

Switching solar panel regulator (boat)

Purpose and operation

Bridging a solar panel regulator during poor charging conditions, to obtain a higher efficiency.

The system has two phases:

1. The FLOAT phase in which the batteries are charged via a stabilizer, set to 13.8 V
2. A BULK phase in which the stabilizer is bridged and the solar panel can deliver directly to the batteries and /or users.

At a voltage of less than 13.5 V, the BULK phase starts.

Above 15.0 V the FLOAT phase starts.

Note: Charging from the solar panels and measuring / controlling takes place near the voltmeters. The actual voltage near the batteries is lower.



The set values depend on the specific situation on board.

For control I use a programmable Arduino Uno type microprocessor that switches a relay which can bridge the 13.8V stabilizer. This way the maximum and minimum voltage of the BULK phase can be adjusted easily in the program.

The delay time between reaching the set voltage and switching the relay is also easy to adjust. This delay is now at 5000 ms (5 seconds)

Because the measuring range of the Arduino is between 0 and 5 volts, a zener diode has been set in line to reduce the measured voltage by 11.82 V.

Het program

```
// _210513_Solar_Charging      ! Disconnect D1 while uploading program
// Remark: float is a data type: floating point      FLOAT is a charging stage
```

```
const int measurePin = A0;  // yellow from zener - monitors the voltage
const int bulkPin = 1;      // white to IN relais
const int BULK_LED = 2;     // yellow LED on in BULK fase
const int FLOAT_LED = 3;    // green LED on in FLOAT fase
float volt_Min = 13.5;      // starting voltage for bulk mode
float volt_Max = 15.0;      // top voltage for bulk mode
float volt_Measured = 0.0;
bool bulkEnabled = true;    // always start in bulk mode
```

```
void setup()
{
  pinMode(bulkPin,OUTPUT);
  pinMode(BULK_LED,OUTPUT);
  pinMode(FLOAT_LED,OUTPUT);
  digitalWrite(bulkPin,HIGH);    // start in bulk mode
  digitalWrite(BULK_LED,HIGH);
}

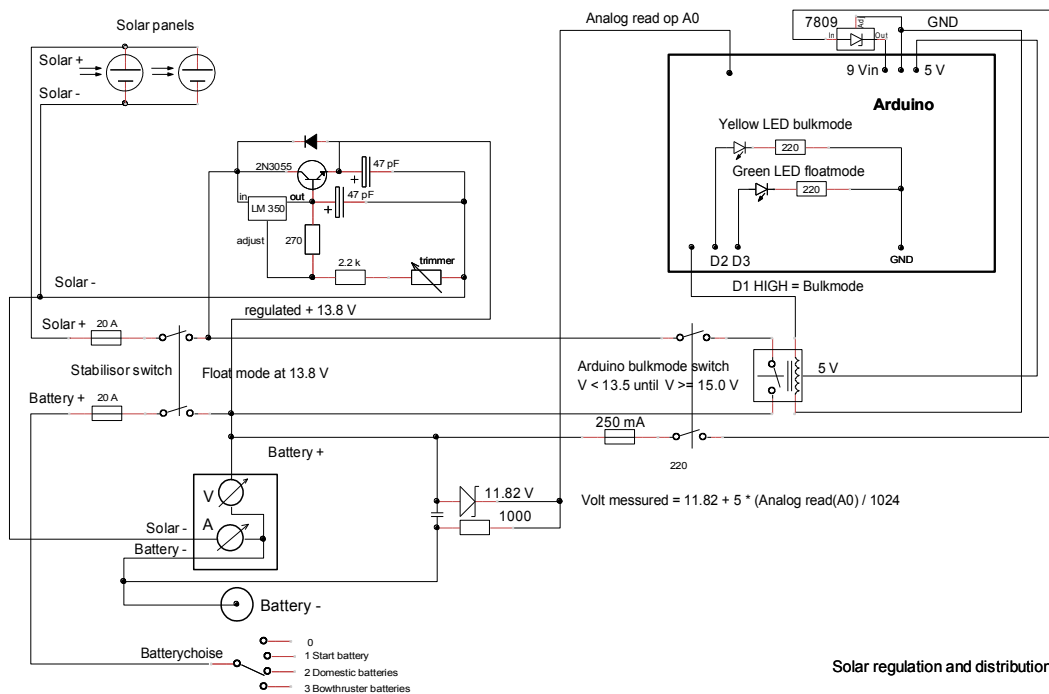
void loop()
{
  // Get the current voltage (11.82 is zener+diode value)
  volt_Measured = 11.82 + 5.0 * analogRead(measurePin) / 1024.0;
  delay(250);
```

```

// Set conditions for charging
if(volt_Measured > (volt_Max )) // too high > switch off
{
  bulkEnabled = LOW;
  delay(5000); //5 seconds
}
if(volt_Measured <= volt_Min) // too low > switch on
{
  bulkEnabled = HIGH;
  delay(5000);
}
if(bulkEnabled == true) // charge direct if conditions are met
{
  digitalWrite(bulkPin,HIGH); // 5 V to relais
  digitalWrite(BULK_LED,HIGH);
  digitalWrite(FLOAT_LED,LOW);
} else if (bulkEnabled == false)
{
  digitalWrite(bulkPin,LOW); // 0 V to relais
  digitalWrite(BULK_LED,LOW);
  digitalWrite(FLOAT_LED,HIGH);
}
}
}

```

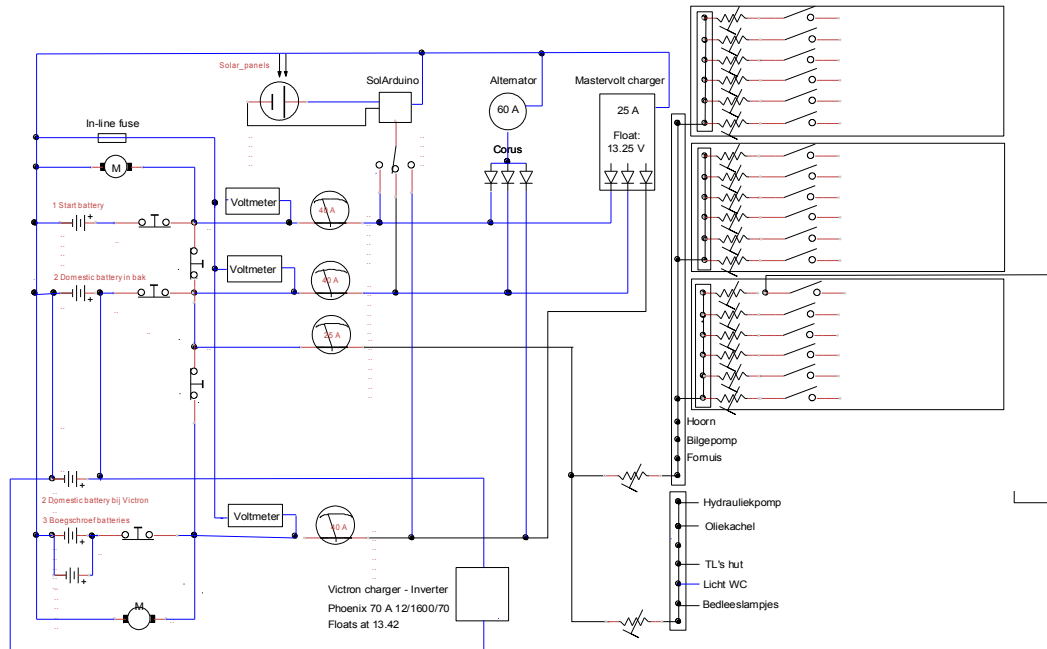
The schematics of the stabilizer and the connection with the Arduino Uno:



The placement of the control system in the 12V circuit:

With the selector switch a choice can be made which battery group is charged with the solar panel

1. Starter battery
2. Domestic
3. Bow thruster



<https://www.bootprojecten.nl/solar-energy/solar-charging-control-with-arduino>

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