



# LR16

## Long-Range Fire Detector

### User and Installation Manual



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## Release History

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|          |                 |                  |

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# 1 Product Overview

Optect's LR16 is a range enhanced IR3 flame detector for hydrocarbon flames in both indoor and outdoor environments. It functions either as a stand-alone alert unit or as part of an integrated system, such as one that includes fire suppression elements. Its versatile connectivity options make it adaptable for various deployment scenarios. Key performance attributes include:

- **Enhanced sensitivity**

The LR16 combines optics with IR3 technology to enhance the sensitivity of detection. This translates to an increased range and/or an enhanced ability to detect smaller fires or partially obscured flames.

- **Long-range detection and a large coverage area**

The LR16 integrates two detection modules: one with a 16-degree enhanced sensitivity (and range) FoV for detecting fires at its maximum range and another with a standard 90-degree Field of View (FoV) for broader coverage close to the device. This enables extensive areas to be monitored with a low number of devices.

- **High Reliability**

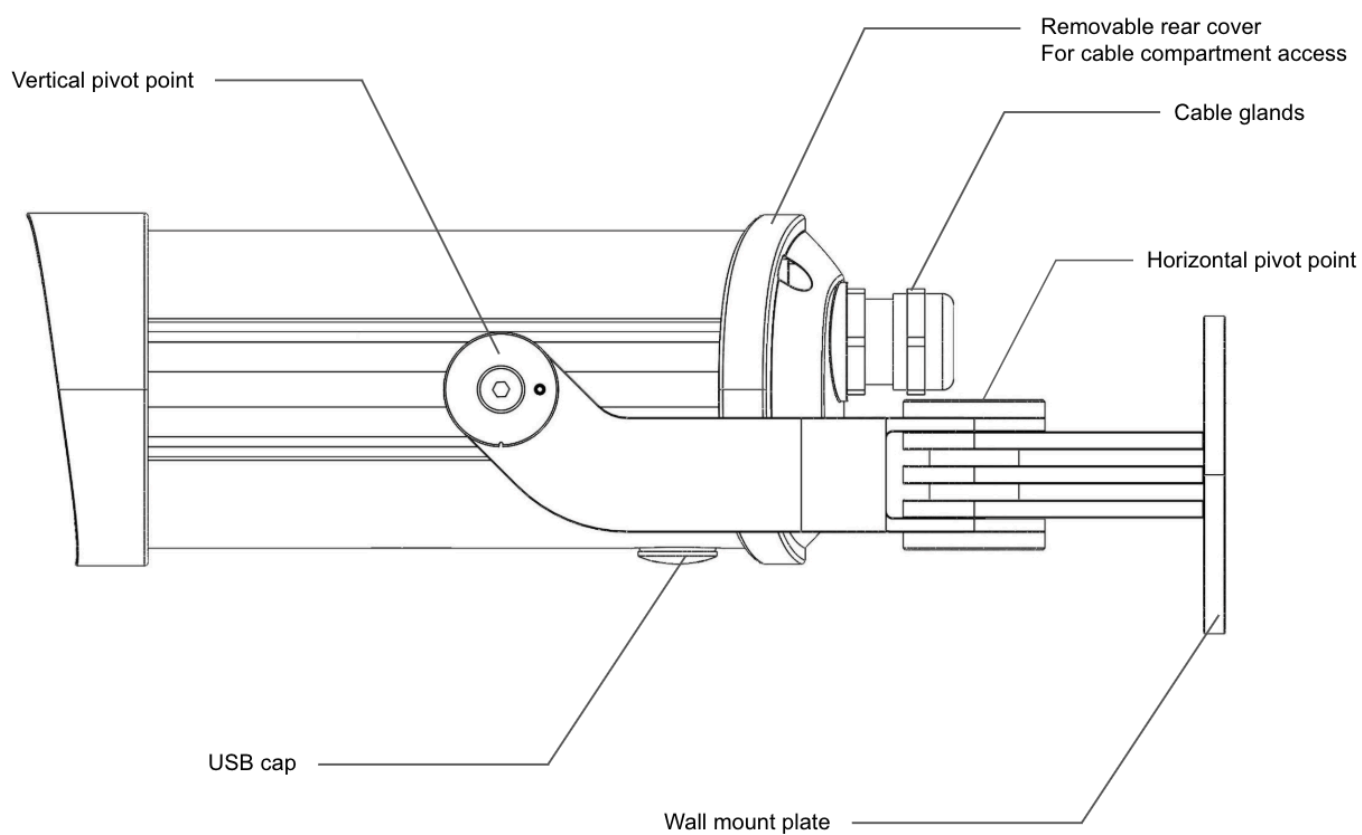
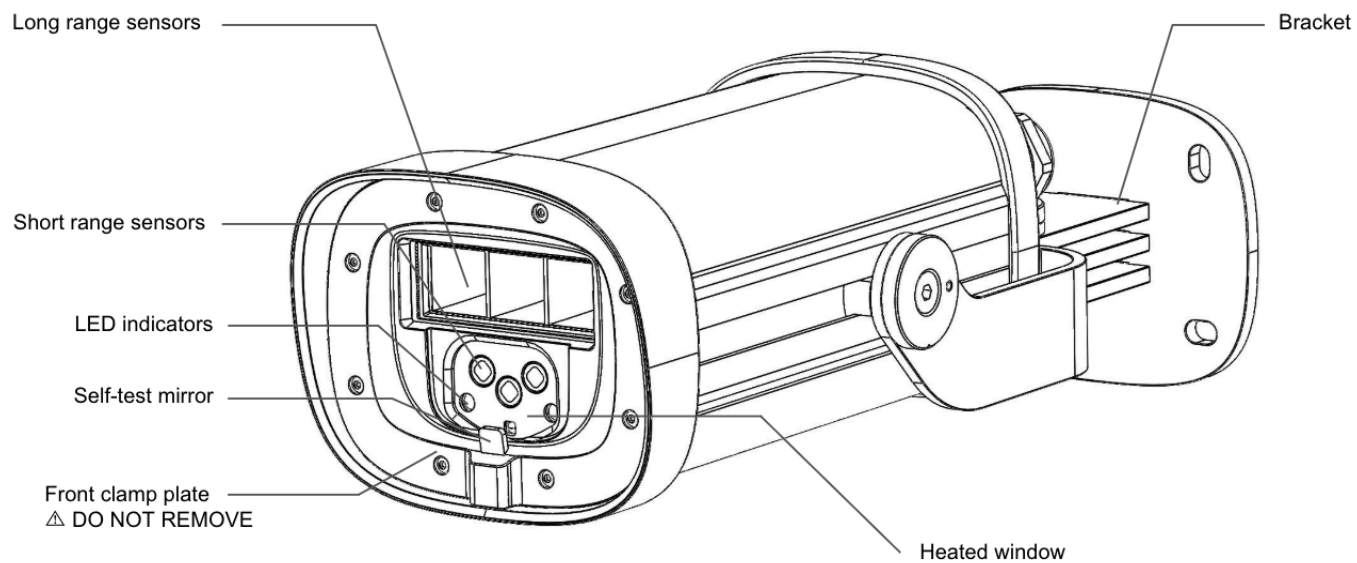
The LR16 employs the reliable and proven IR3 flame detection method. Three wavelengths of light are analysed: one for active flame identification and two for distinguishing the signal from other light sources. Optect has deployed advanced false alarm suppression techniques that enhance the inherent robustness of IR3 technology. These innovations significantly reduce the chances of false alerts, enhancing the detector's dependability.

- **Rapid detection**

The LR16 is able to identify fires in under 5 seconds.

Other features and benefits include:

- **Heated window** to prevent the effects of snow, ice and condensation
- **Built-In-Self Test** to alert operators when the device stops working or requires maintenance
- **Field programmable sensitivity settings** to avoid zone crossover and reduce sensitivity to non-dangerous fire sources
- **Multiple connection options** enabling use in various applications



## 2 Example Applications (A-Z)

|                                    |                                  |
|------------------------------------|----------------------------------|
| Aircraft Hangars                   | Oil and gas pipelines            |
| Atriums                            | Parking                          |
| Battery installations              | Powerlines                       |
| Chemical, fuel and solvent storage | Rail and Truck Terminals         |
| Conveyor belts                     | Recycling plants                 |
| Electric power transformers        | Refineries                       |
| Home protection from wildfires     | Service stations                 |
| Hydrocarbon storage                | Warehouses                       |
| Monitoring of machinery            | Wildfire spotting fire detection |

## 3 Installation

Please read this entire installation section before commencing installation. Not following these guidelines may void the warranty and cause the LR16 to be less reliable.

Installation must follow local rules and standards that are specific to flame detectors such as NFPA 72, where applicable. Seeking advice from a safety engineer is recommended.

### 3.1 Preparing for Installation

Prior to installation:

- Check that you have received the correct order.
- Check that you have the necessary components and tools to install the detector (see [3.2 Components and Tools](#)).
- Check that the external casing of the flame detector is intact. If damaged, immediately contact the local distributor.

#### 3.1.1 Selecting settings

The LR16 can be customised with site-specific settings either prior to or after installation, provided the USB port is accessible. Settings are adjustable via Optect's device user interface software, which can be run on any Windows computer. While the default settings are designed to accommodate a variety of scenarios, it is advisable to confirm their suitability for the specific installation. In particular, the interface options and sensitivity settings may require adjustment. To evaluate the appropriate sensitivity level, the following factors should be considered:

- Size of the fire to be detected at the target detection distance
- Types of combustible materials present
- Potential sources of false positives

#### 3.1.2 Wire selection

- The wire gauge must be selected based on the distance from the detector to the controller and the number of detectors on the same circuit. Refer to the Wiring Instructions in section [3.4 Wiring](#).
- To adhere to EMC directives and protect against RFI and EMI interference, ensure the cable to the detector is shielded and that the detector is grounded. The shield should be grounded at the detector end.

- If armored or shielded cables are used consider the use of cable glands specialized for this cable type. Cable glands must be IP68 rated to maintain the IP68 rating on the detector installation.

### 3.1.3 Determining detector spacing and locations

The placement and number of detectors in the protected area depend on:

- The size of the area to be protected.
- The sensitivity setting of the detectors.
- Any obstructions in the line of sight.
- The detector's field of view.
- Target size of fires at time of detection.
- Fuel type of fires to be detected.

### 3.1.4 Environment

- Factors like dust, snow, or rain can decrease the detector's sensitivity and increase the need for maintenance.
- Modulated or flickering high-intensity infrared sources may impact sensitivity.
- During installation, it's crucial to implement appropriate measures to prevent moisture from coming into contact with the device's electrical connections or components especially when the device is opened by removing the rear cover or unscrewing the USB cap. Maintaining the integrity of the device's moisture protection is essential for its proper functioning and falls under the responsibility of the installer. This includes properly tightening the rear cover bolts, cable glands, and USB cap, as well as selecting an appropriate combination of cables and glands.

### 3.1.5 Detector Positioning and Orientation

- Aim the detector toward the detection area, ensuring an unobstructed view of the area to be protected. The two detection modules cannot be aimed independently. Typically the alignment of the detector is determined by the long-range (16 degree FoV) module whilst the other module provides coverage for areas closer to the detector around it.
- Locate and position the detector so that the area being monitored is within the field of view and range of the device.
- The surface that the detector is mounted on should be a hard surface that is free from vibrations. The surface must be suitable for the mounting material

used and be able to support the weight of the detector and the bracket (see Section [8.4 Mechanical Specifications](#)).

- The detector should be positioned so that it has a clear line of sight to the area being monitored.
- It is recommended to install the detector at height (e.g. 3 meters) to minimise obstructions from furniture, machinery, or vehicles and to reduce the likelihood of human interference. It is good practice to mount the detector at twice the height of the highest object in the area being monitored. Obstructions may increase the detection time.
- It is recommended to install the device with minimal roll to ensure proper functionality. This is especially important for outdoor installations relying on the cowling for dust and water protection.
- The detector should be positioned at a downwards angle to prevent the buildup of dirt and dust on the detector window and maintain a well-defined field of view.
- Ensure all potential factors affecting detection location have been considered before beginning installation.
- The detector should be mounted in a place where it can be easily accessed for servicing and maintenance.
- Avoid mounting the flame detector near areas where there are radiant heat sources. The LR16 should not have a direct view of a friendly fire source.
- Aim to position the detector as far away as possible from sources of electromagnetic interference.

### 3.2 Components and Tools

Ensure that all necessary components and tools are readily available before beginning the installation of the flame detector to complete the process in one session. If the installation is interrupted, seal, secure, and cover the detector and cable entries.

The following components are required.

| Component                                                      | Size            | Quantity | Function           |
|----------------------------------------------------------------|-----------------|----------|--------------------|
| Glands* (It is recommended that spares are readily available). | M16 / M25 x 1.5 | 1-2      | Sealed cable entry |

\* Other glands with the same threading (M16 or M25 depending on the rear cover) can be used instead of the complementary glands included with devices. Cable glands must be

IP68 rated to maintain the IP68 rating on the detector installation.

|                              |           |              |                                                                                   |
|------------------------------|-----------|--------------|-----------------------------------------------------------------------------------|
| Blind Plug                   | M16 / M25 | 0-1          | Seal unused cable entry point                                                     |
| Bracket with nuts and screws |           | 1 (included) | Method of fixing the device in place                                              |
| Mounting supplies            | Various   | 1            | Means of attaching the Bracket to its installation point (such as a wall or pole) |

The following general purpose tools are required for installation.

| Tool                                  | Size                                       | Quantity | Function                                                                 |
|---------------------------------------|--------------------------------------------|----------|--------------------------------------------------------------------------|
| Allen key                             | 3 mm                                       | 1        | To attach the rear cover to the main body                                |
| Allen key                             | 4 mm                                       | 1        | To tighten screws on the bracket                                         |
| Allen key                             | 1.5 mm                                     | 1        | To adjust the grub nut on the bracket washers                            |
| Spanner<br>(for Lapp glands provided) | 21mm for M16 glands<br>30mm for M25 glands | 1        | To tighten glands in rear cover and tighten the glands around the cables |
| Electrician's screwdriver             | Small flat head / slotted                  | 1        | To attach wires to termination plugs                                     |

### 3.3 Opening the detector and preparing the glands

Using a 3 mm Allen key, unscrew the four screws on the rear cover and remove it from the main body. Thread the glands into the holes in the rear cover and tighten them with a spanner. Rear covers are provided with either 2 x M16 threaded holes or 2 x M25 threaded holes. If only one gland is used, a blind plug (not included) may be required to seal the remaining gland opening.

**⚠ CAUTION: The sensor module located in the front of the device contains no serviceable parts and should not be opened under any circumstance. Doing so will void the device warranty.**

## 3.4 Wiring

### CAUTIONS:

- The LR16 is designed for use with low voltage DC power supplies. Use a 12 V or 24 V power supply. 24 V is recommended for long cable runs due to voltage drop. **⚠ CAUTION: DO NOT CONNECT DIRECTLY TO MAINS POWER!**
- Installation and wiring must be done by qualified personnel only.
- To comply with EMC regulations, it's vital to ensure the electrical installation is performed in accordance with this manual and relevant regulations.

### 3.4.1 Wiring type and size:

- Wiring type/ size should be compliant with NFPA 72 requirements and/or local wiring codes and requirements such as FM 3260 requirements (where applicable), EN 54 and associated national implementations within the EU or applicable Canadian electrical and fire alarm codes.
- The choice of wire size should depend on the quantity of connected detectors, the supply voltage, and the length of the cable.
- It is recommended to use shielded cable to safeguard against interference from EMI (Electromagnetic Interference) and RFI (Radio Frequency Interference).

### 3.4.2 Connecting the detector

1. Ensure there is no power going through the cable
2. Feed the cable(s) through the gland(s), leaving sufficient length inside the device to attach the termination plugs.
3. Attach the cables to the termination plugs<sup>1</sup>. The device has:
  - a. a 9 pin connector for relays,
  - b. a 3 pin connector for power supply including grounding,
  - c. a 5 pin connector for RS485 / RS422 and
  - d. a 2 pin connector for 4-20mA.

---

<sup>1</sup> Each connector has a male and female counterpart. The female counterpart can be detached for cable attachment.

See diagram below

4. Plug the female termination plugs to their male counterparts on the termination board.
5. Ground the detector at the nearest grounding point within 3 metres of its location.
6. Leave sufficient cable within the rear cover to make it easy to remove it again in the future.
7. Tighten the cable glands around the cables. Replace the rear cover and tighten the screws in a diagonal pattern ensuring the rear cover is fully sealed against the main body of the device.

Diagram showing termination plugs:



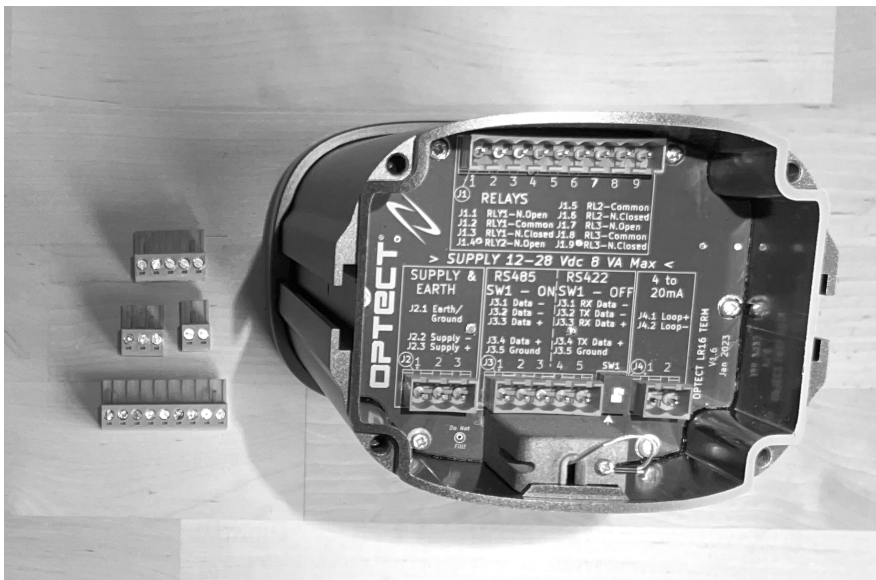
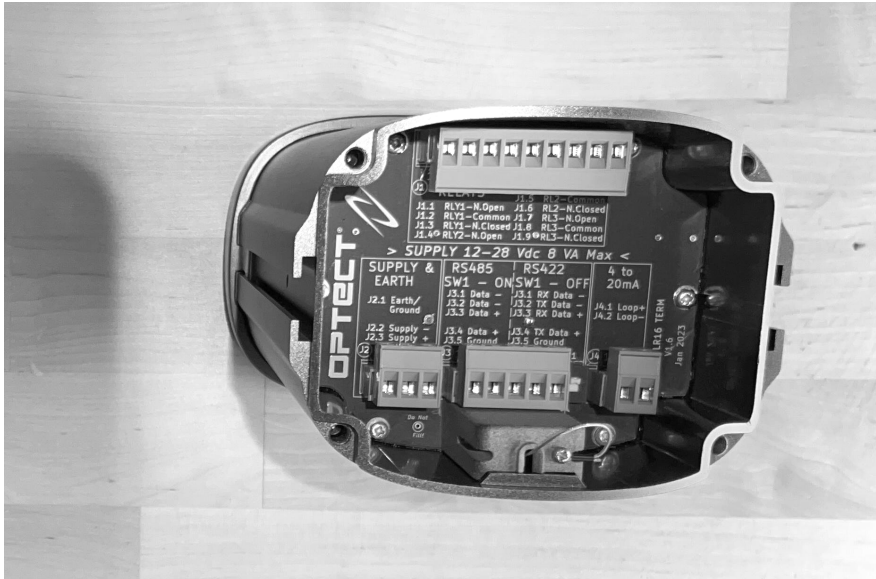
**⚠ WARNING**

**Do NOT connect this device directly to AC power.**

This device is designed to operate only with a specified low-voltage DC source. Direct connection to AC mains (110V/220V) may cause severe damage, electric shock, or fire hazard.

| Power Supply                           | Relays                                                                                                                                 |  |  | 4 - 20 mA        | RS485/422                                               |                                                                     |
|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|--|--|------------------|---------------------------------------------------------|---------------------------------------------------------------------|
| J2.1<br>J2.2<br>J2.3                   | J1.9<br>J1.8<br>J1.7<br>J1.6<br>J1.5<br>J1.4<br>J1.3<br>J1.2<br>J1.1                                                                   |  |  | J4.1<br>J4.2     | J3.1<br>J3.2<br>J3.3<br>J3.4<br>J3.5                    | J3.1<br>J3.2<br>J3.3<br>J3.4<br>J3.5                                |
|                                        |                                                                                                                                        |  |  |                  |                                                         |                                                                     |
| Earth / Ground<br>Supply -<br>Supply + | Normally Open<br>Common<br>Normally Closed<br>Normally Open<br>Common<br>Normally Closed<br>Normally Open<br>Common<br>Normally Closed |  |  | Loop +<br>Loop - | Data -<br>Data -<br>Data +<br>Data +<br>Ground<br>RS485 | RX Data -<br>TX Data -<br>RX Data +<br>TX Data +<br>Ground<br>RS422 |
| DC only                                | ③<br>②<br>①                                                                                                                            |  |  |                  | MODBUS                                                  |                                                                     |

Images of the rear termination board in Optect's LR16 and the termination plugs, detached and attached:

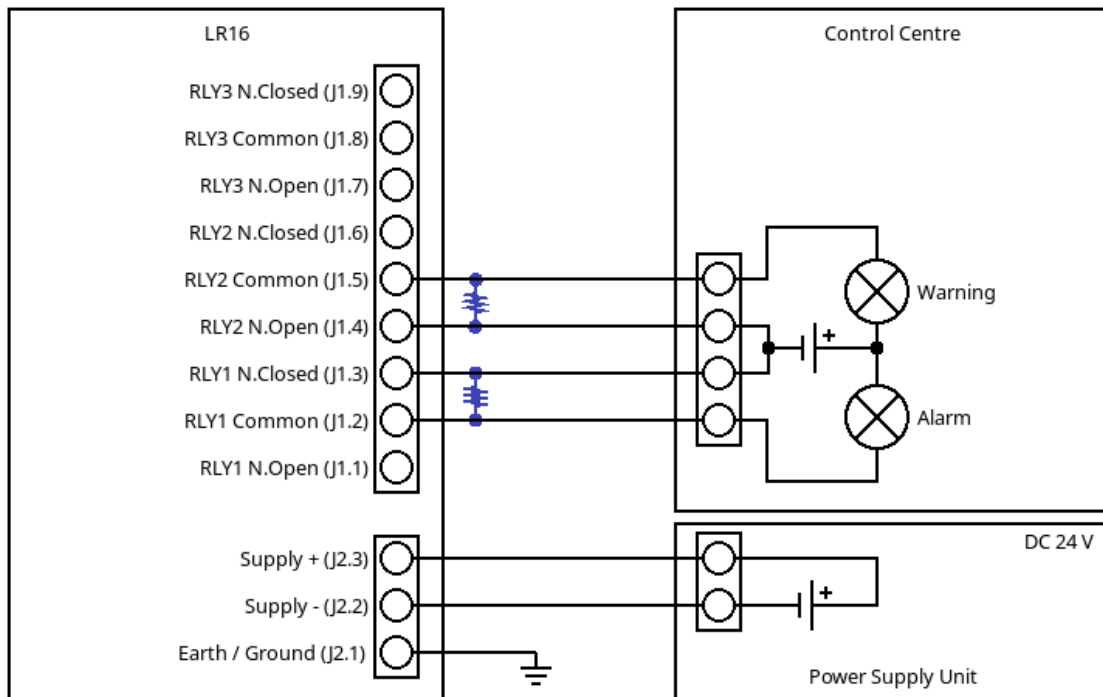


### 3.4.3 Connecting via relays

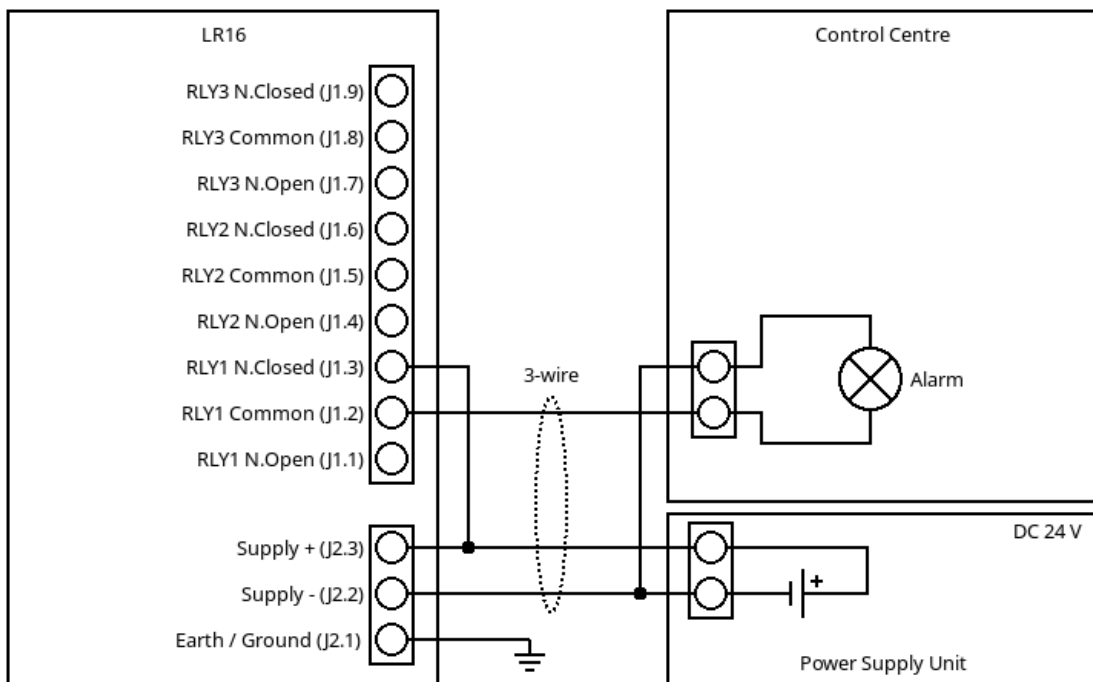
The device includes three relays (voltage free contacts) that can be configured using the LR16 Control Interface software. Each relay can be assigned a function and a mode. The function determines what signal it outputs and the mode determines whether it is normally non-energized or normally energized. The common contact as well as both the normally open and normally closed contacts of all three relays are exposed.

In the default configuration the first relay acts as an alarm relay signalling if there is a fire detected on either the long-range module or the short-range module. The second relay acts as a warning relay and signals if a trouble signal is present on the device.

The following wiring diagram shows a configuration with separate lines for alarm and trouble signals. In this configuration it is possible to use end of line resistors to allow the control center to verify the integrity of the lines at all times (blue in diagram).



It is possible to use the same voltage that supplies the LR16 for signalling via the relays thus reducing the number of wires required. Please ensure that the configuration you choose provides sufficient protection against failure modes such as broken power supplies or cables and is compatible with the control center in use.



The above examples use the normally closed contact of a relay configured to be normally energized as an alarm signal. This prevents silent failure due to power loss of the device, as on power loss the alarm connection will be closed. If the normally open contact were used instead to transmit a NO-Alarm signal it would protect against silent failure on interruption of the cable as well as the interruption of the

cable would interrupt the signal leading to an alarm state for the control central. If a warning signal is used as well the same functionality can be implemented there such that a loss of power or connection leads to a trouble state instead of an alarm state.

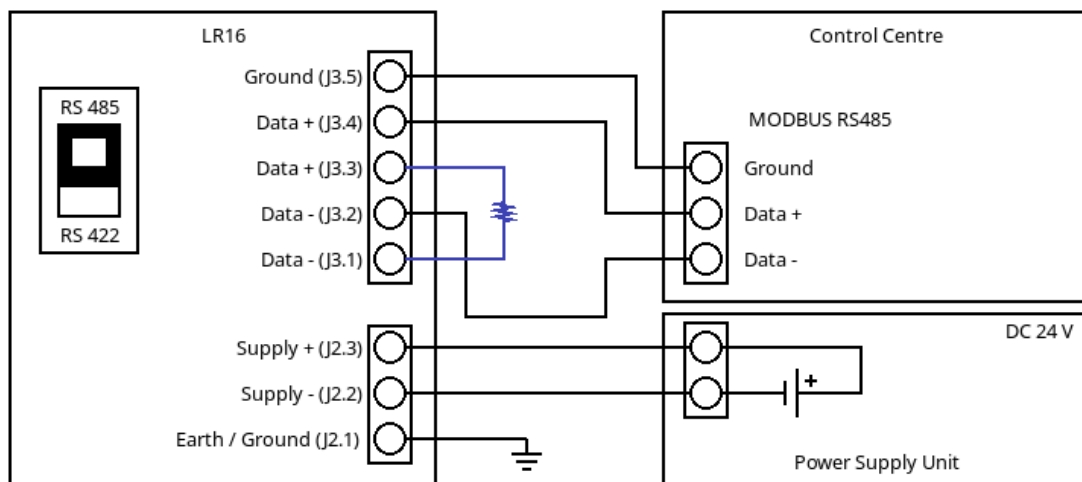
### 3.4.4 Connecting via MODBUS

The device can be interfaced using MODBUS RTU via RS485 or RS422.

**WARNING:** Switching between RS422 and RS485 requires the flipping of a hardware switch on the termination board.

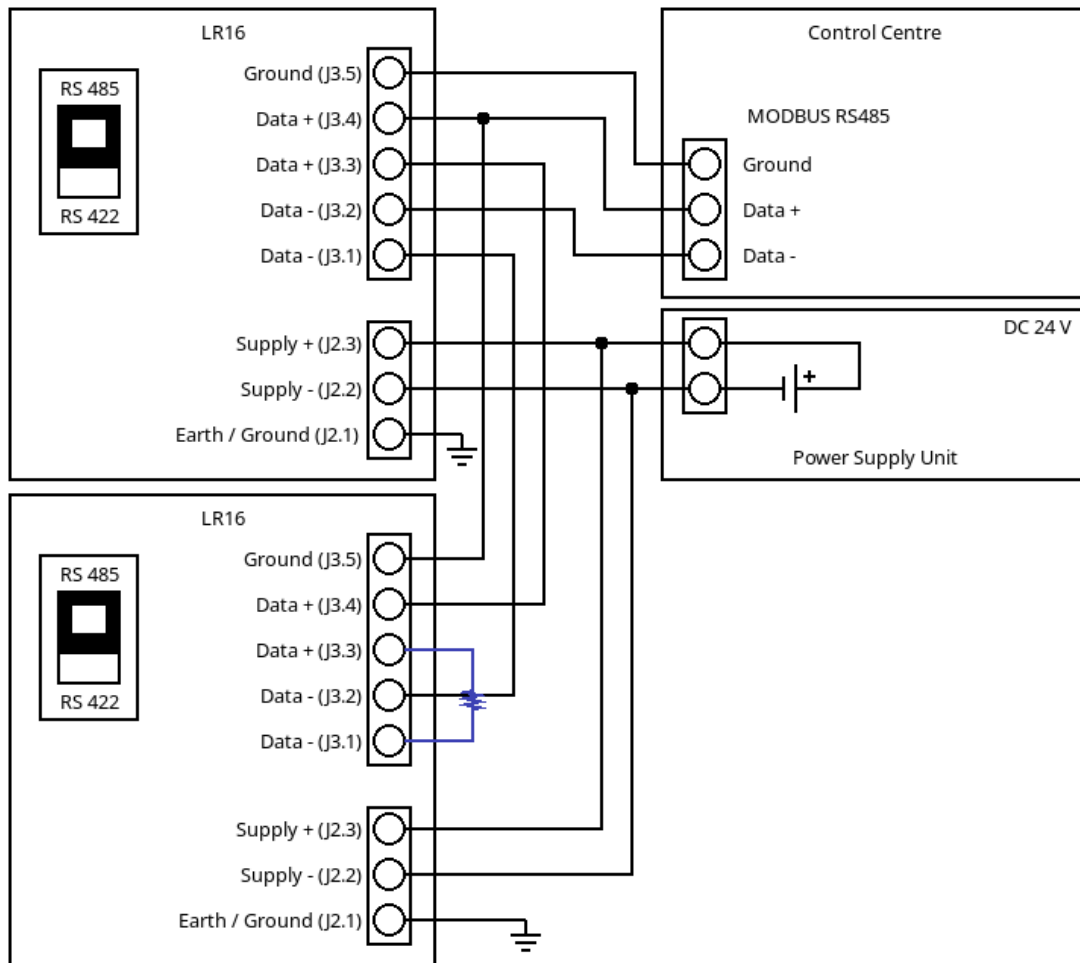
In RS485 mode the switch physically connects the RX and TX lines internally. In this case the second pair of terminals can be used for termination or to loop through to the next device.

The following wiring diagram depicts a single device connected via RS485. A termination resistor is shown in blue (optional depending on configuration).



MODBUS RTU via RS485 allows for multiple devices to be connected to an alarm central via a single bus. In this case make sure to assign unique MODBUS addresses to the devices using the LR16 Control Interface software.

The following wiring diagram shows a configuration with two devices on a RS485 bus. An optional termination resistor is shown in blue:



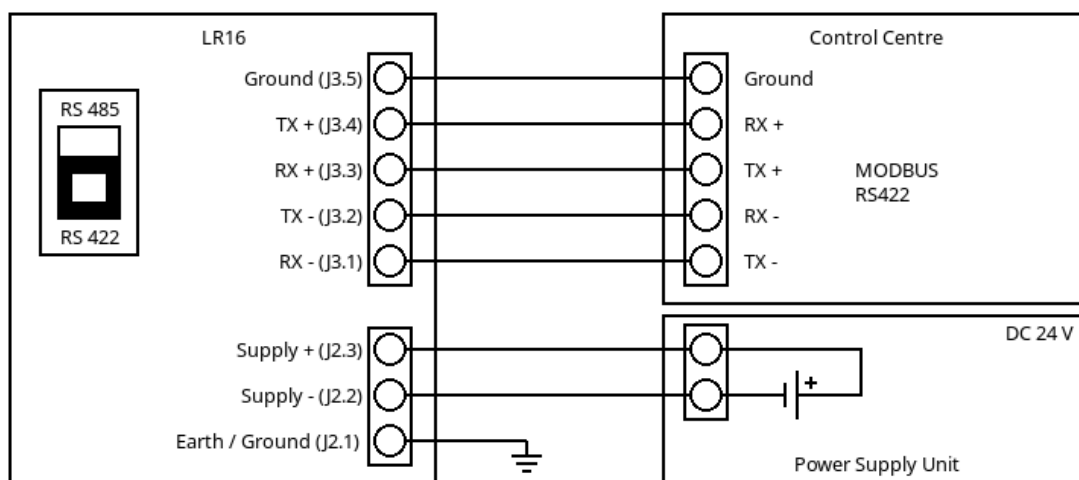
#### 3.4.4.1 Line termination

In some cases, especially if RS485 is used with a high baud rate and long connections, end of line termination may be required. In accordance with electrical engineering methodology the end of line termination should be chosen such that it matches the impedance of the cabling used to minimize reflections at the end. No termination should be applied at devices that are not at the end of the line.

#### 3.4.4.2 RS422 Operation

Whilst less common some MODBUS terminals support MODBUS RTU over RS422. This separates the transmit and receive pathways which requires more electrical lines but can be helpful for special cases such as point-to-point connections including an optical fiber link.

The following wiring diagram depicts a single LR16 connected via RS422

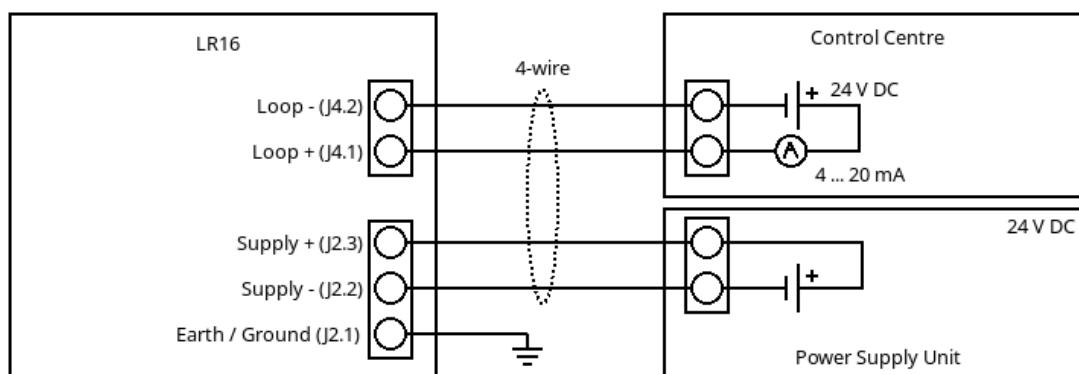


It is possible to configure the LR16 to allow for remote configuration via an RS422 connection and the LR16 Control Interface software using Optect's proprietary protocol. This is only possible if the RS485/422 port is not used for MODBUS communication. The LR16 Control Interface software is meant for configuration of the device and is NOT intended for alarm signalling.

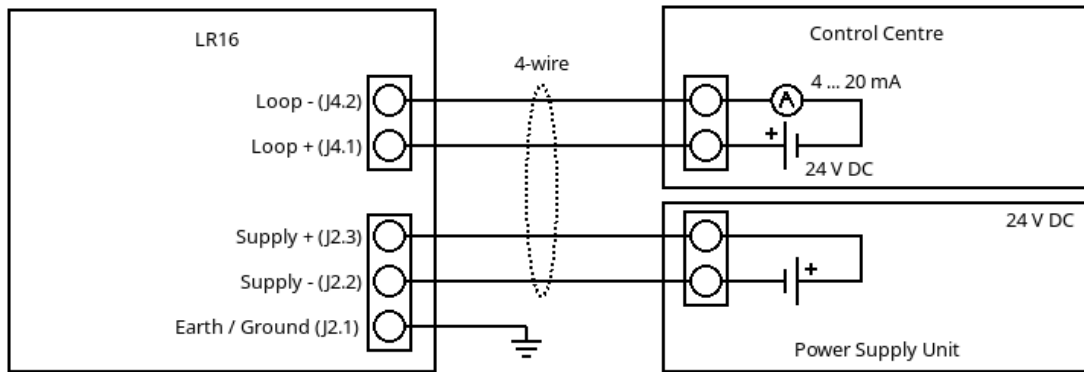
### 3.4.5 Connecting via 4-20 mA

The 4-20 mA interface included in the LR16 relies on an external voltage source and controls the current that flows as a result of the voltage applied. It can act as a sink or source. It can be used with the same supply power that supplies the LR16 allowing for a three wire operation. Please ensure that the configuration chosen is also supported by the control center.

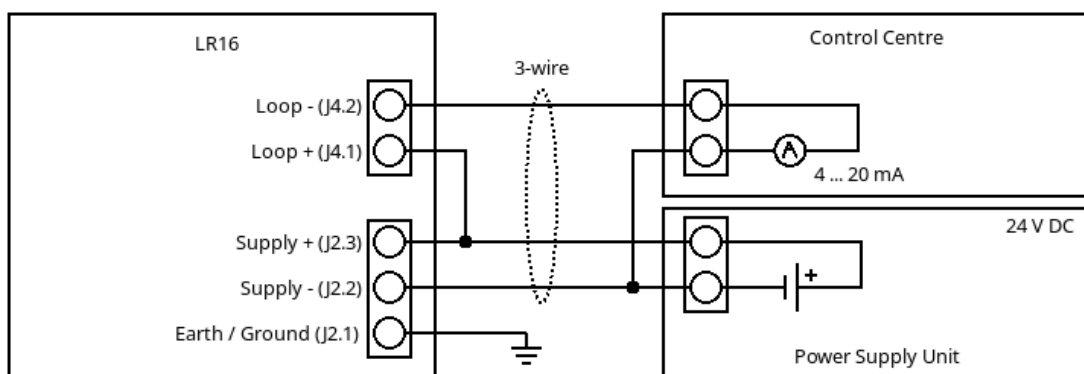
The following diagram shows how to use the device as a sink in a 4-wire configuration (isolated transmitter):



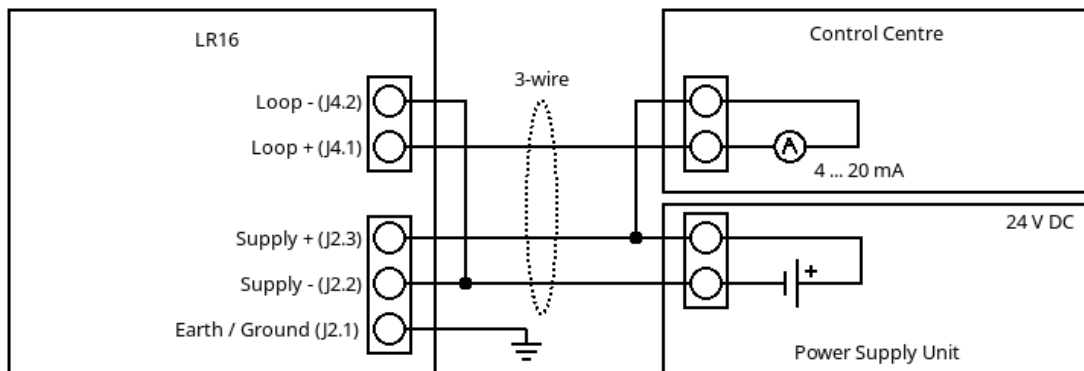
The following diagram shows how to use the device as a source in a 4-wire configuration (isolated transmitter)



The following diagram shows how to use the device as a source in a 3-wire configuration (non-isolated transmitter):



The following diagram shows how to use the device as a sink in a 3-wire configuration (non-isolated transmitter):



### 3.4.6 Conduit Installation

The following guidelines must be followed for conduit installation:

- When mounting with a bracket, use flexible conduit for the final section leading to the detector.
- When threading cables through the conduit, ensure they are not twisted or under tension. Extend the cables approximately 30 cm (12 inches) beyond the detector location to facilitate wiring after installation.

- Conduct a continuity test after pulling the cables through the conduit.
- Ensure that conduit seals are properly tightened to prevent moisture from entering the device at the cable entry points.
- Consider using specialised cable glands compatible with the conduit used.

### 3.5 Attaching the LR16 Detector to its Bracket

To attach the bracket to the LR16:

1. Remove the bracket from the packaging.
2. Align the screw hole in the nut with the holes in the bracket, position the washers on the outside with the pin in the slot and insert the screw.
3. Tighten all screws on the bracket until there is no movement between the bracket and the LR16.

### 3.6 Mounting

The detector must be mounted according to the instructions below for maximum efficiency and performance.

1. For simpler installation, attach the bracket to the main body of the device before mounting the bracket to the fixing point. Doing this at ground level minimizes the number of parts that need managing during mounting.
2. It is advisable to tether the device through the slots of the bracket when installing to avoid damage to the device or danger to anyone below if dropped.
3. A drilling template is supplied with the device to help with mounting on flat surfaces.
4. To easily access the screws when securing the wall plate to the wall, pivot the device to one side to expose two of the screws. Then, repeat the process in the opposite direction for the remaining two screws. If using this method, ensure to adjust the pivot position and tighten the corresponding bolt in the bracket afterwards.

### 3.7 Installation Report

The LR16 Control Interface software provides a feature for the automated generation of an installation report. It is recommended to use this feature to document all relevant installation data.

If the use of the LR16 Control Interface software is not an option record all relevant information for the installation including:

- Device Serial Number

- Date and Time
- Location
- Any non-default settings
- Result of any tests

## 4 Operation

### 4.1 Powering Up

Before powering up the device, carry out the following steps:

- Make sure the detector window is clean. Follow the cleaning procedure [see section [6.1 Cleaning Procedure](#)] if the window is dirty.
- Ensure that the device is positioned correctly.
- Check that there are no potential false alarm sources within the field of view of the detector.
- Check the cabling.
- Make sure the device is grounded.
- Tighten fasteners and glands.

To power up the detector:

1. Enable the power supply of the detector.
2. The detector automatically starts once powered.
3. Wait for up to 30 seconds for the detector to finish the start-up procedure.
  - a. Turning on the detector initiates the following sequence of events:
  - b. Flashes LEDs in red, green and blue to allow for verifying their functionality.
  - c. Shows green LEDs with modulated intensity whilst finalizing the start up procedure.
4. Once online, the green LEDs (if enabled in the settings) will remain on unless a fire is detected or a trouble signal is active. An active trouble signal could indicate an issue during start up or be retained from the last time the device was powered.
5. The device will then enter normal mode. The relays and 4-20 mA outputs are set to reflect the same state as the LEDs.

### 4.2 Configuring the detector

The device can be configured using the USB port and the LR16 Control Interface software. Settings include the following:

- Device settings
- Alarm settings

- Relay settings
- Trouble settings
- Serial settings
- Modbus settings

### 4.3 Maintenance Report

The LR16 Control Interface software includes functionality for a mostly automated generation of a maintenance report. It is recommended to use this to create a record of the device status after the maintenance. This report can contain both, automatically collected and manually added information.

If the use of the LR16 Control Interface software is not an option, record all relevant information for the maintenance event including:

- Device Serial Number
- Date and Time
- Location
- Any non-default settings
- Result of any tests

### 4.4 Testing

A full functional test should be performed by a qualified technician once the device has been installed.

Prior to testing, verify that the alarm output will not trigger any undesired effects.

To perform the full functional test, position a flame source in front of the detector (**only if it is safe to do so**) and hold it there until the LEDs on the front of the device turn red. To verify that both modules are functioning, ensure the flame source is within the 16° field of view of the long-range detector and close enough to activate the short-range detector. The required duration will vary depending on the flame size, its proximity to the detector, and the device configuration.

#### 4.4.1 Built-In Self-Test (BIST)

The detector features an automatic self-check to ensure proper operation. This test verifies that the window is clean and that the device is functioning correctly. The self-check runs automatically every 30 minutes and takes approximately 3 minutes to complete. Detection of fires is not affected while the test is in progress.

If the BIST detects a critically reduced performance or a fault, the two LEDs on the front of the device will turn orange, and a trouble signal will be raised. The device will continue to operate normally while in trouble mode.

### 4.4.2 Continuous Test

The device continuously monitors its core functions to ensure proper operation. This includes checking the integrity of internal memory, verifying the rate at which data is collected, monitoring sensor noise levels, and ensuring that the device's firmware continues to operate as expected. Trouble signals are raised if any issues are detected.

Additional non-core functions can be monitored depending on the device configuration.

### 4.4.3 Verifying Detector Sensitivity

For functional testing of the LR16 detector sensitivity it is recommended to follow locally applicable standards.

A straightforward method for comparing detector sensitivities across devices or over time involves using an upturned 330 ml aluminium drinks can with a small quantity of n-heptane in the concave base. The can provides a stable container for a reproducible reference flame. Place the flame within the detector's field of view at the chosen test distance (e.g., 6 m), ensuring the line of sight is unobstructed. Since this flame is much smaller than the standard 30 cm n-heptane pan fire, detection ranges will be shorter. Ignite the n-heptane with care and verify that the detector triggers within the expected response time. Allow the flame to burn out naturally or extinguish it safely, and always perform the test outdoors under controlled conditions with appropriate fire safety precautions.

## 4.5 LED Display

The LR16 has the following outputs which are communicated using the two LEDs in the display:

| LED1 (left)                                                                                              | LED2 (right)                                                                                             | Meaning                                                                                                                                                     |
|----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br>Any<br>(flashing) | <br>Any<br>(flashing) | Startup sequence                                                                                                                                            |
| <br>Green             | <br>Green             | Normal Operation                                                                                                                                            |
| <br>Yellow            | <br>Yellow            | Trouble Signal<br> <b>Caution: Device might not be fully operational</b> |
| <br>Red               | <br>Grey              | Fire Alarm Near                                                                                                                                             |

|                                                                                             |                                                                                             |                                                                          |
|---------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| Red                                                                                         | Any                                                                                         |                                                                          |
| <br>Any    | <br>Red    | Fire Alarm Far                                                           |
| <br>Blue   | <br>Purple | Device in Firmware Update Mode<br><b>⚠ Caution: Detection not active</b> |
| <br>Purple | <br>Blue   | Device in Data Access Mode<br><b>⚠ Caution: Detection not active</b>     |

#### 4.5.1 Trouble Signal

Refer to section [5 Troubleshooting](#).

#### 4.5.2 Firmware Update Mode

This mode is only used in case a manual firmware update becomes necessary.

**⚠ Caution: Detection is not active whilst in this mode**

To leave this mode, power cycle the detector or use the reboot button (located next to the USB-C port underneath the USB cap).

#### 4.5.3 Data Access Mode

This mode should not be reached during normal operation. It is meant for extracting recorded data from devices used in trials only.

**⚠ Caution: Detection is not active whilst in this mode**

To leave this mode, power cycle the detector or use the reboot button.

### 4.6 Safety Precautions

- The front of the detector should never be opened. It does not contain parts that can be serviced. Opening the front may disturb the critical optical alignment and calibration and may cause irreparable damage. Opening the front will void the warranty.
- Do not open the detector when flammable gases are present.
- Installation must be done by a trained technician.
- The wiring instructions provided in this manual aim to guarantee the device's correct operation under standard conditions. Given the differences in wiring

codes and regulations, it's not possible to assure complete adherence to these rules. Ensure that all wiring conforms to local laws and regulations.

- Usual precautions for handling electrostatic sensitive devices must be taken.
- Extinguishing devices must be deactivated before performing tests or maintenance.
- The equipment should be correctly grounded to safeguard against electric shock and to reduce electrical interference. Do not drill any holes in the enclosure. Evidence of drilling will void warranty.

## 5 Troubleshooting

During troubleshooting make sure to disable any connected extinguishing equipment.

### 5.1 General Troubleshooting

#### 5.1.1 Device Not Responding / No LED Indications

Note: LEDs can be configured to be off in the default state (i.e. no trouble signals or fire alarm active).

1. Verify that the power supply voltage is within the required range.
2. Disconnect power and check wiring for continuity.
3. Inspect the device of visible mechanical damage.
4. Check that the terminal plugs are fully engaged
5. Perform a visual inspection to ensure that the termination compartment is free of moisture or debris.
6. Inspect the front window to ensure that it is not fogged on the inside.

#### 5.1.2 Detector Fails to Trigger During Test

1. Ensure that the device settings match your expectations
  - a. Sensitivity levels: If sensitivity settings are set to low and the flame source is small, it might be necessary to bring the flame source closer to the device.
  - b. The short-range sensitivity level could be set to "off". This setting exists for applications requiring the long-range only.
  - c. Delayed alert: If there is a delayed alert of multiple timesteps, the flame source must be present for longer. For example, for a 4 timestep delay

setting, fire must be present for at least 16 seconds and at the detection limit it could take up to 2 minutes depending on the strength of the fire signal.

- d. Communication Settings: If using relays, RS485, or 4–20 mA outputs to confirm fire signals, ensure they are correctly configured and wired, and verify that the rest of the system is functioning properly.
2. Verify that the test flame source is within the detector's field of view. If testing both short-range and long-range detection modules, ensure that your flame source is within the 16 degree detection cone of the long-range module and within the detection range limits of the short-range 90 degree module.
3. Ensure the flame is of sufficient size (consider sensitivity levels) and duration (consider delayed alert setting).
4. Check if any trouble signals are active on the device.
5. Check the device log for any unexpected entries.

#### 5.1.3 Communication / Signal Issues (for networked detectors)

1. Check that all wiring and connections are secure.
2. Verify network settings or operator panel configuration.
3. Ensure the device is correctly registered in the monitoring system.

#### 5.1.4 Environmental Factors Affecting Detection

- Atmospheric obscurants such as smoke, fog, rain, or blowing dust can attenuate or scatter IR signals, reducing effective range.
- Solar reflections from water, glass, or metallic surfaces may create background IR noise.
- Rapidly changing temperatures (e.g., hot exhaust gases, sun-heated surfaces) can increase the detector's background signal.
- Vegetation, wildlife, or airborne debris may intermittently obscure the optical path.
- Seasonal variations in humidity and dew formation on the optical window can reduce sensitivity.

#### 5.1.5 Detector Alignment / Field of View Issues

Incorrect alignment may cause the target hazard area to fall outside the detector's defined field of view (full angle, both vertically and horizontally: 16° long-range, 90° short-range).

Mounting vibration, building movement, or thermal expansion of structures may shift detector orientation over time.

Nearby obstructions (posts, walls, ducts, trees) can create blind spots or block part of the detection cone.

Long-range aiming tolerances become more critical beyond 300 m, where small misalignments can leave large areas uncovered.

#### 5.1.6 Power Quality Issues

- Voltage dips or surges on the DC supply can cause resets, missed events.
- Electrical noise from motors, inverters, or switching supplies can couple into the detector electronics and impair signal processing. Following the grounding procedures detailed above and any local regulations are essential for mitigating these risks.
- Poor earthing or ground loops may lead to unstable detector performance or communication errors.
- Long cable runs with insufficient gauge can result in voltage drop at the detector terminals.
- Interruption of supply during a fire event may prevent alarm relay actuation or data transmission.

#### 5.1.7 Sensor Aging or Degradation

The LR16 is engineered for maximum service life. Regular maintenance and functional checks are essential to identify any performance degradation, especially as the detector approaches end of life.

#### 5.1.8 When to Contact Support

1. If problems persist after following the guidance in this manual.
2. If unusual behavior or repeated false alarms occur.
3. For firmware updates or advanced diagnostics.

### 5.2 Checking the Cause of a Trouble Signal

1. Connect to the USB port of the device and access the Control Interface software.
2. Check the 'Trouble' tab to identify what caused the trouble signal. Refer to the table below.
3. If the cause of the trouble signal has been rectified, clear the signal by clicking the 'reset all trouble signals' button in the Control Interface software.
4. For trouble signals caused by a dirty front window, the button 'invalidate self test results' must also be clicked to prevent re-triggering of the trouble signal based on recent self-tests. If the trouble signal recurs after cleaning the window, it might be necessary to re-calibrate the self test. This can be done by invalidating previous results, leaving the device for at least 6 hours and then clicking 'recalibrate self test based on latest results'.

5. If none of the above steps rectify the problem, contact the supplier.

Below is a list of the possible trouble signals, their possible causes and corrective actions:

| <b>Problem</b>                           | <b>Possible Cause</b>                                                                                                                                                                                       | <b>Corrective Action</b>                                                                                                                                            |
|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Supply Voltage Low                       | Issues with the power supply to the device                                                                                                                                                                  | Improve the power supply or cabling                                                                                                                                 |
| Supply voltage high                      | Issues with the power supply to the device                                                                                                                                                                  | Check the power supply and replace if necessary                                                                                                                     |
| Backup Battery Voltage Low               | Internal battery faulty / prematurely empty                                                                                                                                                                 | Please contact the manufacturer                                                                                                                                     |
| Backup Battery Voltage High              | Internal battery fault                                                                                                                                                                                      | Please contact the manufacturer                                                                                                                                     |
| Internal Voltage Low                     | If occurring without Supply voltage low this might indicate an issue with the internal power supply circuit                                                                                                 | If occurring without Supply voltage low please contact manufacturer                                                                                                 |
| Internal Voltage High                    | If occurring without Supply voltage high this might indicate an issue with the internal power supply circuit                                                                                                | If occurring without Supply voltage high please contact manufacturer                                                                                                |
| RTC Time Lost                            | Internal clock fault / internal battery fault / firmware issue / device lifetime exceeded<br><br>This is non-critical for the main device function but may lead to incorrect time stamps in the device log. | Reset the clock via the Control Interface software. If it recurs, please contact the manufacturer                                                                   |
| Mechanical Impact During Operation       | Device knocked / dropped whilst powered on                                                                                                                                                                  | Check that the device is operational and still pointing into the correct direction                                                                                  |
| Drift From Install Position - Pitch Roll | Bracket loose or structure device mounted to unstable                                                                                                                                                       | Bracket needs tightening or structure device mounted to needs stabilising                                                                                           |
| Drift From Install Position - Yaw        | Bracket loose or structure device mounted to unstable<br><br>Interference from local magnetic fields may be impacting the yaw drift detection performance                                                   | Bracket needs tightening or structure device mounted to needs stabilising.<br><br>In the case of interference this function may need to be deactivated in settings. |

|                                      |                                                                                                                                                                                           |                                                                                                  |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| Temperature Range Exceeded (High)    | Device exposed to high temperatures that may permanently damage components inside the device and/or temporarily impact performance                                                        | Check that the device is operational and consider moving the device to a more protected location |
| Temperature Range Exceeded (Low)     | Device exposed to low temperatures that may permanently damage components inside the device and/or temporarily impact performance                                                         | Check that the device is operational and consider activating window heater                       |
| Detector Self Test Failed            | Front window of the device is dirty or the reflective mirror is dirty                                                                                                                     | Clean the front window and invalidate previous self-tests                                        |
| Service Overdue                      | Service has not been carried out within the time window specified by the operator in the settings                                                                                         | Conduct the service at the earliest opportunity.                                                 |
| System Data Lost                     | Fault with an internal component                                                                                                                                                          | Please contact manufacturer                                                                      |
| Watchdog Triggered                   | Fault with an internal component                                                                                                                                                          | Please contact manufacturer                                                                      |
| Detection Data Rate Deviation        | Fault with an internal component                                                                                                                                                          | Please contact manufacturer                                                                      |
| Detection Data Channel Rate Mismatch | Fault with an internal component                                                                                                                                                          | Please contact manufacturer                                                                      |
| Unrealistic Detector Noise Level     | Fault with an internal component                                                                                                                                                          | Please contact manufacturer                                                                      |
| Motion Sensor Not Available          | <p>Fault with an internal component</p> <p>This is non-critical for the main device function but may lead to mechanical impact detection and orientation drift detection not working.</p> | Please contact manufacturer                                                                      |
| Motion Sensor Not Found              | <p>Fault with an internal component</p> <p>This is non-critical for the main device function but may lead to mechanical</p>                                                               | Please contact manufacturer                                                                      |

|  |                                                               |  |
|--|---------------------------------------------------------------|--|
|  | impact detection and orientation drift detection not working. |  |
|--|---------------------------------------------------------------|--|

Trouble signals are signaled by LEDs and in addition can be monitored remotely via relays, 4-20 mA output and RS485 / RS422 readout. Using Modbus it is possible to read out the trouble signals individually and reset latched trouble signals.

## 5.2 False alarms and Unintended Triggering

The LR16 is designed to be resilient to false alarms but there are circumstances where non-flame sources of IR or benign fires can trigger the detectors. The following is a list of known sources of false and benign fires with advice on how to mitigate them:

| 5.2.1 False alarm source                                                   |                                                                                                                                                                                                                                                                                                               |
|----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Harsh shadows from the sun covering part of the front face of the detector | Harsh shadow lines will be cast by an object close to the device (within 3m) between the device and the sun. Shadows from objects further away have 'softer' edges and shouldn't cause any issues. Avoid positioning the detector directly underneath a tree or other objects that could cast a harsh shadow. |
| Welding arcs at < 30 m                                                     | If possible, conduct welding outside the field of view or at large distances from the detector. If not possible, shield the detector from view of the arc welder whilst welding using a thermal insulator.                                                                                                    |
| Modulated high powered incandescent lamps at very close range < 3 m        | Adjust the 'alarm delay' settings so that short sudden changes of brightness do not trigger the device.                                                                                                                                                                                                       |
| Cigarette lighter at close range                                           | Adjust the 'alarm delay' settings so that short duration exposure to cigarette lighter flames does not trigger the device.                                                                                                                                                                                    |
| Modulated high powered electric heating elements at very close range < 3 m | Adjust the 'alarm delay' settings so that short sudden changes of IR levels from heating elements does not trigger the device.                                                                                                                                                                                |
| Yard fire / bonfire                                                        | Avoid positioning the device facing towards                                                                                                                                                                                                                                                                   |

### 5.2.1 False alarm source

|               |                                                                                                                                                       |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
|               | benign fires. If not possible, temporarily shield the detector from view using a thermal insulator.                                                   |
| Patio heaters | Avoid positioning the device facing towards patio heaters. If not possible, temporarily shield the detector from view using a thermal insulator.      |
| BBQs          | Avoid positioning the device facing towards BBQs. If not possible, temporarily shield the detector from view using a thermal insulator.               |
| Fire pits     | Avoid positioning the device facing towards non-nuisance fires. If not possible, temporarily shield the detector from view using a thermal insulator. |

## 6 Maintenance

**WARNING:** The Optect LR16 does not have any components that users can service, and it should never be opened. The rear cover and USB cap are the only parts of the device that can be opened.

Attempting to repair or disassemble the electronic sub-assemblies will result in the warranty being voided.

### 6.1 Record of Maintenance

The LR16 Control Interface software provides a largely automated function for generating maintenance reports. Using this feature is recommended to capture all data relevant to the current status and settings of the device.

Records of maintenance should be kept. These should include:

- Date of maintenance (automatically included)
- Contractor name (automatically included if configured)
- Serial number of device (automatically included)
- Details of the maintenance carried out (to be added by the contractor)

If the use of the LR16 Control Interface software is not an option, record all relevant information manually.

### 6.1 Cleaning Procedure

It may be necessary to clean the device window occasionally. The operating environment will determine how often the window needs cleaning. If the detector is exposed to contamination such as sea spray and dust regularly, it may need to be cleaned more often. The LR16 can still detect flames when the window is contaminated but the level of sensitivity will be impacted.

**⚠ CAUTION: To ensure that no undesired effects are caused by alarm or trouble signals raised due to the cleaning action it may be necessary to:**

- a. Disable any connected extinguishing equipment,**
- b. Suppress alarms in a connected alarm panel, or**
- c. Electrically disconnect the device.**

To clean the LR16 window:

1. Clean the window with optical cloth or lint free tissue and a mild detergent. Avoid detergents that leave residues or form surface coatings, particularly those containing silicones as these can deposit light-absorbing films and reduce detector sensitivity.

2. Rinse thoroughly with clean water.
3. Dry the surface with a clean optical cloth or lint free tissue.

## **7 Certification and Approvals**

FM3260

## 8 Technical Specifications

### 8.1 Field Of View (FOV)

Please see the figure below for a depiction of the Field of View (FOV) of the detector including the short-range and long-range modules. The depiction is given for both modules set to the highest sensitivity level. See the performance specification below for an indication on how the maximum range changes for other sensitivity settings.

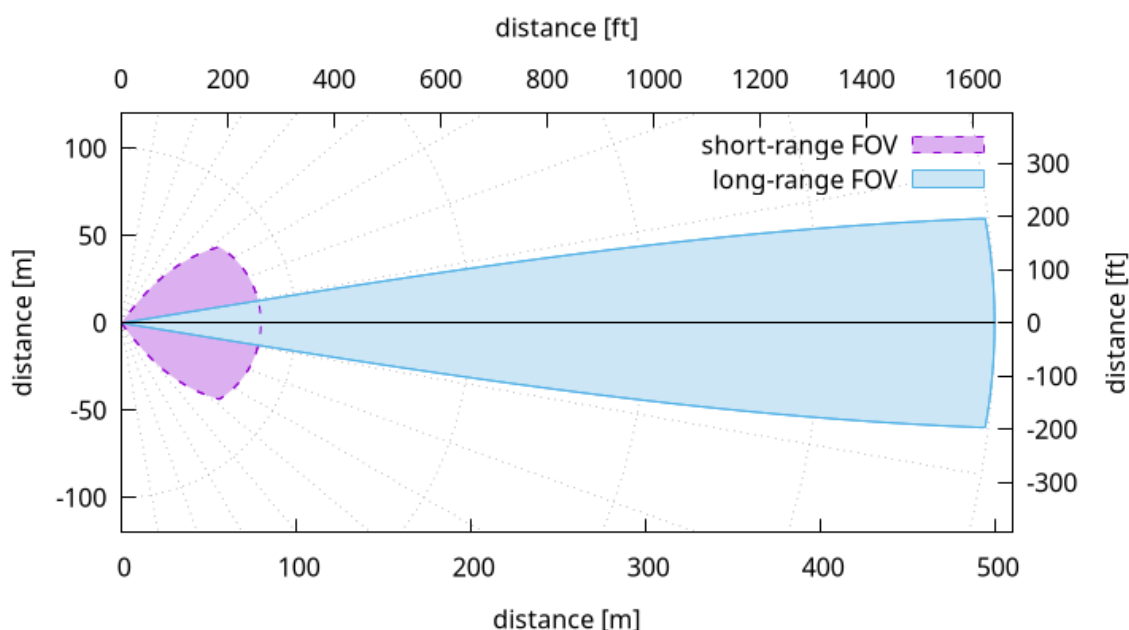


Figure 1: LR16 detector fields of view.

### 8.2 Fire Detection / Performance Specifications

The detector provides four sensitivity levels. The sensitivity can be set separately for the short-range and the long-range modules. The ranges given pertain to the detection of a 1 ft<sup>2</sup> (0.1 m<sup>2</sup>) n-heptane fire.

#### 90 deg FoV short-range module

| Sensitivity Setting | Detector Distance (ft   m) | Notes                                                                                                       |
|---------------------|----------------------------|-------------------------------------------------------------------------------------------------------------|
| High                | 262   80                   | Highest range in presence of other IR sources e.g. sun. Highest vulnerability to false alarms e.g. welding. |
| Medium              | 262   80                   | Some range reduction will occur in presence of other                                                        |

|          |          |                                                                        |
|----------|----------|------------------------------------------------------------------------|
|          |          | IR sources                                                             |
| Low      | 262   80 | Moderate range reduction will occur in presence of other IR sources    |
| Very Low | 131   40 | Significant range reduction will occur in presence of other IR sources |

#### 16 deg FoV long-range module

| Sensitivity Setting | Detector Distance (ft   m) | Notes                                                                                                       |
|---------------------|----------------------------|-------------------------------------------------------------------------------------------------------------|
| High                | 1640   500                 | Highest range in presence of other IR sources e.g. sun. Highest vulnerability to false alarms e.g. welding. |
| Medium              | 1640   500                 | Some range reduction will occur in presence of other IR sources                                             |
| Low                 | 1640   500                 | Moderate range reduction will occur in presence of other IR sources                                         |
| Very Low            | 820   250                  | Significant range reduction will occur in presence of other IR sources                                      |

#### False Stimuli Resilience

| Stimulus                        | Distance (ft   m) | Result   |
|---------------------------------|-------------------|----------|
| Direct Sunlight<br>Un-modulated | Any Distance      | No Alarm |
| Direct Sunlight Modulated       | Any Distance      | No Alarm |

|                                               |              |          |
|-----------------------------------------------|--------------|----------|
| Indirect (reflected) sunlight<br>Un-modulated | Any Distance | No Alarm |
| Indirect (reflected) sunlight<br>Modulated    | Any Distance | No Alarm |
| Arc Welding #7014<br>Un-modulated             | 98   30      | No Alarm |
| Arc Welding #7014<br>Modulated                | 98   30      | No Alarm |
| Incandescent lamp 300 W<br>Un-modulated       | 8   2.5      | No Alarm |
| Incandescent lamp 300 W<br>Modulated          | 8   2.5      | No Alarm |
| Two Fluorescent Light 34 W<br>Un-modulated    | 8   2.5      | No Alarm |
| Two Fluorescent Light 34 W<br>Modulated       | 8   2.5      | No Alarm |
| Halogen Light 500 W<br>Un-modulated           | 8   2.5      | No Alarm |
| Halogen Light 500 W<br>Modulated              | 8   2.5      | No Alarm |
| Electric Heater 1500 W<br>Un-modulated        | 10   3       | No Alarm |
| Electric Heater 1500 W<br>Modulated           | 10   3       | No Alarm |

#### Performance in the presence of false alarm stimuli

| False alarm source | Distance from LR16 | Modulated / Unmodulated | Fire size | Maximum range of fire | Detection time |
|--------------------|--------------------|-------------------------|-----------|-----------------------|----------------|
|--------------------|--------------------|-------------------------|-----------|-----------------------|----------------|

**Performance in the presence of false alarm stimuli**

|                          |      |              |                   | <b>detection</b> |        |
|--------------------------|------|--------------|-------------------|------------------|--------|
| Reflected Sunlight       | -    | Un modulated | 300mmx300m pan    | 500m             | 17s    |
| Reflected sunlight       | -    | modulated    | 300mm x 300mm pan | 250m             | 18s    |
| Direct sunlight          | -    | Un modulated | 300mm x 300mm pan | 500m             | 17s    |
| Direct sunlight          | -    | modulated    | 300mm x 300mm pan | 250m             | 17s    |
| 1500W Heater             | 3m   | Modulated    | 300mm x 300mm pan | 500m             | 4.78s  |
| 1500W Heater             | 3m   | Un modulated | 300mm x 300mm pan | 500m             | 15.31s |
| 500W Halogen lamp        | 2.5m | Modulated    | 300mm x 300mm pan | 400m             | 27.28s |
| 500W Halogen lamp        | 2.5m | Un modulated | 300mm x 300mm pan | 400m             | 12.21s |
| 300W Incandescent lamp   | 2.5m | Modulated    | 300mm x 300mm pan | 400m             | 6.84s  |
| 300W Incandescent lamp   | 2.5m | Un modulated | 300mm x 300mm pan | 400m             | 18.5s  |
| 2 X 34W Fluorescent lamp | 2.5m | Modulated    | 300mm x 300mm pan | 400m             | 6.65s  |
| 2 X 34W Fluorescent lamp | 2.5m | Un modulated | 300mm x 300mm pan | 400m             | 4.82s  |
| Arc Welder #7014         | 30m  | Modulated    | 300mm x 300mm pan | 500m             | 14.62s |
| Arc Welder #7014         | 30m  | Un modulated | 300mm x 300mm pan | 500m             | 13.25s |

Startup Time

30 s

|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Field of View (FoV) | <p>16 degree</p> <p>90 degree<br/>(See section 3.5 for FoV diagram)</p>                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Alarm Response Time | <p>Minimum: 0.5 s</p> <p>Typical: 6-11 seconds<br/>(signals significantly stronger than sensitivity limit)</p> <p>Typical: 1-27 seconds<br/>(at sensitivity limit, no alarm delay)</p> <p>Max: 30 s<br/>(no alarm delay)</p> <p>Intermittent signals or signals fluctuation around the detection limit in strength may lead to an additional increase in response time.</p> <p>Alarm delay setting increases time to detection by:</p> <p>Min: 4s * time steps</p> <p>Max: 24s * time steps</p> |
| Heated window       | <p>Reduces impact of weather conditions such as ice, snow or condensation on the transparency of the optical window</p> <p>Configurable with temperature control or fixed power.</p> <p>Max heating power: 2.5 W</p>                                                                                                                                                                                                                                                                            |
| Built-In Self-Test  | <p>Automatic self test, every 30 min<br/>(See section 4.4)</p> <p>Continuous Tests<br/>(See section 4.4.2)</p>                                                                                                                                                                                                                                                                                                                                                                                  |

### 8.3 Electrical Specifications

|                                                                                                    |                                                |
|----------------------------------------------------------------------------------------------------|------------------------------------------------|
| Supply Voltage <sup>(1)</sup>                                                                      |                                                |
| Typically                                                                                          | 12 - 24 V                                      |
| Minimum                                                                                            | 10 V                                           |
| Maximum                                                                                            | 30 V                                           |
| Power consumption (12 V Supply Voltage, front window heater off, LEDs off, typical) <sup>(2)</sup> | 1.6 W                                          |
| Power consumption without front window heater (typical) <sup>(2)</sup>                             | 2 W                                            |
| Power consumption with front window heater (max) <sup>(2)</sup>                                    | 5.5 W                                          |
| Screw Terminal Wire Sizes                                                                          | 24 AWG to 11 AWG<br>0.5 to 2.5 mm <sup>2</sup> |
| Cable sizes for Lapp glands (included with the LR16)                                               |                                                |
| M16 Gland                                                                                          | 4.5mm - 10mm                                   |
| M25 Gland                                                                                          | 9mm - 17mm                                     |

<sup>(1)</sup> A 24 V power supply is preferable in conditions with long cabling as it is tolerant to a higher voltage loss on the cabling. The device is more energy efficient on a 12 V power supply in conditions where its power consumption is low (heater off).

<sup>(2)</sup> A 12 V power supply is 17 % more power efficient compared to a 24 V power supply in conditions where the window heater is inactive. Turning off the LEDs reduces power consumption by 2...3% compared to setting their brightness to high.

### 8.4 Connectivity

| Connection | Properties |
|------------|------------|
|------------|------------|

|                            |                                                                                       |
|----------------------------|---------------------------------------------------------------------------------------|
| Relay Output               | 1x Alarm, 1x Device Status, 1x Configurable                                           |
| Maximum Rating (per relay) | 1A 30 V DC (30 W)                                                                     |
| 4-20mA (stepped)           | < 4 mA - interface off<br>4 mA - normal operation<br>16 mA - trouble<br>20 mA - alarm |
| RS485 / RS422              | Modbus compatible                                                                     |
| USB-C                      | For on site testing and configuration                                                 |

## 8.5 Mechanical Specifications

|                            |                                                                                        |
|----------------------------|----------------------------------------------------------------------------------------|
| Physical Dimensions        | Length: 9.2 inches (23.3cm)<br>Width: 4.7 inches (12.0cm)<br>Height 3.9 inches (9.9cm) |
| Weight                     | 4.1 lbs (1.85kg) without bracket<br>5.2 lbs (2.35kg) with bracket                      |
| Casing/ Enclosure Material | Aluminium                                                                              |
| Cable Entries (2 options)  | M16 Gland<br>M25 Gland                                                                 |
| Mounting Bracket           | 2 degrees of freedom                                                                   |

## 8.6 Environmental Specifications

|                       |                                    |
|-----------------------|------------------------------------|
| Operating Temperature | -40 °F to 176 °F (-40 °C to 80 °C) |
|-----------------------|------------------------------------|

|                          |                                               |
|--------------------------|-----------------------------------------------|
| Operating Humidity Range | 95 % RH (max)                                 |
| Ingress protection       | IP66<br>IP68 (tested at 3 m depth for 72 hrs) |



## Appendix A - LR16 Product Label

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |             |                                                                                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------------------------------------------------------------------------|
| <b>CE</b> 2026<br>NB 2809                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | FM APPROVED |    |
| Flame Detector – Point Type<br>Model: LR16<br>Standard: EN 54-10:2002 / FM 3260<br><b>2809-CPR-E0045</b><br>DoP No.: DoP-LR16-2025-06-12<br><b>FM25US0217 FM25CA0077</b><br>Manufacturer: Optect Ltd., Unit 1A, Artisans Yard,<br>Claude Avenue, Bath, BA2 1AF, UK<br>Supply: 10–28 VDC, 5.5 W max<br>Environment: –40 °C to +80 °C IP68<br>⚠ DO NOT USE MAINS POWER<br>⚠ TO BE INSTALLED BY TRAINED PERSONNEL<br>⚠ NO USER SERVICEABLE PARTS<br>Serial No.: X00000000 Mfg Date: YYYY - MM<br>For DoP, installation & maintenance instructions see<br>accompanying documentation or <a href="http://optect.com/docs">optect.com/docs</a> |             |                                                                                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |             |  |