

# SMART BOX

## DYNAMIC CHARGING + ENERGY METER



**Ratio**  
**ELECTRIC**

Manual



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### **IMPORTANT**

The energy meter is not MID certified.  
Therefore this meter is not suitable for billing purposes but for reference only.  
Do not disconnect power during charging.

## 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 Smart 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 Smart 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 Smart Box yourself.
- ❖ Do not operate your Smart 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 Smart Box until the problem is identified and corrected.



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



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

**Note:** This Smart Box is designed according 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.

## 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/C-Characteristic	30mA, Type A
32A / 3 Phase	5G6,00mm <sup>2</sup>	40A B/C-Characteristic	30mA, Type A

\* *For cable length upto 25m*

**PLEASE NOTE: All chargers 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.



Fixed cable

Outlet

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

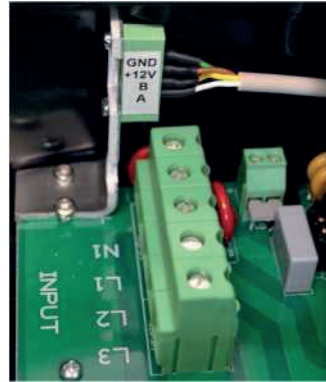
L1=Brown

L2=Black

L3=Grey

N=Blue

Earth=Green/Yellow



8. Connection Current Transformers and Sensorbox

In order to measure the current, Current Transformers are used (type SCT013-00, one for each phase). Clip them around the L1, L2 and L3 wires and plug the other end into the Sensorbox.

The Current Transformers should be placed where the Mains connection enters the building. This way it will be possible to measure the total current per phase and send this information through the Sensorbox to the Smart Box. (see picture page 8)

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



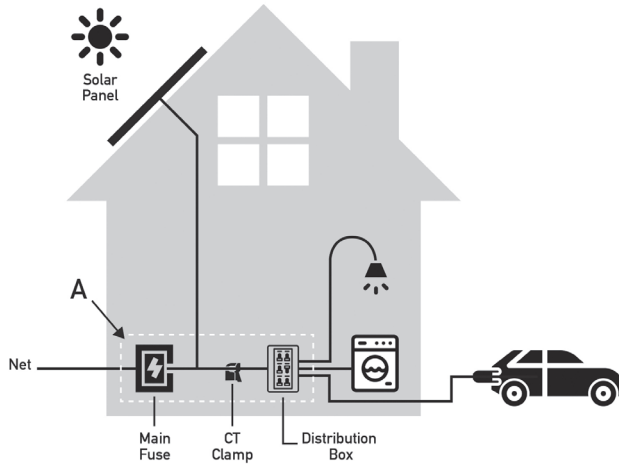
**NOTE:** The data cable between Sensorbox and Smart Box is not supplied. You can use a standard UTP cable or 4 x 0,25 mm<sup>2</sup> data cable.

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.

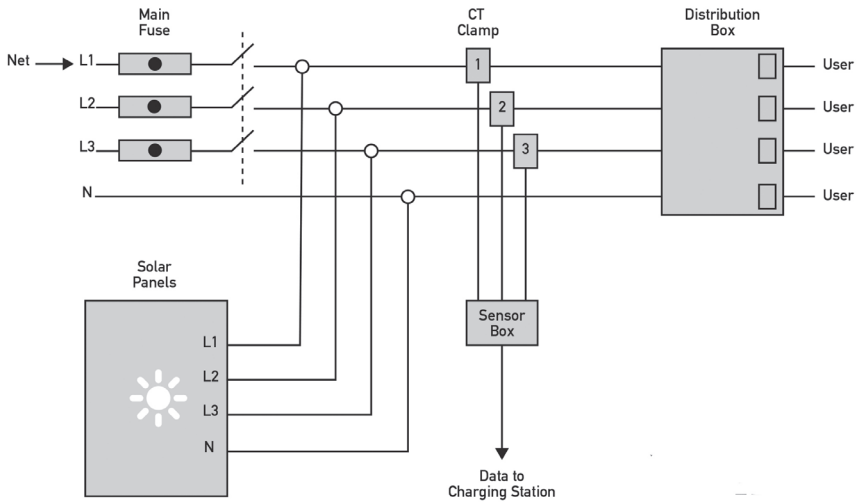
9. Close bottom cover and carefully slide metallized cover over the Charge Station.

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

## Installation of Current Clamps (CT's)



### Detail A





## SETUP-MENU

To enter the setup menu press:

- 2 x left arrow button
- 1 x right arrow button
- 1 x left arrow button
- 1 x middle button
- 1 x left arrow button

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

In the menu you can choose between SETUP:

1. CHG MODE
2. LOAD BAL
3. I MAX HOME
4. I-MIN
5. I-MAX
8. READOUT -> ERR MEMORY

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

### 1 SETUP CHG MODE

SETUP  
 <- CHG MODE ->

In de setup CHG MODE kunt u kiezen tussen:

SETUP CHG MODE  
 <- MANUAL ->

SETUP CHG MODE  
 <- FIXED 16 ->

SETUP CHG MODE  
 <- FIXED 32 ->

SETUP CHG MODE  
 <- SMART ->





## MANUAL

You can set the charging current between 6A and 32A (you can adjust the charging current during charging)



## FIXED 16

with this option you can set the charging current to 16A

## FIXED 32

with this option you can set the charging current to 32A

## SMART

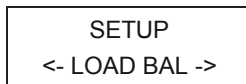
Load Balancing mode – the EV will charge with a dynamic charge current, depending on Sensorbox data and I-MAX HOME, I-MIN and I-MAX settings

You can change the setup by pressing the left or right arrow button. After your choice has been made confirm by pressing the middle button.

## 2 LOAD BAL

It is possible to connect up to 4 Smart Box modules to each other and let them share one mains supply. Configure the Smart Box's load balancing option (LOAD BAL) 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 two units set the first module to Master and second to Slave 1.



DISABLED – no load balancing is used

MASTER – set one of the Smart Box's to Master

SLAVE 1-3 – set the rest of the Smart Box's to Slave 1-3, when using load balancing

In the setup LOAD BAL you can choose between:

SETUP CHG MODE  
 <- DISABLED ->

SETUP CHG MODE  
 <- MASTER ->

SETUP CHG MODE  
 <- SLAVE 1 ->

SETUP CHG MODE  
 <- SLAVE 2 ->

SETUP CHG MODE  
 <- SLAVE 3 ->

You can change the setup by pressing the left or right arrow button.  
 After your choice has been made confirm by pressing the middle button.

You can only use load balancing in SMART mode.

### 3 SETUP I-MAX HOME

Here you can set the maximum available current of your house.  
 To set MAX Mains current you can choose between 10A and 99A.  
 This setup is available in SMART mode.

### 4 SETUP I-MIN

SETUP <- I-MIN ->

Here you can set the minimum charging current.  
 You can choose between 6A and 16A with steps of 1A.  
 The standard setting is 6A.  
 To make your choice please use the left or right arrow button.  
 To confirm press the middle button.



### 5 SETUP I-MAX

SETUP  
 <- I-MAX ->

Here you can set the maximum charging current for the EV.  
 You can choose between 10A and 32A with steps of 1A.  
 To make your choice please use the left or right arrow button.  
 To confirm press the middle button.



## 6. READOUT -> ERR MEMORY

SETUP  
 <- ERR MEMORY ->

E1:  
 E2:  
 E3:  
 E4:  
 E5:



Confirm with the middle button to enter the error memory screen. You can see max. 10 error codes. With the left and right arrow buttons you can scroll to the last code. To return into the setup menu please press the middle button for 5 seconds. In case of error message please contact Ratio Electric for support.

## USER INFORMATION

### 1- PHASE CHARGE STATION

The charging display depends on the chosen charger mode -> MANUAL, FIXED 16, FIXED 32, SMART.

With the right arrow button you can always enter the screen with more information about the consumption of the charger.

#### CHARGING SMART MODE

READY TO  
 CHARGE (A)  
 mode: smart (m)  
 www.ratio.nl

Charger ready, not connected to EV  
 smart (m) -> master  
 smart (s1) -> slave 1 / smart (s2) -> slave 2 / smart (s3)  
 -> slave 3

READY TO  
CHARGE (B)  
mode: smart (m)  
www.ratio.nl

Charger connected to EV

CHARGING  
I set [A] : x x  
Pt [W] : x . x  
Et [kWh] : kWh  
Ih : xx xx xx ( x x )  
www.ratio.nl

Charging display

I set [A] – available current

Pt [W] – power

Et [kWh] – total consumption (never reset)

Ih – x x : measured current ( x x ) : setting I HOME MAX

As in all other chosen charger modes you can reach the next screen with the right arrow button.

The menu below can be reached with the arrow button from a READY TO CHARGE screen but also from CHARGING screen.

Here you can find more information about the consumption:

I: current (A)  
U: voltage (V)  
P: power (kWh)  
Et: total kWh value (never canceled)

I: A  
U: V  
P: kWh  
Et: kWh  
www.ratio.nl

By pressing the middle button, you can see the meter readings of the last 5 sessions.

Et (1): kWh  
Et (2): kWh  
Et (3): kWh  
Et (4): kWh  
Et (5): kWh

The values can be deleted by pressing the left and right arrow buttons at the same time.

With the middle button you can go back to the previous screen.

## CHARGER ERROR

CHARGER  
NOT READY  
ERR:.....  
  
www.ratio.nl

In case of the charger error, you will see the error screen with the error code. If multiple errors occur the codes will alternate.

By error message please contact Ratio Electric for support.

To return into the setup menu please press the middle button for 5 seconds.

## 3 PHASE CHARGE STATION

The charging display depends on the chosen charger mode -> MANUAL, FIXED 16, FIXED 32, SMART. With the right arrow button you can always enter the screen with more information about the consumption of the charger.

READY TO  
CHARGE (A)  
mode: smart (m)  
  
www.ratio.nl

### CHARGING SMART MODE

Charger ready, not connected to EV

smart (m) -> master

smart (s1) -> slave 1 / smart (s2) -> slave 2 / smart (s3)

-> slave 3

READY TO  
CHARGE (B)  
mode: smart (m)  
  
www.ratio.nl

Charger connected to EV

CHARGING  
I set [A] : x x  
Pt [kW] : x . x  
Et [kWh] : kWh  
Lh: xx xx xx (x x)  
  
www.ratio.nl

Charging display

I set [A] – available current

Pt [kW] – power

Et [kWh] – total consumption (never reset)

Lh – x x : measured current per phase ( x x ) :  
setting I HOME MAX

As in all other chosen charger modes you can reach the next screen with the right arrow button.

The menu below can be reached with the arrow button from a READY TO CHARGE screen but also from CHARGING screen.

Here you can find more information about the consumption:

I:	current (A)	I 1:	A
		I 2:	A
		I 3:	A
U:	voltage (V)	U 1:	V
		U 2:	V
		U 3:	V
P:	power (kWh)	P 1:	kWh
Et:	total kWh value (never reset)	P 2:	kWh
		P 3:	kWh
		Et:	kWh

By pressing the middle button, you can see the meter readings of the last 5 sessions.

Et (1):	kWh
Et (2):	kWh
Et (3):	kWh
Et (4):	kWh
Et (5):	kWh

The values can be deleted by pressing the left and right arrow buttons at the same time.

With the middle button you can go back to the previous screen.

## CHARGER ERROR

CHARGER NOT READY ERR: .....
<a href="http://www.ratio.nl">www.ratio.nl</a>

In case of the charger error, you will see the error screen with the error code. If multiple errors occur the codes will alternate.

By error message please contact Ratio Electric for support.

To return into the setup menu please press the middle button for 5 seconds.

## SPECIFICATIONS

Charging System	IEC61851, Mode 3
Cable version car connector	IEC 62196, type 1 or type 2
Outlet version	IEC 62196, type 2 Outlet
Power input	single-phase or 3 phase, 230V-400V, 16 A and 32A
Power output	3.7 kW, 7.4 kW, 11 kW, 22 kW
Earth leakage protection	AC 30mA, DC 6mA
Dimensions	400mm x 250mm x 105mm
Housing	PC/ABS-VO
Weight	4 kg (incl. cable)
Environment Operating Temperature	IP54, rain-tight -25°C tot +40°C
Marking	CE

## MAINTENANCE

The Smart Box requires no maintenance other than occasional cleaning.



**Warning:** Switch off your Smart 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 Smart 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 Portable Charging device will void this warranty.**

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





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