

HARDKORR



6-STAGE WATERPROOF PWM SMART SOLAR REGULATOR



N27988

USER MANUAL

v1.5.0 - March 2020

Congratulations!

You have made an excellent choice by purchasing this high quality HARD KORR PWM solar regulator, which has been manufactured to the highest quality standards.

We want you to be completely satisfied with your purchase, so this solar regulator is backed by a 2-year warranty. Our warranty policy is located at the back of this user's manual.

If you require technical support regarding this product, please call (07) 3801 8332 or email info@korrlighting.com.au

Available models

Our PWM solar regulators are available in two models:

HKPSOLR10A

Rated for 12V solar panel (Max. 25V)

Rated maximum output current of 10Amp

HKPSOLR15A

Rated for 12V solar panel (Max. 25V)

Rated for maximum output current of 15Amp

Warnings

RISK OF EXPLOSIVE GASES: WORKING IN VICINITY OF A LEAD-ACID BATTERY IS DANGEROUS. EXPLOSIVE GASES DEVELOP DURING NORMAL BATTERY OPERATION. BE CERTAIN THERE IS ENOUGH VENTILATION TO RELEASE THE GASSES.

IT IS IMPORTANT THAT EACH TIME BEFORE USING OR CONNECTING YOUR SOLAR REGULATOR, YOU READ THIS MANUAL AND FOLLOW THE INSTRUCTIONS EXACTLY.

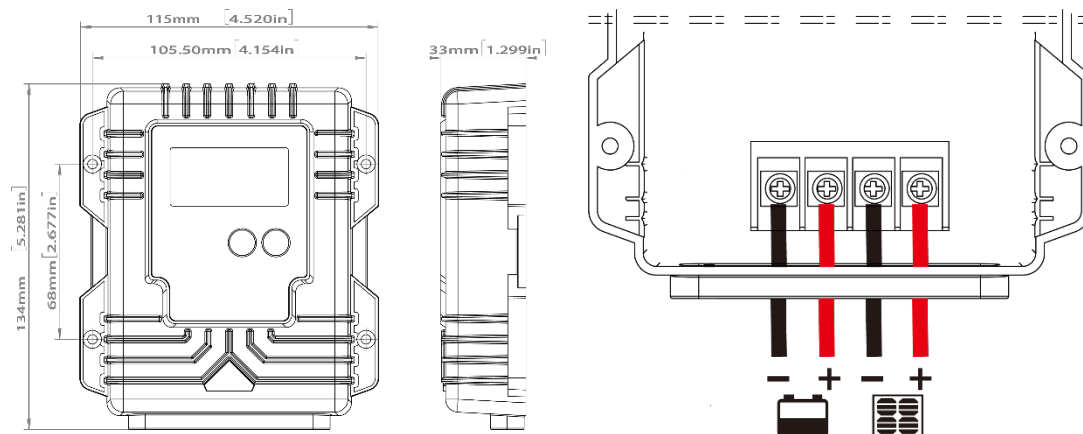
- Make sure you connect the red to the positive on the battery and the black to the negative on battery. Connecting to the wrong terminals may burn out the regulator.
- Confirm that the power wires are tightened to the correct torque to avoid excessive heating from a loose connection.
- Be very careful not to short circuit to the battery connections.
- Accidental 'shorting' of the terminals or wiring can result in sparks causing personal injury or a fire hazard. We recommend that you cover up the panel(s) with some sort of soft cloth so you can block all incoming light during the installation. This will ensure that no damage is caused to the solar panel or battery if the wires are accidentally short circuited.

Key Features

- PWM technology, switching control by MOSFET
- Suitable for most rechargeable lead acid batteries including Flooded (WET), AGM, GEL, Calcium battery and Lithium batteries.
- Common negative grounding connection
- High efficiency and low power consumption
- Battery type setting and battery condition indication
- Smart charging control
- Charging time management
- LED indication for the battery condition and charging states
- Digital display shows charging parameters and battery settings
- Thermal protection
- Over voltage protection, Short circuit protection, Reverse polarity protection
- Water proof
- Corrosion-resistant terminals and connectors.
- Conformal coating applied to the circuit board to protect against moisture
- Designed according to CE standard, EMC, FCC compliance.

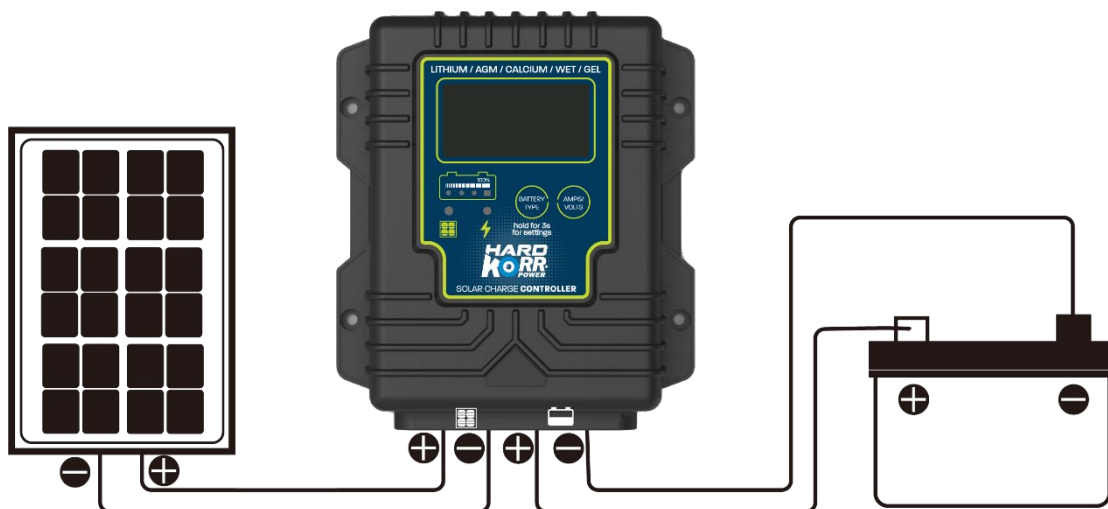
Installation

The quickest and easiest way to mount the unit is to use four plastic spacers and self-tapping screws (not supplied) and mount the unit to a flat surface.



Wiring Connections

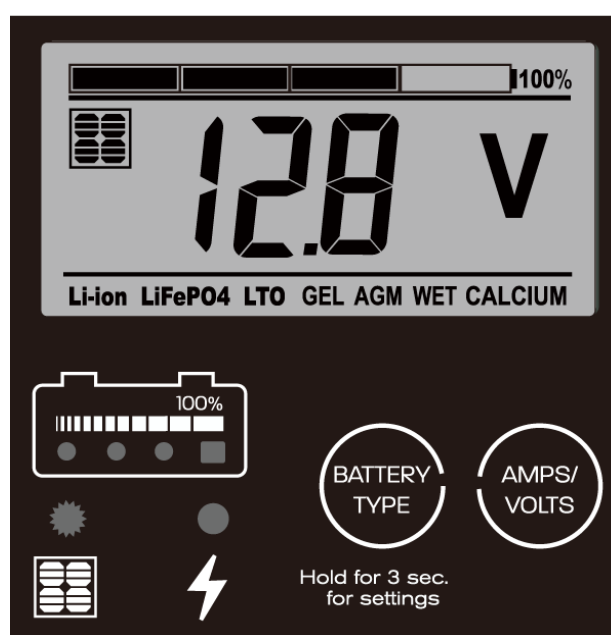
The Solar Regulator has 4 terminals which are clearly marked 'Solar' and 'Battery'. Refer to the wiring diagram as shown below.



When the connections are completed, the Solar Regulator will start working automatically.

Operation – LCD Display

Please check your battery manufacturer's specifications to select correct battery type. The unit has charge programs for seven different battery types: Lithium-ion, Lithium Iron Phosphate (LiFePO₄), Lithium Titanate Oxide (Li₄Ti₅O₁₂), Gel, AGM, Wet and Calcium.



Press **BATTERY TYPE button** and hold for 3 seconds to go into your battery type selection mode. The default setting is AGM Battery; once you select a battery type, the regulator will automatically memorise it for future use.

Li-ion charge program is compatible with the following 3-SERIES Li-ion batteries:

- Lithium Cobalt Oxide LiCoO_2 (LCO)
- Lithium Manganese Oxide LiMn_2O_4 (LMQ)
- Lithium Nickel Manganese Cobalt Oxide LiNiMnCoO_2 (NMC)
- Lithium Nickel Cobalt Aluminum Oxide LiNiCoAlO_2 (NCA)

CAUTION: SELECTING THE INCORRECT BATTERY TYPE SETTING MAY DAMAGE YOUR BATTERY.

When the regulator powers on, the unit will run self-qualify mode and automatically show the below items on LCD before commencing the charging process.

 Self-test starts, digital meter segments test

 Software version test

 Rated voltage and current test

After commencing the charging process, the LCD will display the charging status as detailed below.

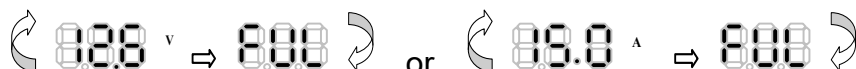
By pressing the **VOLT / AMP button** in sequence, the LCD display will cycle through the battery voltage (V), charging current (A) and charged capacity (Ah).



Note that at night only the voltage will be displayed.

Display when battery fully charged:

When the battery is fully charged, the LCD will switch every two seconds between displaying "FUL" and displaying the charge status.

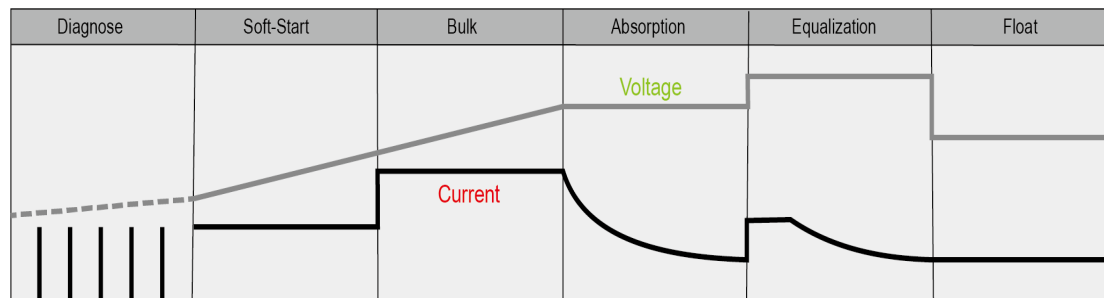


The display can be changed at any time during charging process.

Charging Stages



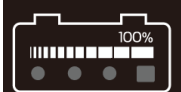
The unit has a 6-stage charging algorithm.

Diagnose* - Soft Charge – Bulk Charge - Absorption charge – Equalizing Charge* - Float Mode



Diagnose (lithium only)	Checks the Lithium battery initial voltage to determine if going to Soft start or Bulk charge; if the Lithium battery is protected by BMS, the regulator will automatically send the signal periodically to the battery terminals to activate the BMS against protection.
Soft start	When batteries suffer an over-discharge, the regulator will softly ramp the battery voltage up to 10V.
Bulk charge	Maximum current charging until batteries rise to Absorption level.
Absorption	Constant voltage charging and battery is over 85% for lead acid battery; a Li-ion battery, LiFePO4 battery and LTO battery will close fully charging after absorption stage, the absorption voltage level will reach 12.6V for Li-ion battery, 14.4V for LiFePO4 battery; 14.0V for LTO battery.
Equalization (wet/calcium only)	When the battery is deeply drained below 10V or every 28 days cycle, it will automatically run this stage to bring the internal cells as an equal state and fully complement the loss of capacity. (Li-ion, LiFePO4, LTO, Gel and AGM battery do not run Equalization charge)
Float charge/ re-bulk charge	Battery is fully charged and maintained at a safe level. A fully charged Lead acid battery (GEL, AGM, WET and Calcium battery) has a voltage of more than 13.8 Volts; if the lead acid battery voltage drops to 12.8V at float mode, it will return to Bulk charge; Li-ion, LiFePO4 and LTO battery have no float mode; If a Li-ion battery voltage drops to 12.0V after absorption stage, it will return to Bulk charge; if a LiFePO4 battery voltage drops to 13.4V, or LTO battery voltage drops to 13.2V after Absorption stage, they will return to Bulk charge.

LED Indication

LED indications							LCD Display	LCD Backlight
LED Color	ORG	BLUE	BLUE	BLUE	BLUE	GREEN		White
Soft-start charging	ON	ON	FLASH	OFF	OFF	OFF	Normal Display	ON
Bulk charge (charged capacity < 25%)	ON	ON	FLASH	OFF	OFF	OFF		
Bulk charge (charged capacity < 50%)	ON	ON	ON	FLASH	OFF	OFF		
Bulk charge (charged capacity < 75%)	ON	ON	ON	ON	FLASH	OFF		
Absorption charging	ON	ON	ON	ON	ON	FLASH		
Float charging	ON	OFF	OFF	OFF	OFF	ON		
Solar weak (At dawn or dusk)	FLASH	OFF	Subject to battery voltage					
In the night	OFF	OFF					OFF	
Solar good, VB < 5V	ON	OFF	OFF	OFF	OFF	OFF	b03 / bLv	FLASH
Solar good, battery reversed	ON	OFF	OFF	OFF	OFF	OFF	b02/ brc	FLASH
Solar good, battery over-voltage	ON	OFF	FLASH	FLASH	FLASH	FLASH	b01 / bov	FLASH
Solar off, battery over-voltage	OFF	OFF	FLASH	FLASH	FLASH	FLASH	b01 / bov	FLASH
Solar good, battery over 65°C	ON	OFF	Subject to battery voltage				xxC/bot	FLASH
Battery good, solar reverse	FLASH	OFF					P02/Prc	FLASH
Battery good, solar over-voltage	FLASH	OFF					P01/Pov	FLASH
Over Temperature Protection							xxC/Pot	FLASH

Specifications

1	Electrical Parameters			
1-1	Rated solar panel amps	10/15	Max.	AMP
1-2	Normal input Solar cell array voltage	15-22		VDC
1-3	Max. solar cell array voltage (output has no load)	25	Max.	VDC
1-4	The regulator lowest operating voltage at solar or battery side	8V	Min	VDC
1-5	Standby current consumption at night	5	Max	mA
1-6	Maximum voltage drop-Solar panel to battery	0.25	Max.	VDC
2	Charging characteristics			
2-1	Minimum battery starts charging voltage	3	Min	VDC
2-2	Soft start charging voltage	3-10	+/-0.2	VDC
2-3	Soft start charging current (50% PWM duty)	Up to 5/7.5/10		AMP
2-4	Bulk charge	By the maximum rated current		
2-5	Absorption charging voltage at 25°C			
	--Gel type battery	14.1	+/-0.2	VDC
	--AGM type battery (default setting)	14.4	+/-0.2	VDC
	--WET type battery	14.7	+/-0.2	VDC
	--Calcium type battery	14.9	+/-0.2	VDC
	--LTO battery	14.0	+/-0.2	VDC
	--LFP battery	14.5	+/-0.2	VDC
	--Li-ion battery	12.6	+/-0.2	VDC
2-6	Absorption transits to Equalizing or Float condition:			
	--Charging current drops to	1.5	+0.1	AMP
	-- or Absorption charging timer timed out	4		Hour
2-7	Equalization charging active (Only for WET or Calcium battery)			
	--Battery voltage discharged to less than	10	+/-0.2	VDC
	--Automatic equalizing charging periodical	28		Day
2-8	Equalization charging voltage at 25°C	15.5	+/-0.2	VDC
2-9	Equalization charging timer timed out	2		Hour
2-10	Float voltage (GEL, WET, Calcium, AGM battery) at 25°C	13.8	+/-0.2	VDC
	Restart voltage for LTO battery	13.2	+/-0.2	VDC
	Restart voltage for LFP battery	13.4	+/-0.2	VDC
	Restart voltage for Li-ion battery	12.0	+/-0.2	VDC
2-11	Voltage control accuracy	+/- 1%		
2-12	Battery temperature compensation coefficient	-24		mV/°C
2-13	Temperature compensation range	-20 ~ +50		°C
3	Protection			
3-1	Against reverse polarity or short circuit at panel or battery			
3-2	No reverse current from battery to solar at night			
3-3	Over temperature protection during charging	65		°C
4	Electrical parts			
4-1	Input output terminal	M5 terminals		
5	Physical Parameters			
5-1	Regulator material	Plastic, Standard ABS		
5-2	Power terminal maximum stranded wire size	#10 AWG stranded- 5 mm ²		
5-3	Power terminal torque	Up to 17 in-lb (0.2n-m)		
5-4	Mounting	Vertical wall mounting		
5-5	IP grade	IP65,		
5-6	Net weight	Approx. 300g		
6	Environmental characteristics			
6-1	Operating temperature	-25 ~ 50°C / -13~122°F		
6-2	Storage temperature	-40 ~ 85°C / -40~185°F		
6-3	Operating Humidity range	100% no condensation		

Frequently Asked Questions

Q. Can I connect this solar regulator to an existing Anderson plug on my camper / caravan?

A. The solar panel must connect directly to the battery. If you wish to connect your solar panel via Anderson plugs on camper trailer or caravan, you must bypass this regulator.

Q. Why am I getting no power through my solar panel?

A. Check the following:

1. Make sure all Anderson connectors are plugged in.
2. Make sure a wire has not been pulled out of the regulator.
3. Please ensure solar panel is connected directly to a battery (not through any secondary regulator / charger)

(Note: If reset of regulator is needed, remove all wires from battery)

Q. Why is my solar panel not producing its rated output?

A. Your solar panel will produce maximum output on a clear (cloudless) day when the temperature is between 24-28 degrees Celsius. It must also be connected to a battery that is at less than 80% capacity. Once a battery reaches 80% capacity, the regulator will gradually reduce the charge current until it reaches 100%.

Warranty Policy

While we utilise the best manufacturing practices, there are occasional cases of product failure.

Our goods come with guarantees that cannot be excluded under the Australian Consumer Law. You are entitled to a replacement or refund for a major failure and compensation for any other reasonably foreseeable loss or damage. You are also entitled to have the goods repaired or replaced if the goods fail to be of acceptable quality and the failure does not amount to a major failure.

Hard Korr warrants that this product will be free from defects in material and workmanship for the period of time we stipulate. The warranty commences on the date of purchase by the original purchaser, and is not transferable.

To access the benefits of this warranty, you must retain your proof of purchase and follow any other direction we reasonably give you (e.g. completing and returning your warranty card if applicable).

If you believe your Hard Korr product is defective, it must be returned to Hard Korr for inspection by our warranty claims department. Hard Korr will not be liable for any charges you incur relating to installation, repair or removal of Hard Korr products, nor for any costs incurred in returning the product to us.

To begin your warranty claim:

1. You must have a Return Authorization (RA) number. To get your RA number, please complete the form found on our website and wait for the warranty team to contact you.
2. Once you have an RA number, you must arrange for the product must be shipped back to Hard Korr (except in the case of fridge/freezers, which must be taken to an authorised service agent for examination). The address for shipment is 25 Old Pacific Hwy, Yatala Qld 4207.
3. Please include a copy of your original proof of purchase.
4. Please be sure that your RA number is clearly marked on your documentation as well as on the outside of the packaging used for shipping.

Completing the steps above will ensure faster processing of your claim, so that Hard Korr® can get your product back to you as soon as possible.

If Hard Korr determines, at our sole discretion, that your product is defective in material or workmanship, we will honor your warranty claim. We will determine the proper handling of all warranty claims including whether the item is repaired or replaced.

Your warranty is voided if we (at our sole discretion) determine that there is evidence of one or more of the following:

- Negligence: Improper installation, improper or extreme use, etc.
- Abuse: Road hazards, Damage beyond the limits of "normal wear and tear."
- Unauthorized Repair: Repair service performed by an unauthorized service centre.
- Disassembly: Any attempt to open, tamper with or otherwise compromise the integrity of the product.

Hard Korr warranties only apply to the original purchaser and may not be transferred under any circumstances.

Discontinued Items:

Discontinued items that are still under warranty will be reviewed by Hard Korr®. If a discontinued item is covered under warranty it may be replaced by an equivalent item. If an equivalent item is not available Hard Korr® will determine terms of resolution on a case-by-case basis.

Exceptions to this Warranty:

Painted Finish: Hard Korr uses the highest quality materials available, but depending on location, environment and exposure, painted surfaces can fade. We will not approve any warranty claims that relate to faded paint.

Damage to Lenses: Please be aware that certain chemicals cause damage to polycarbonate plastics. Do not use cleaning products that contain any chemicals in the following list: Acetic Acid Aq., Acetone, Ammonium Carbonate Aq., Ammonium Chloride Aq., Benzene, Calcium Hypochlorite, Chloroform, Chromic Acid Aq., Ethyl Acetate, Ethylene, Glycol Aq., Formaldehyde Aq., Citric Acid, Heptane, Hydrofluoric Acid Aq., Lubricating Oils (Petroleum), Methyl Ethyl Ketone, Methyl Chloride, Mineral Oils, Oleic Acid, Ozone, Phosphoric Acid Aq., Toluene, Turpentine, Zinc Chloride Aq.

Hard Korr will not approve any warranty claims for lighting products where we reasonably believe that products have been exposed to any of these chemicals.

HARDKORR

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WWW.HARDKORR.COM