**Measure and deliver, micro-supply**

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# Introduction

This application note is about the micro-supply. This electronic device brought an interest because of its usefulness in upcoming years. By crafting a device, this small and powerful it brings skill and advanced electronics to the table. The micro-supply is an electronic device that can measure small currents and deliver or supply a voltage of 5 volt DC. The starting point of this project was to read the given PDF when choosing the project. The article can be found in the bibliography.

# Material & methode

## Material

Afbeelding met tafel

Automatisch gegenereerde beschrijving

Figuur : Bill of material

[170464-018-10-ORIGINAL-BOM-170464-1-microsupply-v1.0 (1).xlsx](file:///C:\Users\12002476\Desktop\application%20note%202\microsupply\170464-018-10-ORIGINAL-BOM-170464-1-microsupply-v1.0%20(1).xlsx)

While buying the components and parts, there were a few issues with the price compared to the given bill of materials. Some resistors were not accessible. by adjusting the bill of materials with other resistors that have the same resistance and footprint the problem would vanish.

The price of the OLED-screen is contrary. By comparing multiple websites, the lowest price came to 5 euro, as given in the bill of materials. The main problem that attracted attention is the total price. Because the bill of materials is outdated, the prices are increased and the total price was far higher than the given price. The price came double the given price.

## methode

This product was created by following a process. The first step was to inform about the device and know what it does and how it works. By doing that, the knowledge will help in the further process.

After getting to know the product, recreating and improving the electronic circuit and mechanical design was the next step. The main thing in this step was getting a better placement for the component. The size of the product could be decreased or could make the same size more useful. The redesigning and constructing of the schematics were created in Altium. Problems that concurred during the Altium designing were footprints or components that did not exist in Altium. By downloading a library, this problem can be solved.

When the schematics are finished, the following and second step is to order the materials/components for the PCB. The PCB is ordered and created at a given factory on the basis of the Altium-design. The components were divided into through-hole and surface-mounted devices or better called SMD components. All resistors, capacitors and semiconductors are SMD or surface-mounted devices. They are ecofriendly and cheaper than normal components. In this project a lot of microprocessors or IC’s are passing by. They have their own type of footprint. The most common type used by the micro-supply is the 0805. All mechanical components use a through-hole. Mechanical components consist an OLED-screen, USB-input, a 9-12 voltage adapter input, 4 push buttons, a + an – wire connector and 5 headers to connect the Arduino uno with the device.

The third step of making a electronic device is to merge the components and PCB together. By using the schematic and pre-printed PCB, all the components are placed on the right place and socket. A test is executed to test the PCB for receiving 9-12 voltage DC.

As second last step, the device needs a code put into the Arduino Uno, because the code is the drive source of a device. The device needs to be tested if it works and if it meets its limits. The device will be taken through a certain amount of tests. When all tests succeed, the device is ready for usage.

To deliver a solid project, the last step is to create a casing for your electronic devices. The casing must meet a few standards. The first standard is to make the casing interesting and not a simple box. When selling a product, the product could use a nice style or casing to attract attention of the customers.

To finish the project, a brand logo has to be created for the casing. The logo has to represent a brand that constructs the devices. A brand needs to come with a solid casing to protect there electronics against things that could occur during it’s usage. By protecting the electronics, everything should stay in place and remain undamaged. AutoCAD supplies services to create the 3D-design for the casing and the 2D-design for the logo.

# Result

## Micro-supply

### Setup

The setup of this device has a few requirements to make it functional. On the basis of the 4 LEDs, the device shows if it is ready for use or not. The LEDs are divided in 4 colors with each a specific function:

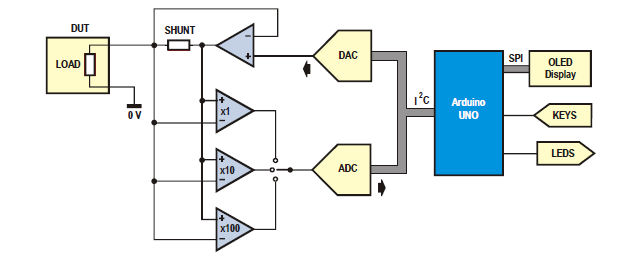
* Led 1(Green) = indicates if the IoT-device is getting a supply voltage.
* Led 2(red) = software switch activated and IoT-device is switched off.
* Led 3(yellow) = nictates when IoT-device is receiving a supply voltage and is on or off when there is a program disorder.
* Led 4(blue) = shield receiving external supply

To operate the device, there are 4 push buttons that can be used. Each with there own function to operate the device.

* S1 = activate/deactivate of the output.
* S2 = Up / next / yes
* S3 = Down / no
* S4 = Reset the output.

To start the device, the Arduino has to be turned on and while pressing S2 and S3. By doing that, the device uses a small test to make sure it works. The shield will be calibrated. When everything is booted up, instructions will show on the display.

### Working principale

A digital/analog-converter or DAC delivers an adjustable supply voltage to the IoT-device. Because the converter cant handle large currents, the amplifier has a maximum current of 40mA. Due the voltage drop on the shunt resistor, the load can be determined. To create a digital signal, the voltage on the shunt resistor has to pass through a variation of instrumentation amplifiers. With the digital/analog converter or ADC, the measured current values will be converted to a digital signal. The signal is created on the output of the 3 instrumentation amplifiers. To view the output voltage and output current, it will be displayed on the OLED-display. The device can measure between a range from 1µA to 40mA. The smallest current is 40 000 times smaller than the biggest value. The display is used to receive verifications if the device is working while in test phase.

Figuur 2: Principale schematic

## Micro-supply parts

### PCB

Afbeelding met tekst, elektronica, circuit

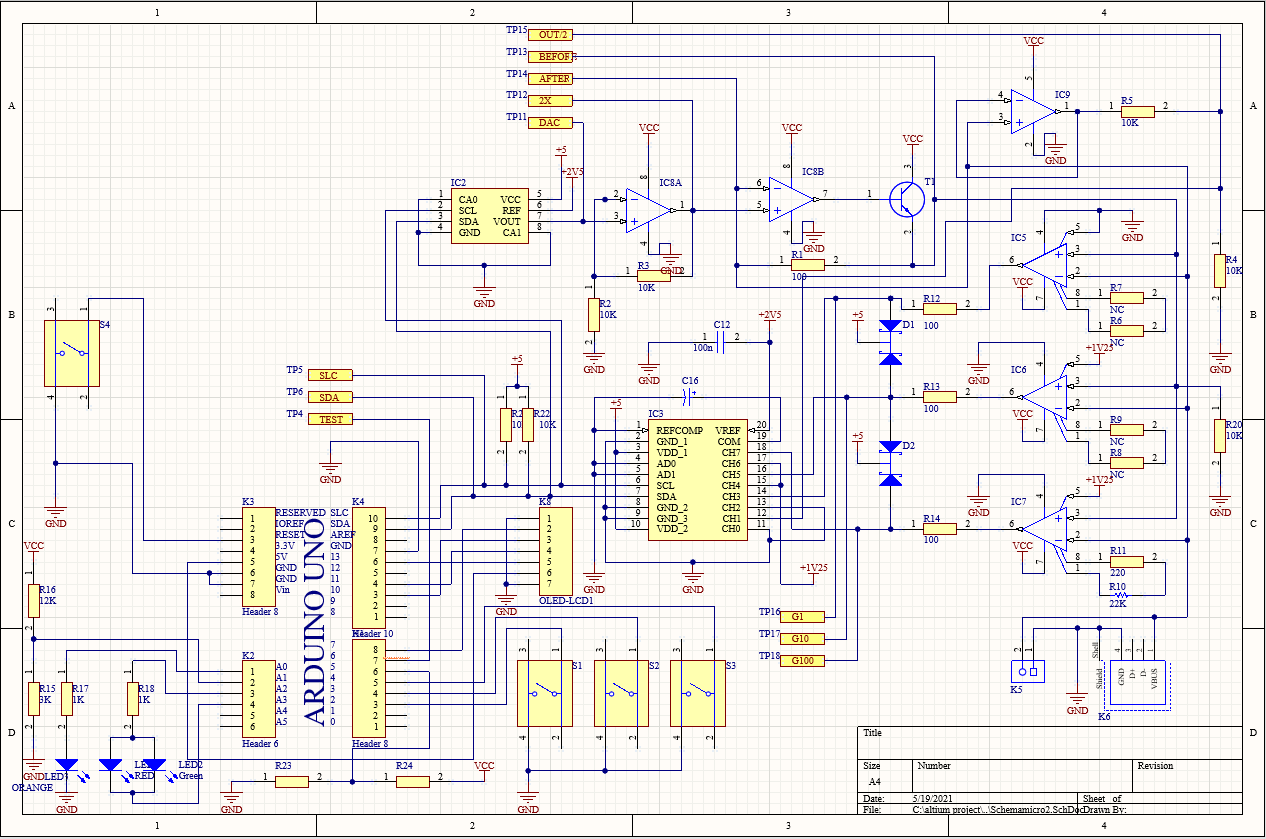
Automatisch gegenereerde beschrijvingPCB or printed circuit board is the base of the whole project. Every component will be placed carefully on the PCB. The PCB is connected with copper traces or channels. Channels can be drawn on bottom and top layers for clean channels. By using via’s, a connection can be made from bottom to top layer and vice versa.

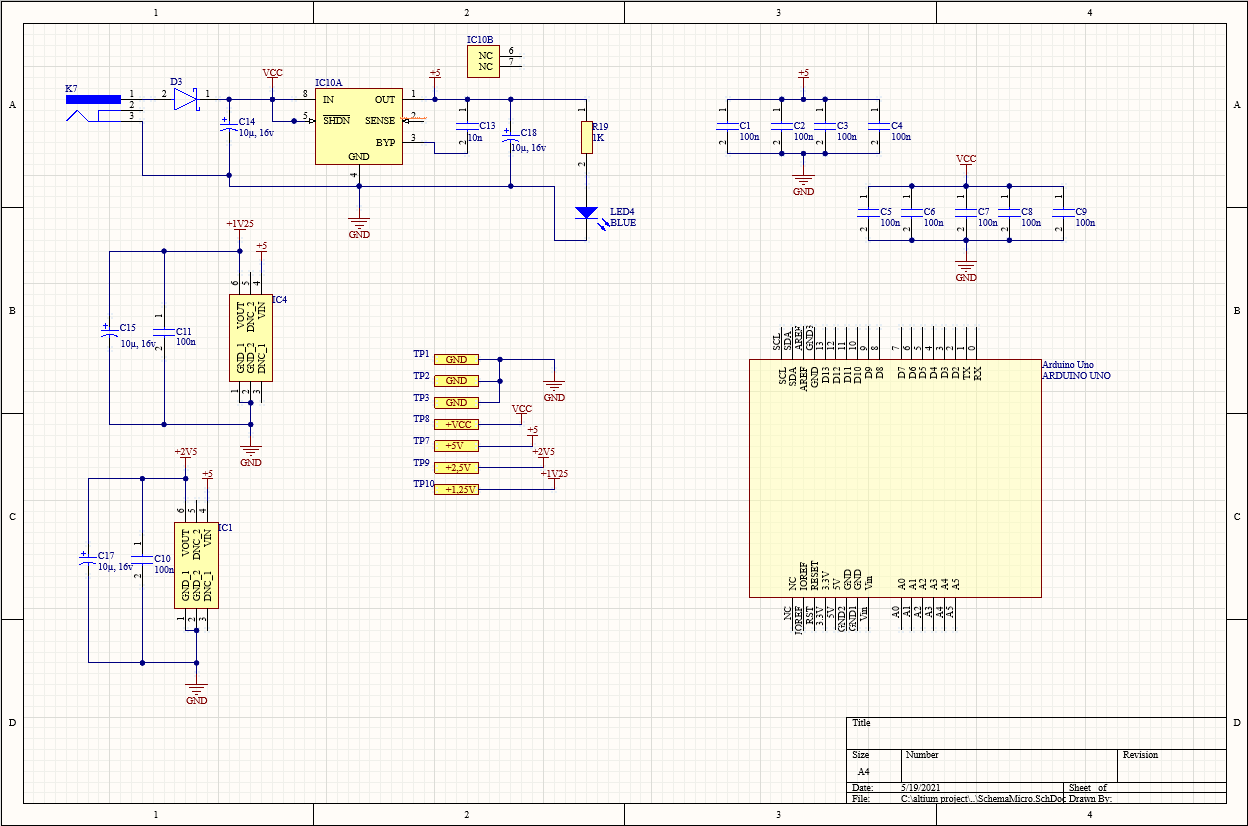
When the components are placed in the right position, the channels will recreate the schematics drawn in Altium. The PCB was created by following the previous design. By placing all mechanical components on the outside of the PCB, a clean path is created to connect all other components to the middle of the board.

Figuur 3: Altium PCB-design

When coming from a previous design, improvement can be applied. The design could be reduced 3cm in length and is there for more ecofriendly.

### Schematic





## autocad

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this is the 3D casing design created in AutoCAD. It’s designed into 2 part, a box shaped container and a lid.

The container is designed to hold and protect the PCB from getting damaged. It uses 2 beams to support the PCB, because there needs to be space under the PCB so the Arduino uno can fit properly. On both sides of the casing, square holes are mode for in- and outputting cables. Edges are made round and smooth to prevent damage to the cables.

The lit has 3 holes, 2 to reach the 4 buttons, to operate the device. The last square hole is for the OLED-screen, to make it visual. The lit makes a perfect fit for the container.

## PC-software

Because the micro-supply sends out a frequency of 1Khz, a pc-program has to present a real-time chart. The first program used to accomplish the chart was Eclipse/java, but this program had a poor serial communication with the Arduino. After a few tests, a virtual java-machine(VJM) did the job named IKVM.NET. The application saves around 4000 measurements, that could be viewed in a 4 second measurement. The 4 second measurement could be divided in 1, 2 an 4 seconds and visualized on the application. The used PC must have 64-bit windows 10, to run the application.

# Discussion

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When construction a device, problems can occur. One of those problems was the 9-12 Voltage adapter input. By not paying attention, the through-hole of the adapter was switched around, which causes the adapter to not fit on the side of the PCB. By using loose cables, the connector could be turned around. The only problem is that it is not firm and not solvable. The second and last problem that came a cross was the soldering furnace. The soldering furnace solder all IC’s and SMD’s on to the PCB because they are far to small to be soldered by hand. During that process, a few IC’s got soldered. Because the legs of the IC’s are sometimes so close to each other, some legs made a short circuit. Because that is a major problem, the legs had to be soldered by hand.

The micro-supply was a challenging project. It tested me on a lot of levels: soldering, planning and dedication. The project had a slow start, but when coming closer to the finish it took shape. I would do exactly the same steps as I did with this project. The only approach that I would change is ordering the components. When ordering the components, it went quickly. If I started earlier or took more time on this step, I could have saved more money and the project would cost a lot less. The price was double the given amount. Time was the biggest problem when creating this project. By working to fast and too inattentive, the adapter mistake could not be fixed on time properly, because I would have to order a whole new PCB-design. And that would cost a lot more time and money.

# Bibliografie

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| [1] | J. Aubinais, „elektromagazine,” september 2019. [Online]. Available: https://www.elektormagazine.nl/magazine/elektor-112/51099. [Geopend 4 april 2021]. |
| [2] | J. Aubinais, „elektromagazine,” september/oktober 2019. [Online]. Available: https://elektormagazine.s3.eu-central-1.amazonaws.com/private/ep/ideas/170464/articles/170464-04.pdf?X-Amz-Content-Sha256=UNSIGNED-PAYLOAD&X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIAIKYIQBBARUN7VXIQ%2F20210404%2Feu-central-1%2Fs3%2Faws4\_request. [Geopend 4 april 2021]. |