

# SOLAR BOX SOLAR & DYNAMIC CHARGING



**Ratio**  
**ELECTRIC**

Manual

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## IMPORTANT SAFETY INSTRUCTIONS

Carefully read these instructions and the charging instructions in your vehicle owner's handbook before charging your electrical vehicle.

Take special note of all information marked with the following symbols:

**Note:** *This means pay particular attention. Notes contain helpful suggestions*

**Caution:** *This symbol means be careful. You are capable of doing something that might result in damage to equipment.*



**Warning:** *This symbol means danger. You are in a situation that could cause bodily injury. Before you work on any electrical equipment, be aware of the hazards involved with electrical circuitry and standard practices for preventing accidents.*

### Safety Guidelines

- ❖ Use this Solar Box to charge electric vehicles equipped with a conductive charge port only. See the vehicle's owner's handbook to determine if the vehicle is equipped with a conductive charge port.
- ❖ Make certain the Solar Box's supply cable is positioned so it will not be stepped on, tripped over, or otherwise subjected to damage or stress.
- ❖ There are no user serviceable parts inside. Refer to the Customer Support section in this manual for service information. Do not attempt to repair or service the Solar Box yourself.
- ❖ Do not operate your Solar Box if it or the supply cable or housing is visibly damaged. Switch off the MCB in the electrical cabinet and contact your Service Representative for service immediately. Refer to the Customer Support section in the manual for information on the Service Representative in your area.

## SAFETY INFORMATION



**Warning:** When using electric products, basic precautions should always be followed, including the following:

Read all the safety warnings and instructions before using the product. Failure to follow the warnings and the instructions may result in electric shock, fire and / or serious injury.

This device should be supervised when used around children.

Do not put fingers into the electric vehicle connector.

Do not use this product if the flexible power cord or EV cable are frayed, have broken insulation, or any other signs of damage.

Do not use this product if the enclosure or the EV connector are broken, cracked, open, or show any other indication of damage



**Warning:** If, at any time, you think the equipment is unsafe, switch off the MCB in your electrical cabinet and immediately contact Customer Support for service. Do not use your Home Box until the problem is identified and corrected.

**Caution:** Children should not be allowed to use this Home Box. Do not allow children to play in or around the Solar Box. Close supervision of children is necessary when the Solar Box is used.

**Caution:** Do not open the enclosure.

**Note:** This Solar Box is designed according to the IEC61851 Mode 3 standard.

**Note:** This product must be grounded/protective earthed. If it should malfunction or breakdown, grounding provides a path of least resistance for electric current to reduce the risk of electric shock. This product is equipped with a cord having an equipment grounding conductor and a grounding plug.



**Warning:** Improper connection of the equipment-grounding conductor is able to result in a risk of electric shock. Check with a qualified electrician or serviceman if you are in doubt as to whether the product is properly grounded.

## DESCRIPTION

**This charging station is used for charging electric vehicles (EV's) and is compatible with the common IEC61851 standard.**

**This unit includes a charging station, 1 (single phase) or 3 (3-phase) current clamps (CT's) and a sensorbox V2.**

**The sensorbox measures the current (direction) of the power in the electrical cabinet and transmits this information to the charging station.**

**When other appliances are switched on, the power to the EV will automatically be reduced.**

**It is also possible to charge the EV on pure solar power. The charging station uses the sensorbox to try to sent all generated power from the solar panels to a charging EV.**

## INSTALLATION

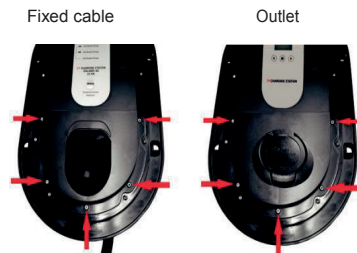
1. The installation must be done by a qualified and licenced electrician according the local legislation.
2. The electrical installation must be free of power during the entire installation period.
3. Since this Charging Unit uses circuits that reference to ground, no Megging must be done after connecting to power.
4. Wiring and protection:

Version	Wiring *	Mains Circuit Breaker (MCB)	Residual Current Device (RCD)
32A / 1 Phase	3G6,00mm <sup>2</sup>	40A B-Characteristic	30mA, Type A
32A / 3 Phase	5G6,00mm <sup>2</sup>	40A B-Characteristic	30mA, Type A

\* *For cable length upto 25m*

**PLEASE NOTE: All charges include an AC (> 30mA) and DC (> 6mA) residual-current-detection. Always place a type A RCD and the MCB (or combination unit) in the electrical cabinet.**

5. Open bottom cover of the Charge Station (5 screws – see picture). Carefully brake out required cable opening for incoming power cable and charge cable.  
Use supplied M25 cable gland to fix power cable from the bottom.  
Use supplied grommet to fix power cable from the back.  
Use supplied M25 cable gland to fix charge cable.
6. Use 4 wood screws M4,5x35mm to mount Charging Station on the wall. The Charging Station should be installed between 0,80m and 1,20m from bottom to the ground.



7. Connect in-coming power to the left terminal block.

Single Phase :

L1=Brown

N= Blue

Earth= Green/Yellow

3 Phase

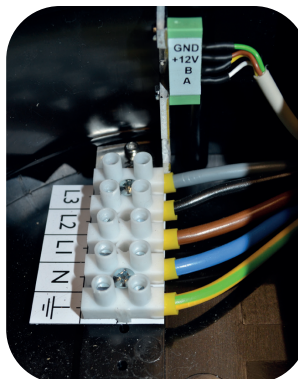
L1=Brown

L2=Black

L3=Grey

N=Blue

Earth=Green/Yellow



8. Connection Sensorbox V2 and CT's

The Sensorbox V2 has three inputs for CT's (current transformers) and a voltage input to determine the direction of the current. The connection to the charging station is via a 4-pole plug.

With the Sensorbox V2 it is possible to determine the direction of the current, this makes it possible to charge the EV with self-generated solar power.

The voltage input (220-240V) is not a power supply for the Sensorbox, but serves to determine the direction of the measured current.

The CT's are placed just after the main fuse but before the connection of the solar panels. See page 9. This way it will be able to measure the total current per phase and send this information to the Smart Box.

In order to measure the current, Current Transformers are used (type SCT013-000, one for each phase). Clip the CT's around the phase wires.

Try to find out which wire is L1 and connect it to connection 1 of the Sensorbox. Make sure that the orientation of the CT's is in the same direction for all phases. (arrow on the CT in the same direction). From the same phase also a voltage connection must be made to the mains input of the Sensorbox. Use the supplied mains cable for this.

**Attention : The voltage input (mains) must be connected to the same phase as the CT connected to terminal 1!**

Then connect the CT's of phase L2 (to 2) and L3 (to 3) (when used).

### 9. Connection of the SensorBox to the Charging station

The data cable on the Sensorbox should be connected to terminals A (white), B (yellow), +12V (brown) and GND (green).



**NOTE:** The data cable between Sensorbox and Smart Box is not supplied. You can use a standard UTP cable or 4 x 0,25 mm<sup>2</sup> data cable.

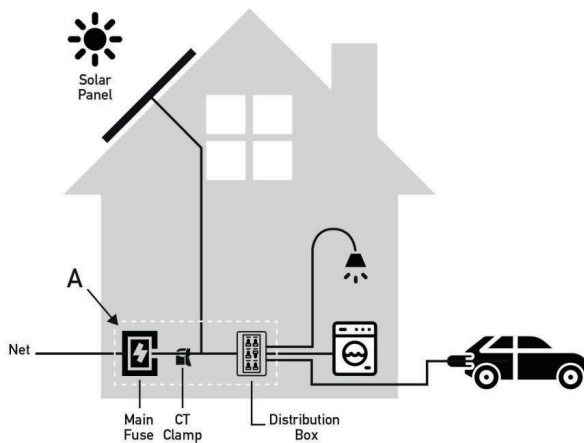
Connect the data cable in the charging station with the supplied 4 pole connector. Master/Slave configuration: Connect the A, B and GND connection from the Master to the Slave(s). So A connects to A, B goes to B etc. Make sure that the +12V wire coming from the Sensorbox is connected to the Master Smart Box only.

### 10. Close the bottom cover and carefully slide grey cover over the Charging Station.

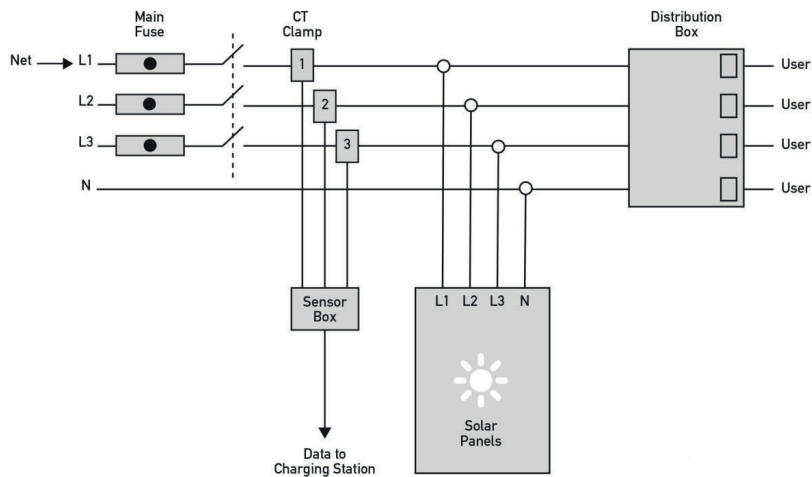
**IMPORTANT: OUTLET VERSION - before closing outlet cover, be sure the outlet is unlocked!**



## Installation of Current Clamps (CT's)

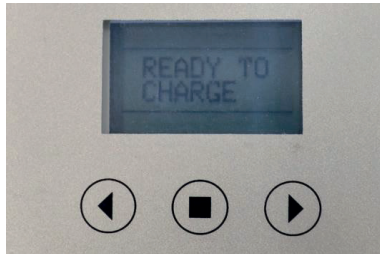


### Detail A



## CONFIGURING THE SOLAR BOX

The Solar Box has a display to show the charging status and push buttons to do the setup. After you have connected the Solar box to the power you will see in the display: Ready to charge.



Hold the center button for 2 seconds to enter the menu. You can now use the left and right buttons to go to the different menu options.

Pressing the center button, selects the option, and allows you change the value (for example change the charging current).

What is displayed depends on the options you have set.

If you enabled smart mode (MODE->SMART) then the MAINS and MIN option will be shown.

If you selected the CONFIG->FIXED option, a fixed cable is to be used,

The EXIT menu option stores the settings, if you don't want to store the settings, wait 2 minutes (or disconnect the mains) and the setup menu will be exited without saving any settings.

After starting, the charger is always ready to charge with the previous settings. You can't access the setup during the charging.

## ALL MENU OPTIONS

You can use the left or right arrow button to switch between the settings. Confirm your choice always with the middle button.

**CONFIG:** Configure Solar Box with Type 2 Socket or Fixed cable

- SOCKET            Solar Box has a type 2 socket
- FIXED             Solar Box has a fixed charging cable

**LOCK:** Enable or disable the locking actuator (config=socket)

- DISABLED        No lock is used
- SOLENOID        Ratio lock (**PRESET**)
- MOTOR            Phoenix contact lock

**MODE:** Use Normal mode or Smart/Solar mode (requires Sensorbox)

- NORMAL          The EV will charge with the current set at MAX
- SMART            The EV will charge with a dynamic charge current, depending on Sensorbox data and MAINS, MAX, MIN settings
- SOLAR            The EV will charge on solar power only (**PRESET**)
- START – set the current on with the EV should start Solar charging, surplus energy start current
- STOP – stop charging when there is not enough solar power available *Disabled* – 60 minutes (Disabled = never stop charging)

**LOAD BAL:** Load Balancing mode for 2 – 4 Smart Box units

- DISABLED        No load balancing is used (**PRESET**)
- MASTER          Set one of the Solar Box units to Master
- SLAVE 1-3        And the rest to Slave 1 – 3, when using load balancing

**MAINS:** Set Max Mains current / I-max home (\*)

- 10-99A

**MIN:** Set MIN charge current for the EV (\*)

- 6-16A

**CIRCUIT:** Set the max current the circuit can handle (load balancing)

- 13-80A

**MAX:** Set MAX charge current for the EV

- 10-80A

**SWITCH:**

- SMA-SOL S        (**PRESET**) DO NOT CHANGE SETTINGS

**RCMON:** Connect a Residual Current Monitor for detecting DC leakage current

- DISABLED        The RCD option is not used
- ENABLED         (**PRESET**) DO NOT CHANGE SETTINGS

**MAINSMET:** Set type of MAINS meter

- SENSORBOX      (**PRESET**) DO NOT CHANGE SETTINGS

**CAL:** (**PRESET**) DO NOT CHANGE SETTINGS

**(\*) = Only in Smart/Solar Mode or when Load Balancing has been set to Master**

## LOAD BALANCING

It is possible to connect up to 4 Solar Box modules to each other and let them share one mains supply.

### Software configuration

Configure the Solar Box units load balancing option (LOADBL) and set one module to MASTER, the others to SLAVE 1,2,3.

Make sure there is only one Master, and the Slave numbers are unique.

Example: for a two units Load Balancing setup, set the first module to Master and the second to Slave 1.

On the Master configure the following:

MODE	Set this Smart if a Sensorbox with CT's is used to measure the current draw on the mains supply. It will then dynamically change the charge current for all connected EV's. If you are using a dedicated mains supply for the EV's you can leave this set to Normal.
MAINS	Set this to the capacity of the mains supply.
CIRCUIT	Set this to the maximum current of the circuit. This will be the maximum current all EV's combined will use.
MAX	Set the maximum charging current for the EV connected to this Smart Box.
MIN	Set to the lowest allowable charging current for all connected EV's.

On the Slave's configure the following:

MAX	Set the maximum charging current for the EV connected to this Smart Box.
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After setting the Slave's load balancing option, there will be an error message on the display: "ERROR NO SERIAL COM"

This indicates, that the Slave unit was not able to communicate to the Master. This message will disappear after the modules are correctly wired up.

### Hardware connections

Connect the A, B and GND connections from the Master to the Slave(s).

So A connects to A, B goes to B etc...

If you are using the Sensorbox, you should also connect the A, B and GND wires to the same screw terminals of the Smart Box. Make sure that the +12V wire coming from the Sensorbox is connected to only one Smart Box. This wire will provide power to the Sensorbox.

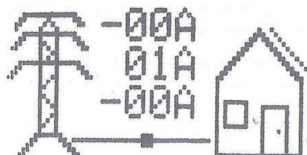
## ERROR MESSAGES

If an error occurs, the Sensor Box will stop charging and display one of the following messages:

ERROR NO SERIAL COM	No signal from the Sensorbox or other HomeBox (when load balancing is used) has been received for 10 seconds. Please check the wiring to the Sensorbox or other HomeBox.
ERROR NO CURRENT	There is not enough current available to start charging, or charging was interrupted because there was not enough current available to keep charging. The HomeBox will try again in 60 seconds.
ERROR HIGH TEMP	The temperature inside the module has reached 65° Celsius. Charging is stopped. Once the temperature has dropped to 55° Celsius charging is started again.

## TESTING AND CONFIGURING

Configure the Solar Box and make sure the option MODE is set to SOLAR. Also make sure the menu option MAINSMET is set to SENSORBOX. After exiting the menu, the measured currents should be visible on the display.



From top to bottom the display shows the measured values for L1, L2 and L3. A minus indicates that the power at that phase is delivered to the grid.

When using the CT's, it's possible that the measured currents are not displayed correctly.

If there are negative values shown, while not feeding back to the grid, the voltage input plug (MAINS) on the Sensorbox should be reversed.

In case of deviating values, check the order of the CT connections on the Sensorbox. The value of L1 must be displayed correctly, if the voltage input is also connected to the same phase.

If necessary, swapping the CT's on connection 2 and 3 should be sufficient to get everything right.

## SPECIFICATIONS

Charging System	IEC 61851 Mode 3
Cable version car connector	IEC 62196 Type 1 and type 2
Outlet version	IEC 62196 Type 2 Outlet
Power input	single-phase or 3 phase, 230V-400V, 16A and 32A
Power output	3.7kW, 7.4kW, 11kW, 22kW
Earth leakage protection	AC 30mA, DC 6mA
Dimensions	400mm x 250mm x 105mm
Housing	PC/ABS-VO
Weight	4 kg (incl. cable)
Environment	IP54, rain-tight
Operating Temperature	-25°C to +40°C
Marking	CE

## MAINTENANCE

The Home Box requires no maintenance other than occasional cleaning.



**Warning:** Switch off your Homer Box before cleaning the unit.



**Warning** To reduce the risk of electrical shock or equipment damage, be cautious while cleaning the connectors and case.

Clean the Home Box using a soft cloth lightly moistened with mild detergent solution. Never use any type of abrasive pad, scouring powder, or flammable solvents such as alcohol or benzene.

## FCC INFORMATION

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

This product has been designed to protect against Radio Frequency Interference (RFI). However there are some instances where high powered radio signals or nearby RF-producing equipment (such as digital phones, RF communications equipment, etc.) could affect operation.

If interference to your charge station is suspected, we suggest the following steps be taken before consulting your Service Representative for assistance:

1. Reorient or relocate nearby electrical appliances or equipment during charging.
2. Turn off nearby electrical appliances or equipment during charging.

**Caution:** Changes or modifications to this product by other than an authorized service facility may void FCC compliance.

## WARRANTY INFORMATION

**Ratio Electric B.V. warrants this product to be free from defects in material, manufacture and design for a period of three years after the date of purchase. If this product is defective in materials, manufacture or design during this warranty period, Ratio Electric B.V. will, at its option, repair or replace the product.**

**Repair parts and/or replacement products may be either new or reconditioned at Ratio Electric B.V. discretion.**

**This limited warranty does not include service to repair damage from improper installation, improper connections with peripherals, external electrical fault, accident, disaster, misuse, vandalism, unauthorized alteration or repair, abuse or modifications to the product not approved in writing by Ratio Electric B.V.**

**Any evidence of an attempt to disassemble the Solar Box will void this warranty.**

**Any service repair outside the scope of this limited warranty shall be at applicable rates and terms then in effect.**

CONTACT / CUSTOMER SUPPORT



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