Turn your Car Battery Charger   
into a Smart Charger

# How this charger works

A 6A or 8A Car Battery Charger or 18V 6Aor 8A power supply is used  
This system is connected to the battery and left on all the time  
it monitors the battery voltage and decides when to start charging the battery and when to stop charging the battery to prevent over charging the battery  
  
The Arduino Senses the temperature using a NTC Resistor R4  
The Arduino senses the battery voltage across Resistor R7 and R3 senses the charger voltage  
  
When the Battery Voltage is lower than the Voltage for a specific temperature then the Arduino send a 5v signal to the base of Transistor T1 this transistor will switch on the Relay and the battery gets charged  
  
When the Battery Voltage is higher than the Voltage for a specific temperature then the Arduino send a zero volt signal to the base of Transistor T1 this transistor will switch off the Relay and the battery stops getting charged  
  
In the software we will implement Hysteresis so that the relay does not chatter

The following is a simple circuit using a 12V 20A mechanical Relay   
Diagram, schematic

Description automatically generated  
This charger will disconnect the external load when the battery needs a charge   
It will reconnect the load when the battery is charge  
It protects the battery from over charging and from running flat when the battery voltage is too low  
**The 7810 Voltage regulator produces 10V output also used to power the Arduino**

# The following Circuit uses a 15A or 20A Solid State Relay

Diagram, schematic

Description automatically generated  
**Please note for this circuit to work you must use a charger with a grounded negative output**  
If your charger’s negative output is floating from the ground, please use the previous circuit

# Arduino Software

Both Circuits will use the same software

The software will detect the pressing of the push button switch and release the relay  
The voltage of the charger will be measured, and the temperature will be measured   
there are three LEDS a Red, Yellow, and Green LED. The Red LED will display if the charger voltage is too high the Yellow will display if the charger voltage is too low, and the Green LED will display if the charger voltage is correct for that temperature allowing you to adjust the charger Voltage

When the push button is not pressed the battery will be charged and the LEDs will display the battery voltage state.

When the battery is charged the Arduino will release the relay for 10 minutes and then start monitoring the battery voltage  
  
This will prevent the battery from over charging and the charger can be lest permanently on

# Deep Cycle Batteries

Deep cycle battery, on the other hand, have much thicker plates and, they are solid, not sponge. These thicker plates have less surface area and thus less of the instant power that a starting battery needs.   
**They are designed to be discharged down to 20% of their maximum charge repetitively**.  
**Float Voltage**

|  |  |  |  |
| --- | --- | --- | --- |
| 20% | 30% | 40% | 50% |
| 12.51V | 12.69V | 12.86V | 13.03V |

# Charging the Battery

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Battery Capacity** | | **Charging time** | | | | |
| 2AH to 10AH | | 0.5 to 2 | | | hours | |
| 10AH to 20AF | | 2 to 4 | | | hours | |
| 20AH to 40AH | | 4 to 5 | | | hours | |
| 40AH to 60AH | | 6 to 8 | | | hours | |
| 60AH to 100AH | | 8 to 12 | | | hours | |
| **Temperature** | | | | **Charging Voltage** | | | |
| >30 deg C | | | | 14.5 | | Volts | |
| 8 deg C to 30 deg C | | | | 14.8 | | Volts | |
| <8 deg C | | | | 15.5 | | Volts | |
|  |  | |  | |  | | | | | |  |  |  |
|  | **Temperature** | |  | | **Charge voltage** | | | | | |  | **Float Voltage** |  |
|  | -10 | | C | | 15.66V to 16.26V | | | | | |  | 13.92V to 14.22V |  |
|  | 0 | | C | | 15.3V to 15.9V | | | | | |  | 13.8V to 14.1V |  |
|  | 10 | | C | | 14.94V to 15.54V | | | | | |  | 13.68V to 13.9V |  |
|  | 20 | | C | | 14.58V to 15.18V | | | | | |  | 13.56V to 13.86V |  |
|  | 30 | | C | | 14.22V to 14.82V | | | | | |  | 13.44V to 13.74V |  |
|  | 40 | | C | | 13.86V to 14.46V | | | | | |  | 13.32V to 13.62V |  |
|  | 50 | | C | | 13.50V to 14.10V | | | | | |  | 13.20V to 13.50V |  |
|  |  | |  | |  | | | | | |  |  |  |

**Battery in Charger Charge Voltage 14.8V Temperature 24C Float Voltage 13.72 to 13.76V  
Float Voltage**

|  |  |  |  |
| --- | --- | --- | --- |
| 20% | 30% | 40% | 50% |
| 12.51V | 12.69V | 12.86V | 13.03V |

# Charging Efficiency

Graphical user interface, text

Description automatically generated

# Battery Charge Chart

Table

Description automatically generated

Table

Description automatically generated

# Battery Voltage Sensor

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | | |  |  |  | | |  |
|  | **Battery Voltage** | | |  | **Sensor Voltage** |  | | |  |
|  | 11 | | | V | 2.7 | V | | |  |
|  | 11.2 | | | V | 2.75 | V | | |  |
|  | 11.3 | | | V | 2.8 | V | | |  |
|  | 11.5 | | | V | 2.85 | V | | |  |
|  | 12 | | | V | 2.95 | V | | |  |
|  | 12.2 | | | V | 3 | V | | |  |
|  | 12.4 | | | V | 3.05 | V | | |  |
|  | 12.5 | | | V | 3.09 | V | | |  |
|  | 12.6 | | | V | 3.11 | V | | |  |
|  | 12.7 | | | V | 3.14 | V | | |  |
|  | 12.8 | | | V | 3.15 | V | | |  |
|  | 12.9 | | | V | 3.19 | V | | |  |
|  | 13 | | | V | 3.21 | V | | |  |
|  | 13.1 | | | V | 3.24 | V | | |  |
|  | 13.2 | | | V | 3.25 | V | | |  |
|  | 13.3 | | | V | 3.25 | V | | |  |
|  | 13.4 | | | V | 3.3 | V | | |  |
|  | 13.5 | | | V | 3.32 | V | | |  |
|  | 13.6 | | | V | 3.35 | V | | |  |
|  | 13.7 | | | V | 3.38 | V | | |  |
|  | 13.8 | | | V | 3.41 | V | | |  |
|  | 13.9 | | | V | 3.43 | V | | |  |
|  | 14 | | | V | 3.44 | V | | |  |
|  | 14.1 | | | V | 3.45 | V | | |  |
|  | 14.2 | | | V | 3.48 | V | | |  |
|  |  | | |  |  |  | | |  |
|  | **Temperature** | | |  | **Charge voltage** | | | |  | **Float Voltage** | | |  |
|  | -10 | | | C | 15.66V to 16.26V | | | |  | 13.92V to 14.22V | | |  |
|  | 0 | | | C | 15.3V to 15.9V | | | |  | 13.8V to 14.1V | | |  |
|  | 10 | | | C | 14.94V to 15.54V | | | |  | 13.68V to 13.9V | | |  |
|  | 20 | | | C | 14.58V to 15.18V | | | |  | 13.56V to 13.86V | | |  |
|  | 30 | | | C | 14.22V to 14.82V | | | |  | 13.44V to 13.74V | | |  |
|  | 40 | | | C | 13.86V to 14.46V | | | |  | 13.32V to 13.62V | | |  |
|  | 50 | | | C | 13.50V to 14.10V | | | |  | 13.20V to 13.50V | | |  |

(The software will be published in the next article)