



Shield Digital Control Module (DCM)

Installation Manual

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Important Guidelines

Please read this instruction leaflet thoroughly before commencing installation.

- ✓ Install the Digital Control Module (DCM) accordingly to meet local and country installation requirements.
- ✓ The DCM must be installed in accordance with NFPA 70 & 72, NEC 760 (National Electric Code) 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 Shield Digital Linear Heat Detection (LHD) cable.
- ✓ Test the LHD Cable before connecting it to the DCM using a multimeter.
- ✓ Ensure the end of line resistor (1kohm) is securely connected at the end each LHD cable.
- ✓ If only one zone is required leave the end of line resistor (1kohm) 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 DCM (36Vdc).



Do not connect lengths of LHD cable in 'T' connections or spurs.

General Description

Digital Control Module

The Shield Digital Control Module (DCM) is a dual zone module for monitoring up to two zones of Shield Digital LHD Cable. If an overheat or fire situation triggers either zone of the 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 Digital LHD 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.

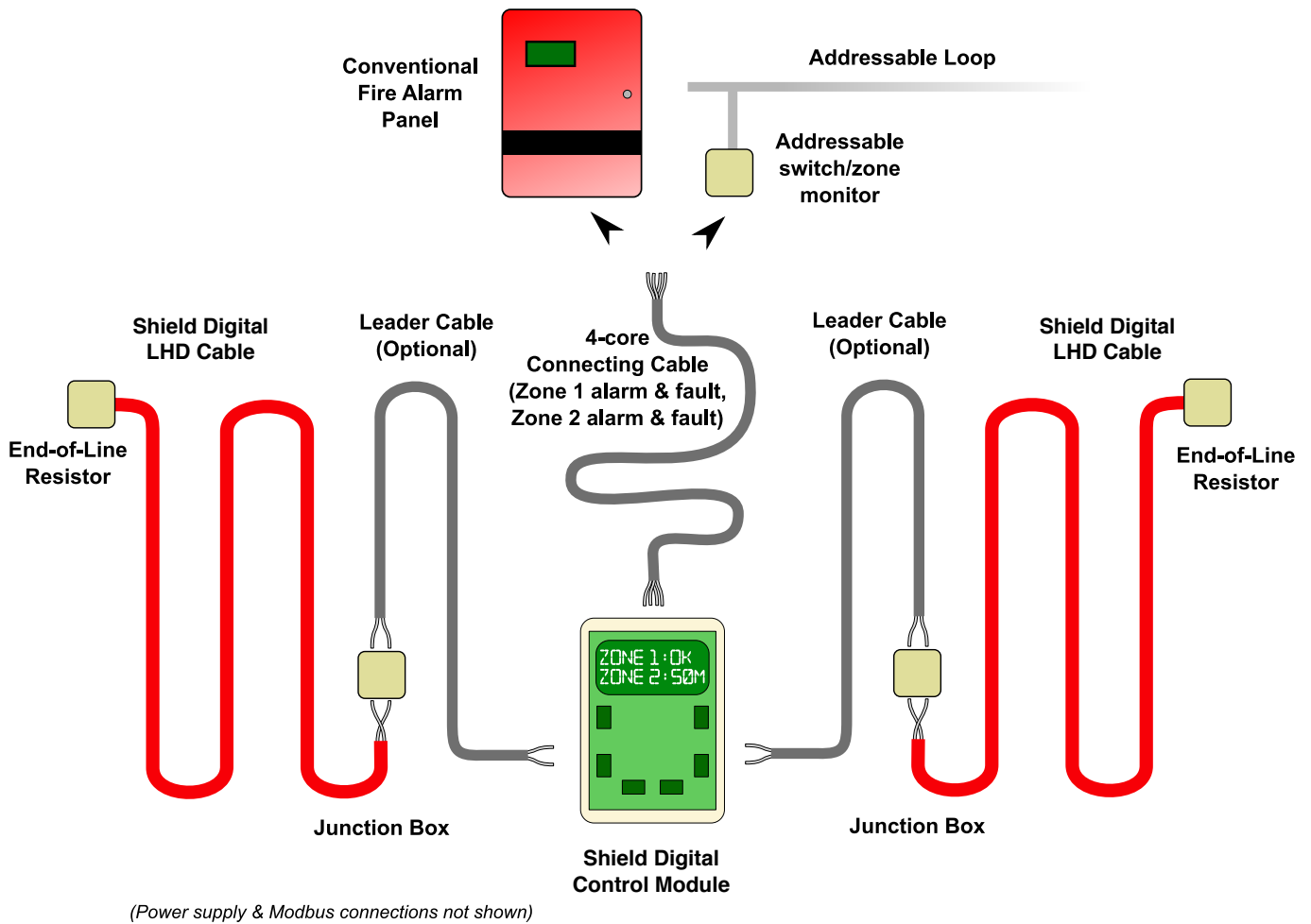


Figure 1: Typical Installation of the Shield Digital Control Module

Specifications

Part No:	LH-DCM (-M suffix M16 knockouts on bottom) (-Pg suffix PG16 knockout on bottom)		
Description:	Digital Control Module – LH-DCM – SHIELD		
Revision:	1.0		
Enclosure:			
...Dimensions	H180mm x W120mm x D60.5mm (H7.1in x W4.72in x D2.38in)		
...Rating	NEMA 4, 4X (IP65)		
...Finish	Light Gray with clear lid		
...Display	2 line, 16 character backlit display showing zone status		
Approvals:	UL 864 10th ed.		
Power Requirements:	<i>All circuits power limited if powered from a power limited supply</i>		
	Min.	Nominal	Max.
...Operating Voltage (UL tested)	14Vdc	— to —	36Vdc
...Operating Voltage	12Vdc	— 24Vdc —	36Vdc
Current Consumption:	↓	↓	↓
...Normal Operation (standby)	<15mA	<7mA	<5mA
...Alarm	<40mA	<23mA	<15mA
Operating Temperature Range:	-20°C – +50°C (-4°F – +122°F)		
Terminal Blocks:			
...Spacing	5mm Rising Clamp		
...Rating	16A		
...Wire Size	0.08mm ² (28AWG) to 4mm ² (11AWG)		
Supervised Circuits:	Power, Input Zone 1 & Input Zone 2		
Inputs:	<i>Up to two Class B zones of Shield Digital LHD Cable</i>		
...Max Zone Length	3000m (10,000ft)		
...Min Zone Length	1m		
...End of line resistor	1kohm (included)		
...Short circuit current	0.5mA		
...Max Voltage	5V		
...Ground fault impedance	0ohms		
Outputs:			
...Communications	Two wire RS-485 Modbus RTU/ASCII		
...Sounder	2.4kHz 92dBa @ 10cm Buzzer		
...Alarm	2x Form C volt-free relay contacts (resistive, common)		
	<i>Max V</i>	30Vac or 42.4Vdc	
	<i>Max Current</i>	2A	
	<i>Max Switching Power</i>	60W, 62.5VA	
...Fault	2x Optoisolated phototransistor output (resistive, common)		
	<i>Max V</i>	35Vdc	
	<i>Max Current</i>	80mA	
	<i>Max Power Dissipation</i>	150mW	

Leader Cable

The Shield DCM can be connected via leader cable to the start of the Digital LHD cable. During installation the voltage drop across the leader cable is calibrated out to give an accurate distance reading when an alarm is triggered (see page 9 for calibration procedure).

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

Cable Size	Max Leader Cable Length
20AWG (16x0.2mm or 0.8mm dia, copper)	1000m
22AWG (7x0.25mm or 0.6mm dia, copper)	600m
24AWG (7x0.2mm or 0.5mm dia, copper)	390m

Static Discharge Cautionary

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

CAUTION

Static charges produce voltages high enough to damage electronic components. Follow these precautions when installing, servicing, or operating the DCM:

- Work in a static-free area.
- Discharge any static electricity you may have accumulated.
- Discharge static electricity by touching a known, securely grounded object.
- Do not handle the printed circuit board (PCB) without proper protection against static discharge.

In the event that the DCM 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 installation procedure section. In the event of the setup information being corrupted the unit should be reset following the *Resetting the DCM procedure*.

Mounting Dimensions

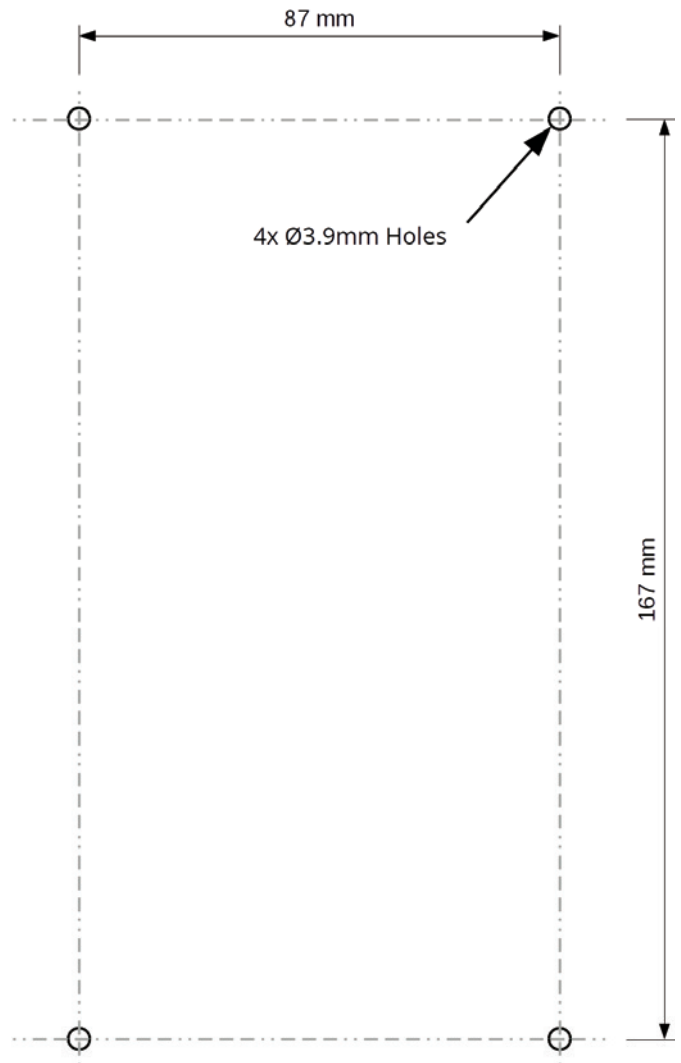


Figure 2: Mounting Dimensions for the Shield DCM

Installation

The DCM allows accurate location of an alarm point along a length of Shield Digital LHD cable. It continuously monitors up to two zones of cable for a fault (open circuit) or an alarm (overheat or fire condition). Because of the wide range of applications that Digital 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 DCM, 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 DCM (see figure 1):

- 1) The Digital LHD cable can be connected directly to the DCM
- 2) The Digital LHD cable is connected to a length of leader cable which is connected to the DCM. In this scenario the leader cable must be "calibrated out" during commissioning of the DCM.

Connections Diagram

Figure 3 shows the connections diagram for the DCM. The unit is provided with a 1kohm end of line resistor in each zone input. If only one zone is required, leave the 1kohm resistor connected across the zone which is not in use. Otherwise the 1kohm resistor should be connected at the end of the Digital LHD cable.

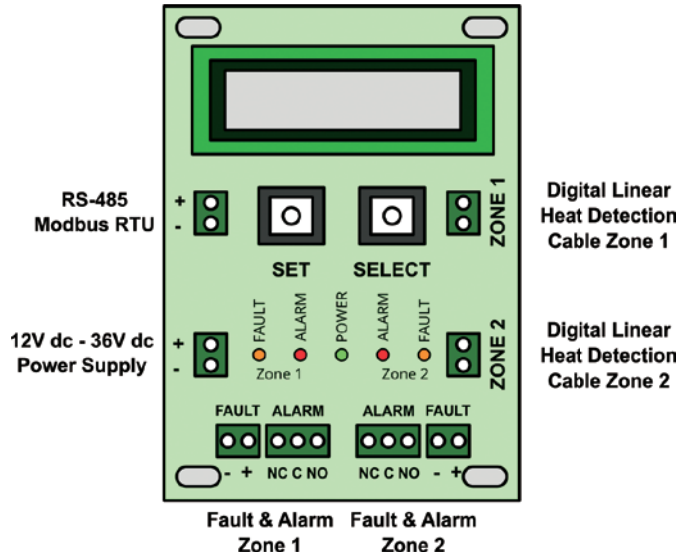


Figure 3: Wiring Diagram for the Shield DCM

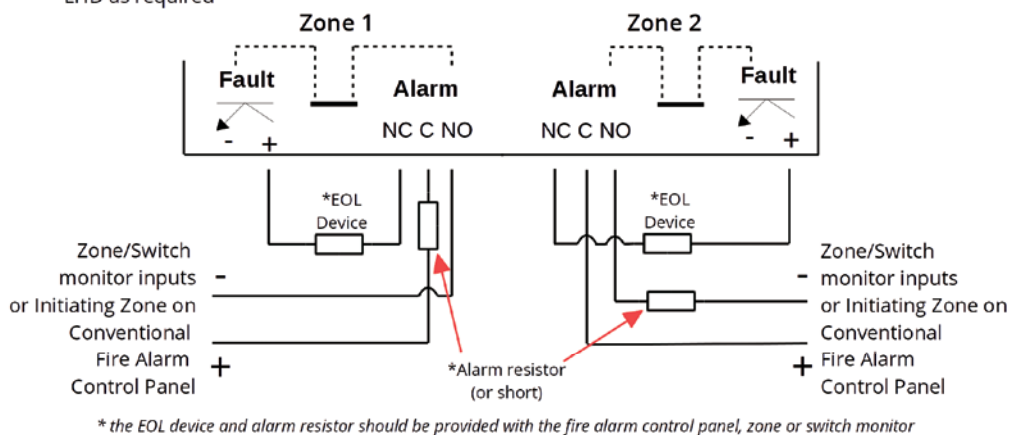
Operating Modes Wiring Diagram Independent

There are two operating modes for the Digital Control Module:

1. **Independent** – This is when the DCM is used as a two zone system. When a fault or overheat condition occurs on an 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 1kohm resistor in the zone input terminals as supplied. In this mode, the two zones can either contain identical rated temperature LHD cables or two different rated temperature LHD cables, e.g. a 68 deg C in zone 1 and a 105 deg C in zone 2.

Operating Mode: Independent (Default)

Alarm and fault outputs operate independently and correspond to the LHD zone. May be used with one or two zones of LHD as required



Operating Modes Wiring Diagram Interlock

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 Digital LHD cable should be attached to both zones of the DCM. The alarm output is only activated when both LHD cables trigger an alarm due to an overheat condition. If one 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 LHD cable and not an overheat condition.

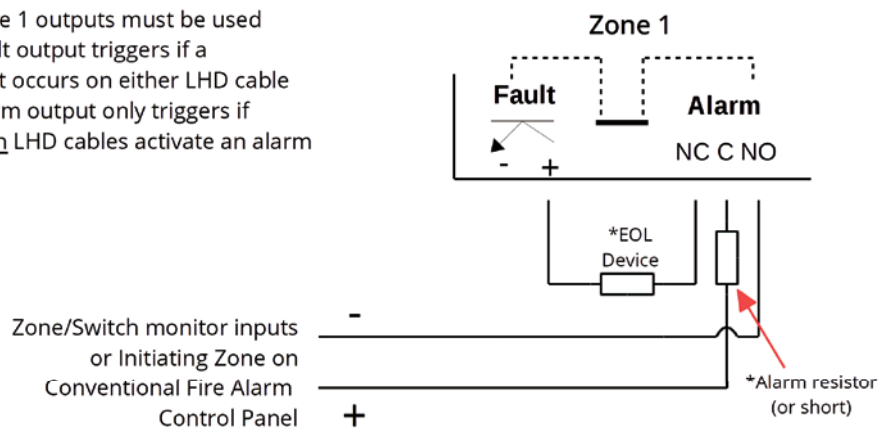
- Only use Zone 1 fault and alarm outputs in Interlock mode.
- Two linear heat detectors with the same temperature rating must be used and a minimum of two linear heat detectors must be installed in each protected space.
- The spacing between detectors should be less than 0.7 times the rated linear spacing, in accordance with National Fire Alarm Code, NFPA 72.

See the Shield Digital LHD Installation Instructions for the linear spacing specification.

Operating Mode: Interlock

Zone 1 outputs must be used
Fault output triggers if a
fault occurs on either LHD cable
Alarm output only triggers if
both LHD cables activate an alarm

Fault - and Alarm NO linked by jumper on PCB
Do not remove if being used with UL fire alarm system



* the EOL device and alarm resistor should be provided with the fire alarm control panel, zone or switch monitor

Commissioning

1. After wiring the unit up (see wiring diagram) power up the device. Device will show screen including software revision number.

2. 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.

3. After the initial title screen the next screen will show a menu (see right) with three options: Load Configs, New Configs and Self Test. On a previously configured device, after 10s of no button press the device will automatically proceed to loading saved configs.

4. 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.

5. Select the operating mode. (see "Operating modes" (pages 7-8) for more detail.

Independent: the two zones operate independently of each other (default).

Interlock: 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.

6. Select the cable type connected to Zone 1 (68°C/88°C/105°C/185°C)

7. Select the cable type connected to Zone 2 (68°C/88°C/105°C/185°C)

8. If leader cable is connected between the LHD cable and the DCM for this zone, press the Select button and select Yes. Press the Set button to continue.

9. The controller will then ask if the zone is ready to be calibrated. **The leader cable must be connected to the DCM and shorted out at the end where it connects to the START of the LHD cable. Once this is done press the Set button.**

10. The DCM will display the voltage drop across the leader cable. **Remove the short from the leader cable and connect it to the START of the LHD cable as normal.**

11. If the LHD cable is connected directly to the DCM then select No and press the Set button to continue.

```
SHIELD DUAL  
ZONE DCM R1234
```

```
MAIN MENU  
LOAD CONFIGS
```

```
LOADING SAVED  
CONFIGS...
```

```
OPERATING MODE:  
INDEPENDENT
```

```
Z1 CABLE TYPE:  
68C
```

```
Z2 CABLE TYPE:  
68C
```

```
ZONE 1 LDR CABLE  
YES
```

```
READY TO  
CALIBRATE?
```

```
ZONE 2 CAL:  
109 MV
```

```
ZONE 2 LDR CABLE  
NO
```

Commissioning (Cont.)

12. 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 conditioned has been cleared.

```
LATCHING OUTPUTS  
NO
```

13. Select whether the Modbus output should be enabled. If this is not enabled then proceed to step 17.

```
MODBUS OUTPUT ON  
YES
```

14. Select required Modbus type, either RTU or ASCII.

```
MODBUS TYPE  
RTU
```

15. Set the Modbus address for this device (1-247).

```
MODBUS ADDRESS  
1
```

16. Cycle through the possible Baud Rates for the Modbus RTU/ASCII output. (2400, 4800, 9600, 19200, 38400, 57600, 115200).

```
BAUD RATE  
2400
```

17. Select the number of data bits for the Modbus RTU/ASCII output. (7 or 8)

```
DATA BITS  
7
```

18. Select the number of stop bits for the Modbus RTU/ASCII output. (1 or 2).

```
STOP BITS  
1
```

19. Select the parity for the Modbus RTU/ASCII output. (even/odd/none).

```
PARITY  
EVEN
```

20. Once the unit has been commissioned the display will show the zone status. In normal operation the display will show OK for each Zone.

In Interlock mode the display will show

{Zone 1: OK

{Zone 2: OK

to indicate the zones are linked and an alarm is only transmitted if both zones are triggered.

```
ZONE 1: OK  
ZONE 2: OK
```

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

```
ZONE 1: 534 M  
ZONE 2: OK
```

Commissioning (Cont.)

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

```
ZONE 1: 1751 FT  
ZONE 2: OK
```

23. 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 to the right, depending upon which zone is in fault

```
ZONE 1: RLY FLT  
ZONE 2: OK
```

24. 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.

```
ZONE 1: OK  
ZONE 2: I/F FAULT
```

25. The unit monitors for cable faults (open circuit) and ground faults (where one conductor of LHD cable may be touching bare metal at some point). An open circuit will be displayed as fault (as per zone 1 shown right). A ground fault will be shown as 'gnd flt' (as per 2 shown right).

```
ZONE 1: FAULT  
ZONE 2: GND FAULT
```

Self Test


1. 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 verify that the unit is corrected to an external system correctly. The screen will flash "SELF TEST/MODE" every few seconds.

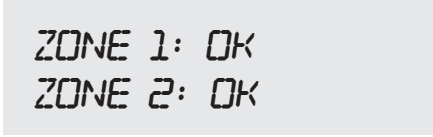
2. In self test mode the device cycles between normal operation, alarm and fault every approx. 8 seconds. In normal operation the display will show ok. The alarm relays will be off and the fault output normally conducting (on).

3. 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.

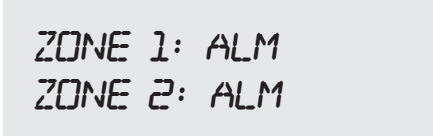
4. In self test mode and fault condition the display will show fault. The fault outputs will stop conducting (off). After approx. 8 seconds the unit will return to normal condition. To exit self test mode, press and hold both SET and SELECT buttons for 10s or more until the device resets.



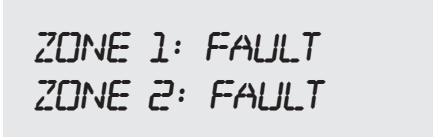
SELF TEST
MODE



ZONE 1: OK
ZONE 2: OK



ZONE 1: ALM
ZONE 2: ALM



ZONE 1: FAULT
ZONE 2: FAULT

Two-wire RS-485 Modbus RTU/ASCII Communications

The Shield DCM includes a two wire RS-485 Modbus output which can be enabled to output the status of each zone of Digital LHD Cable. The DCM Modbus output supports the Modbus RTU/ASCII 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 DCM will respond in the following manner:

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

The DCM stores the information for each zone of the 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=68°C, 3=88°C, 4=105°C, 5=185°C
3	Zone 2 cable type	1=68°C, 3=88°C, 4=105°C, 5=185°C

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

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

Resetting the Shield DCM Unit

WARNING: This procedure will erase ALL stored settings and reset the Shield DCM unit 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 Shield DCM unit back to the factory state, when the unit is powered up and in normal operation (see step 15 in the Commissioning procedure), 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.