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## Scope

The installation guide provides a comprehensive description of the FyreLine EN54 Fixed Controller.

This guide introduces the FyreLine FLDC-EN54 features, technical specifications and gives an understanding of its components and their function. You will also find instructions on installing, cabling and testing.

This guide is for anyone involved with the design, maintenance and purchasing of a FyreLine EN54 Fixed system with FLDC-EN54. It is assumed that anyone using this product has the knowledge and appropriate certification from local fire and electrical authorities.

## Document Conventions

The following typographic conventions are used in this document:

Convention	Description
<b>Bold</b>	Used to denote: Emphasis.
<i>Italics</i>	<b>Used to denote:</b> References to other parts of this document or other documents.

The following icons are used in this document:

Convention	Description
	<b>Recommended guideline:</b> Advising to do so.
	<b>Caution:</b> Not appropriate to do so or; care taken to avoid danger or mistakes.

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# 1 Important Guidelines

Please read this instruction leaflet thoroughly before commencing installation.

	Install the Fixed Controller (FLDC-EN54) accordingly to meet local and country installation requirements.
	The FLDC-EN54 must be installed in accordance with BS 5839-1 (or country equivalent) and IEC 60364 and authorities having jurisdiction.
	Ensure the product is installed, commissioned and maintained by persons according to good engineering practices and who have received sufficient training on the unit.
	Only use FyreLine EN54 Fixed Linear Heat Detection cable with the FyreLine EN54 Fixed Controller.
	Test the Linear Heat Detection Cable before connecting it to the FLDC-EN54 using a multimeter.
	Ensure the end of line resistor (3.6kohm) is securely connected at the end each linear heat detection cable.
	If only one zone is required leave the end of line resistor (3.6kohm) connected across the terminals of the unused zone.
	Ensure any cable glands used are tightened to form a secure and moisture proof seal around the detection cable and any other cable in or out of the unit.
	Do not exceed the maximum operating voltage of the FLDC-EN54 (36V DC).
	Do not connect lengths of linear heat detection cable in 'T' connections or spurs.

## 2 Overview

The FyreLine EN54 Fixed Controller (FLDC-EN54) is a dual zone module for monitoring up to two zones of FyreLine EN54 Fixed Linear Heat Detection (LHD) Cable. If an overheat or fire situation triggers either zone of the Fixed LHD cable the unit automatically calculates and displays the distance along the cable, in feet and metres, to the alarm point. The two zones can operate independently of each other, or in interlock mode and a separate alarm and normally conducting fault output are provided for each zone. The unit is intended to be installed between the Fixed Linear Heat Detection cable and a conventional or addressable fire alarm control panel. It has power, fault and alarm lights, as well as volt free outputs for fault and alarm, corresponding to each zone. It may also be connected to a industrial process control system using the two wire RS-485 Modbus RTU/ASCII output.

### 2.1 Typical Addressable System Wiring

PSU and Modbus connections not shown.

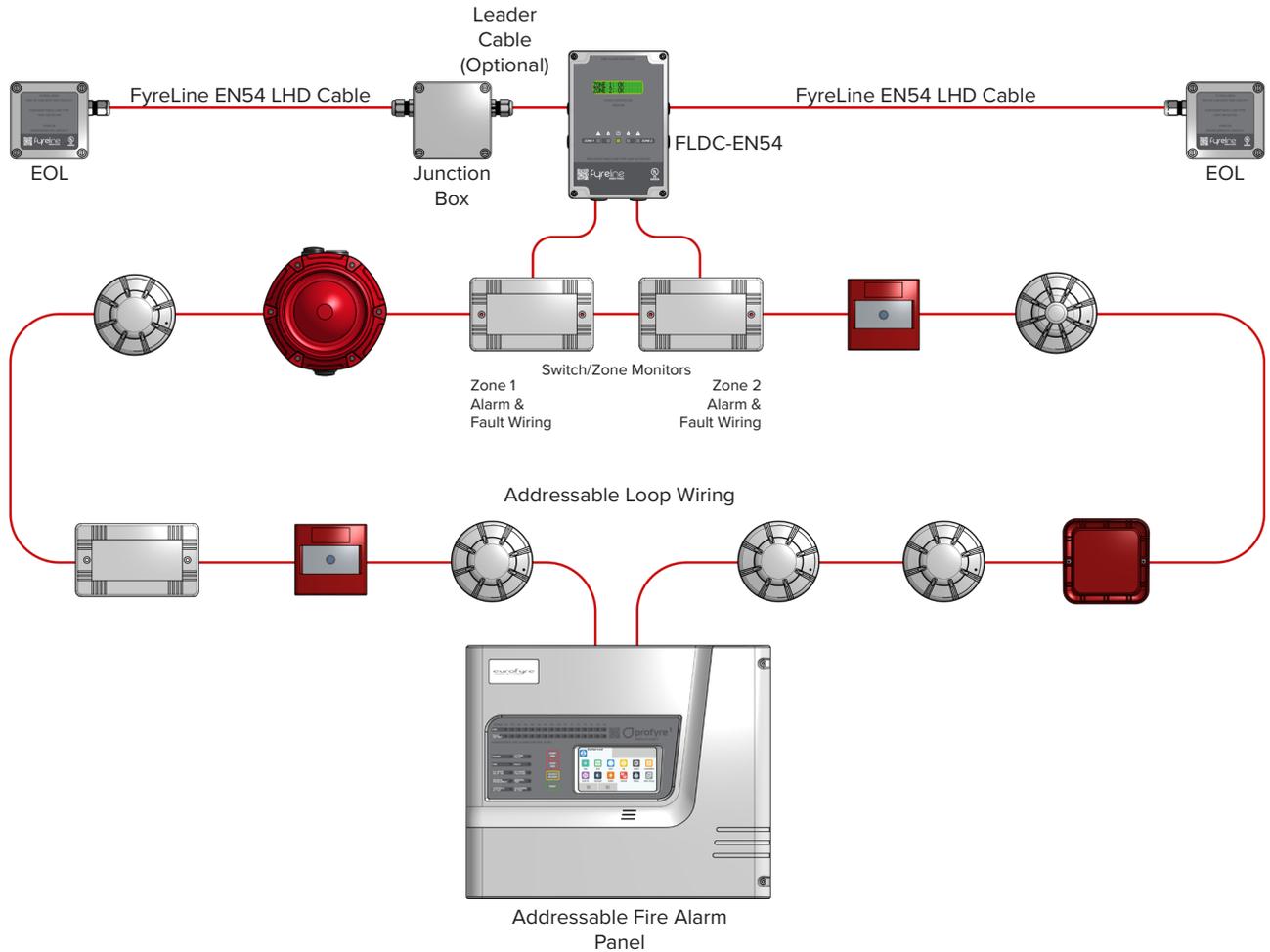


Figure 1: Typical Installation of the FyreLine EN54 Fixed Controller on a Addressable System

## 2.2 Typical Conventional System Wiring

PSU and Modbus connections not shown.

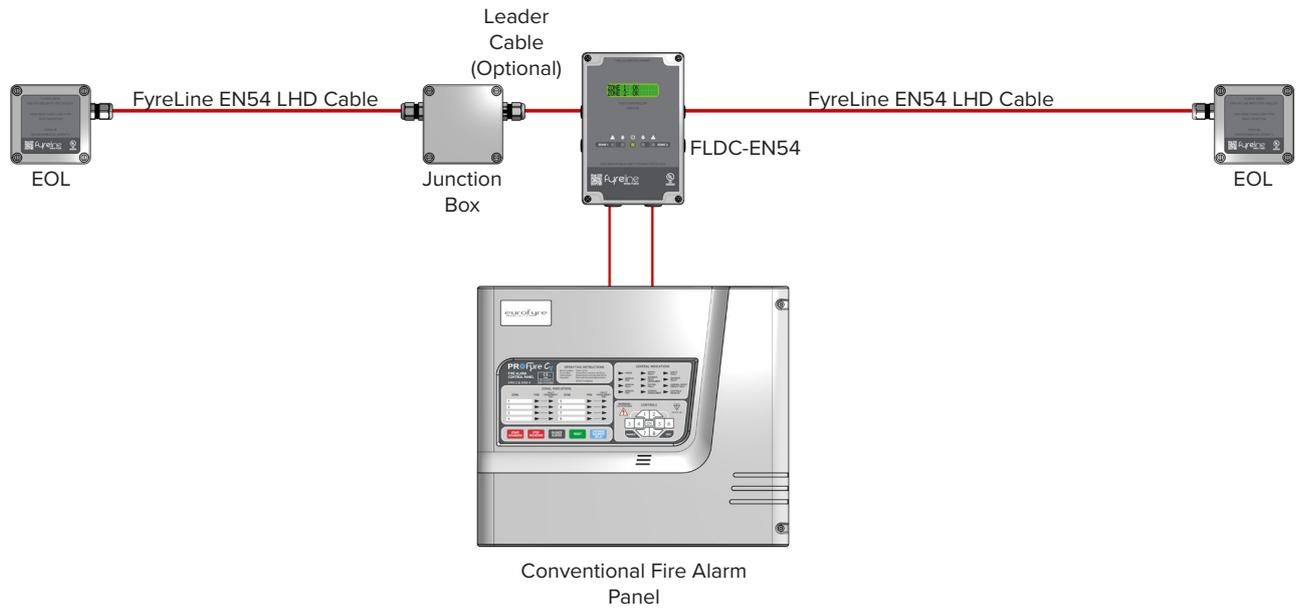


Figure 2: Typical Installation of the FyreLine EN54 Fixed Controller on a Conventional System

### 3 Technical Specification

Part Number	18-400		
Description	FyreLine EN54 Fixed Controller		
UL Model Number	FLDC-EN54		
UL File Number	S36489		
Revision	1.9.2-EN		
Approvals	EN54-28:2016		
<b>Enclosure</b>			
Dimensions (W x H x D)	120mm x 180mm x 60.5mm (4.72" x 7.08" x 2.38")		
Rating	NEMA 4, 4X (IP65)*1		
Finish	Light grey with clear lid		
Display	2 lines, 16 character back-lit display showing zone status		
Power Requirements	All circuits power limited if powered from a power limited supply		
Operating Voltage	12V DC	24V DC	36V DC
<b>Current Consumption</b>			
Normal Operation (Standby)	<15mA	<7mA	<5mA
Alarm	<40mA	<23mA	<15mA
Operating Temperature Range	-20°C to +50°C (-4°F to +122°F)*2		
<b>Terminal Blocks</b>			
Spacing	5mm Rising Clamp		
Rating	16A		
Wire Size	0.08mm <sup>2</sup> (28AWG) to 4mm <sup>2</sup> (11AWG)		
Supervised Circuits	Power, Input Zone 1 & Input Zone 2		
Inputs	Up to two Class B zones of FyreLine EN54 Fixed LHD Cable		
Max Zone Length	1000m (3,280ft)		
Min Zone Length	1m (3,2ft)		
End of Line Resistor	3.6kohm (included)		
Short Circuit Current	0.5mA		
Max Voltage	5V		
<b>Outputs</b>			
Communications	Two wire RS-485 Modbus RTU/ASCII		
Sounder	2.4kHz Buzzer		
Alarm	2x Form C volt-free relay contacts (resistive, common) Max V: 30V AC or 42.4V DC Max Current: 2A Max Switching Power: 60W, 62.5VA		
Fault	2x Optoisolated photo-transistor output (resistive, common) Max V: 35V DC Max Current: 80mA Max Power Dissipation: 150mW		

\*1 Outside the scope of EN54-28:2016, not verified by UL.

\*2 Verified by UL to EN54-28:2016 Environmental Group II between -10°C to +55°C

## 4 Installation

### 4.1 Overview

The FLDC-EN54 allows accurate location of an alarm point along a length of FyreLine EN54 Fixed Linear Heat Detection (LHD) cable. It continuously monitors up to two zones of Fixed LHD cable for a fault (open circuit) or an alarm (overheat or fire condition). Because of the wide range of applications that Fixed LHD cable can be used for, it may not always be possible, or be too time consuming, to locate where along the cable an alarm has occurred. Using the FLDC-EN54, when an alarm occurs the distance to the overheat condition is immediately calculated and displayed on the integrated display.

If a fault is detected, the corresponding fault output stops conducting, triggering a fault at the fire alarm control panel. If an alarm is detected, the corresponding alarm output changes state, triggering an alarm at the fire alarm panel.

The fault outputs also stop conducting on power loss to the unit or microprocessor fault, triggering a fault at the fire alarm control panel.

The two wire RS-485 Modbus RTU/ASCII output also outputs the current state of both zones. See the section “Modbus RTU/ASCII Communications” for more detail.

There are two primary configurations of the FLDC-EN54 (see figure 1 and 2):

1. The Fixed LHD cable can be connected directly to the FLDC-EN54.
2. The Fixed LHD cable is connected to a length of leader cable which is connected to the DSCU-EN. In this scenario the leader cable must be ‘calibrated out’ during commissioning of the FLDC-EN54.

### 4.2 Connections

Figure 3 shows the connections diagram for the FLDC-EN54 unit. The unit is provided with a 3.6kohm end of line resistor in each zone input. If only one zone is required, leave the 3.6kohm resistor connected across the zone which is not in use. Otherwise the 3.6kohm resistor should be connected at the end of the Fixed Linear Heat Detection cable.



Figure 3: FyreLine EN54 Fixed Controller Connections

### 4.3 Operating Modes Wiring Diagram Independent

There are two operating modes for the Fixed Controller.

#### 4.3.1 Independent

This is when the FLDC-EN54 is used as a two zone system. When a fault or overheat condition occurs on a Fixed LHD zone, the corresponding fault or alarm output respectively is triggered. The two zones operate independently and both sets of outputs should be connected to a fire alarm control panel. If the zone is not required leave the 3.6kohm resistor in the zone input terminals as supplied. In this mode, the two zones can either contain identical rated temperature Fixed LHD cables or two different rated temperature Fixed LHD cables.

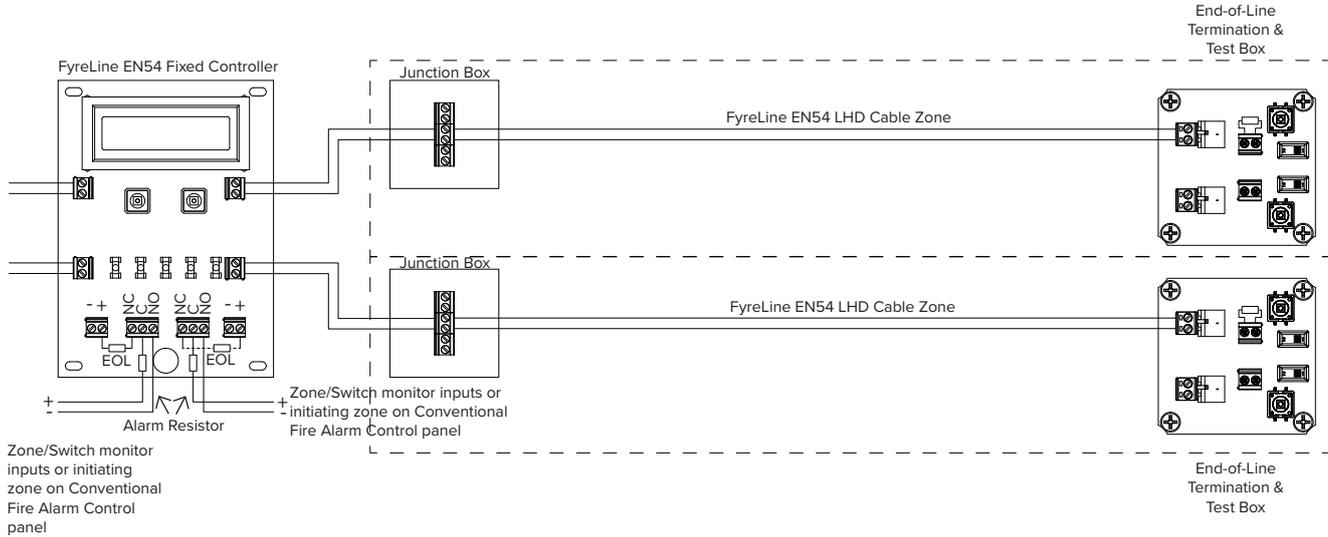


Figure 4: Typical Independent Wiring Diagram

The EOL and Alarm resistor are usually provided with the fire alarm panel or zone/switch/IO module. For more information please refer to the fire alarm panel or addressable module installation instructions.

	<p><b>On each zone output group, the Fault '-' (negative terminal) and alarm NO terminal are connected by a jumper on the FLDC-EN54 PCB. Do not remove or break this jumper when the system is used with an EN54 fire alarm system in the wiring configuration shown.</b></p>
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### 4.3.2 Interlock

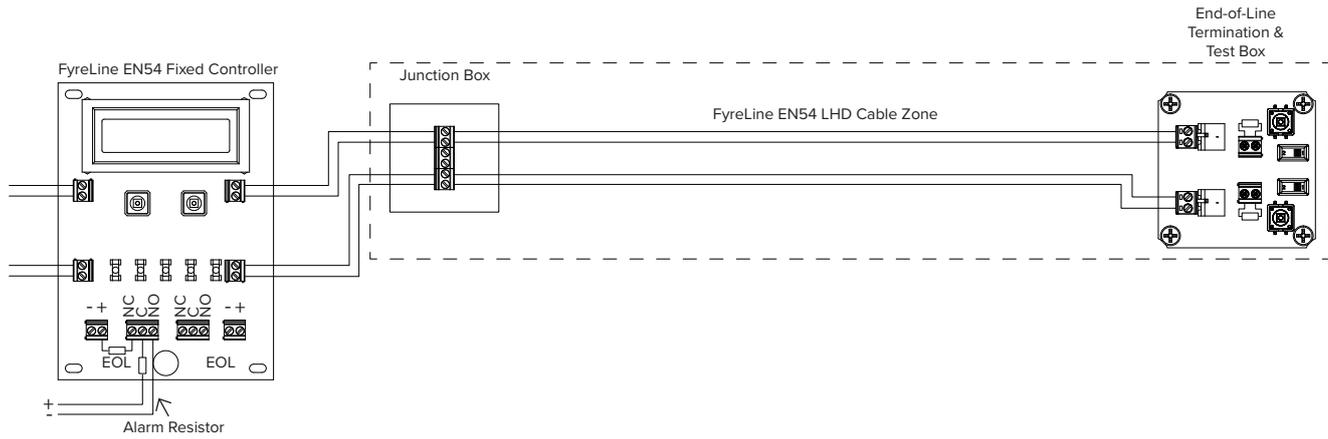
This mode is for applications which require a fail-safe guarantee that an alarm is only triggered when an overheat condition has been detected. This mode may also be known as coincidence detection. In this case, the same rated temperature Fixed LHD cable should be attached to both zones of the FLDC-EN54. The alarm output is only activated when both Fixed LHD cables trigger an alarm due to an overheat condition. If one Fixed LHD cable zone input registers an alarm but the second does not, the alarm output will not be activated. This is to prevent an alarm if a mechanical or other issue has triggered one Fixed LHD cable and not an overheat condition.



Only use Zone 1 fault and alarm outputs in Interlock mode.

Two linear heat detectors with the same temperature rating must be used and a minimum of two linear heat detectors must be installed in each protected space.

See the FyreLine EN54 Fixed LHD Installation Guide for the linear spacing specification.



Zone/Switch monitor inputs or initiating zone on Conventional Fire Alarm Control panel

Figure 5: Typical Interlock Wiring Diagram

The EOL and Alarm resistor are usually provided with the fire alarm panel or zone/switch/IO module. For more information please refer to the fire alarm panel or addressable module installation instructions.



On each zone output group, the Fault '-' (negative terminal) and alarm NO terminal are connected by a jumper on the FLDC-EN54 PCB. Do not remove or break this jumper when the system is used with an EN54 fire alarm system in the wiring configuration shown.

## 5 Useful Information

### 5.1 Leader Cable

In certain applications it may be desirable or necessary to use non-sensing leader cable between the FyreLine EN54 Fixed Controller and the Fixed LHD cable. For example, if the FLDC-EN54 unit is located some distance away from the area protected by the Fixed LHD cable. This may be required if the expected ambient temperature range, or other environmental conditions, where the Fixed LHD cable is to be used is greater than the maximum ambient temperature range for the FLDC-EN54 unit. (see steps 8, 9 and 10 in the Commissioning section on page 14).

The maximum length of leader cable that can be used per zone is dependent upon the leader cable diameter. The following is a guideline for typical cable sizes and maximum length:

Cable Size	Max Leader Cable Length
20AWG (16 x 0.2mm or 0.8mm dia. copper)	1000m

## 5.2 Static Discharge Cautionary

The following items are cautionary notes that will help prevent equipment damage or malfunction caused by static discharge:

	<p>Static charges produce voltages high enough to damage electronic components. Follow these precautions when installing, servicing, or operating the FLDC-EN54:</p> <ul style="list-style-type: none"> <li>• Work in a static-free area</li> <li>• Discharge any static electricity you may have accumulated.</li> <li>• Discharge static electricity by touching a known, securely grounded object.</li> <li>• Do not handle the printed circuit board (PCB) without proper protection against static discharge.</li> </ul> <p>In the event that the FLDC-EN54 malfunctions after encountering a static discharge correct operation of the unit can be restored by interrupting power to unit for a brief period (approximately 10s). Setup information can be verified by following the steps in the commissioning section. In the event of the setup information being corrupted the unit should be reset following the Resetting the FLDC-EN54 procedure.</p>
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## 5.3 Mounting Dimensions

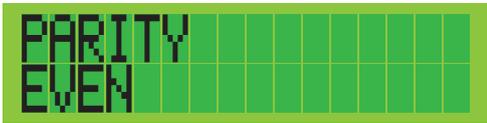
The FLDC-EN54 is intended to be wall-mounted. 4 holes should be drilled according to the mounting dimensions given in figure 6. The corresponding mounting holes on the FLDC-EN54 unit can be found by removing the lid of the device. The mounting holes are located adjacent to the lid screw positions. Suitable screws for the type of wall the FLDC-EN54 is to be mounted on will need to be provided for separately. The maximum screw head diameter is 7mm and the maximum screw thread diameter is 4mm.



Figure 6: Mounting Dimensions for the FLDC-EN54

## 6 Commissioning

<p>After wiring the unit up (see wiring diagram) power up the device. Device will show screen including software revision number.</p>												
<p>If the unit is being setup for the first time the following options will be shown. If the unit has previously been installed the display will automatically cycle through the options, showing the stored settings.</p>												
<p>After the initial title screen the next screen will show a menu with three options: Load Configs, New Configs and Self Test. On a previously configured device, after 10s of no button being pressed the device will automatically proceed to loading saved configs.</p>												
<p>If "Load Configs" is selected or no button has been pressed after 10s on a previously configured device, the screen will show "Loading Saved Configs". The previously saved parameters will then be displayed.</p>												
<p>Select the operating mode. (see "Operating modes" (pages 11-12) for more detail.</p> <ul style="list-style-type: none"> <li>• <b>Independent:</b> the two zones operate independently of each other (default).</li> <li>• <b>Interlock:</b> Both fault outputs activate when a fault occurs on either zone 1 or zone 2. Both alarm outputs activate only when both LHD zones trigger an alarm.</li> </ul>												
<p>Select the relevant operating programme for Zone 1 based on the table below:</p> <table border="1" data-bbox="124 1048 783 1205"> <thead> <tr> <th rowspan="2">Alarm (or activation) temperature</th> <th colspan="2">Cable Set-Up</th> </tr> <tr> <th>T078-V10-A045</th> <th>T088-V10-A065</th> </tr> </thead> <tbody> <tr> <td>78°C (FLD78-EN)</td> <td>✓</td> <td></td> </tr> <tr> <td>88°C (FLD88-EN)</td> <td></td> <td>✓</td> </tr> </tbody> </table>	Alarm (or activation) temperature	Cable Set-Up		T078-V10-A045	T088-V10-A065	78°C (FLD78-EN)	✓		88°C (FLD88-EN)		✓	 <p><i>In this example, the first option has been chosen for an alarm temperature of 78°C</i></p>
Alarm (or activation) temperature		Cable Set-Up										
	T078-V10-A045	T088-V10-A065										
78°C (FLD78-EN)	✓											
88°C (FLD88-EN)		✓										
<p>Select the relevant operating programme for Zone 2 based on the table below:</p> <table border="1" data-bbox="124 1317 783 1473"> <thead> <tr> <th rowspan="2">Alarm (or activation) temperature</th> <th colspan="2">Cable Set-Up</th> </tr> <tr> <th>T078-V10-A045</th> <th>T088-V10-A065</th> </tr> </thead> <tbody> <tr> <td>78°C (FLD78-EN)</td> <td>✓</td> <td></td> </tr> <tr> <td>88°C (FLD88-EN)</td> <td></td> <td>✓</td> </tr> </tbody> </table>	Alarm (or activation) temperature	Cable Set-Up		T078-V10-A045	T088-V10-A065	78°C (FLD78-EN)	✓		88°C (FLD88-EN)		✓	 <p><i>In this example, the first option has been chosen for an alarm temperature of 78°C</i></p>
Alarm (or activation) temperature		Cable Set-Up										
	T078-V10-A045	T088-V10-A065										
78°C (FLD78-EN)	✓											
88°C (FLD88-EN)		✓										
<p>If leader cable is connected between the Fixed LHD cable and the FLDC-EN54 unit and/or the LHD cable is installed in a hazardous area and IS barriers are being used, the voltage drop to the start of the LHD cable must be measured by the FLDC-EN54 unit in order to ensure correct operation and accurate distance location. In order to do this, with the leader cable and/or IS barriers and LHD cable connected to the FLDC-EN54 unit, short out the connection at the start of the LHD cable. Select "Yes" and press Set to continue.</p>												
<p>If "Yes" was selected in step 8, the FLDC-EN54 unit will then ask if the zone is ready to be calibrated. Ensure that the connection between the leader cable and/or the IS barriers and the start of the Fixed LHD cable is securely shorted out between the two cores. When this is done, press the "Set" button to continue.</p>												

<p>The FLDC-EN54 unit will display the voltage drop across the leader cable. If necessary, press “Select” to perform the calibration measurement again. The FLDC-EN54 unit will display the updated voltage drop in mV (milli-volts). The display value should be equal to approximately half the loop resistance (in ohms) from the FLDC-EN54 unit, with the short in place. Once the voltage drop has been confirmed correct, press “Set” to continue. Now remove the short at the start of the LHD cable.</p>	
<p>If the Linear Heat Detection cable is connected directly to the FLDC-EN54 then select No and press the Set button to continue.</p>	
<p>Select whether you would like the alarm outputs for both zones to be latching. If set to Yes, then if an alarm is triggered the unit will either require the power supply to be interrupted (min. 2s) or the Set button to be pressed to reset to normal once the alarm condition has been cleared.</p>	
<p>Select whether the Modbus output should be enabled. If this is not enabled then proceed to step 20.</p>	
<p>Select required Modbus type, either RTU or ASCII.</p>	
<p>Set the Modbus address for this device (1 - 247).</p>	
<p>Cycle through the possible Baud Rates for the Modbus RTU/ASCII output. (2400, 4800, 9600, 19200, 38400, 57600, 115200).</p>	
<p>Select the number of data bits for the Modbus RTU/ASCII output. (7 or 8).</p>	
<p>Select the number of stop bits for the Modbus RTU/ASCII output. (1 or 2).</p>	
<p>Select the parity for the Modbus RTU/ASCII output. (even/odd/none).</p>	

## 7 Normal Operation

Once the unit has been commissioned, the display will show the zone status. In normal operation, the display unit in independent mode will show:

Zone 1: OK  
Zone 2: OK



The display unit in interlock mode will show:

{Zone 1: OK  
{Zone 2: OK

This indicates the two zones of LHD cable are linked and an alarm is only transmitted if both zones are triggered.



**!** Either of the display screens above and a single flashing Power light (green colour) should be visible when FyreLine EN54 Fixed Controller is in normal operation.

## 8 Fault/Alarm Conditions

If an alarm condition occurs the FLDC-EN54 automatically calculates the distance along the cable to the trigger point and first displays this value in metres.



The display alternates showing the distance along the cable to the trigger point in metres and in feet.



The unit monitors for relay faults. If an alarm condition occurs but the relay does not switch state (due to a coil failure for example) the device will go into relay fault and show the screen below, depending upon which zone is in fault.



The unit monitors for interference faults when the input may be changing between alarm, ok and fault conditions, for example, too rapidly. In this case an I/F fault is displayed on the corresponding zone. Check all cable terminations are securely fastened and for other sources of noise.



The unit monitors for cable faults (i.e. an open circuit). An open circuit will be displayed as fault (as per zone 2 shown right).



In interlock mode, the alarm outputs are only activated when both LHD cables are triggered. If one cable triggers but not the other the display will show the distance to the alarm on the triggered zone and the corresponding alarm LED will flash slowly.



In interlock mode, if both cables go into an alarm, the alarm outputs will be activated and the display will show the distance to the alarm for each zone. The zone 1 and zone 2 alarm LEDs will light continuously.



## 9 Testing & Verification

<p>If self test mode is selected the device will first load the saved configs then proceed to cycle through normal operation, alarm and fault. This is to allow the installer/maintenance engineer to verify that the unit is connected to an external system correctly. The screen will flash “SELF TEST/MODE” every few seconds.</p>	
<p>In self test mode the device cycles between normal operation, alarm and fault every approx. 8 seconds. In normal operation the display will show OK. The alarm relays will be off and the fault output normally conducting (on).</p>	
<p>In self test mode and alarm condition the display will show alarm. The alarm relays will be on. After approx. 8 seconds the unit will go into fault condition.</p>	
<p>In self test mode and fault condition the display will show fault. The fault outputs will stop conducting (off). After approx. 8 seconds the unit will return to normal condition. To exit self test mode, press and hold both SET and SELECT buttons for 10s or more until the device resets.</p>	

## 10 Two-wire RS-485 Modbus RTU Communications

The FyreLine EN54 Fixed Controller includes a two wire RS-485 Modbus output which can be enabled to output the status of each zone of Fixed Linear Heat Detection Cable. The FLDC-EN54 Modbus output supports the Modbus RTU protocol and the following functions:

- Function code 4 (Read Input Registers)

The request for reading the input registers should be constructed in the following manner:

- Address of first register to be read (16-bit)
- Number of registers to read (16-bit)

The FLDC-EN54 will respond in the following manner:

- Number of bytes of register values to be read (8-bit)
- Register values (16-bits per register)

The FLDC-EN54 stores the information for each zone of the Fixed LHD cable in the following format:

Register	Description	Possible Values
0	Zone 1 Status	-1 or 65535=fault on zone 0=zone ok 1-32767=distance in metres to trigger point
1	Zone 2 Status	-1 or 65535=fault on zone 0=zone ok 1-32767=distance in metres to trigger point
2	Zone 1 cable type	1=65°C or 68°C, 2=75°C or 78°C, 3=85°C or 88°C, 4=100°C, 105°C and 110°C, 5=185°C, 6=230°C
3	Zone 2 cable type	1=65°C or 68°C, 2=75°C or 78°C, 3=85°C or 88°C, 4=100°C, 105°C and 110°C, 5=185°C, 6=230°C

Table 5: FLDC-EN54 Information Format

If the start address plus the requested number of registers exceed 4, the FLDC-EN54 will return an ILLEGAL DATA ADDRESS error.

If the request contains a function code other than those supported the FLDC-EN54 will return an ILLEGAL FUNCTION error.

## 11 Factory Default Settings



**This procedure will erase ALL stored settings and reset the FyreLine EN54 Fixed Controller back to its factory default state. The cable types, leader cable calibration, latching output selection and Modbus setup will all require selecting after this procedure.**

To reset the FLDC-EN54 unit back to the factory state, when the unit is powered up and in normal operation, press and hold the SET and SELECT buttons for a minimum of 10 seconds continuously. While the SET and SELECT buttons are held down the power LED will flash quickly to confirm this procedure is about to take place. After approximately 10 seconds, the unit will restart and return to step 1 in the Commissioning procedure. The settings are only erased if the menu option "New Configs" is selected.

## 12 Glossary

**Alarm condition** – A fire or overheat around the Fixed LHD cable which activates the cable and triggers the FLDC-EN54 unit.

**Cable glands** – Used to form a dust-proof and weatherproof seal around a cable entering the FLDC-EN54 unit.

**Fixed linear heat detection cable** – a sensing cable comprised of a pair of twisted low resistance conductors that fuse together at a specific temperature and induce an alarm on a fire panel or interface module.

**End of line resistor** – A component which allows a residual current flow through a circuit to monitor the integrity of the circuit. In the event of a break in the circuit, current will stop flowing completely and a trouble or fault signal will be triggered.

**Fault condition** – A break in one or both cores of the Fixed LHD cable or a malfunction of the FLDC-EN54 unit.

**Independent mode** – The mode on the FLDC-EN54 unit where both zones operate separately. Each zone can trigger a fault or alarm, or be in the normal state, regardless of the state of the other zone.

**Interlock mode** – The mode on the FLDC-EN54 unit where the alarm relay outputs will only activate when both Fixed LHD cables go into alarm. If one cable triggers but not the other, the alarm relay outputs will not be triggered.

**Junction box** – A secure, dust-proof and weatherproof enclosure to protect a join between two lengths of Fixed LHD cable or a length of Fixed LHD cable and leader cable.

**Leader cable** – A non-temperature sensing cable which transmits the signals between two components in the system, e.g. the FLDC-EN54 unit and the Fixed LHD cable. Does not provide fire detection and may be fire-rated to continue functioning even in a fire condition.

**Two-wire RS-485 Modbus RTU/ASCII Communications** – An industry standard, signalling protocol used to communicate information between components in a system, for example a SCADA system or PLC. Often used to provide more information to be communicated than simple open or closed status communicated by a relay output.

**Zone** – a single circuit of FyreLine linear heat detection cable connected across either a FyreLine FLDC-EN54 or a fire panel and an end of line resistor.

