

# ***DMS technologies***

**12V RED FLASH™**

***Low Voltage Disconnect***

***User Manual***



## Product Overview

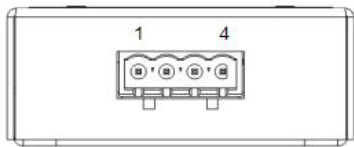
The **RED FLASH™** Low Voltage Disconnect (LVD) Unit is a low power device that can be used to prevent over-discharge and subsequent damage of batteries, regardless of battery technology. It has been designed to operate on 12V nominal systems and can be easily adjusted to suit the application, offering much better protection than conventional systems.

The LVD displays the battery's state of charge (SoC) using 3 LEDs. The State of Charge indicator adjusts automatically to account for changes in battery voltage due to varying load currents. The LVD is fitted with a microcontroller, which offers improved functions over other disconnect products. It has been designed with very low power consumption and can be used on either small or large capacity batteries. Currents of up to 10A can be controlled on board with an optional external relay allowing for load applications of up to 200A. It is fully protected against spikes, surges and reverse polarity connection.

All of the controls and output indicators that are available on the LVD unit can also be accessed remotely via a multipole connector.

## Connections

High power connections to the LVD are made via a 4-way terminal block (Camden electronics - CTB9200/4A). One terminal block is provided with the unit. The connections are as follows:



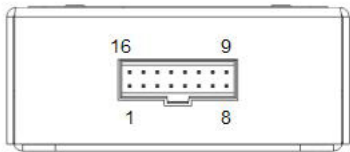
High Power Connector

Pin	Function
1	B -VE (Battery negative)*
2	L -VE (Load negative)*
3	B +VE (Battery positive)
4	L +VE (Load positive)

\*Electrically connected to metallic case

The low power connector on the LVD allows for the connection of external state of charge (SoC) indicators, external 'on', 'off' and 'push-to-test' buttons, and a link wire for enabling the 'Auto Reconnect Mode'. The LVD's remote output connections are made via a Molex 16 way C-grid III connector.

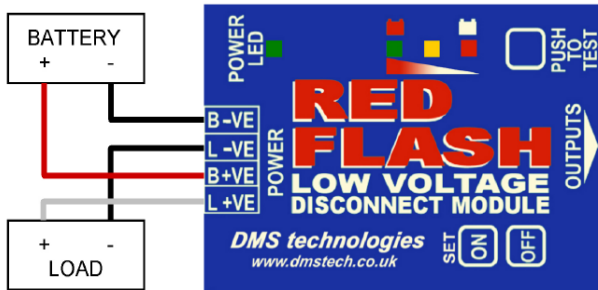
The connections are as follows:



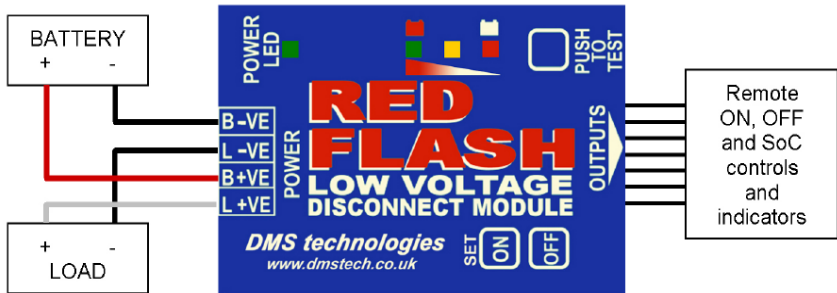
Low Power Connector

Pin	Function
1	On Button (A)
2	On Button (B)
3	Off Button (A)
4	Off Button (B)
5	Push to Test Button (A)
6	Push to Test Button (B)
7	LED1 (Green) Anode
8	LED2 (Amber) Anode
9	LED3 (Red) Anode
10	Power LED Anode
11, 12	LED Common Cathode
13, 14	No Connection
15	Auto Reconnect Link (A)
16	Auto Reconnect Link (B)

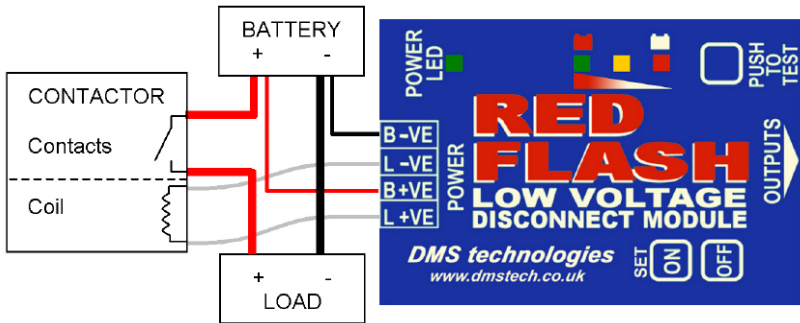
**Standard Connection** - The LVD Unit can be fitted into a circuit in various configurations. Typically, it is fitted between the battery and load and is connected as shown in the diagram below. In this configuration, the maximum load current is 10A.



**Remote Connection** - The LVD Unit can be controlled via a remote connection using the low power, 16-way 'Outputs' connector. This allows the unit to be mounted near the battery but the display and controls to be fitted elsewhere. The diagram below shows a typical connection. In this configuration, the maximum load current is 10A.



**High Current Connection** - The LVD Unit can be used to control very high currents. An external relay or contactor is fitted between the battery and load. The contactor is controlled using the load output from the LVD unit. The relay or contactor coil voltage must be 12V nominal and is connected as shown in the diagram below. The control functions can be operated remotely as described previously.



⚠ The LVD's outer metallic case is electrically connected to the 'Battery -VE' and 'Load -VE' connections.

⚠ External 'ON', 'OFF' and 'Push to Test' switches must be momentary, normally open switches. The use of latching or normally closed switches will prevent the LVD from operating correctly and may also cause the LVD to become irreparably damaged.

⚠ Do not connect the battery to the load terminals and ensure correct polarity is observed for all connections at all times.

⚠ External state of charge (SoC) LEDs should have a forward current ( $I_f$ ) of 20mA, and a forward voltage ( $V_f$ ) of 2.5V. The external power LED should have a forward current ( $I_f$ ) of 20mA, and a forward voltage ( $V_f$ ) of 2.5V.

⚠ The LVD will not balance the cells within a battery. When used with a Lithium-ion battery, the charger must incorporate the appropriate cell balancing functions.



## Setting the Low Voltage Threshold Voltage

The LVD's default disconnect threshold voltage of 10.8V is adjusted as follows:

- Set a power supply to 13V using a voltmeter.
- Connect a power supply to the LVD as if it were a battery. (Ensuring correct polarity).
- Ensure that the load is not connected to the LVD.
- Turn the unit on by pushing the ON / SET button (the power LED will illuminate).
- Press and hold the ON / SET button until the power LED begins to flash (approximately 5 seconds). The LVD is now in configuration mode.
- Set the power supply to the desired low voltage threshold (between 9.9V and 12.8V).
- Press the 'ON' button again to store this at the disconnect threshold voltage. The power LED should flash rapidly then the LVD will disconnect and turn off.

Configuration mode automatically times out and the LVD reverts to normal operation after 2 minutes if no low voltage threshold is set. Factory defaults can be restored by pressing and holding the 'ON' and 'OFF' buttons simultaneously for approximately 10 seconds. The power LED will extinguish and SoC LEDs will illuminate for 3 seconds to indicate this.

## Modes of Operation

The LVD has two modes of operation, which are detailed below:

**Manual Reconnect Mode** - In this mode, when the LVD disconnects, the entire unit turns off. This means that it consumes zero current, thus preventing any further discharge of the battery. When the battery has been recharged or changed, the 'ON' button must be pressed in order to reconnect the load. This is the LVD's default mode of operation.

**Auto Reconnect Mode** - In this mode, when the LVD disconnects, it enters an ultra low-power monitoring mode. When the battery voltage rises above 12.8V, the LVD will reconnect. The load can also be reconnected at any time (providing the battery voltage is above the set disconnect threshold) by pressing the 'ON' button. Pressing the 'OFF' button disconnects the load (if connected) and prevents automatic reconnection until the 'ON' button is pressed.

Auto reconnect mode is enabled by connecting a jumper wire between pins 15 and 16 on the low power connector.

## Operational Details

- Connect the battery and load to the LVD as shown in the appropriate diagram above
- Turn the LVD unit on by pushing the 'ON' button. This is indicated by the power LED illuminating. Providing the battery voltage is above the set 'disconnect threshold voltage', the LVD will turn on and connect the load to the battery.
- The battery will remain connected until the battery voltage reduces below the disconnect threshold voltage or until the OFF-button is pressed

## State of Charge

The State of Charge (SoC) measurement has been set up specifically for Lead-Acid batteries. In order to check the state of charge, the unit must be turned on. To test, press the 'Push to Test' button and the LEDs will illuminate to show the estimated battery level. The state of charge can be checked when the unit is either on-load or off-load.

## **On-Load State of Charge Measurement**

The state of charge can be checked when the unit is providing current to the load. This type of measurement is best suited to loads that are constant. Loads that have high peak current may give inaccurate results. On-load measurements will automatically compensate for the load current and adjust the indicators to suit. The readings are most accurate for batteries that have capacities between 5Ah and 100Ah.

**Note:** This function will not be accurate for high discharge currents where an external contactor is used.

## **Off-Load State of Charge Measurement**

Off-load state of charge measurement is the most accurate method of determining the battery level and is independent of the battery capacity (i.e. works for all lead acid batteries). Off-load measurements are best taken after a period of rest of approximately 1 hour (i.e. the battery is neither discharged nor recharged).

## Electrical Specification

The following table defines the maximum and minimum electrical ratings:

<b>Parameter</b>	<b>Min.</b>	<b>Max.</b>
Continuous Load Current (On Board)	N/A	10A
Continuous Load Current (Off Board)	N/A	200A
Battery Voltage	9.0V	15V
Disconnect Voltage Threshold Limits	9.9V	12.8V
Reconnect Voltage	N/A	12.8V
Disconnect Delay	10s	12s
Disconnected Quiescent Current*		
Manual Reconnect Mode	N/A	0A
Auto Reconnect Mode	N/A	100uA
Average Connected Quiescent Current*	N/A	1mA

\*Assuming no buttons are pressed or switches activated

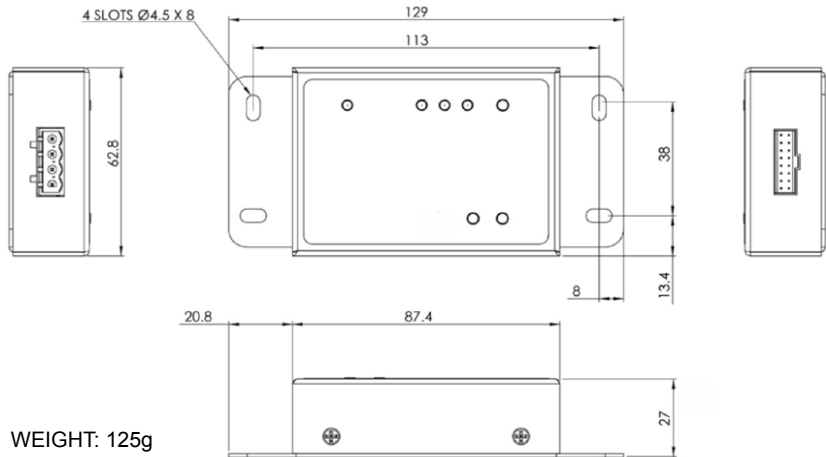
## Environmental Details

The following list defines the absolute maximum environmental ratings. Use of this device outside of these limits may lead to incorrect operation or permanent damage to the unit.

Operating temperature range:	-10°C to +60°C
Storage temperature range:	-40°C to +90°C
Humidity range:	to 90% RH

## Mechanical Details

The LVD is housed in an Aluminium case. The power connections are on one side of the case and the function connections are on the other. The case has four fixing points. The mechanical dimensions are detailed in the diagram below:



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**RED FLASH™** LVD is manufactured by ***DMS technologies*** in the UK. We reserve the right to change the specification without notice.