
RARON Charge Controller

User Manual

Version 0.7.6

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INTRODUCTION

RARON charge controller is intended for use in electric vehicle charging stations. It controls the charging procedure of the electric vehicle and communicates with the electric vehicle in compliance with IEC61851 and SAE J1772 standards. The product is designed to be mounted on standard DIN EN 60715 rail.

This user manual contains the instructions needed for commissioning RARON charge controller. These instructions are intended for electrically skilled persons.

This manual is also available for download at <http://raron.eu>.

CHARGE CONTROLLER FEATURES

- Designed in a form factor of DIN rail enclosure
- Switched 230V contactor output
- Can be used with fixed cable or socket (automatically detects cable 16/32/63A)
- Locking actuator or motor support (depending on the version), unlocks at power failure
- Built-in high temperature switch-off
- Dimensions: 22 x 91 x 58 mm
- Current limiting can be implemented using a resistor

CONTROLLER VERSIONS

The charge controller is available in the following configurations with product codes corresponding to each configuration depending on charge current and locking algorithm.

	Actuator DSIEC-EL	Actuator DSIEC-ELC	Motor Küster/Phoenix contact	Motor	None
16 A	CC-16-A	CC-16-AC	CC-16-MKP	CC-16-M	CC-16
24 A	CC-24-A	CC-24-AC	CC-24-MKP	CC-24-M	CC-24
32 A	CC-32-A	CC-32-AC	CC-32-MKP	CC-32-M	CC-32
XX A	CC-XX-A	CC-XX-AC	CC-XX-MKP	CC-XX-M	CC-XX

When choosing the controller version, it should be kept in mind that the charge current can be optionally limited from that set in the controller firmware by adding a resistor between CL and GND, but increasing the charge current is not possible above that pre-set in the firmware.

RECYCLING

RARON charge controller is to be recycled according to your local guidelines of disposal of electronic waste.

SAFETY INSTRUCTIONS

RARON charge controller is intended for commissioning by electrically skilled persons.

Please observe local safety regulations! Installation requirements can vary by country or region, and the requirements of the local rules and regulations in your area must be met.

Contact with live components can result in serious injuries.
Disconnect power supply to the components of the electric vehicle charging station before starting any work.

Use of an unsuitable contactor can cause heat generation or fire.
Appropriate contactor must be chosen.

BUILDING THE EVSE

REQUIRED PARTS

The required parts will depend on the type of EVSE to be built.

For EVSE with fixed cable the following is required:

- housing with DIN rail;
- contactor with appropriate current rating;
- RARON EV Charge Controller;
- Fixed cable with Type 2 or Type 1 plug (depending on the EV);

For EVSE with Type 2 socket you will require:

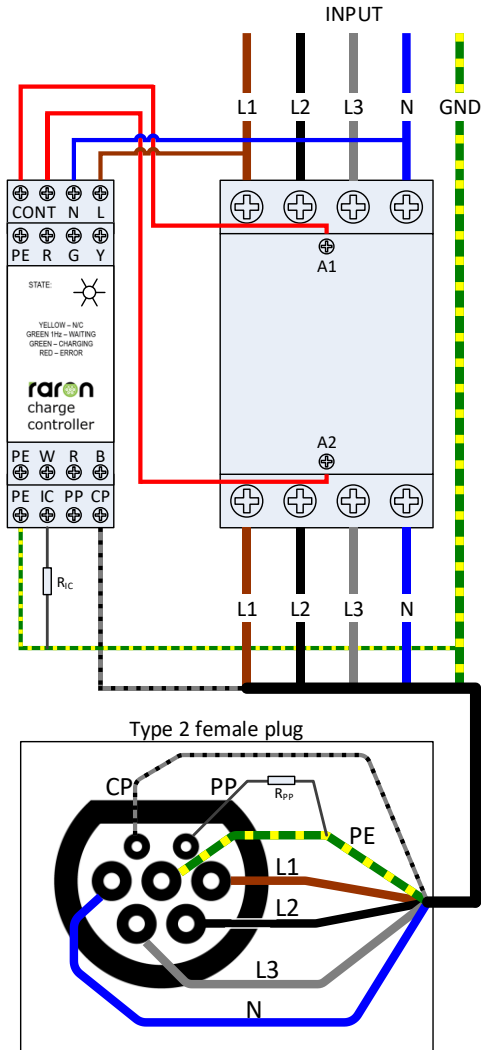
- housing with DIN rail;
- contactor with appropriate current rating;
- RARON EV Charge Controller;
- Type 2 socket, with locking solenoid or motor, if desired.

The use of RCBO (Residual Current Breaker with Overcurrent) is advised in the EVSE or on the distribution board for power supply INPUT connection.

When using a fixed charging cable a resistor R_{pp} between PP and PE on the plug is required. Otherwise the charge rate will be limited to 13A. The values are: $100 \Omega = 63 \text{ A}$, $220 \Omega = 32 \text{ A}$ and $680 \Omega = 16 \text{ A}$.

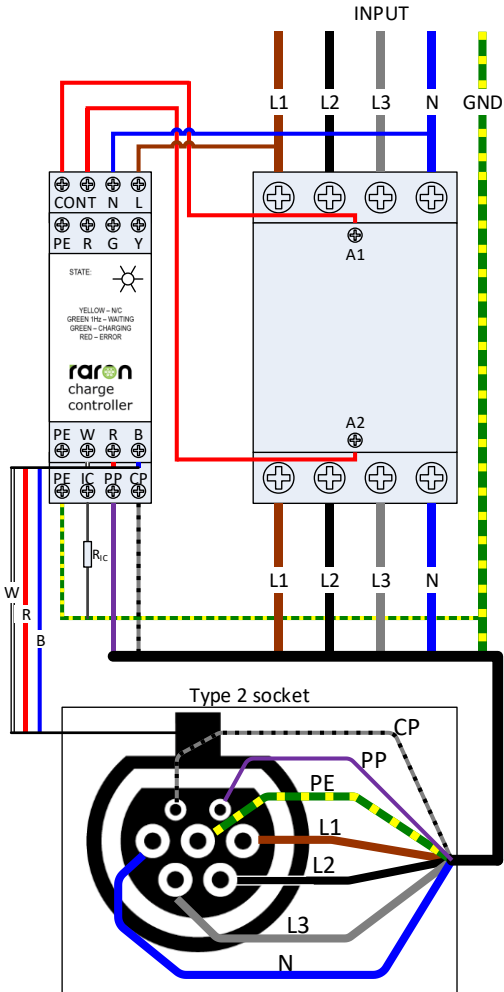
USE WITH A FIXED CABLE

EVSE with a fixed cable is built as shown in the following schematic.



USE WITH A SOCKET

EVSE with a socket is built as shown in the following schematic.



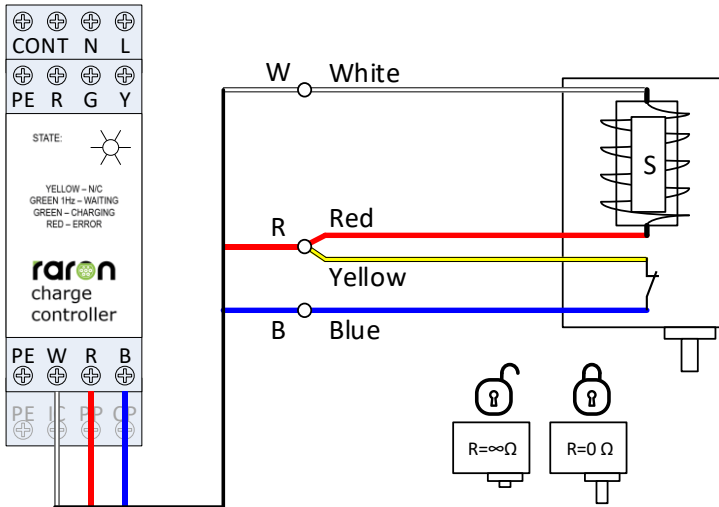
USE WITH SOLENOID LOCK DSIEC-EL

For use with solenoid lock (DUOSIDA DSIEC-EL or similar) the charge controller outputs are configured as follows:

B – Signal. If the solenoid is locked +12V is expected, if it is unlocked 0V is expected.

R and W – Locking of solenoid is powered through these outputs for locking and unlocking. Locking is done with 300ms pulse. If it is detected that the solenoid has not function, the locking/unlocking action is repeated after 5 seconds. If the locking action is reverse, the wires should be swapped between R and W connections.

Connection of DSIEC-EL solenoid:



There can be different colour wires used for DSIEC-EL solenoids, therefore it is advised to consult the datasheet of the manufacturer. The connections can also be determined using a multimeter.

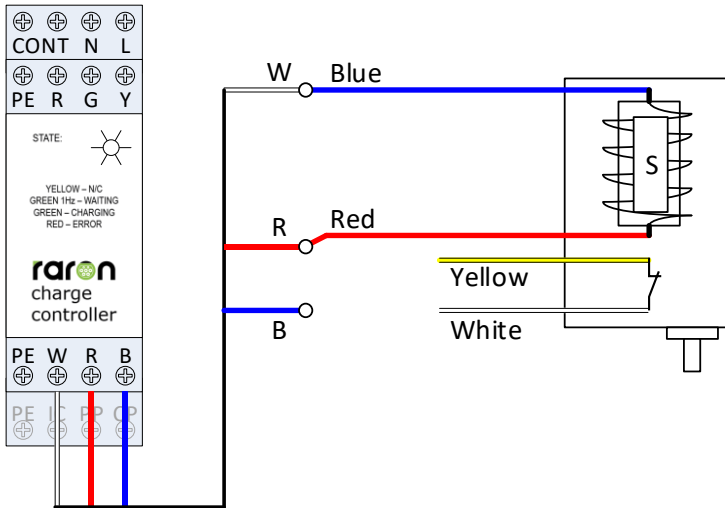
USE WITH SOLENOID LOCK DSIEC-ELC

For use with solenoid lock (DUOSIDA DSIEC-EL or similar) the charge controller outputs are configured as follows:

R and W – solenoid is powered through these outputs for locking. Solenoid stays locked while power is supplied and unlocking happens when power is cut. If the locking action is reverse, the wires should be swapped between R and W connections.

B – Not used.

Connection of DSIEC-ELC solenoid:



There can be different colour wires used for DSIEC-ELC solenoids, therefore it is advised to consult the datasheet of the manufacturer. The connections can also be determined using a multimeter.

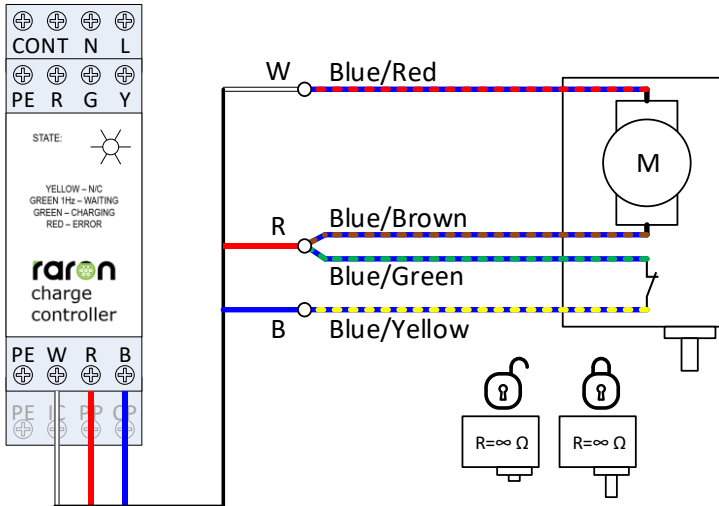
USE WITH KÜSTER/PHOENIX CONTACT MOTOR LOCK

For use with a motor lock (Küster 02S 0156758, Phoenix contact EV-T2M3S-E-LOCK12V or similar) the charge controller lock outputs are configured as follows:

B – signal. If the motor is locked or unlocked 0V is expected, otherwise +12V.

R and W – Locking of motor is powered through these outputs for locking and unlocking. Locking is done with 600ms pulse. If it is detected that the motor has not functioned, the locking/unlocking action is repeated after 5 seconds. If the locking action is reverse, the wires should be swapped between R and W connections.

Connection of Küster/Phoenix contact motor:



There can be different colour codes for the wires of locking motors, therefore it is advised to consult the datasheet of the

manufacturer. The connections can also be determined using a multimeter.

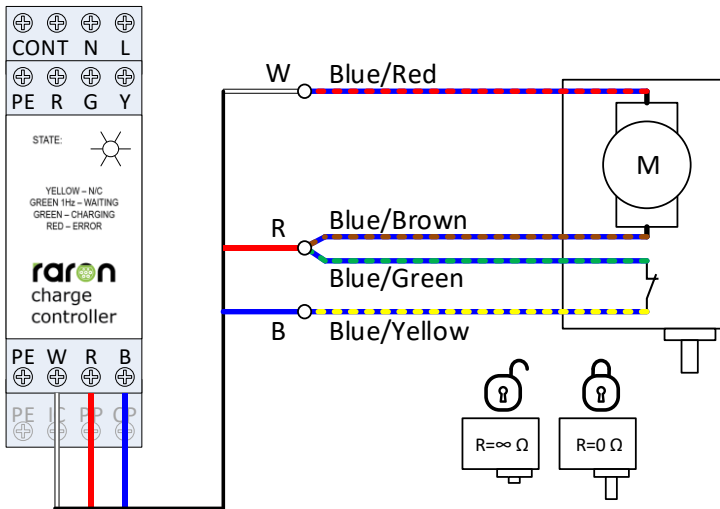
USE WITH ANOTHER MOTOR LOCK

For use with a motor lock (that has 0 resistance between signal cables when locked, and infinite resistance when unlocked) the charge controller lock outputs are configured as follows:

B – signal. If the motor is locked +12V is expected, if it is in unlocked state, 0V is expected.

R and W – Locking of motor is powered through these outputs for locking and unlocking. Locking is done with 600ms pulse. If it is detected that the motor has not functioned, the locking/unlocking action is repeated after 5 seconds. If the locking action is reverse, the wires should be swapped between R and W connections.

Connection of another motor:



There can be different colour codes for the wires of locking motors, therefore it is advised to consult the datasheet of the manufacturer. The connections can also be determined using a multimeter.

SPECIAL CONFIGURATIONS

In some electricity networks where the neutral N is not available from the power supply, on the input the phase L3 is to be connected to N. Use this connection only if the charger on your car is suitable for such power supply. Recommendations of your vehicle manufacturer on this should be closely followed, as improper power supply can lead to damage of the charger on your vehicle.

CONTROLLER TERMINALS

The following table presents the descriptions of the terminals of the RARON charge controller. The descriptions apply to all versions of the controller, except for terminals B, R and W for which the operation depends on the controller version.

TERMINAL	DESCRIPTION
L	Connects to AC “live” or “line” with 90-264V AC @ 47-63 Hz
N	Connects to AC “neutral” line with 90-264V AC @ 47-63 Hz
Contactors	Two connectors. Connects to 230V spool connection of the contactor, usually marked as A1 and A2. <i>WARNING! Selecting a contactor with incorrect power or voltage rating can lead to damage of the charge controller, personal injury or fire.</i>

TERMINAL	DESCRIPTION
PE	Connects to ground connection of the electricity supply or earth connection.
Y, G and R	Protected connection for yellow (Y), green (G) and red (R) LED. Connects to anode (+) pole of LED. The cathode of LED should be connected to PE.
B	Solenoid or motor signal connection. ¹
R	Solenoid or motor power connection. ¹
W	Solenoid or motor power connection. ¹
CP	Control Pin. Connects to the CP of IEC61851/J1772 EVSE socket/plug.
PP	Proximity Pin. Connects to the PP of IEC61851 EVSE socket.
IC	Input Current. Connects to input current limit selecting resistor, switch or dial. Input current limit resistor values are listed further in the document.

¹ For details on use with solenoid or motor lock please see section “Use with a socket” on page 8.

INPUT CURRENT LIMIT RESISTOR VALUES

The optional input current limit resistor between IC and GND can be added. This allows limiting the charge current of the EVSE or implementing a switch potentiometer. The resistor values (E96 1%) are listed in the following table.

6 A	-	191 Ω	31 A	-	698 Ω	56 A	-	1960 Ω
7 A	-	205 Ω	32 A	-	732 Ω	57 A	-	2050 Ω
8 A	-	221 Ω	33 A	-	750 Ω	58 A	-	2100 Ω
9 A	-	237 Ω	34 A	-	787 Ω	59 A	-	2210 Ω
10 A	-	249 Ω	35 A	-	825 Ω	60 A	-	2320 Ω
11 A	-	267 Ω	36 A	-	845 Ω	61 A	-	2430 Ω
12 A	-	280 Ω	37 A	-	887 Ω	62 A	-	2550 Ω
13 A	-	301 Ω	38 A	-	931 Ω	63 A	-	2670 Ω
14 A	-	316 Ω	39 A	-	976 Ω	64 A	-	2870 Ω
15 A	-	332 Ω	40 A	-	1000 Ω	65 A	-	3010 Ω
16 A	-	348 Ω	41 A	-	1050 Ω	66 A	-	3160 Ω
17 A	-	374 Ω	42 A	-	1070 Ω	67 A	-	3320 Ω
18 A	-	392 Ω	43 A	-	1130 Ω	68 A	-	3570 Ω
19 A	-	412 Ω	44 A	-	1180 Ω	69 A	-	3740 Ω
20 A	-	432 Ω	45 A	-	1210 Ω	70 A	-	4020 Ω
21 A	-	453 Ω	46 A	-	1270 Ω	71 A	-	4220 Ω
22 A	-	475 Ω	47 A	-	1330 Ω	72 A	-	4530 Ω
23 A	-	487 Ω	48 A	-	1370 Ω	73 A	-	4870 Ω
24 A	-	511 Ω	49 A	-	1430 Ω	74 A	-	5230 Ω
25 A	-	536 Ω	50 A	-	1500 Ω	75 A	-	5620 Ω
26 A	-	562 Ω	51 A	-	1580 Ω	76 A	-	6190 Ω
27 A	-	590 Ω	52 A	-	1620 Ω	77 A	-	6650 Ω
28 A	-	619 Ω	53 A	-	1690 Ω	78 A	-	7320 Ω
29 A	-	634 Ω	54 A	-	1780 Ω	79 A	-	8060 Ω
30 A	-	665 Ω	55 A	-	1870 Ω	80 A	-	9090 Ω

If 0 Ω connection is added between IC and GND, the controller switches to State A and will not switch to other states.

Note: these resistor values do not allow exceeding the maximum setting of the charge controller. E.g. if you have chosen a controller with the maximum firmware limit of 16A, the settings above 16A cannot be set using a resistor.

LED INDICATOR AND OPERATING STATES

The charge controller has a three-colour LED indicator that displays operating states and fault conditions. It can be lit green, yellow or red.

COLOUR	STATUS	DESCRIPTION
-	NOT LIT	Charge controller has no power or is switched off.
YELLOW	LIT	Charge controller in State A: vehicle is not connected.
GREEN	FLASHING, 1Hz	Charge controller in State B: vehicle is connected, ready to charge.
GREEN	LIT	Charge controller in State C: vehicle is charging.
RED	LIT	Error. Temperature too high or diode test failed. Check device for overheating and if the charge cable connections are dry/clean.

OPERATION ALGORITHM

If no LEDs are lit, it indicates that the charge controller is not powered. On power-up the charge controller flashes LEDs in start-up sequence red, green and yellow twice to indicate booting up.

After start-up the charge controller enters State A. In state A the yellow LED is lit indicating that the vehicle is not connected.

Once the vehicle is connected the controller enters State B. A green LED is flashing at 1 Hz indicating readiness to charge.

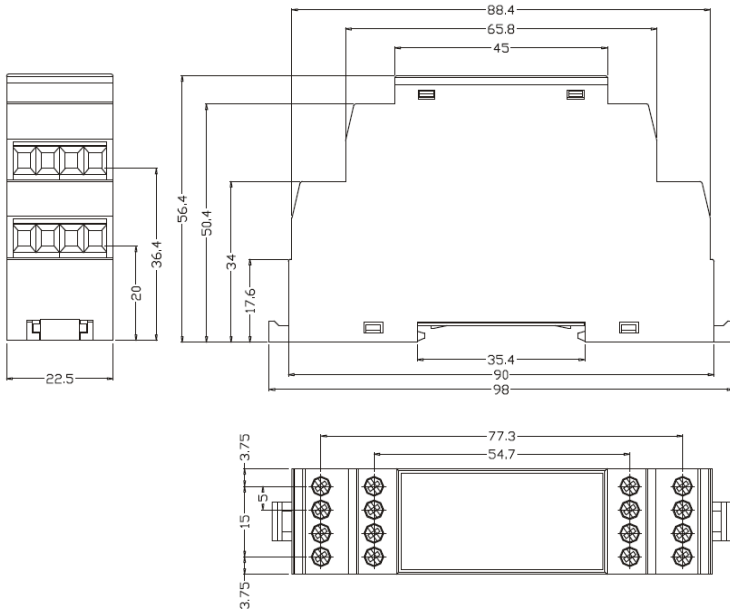
Once the vehicle starts charging, the controller enters State C. A solid green LED is lit. The actuator or motor locks the cable (if charger built with charging socket).

When charging is finished or interrupted at the vehicle, the controller enters State B, green led is flashing at 1 Hz. Charging can be restarted or vehicle disconnected.

If the charger is built with charging socket the actuator/motor unlocks the cable when charging is stopped, controller enters error mode or power is lost.

If temperature gets too high or diode test fails (possibly charge plug/socket wet), the controller enters error mode. Charging is stopped immediately. Controller stays in error mode until the reason for it is mitigated.

CONTROLLER DIMENSIONS



SERVICE AND MAINTENANCE

The EVSE charge controller does not require maintenance.

There are no user-serviceable parts in the controller. In case of failure the controller must be replaced.

DISCLAIMER

This evaluation kit is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY and is not considered by RARON OÜ to be a finished end-product fit for general consumer use. Persons handling the product(s) must have electronics training and observe good engineering practice standards. As such, the product(s) being provided are not intended to be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including product safety and environmental measures typically found in end products that incorporate such semiconductor components or circuit boards. This evaluation kit does not fall within the scope of the European Union directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE or UL, and therefore may not meet the technical requirements of these directives or other related directives.

The user assumes all responsibility and liability for proper and safe handling of the product. Further the user indemnifies RARON OÜ from all claims arising from the handling or use of the goods. Due to the open construction of the product, it's the user responsibility to take any and all appropriate precautions with regard to electrostatic discharge, conducted and radiated emissions.

EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT SPECIAL INCIDENTAL OR CONSEQUENTIAL DAMAGES.