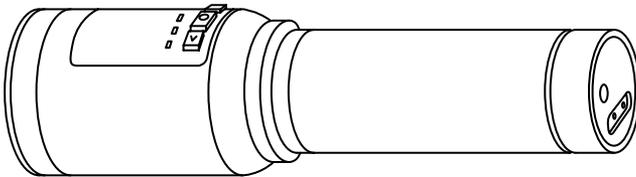




TDL 220 USER MANUAL

PLEASE READ THIS MANUAL BEFORE SWITCHING THE UNIT ON.
IMPORTANT SAFETY INFORMATION INSIDE.



ICI cameras fall under US Federal Law and Export Control.

2105 W. Cardinal Dr. Beaumont, TX 77705

For more information, contact us: (409) 861-0788 | sales@infraredcameras.com | www.infraredcameras.com

Revision History

02.2022-001	Document created
08.2023-001	Updated inspections methods and photos

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1. Disclaimers

1-1 Terms and Conditions

Warranty Terms and Condition of Sale are made available online at:

<https://infraredcameras.com/support/terms-and-conditions-of-sale/>

1-2 U.S. Government Regulations

This product may be subject to U.S. Export Regulations. Please send any inquiries to support@infraredcameras.com

1-3 Copyright

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1-4 Quality Assurance

Infrared Cameras, Inc. is committed to a policy of continuous development; therefore we reserve the right to make changes and improvements on any of the products without prior notice.

1-5 Customer Help

For customer help, visit:

<https://infraredcameras.com/support/>

E-mail:

support@infraredcameras.com

2. User Notice

2-1 Calibration

Laser wavelength drift is a normal characteristic of the device. It is recommended that users self-calibrate the device every 3 months. Instructions for calibrating the laser wavelength can be found in Section 8-9 Laser Calibration.

2-2 Accuracy

For very accurate results, we recommend that you wait a minimum of 5 minutes after you have started the camera before measuring for a gas leak.

2-3 Cybersecurity

After the products are connected to the Internet, they may face risks including but not limited to network attacks, hacker attacks, virus infections, etc. The company will not be responsible for the abnormal operation of the products and any loss or liability caused therefrom shall be at your own risk.

2-4 Disposal of Electronic Waste

Electrical and electronic equipment (EEE) contains materials, components and substances that may be hazardous and present a risk to human health and the environment when waste electrical and electronic equipment (WEEE) is not handled correctly.

Equipment marked with the below crossed-out wheeled bin is electrical and electronic equipment. The crossed-out wheeled bin symbol indicates that waste electrical and electronic equipment should not be discarded together with unseparated household waste, but must be collected separately.

All local authorities have established collection schemes under which residents can dispose of equipment at a recycling center or other collection points, or WEEE will be collected directly from households. More detailed information is available from the administration of the relevant local authority. Always dispose of waste in accordance with local, state, and federal regulations.



2-5 Intended Use

The TDL 220 is an advanced handheld system which detects methane gas (CH₄). It adopts Tunable Diode Laser Absorption Spectroscopic (TDLAS) technology, which has high sensitivity and quick response. The device assists users in accurately detecting leaks and their sources to drive preventive maintenance and improve work efficiency.

Environment of use: gas pipeline, oil refineries, chemical plants in petroleum and petrochemical industry, metallurgical industry, power industry among other places that may have gas leakage.

You agree that this product is for civilian use only, and shall not use applications that may infringe the rights of third parties, medical and safety devices or other applications where product failure may lead to life-threatening or personal injury, as well as weapons of mass destruction, chemical and biological weapons, nuclear explosions, unsafe use of nuclear energy, dangerous or humanitarian purposes. Any loss or liability caused therefrom shall be at the your own risk.

2-6 Manual Update

The user manual will be updated from time to time. To access the latest manuals, translations of manuals, and notifications, go to:

<https://infraredcameras.com/product-resources/>

The manufacturer reserves the right to alter the specifications of the product without prior notification. The manufacturer allows himself the right to modify without any preliminary opinion the technical specifications of the product.

2-7 Scope of Application

Infrared Cameras, Inc. issues generic manuals that cover several cameras within a model line.

This means that this manual may contain descriptions and explanations that do not apply to your particular camera model. This manual may contain technical inaccuracies or typographical errors.

2-8 Authoritative Versions

The authoritative version of this publication is English. In the event of divergences due to translation errors, the English text has precedence.

Any late changes are first implemented in English. Other languages may or may not be available.

2-9 Training

Users may benefit from an infrared certification. To read about infrared training and certifications, visit:

<https://infraredtraininginstitute.com/>

3. Safety Information

- Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
- To prevent eye damage and personal injury, do not look into the laser. Do not point the laser directly at people or animals or indirectly off reflective surfaces.
- Do not disassemble or modify the thermal device.
- Do not point the imager (with or without the lens cover) at intensive energy sources, e.g. devices that emit laser radiation, or the sun. This can affect the accuracy of the camera, and cause damage to the detector.
- Do not use the imager in temperatures higher than 50 °C (122 °F) or lower than -15 °C (5 °F). High/low temperatures can cause damage to the device.
- Always charge the battery in the special temperature range. The temperature range to charge the battery is 0 °C to 40 °C (32 °F to 104 °F). Charging the battery at temperatures outside this range can cause the battery to become hot or to explode. It can also decrease the performance or the life cycle of the battery.
- Do not continue to charge the battery if it does not become charged in the specified charging time. If you continue to charge the battery, it can become hot and cause an explosion or ignition. Injury to persons can occur.
- Do not attach the batteries directly to a car's cigarette lighter socket. Using the incorrect equipment can cause the battery to become hot or cause an explosion.
- Only use the correct equipment to discharge the battery. Using the incorrect equipment can decrease the performance or the life cycle of the battery. Using the incorrect equipment can cause the battery to become hot or cause an explosion.
- Do not connect the positive terminal and the negative terminal of the battery to each other with a metal object (such as wire). Damage to the batteries can occur.
- The battery contains safety and protection devices which, if they become damaged, can cause the battery to become hot, or cause an explosion or an ignition.
- Do not put holes in the battery with objects. Damage to the battery may occur.
- Do not hit the battery with a hammer or apply strong impacts or electric shocks to it. Damage to the battery may occur.
- Do not put the battery in or near a fire, stove or other high-temperature locations. Damage or ignition of the battery may occur.
- Do not put the battery in direct sunlight or other high-temperature locations. Damage or ignition of the battery may occur.
- Do not solder directly onto the battery. Damage to the battery may occur.

- Do not get water or salt water on the battery or device or permit the device or battery to get wet. Damage to the battery may occur.
- Remove any water or moisture on the battery before you install it. Damage to the battery may occur.
- If there is a leak from the battery and the fluid gets into the eyes, do not rub the eyes. Flush well with water and immediately get medical care.
- Always dispose of battery in accordance with local, state and federal regulations.
- Do not use the battery if, when used, charged, or placed in storage, there is an unusual smell from the battery, the battery feels hot, changes color, changes shape, or is in an unusual condition. Speak with a sales office if one or more of these problems occurs.
- Clean the case with a damp cloth and a weak soap solution. Do not use abrasives, isopropyl alcohol, or solvents to clean the case or lens/screen.
- Be careful when cleaning the infrared lens. Do not clean the infrared lens too vigorously. This can damage the anti-reflective coating.
- Avoid condensation. Taking the imager from cold to hot will cause condensation in Device. To protect the imager, power on the device and wait until it becomes warm enough for the condensation to evaporate.
- Keep device out of reach of children.
- After the eyepiece is used for long time, its contrast will be lowered, and the scene will be whitened. You can switch to the LCD display, and switch back to the eyepiece some time later.
- Storage: If you do not use the imager for a long period of time, put the device in a cool and dry environment. Batteries should be stored in an ambient temperature of -20 °C to 20 °C (-4 °F to 67.9 °F). Lithium batteries will discharge time and should be fully charged before storage. It is recommended to fully recharge the batteries every 3 months to prevent damage. Store the device in an ambient temperature of -40 °C to 70 °C (-40 °F to 158 °F).

THE ENCAPSULATION RATING IS ONLY APPLICABLE WHEN ALL THE OPENINGS ON THE CAMERA ARE SEALED WITH THEIR CORRECT COVERS, HATCHES, OR CAPS. THIS INCLUDES THE COMPARTMENTS FOR DATA STORAGE, BATTERIES, AND CONNECTORS.

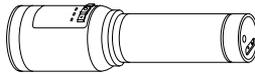
4. Technical Specifications

Target Gas	Methane (CH ₄)
Sensitivity:	5 ppm.m
Measurement Range	0 ppm.m to 100,000 ppm.m
Detection Distance:	20 m (65.6 ft)
Response Time:	T90 < 0.1 seconds
Operation Range	-20 °C to 50 °C (-4 °F to 122 °F)
Storage Range	-20 °C to 60 °C (-4 °F to 140 °F)
Humidity	0 % ~ 99 % relative, non-condensing
Dimensions (without lens)	220 mm x 90 mm x 90 mm (L x W x H ± 0.5 mm) (8.66" x 3.54" x 3.54" (L x W x H ± 0.02"))
Power	DC 3.7V
Battery	Li-ion, rechargeable/replaceable
Operation Time	10 hours
Weight (with battery)	380 g (13.4 oz)
Screen:	Color LCD
Explosion-Proof Grade:	EX ib IIB T4 Gb
IP Rating	IP68
Alarming Method	Visual and audible
Laser	Detection: Class 1 Aiming: Class 3R
Unit Type:	ppm.m, LEL.m, and VOL.m
Bluetooth support	

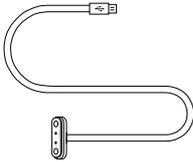
Specifications subject to change without further notice. Models and accessories subject to regional market considerations. License procedures may apply. Products described herein may be subject to US Export Regulations. Please refer to support@infraredcameras.com with any questions.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

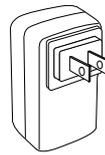
5. Package Includes



TDL 220 Device



Charging Cable

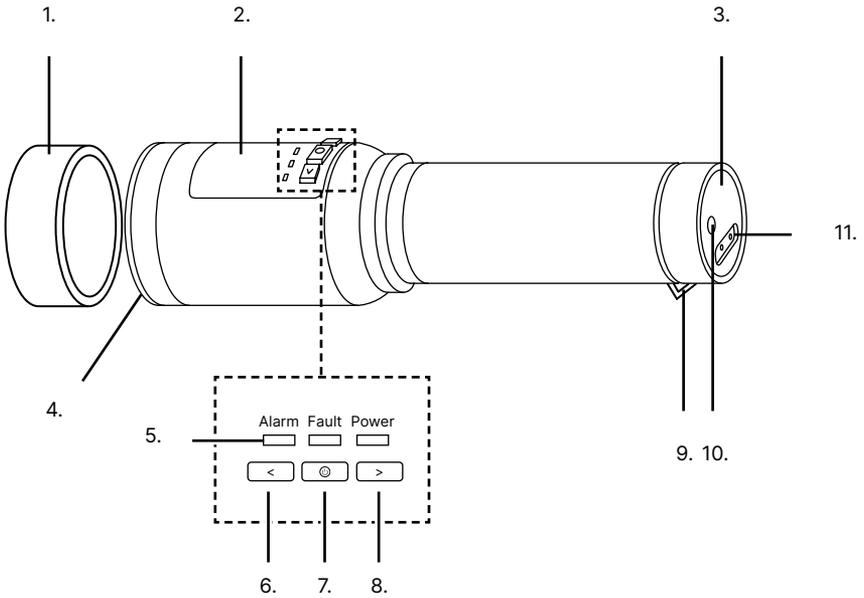


Power Adapter

ENSURE ALL SYSTEM EQUIPMENT AND COMPONENT ITEMS ARE PRESENT BEFORE BEGINNING INSTALLATION

6. Structure

6-1 Appearance and Definitions of Interface



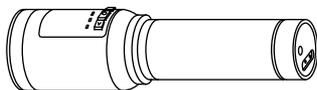
- | | | | |
|----|-----------------|-----|----------------------|
| 1. | Lens Cap | 7. | Power/Standby/Select |
| 2. | LCD Screen | 8. | Right Button (>) |
| 3. | Battery Pack | 9. | Wrist Band Loop |
| 4. | Optical Lens | 10. | Speaker |
| 5. | LED Indicators | 11. | Charge Port |
| 6. | Left Button (<) | | |

7. Quick Start Instructions

7-1 Setup

A.

The camera is used as a handheld device.



B.

Power on device.



TURN ON THE DEVICE BY PRESSING AND HOLDING THE POWER BUTTON UNTIL YOU FEEL THE VIBRATION; THEN, RELEASE THE POWER BUTTON.

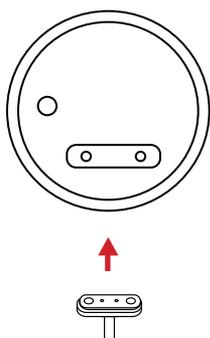
TO POWER OFF THE DEVICE, FIRST DOUBLE-PRESS THE POWER BUTTON TO ENTER STANDBY MODE; THEN, PRESS AND HOLD THE POWER BUTTON FOR 3 SECONDS.

CALIBRATE THE LASER OF THE DEVICE TO ENSURE ACCURATE RESULTS. IT IS RECOMMENDED USERS CALIBRATE THE LASER EVERY 3 MONTHS.

7-2 Charging Instructions

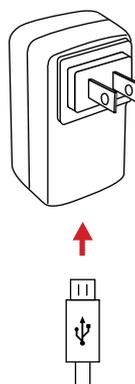
A.

Align the metal prongs of the charging cable with the bottom of the device; then, touch the cable to the device. Magnets will hold the charging cable in place.



B.

Plug the USB end of the charging cable into the bottom of the power adapter.



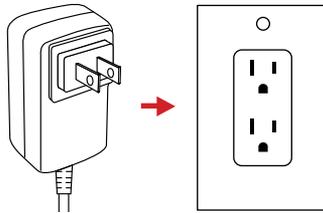
IF THE CHARGING CABLE DOES NOT ATTACH TO THE DEVICE EASILY THE MAGNETS ARE NOT ALIGNED PROPERLY. INVERT THE MAGNET ALIGNMENT AND TRY AGAIN.

WHEN THE CHARGING CABLE IS NOT PLACED ON THE MAGNETIC CHARGING SLOT CORRECTING THE DEVICE WILL NOT CHARGE. THE LIGHT FLASHES RED WHEN THE CABLE IS PLACED CORRECTLY AND THE DEVICE IS CHARGING. WHEN THE BATTERY IS FULLY CHARGED THE LIGHT TURNS GREEN. A BATTERY ICON SHOWS THE LEVEL OF CHARGE ON SCREEN.

CHARGE THE BATTERY FOR A MINIMUM OF 3 HOURS BEFORE USING THE DEVICE.

C.

Plug power adapter into a 110/120V electrical outlet.



ENSURE THE IMAGER IS NEAR ROOM TEMPERATURE BEFORE CHARGING THE DEVICE. DO NOT CHARGE IN EXTREMELY HOT OR COLD AREAS. THE BATTERY CAPACITY MAY BE DECREASED IF CHARGED IN AN EXTREME TEMPERATURE ENVIRONMENT.

IF YOU DO NOT USE THE IMAGER FOR A LONG PERIOD OF TIME, PUT THE DEVICE IN A COOL AND DRY ENVIRONMENT. THE BATTERY WILL DISCHARGE OVER TIME; THEREFORE, THE IMAGER SHOULD BE CHARGED OCCASIONALLY TO PREVENT DAMAGE TO THE BATTERY OR THE DEVICE.

8. Operation Instructions

8-1 How to Charge the Battery

Charge the battery for a minimum of 3 hours before using the imager for the first time. A fully charged device can continuously work for 8 hours. The detector will remind the user to charge the device when the battery level is low.

When charging starts, the battery symbol on the screen and the red indicator light flashes to indicate charging is in progress. If the charging cable fails to connect or if the device is not charging, the battery symbol and indicator light does not power on.

When the power symbol shows full and the green indicator light powers on, the battery is full.

If the device enters a sleep state during charging, press and hold either < or > for 3 seconds; then, the system will awaken.

8-1-1 Charging via Charging Cable

Charging should be performed in a safe, dry environment. Ensure the device is powered off during charging.

1. Align the metal prongs of the charging cable with the bottom of the device; then, touch the cable to the device. Magnets hold the charging cable in place.
2. Plug the USB end of the charging cable into the bottom of the power adapter.
3. Plug the power adapter cord of the battery charging base into a 110v/120V electrical outlet.

WHEN THE CHARGING CABLE IS NOT PLACED ON THE MAGNETIC CHARGING SLOT CORRECTING THE DEVICE WILL NOT CHARGE. THE LIGHT FLASHES RED WHEN THE CABLE IS PLACED CORRECTLY AND THE DEVICE IS CHARGING. WHEN THE BATTERY IS FULLY CHARGED THE LIGHT TURNS GREEN. A BATTERY ICON SHOWS THE LEVEL OF CHARGE ON THE SCREEN.

ENSURE THE IMAGER IS NEAR ROOM TEMPERATURE BEFORE CHARGING THE DEVICE. DO NOT CHARGE IN EXTREMELY HOT OR COLD AREAS. THE BATTERY CAPACITY MAY BE DECREASED IF CHARGED IN AN EXTREME TEMPERATURE ENVIRONMENT.

DO NOT TRY TO REPLACE THE BATTERY PACK. THE REPLACEMENT OF BATTERY PACK SHOULD BE CARRIED OUT BY PROFESSIONAL PERSONNEL.

8-2 Power On/Off the Device

Pressing and hold the power button until the beep is heard; then, release the power button. It takes approximately 50 seconds for the head-up display to load.

To power off the device, first Double-press the power button to enter standby mode; then, press and hold the power button for 3 seconds. Release the power button at the end of the shutdown progress bar.

AFTER POWERING OFF, WAIT TEN SECONDS BEFORE ATTEMPTING TO POWER THE DEVICE ON AGAIN.

THE DEVICE NEEDS SUFFICIENT TIME TO WARM-UP FOR THE MOST ACCURATE MEASUREMENTS. THIS TIME CAN OFTEN VARY BY ENVIRONMENTAL CONDITIONS. IT IS BEST TO WAIT A MINIMUM OF 5 MINUTES FOR THE DEVICE TO COMPLETELY WARM-UP.

8-3 Standby Mode/Detection Mode

The device enters standby mode automatically when it is powered on. While in standby mode the device cannot detect gas concentration levels. Users must switch to detection mode to begin detecting for gas leaks.

Change modes as follows:

1. In standby mode, double-pressing the power button to enter detection mode. Double-pressing the power button again causes the detector to stop detecting and enter standby mode.

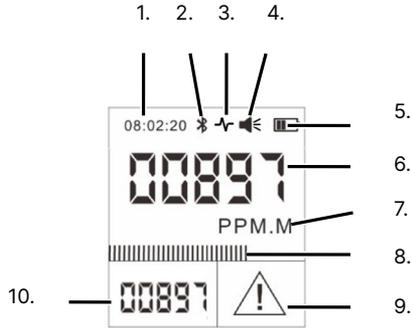
8-4 Sleep Mode

When in standby mode, if the device is unused for a period of time, the device enters sleep mode. Press any button to exit sleep mode. The start-up time takes several seconds. After the device has awoken, double-pressing the power button causes the detector to enter detection mode. Double-press the power button again to re-enter standby mode.

PRESS ANY BUTTON TO EXIT SLEEP MODE. DOUBLE PRESS THE POWER BUTTON TO ENTER DETECTION MODE.

8-5 User Interface

The device interface appearance:



- | | |
|-----------------|--------------------------|
| 1. Time | 6. Gas Concentration |
| 2. Bluetooth | 7. Measurement Unit |
| 3. Laser | 8. Laser Reflection Rate |
| 4. Alarm | 9. Alarm Notification |
| 5. Battery Life | 10. History (Peak Value) |

8-5-1 Threshold Settings

A visual alarm displays on the screen and the red LED indicator powers on when thresholds are either met or exceeded. The initial threshold value of the detector is 100.

Adjust the alarm threshold as follows:

1. In detection mode, press > to open the alarm threshold sub-menu.
2. Press < to lower the threshold; press > to raise the threshold.



8-5-2 Gas Alert Notification

When the gas concentration exceeds the alarm threshold, an audible alarm sounds, the red alarm LED powers on, and an alert icon is displayed on the screen. The gas concentration also shows on the screen in real-time.

If the user presses the power button during an alarm, the device history is deleted.



8-5-3 Fault Alert Notification

A fault alert shows on the screen and the yellow fault LED powers on if the laser reflection ratio is lower than the preset value. Change the angle of measuring distance or move closer to the target to continue detecting.



IF THE USER CONTINUES TO EXPERIENCE FAULT NOTIFICATIONS AFTER CHANGING THE INSPECTION ANGLE THEY SHOULD MOVE CLOSER TO THE TARGET AREA.

IF THE USER CONTINUES TO EXPERIENCE FAULT NOTIFICATIONS MOVING CLOSER TO THE TARGET AREA THEY SHOULD RECALIBRATE THE LASER; SEE SECTION 10-5 LASER CALIBRATION.

8-6 Records

During the detection process, users can press and hold > to save alarm data to the internal record. Users can recover the values as follows:

1. In standby mode, press > to open the records history menu.
2. Press > to view the next page. Press the Power button to delete the records. Press < to return to standby mode.

< Records >		
1	2020.07.01 08:20:32	09876
2	2020.07.01 08:20:10	02595
3		
4		
5		
6		
Back DEL NEXT		

DURING THE DETECTION PROCESS, USERS MUST PRESS AN HOLD > TO ADD A VALUE TO THE INTERNAL RECORD. IF THE USER DOES NOT PRESS AND HOLD > THE VALUE WILL NOT BE ADD TO THE RECORD.

8-7 Settings

8-7-1 Unit Settings

Adjust the system units as follows:

1. In standby mode, press and hold < to open the unit settings menu.
2. Press < or > to change the unit: PPM.M, %LEL.M, or %VOL.M.
3. Press the Power button to save changes close the menu. Pressing the Power button on the current transmittance setting cancels changes and returns the user to standby mode.

8-7-2 Detection Speed

The default speed of the device is 3 with 1 being the fastest. Users can change the speed of detection as follows:

1. In detection mode, press < to open the detection speed menu.
2. Press < or > to change the value.
3. Press the Power button to save changes close the menu. Pressing the Power button on the current transmittance setting cancels changes and returns the user to standby mode.

8-7-3 Peak Settings

Default value is the minimum value of 100. Users can change the value as follows:

1. In standby mode, press and hold > to open the peak settings menu.
2. Press < or > to change the value.
3. Press the Power button to save changes close the menu. Pressing the Power button on the current transmittance setting cancels changes and returns the user to standby mode.

8-7-4 Transmittance

The default transmittance level is 20. Change the transmission level as follows:

1. In standby mode, press < to open the transmittance menu.
2. Press < or > to change the value.
3. Press the Power button to save changes close the menu. Pressing the Power button on the current transmittance setting cancels changes and returns the user to standby mode.

8-7-5 Basenoise

The default basenoise value is 10. Adjusting the value performs environmental interference cancellation.

Change the language as follows:

1. In standby mode, double press < to open the basenoise menu.
2. Press < or > to change the value.
3. Press the Power button to save changes close the menu. Pressing the Power button on the current transmittance setting cancels changes and returns the user to standby mode.

8-7-6 Volume Settings

An audible alarm sounds automatically when thresholds are either met or exceeded. Adjust the alarm volume as follows:

1. In standby mode, press > to open the volume sub-menu.
2. Press < to lower the volume; press > to raise the volume.



8-7-7 Mute

Press and hold the "<" button to switch between the mute and alarm mode. Mute mode automatically disables with re-entering detection mode from standby mode.



8-7-8 Device Information

Access information about the device as follows:

1. In standby mode, double press > to view device information.
2. Press the Power button to close.

9. Introduction to Gas Detection

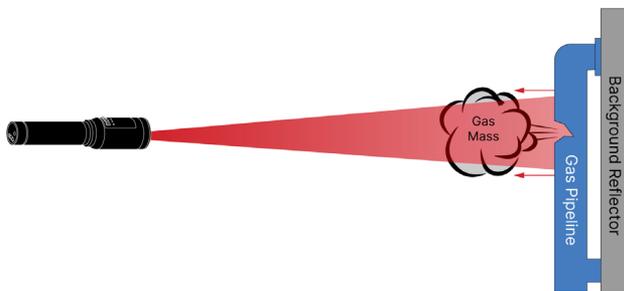
The TDL 220 adopts advanced tunable diode laser absorption spectroscopy (TDLAS) technology combined with digital signal processing (DSP) techniques.

9-1 What is TDLAS & DSP?

TDLAS is a technique used for detecting trace amounts of gas using wavelength scanning and current tuning characteristics to select the specific absorption line of a gas; in the case of the TDL 220, the device is tuned to methane (CH_4). The adopted DSP techniques allow for signal generation to improve anti-interference, stability, and the repeatability of testing.

9-2 Principles of Detection

When the laser from TDL 220 hits the target gas pipeline, part of the laser beam will be absorbed if there is a gas leak. After passing through the gas, the laser beam returns after bouncing off the surface of the earth or a wall behind the gas. The returned light is collected by an optical lens and is received by a highly sensitive detector. Then, the device processes the signals and gives information pertaining to the gas integral concentration between the detector and background reflector.



9-3 Detection Conditions and Factors

9-3-1 Detection Conditions

In order to obtain accurate results 3 conditions must be met:

1. The gas plume concentration and size must be greater than the minimum sensitivity of the device.
2. The detecting laser must pass through the gas mass.
3. The background target (i.e., ground, building, etc.) has to reflect the laser beam back, and the reflection rate must not be less than the requirement of the device.

9-3-2 Factors to Consider

Several factors may affect the concentration and size of a gas mass:

1. Windy weather or high temperatures will lead to a rapid diffusion of gas clouds and decrease the levels of concentration available for detection. Begin gas leak detections in the early morning or late evening on days with low wind speeds to better detect gas leaks.
2. Since the density of methane gas is lower than that of air, it will spread upward and outward after a leak has occurred. This means the gas will be found in lower concentrations the higher and farther away from its source it is detected. Aim directly at known sources of methane, such as pipes, to increase the odds of finding gas leaks quickly. Scan the surrounding areas in a stable "S" pattern to ensure the laser completely scans a the target area.
3. The device relies on background targets (i.e., ground, building, etc.) to reflect the laser beam back to the device, and the reflection rate must not be less than the requirement of the device. If there is not an available target reflector, device operators can miss gas leaks. Users may be required to move to a new position or change the angle of the device to assist in gas leak detection.
4. The TDL 220 can detect leaks from up to 150 meters. However, as the scanning distance is increased the laser light level returned to the device will decrease as well. Inspectors should ensure they are close to the target area to get the best results. Changing the angle of the device may also help.
5. Obstructions in the landscape can cause dark zones where the laser is unable to scan. Users may be required to move to a new position or change the angle of the device to complete an inspection.
6. Strong reflective surfaces, e.g. stainless steel, glass, polished surfaces, etc., may trigger a false alarm. Users should ensure they scan a target area from multiple angles.
7. Underground leaks are harder to detect. Drilling or digging may be required to find the exact source of a methane leak.

The operator should take the above factors into account when inspecting to get accurate picture of potential gas leaks.

WINDY WEATHER, HIGH TEMPERATURES, DENSITY, AND OBSTRUCTIONS IN THE ENVIRONMENT ARE JUST A FEW FACTORS TO CONSIDER WHEN INSPECTING FOR GAS LEAKS. USERS MAY BE REQUIRED TO MOVE TO A NEW POSITION CLOSER TO THE TARGET AREA OR CHANGE THE ANGLE OF THE DEVICE TO COMPLETE AN INSPECTION. USERS SHOULD SCAN TARGET AREAS FROM MORE THAN ONE LOCATION TO GET AN ACCURATE PICTURE OF POTENTIAL GAS LEAKS.

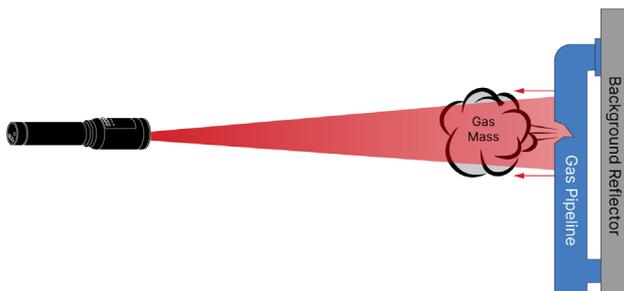
THE TDL 220 CAN DETECT GAS LEAKS UP TO 150 METERS AWAY. HOWEVER, IT IS BEST TO BE WITHIN 30 METERS OF THE TARGET AREA IN ORDER TO QUICKLY PINPOINT GAS LEAKS.

9-4 How to Perform an Inspection

Users should ensure the device is fully charged before beginning inspections. The laser must bounce off a surface and return to the device in order for a reading to appear on the screen. If the laser does not bounce against a surface, meaning the laser continues on and no reading shows on the device.

9-4-1 Above Ground Pipelines

1. Power on the TDL 220; then, double-press the power button to enter detection mode. Gas leaks cannot be found while in standby mode.
2. Sweep the detector in a stable “S” pattern to ensure the laser completely scans the target area and shines off a reflector surface, e.g. pipe, wall, etc., and returns to the device
 - When there is an alarm, the operator should scan the target area in a back-and-forth manner. An alarm on every sweep is a sure sign of a gas leak.
 - When a leak has been detected, the detected methane concentration is displayed on the LCD screen of the device. Pass over the area multiple times to find where the volume is largest.



SINCE THE DETECTING LASER IS INVISIBLE, THE INSTRUMENT IS EQUIPPED WITH AN AIMING LASER, WHICH IS PARALLEL TO THE DETECTING LASER. DURING INSPECTIONS, TRY TO KEEP THE AIMING LASER 30 MM TO THE LEFT OF THE OBJECT BEING MEASURED.

THE TDL 220 CAN DETECT GAS LEAKS UP TO 150 METERS AWAY. HOWEVER, IT IS BEST TO BE WITHIN 30 METERS OF THE TARGET AREA IN ORDER TO QUICKLY PINPOINT GAS LEAKS.

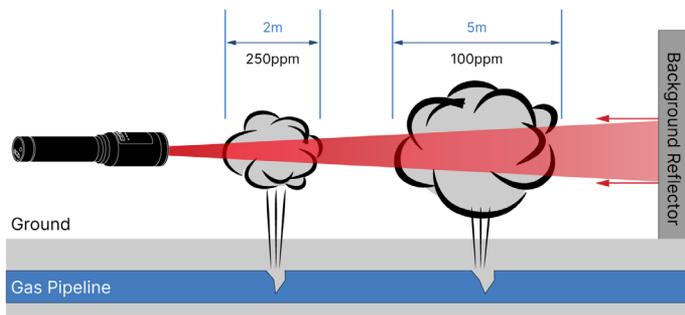
WINDY WEATHER, HIGH TEMPERATURES, DENSITY, AND OBSTRUCTIONS IN THE ENVIRONMENT ARE JUST A FEW FACTORS TO CONSIDER WHEN INSPECTING FOR GAS LEAKS. USERS MAY BE REQUIRED TO MOVE TO A NEW POSITION CLOSER TO THE TARGET AREA OR CHANGE THE ANGLE OF THE DEVICE TO COMPLETE AN INSPECTION. USERS SHOULD SCAN TARGET AREAS FROM MORE THAN ONE LOCATION TO GET AN ACCURATE PICTURE OF POTENTIAL GAS LEAKS.

9-4-2 Under Ground Pipelines

9-4-2-1 Background Reflector Method

For this method, users rely on bouncing the laser off a background such as a wall or facility structure. This method is particularly useful if the user is not sure exactly where the pipeline is buried.

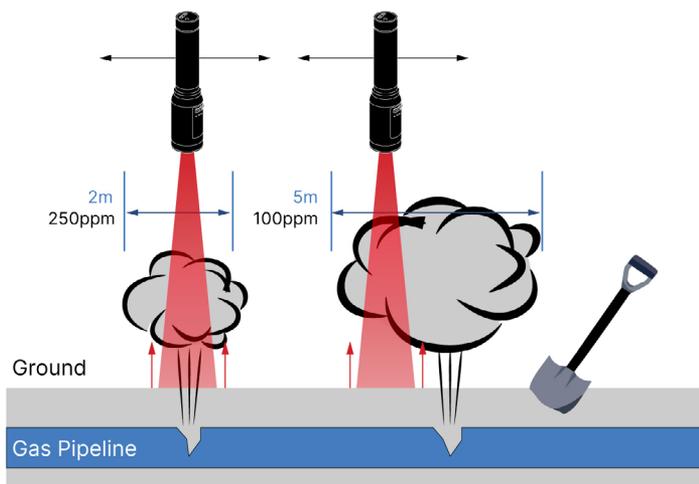
1. Power on the TDL 220; then, double-press the power button to enter detection mode. Gas leaks cannot be found while in standby mode.
2. Walking area of the buried pipeline, sweep the detector horizontal to the ground to ensure the laser completely scans the target area, shines off a reflector surface, e.g. a wall, etc., and returns to the device.
 - When there is an alarm, the operator should scan the target ground area in a back-and-forth manner using the method mentioned in Section 9-4-2-2 Ground Method. An alarm on every sweep is a sure sign of a gas leak.
 - When a leak has been detected, the detected methane concentration displays on the LCD screen of the device. Pass over the area multiple times to find where the volume is largest.
 - The gas leak should be located in the place where the gas volume is the highest. Drilling or digging may be required to find the exact source of a methane leak.



9-4-2-2 Ground Method

For this method, users rely on bouncing the laser off the ground. This method is particularly useful if the user knows exactly where the pipeline is buried.

1. Power on the TDL 220; then, double-press the power button to enter detection mode. Gas leaks cannot be found while in standby mode.
2. Walking area of the buried pipeline, sweep the detector perpendicular to the ground to ensure the laser completely scans the target area, bounces off ground, and returns to the device.
 - When there is an alarm, the operator should scan the target ground area in a back-and-forth manner. An alarm on every sweep is a sure sign of a gas leak.
 - When a leak has been detected, the detected methane concentration displays on the LCD screen of the device. Pass over the area multiple times to find where the volume is largest.
 - The gas leak should be located in the place where the gas volume is the highest. Drilling or digging may be required to find the exact source of a methane leak.



WINDY WEATHER, HIGH TEMPERATURES, DENSITY, AND OBSTRUCTIONS IN THE ENVIRONMENT ARE JUST A FEW FACTORS TO CONSIDER WHEN INSPECTING FOR GAS LEAKS. USERS MAY BE REQUIRED TO MOVE TO A NEW POSITION CLOSER TO THE TARGET AREA OR CHANGE THE ANGLE OF THE DEVICE TO COMPLETE AN INSPECTION. USERS SHOULD SCAN TARGET AREAS FROM MORE THAN ONE LOCATION TO GET AN ACCURATE PICTURE OF POTENTIAL GAS LEAKS.

9-5 Glossary of Terms

Below are common terms used in gas leak detection.

Detecting laser: the laser beam sent by the device for detecting the gas leaks; the detecting beam is invisible.

Aiming laser: the visible laser beam sent by the device to assist the user in aiming at the target.

Scanning distance: the longest working distance of the device

Reflection fault: a fault caused by the device being unable to receive enough returned light; faults are usually caused by the reflective rate of the background reflector, scanning distance, ambient environment, etc.

TDLAS technology: an advanced technique of gas detection that adopts laser wavelength scanning and current tuning characteristics.

Integral concentration: methane column integral concentration (ppm.m) is equal to the methane concentration (ppm) multiplied by the gas plume thickness.

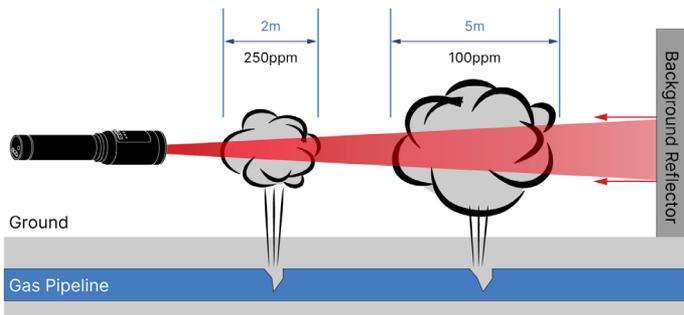
The traditional measurement of gas detection is the unit ppm or %LEL.

The TDL 220 measures the integral gas concentration along the "effective path of light transmission", between the detector and the target reflector. As such, the unit of the device is different than a traditional methane gas detector. The unit used is the average concentration of PPM * m or ppm.m; the units lel.m and vol.m are also available..

METHANE COLUMN INTEGRAL CONCENTRATION (PPM.M) = METHANE CONCENTRATION (PPM) X GAS PLUME THICKNESS.

The following describes a 5 m deep at 100 ppm gas plume:

A gas plume of 2 m deep at 250 PPM appears in the path between the TDL 220 and the working beam of the background reflector is equal to that of 100 ppm * 5m = 250 ppm * 2m = 500 ppm.m.



10 Cleaning and Maintenance

10-1 Cleaning the Germanium Lens

Do not use corrosive chemicals on the device. If dirt is found, please use the following methods:

1. Clean outer surfaces with a clean, soft cotton or microfiber cloth.
2. Use a blown balloon, dust blower, or a soft brush to clean loose particles from the lens surface; then use medical gauze or equivalent non-abrasive lens tissue with a small amount of rubbing alcohol. Gently wipe the lens surface from the middle to the edge, paying attention to not scratch the lens. Avoid using too much liquid. If the lens is still not clean, replace the cloth and repeat the wiping process.

DO NOT USE CORROSIVE CLEANING SOLUTIONS ON THE OPTICAL GLASS COMPONENTS. DISINFECT THE CAMERA SURFACE REGULARLY WITH A NON-CORROSIVE SANITIZING PRODUCT.

10-2 Disinfecting the Camera Surface

Do not use corrosive cleaning solutions on the optical glass components. It is recommended to disinfect the camera surface regularly with a non-corrosive sanitizing product. Follow the directions provided by the manufacturer of the cleaning solution. Adhere to the sanitation protocols and cleaning schedule set forth by the employer.

10-3 Device Calibration

Laser wavelength drift is a normal characteristic of the device. In order to keep the detector operating with a high sensitivity, it is recommended to re-calibrate the wavelength every 3 months.

Calibration instructions are in Section 10-5 Laser Calibration

CALIBRATE THE LASER OF THE DEVICE TO ENSURE ACCURATE RESULTS. IT IS RECOMMENDED USERS CALIBRATE THE LASER EVERY 3 MONTHS.

10-4 Storage

When the equipment is not in use, the device should be placed in a dust-free and moisture-free environment with a stable temperature and humidity.

10-5 Laser Calibration

To ensure the normal operation and high sensitivity of the detector, the device is equipped with a calibration gas chamber for laser wavelength calibration. It is recommended that users calibrate their device every 3 months.

The calibration steps are as follows:

1. Ensure the device is fully charged.
2. In standby mode, press and hold < and > simultaneously; then, release to start calibration. When calibration starts, the user sees "Calibration" on the screen. The process can take up to ~3 minutes. If the calibration is successful, "Calib Successful" shows on the screen and the device automatically returns to the standby mode. If the calibration fails, the user needs to re-calibrate the device until the calibration is successful. Pressing buttons during calibration may cancel the calibration process; if this occurs, the user needs to restart the calibration until the operation is successful.
3. From standby mode, power off the device.
4. Power on the device to finish calibration. Regular detection can now begin.

Laser wavelength drift is a normal characteristic. In general, the drift will not affect the sensitivity of the measurement. Regardless, it is recommended that users calibrate their device every 3 months.

PRESSING BUTTONS DURING THE CALIBRATION PROCESS MAY CANCEL THE CALIBRATION PROCESS. THE USER NEEDS TO RESTART THE CALIBRATION UNTIL THE CALIBRATION OPERATION IS SUCCESSFUL. "CALIB SUCCESSFUL SHOWS ON THE SCREEN WHEN THE CALIBRATION IS SUCCESSFUL.

THE CALIBRATION PROCESS CAN TAKE UP TO 3 MINUTES TO COMPLETE.

RESTART THE DEVICE AFTER THE DEVICE PERFORMS A SUCCESSFUL CALIBRATION. FAILING TO RESTART THE DEVICE MAY LEAD TO FURTHER WAVELENGTH DRIFT AND CAUSE SENSITIVITY ISSUES.

IT IS RECOMMENDED THAT USERS CALIBRATE THE LASER EVERY 3 MONTHS.

CALIBRATION MAY FAIL ON THE FIRST TRY. RE-CALIBRATE THE DEVICE UNTIL THE CALIBRATION IS SUCCESSFUL. THE USER WILL KNOW THE CALIBRATION IS SUCCESSFUL WHEN THE DEVICE RETURNS TO THE MAIN MENU AFTER CALIBRATION IS COMPLETE.

11 Troubleshooting

If the user encounters any problems while using the device, refer to the following options. If the problem persists, disconnect the power and contact the customer support department.

11-1 Device Does Not Power On

- Charge battery

11-2 Device Shuts Off Unexpectedly

- Charge battery

11-3 No Readings

- Open the lens cap
- If lens is foggy, use professional equipment to clean the lens

11-4 Reflection Fault

11-4-1 Target Beyond Range

- Move closer to the target
- Change the measuring angle
- If lens is foggy, use professional equipment to clean the lens

11-4-2 Low Reflectivity of the Background

- Move closer to the target
- Change the reflecting background
- Change the measuring angle
- If lens is foggy, use professional equipment to clean the lens

11-4-3 Dirty Optical Lens

- If lens is foggy, use professional equipment to clean the lens

11-5 System Fault

11-5-1 Laser Wavelength Drift

- Reboot the device
- Calibrate the wavelength
- Contact customer service

11-5-2 Low Battery

- Charge battery

11-6 Continuous Alarming without Gas Leak

11-6-1 Low alarming level

- Adjust alarming level
- Calibrate the wavelength

11-6-2 Scanning too Fast

- Slow down the scanning process

11-6-3 Target Beyond Range

- Move closer to the target

11-6-4 Excess Background Reflectivity

- Change the reflecting background
- Change the measuring angle

11-7 No Alarm in Presence of Gas Leak**11-7-1 Laser Wavelength Drift**

- Reboot the device
- Calibrate the wavelength
- Contact customer service

11-7-2 Laser Not Passing Through Gas

- Align the aiming laser and the laser sight
- Move to a better position
- Change the measuring angle

11-8 Charging Indicator Light**11-8-1 Loose charger contact**

- Align the magnetic charger properly
- Reboot the charger

11-8-2 Charger Fault

- Reboot the charger
- Contact customer support

12 About ICI

ICI manufactures complete systems and software. We can provide complete engineering, software, and OEM solutions. Our Fortune 500 clients rely on us for infrared equipment and thermography training (which we offer through the Infrared Training Institute).

In addition to providing custom germanium, silica, and sapphire optics, we also build windows for enclosures, as well as custom pan and tilt units. We can even provide customizable explosion-proof systems.

Our knowledge and experience stems from years of using infrared imaging and temperature measurement instruments to provide solutions to: managers, engineers, scientists, inspectors and operators in space, power companies, medical, pulp and paper, food industry, research and development, and various process industries. You can see our products and services used in industrial, commercial, and government applications worldwide. Additionally, our ICI 7320 was awarded "Product of the Month" by NASA*. Originally named Texas Infrared (still DBA), Infrared Cameras, Inc. has been in business since March, 1995.

Thank you for your dedicated and continued support.

Infrared Cameras, Inc.
2105 W. Cardinal Dr.
Beaumont, TX 77705

Phone: (409) 861-0788
Toll Free: (866) 861-0788
International: (409) 861-0788

Customer Support: support@infraredcameras.com
Website: www.infraredcameras.com

You may reach a customer care representative by phone or email during regular business hours: Monday – Friday 8:00AM - 5:00PM CST.

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