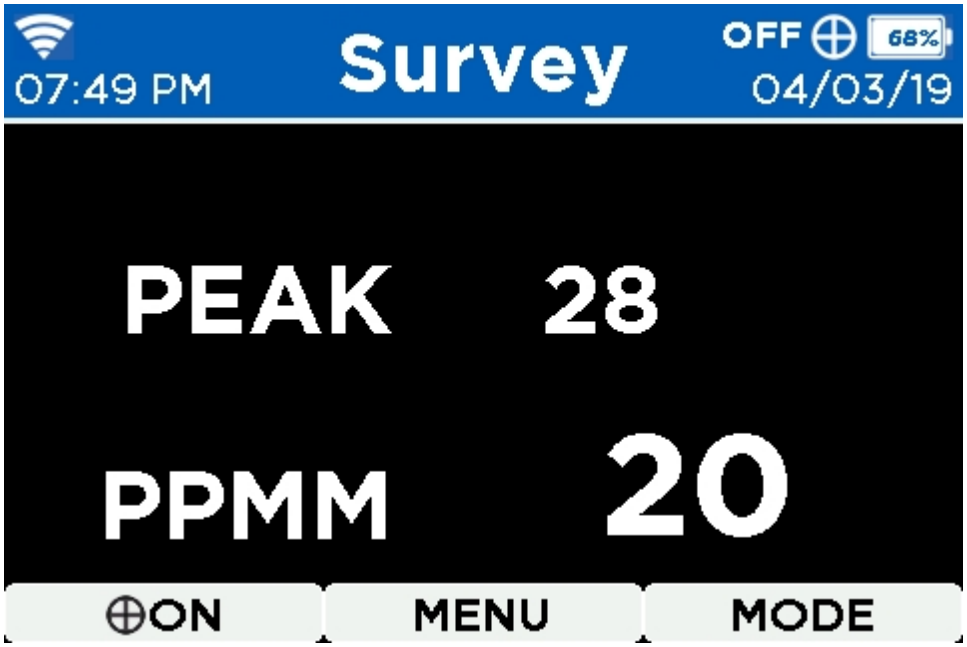


WiFi

The WiFi option within the RMLD-CS allows operators to connect with their apple/android/pc devices through specific applications. The instrument sends out real time warnings, errors, and data (instrument readings). Connecting via WiFi will also allow the operator to access useful information stored on the device, such as Self-Test logs, data logging, fault codes, and screen captures.

To enable the WiFi feature, scroll to WIFI in the menu and select either AP or STATION mode.





When connected, the WiFi icon will be displayed in the status bar and will be white in color. A red WiFi icon denotes no connection or the instrument is attempting a connection.

AP Mode

The Access Point (AP) mode will broadcast a wireless network directly from the RMLD-CS instrument. The operator must search for this network and connect directly to the instrument using the AP WiFi SSID network name and password.

Telemetry Streaming

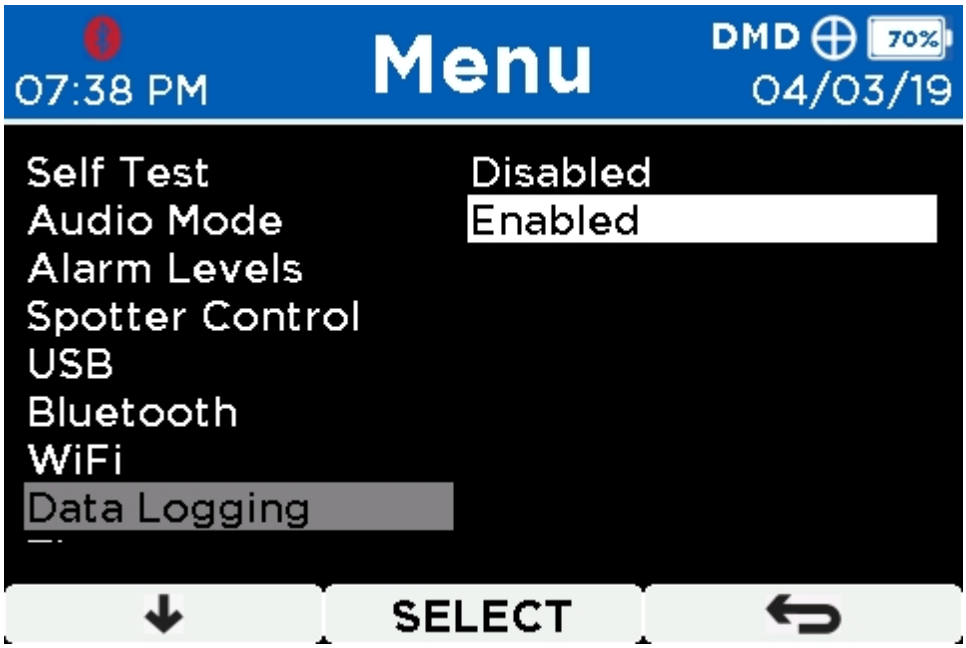
Using a PC or mobile application, the operator can stream live data for display. The data includes PPM-M readings, time stamps, GPS and system state information. For instructions and recommendations on how to connect and view data, please contact HEATH for additional information.

File Access

Using a PC, the operator can access the stored files located within the instrument. To view and download the files, open any web browser while connected through WiFi and enter *10.123.45.1:80* into the address bar.

Data Logging

The RMLD-CS data logging feature allows the instrument to store complete telemetry records of the instrument, while powered on, to an internal SD memory card. To enable this feature, select DATA LOGGING from the MENU, then select ENABLED.



To disable this feature, select DATA LOGGING in the MENU, then select DISABLED.

NOTE: Data logging *does not* need to be enabled in order for the instrument to record FAULT logs, SELF-TEST logs, or screen captures.

Data telemetry is recorded into multiple log files during operation. The following measurement information is contained within the log files:

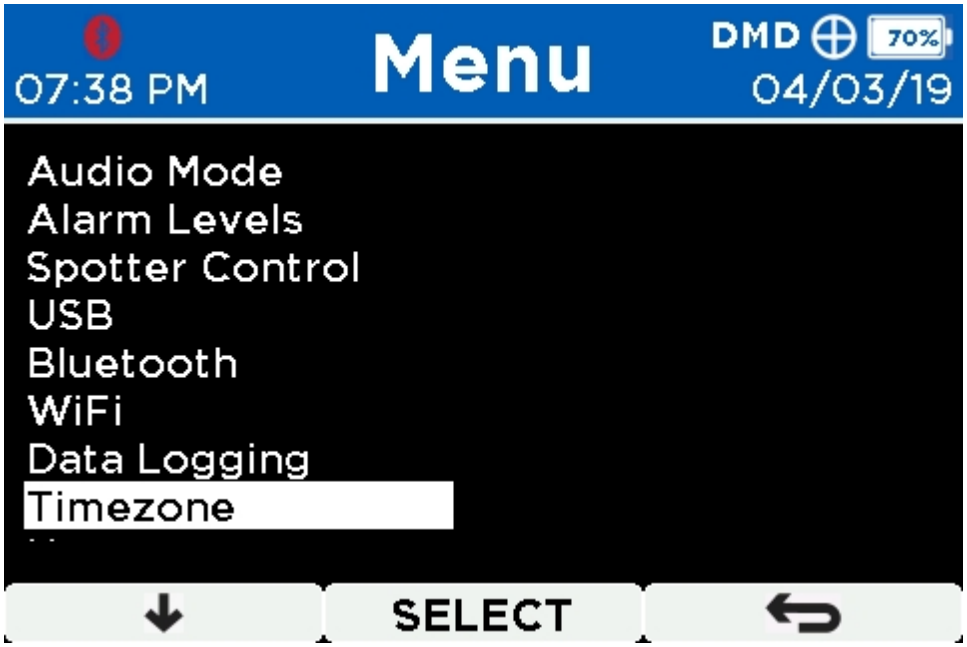
- CH4 PPM-M measurement
- Battery level
- Battery voltage
- GPS location
- Timestamp
- Serial number of the instrument

The log file also contains various system status fields and values that can be used to help evaluate instrument performance or aid in troubleshooting if a fault condition occurs.

Timezone

The timezone menu option will allow the user to select the desired offset, in hours, from UTC time acquired by the GPS.

In the menu, select TIMEZONE, then use the arrow buttons to adjust the desired offset. Select the back arrow button when complete.

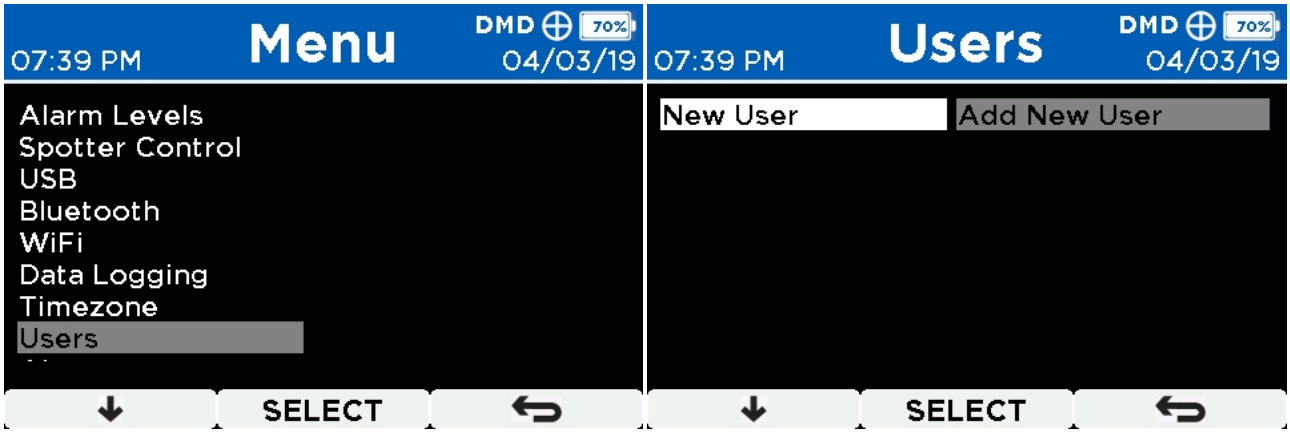


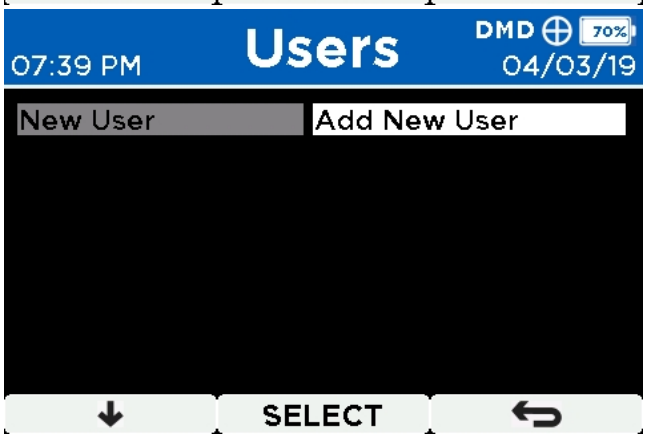
User Profiles

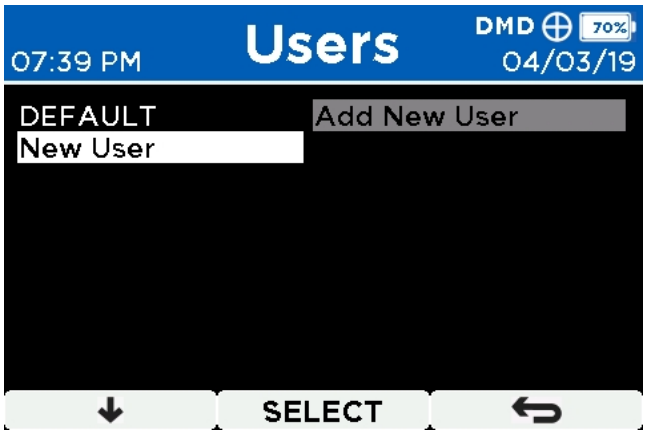
User profiles allow multiple operators to utilize the RMLD-CS instrument with customized settings and unique PIN protection to enable use.

Adding a New User

Press the MENU button and scroll down to select USERS from the menu. Select NEW USER, then select ADD NEW USER.

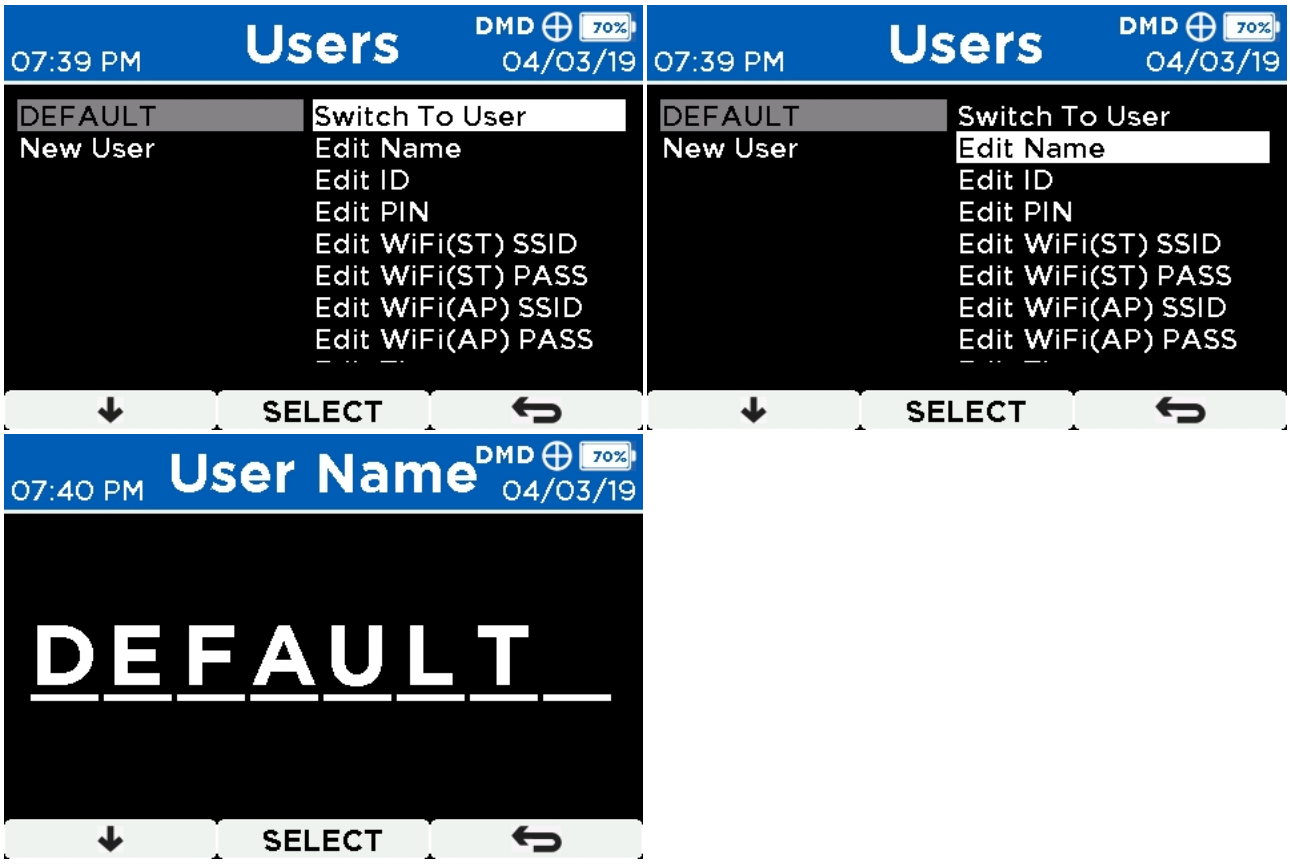






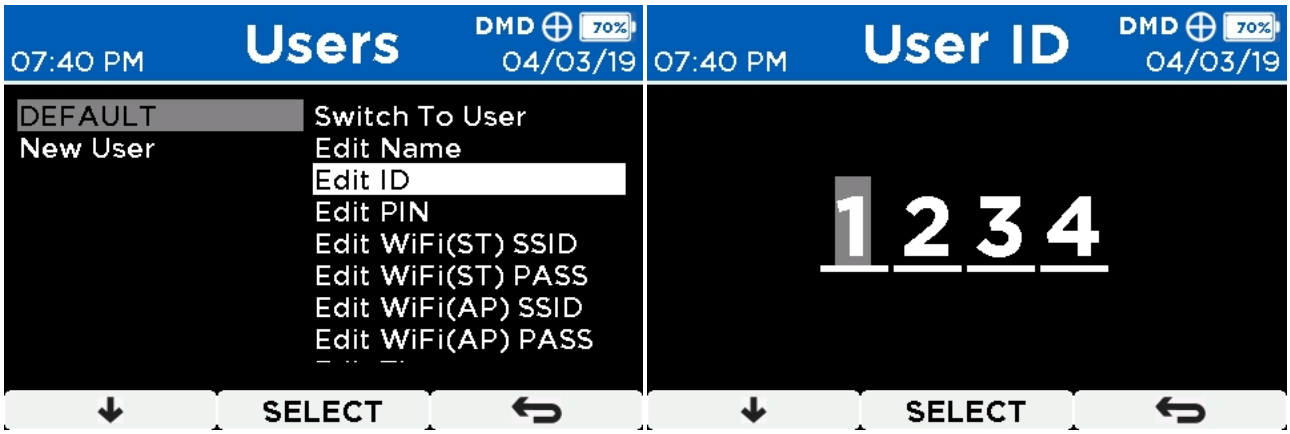
Renaming a User

Select the user to be renamed. Scroll down the sub menu and select EDIT NAME. Use the down arrow button to scroll through each letter. Pressing SELECT will accept the change and move to the next place holder. Pressing the BACK ARROW button will return to the previous menu and accept the name shown.



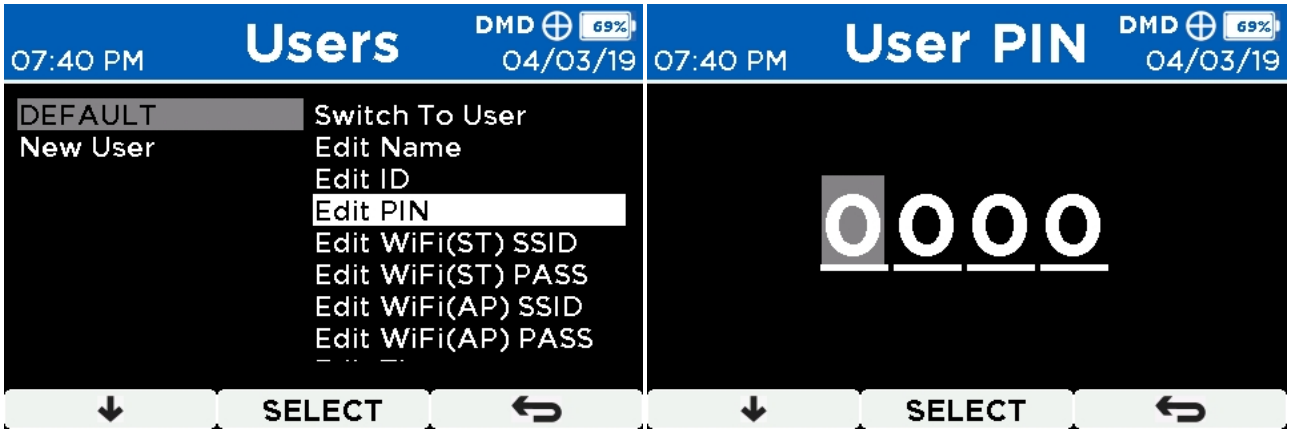
Changing User ID

Select the user from the menu and scroll to EDIT ID. Press select and use the down arrow button to scroll through the numeric options. Pressing SELECT will accept the change and move to the next place holder. Pressing the BACK ARROW button will accept the change in user ID and return to the previous menu.



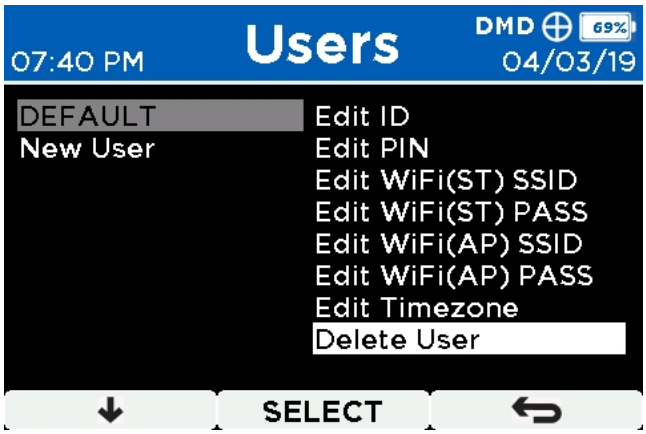
Setting User PIN

Select the user from the menu and scroll to EDIT PIN. Press select and use the down arrow button to scroll through the numeric options. Pressing SELECT will accept the change and move to the next place holder. Pressing the BACK ARROW button will accept the change in user PIN and return to the previous menu.



Deleting a User

Press the MENU button and scroll down to select USERS from the menu. Select the user to be deleted, then select DELETE USER.

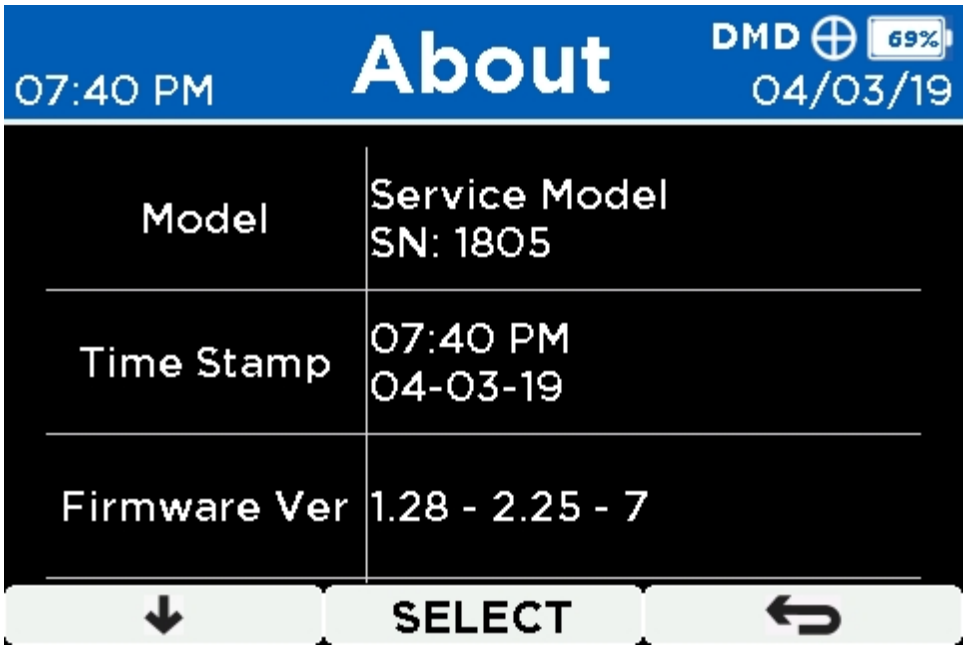

07:40 PM
Users
DMD
69%
04/03/19
DEFAULT
New User
Edit ID
Edit PIN
Edit WiFi(ST) SSID
Edit WiFi(ST) PASS
Edit WiFi(AP) SSID
Edit WiFi(AP) PASS
Edit Timezone
Delete User
SELECT

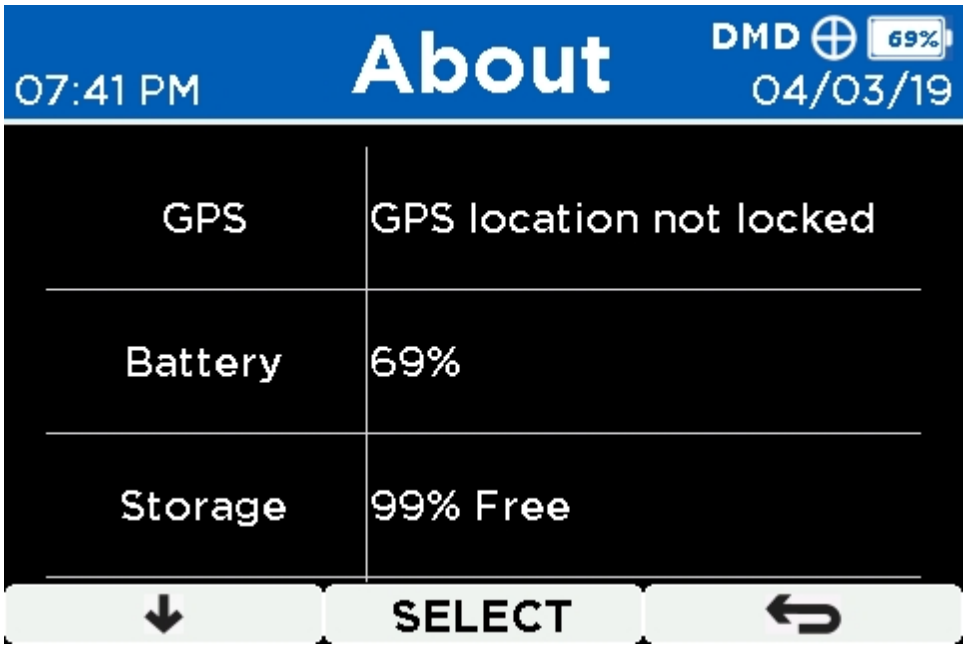
About Screen

The ABOUT menu item will display information relative to the current state of the instrument. Press the MENU button, scroll down to ABOUT and press SELECT.

Use the down arrow button to scroll through the available information:

- Model Name and Serial Number
- Current Time and Date
- Firmware Version
- GPS Status
- Battery Percent Remaining
- Internal SD Card Storage Remaining
- Recent Error Codes
- Bluetooth Status
- WiFi Status
- Heath Consultants Incorporated Contact Information





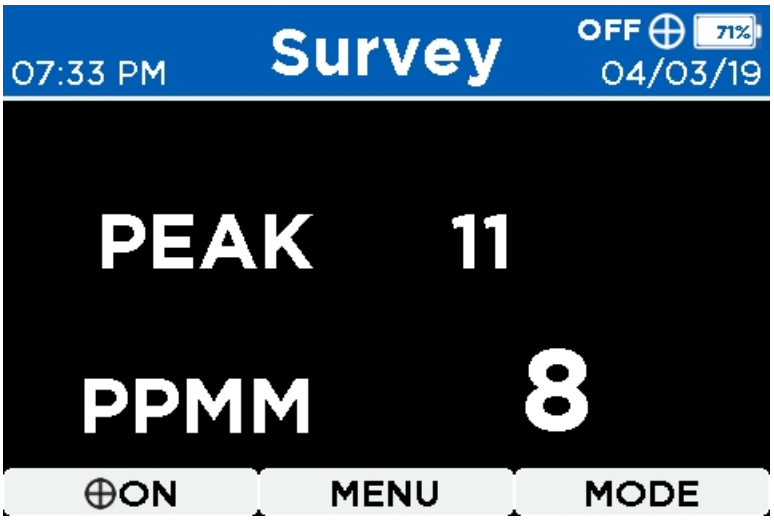
Additional Features

Screen Mode - Survey

The Survey screen mode will display avnumerical readout of PPMM readings. This allows the operator a no-clutter screen to survey with the instrument.

During DMD Audio Mode, the Peak and PPMM values will turn red in color when a methane signal is detected.

The Peak value is held for two seconds before resetting to a lower current reading. The Peak value will instantly change if a higher reading is obtained by the instrument.

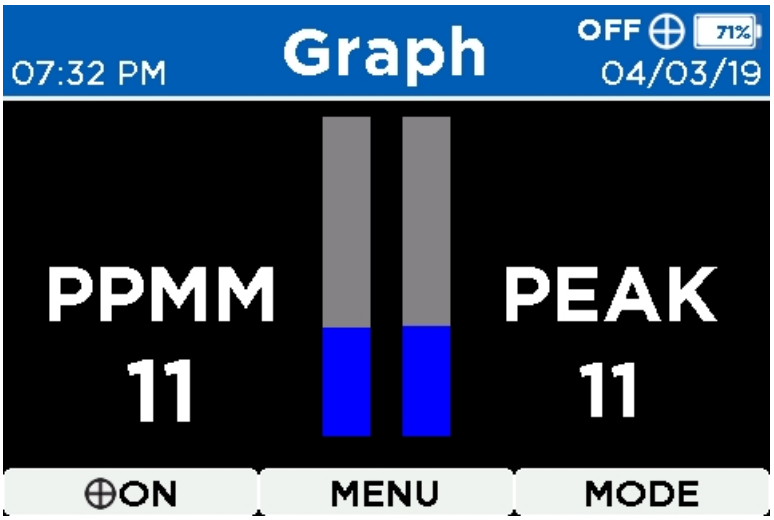


Screen Mode - Graph

The Graph screen mode will display a bar graph in addition to the numerical readout of PPMM readings. This allows the operator to easily see the changing values while surveying with the instrument.

During DMD Audio Mode, the bars will turn red in color when a methane signal is detected.

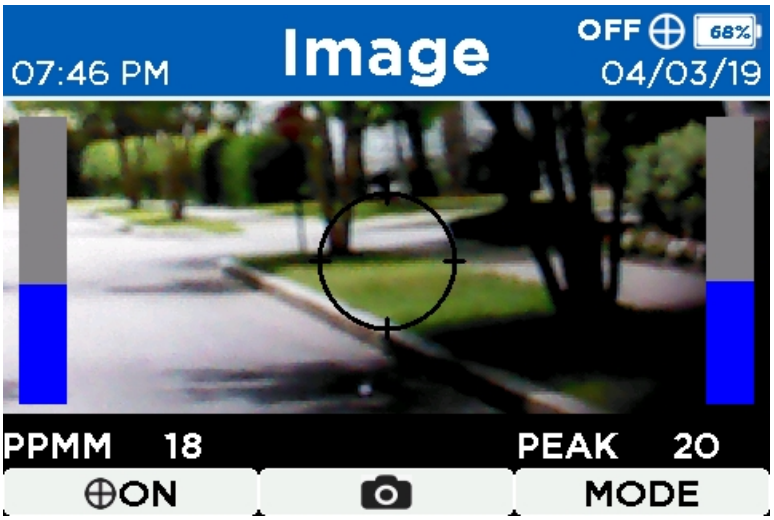
The Peak value is held for two seconds before resetting to a lower current reading. The Peak value will instantly change if a higher reading is obtained by the instrument.



Screen Mode - Image

The IMAGE mode allows the user to view a live image of where the RMLD-CS is pointed as well as current and peak PPMM readings. This feature is especially useful in bright sunlight when the green spotter laser may be hard to see.

NOTE: The center reticle is a general representation of where the IR beam is located. The beam may not be located at the exact center of the circled image and the operator should always sweep the area of interest to ensure beam coverage.



Pressing the CAMERA button while in image mode will take an image snapshot that is recorded to the internal SD card. A text file will also be recorded onto the SD card, capturing the current instrument readings, timestamp, GPS, and other information.

Surveying with the RMLD-CS

Refer to your company's specific training and procedures for being qualified for leak surveying.

In order for the RMLD-CS to detect a gas leak, three conditions must be met:

1. The gas plume concentration and size must be greater than the minimum sensitivity of the instrument.
2. The infrared beam must pass through the plume.
3. The background target (i.e., ground, building, etc.) has to reflect the infrared beam back.

Several factors influence the gas plume size and concentration. First, very low flowing leaks may produce small to non-measurable plumes. Also, surface types such as concrete will spread the leak and create spot leaks through surface cracks and holes. Weather conditions like high winds and higher temperatures will cause the plume to dissipate faster. The operator must consider these factors and their effects throughout the survey.

The most important aspect to using the RMLD-CS is the proper control and aiming of the infrared beam.

The first thing you will need to learn when surveying with the RMLD-CS is to control the aiming of the laser and rate of sweeping. Radical or abrupt motion may cause the RMLD-CS to give false detections due to rapidly changing distance or background that the laser detects. Radical or abrupt motion may cause the IR beam to not thoroughly scan the area.

Here are a few tips for surveying along the main:

- Use a smooth sweeping motion.
- Keep the beam pointed out 15 to 20 feet. This allows for the beam footprint on the ground to be large enough to provide good coverage, and control over the path of the beam.
- Scan service tap and valve areas as you approach them.
- Target probable vent locations such as cracks, vegetation damage, etc.

While scanning the service line/meter where the location is known, keep these tips in mind:

- Use the advantage of the beam by sweeping wider around the line location.
- Work the beam up the line in an "S" pattern.
- Scan the meter area.
- Re-scan down the line using the "S" pattern.
- Move in closer if the range is too far or ground elevation causes the beam to not come into contact with the ground (dark zones).

While scanning a service where the location is not known:

- Use an “X” pattern or similar pattern to thoroughly scan the area.
- Target typical vent areas i.e., along the street or sidewalk edges.
- Target locations where valves may be placed.
- Scan along the foundation of the structure.
- Move in closer if the range is too far or ground elevation causes the beam to not come into contact with the ground creating dark zones (shadow).

When scanning the meter, keep the following considerations in mind:

- Maintain at least 10 feet from the meter so the beam width is not too small.
- Thoroughly scan the ground around the meter.
- Use the best angle to the meter that provides a good background behind the meter.
- If the meter is out in the open, or the angle is limited such that there is no background right behind the meter; scan the meter in a horizontal “Z” pattern maintaining a constant distance as you sweep across.

If a leak is located near or on the meter, these tips help to determine if the leak is underground or on the meter:

- Try to keep the wind to your back.
- Stand about 5 to 10 feet from the meter. Use the *Real Time (Geiger)* audio mode to help pick out the strongest return.
- Start out aiming low on the ground.
- Work the beam up and around the piping (Note: The spotter laser is about 1.25” to the right of the IR laser beam).

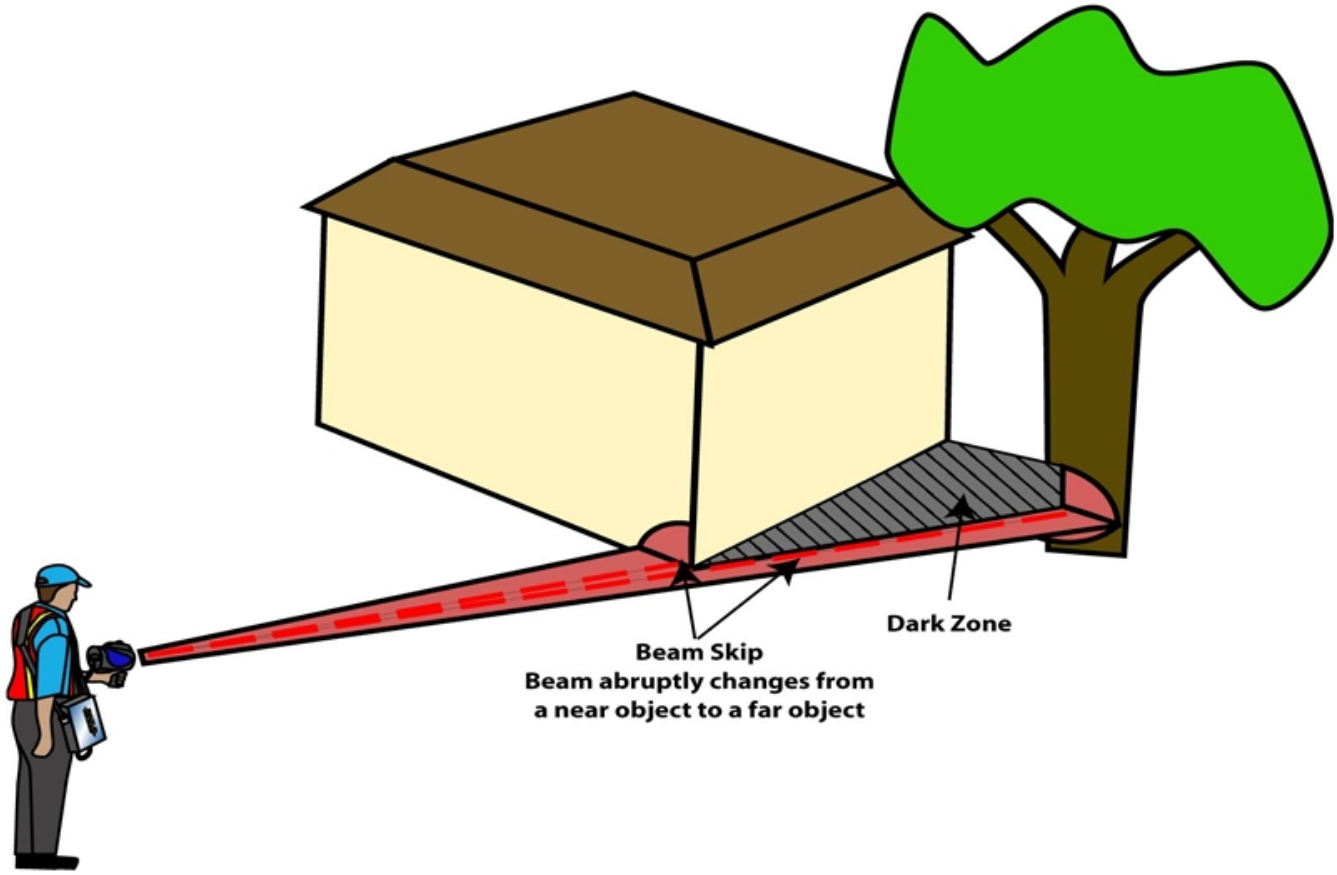
If in doubt and if the leak is underground, bar hole the area.

Long Range Scanning

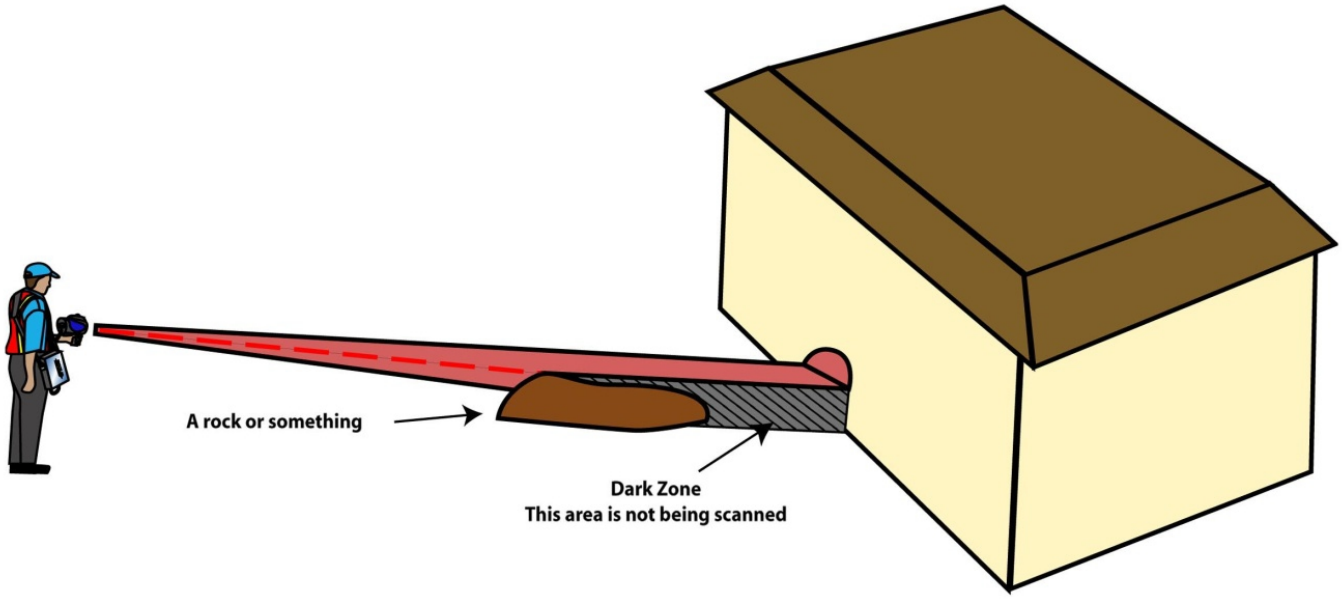
The RMLD-CS can detect leaks from up to 100 ft. away. Actual distance may vary due to target surface and environmental conditions. As the scanning distance is increased, the laser light level returned will decrease. As the maximum distance is approached, a “low return signal” tone is heard. You will need to move in closer.

For best results when scanning at distances greater than 50 feet, it is important to slow down the scanning rate and take care in pointing the laser. When taking aim, use the spotter laser or the camera feature to ensure proper scanning of the target area.

Be aware of the ground elevation. Scanning across the top of a knoll or past the edge of a structure can result in beam skips (a sudden change in distance) which may give you a false detection.



Obstructions or variations in the landscape can cause dark zones where the laser doesn’t scan. Look for the best angle to thoroughly scan these areas. Scanning up a hillside may cause beam skipping or dark zones around the foundation of a structure.


A rock or something
Dark Zone
This area is not being scanned

Dealing With False Detections

While using the DMD mode, several conditions may occur that will cause the algorithm to give a detection indication. The most common situations are:

- Abrupt or jerky motions causing the scanning distance to rapidly change.
- Overly strong returns due to strong reflectors.

The most common point that a false detection occurs is in the 50 feet (15 m) range. This is due to the beam footprint becoming very large. Abrupt motion, change in terrain, or distance to an object may cause the DMD to give a short low detection. To verify if the detection is due to a leak, pause at this distance, aim off to the side and re-sweep across the area to determine if gas is present.

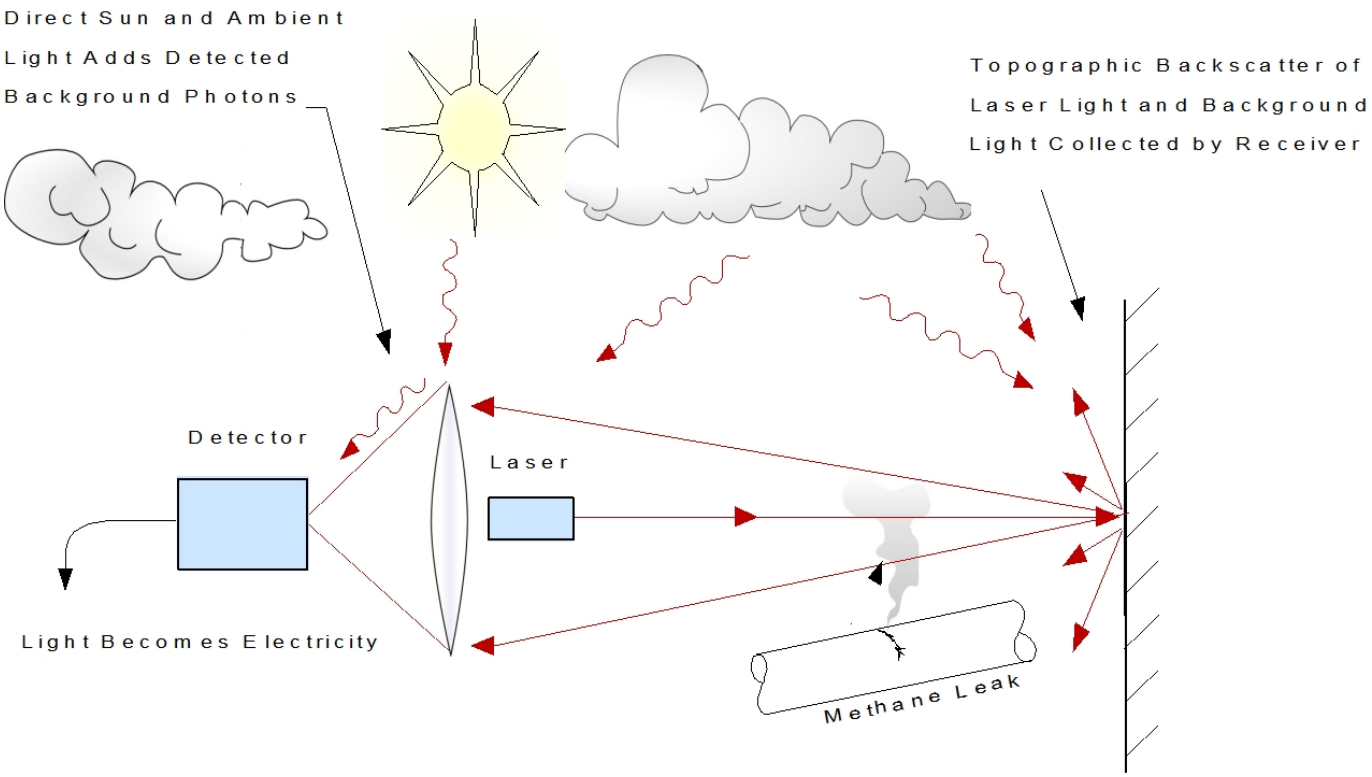
Scanning from a long range to a short range will also minimize false detection.

Strong reflections off certain types of surfaces (e.g., black garbage bags, water droplets, glass, polished surfaces, stones, license plates, reflectors, etc.) may give a false detection. Re-scan the area from a slightly different angle.

How Does the RMLD-CS Measure Gas?

With the RMLD-CS it is now possible to survey areas that are hard to reach or not easily accessible. The RMLD-CS does not have to be within the gas plume because it uses laser technology known as Tunable Diode Laser Absorption Spectroscopy. As the laser passes through a gas plume, the methane absorbs a portion of the light, which the RMLD-CS then detects. This technology makes it possible to detect leaks along the sight line without always having to walk the full length of the service line.

The invisible Infrared (IR) detector laser beam is transmitted from the launch port. With a normal background, such as brick, concrete, and grass, it has a maximum distance of up to 100 ft. away (actual distance may vary due to surface condition).



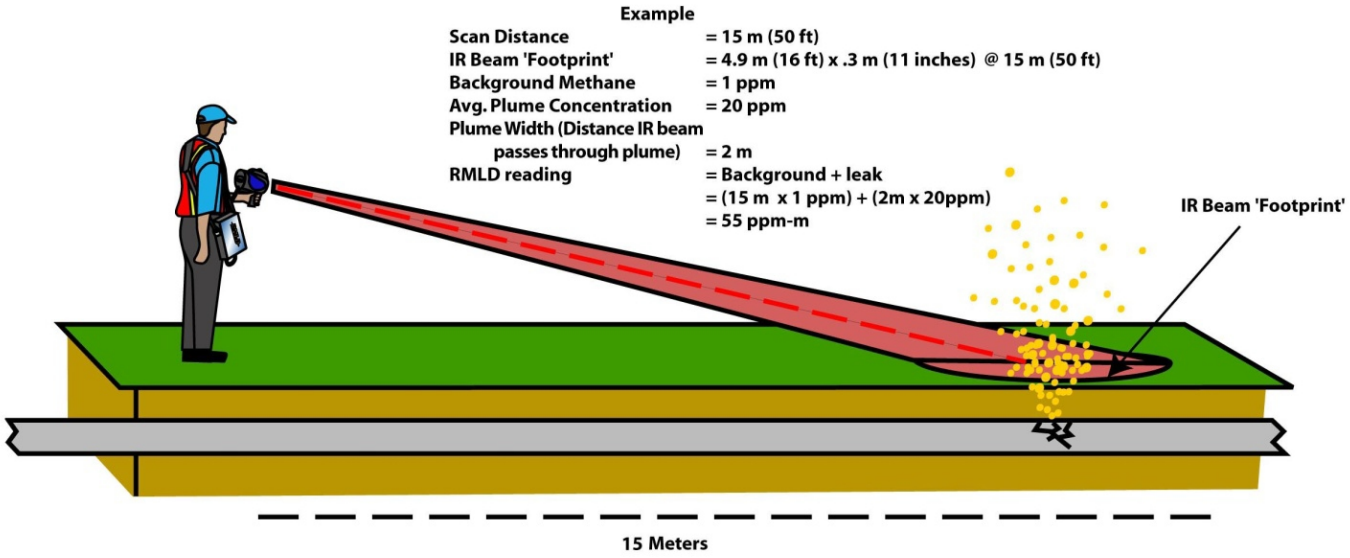
To detect leaks, as the above illustration depicts, when the infrared laser beam passes through a gas plume, and is reflected back, the reflected light is collected and converted to an electrical signal that carries the information needed to deduce the methane concentration.

The laser light is selective to methane, and will not false-alarm on other hydrocarbons.
This signal is processed so that methane concentrations can be reported in parts-per-million-meter or ppm-m.

PPM-M is the product of the methane concentration times the width of the plume. For example, if the leak is creating a gas cloud of 1000 PPM and is about ½ meter in width (the distance the infrared beam passes through the plume). The RMLD-CS will measure 500 ppm-m.

For another example, if the average concentration of the gas cloud is 20 PPM and is about two (2)

meter in width, the RMLD-CS will measure 40 ppm-m, plus a background level of 15 ppm-m in this case, displaying a total value of 55 ppm-m.



The infrared beam width is about 22” at 100 feet. It is important to note that the laser beam “footprint” width and distance increases as the distance increases (see Figure 4-5). This is why it is much easier to detect leaks from a distance of 10 to 15 feet and beyond.

NOTE: There is always a small amount of methane in the air. This natural methane background is also measured by the RMLD-CS. The ppm-m reading will then increase as the scanning distance increases.

NOTE: The nature of a gas plume is highly variable. The above illustrations are intended to convey the basic theory. Some leaks may have a high surface concentration with little to no measurable plume above the surface.

Troubleshooting

The advanced design of the RMLD-CS makes it one of the most reliable leak survey instruments available. However, should you experience problems with the instrument or suspect that the instrument is not operating properly, do not use the instrument for leak survey work until the problem is resolved.

Only a qualified RMLD-CS repair technician should attempt to repair or adjust the instrument. There are no user serviceable components within the RMLD-CS that can be repaired or replaced.

Most often, a problem has a simple cause. The following table provides a list of common problems, cause and solution. Should you have a problem not listed or the solution doesn't work, please contact HEATH CUSTOMER SERVICE for further assistance.

Symptom	Probable Cause(s)	Solution
Readings are higher than normal at short range and lower than normal for long range	Laser calibration has drifted	Run Self-Test
Concentration reading low and will not pass the Self-Test	Laser calibration has drifted	Run Self-Test up to three (3) times and then contact Customer Service
Unit will not turn on	Low battery	Replace or recharge battery pack
Continual warning sound or screen notification when scanning	Scanning at a distance beyond the RMLD-CS range	Move closer to the target, or
	Background surface is absorbing or reflecting the IR light level	Change angle to the target to get a better reflecting background
	Low battery	Check battery level and recharge if necessary
Excessive false detection while scanning at longer distances	Scanning too fast	Slow down the scanning rate. Pause at the long range and sweep towards you
	Alarm detection threshold set too low	Increase the Alarm detection threshold
	Scanning at the range limit of the instrument	Move in closer
Excessive false detection while scanning at closer distances	Scanning too fast	Avoid making abrupt motions while scanning
	Alarm detection threshold set too low	Increase the Alarm Detection Threshold
Excessive false detection or loss of sensitivity	Laser output not optimized	Perform Self-Test procedure
	Alarm Detection Threshold set too	Check the Alarm Detection

	high or low for conditions	Threshold
Error message or Warning icon on continuously	Low battery	Check battery level and recharge if necessary Allow for the temperature of the instrument to stabilize
	Moisture condensation on mirror due to rapid change in temperature Internal component failure	Note error message and contact HEATH
Battery indicator does not show full charge after charging	Battery not fully charged	Charge battery pack until solid green light on charger is on
	Battery level calibration error	Run unit until it shuts off, then fully recharge battery pack without interruption
Low Signal or Low Light	Background surface is absorbing or reflecting the IR light level	Change angle to the target to get a better reflecting background
	Scanning at the range limit of the instrument	Move in closer
Saturated	Background surface is reflecting the IR light level	Change angle to the target to get a better background
No WiFi connection	Incorrect credentials	Verify credentials
	Outside of WiFi range	Place unit closer to WiFi point
	WiFi disabled in menu	Enable WiFi in menu
No Bluetooth connection	Bluetooth is disabled	Enable Bluetooth in menu
	Device not paired	Pair device with instrument
USB not recognized	USB cable does not work	Use another USB cable
	Port is not working	Try a different USB port or allow computer to load drivers
	Low battery	Charge or replace battery pack
	Driver did not install properly	Uninstall device driver and allow to reinstall
	IT restrictions	Contact local IT support

Maintenance

In order to maintain the RMLD-CS in good working condition, the following maintenance should be performed as indicated:

Maintenance Item	**Frequency**
Clean outer surfaces with damp rag	As needed
Clean instrument window with damp KimWipe™ or equivalent none abrasive lens tissue	As needed to prevent dust or water stain build up
Self-Test	Daily to ensure that the instrument is functioning properly
Battery pack recharge	Recharge to full capacity after each use
Replace battery pack	As needed

Notes

Warranty and Repair

All instruments and products manufactured by Heath Consultants Incorporated are warranted to be free from defects in material and workmanship for one (1) year from the date of shipment.

Furthermore, the warranty on authorized repairs in the Houston Factory Service Center (FSC) and other regions is ninety (90) days materials and thirty (30) days labor. This repair warranty does not extend any other applicable warranties.

Our warranty covers only failures due to defects in materials or workmanship which occur during normal use. It does not cover failure due to damage which occurs in shipment, unless due to improper packing, or failures which result from accident, misuse, abuse, neglect, mishandling, misapplication, alteration, modification, or service by anyone other than a Heath warranty repair location.

Batteries and damage from battery leakage and all expendable items such as filters and tubing are excluded from this warranty.

Heath's responsibility is expressly limited to repair or replacement of any defective part, provided the product is returned to an authorized warranty repair location, shipped prepaid, and adequately insured. Return shipping charges and insurance will be paid by Heath warranty expense.

We do not assume liability for indirect or consequential damage or loss of any nature in connection with the use of any Heath product. There are no other warranties expressed, implied, or written except as listed above.

Heath warrants only that the parts manufactured by it will be as specified and free of defects. Heath makes no other warranties or representations of any kind whatsoever, express or implied, and any and all implied warranties including any warranty of merchantability and fitness for a particular purpose or use are hereby disclaimed.

Return Procedure

The following steps will expedite the repair of your instrument:

1. Contact Heath Factory Service at 713-844-1350 to request a repair form. The form is also available on-line at http://heathus.com/info-center/repair-forms/

2. Package carefully using the original shipping carton and cushions if available and return all components including the repair form.

The repair form requests information such as complete shipping and billing addresses, instrument or product name, model number and serial numbers. Also included will be a brief description of the problem you are experiencing and the person and phone number to be contacted for additional information and approvals. An RMA number will be assigned to the return.

CORPORATE HEADQUARTERS

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Technical Support

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HEATH CONSULTANTS

Your Safety...Our Commitment