The PWM-Bullet 10 is a robust, almost bullet-proof, PWM Solar Charge controller designed and built in South Africa for the toughest African conditions. The PWM-Bullet is an inline unit with a 10-Amp continuous current rating.

Completely sealed and resin impregnated, the controller can take a severe battering, be permanently submerged or buried and still continue functioning day after day.

The charger can be programmed to adjust the charging parameters to either suit 'normal' wet/flooded lead acid batteries, 'deep cycle' (AGM / crystal) type batteries or new Lithium / LiFeYPO4 batteries. The charger is programmed by connecting the charger to the battery while holding a 1.5V (AA, AAA, C or D) cell across the PV terminals. The red LED will continuously blink to indicate programming mode, while the green LED will blink to indicate the selected program

MODE	Blinks	
Normal	*	14.4 Volt Absorption 13.2 Volt Float
Deep Cycle	**	14.8 Volt Absorption 13.6 Volt Float
Lithium	***	13.8 Volt at all times. Float cycle omitted.

By releasing and touching the 1.5V cell the controller will cycle through the 'Normal', 'Deep Cycle' or 'Lithium' mode. After 10 seconds of inactivity the Controller will save the selected mode and continue normally. When the unit is connected to a battery both the green and red LEDs will blink simultaneously to indicate the selected mode.

Intelligent microprocessor controlled 4-stage charging optimally uses available power from the Photovoltaic Panels while ensuring that the connected battery is at its peak possible charge state at all times.

MODE	Blinks	
Initialization	****	The controller ramps up the current while monitoring the voltage across the battery. If maximum current is reached the controller switches to Bulk mode but if the selected Absorption voltage is reached first the controller switches to Absorption mode.
Bulk	***	Full current is applied while the voltage is monitored. If the selected Absorption voltage is reached the controller switches to Absorption mode.
Absorption	**	The voltage is maintained at the selected Absorption level by modulating the current. If the controller cannot maintain the voltage by modulation it will switch back to Bulk mode after a while. If the voltage is successfully maintained the controller will monitor the current and if less than 10% of the available current is used to maintain the Absorption voltage the controller will switch to Float mode after a while.
Float	*	The voltage across the battery is reduced and maintained at the selected Float level. The controller never applies more than 20% of the available current to maintain the battery at the Float level, and should the voltage drop below the selected level for some time the controller will start a new charge cycle by switching to Initialization mode.

If the Photovoltaic Panels do not supply sufficient power to charge the batteries the controller will enter sleep mode. During this mode no LED will blink, and the controller will only consume around 3mA of current. The controller will however constantly monitor the Photovoltaic Panels and start a charge cycle if sufficient power is available.

The controller will monitor and report error conditions as below. When an error condition is active charging will be suspended, and when the error condition clears charging will resume.

ERROR	Blinks	
Voltage Low	*	Battery voltage below 9V
Voltage High	**	Battery voltage above 15.5V
Overheat	***	Controller overheating