

# **Commissioning Procedure & Instruction Manual**

*MR2-24/30V0 OPEN CHASSIS CHARGER*

*MK3 VERSION*

**Manufactured For**

**Rickson Engineering Ltd**



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**SPECIFICATION FOR MR2 - 24V & 30V BATTERY CHARGERS.**

<b>INFORMATION</b>	<b>24V Charger</b>	<b>30V Charger</b>
INPUT VOLTAGE:	188-234V AC	As Left
INPUT POWER FACTOR:	>0.75 LAGGING	As Left
INPUT CURRENT:	APPROX 0.8A AC	As Left
FREQUENCY:	50-60HZ	As Left
OUTPUT VOLTAGE (FLOAT):	28.2V DC +/-1%	35V DC +/-1%
OUTPUT VOLTAGE (BOOST):	N/A	N/A
OUTPUT RIPPLE VOLTAGE:	<50mV PK-PK	As Left
OUTPUT CURRENT (SET AMPS):	120/800mA. Max 2A Trip Level 25V DC	As Left 30V DC
AUX OUTPUT CURRENT:	N/A	N/A
AUX OUTPUT VOLTAGE:	N/A	N/A
AUX OUTPUT RIPPLE VOLTAGE:	N/A	N/A
HIGH ALARM SETTING:	29V DC +/-1%	36V DC +/-1%
LOW ALARM SETTING:	20V DC +/-1%	25V DC +/-1%
CHARGE FAIL SETTING:	Less than approx 9mA	As Left
EARTH ALARM SETTING:	N/A	N/A
LOW MAINS SETTING:	N/A	N/A
LOW BATTERY DISCONNECT SETTING:	N/A	N/A
BATTERY IMBALANCE SETTING:	N/A	N/A
SIZE:	300mmW 225mmD	
WEIGHT:	APPROX 2.55 Kg	
IP RATING:	N/A	



***INTRODUCTION TO THE MR2 RANGE OF BATTERY CHARGERS.***

The MR2 constant current/constant potential battery charger has been specifically designed to meet the requirements of battery manufacturers' specifications when used in switch tripping or other applications where a quick recharge, together with a safe secondary level of float charge.

The output voltage and current settings are fully adjustable and will meet a wide range of applications where battery capacity can vary from 4 up to 10 amp-hours and the number of cells change.

The output voltage level can be preset to cover a range of 20-36 and can be adjusted using a PCB mounted potentiometer. With a different model transformer and changes to some of the on-board component values, the unit can be converted for 48V operation.

Initial - secondary current levels, the I1 - I2 trip level, high and low alarm levels are also adjustable using dedicated pots.

Technical instruction on how to reset the units can be found on page 7.



***FEATURES OF THE MR2 RANGE OF BATTERY CHARGERS.***

Output Ripple less than 50mV PK to PK.

Meets the following national and international standards

Low Voltage DC Power Supplies

IEC 61204-3	BS EN 61204-3
IEC 61204-6	BS EN 61204-6

Stabilized DC Power Supplies

IEC 60478-1	BS EN 5654-1
IEC 60478-2	BS EN 5654-2
IEC 60478-4	BS EN 5654-4

Information Technology Equipment Safety

IEC 60950-1	BS EN 60950-1
IEC 60950-21	BS EN 60950-21

Electromagnetic Compatibility

IEC 61000-6-1	BS EN 61000-6-1
IEC 61000-6-2	BS EN 61000-6-2
	BS EN 55014-1
	BS EN 55014-2

Earthing	BS 7430
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Automatic negative temperature co-efficient at 20 degrees centigrade and above.

Short circuit protection. The MR2 charger incorporates an uprated heatsink & output Transistor which enables the unit to withstand temporary short circuits. Additionally the Unit will recharge totally discharged batteries quickly. The thermal protection fitted to Earlier versions of this unit has been removed to reduce the recharge period to a minimum.

Output current regulation better than 0.5%.

On board thermal trip protection circuitry.

Test facility to disable charger for battery capacity evaluation.

On board LED drivers for High, Low, Charge Failure alarms and Mains On.

On board timer factory set with battery voltage override facility.

Manual boost facility: Disables I2 current mode and switches charger to I1.

Potentiometers fitted allowing user adjustment of High alarm, Low Alarm, Charge Failure, Float Voltage, I1, I2 current modes and Trip Level.

Terminations provided for add on alarm relay modules.



**CONNECTIONS TO THE MR2 RANGE OF BATTERY CHARGERS.**

A terminal strip is fitted to the printed circuit board. Connections to the charger are as follows:-

TERMINAL No	CONNECTION/FUNCTION
1	Live Input
2	Neutral Input
3	Earth
4	Battery Positive
5	Battery Negative
6	Voltmeter Positive
7	Voltmeter Negative
8	Ammeter Positive
9	Ammeter Negative
10	Boost Switch
11	Boost Switch
12	External Battery Thermal Trip
13	External Battery Thermal Trip
14	Mains On LED +
15	Mains On LED -
16	Charge Fail LED +
17	Charge Fail LED -
18	Low Alarm LED +
19	Low Alarm LED -
20	High Alarm LED +
21	High Alarm LED -
22	Test Switch
23	Test Switch



***COMMISSIONING PROCEDURE FOR THE MR2 RANGE OF BATTERY CHARGERS.***

In order to install and commission the charger, the following instructions should be followed:-

1. Connect mains leads to terminals 1, 2 and 3.
2. Connect the battery to terminals 4(+) and 5(-).
3. Connect a voltmeter to terminals 6(+) and 7(-).
4. Connect an ammeter to terminals 8(+) and 9(-) or fit a link.
5. Connect a normally open boost switch to 10 and 11.
6. Connect the normally closed contact of the battery pack thermal trip to 12 and 13 or fit a link.
7. Connect the mains on led to terminals 14(+) and 15(-).
8. Connect the charge failure led to terminals 16(+) and 17(-).
9. Connect the low alarm led to terminals 18(+) and 19(-).
10. Connect the high alarm led to terminals 20(+) and 21(-).
11. Connect a normally open Test switch to terminals 22 & 23.

Once all of the above connections are complete, the mains supply can be switched on.



### ***OPERATION OF MR2 RANGE OF BATTERY CHARGERS.***

The incoming mains supply is taken from terminals 1, 2 and 3 and is fed to the output terminals P and P and on to the transformer primary connections via cable.

The isolated secondary output from the mains transformer is fed onto the PCB mounted terminals S and S where it is rectified and smoothed by BR1 and C4 in order to supply the on board electronics and the charger output.

The output voltage is monitored on a continuous basis by the op amp IC1. Any change in the output potential is detected by pin 3 which alters the output drive signal from pin 1 which feeds the voltage control transistor.

Output current is measured by monitoring the volts drop across the resistor R50. Changes in this potential are detected by pin 5 of IC1 which adjusts the output drive signal from pin 7 which feeds the current limit transistor.

Both the voltage control and current limit transistors are connected to the base of the main output transistor T9. As the transistors conduct they adjust the base potential on T9 which alters the output voltage or current.

Output current levels depend upon the logic output signals derived by the voltage sensing network R5, VR6 and R49. Set at 30V for example, batteries with terminal voltages of <30v force the charger into the primary current mode I1. In this case the output current will be at maximum.

As the battery voltage crosses the trip potential (30V in this example), the output voltage from pin 14 of IC2 switches from zero to 15V dc which causes the charger to switch into the secondary current mode I2. Where batteries fail to recharge normally, the I1 - I2 trip is initiated by an on board timer.

When required, the charger can be forced into the I1 initial current mode by applying a short circuit to the terminals 10 and 11. This overrides the voltage sensing logic and the timer but not the battery charge output voltage sensing circuit. So, when the battery output voltage reaches to the pre-set changeover level, the charger will switch to the I2 secondary current mode regardless whether terminals 10 and 11 are short-circuited or not. Please note that the forced I1 initial current mode has no effect on the status of I1 and I2 indicators.

In series with the output supply is a diode. It is fitted to prevent discharge of the batteries when the mains supply to the charger is interrupted. A small discharge current will be drawn however in order to energise the alarm circuits.

A current sensing charge fail monitor is fitted to the MR2 range of chargers. Should the charging Current fall below a preset limit, the alarm switches from healthy to fault mode.

The high and low voltage alarm monitors function in a similar manner to the charge failure alarms. The cathode potential is monitored and potentials greater than or less than predetermined levels initiate the alarms.

### ***ADD ON ALARM RELAYS***

Add on alarm relays designed specifically for the MR2 range of battery chargers is available. They are connected to the appropriate connectors, 5, 6 or 7. Fitted with a single pole relay, the add on alarm units are ideally suited for remote signal applications.



**SETTING UP THE MR2 RANGE OF BATTERY CHARGERS.**

1. **I1 & I2 TRIP LEVEL**  
Disconnect the batteries from the charger leaving all other connections intact.  
Adjust the potentiometer VR1 until the output voltage is at the required trip potential.  
Adjust potentiometer VR6 clockwise until the I1 LED switches on. Turn VR6 anti-clockwise until the I1 LED switches off and the I2 LED switches on.
  
2. **CURRENT SETTINGS**  
Make sure a discharged battery and all other items are connected to the output terminals of the charger.  
With the mains supply on adjust potentiometer VR3 until the output current is at the required level.  
The battery voltage must be some 2-3 volts below the trip level to correctly set the unit.  
Allow the battery voltage to cross the trip threshold and the I2 LED to switch on. Adjust potentiometer VR2 until the output current is at the required level.  
  

I1 SETTING RATE	$0.2 \times \text{Cell Capacity} = 0.2 \times 4 = 0.8\text{A}$
I2 SETTING RATE	$0.03 \times \text{Cell Capacity} = 0.03 \times 4 = 0.12\text{A}$
  
3. **HIGH ALARM SETTING**  
Disconnect the battery from the charger output terminals.  
Adjust the charger output until the potential is at the required high alarm trip level.  
Adjust the potentiometer VR5 until the high alarm LED switches on.  
The setting can be confirmed by reducing the output voltage by 1 volt followed by a slow adjustment in the opposite direction. The LED will switch on at the preset level.
  
4. **LOW ALARM SETTING**  
Disconnect the battery from the charger output terminals.  
Adjust the charger output until the potential is at the required low alarm trip level.  
Adjust the potentiometer VR4 until the low alarm LED switches on.  
The setting can be confirmed by increasing the output voltage by 1 volt followed by a slow adjustment in the opposite direction. The LED will switch on at the preset level.
  
5. **FLOAT VOLTAGE ADJUSTMENT**  
With the batteries disconnected from the charger output terminals adjust potentiometer VR1 until the output voltage is at the required level.





***FAULT FINDING ON THE MR2 RANGE OF BATTERY CHARGERS.***

The MR2 battery charger, when used within the prescribed operating parameters are designed to be totally reliable and maintenance free. In the unlikely event of failure proceed as follows:-

1. Make sure the thermal trip connected to the charger is closed.  
This can be confirmed using a multimeter set to ohms.
2. Check the condition of all three on board fuses. MAINS DISCONNECTED
3. Measure the secondary output voltage from the transformer.  
The reading obtained should be approx 40V AC.
4. Measure the voltage across the rectifier (BR1) positive and negative terminals.  
The reading obtained should be approx 60V dc.

If all tests are complete and the results specified on this sheet are obtained, the pcb assembly should be replaced.

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RC1 RESISTOR 1K0 2.5W  
 RC2 RESISTOR 10K 0.4W  
 RC3 RESISTOR 22K 0.4W  
 RC4 RESISTOR 18K 0.4W  
 RC5 RESISTOR 18K 0.4W  
 RC6 RESISTOR 22K 0.4W  
 R7 RESISTOR 3K9 0.4W  
 R8 RESISTOR 22K 0.4W  
 R9 RESISTOR 2K2 0.4W  
 R9A RESISTOR 10K 0.4W  
 R10 RESISTOR 10K 0.4W  
 R11 RESISTOR 10K 0.4W  
 R12 RESISTOR 3K3 0.4W  
 R13 RESISTOR 68K 0.4W  
 R14 RESISTOR 3K3 0.4W  
 R15 RESISTOR 22K 0.4W  
 R16 RESISTOR 27K 0.4W  
 R17 RESISTOR 10K 0.4W  
 R18 RESISTOR 8K2 0.4W  
 R19 RESISTOR 8K2 0.4W  
 R20 RESISTOR 120K 0.4W  
 R21 RESISTOR 10K 0.4W  
 R22 RESISTOR 10K 0.4W  
 R23 RESISTOR 10K 0.4W  
 R24 RESISTOR 8K2 0.4W  
 R25 RESISTOR 10K 0.4W  
 R26 RESISTOR 2K7 0.4W  
 R27 RESISTOR 2K7 0.4W  
 R28 RESISTOR 22K 0.4W  
 R29 RESISTOR 8K2 0.4W  
 R30 RESISTOR 22K 0.4W  
 R31 RESISTOR 5M6 0.4W  
 R32 RESISTOR 680K 0.4W  
 R33 RESISTOR 5M6 0.4W  
 R34 RESISTOR 22K 0.4W  
 R35 RESISTOR 2K7 0.4W  
 R36 RESISTOR 8K2 0.4W  
 R37 RESISTOR 5M6 0.4W  
 R38 RESISTOR 10K 0.4W  
 R39 RESISTOR 10K 0.4W  
 R40 RESISTOR 10K 0.4W  
 R41 RESISTOR 10K 0.4W  
 R42 RESISTOR 10K 0.4W

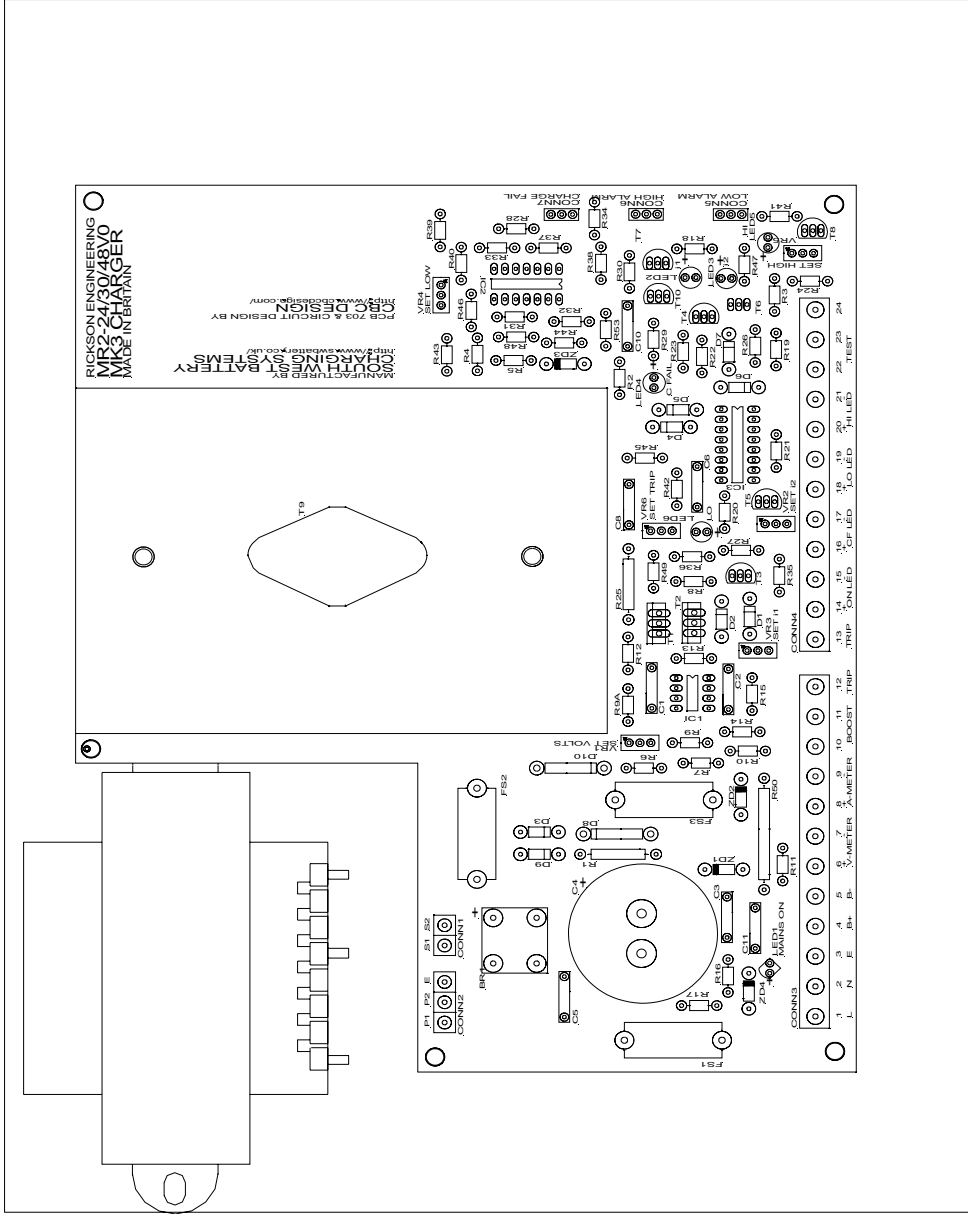
R43 RESISTOR 10K 0.4W  
 R44 RESISTOR 10K 0.4W  
 R45 RESISTOR 10K 0.4W  
 R46 RESISTOR 3K9 0.4W  
 R47 RESISTOR 3K9 0.4W  
 R48 RESISTOR 22R 0.4W  
 R49 RESISTOR 3K9 0.4W  
 R50 RESISTOR R47 6W  
 R53 RESISTOR 2K2 0.4W  
 C1 CAPACITOR 0.1uF 250V POLYES  
 C2 CAPACITOR 0.1uF 250V POLYES  
 C3 CAPACITOR 0.1uF 250V POLYES  
 C4 CAPACITOR 10,000uF 63V ELEC  
 C5 CAPACITOR 0.1uF 250V POLES  
 C6 CAPACITOR 0.047uF 250V POLYES  
 C8 CAPACITOR 0.1uF 250V POLYES  
 C10 CAPACITOR 0.1uF 250V POLYES  
 C11 CAPACITOR 0.0047uF 400V POLYES  
 ZD1 ZENER DIODE 15V 1.3W  
 ZD2 ZENER DIODE 5V1 0.5W  
 ZD3 ZENER DIODE 5V1 0.5W  
 ZD4 ZENER DIODE 24V 0.4W  
 VR1 POTENTIOMETER 5K VERT  
 VR2 POTENTIOMETER 5K VERT  
 VR3 POTENTIOMETER 5K VERT  
 VR4 POTENTIOMETER 10K VERT  
 VR5 POTENTIOMETER 10K VERT  
 VR6 POTENTIOMETER 10K VERT  
 LEDS 4-6 3mm RED  
 LED2 1&3 3mm GREEN  
 LED2 3mm AMBER  
 T1 TRANSISTOR TIP150  
 T2 TRANSISTOR TIP150  
 T3 TRANSISTOR BC546  
 T4 TRANSISTOR BC546  
 T5 TRANSISTOR BC546  
 T6 TRANSISTOR BC546  
 T7 TRANSISTOR BC546  
 T8 TRANSISTOR BC546  
 T9 TRANSISTOR MJ11016  
 T10 TRANSISTOR BC546  
 D1 DIODE LINK  
 D2 DIODE 1N4148  
 D3 DIODE 1N4007

D4 DIODE 1N4148  
 D5 DIODE 1N4148  
 D6 DIODE 1N4148  
 D7 DIODE 1N4148  
 D8 DIODE 1N4148  
 D9 DIODE 1N5402  
 D10 DIODE 1N5402  
 IC1 DUAL OP AMP LM358N  
 IC2 QUAD OP AMP LM324N  
 IC3 TIMER MC14521B  
 FS1 FUSEHOLDER/COVER & 2AFUSE  
 FS2 FUSEHOLDER/COVER & 1AFUSE  
 FS3 FUSEHOLDER/COVER & 1AFUSE  
 BR1 RECTIFIER  
 HEATSINK X1 FARNELL 253-730  
 O/P TERMS X2 CAMDEN CTB1100/12  
 2 WAY PCB TERMINALS X1  
 3 WAY PCB TERMINALS X1  
 8 PIN IC BASE X1  
 14 PIN IC BASE X1  
 16 PIN IC BASE X1

TITLE	JOB NUMBER	CUSTOMER	ISSUE	DATE	REVISION	DRG No	P9912AS
.703 PCB PARTS & LAYOUT DIAGRAM 12 & 15 LEAD ACID CELL VERSION (20 -25 NICADS)	11803	RICKSON ENGINEERING	1	13-9-99	FIRST ISSUE	SCALE	N/A
MATERIAL	CBC JOB NUMBER 0693	ORDER NUMBER 300902				SHT 1	OF 1
BATTERY CHARGING SYSTEMS. TEL (01453) 872865. ENGINEERING: CBC DESIGN. TEL (01275) 878362.		SITE HONG KONG				DRN	A FIDLER
						CKD	A FIDLER

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THIRD ANGLE PROJECTION



RICKSON ENGINEERING  
 MR2-24/30/48V0  
 MK3 CHARGER  
 MANUFACTURED BY  
 CHARGING SYSTEMS  
 SOUTH WIND SYSTEMS  
 LTD  
 1122 WWW.WINDSYSTEMS.CO.UK  
 CBC DESIGN  
 1123 WWW.CBCDESIGN.COM

TITLE	JOB NUMBER	CUSTOMER	ISSUE	DATE	REVISION	DRG No	M9912A
MR2-24,30 & 48V0 CHARGER LAYOUT	11803	RICKSON ENGINEERING	1	13-9-99	FIRST ISSUE	SCALE	N/A
MATERIAL	CBC JOB NUMBER 0693	ORDER NUMBER 300902				SHT. 1	OF 1
BATTERY CHARGING SYSTEMS. TEL (01453) 872865. ENGINEERING: CBC DESIGN. TEL (01275) 878362.		SITE HONG KONG				DRN	A FIDLER
						CKD	A FIDLER