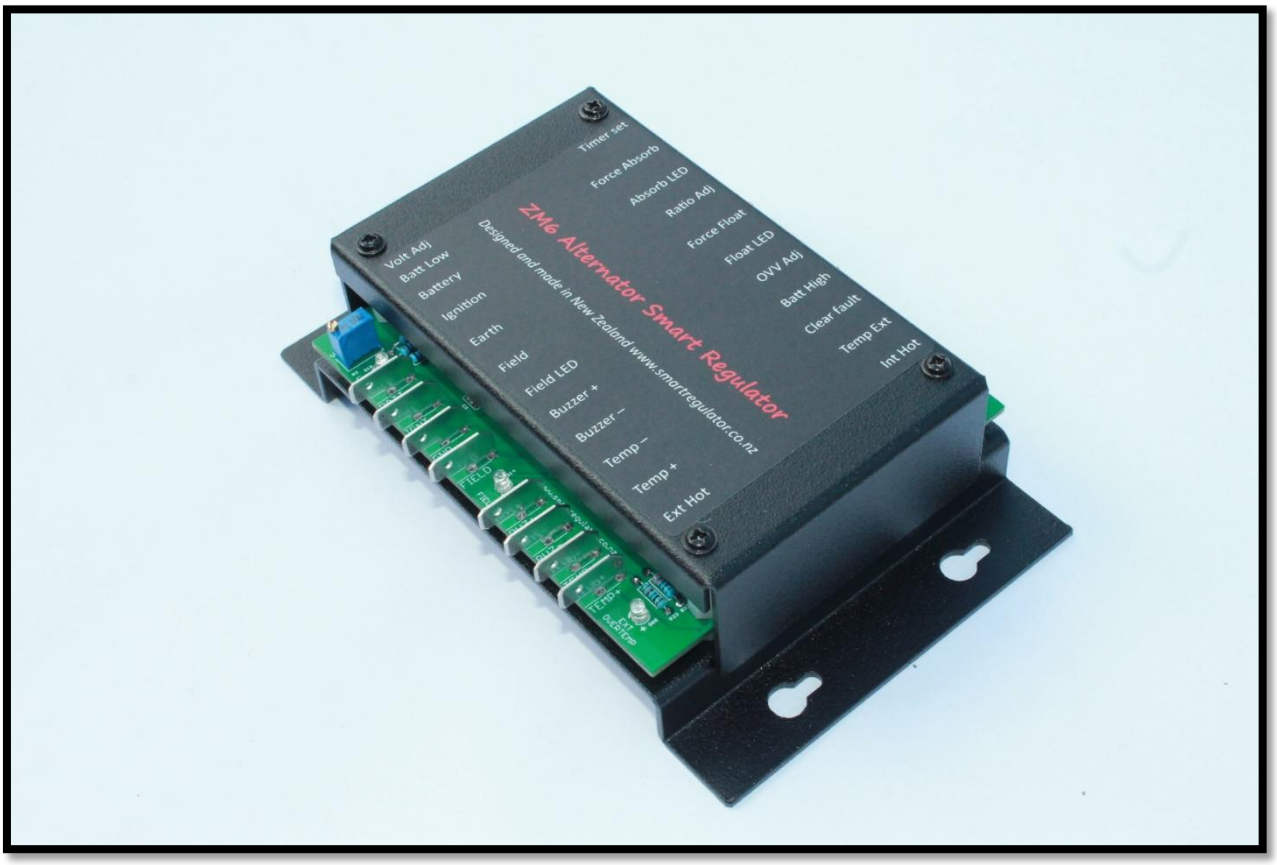
Installation & User Manual



ZM6 Voltage Regulator

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Features

- The regulator provides an easily adjustable voltage setting, allowing users to accommodate various battery chemistries. This flexibility ensures optimal charging performance tailored to specific battery requirements.

- Designed for versatility, the unit is suitable for both 12-volt and 24-volt system voltages. Configuration is managed using jumpers, enabling seamless adaptation to different setups.

- This regulator is compatible with N-type and P-type alternators, with regulation type controlled by a removable fuse. This feature makes it suitable for a wide range of alternator models.

- A soft start mechanism is implemented to ease the sudden inrush of current during initial operation, promoting longevity and reliability of connected components.

- Comprehensive fault protection covers both low voltage and overvoltage scenarios. In the event of a fault, the field shuts down automatically. A manual reset of the system is available via the CLEAR button. Fault detection is delayed for 9 seconds during initial power-up and features a ½ second delay once the system is running.

- Current limiting protection is provided for both external and internal temperature faults. In these cases, the field current is reduced to an adjustable figure between 12.75V and 13.75V, until the temperature returns to acceptable levels. Fault conditions are clearly indicated by the illumination of an ORANGE LED.

- The regulator features distinct ABSORPTION and FLOAT charging stages, with LEDs indicating the current state. Users can select the desired stage: activating the FLOAT button brings float voltage earlier in engine operation, while the ABSORPTION button extends the absorption cycle as needed.

- LED Status Indicators
- A BLUE LED indicates field output.
- A GREEN onboard LED flashes to show the oscillator is running, visible only during the Absorption phase, this is completely normal and of no concern to functionality.

- The product includes a 24-month warranty, covering repair or replacement free of charge. The warranty does not cover damage resulting from incorrect installation, accident, misuse, or neglect, and is void if the unit is tampered with. Freight charges are not covered under warranty.

- The regulator is designed, built, and supported in New Zealand. Circuit boards are protected by a conformal coating material, safeguarding against moisture, dust, and chemicals.

- For detailed operation and setup instructions, refer to the "ZM6 operation and set up" video available on YouTube by searching "ZM6 Smart Regulator".

Alternator Modification

Whether N-type or P-type is used, there is no performance difference or advantage; it typically depends on the alternator manufacturer's preference. Some alternators are designed for P-type, but most use N-type.

ZM6 N: Negative Brush Control System Overview

The ZM6 N is a Type A negative brush control system in which the positive brush receives a continuous power supply. The alternator output is regulated by adjusting the negative brush based on the ZM6 settings.
The disadvantage of N switching is the alternator will require external excitation via the D+ terminal on the alternator.

ZM6 P: Positive Brush Control System Overview

The ZM6 P is a type B positive brush control system, where the positive brush regulates the field and the negative brush is connected to earth.

P configuration is our preferred connection, better excitation and more forgiving for bad earths or connections.

To use an external regulator, the alternator must be modified; this can be performed either by the user or a qualified auto electrical shop. External brush blocks may be obtained from this us or through most auto electrical shops. Alternator modification services are also available.

The advantage of P switching is the alternator will not require external excitation via the D+ terminal on the alternator.

Instructions for converting various alternators to accommodate an external regulator are provided for download on the company website.

Ignition Light

Some alternator modifications to allow for external regulation results in the ignition light D+ terminal to be inactive, we have a simple relay modification to allow the normal functioning of the ignition light.

Alternator Size

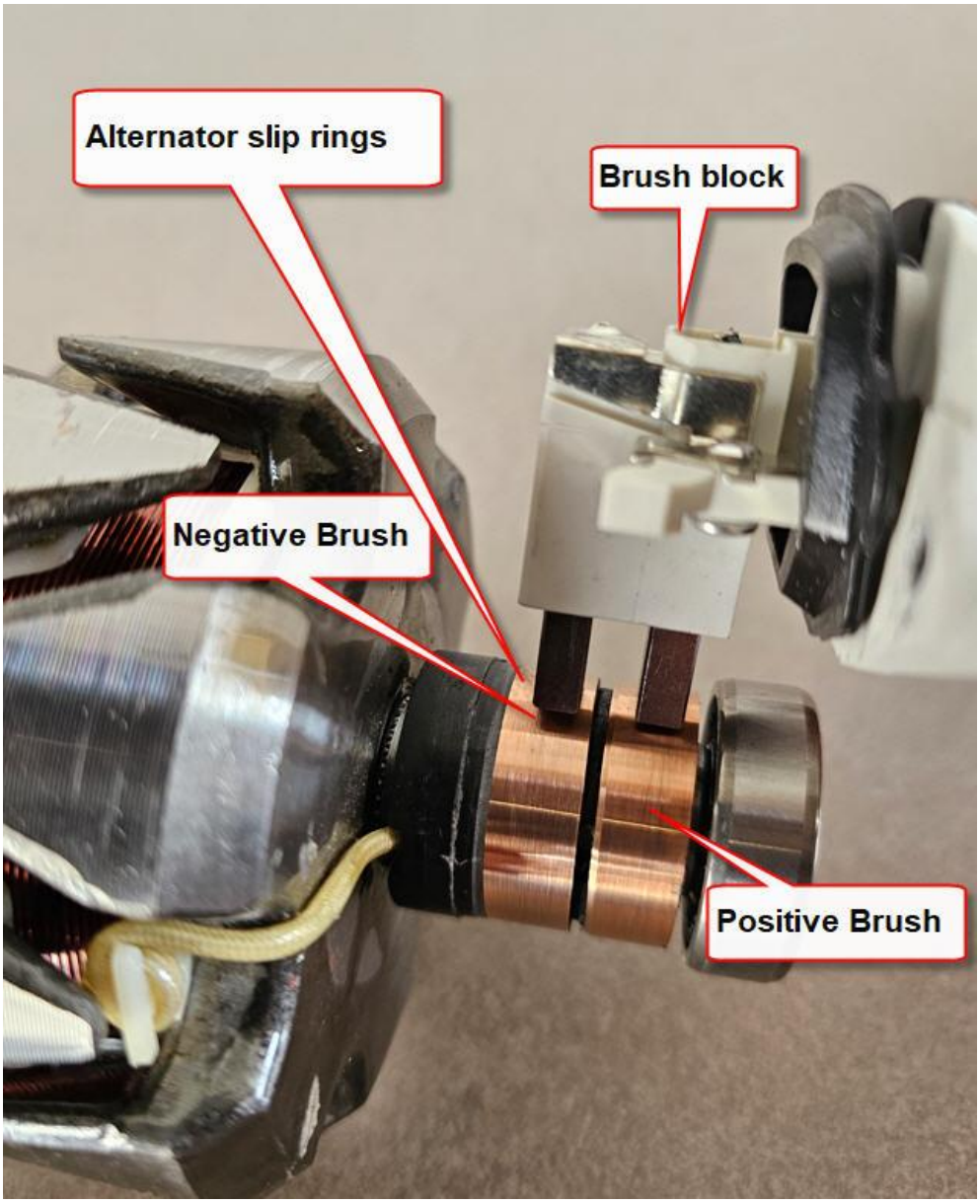
I always recommend a Bosch 80- 120-amp alternator, which is about the highest rating without going into high priced alternators.

No matter how good any smart regulator is, if the alternator is not spinning fast enough then you will not get a good charge current into your battery bank.

You need to calculate what your lowest cruising rpm is and arrange your pulley size to ensure your alternator is producing the best possible output, absolute minimum is 2500 alternator rpm.

Remember, for every 25 amps you will draw 1hp power of engine energy.

The following photo shows alternator brush orientation



Installation tips

Pulley Ratios and Alternator RPM
It is essential to ensure that your pulley ratios are correctly matched to your cruising RPM. The alternator should be spinning at a minimum of 3000 RPM, with a preferred range of 5000 RPM up to 8000 RPM. This ensures that your alternator delivers an adequate charging output to the battery bank.

Earth Leads and Electrical Connections
Run separate earth leads from the engine block to the alternator and starter, rather than using the engine block as a common path. High resistance in the earth path can cause current to flow through engine bearings, potentially resulting in arcing and damage. Dedicated earth leads provide peace of mind and reliable operation.

Battery Selection and Configuration
Always use the same type of batteries within your system, whether that is Lead-acid, Gel, or AGM. Mixing different battery types is not recommended. A typical installation should comprise two separate battery banks: one dedicated to engine starting and another for house loads. Batteries should be charged in parallel using a voltage-sensitive relay.

Alternator Drive and Belt Capacity
Ensure that your engine is equipped with a sufficiently robust belt to handle the load of the alternator you have selected. Inadequate belt strength can compromise charging performance and lead to mechanical issues.

Battery Maintenance and Capacity Planning
Do not leave batteries discharged for extended periods, except for LifePO4 batteries which are an exception. When planning your battery capacity, ensure that your house batteries are not discharged below 50% of their rated capacity. For emergency starting, incorporate a means to cross-connect the battery banks.

Electrical Protection and Voltage Drop
Protect all circuits with appropriate fuses or circuit breakers to prevent electrical damage. Voltage drop can severely impact system performance, so it is important to identify and rectify any problematic connections.

Connecting Batteries: Series vs. Parallel
When connecting batteries in series, the amp-hour capacity remains the same as that of a single battery, but the voltage is doubled. In contrast, connecting batteries in parallel doubles the amp-hour capacity while maintaining the voltage of a single battery.

Alternator Cooling and Corrosion Prevention
Alternators are equipped with large fans that draw air from the back to the front for cooling purposes. In marine environments, salt-laden air can be drawn into the alternator, causing corrosion in non-marinized units. To extend the life of your alternator, consider having the internal components coated with high-quality paint.

Ammeter Selection
Automotive 'in-line' ammeters can introduce significant voltage drop in your charging system. If your system charges at a low current and quickly drops to 10 amps, the 'in-line' ammeter may be to blame. The recommended alternative is a 'shunt' type ammeter, which minimises voltage drop.

Battery Switch Operation
Never turn off the battery switch while the engine is running. Doing so can result in catastrophic failure of the alternator and/or the smart regulator.

ZM6 Specifications

Voltage	12- volt or 24-volt (switched via jumper)
Polarity types	"N" or "P" switching (switched via fuse)
Charging stages	Bulk – Absorption - Float
Adjustable ratio Absorption to Float	Yes, adjustable by user (0 to 2 volts)
The factory setting for ratio	(12v) 0.6 volt - (24v) 1.2 volts
Approximate time at the Absorption rate	0-140 minutes (20-minute increments)
Absorption Indicator	Yellow LED
Float Indicator	Green LED
Alternator range	0–350-amp alternator (brush or brushless)
Maximum Continuous Field current	5 amps (most alternators are 2-4 amps)
12-volt version voltage adjustment range	12 to 15.5 volts
The factory setting for voltage regulation	(12v) 14.7 volts - (24v) 29.4 volts
24-volt version voltage adjustment range	24 to 32 volts
Reverse polarity protection	Yes
Overvoltage protection	Yes, adjustable by the user, a RED LED to indicate overvolt and unit will shut down field
The factory setting for overvoltage protection	(12v) 15.5 volts - (24v) 31 volts
Overtemperature current limiting protection	Derates output until condition of over temperature reverts to normal. Indicated by ORANGE LED 12.75 v to 13.75v adjustable range
Low voltage protection	Shuts off FIELD control (factory set 10.6v)
Minimum Ignition input voltage	11.7v (see FAQ page 23 for explanation)
Overvoltage Indicator	Red LED and buzzer (supplied)
Unit size	167mm long x 43mm high x 100mm wide.
Weight	250 grams
Fuses (Field)	(Fitted inside unit) a 5-amp mini blade
Fuses (Ignition) draws 70ma	Ignition recommend 5 amp
Fuses (Battery sense) draws up to 390ma	Battery sense recommended 5 amp

How the ZM6 works

Timer Block:
Manages the transition between absorption and float charging stages.
User-selectable in 20-minute increments (factory default: 120 minutes).

Voltage Comparison Logic:
Continuously monitors battery voltage.
Compares actual voltage to the user-selected setpoint.
Incorporates hysteresis to maintain a stable feedback loop.

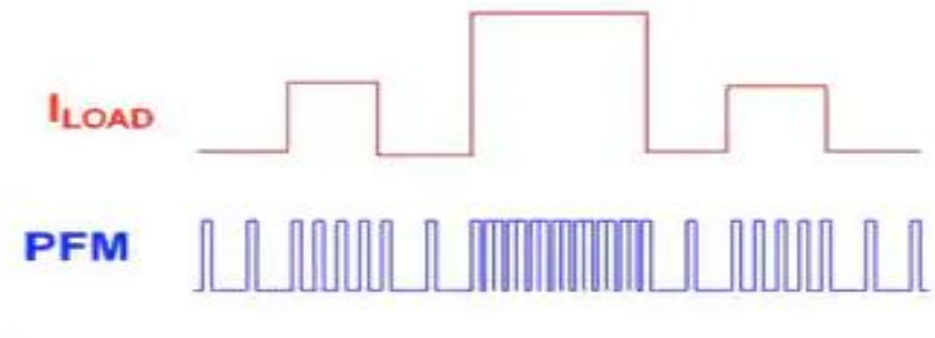
Darlington Transistor Output Stage:
Receives a pulse frequency modulation (PFM) signal from the oscillator.
Switches the alternator field current on and off based on output voltage changes.

Charging Regulation:
The oscillator modulates the analogue voltage signal, generating a PFM signal for the Darlington output.
When the battery voltage reaches the setpoint, the field current is disengaged.
A small holding current prevents the ignition light from illuminating.

Stage Transition:
The timer block oversees the switch from absorption to float stage, based on user settings.

Protection Features:
Overvoltage/Undervoltage: Disables the field circuit to protect the system.
Overtemperature: If the alternator or output transistors overheat, output is derated until temperatures return to safe levels. The regulator will cycle on and off as needed.
Current Limiting: User-adjustable for fault conditions.
Reverse Polarity Protection: Built into the design.

Alternator Compatibility:
Suitable for any alternator where field current draw does not exceed 5 amps continuous or 8 amps intermittent (most alternators operate at 1–2 amps).



Graph showing pulse frequency modulation versus load.

Top of board controls

(1) Absorption Time Dip Switch – This allows user defined absorption time 0-140 minutes.

(2) Absorption Switch – to force Absorption mode

(3) Absorption LED (Yellow) to indicate system is in absorption mode

(4) Ratio – Adjusting voltage between Absorption and Float settings,

(5) Float Switch – to force Float mode

(6) Float LED (Green) to indicate system is in float mode

(7) Overvoltage Adj – RED LED for overvoltage situation.

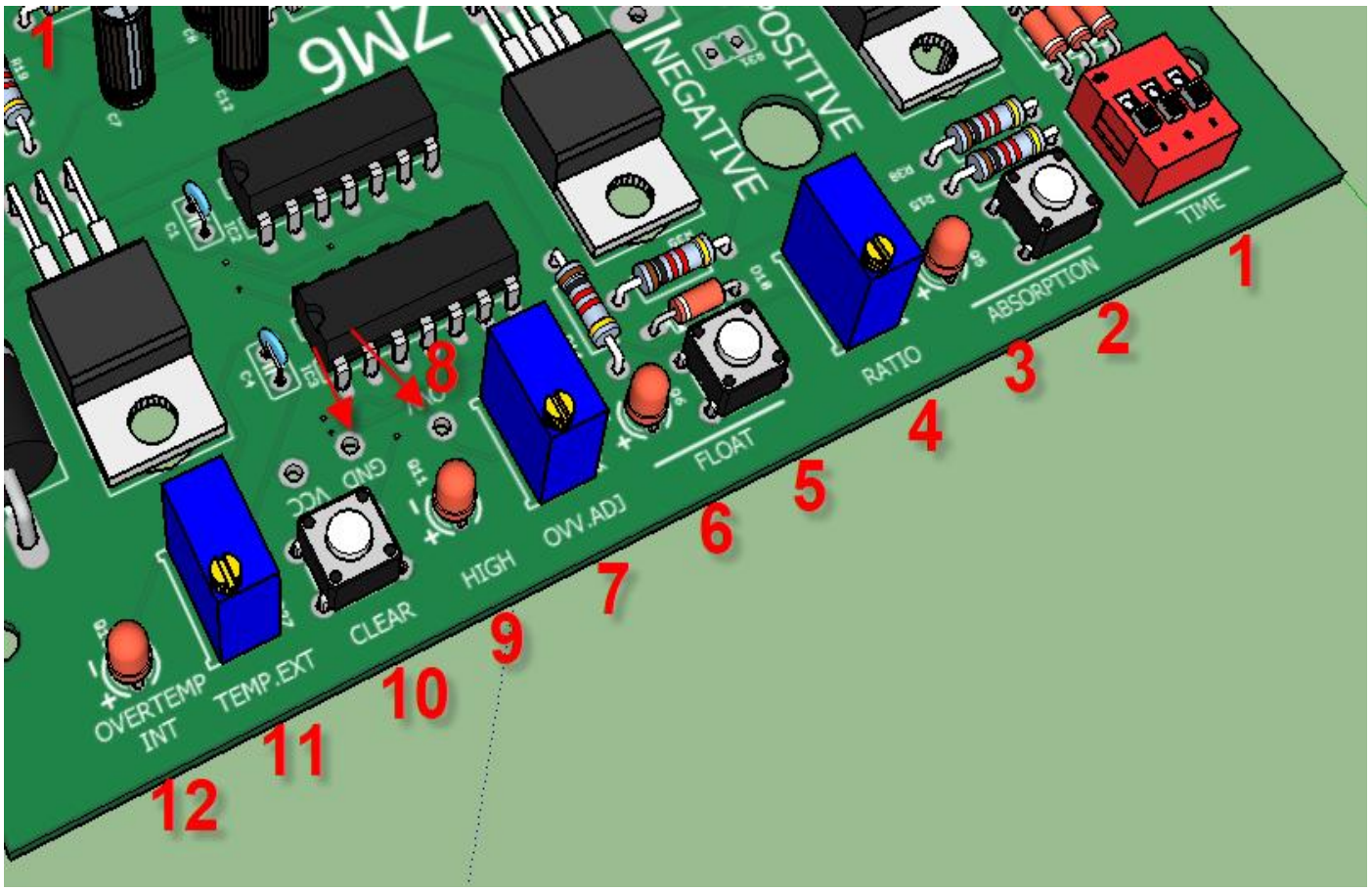
(8) O V V – Overvoltage adjustment test point

(9) High LED – Red Led indicates over voltage

(10) CLEAR FAULT –, Push button, Overvoltage /undervoltage / if a fault is detected system will disable the field circuit, solve the issue and reset by pushing button.

(11) Temp EXT – External temperature adjuster**,** refer in following pages on adjustment process

(12) INTERNAL HOT – ORANGE LED Indicates an overtemperature/fault on internal components linked to output stage. This is pre-set to 38 degrees C and would typically indicate an alternator problem.



Bottom of board controls

(14) VOLTAGE ADJ – For adjusting set voltage, (this is what you will use on a regular basis)

(15) LOW VOLTS LED – to indicate low battery voltage 10v or 20v for 24-volt versions.

(16) BATT SPADE – Battery sense wire via a 5-amp fuse.

(17) IGN SPADE – Ignition feed wire via a 5-amp fuse.

(18) GND SPADE – Ground or earth.

(19) FIELD SPADE – Field terminal to alternator (on board fuse)

(20) FIELD LED – This indicates a FIELD output on, will flicker.

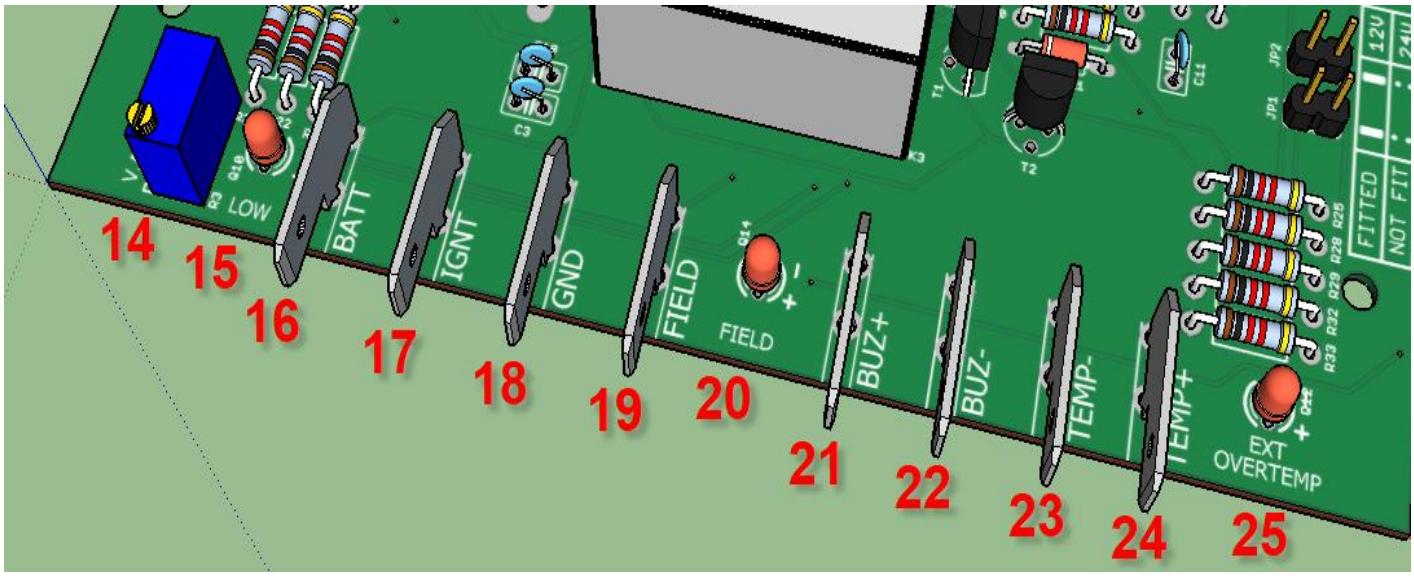
(21) BUZZ + SPADE – for the supplied buzzer unit, polarity not important.

(22) BUZZ – SPADE - for the supplied buzzer unit, polarity not important (11v output)

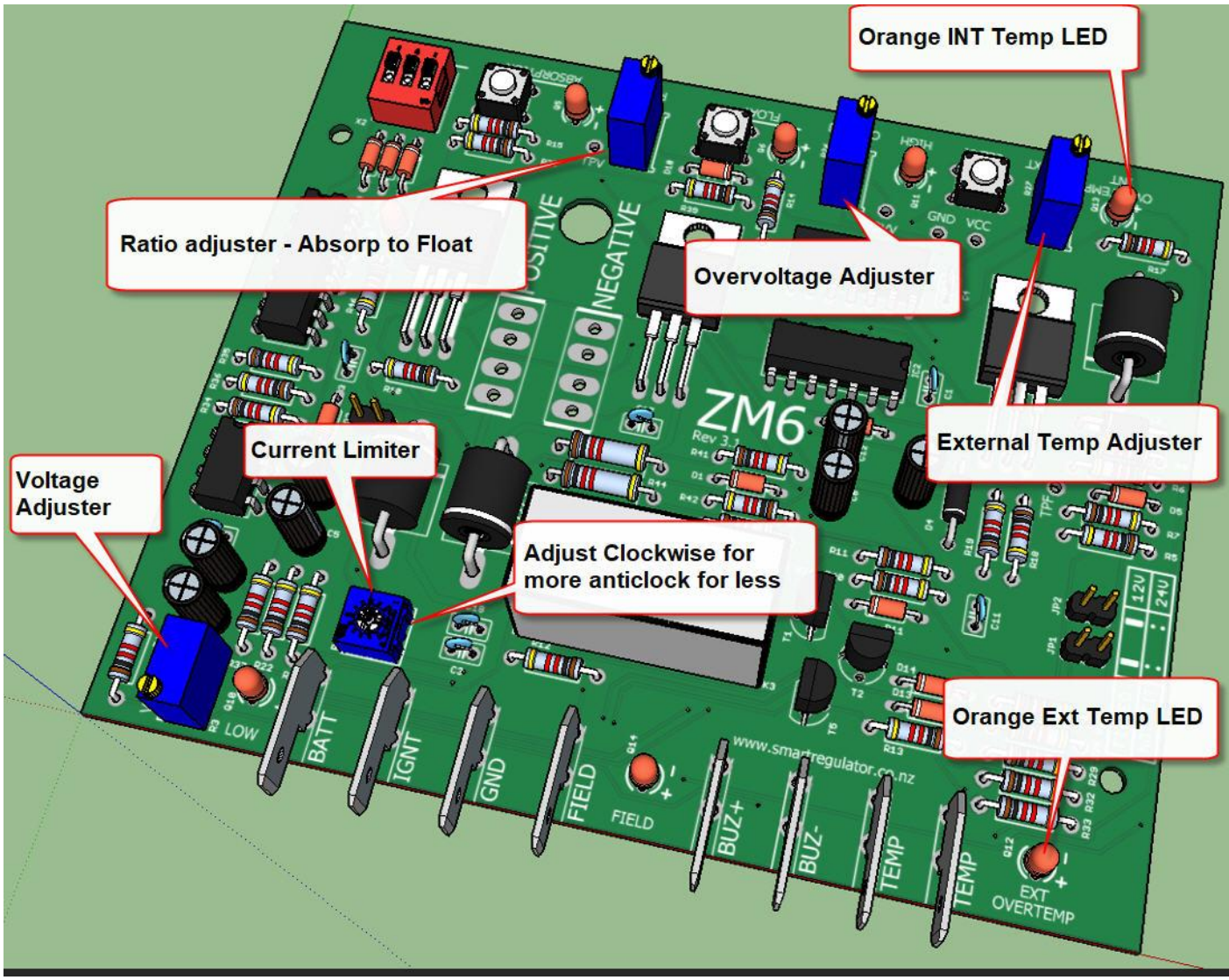
(23) TEMP – SPADE – if optional temp probe, polarity not important.

(24) TEMP + SPADE - if optional temp probe, polarity not important.

(25) EXT OVERTEMP LED – This ORANGE Led will illuminate if an overtemperature occurs and the field will be isolated



Board controls - Adjustments



Installation

Mount the unit preferably remotely from the engine bay to ensure a clean dry, cool environment. Connect **NO** bigger than 14 gauge (2.5mm) (7.5amp) tinned wires to the following terminals.

A maximum of 4 metre FIELD wire distance from the alternator to ZM6 due to inductive switching of field, or else voltage fluctuations may occur.

BATTERY (16): Connect this terminal directly to the positive side of the battery. If you have two batteries i.e.: a start and house, suggest you connect it to the house battery, this will prevent any spikes from high drain current items like starters, etc. Suggest you use a red wire for this terminal, or mark the wire clearly. You should connect this wire with an inline fuse (5 amp) **Do not connect via any switch.** If you have a diode block, make sure you sense on the opposite side of the unit, if you're unsure, check for voltage on B+ alternator terminal, if zero you most probably have a diode block

IGNITION (17): Connect this terminal to the ignition switch. To avoid confusion a suggested colour is Yellow or mark the wire clearly. You should connect this wire with an inline fuse (5 amp) located close to the ignition switch. ***Do not connect the ZM6 IGN to the D+ terminal of the alternator.***

EARTH (18): Connect this terminal directly to a good negative supply bus bar. If you are unsure place, it directly on the negative post of the battery, suggest you use a black wire for this terminal, or mark the wire clearly.

FIELD (19): This unit controls the field side of the brush block. Connect this wire directly to the alternator field terminal, once the alternator has been converted.

BUZZER (21) + and (22)-: If using the optional supplied buzzer/ light, unit then the polarity is not critical. Maximum current draw 11 volts at 1 amp for any device connected. If you do not use the buzzer and the unit shuts down for any reason, start by resetting the clear button.

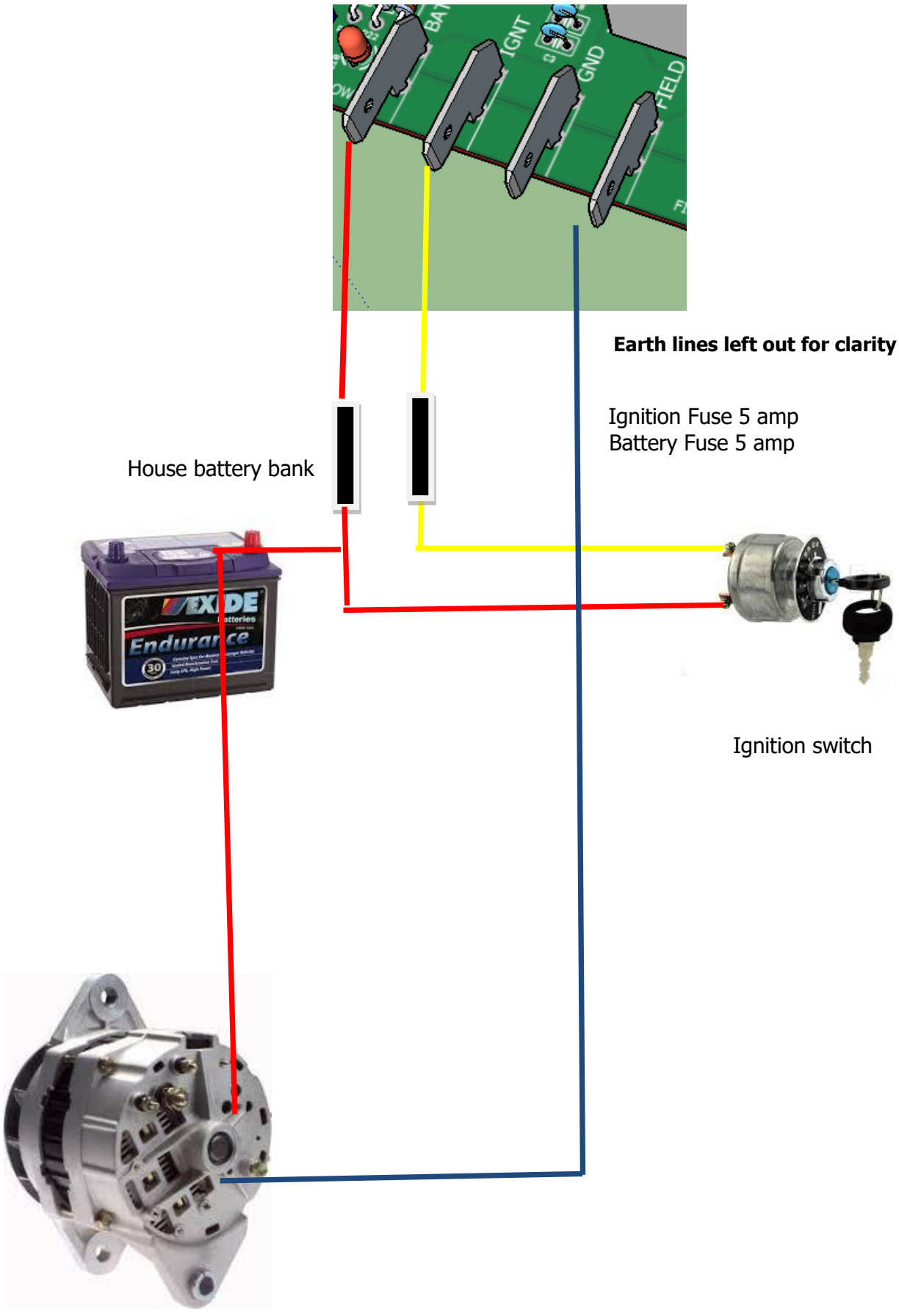
If you are unsure if your alternator is configured correctly do the following test:

Remove the field wire from ZM6 N and with the engine idling, briefly (2-4 seconds) hold the alternator field wire to earth.

Field to positive for ZM6 P.

Note: you will get a spark. You will hear the engine load up and the output voltage should quickly rise, this indicates the alternator is configured correctly.

Installation – Diagram



Installation check list

If you select the **"Works" option** at purchase, most regulator settings will be pre-configured for you. A copy of our configuration worksheet will also be provided. The factory setting is 12 v system,14.7v Absorption, 14.0 Float, 70 degrees temp setting and 15.4v overvoltage and configured for P switching.

House battery should be fully charged before configuring unit, this will allow for more stable setting. ZM6 settings should be done at normal cruise rpm., not idle rpm.	
Alternator configured for correct field polarity, P or N switching, see Page 4	
Wiring to ZM6 installed per instructions, fuses in place, page 13, check ignition input voltage, must be above 11volts	
If unsure of polarity, and BEFORE connecting the ZM6, carry out test per Page 24	
ZM6 configured for correct voltage, 12v or 24v system using two jumpers page 15	
ZM6 configured for correct field polarity, P or N switching fuse, Page 16	
Temperature probe fitted (optional) see Page 22 for set up (default is 70 degrees)	
Absorption DIP switch set to time at Absorption for the correct battery type, pg21	
Buzzer installed (recommended)	
Start engine, push FLOAT force button, check Green LED on, and Field LED on after 20 seconds of operation. See page 9	
Adjust lower float voltage using VOLT ADJUST potentiometer	
Let voltage stabilise for a period of time and fine tune voltage setting, you might need to check over a period of several trips to make sure it has stabilised.	
Force ABSORPTION button, Yellow LED should be on and green LED on board should be flashing, this is normal and NOT a fault indicator. (this does not refer to the FLOAT LED)	
Adjust Absorption voltage using Ratio potentiometer stabilise for a period of time and fine tune voltage setting	
Whilst at set Absorption voltage check battery overvoltage setting 5.95 to 6.0 volts, this will provide an overvoltage trip of 15.2 to 15.4 volts. See page 20 for details	
Short out two temperature probes and check that the Orange LED illuminates, and voltage drops to approximately 12.75 to 13.75 volts. Factory set to 13.0 volts	
Reset system by pushing CLEAR button, check field LED on and charging	
We strongly recommend that as soon as you get started, do the running Alternator Diode Test (Page 25) of this manual, there are a number of times the ZM6 indicates an internal fault in the ZM6, this is typically an alternator issue.	

Set up

It is suggested that you start this process with fully charged batteries. This will provide a stable platform for setting the ZM6 'set voltage'.

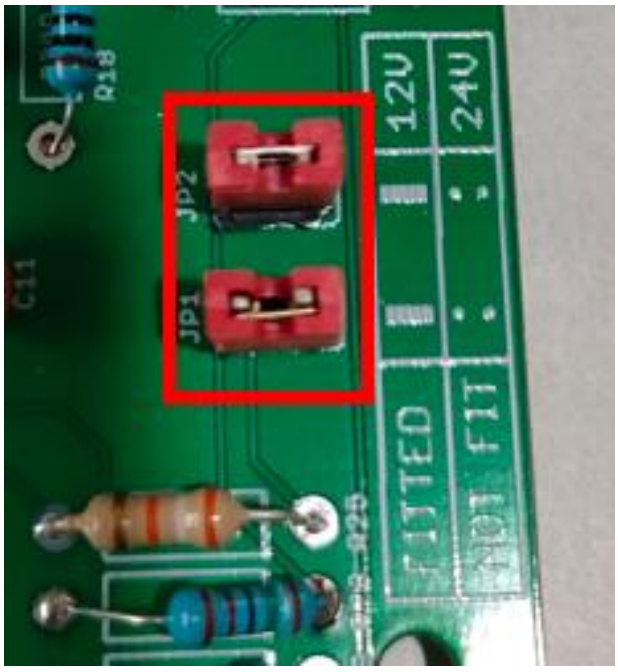
The default charge voltage is factory set to (29.2v) 14.7 volts Absorption and (27.8v) 14.0 volts Float and the overvoltage is set to (30.5v) 15.5 volts. All set with a 5 -10 amp load You will need to fine tune the adjustments to take care of voltage drops in your own installation as they do vary.

Note: Before powering up the unit the ZM6 board must be configured for the correct voltage and correct alternator field polarity as follows:

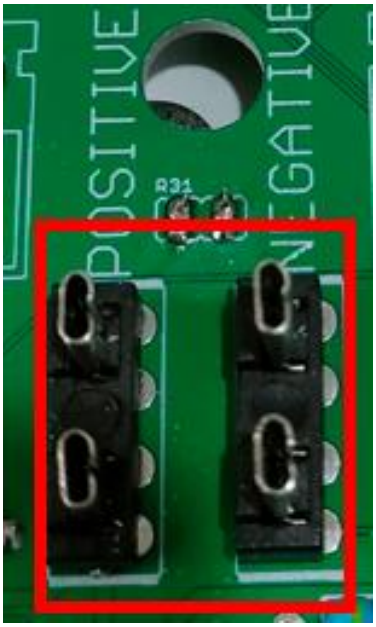
1/ Remove the top cover of the ZM6 by removing the four corner screws.

2/ **NOTE; Do not touch any of the Integrated circuit (ICs) as static electricity on your hands could damage the chip**

3/ With the spade terminals facing the bottom and looking at the board there are two jumpers on the bottom right corner. For 12volt operations the jumpers should be ON. For 24-volt operations the jumpers must be removed. (Default 12v, jumpers ON)



Set up, continued.



4/ On the top left side there are two fuse holders being Left side for positive switching alternators, and the right-hand fuse holder is for negative switching alternators. (Default P)

NOTE: Only One fuse should be in at any one time, failure to adhere to this will short circuit the output stage.

5/ We suggest you carry a spare mini blade fuse of a 5-amp value

6/ Start engine and immediately select FLOAT by pressing float switch (5), then adjust lower float voltage to desired setting by adjusting Volt Adjustment potentiometer (14), wait for voltage to stabilise and fine tune as required.

7/ Press Absorption switch (2) and adjust upper voltage to Absorption voltage by means of the Ratio adjuster (4) to the desired setting, let stabilise

8/ Whilst at Absorption voltage, adjust overvoltage (7) setting to 5.95 to 6.0 volts (8)

9/ refit top cover and then the unit is ready for service. Note, the lid screws are plastic and they screw into a plastic spacer, do not overtighten.

Note: all screw adjustments are Clockwise to increase range, Counterclockwise to decrease range.

Suggested set voltages

12 VOLT UNITS

Suggested Set Voltages	From	To
Lead Acid and AGM (Absorption Setting)	14.6 V	14.9 V
Lead Acid and AGM (Float Voltage)	13.8 V	14.0 V
Gel Cell (Absorption Setting)	13.9 V	14.4 V
Gel Cell (Float Voltage)	13.1V	13.8 V
LifeP04 (Absorption Setting)	14.0 V	14.3 V
LifeP04 (Float Voltage)	13.5 V	13.7 V

24 VOLT UNITS

Suggested Set Voltages	From	To
Lead Acid and AGM (Absorption Setting)	28.4 V	29.6 V
Lead Acid and AGM (Float Voltage)	27.2 V	28.4 V
Gel Cell (Absorption Setting)	27.6 V	28.4 V
Gel Cell (Float Voltage)	26.4 V	27.2 V
LifeP04 (Absorption Setting)	28.0 V	28.6 V
LifeP04 (Float Voltage)	27.0 V	27.4 V

Remember to set the voltage at your normal cruise rpm if possible and only adjust after the battery level has stabilised.

If you have a lead-acid battery with vented caps, then you can set the voltage to the upper limit. If the battery is 'maintenance free' sealed type, then you will need to set the voltage to the lower end of the scale.

For marine installations, setting the ZM6 whilst in dock will always see a shift when you are out at sea, just monitor and adjust as required on your first trip out with normal loads on.

Once you have this set, there should not be any further adjustments required.

The above is only a guide, check with your battery manufacturer.

Changing ratio

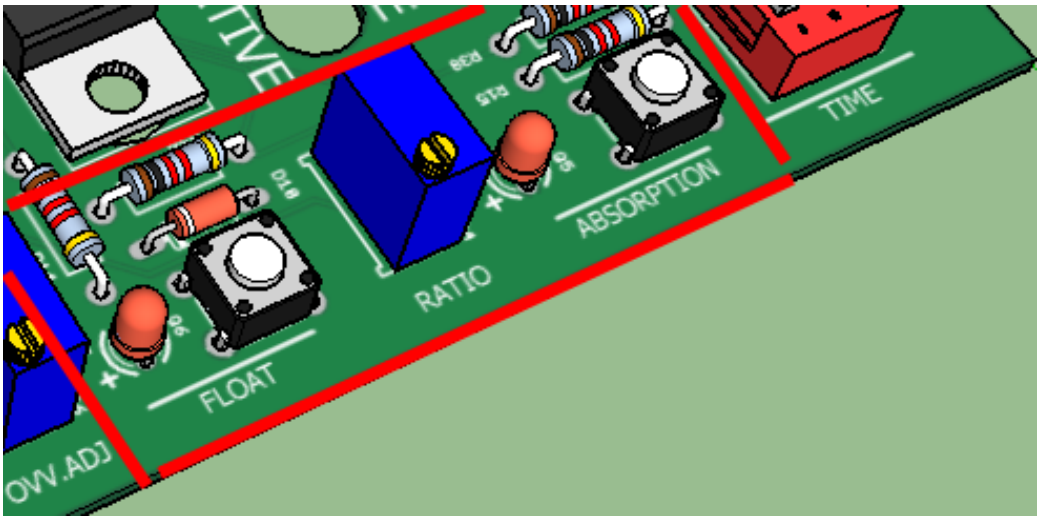
The function of the ratio is to set the relationship between Absorption voltage and Float voltages, once set any change of the VOLT ADJ will provide a corresponding change to the Float voltage. The unit has been factory set to provide a ratio of 0.7v between the Absorption and Float rates. Some AGM batteries require a 1.0v ratio. To change this ratio, proceed as follows.

1/ Note: all screw adjustments are as follows, clockwise to increase, counterclockwise to decrease.

2/ with the engine running at normal cruise rpm and normal load applied push the FLOAT push button (5), the **Green** Float LED (6) should be **On**. Adjust the VOLT ADJ potentiometer (14) to the desired **lower** voltage, let's say 13.7v, stabilise and ensure voltage steady on the desired figure. Each turn of the VOLT ADJ pot is equal to approximately 0.12volt change.

3/ Push the Absorption button (2), the Yellow Absorption LED (3) should be **On**

4/ You then adjust the RATIO potentiometer (4) to the desired **upper** voltage, say 14.7v, stabilise for 5 minutes and ensure voltage steady on the desired figure. Each turn of the RATIO pot is equal to 0.6volt change.



Current Limiter Adjustment

The system is designed to derate the unit to a lower voltage / current output whilst the condition of over temperature remains. This control is for both internal and external temperature sensing.

The factory default will show as a range of 12.75 volts to 13.75 volts and the current will depend on capacity of the alternator/battery combination.

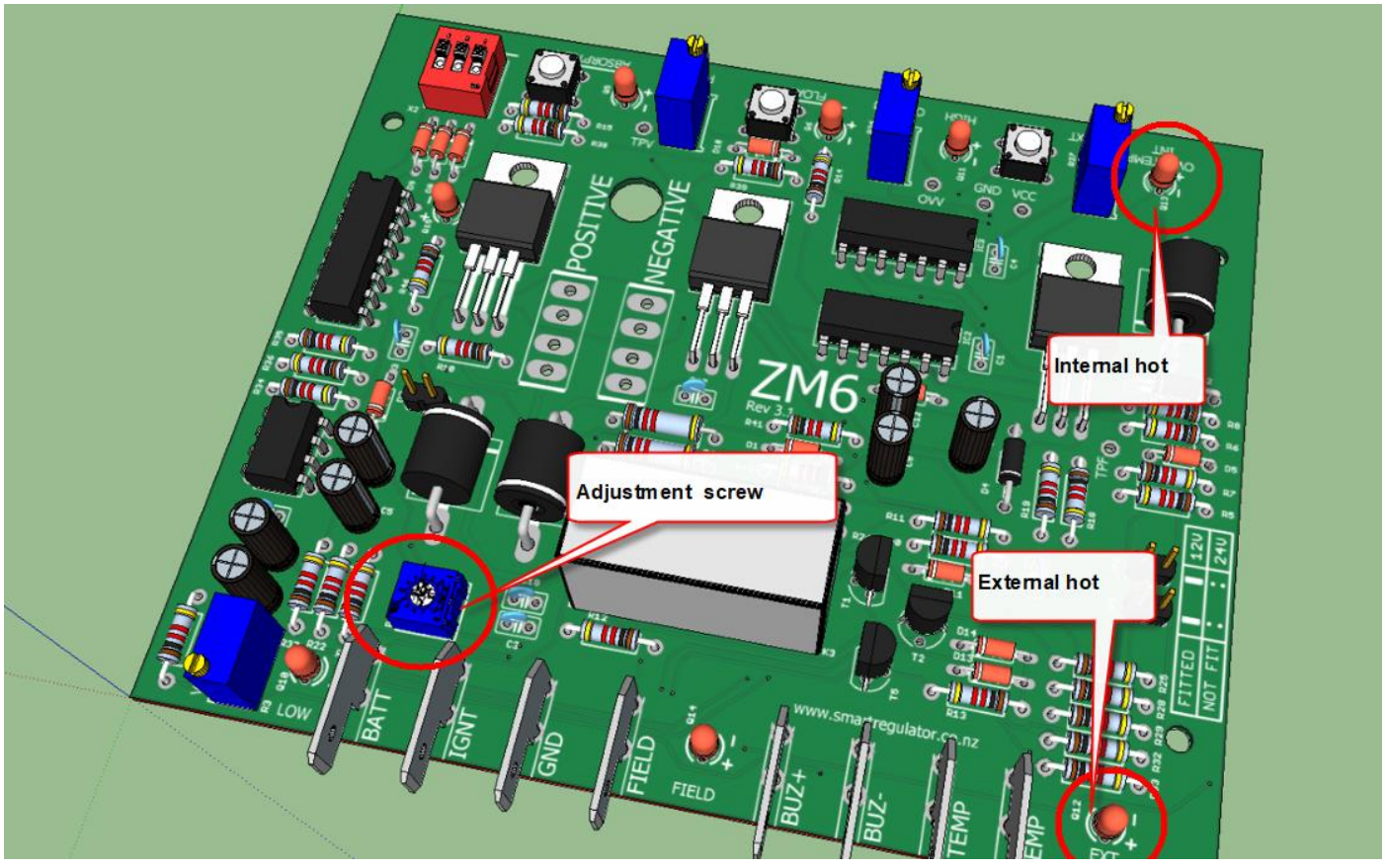
To adjust this value there is an onboard adjuster (shown on the below graphic)

Start by shorting out the temp pins, this will force the fault condition, Orange LED on.

Adjust when in Absorption mode.

Clockwise to increase and anticlockwise to decrease the value.

If in a fault condition (ORANGE LED ON), and the ZM6 is cycling quickly between the temperature limit it would be prudent to lower the setting to prevent damage to the system components being the ZM6 / alternator and possibly the battery.



Changing Overvoltage sense.

The purpose of the overvoltage function is to set a predetermined voltage value that in the event of reaching that higher voltage the system shuts down the field output until the situation is restored and the CLEAR button is pressed.

Adjusting threshold Method 1

1/ Using a digital voltmeter using the "+" probe on the test point labelled "O V V" (8) located behind the LED "High".

The "– "probe on the GND test point and with unit powered up and at normal operating voltage.

2/ Adjust the "O V V" potentiometer (7) to obtain between 5.95 to 6.0 volts at test point "O V V "at your Absorption voltage set. (Note, anticlockwise for higher voltage, clockwise for lower voltage)

Adjusting threshold Method 2

1/ Adjust the "O V V" adjusting potentiometer (7) in (clockwise) 2 turns to take it well out of range.

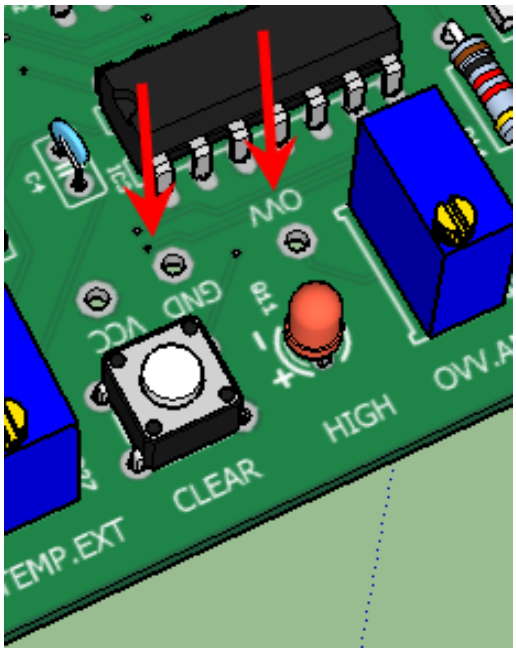
2/ Set "Volt Adj" (14) voltage at 14.5 volts (29 volts)

3/ Adjust over-voltage screw (7) out slowly (counterclockwise) until the RED LED (9) illuminates and warning buzzer activates.

4/ Adjust over-voltage screw in 1 turn

5/ Reset by pushing the CLEAR push button.

Note, slight glowing of the OVV LED is normal, if you trip the system make sure you reset by pushing CLEAR



Setting Absorption time.

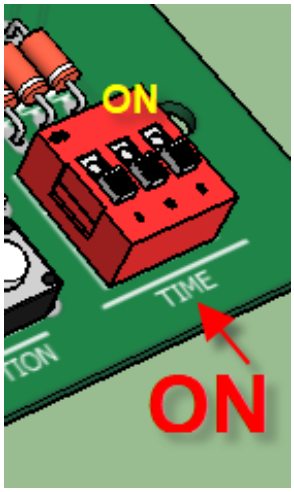
The purpose of the Absorption time is to preselect a time for the unit to hold the voltage at the Absorption voltage, after that pre-set time the unit will go to the float volage previously selected. At any time, you can toggle between Float and Absorption

The unit is factory set to 120 minutes
You can select any of the following combinations to obtain zero minutes to 140 minutes absorption time and stepped in 20-minute increments.
Note: 20 minutes plus or minus 2% minutes
A 3-position dip switch (1) is the method to change timing duration.

Typically for most batteries 120 minutes is sufficient with the following exceptions:

1/ LifeP04 – look for 20 to 40 minutes maximum absorption time
2/ smaller battery banks < 100amp hour – look at 40 to 60 minutes
3/ Older Lead acid or AGM > 120 minutes
4/ big battery banks > 250amp hour 140 minutes

Minutes	SW1	SW2	SW3
0			
20			ON
40		ON	
60		ON	ON
80	ON		
100	ON		ON
120	ON	ON	
140	ON	ON	ON



Setting External temperature. (optional)

For those wanting to make their own temp probe it is simply a matter of connecting a 10k NTC to the ZM6. An NTC can purchased from the likes of Jaycar (RN3440)

The unit works by sensing the resistance of the temp bulb, once the pre-set temperature is reached the unit will shut down the field output, once the temperature drops as indicated by the LED, the user must manually reset by pushing CLEAR

For those replacing an Ample Power unit DO NOT use the existing temp sensor probe as it is the wrong resistance value.
To calibrate, this can be done by connecting set known resistor values across the two terminals. Supplied with the optional temperature probe are 2 x resistors set for 50 degrees and 90 degrees. Or you can use the likes of a rice cooker and temperature gauge to accurately set to your desired temperature using the temperature probe.

For battery monitoring 50 degrees is the recommended maximum
For alternator monitoring 80 to 90 degrees is the recommended maximum
If you desire any other temperature setting here is the values required

Desired temperature	Resistor value
50	3K3Ω
60	2K4Ω
70	1K8Ω
80	1K2Ω
90	912Ω

Process of setting desired temperature range
1/ disconnect the field wire (19) from the ZM6 to prevent the alternator field activating
2/ power up the unit
3/ place the desired resistor value on the pins Temp+ (23) and Temp – (24) (Note: polarity not important)
4/ Adjust the temperature External (11) adjuster to just have the overtemperature LED (25) illuminate and buzzer will sound. Clockwise for increase temperature, counterclockwise to decrease temperature. Once the ORANGE LED goes out, push the CLEAR button.
5/ remove resistor, push CLEAR button if no field LED on (10)
6/ Reconnect the field connector to the ZM6 with the unit powered down

As a suggestion for battery monitoring, connect to the negative battery post
For alternator monitoring the ideal place is the alternator stator however securing is not easy so an, aft through bolt is sufficient, but you will need to check the difference between the probe location and the hottest part of the alternator which is generally the stator, use an infrared thermometer.
If you have an external BMS for LifeP04 batteries or any other monitor for voltage exceedances, you can connect across the temp probes to act as another method to derate output.

FAQ – Frequently Asked Questions

Q	What wiring changes are required on my existing installation?
A	As well as running a wire to your alternator field terminal, you will need an ignition source to the ZM6 and a battery positive wire and an earth wire.
Q	Will this unit work through a VSR (Voltage Sensitive relay)?
A	Yes. A good way to allow dual battery charging, sense off the house battery.
Q	Will this unit work through a diode splitter?
A	Yes. The ZM6 can compensate for the typical voltage drop over a diode bank, providing that the battery sense wire is on the battery side of the diode bank.
Q	Can you refurbish my alternator and convert it to an external regulator?
A	Yes, we do this regularly for clients.
Q	Can I modify my alternator?
A	Yes. It is a matter of running a field wire to the appropriate side of the brush block. The ZM6 N controls the earth side of the brushes. The ZM6 P controls the positive side of the brushes.
Q	What is the difference between N and P switching?
A	Certain manufacturers elect to switch the positive brush whilst the majority of others switch the negative brush, as a user you do not know the difference in an operational sense.
Q	When I first power up the ZM6 the BLUE field LED comes on immediately and zero charge?
A	The Ignition voltage is too low, must be above 11.7v, if voltage is correct the field LED should come on after 6-8 seconds
Q	There is a Green LED flashing on the inside of the unit?
A	This LED flashes with the onboard oscillator which will run when in Absorption mode only, it is normal function of the unit.
Q	What is the field LED function, and will it indicate a blown fuse on the field line?
A	The purpose of the field LED is to indicate that the ZM6 microprocessor is outputting a field current. It is located downstream of the fuse so will NOT indicate a failed field fuse (5 amp)
Q	The unit is powered up and the system does not charge and there are no fault LED's on nor is the field LED on?
A	Push the CLEAR button or reset ignition, a previous fault has shut down the system and requires resetting.

Fault Finding

Write down the circumstances leading to the discovery that a problem exists. Make it as clear as possible. If you're not charging, and you have just installed a new alternator, suspecting the regulator is faulty may not be the best decision. Wiring errors or compatibility issues between the alternator and regulator are prime suspects. We are happy to work through any charging issues you have, but please do the basic fault finding first. The majority of faults reported are wiring installation issues.

No Alternator Output

Check that the blue Field LED is on with the unit powered up, push the CLEAR button to make sure no fault exists, is the BLUE Field LED on?

Check FIELD fuse inside unit

Check to see if there is a voltage supply to the IGN terminal on ZM6, Absorption LED should be ON.

Is the ignition light connected and working correctly, i.e., is the alternator 'excited'? Check fuses.

If the BLUE Field LED comes on and then goes out, start again and watch which of the four possible trip LEDS comes on (Briefly) to indicate where the fault lays.

We have several cases of the IGN voltage slumping during start to below 10.4v which will trip out the unit, in this case use a relay from a battery supply to feed the ignition spade terminal. Or as a test, bridge Battery and Ignition and see if the unit operates without faulting.

To Test alternator

Remove the field wire from ZM6 N and with the engine idling, briefly (2-4 seconds) hold the alternator field wire to earth. Note: you will get a spark. You will hear the engine load up and the output voltage should quickly go towards 16v+. Stop the test before any overvoltage occurs and you are sure of getting a voltage rise

Remove the field wire from ZM6 P and with the engine idling, briefly (2-4 seconds) hold the alternator field wire to positive. Note: you will get a spark. You will hear the engine load up and the output voltage should quickly go towards 16v+. Stop the test before any overvoltage occurs and you are sure of getting a voltage rise

This would indicate that the alternator is fine and the ZM6 is at fault.

Another way of checking the field output of the alternator, is to put a small wattage bulb (incandescent) between FIELD and BATT on a ZM6 N or between FIELD and EARTH for a ZM6 P and again adjust the VOLT ADJ pot. You should see light come on. However, the battery voltage must be above 13.6 volts for this test to work.

A very common issue is lack of excitation of the alternator via the D+ terminal. This can be checked by turning on Ignition and using a steel blade of a screwdriver see if the rotor shaft is magnetised, this will indicate that the filed is excited.

If you are unsure run a wire from B+ to the D+ for the purposes of fault finding.

Internal hot indication

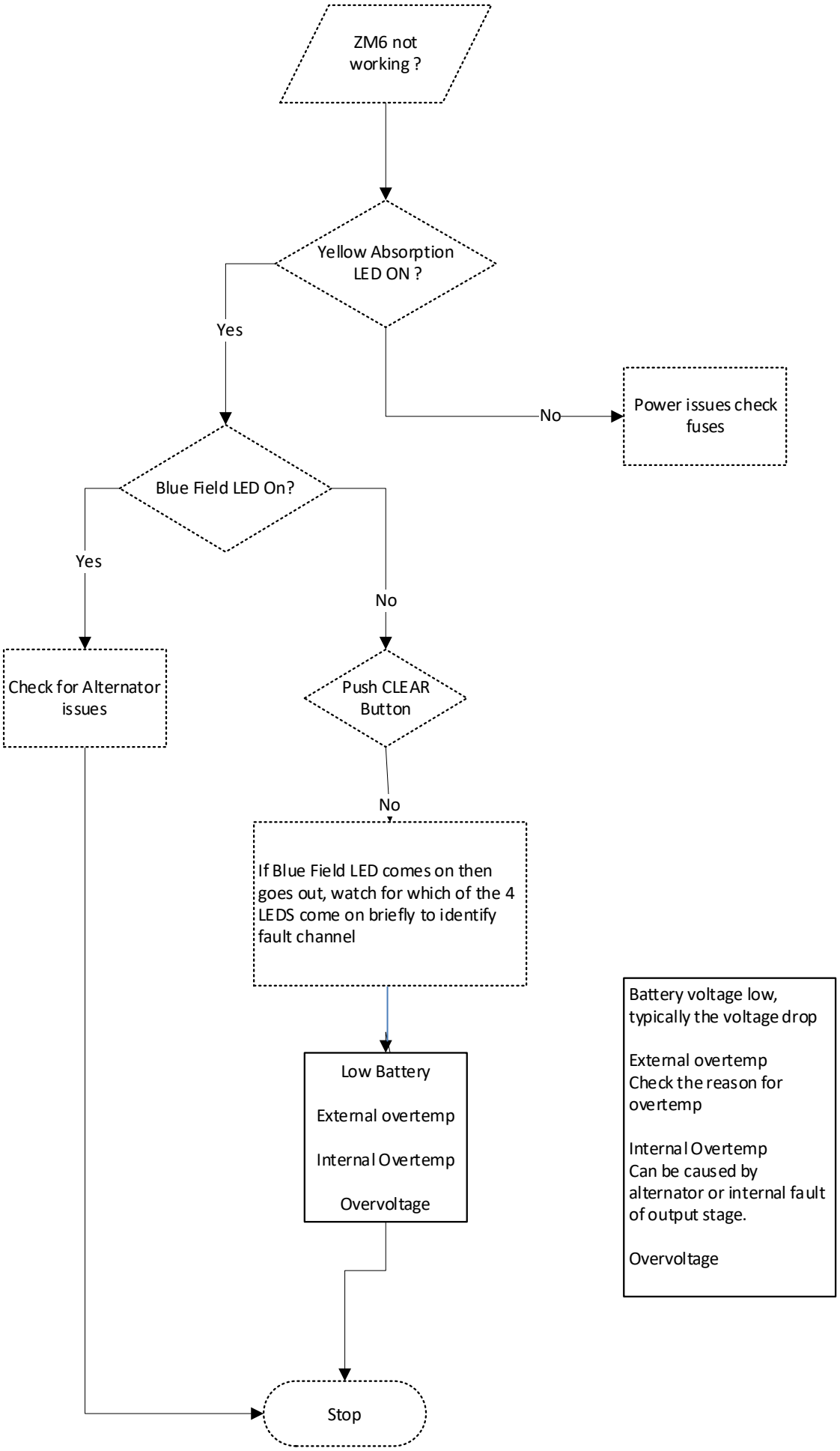
This sensor has detected that either of the two output transistors are in excess of 48 degrees C

Which means that there is an alternator fault or some internal fault. The unit will go into current limiter mode and as such time as the ORANGE LED goes out you will not get full output. Typically, our experience has been an alternator fault not a ZM6 issue, check all your earth leads as this can create the fault, also carry out the following test.

If during orange LED activation the FIELD LED will be off and your tachometer will drop to zero (if the tachometer senses off the alternator.

Alternator Diode Test

- Using a digital voltmeter, set to AC volts (Note must be AC not DC)
- Using the red and black test leads probe between B+ and alternator ground, Red to B+ Black to Ground, note reading, should be 0.0v
- Voltage should be below 0.5v AC
- Reverse those two connections, Black to B+ and Red to Ground, note reading, should be 0.0v
- If any greater than 0.5vAC your alternator diodes are at fault and need to be rectified as they will damage delicate electronics on board, including the ZM6


ZM6 not working ?
Yellow Absorption LED ON ?
Yes
No
Power issues check fuses
Blue Field LED On?
Yes
No
Check for Alternator issues
Push CLEAR Button
No
If Blue Field LED comes on then goes out, watch for which of the 4 LEDS come on briefly to identify fault channel
Low Battery
External overtemp
Internal Overtemp
Overvoltage
Battery voltage low, typically the voltage drop
External overtemp
Check the reason for overtemp
Internal Overtemp
Can be caused by alternator or internal fault of output stage.
Overvoltage
Stop

Product Liability

In no event shall we be held liable for any direct, indirect, punitive, incidental, special consequential damages, to property or life whatsoever, arising out of installation or misuse of our products. Please ensure installation is as per our installation instructions.

Warranty Details

This unit is covered by a 24-month warranty on a return-to-base basis.

We will repair or replace free of charge; we will not offer an exchange service.

Freight charges to return units are not covered by warranty.

The warranty does not include damage from incorrect installation.

The warranty is void if the cover is removed or if the unit is tampered with.

A full refund will be provided to any goods returned to our facility, in their original packaging, and within 30 days and if the goods have not been used. If goods have been used or installed and powered up then a recertification fee of up to 15%, will apply. This is to ensure no damage has occurred during installation and power up.

Shipping expenses, in both directions, are not refundable.

Phone Assistance

We are happy to provide telephone support, however, we are not mind readers and you will get asked "did you follow the fault-finding section" before you ring our office!

Also do read the FAQ as we try to include topics whenever people experience problems.

When you do make contact please provide as much information about your installation so that we can best assist with fault finding.

You can save yourself (and I) a lot of grief if you have done this, before ringing, and remember everyone blames the "little black box" first before looking at other components in the loop!!

As the old saying goes RTFM

Contact Details

For any questions or warranty matters contact:

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The latest revision of this manual can be obtained from our website

www.smartregulator.co.nz