



Aidan Williamson <aidan.d.williamson@gmail.com>

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## ad7747 arduino

24 messages

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**Klemen Živkovič** <klemen.zivkovic@gmail.com>

Thu, Aug 27, 2015 at 7:42 AM

To: aidan.d.williamson@gmail.com

Dear sir,

I was reading open source ecology for capacitive sense device and I found your email.

[http://opensourceecology.org/w/images/e/ec/Cap\\_Sensor\\_Email\\_Chain\\_7-11-2014.pdf](http://opensourceecology.org/w/images/e/ec/Cap_Sensor_Email_Chain_7-11-2014.pdf)

[http://opensourceecology.org/wiki/Paul\\_Log](http://opensourceecology.org/wiki/Paul_Log)

Can you please tell me in what status is device if it works or not, and have you been able to successfully use it to measure distances to workpiece?

Regards,  
Klemen Živkovic  
Slovenia

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**Aidan Williamson** <aidan.d.williamson@gmail.com>

Fri, Aug 28, 2015 at 7:02 AM

To: Klemen Živkovič <klemen.zivkovic@gmail.com>

Hello Klemen!

The device had not been fully developed. I was basically the only one working on that project at Factor E Farm in July 2014. Paul, of Paul Log, designed the board but never tested it. He had some boards made and I assembled one (actually I taught someone how to solder using it). I then created a jig that could move parallel aluminum plates up/down. I wrote a program for it and was able to get data after a more experienced programmer showed up on site and found a small flaw in my serial communications with the device. That's when other on-site projects eclipsed the capacitive sensor project.

YYou can

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**Aidan Williamson** <aidan.d.williamson@gmail.com>

Fri, Aug 28, 2015 at 8:41 PM

To: Klemen Živkovič <klemen.zivkovic@gmail.com>

Hello Klemen!

The device had not been fully developed. I was basically the only one working on that project at Factor E Farm in July 2014. Paul, of Paul Log, designed the board but never tested it. He had some boards made and I assembled one (actually I taught someone how to solder using it). I then created a jig that could move parallel aluminum plates up/down. I wrote a program for it and was able to get data after a more experienced programmer showed up on site and found a small flaw in my serial communications with the device. That's when other on-site projects eclipsed the capacitive sensor project.

Are you interested in developing the sensor or do you need a solution for height sensing in a CNC machine?

Aidan

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**Klemen Živkovič** <klemen.zivkovic@gmail.com>

Fri, Aug 28, 2015 at 8:52 PM

To: Aidan Williamson <aidan.d.williamson@gmail.com>

I soldered device myself and I am testing it not with arduino but with esp8266. Its 4\$ chip that has wifi built in. It works but it is giving somehow weird result.

I plan to build plasma pipe cutter (you can see designs on my google albums). And because of that I need height controller.

First results (I still haven't connected shielded cable) which w quite oscillations in measurements. Now there are bare pins waiting for shielded cable and i did some test with piece of metal approaching those pins.

If there is better more stable noncontacting method for distance measurement please let me know.

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**Klemen Živkovič** <klemen.zivkovic@gmail.com>  
To: Aidan Williamson <aidan.d.williamson@gmail.com>

Sat, Aug 29, 2015 at 4:43 AM

You can check my video of thing in operation at:  
<https://plus.google.com/+KlemenZhivko/posts/69LMqBf6V29>

So what cable do I need to pick up for this to work as good as possible?

If I understand correctly GND needs to go to work piece that probe will sense its distance from? Yes?  
Do you have some instructions how to build probe and isolate it from emf as much as possible?

The code i USE NOW IS:

```
void readAD7747()
{
  // http://opensourceecology.org/w/images/e/ec/Cap_Sensor_Email_Chain_7-11-2014.pdf
  // http://opensourceecology.org/wiki/Paul_Log

  system_soft_wdt_feed();

  Wire.begin();           //sets up i2c for operation
  Wire.beginTransmission(0x48);
  Wire.write(0xBF);
  Wire.write(0x00);
  Wire.endTransmission();
  delay(4);
  Wire.beginTransmission(0x48);           // begins write cycle
  Wire.write(0x07);           //address pointer for cap setup register
  Wire.write(0xA0);           //b'10100000' found from datasheet page 16
  Wire.endTransmission();           //ends write cycle
  delay(4); // Wait for data to clock out? I'm not 100% sure why this delay is here (or why it's 4ms)
  Wire.beginTransmission(0x48);           //begins transmission again
  Wire.write(0x09); //address pointer for capacitive channel excitation register
  Wire.write(0x0E);           //recommended value from datasheet
  Wire.endTransmission();
  delay(4);
  Wire.beginTransmission(0x48);
  Wire.write(0x0A);           //address pointer for the configuration register
  Wire.write(0x21); //b'00100001' for continuous conversion, arbitrary VTF setting, and mid-range capacitive conversion time
  Wire.endTransmission();
  Wire.beginTransmission(0x48);
  Wire.write(0x0B);           //CAP DAC A Register address (Positive pin data)
  Wire.write(0x80);           //b'10111111' for enable Cap DAC A
  Wire.endTransmission();
  Serial.println("Loop will start"); //test to make sure serial connection is working
```

```
//WDT.alive();
//system_soft_wdt_restart();

while (true)
{
Wire.beginTransmission(0x48); //talking to chip
Wire.write(byte(0x00)); //status register address
Wire.endTransmission();
Wire.requestFrom(0x48, 1); //request status register data
int readycap;
//Serial.println(" Trying read..."); //try read
readycap = Wire.read();
if ((readycap & 0x1) == 0)
{
// ready?
//Serial.print(system_get_time());
//Serial.println(" Data Ready");
//delay(10);
Wire.beginTransmission(0x48); //arduino asks for data from ad7747
Wire.write(0x01); //set address point to capacitive DAC register 1
Wire.endTransmission(); //pointer is set so now we can read the

//Serial.print(system_get_time());
//Serial.println(" Data Incoming");
//delay(10);
Wire.requestFrom(0x48, 3,false); //reads data from cap DAC registers 1-3
while (Wire.available())
{
//Serial.print(system_get_time());
//Serial.println(" Wire available.");
unsigned char hi, mid, lo; //1 byte numbers
long capacitance; //will be a 3byte number
float pf; //scaled value of capacitance
hi = Wire.read();
mid = Wire.read();
lo = Wire.read();
capacitance = (hi << 16) + (mid << 8) + lo - 0x800000;
pf = (float) capacitance * -1 / (float) 0x800000 * 8.192f;
//Serial.print(system_get_time());
//Serial.print(" ");
Serial.println(pf, DEC); //prints the capacitance data in decimal through serial port
}
//Serial.println();
}
//Serial.print(system_get_time());
//Serial.println(" Loop Done");
system_soft_wdt_feed();
}
}
```

How do I need to incorporate temperature compensation?

regards  
Klemen Zivkovic  
Slovenia

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**Aidan Williamson** <aidan.d.williamson@gmail.com>  
To: Klemen Živkovič <klemen.zivkovic@gmail.com>

Sat, Aug 29, 2015 at 2:41 PM

Hi Klemen,

Temperature compensation is farther down the line. First we need to get the chip to accurately read the capacitance of a known capacitor. I made a basic 3cm parallel plates "capacitor" which you can see on this video:

<https://www.youtube.com/watch?v=NZqa3A80I5Q>.

If I were you, I would make something similar and get the board to give you good, repeatable results.

From Paul Log:

Use RG6U cable. The shield of this cable connects to the Shield terminal of J2 pin 1 or 3, the inner conductor connects to the CapSense terminal of J2 pin 2. For plasma cutting additional ferrite will have to be added to the cables and to the entrance and exit of the metal board housing. Grab some of that cable and put a female header pin on the center conductor and just push the shield wires around the other two pins.

Yes, ground to work piece and sense line to ring or sensor if I remember correctly. I just used an alligator clip from the board's ground plane to one plate of the capacitor.

As for a probe, they say you should use a ring around the torch as seen here: [http://opensourceecology.org/wiki/Sensing\\_Distance\\_from\\_Work\\_Piece#Oxyfuel\\_Torch\\_Technology](http://opensourceecology.org/wiki/Sensing_Distance_from_Work_Piece#Oxyfuel_Torch_Technology)

This is UNTESTED! You will have to see what you can come up with. Please share your findings if possible! You can easily add to the OSE wiki by signing up and making a log.

[http://opensourceecology.org/wiki/Klemen\\_Log](http://opensourceecology.org/wiki/Klemen_Log) Create that page and put in your video!

Good luck,

Aidan

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**Klemen Živkovič** <klemen.zivkovic@gmail.com>  
To: Aidan Williamson <aidan.d.williamson@gmail.com>

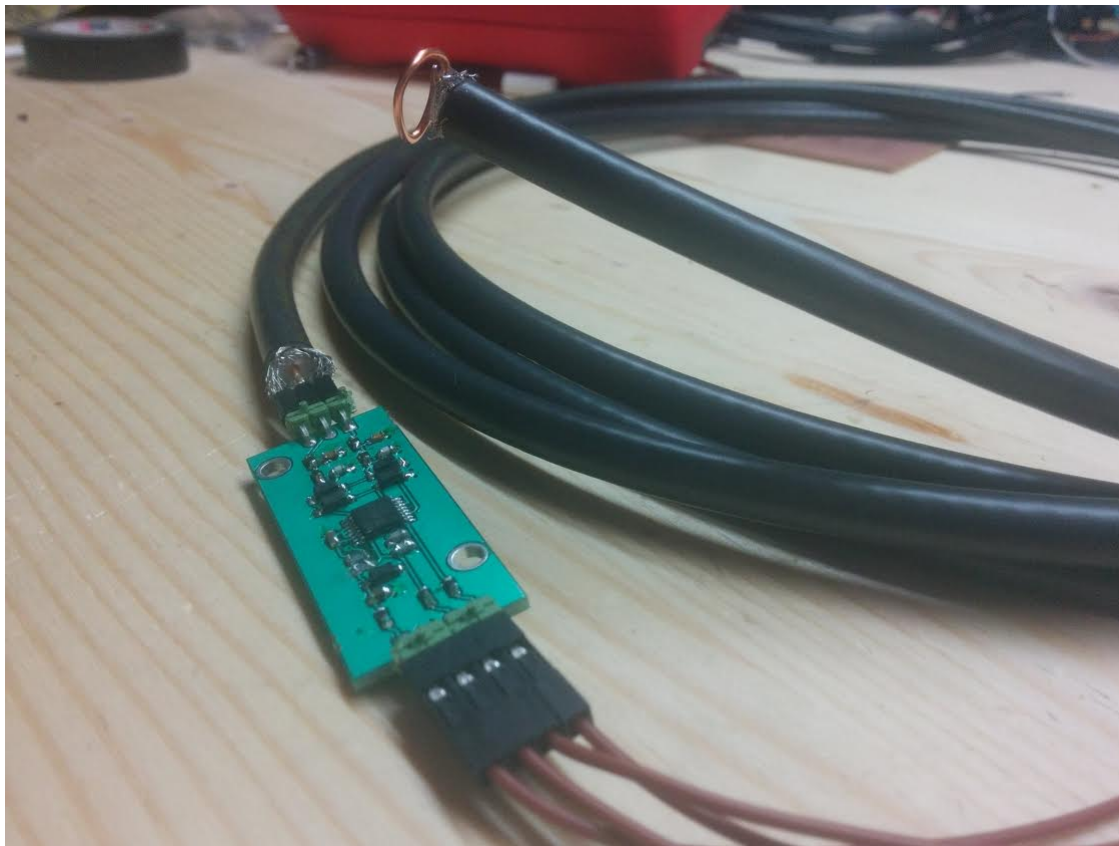
Mon, Sep 7, 2015 at 11:55 AM

Hi Aidan,

thank you very much for reply. Today I received coaxial RG6u cable from Farnell.

My setup will be as follows:

3m coax cable at one end 3 pin connector (2.54mm raster) to ad7747 board, at other end coax circular wire made from same coax cable. Please check picture and tell me if you see something wrong with my setup that could lead to wrong or bad results.



I don't have test rig - but I have CNC6040 that I will use to retrieve or take precise Z axis versus capacity measurement data.

I will connect metal piece (toward end of coax cable will be moving) to the ad7747 GND - is this OK?

When I will have this data I will send you result for discussion.

Regards,  
Klemen

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**Aidan Williamson** <aidan.d.williamson@gmail.com>  
To: Klemen Živkovič <klemen.zivkovic@gmail.com>

Mon, Sep 7, 2015 at 12:18 PM

I think that should work! Make sure the the shielding and the coax center wire is not shorting - no continuity between shield and center wire. Make the coax cable AS SHORT AS POSSIBLE!

I don't really know what else to say because you are already as far as I got. I'm not sure if I ever got good data out of the device because my work was interrupted and unfortunately I did not leave extremely detailed notes.

Let me know if you get any data that shows a linear relationship between the distance between the sense and the work...

It should be linear:

From Wikipedia:

$$C = \epsilon_r \epsilon_0 \frac{A}{d}$$

where

$C$  is the capacitance, in Farads;

$A$  is the area of overlap of the two plates, in square meters;

$\epsilon_r$  is the [relative static permittivity](#) (sometimes called the dielectric constant) of the material between the plates (for a vacuum,  $\epsilon_r = 1$ );

$\epsilon_0$  is the [electric constant](#) ( $\epsilon_0 \approx 8.854 \times 10^{-12} \text{ F}\cdot\text{m}^{-1}$ ); and

$d$  is the separation between the plates, in meters;

Aidan

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**Klemen Živkovič** <klemen.zivkovic@gmail.com>  
To: Aidan Williamson <aidan.d.williamson@gmail.com>

Mon, Sep 7, 2015 at 3:46 PM

Hi Aidan,

I just made test and you can check my video on YouTube:  
[https://www.youtube.com/edit?o=U&video\\_id=RV-y1Z-Z4b4](https://www.youtube.com/edit?o=U&video_id=RV-y1Z-Z4b4)

regards,  
Klemen

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**Aidan Williamson** <aidan.d.williamson@gmail.com>  
To: Klemen Živkovič <klemen.zivkovic@gmail.com>

Mon, Sep 7, 2015 at 4:41 PM

please re-send link. you sent me to your account page and it takes me to my account page

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**Klemen Živkovič** <klemen.zivkovic@gmail.com>  
To: Aidan Williamson <aidan.d.williamson@gmail.com>

Mon, Sep 7, 2015 at 4:42 PM

Sorry my mistake. Here is right one:

<https://youtu.be/RV-y1Z-Z4b4>

Regards

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**Aidan Williamson** <aidan.d.williamson@gmail.com>  
To: Klemen Živkovič <klemen.zivkovic@gmail.com>

Mon, Sep 7, 2015 at 8:21 PM

awesome! what are you using to plot the data?

Is it linear (I could not see)?

Is it repeatable?

If it is not linear, it may be because the different sizes of the ring and the work. That may complicate the simple equation that I sent you. Need to look in to that.

Congrats - looks promising.

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**Aidan Williamson** <aidan.d.williamson@gmail.com>  
To: Klemen Živkovič <klemen.zivkovic@gmail.com>

Mon, Sep 7, 2015 at 8:22 PM

Make the ring bigger- make it surround the entire spindle. ~60cm maybe?

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**Aidan Williamson** <aidan.d.williamson@gmail.com>  
To: Klemen Živkovič <klemen.zivkovic@gmail.com>

Mon, Sep 7, 2015 at 8:25 PM

nevermind, I see you used SMING framework to plot the data

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**Klemen Živkovič** <klemen.zivkovic@gmail.com>  
To: Aidan Williamson <aidan.d.williamson@gmail.com>

Tue, Sep 8, 2015 at 3:34 PM

Hi Aidan,

thanks for comments - I appreciate it very much - but I saw them just know.

It my last uploaded video to YouTube you will clearly see capacity to height relationship this time I am moving from 0mm to 10mm in 0.1mm steps, in 200ms time delays - its not linear at all but with that kind of curve it could be linearised.

[https://youtu.be/W4\\_Fm4X\\_C6c](https://youtu.be/W4_Fm4X_C6c)

What it worries me is that when I turn on AC-DC 12V converter to power smoothieboard that drives my CNC - I start getting oscilations on capacity measurements, like you see on first and this last video.

If I turn off AC to DC converter oscillation of measurements are gone.

Could it be that my ground line that goes from sensor GND to work piece GND is catching EMF?

Should I connect shielded GND cable from work piece to sensor GND?

regards,  
Klemen

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**Klemen Živkovič** <klemen.zivkovic@gmail.com>  
To: Aidan Williamson <aidan.d.williamson@gmail.com>

Tue, Sep 8, 2015 at 3:46 PM

Aidan,

to simulate how turned off ACDC influence measurements I recorded this video:

[http://youtu.be/\\_AUU869t7iY](http://youtu.be/_AUU869t7iY)

How can this be?

regards,  
[Quoted text hidden]

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**Aidan Williamson** <aidan.d.williamson@gmail.com>  
To: Klemen Živkovič <klemen.zivkovic@gmail.com>

Tue, Sep 8, 2015 at 9:39 PM

If possible, make sure all devices are powered by the same power supply. Also, make sure that the coaxial cable is as short as possible. Mount the ad7747 and the arduino on the spindle if possible and then send the data from the arduino on a longer, shielded usb cable.

On the video titled "Move 10mm 0.1mm per 200ms" , what is the actual z height? How many cm above the part are you? You gave difference but I would also like to know what the start and end points were.

Thanks!  
Aidan

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**Klemen Živkovič** <klemen.zivkovic@gmail.com>  
To: Aidan Williamson <aidan.d.williamson@gmail.com>

Wed, Sep 9, 2015 at 1:40 AM

Hi Aidan,

See my answers below...

On Sep 9, 2015 03:39, "Aidan Williamson" <aidan.d.williamson@gmail.com> wrote:

>

> If possible, make sure all devices are powered by the same power supply. Also, make sure that the coaxial cable is as short as possible. Mount the ad7747 and the arduino on the spindle if possible and then send the data from the arduino on a longer, shielded usb cable.

Short coax makes sense, but shielded usb cable?

I am having esp8266 and not arduino, that is powered by usb cable so data goes from esp8266 to pc by wireless ethernet.

On other side of esp is i2c 4 wires 15cm long and from sensor 3m of coax (didn't want to shorten it but now I would need to see if this long 3m coax acting as antenna - but still rg6u is heavily shielded).

>

> On the video titled "Move 10mm 0.1mm per 200ms" , what is the actual z height? How many cm above the part are you? You gave difference but I would also like to know what the start and end points were.

The start point is touch to workpiece so 0mm, end point is 10mm.



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>>>>>>>> where

>>>>>>>>

>>>>>>>> C is the capacitance, in Farads;

>>>>>>>> A is the area of overlap of the two plates, in square meters;

>>>>>>>>  $\epsilon_r$  is the relative static permittivity (sometimes called the dielectric constant) of the material between the plates (for a vacuum,  $\epsilon_r = 1$ );

>>>>>>>>  $\epsilon_0$  is the electric constant ( $\epsilon_0 \approx 8.854 \times 10^{-12} \text{ F}\cdot\text{m}^{-1}$ ); and

>>>>>>>> d is the separation between the plates, in meters;

>>>>>>>> Aidan

>>>>>>>>

>>>>>>>>

>>>>>>>>

>>>>>>>> On Mon, Sep 7, 2015 at 11:55 AM, Klemen Živkovič <klemen.zivkovic@gmail.com> wrote:

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>>>>>>>>

>>>>>>>>

>>>>>>>>

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**Aidan Williamson** <aidan.d.williamson@gmail.com>

Wed, Sep 9, 2015 at 2:35 PM

To: Klemen Živkovič <klemen.zivkovic@gmail.com>

Hey Klemen,

I didn't know you were using wifi. shielded usb would be extra precaution but in all honesty a noisy PSU is not THAT noisy...

We may need to play with the AD7747 registers to amplify more - I will have to take a look at the datasheet when I have time (not for a few days) but maybe you can figure out how to amplify the signal more.

RG6U is heavily shielded but we may want to try a flat 3 conductor cable instead. This is what the designer of the board told me last year: "*With a 3 conductor flex cable the center conductor is actually quite well shielded and it has much lower parasitic capacitance than coax.*"

Aidan

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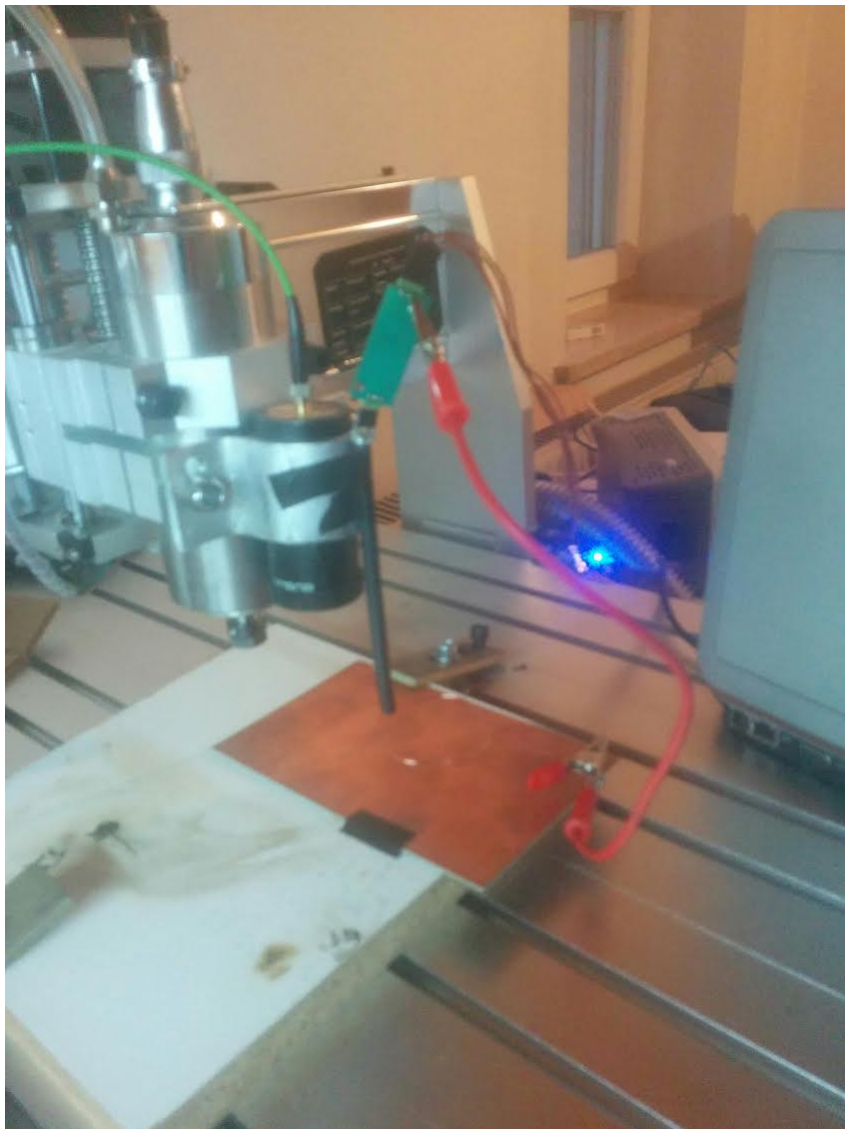
**Klemen Živkovič** <klemen.zivkovic@gmail.com>

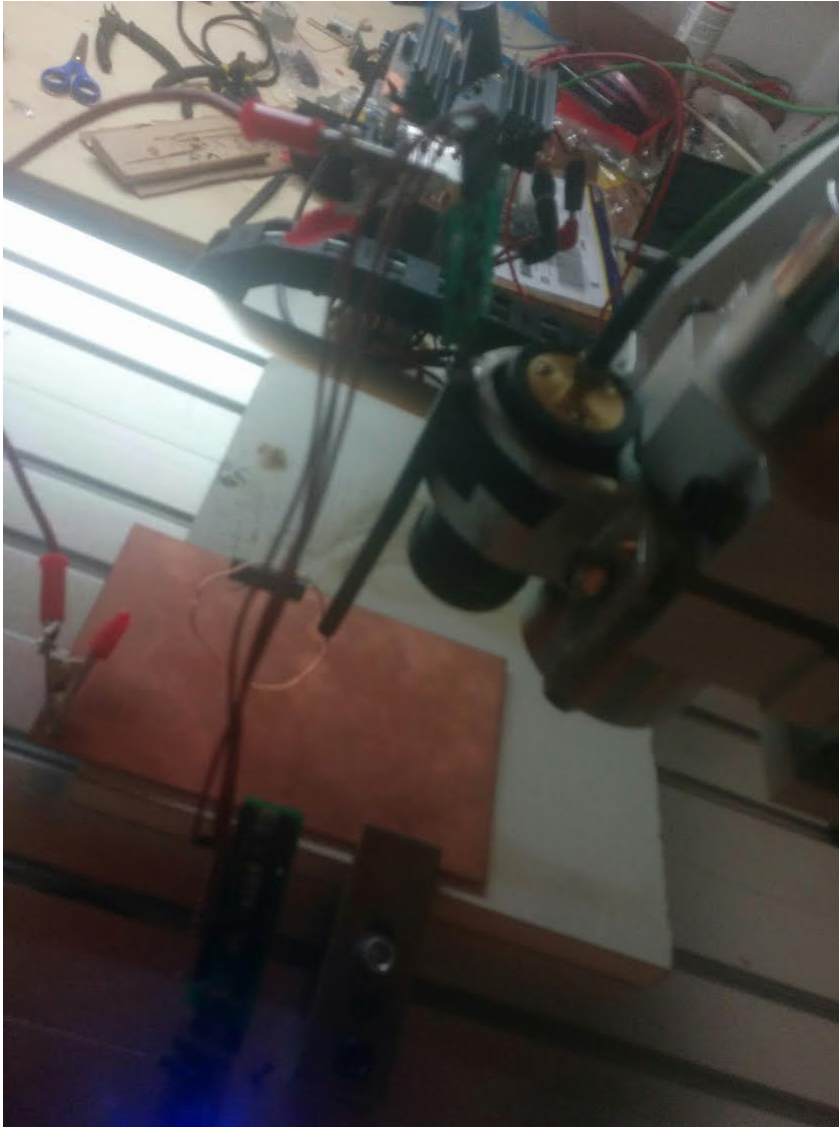
Thu, Sep 10, 2015 at 2:18 PM

To: Aidan Williamson <aidan.d.williamson@gmail.com>

Hi Aidan,

as per your suggestion, I made new setup - this time with shorter Rg6U coax cable, and larger ring.





Here is the result:

<https://youtu.be/xa7o7dXRJM4>

I have neon light in my lab and if I turn it on capacity measurements go crazy - so I need to isolate it somehow from EMF also? Any idea?

regards  
Klemen

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**Klemen Živkovič** <klemen.zivkovic@gmail.com>  
To: Aidan Williamson <aidan.d.williamson@gmail.com>

Thu, Sep 10, 2015 at 2:20 PM

Sorry this is latest video ;):  
<https://youtu.be/9mzMwZpEM50>

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**Aidan Williamson** <aidan.d.williamson@gmail.com>

Thu, Oct 8, 2015 at 1:52 PM

To: Klemen Živkovič <klemen.zivkovic@gmail.com>

Hey Klemen,

Sorry I have not responded to you for a while. Very busy over here with my personal life.

Where are you with this project? What is your current obstacle?

Very best to you,

Aidan

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**Klemen Živkovič** <klemen.zivkovic@gmail.com>

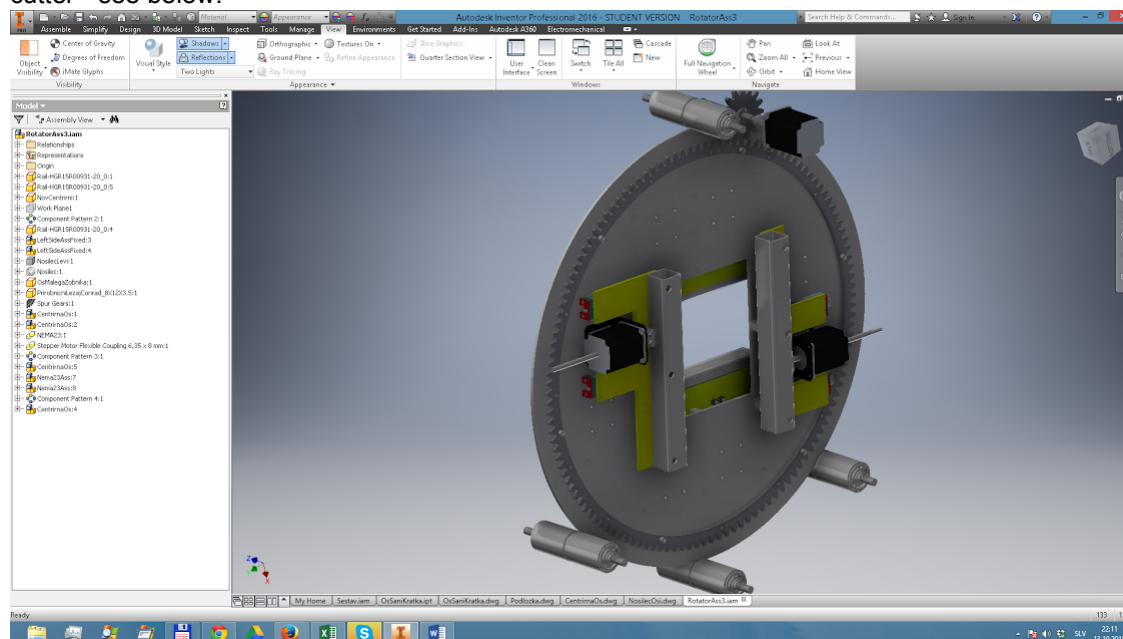
Tue, Oct 13, 2015 at 4:18 PM

To: Aidan Williamson <aidan.d.williamson@gmail.com>

Hi Aidan,

I know personal things can complicate from time to time - I hope they will settle.

Currently I am developing electronics for driving 4 stepper motors for clamping pipe inside rotator for plasma pipe cutter - see below:



Electronics will be based on esp8266 (tiny little chinese 4\$USD chip with wifi) that will allow me to interpret gcode like commands to move steppers to appropriate position and clamp pipe hopefully in centre of this rotating circle.

AD7747 measurements was little noisy also when I shorted coax cable that goes from ad7747 to form copper ring for cap sensing.

Idea I got is that I whould probably shieldground wire that goes from AD7747 to workpiece - I still havent tried that but this could be probably cause of measurement noise (still need to prove that).

I made few youtube videos (probably you saw them all). I also made bigger coper sense ring to find out I get bigger capacity measurements (that sounds logic from formula you mentioned).

What project are you on now? Are you working on some open ecology project? It seems quite impossible for me since I don't know how such projects are funded - and R&D is always connected with quite a lot of \$\$\$...

regards,

Klemen Zivkovic  
Slovenia

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**Aidan Williamson** <aidan.d.williamson@gmail.com>  
To: Klemen Živkovič <klemen.zivkovic@gmail.com>

Tue, Oct 13, 2015 at 5:53 PM

Klemen,

I'm glad to hear that the bigger ring gave you larger capacitance measurements. Did it also allow you to sense farther from the workpiece? We need to figure out where the noise is coming from. It might actually be coming from the chip itself if we are pushing it to the maximum capabilities.

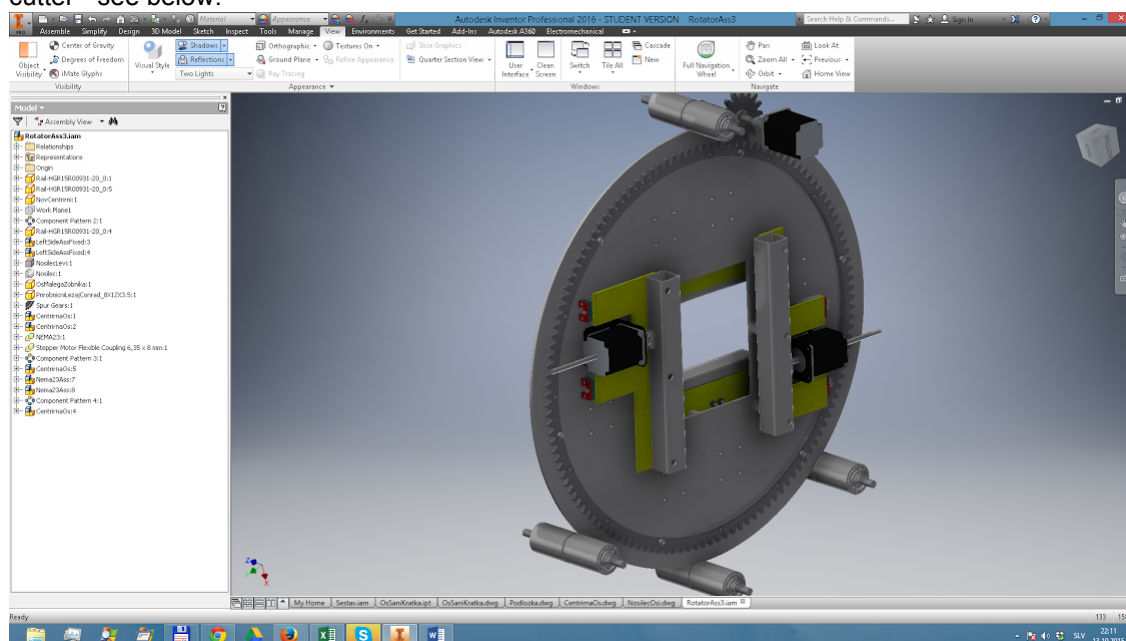
I do not work full time for OSE. At the moment I am doing very little work for Marcin. It is not R&D - only preparing a workshop for teaching how to manufacture the CEB Press. Yes, it is impossible to get money for working for OSE, it has to be a labor of love.

On 10/13/2015 4:18 PM, Klemen Živkovič wrote:

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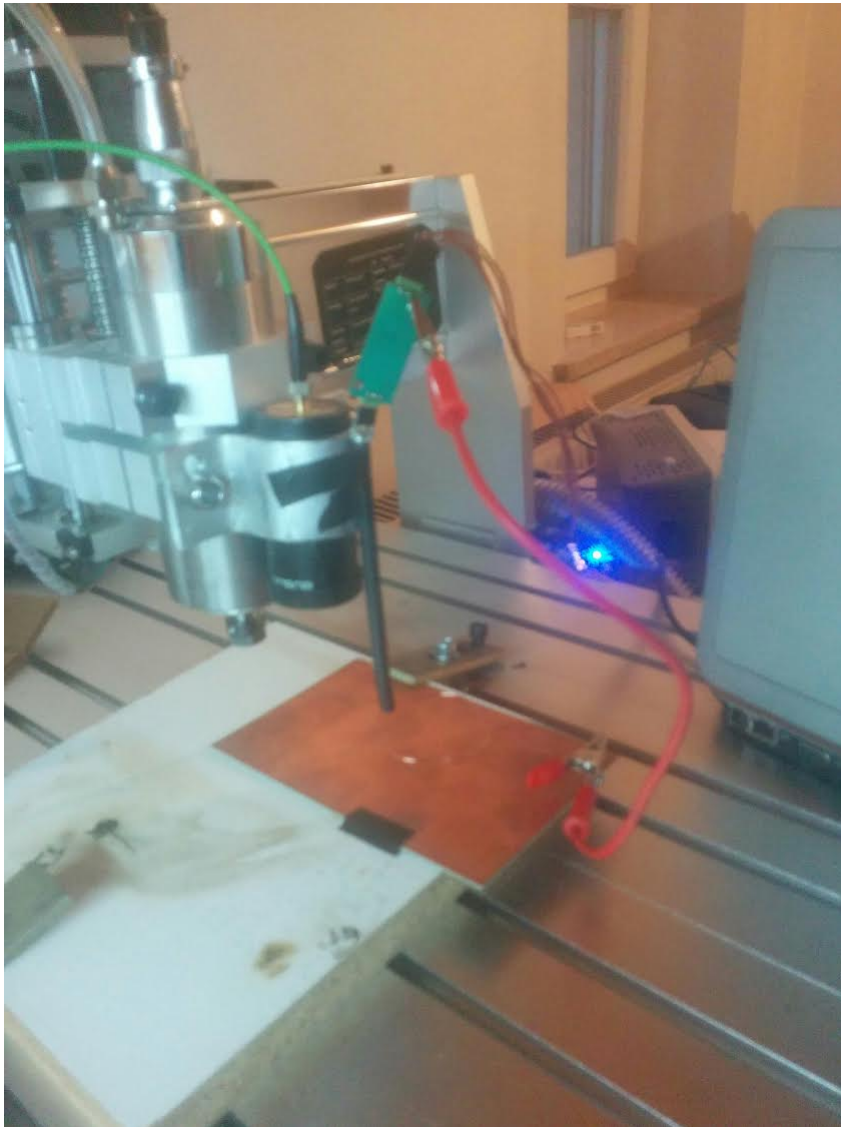
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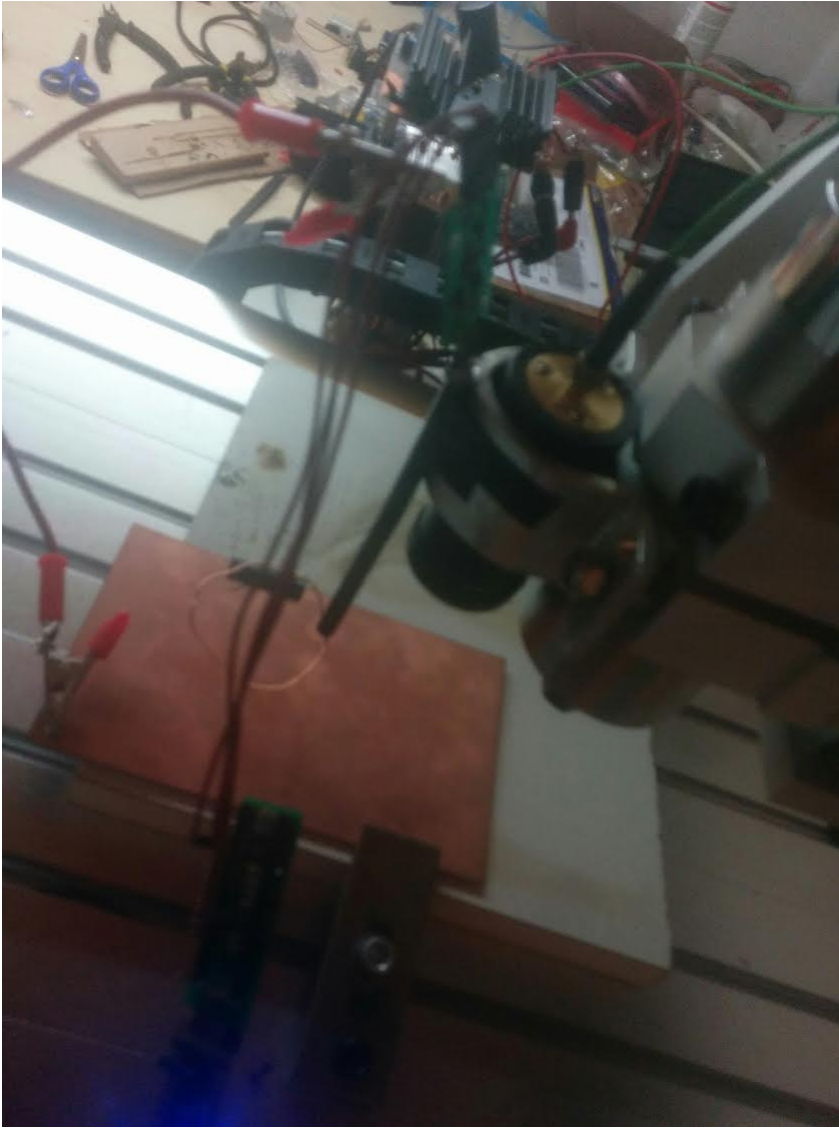
<https://youtu.be/9mzMwZpEM50>

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*shielded and it has much lower parasitic capacitance than coax."*

Aidan

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On Sep 9, 2015 03:39, "Aidan Williamson" <aidan.d.williamson@gmail.com> wrote:

>

> If possible, make sure all devices are powered by the same power supply. Also, make sure that the coaxial cable is as short as possible. Mount the ad7747 and the arduino on the spindle if possible and then send the data from the arduino on a longer, shielded usb cable.

Short coax makes sense, but shielded usb cable?

I am having esp8266 and not arduino, that is powered by usb cable so data goes from esp8266 to pc by wireless ethernet.

On other side of esp is i2c 4 wires 15cm long and from sensor 3m of coax (didn't want to shorten it but now I would need to see if this long 3m coax acting as antenna - but still rg6u is heavily shielded).

>

> On the video titled "Move 10mm 0.1mm per 200ms", what is the actual z height? How many cm above the part are you? You gave difference but I would also like to know what the start and end points were. The start point is touch to workpiece so 0mm, end point is 10mm.

> Thanks!

> Aidan

>

>

>

> On 9/8/2015 3:46 PM, Klemen Živkovič wrote:

>>

>> Aidan,

>>

>> to simulate how turned off ACDC influence measurements I recorded this video:

>>

>> [http://youtu.be/\\_AUU869t7iY](http://youtu.be/_AUU869t7iY)

>>

>> How can this be?

>>

>> regards,

>>

>> On Tue, Sep 8, 2015 at 9:34 PM, Klemen Živkovič <klemen.zivkovic@gmail.com> wrote:

>>>

>>> Hi Aidan,

>>>

>>> thanks for comments - I appreciate it very much - but I saw them just now.

>>> In my last uploaded video to YouTube you will clearly see capacity to height relationship this time I am moving from 0mm to 10mm in 0.1mm steps, in 200ms time delays - it's not linear at all but with that kind of curve it could be linearised.

>>> [https://youtu.be/W4\\_Fm4X\\_C6c](https://youtu.be/W4_Fm4X_C6c)

>>>

>>> What worries me is that when I turn on AC-DC 12V converter to power smoothieboard that drives my CNC - I start getting oscillations on capacity measurements, like you see on first and this last video.

>>> If I turn off AC to DC converter oscillation of measurements are gone.

>>>

>>> Could it be that my ground line that goes from sensor GND to work piece GND is catching EMF?

>>>

>>> Should I connect shielded GND cable from work piece to sensor GND?

>>>  
>>> regards,  
>>> Klemen  
>>>  
>>>  
>>> On Tue, Sep 8, 2015 at 2:25 AM, Aidan Williamson <[aidan.d.williamson@gmail.com](mailto:aidan.d.williamson@gmail.com)> wrote:  
>>>>  
>>>> nevermind, I see you used SMING framework to plot the data  
>>>>  
>>>> On Mon, Sep 7, 2015 at 8:22 PM, Aidan Williamson <[aidan.d.williamson@gmail.com](mailto:aidan.d.williamson@gmail.com)> wrote:  
>>>>>  
>>>>> Make the ring bigger- make it surround the entire spindle. ~60cm maybe?  
>>>>>  
>>>>> On Mon, Sep 7, 2015 at 8:21 PM, Aidan Williamson <[aidan.d.williamson@gmail.com](mailto:aidan.d.williamson@gmail.com)> wrote:  
>>>>>>  
>>>>>> awesome! what are you using to plot the data?  
>>>>>>  
>>>>>> Is it linear (I could not see)?  
>>>>>>  
>>>>>> Is it repeatable?  
>>>>>>  
>>>>>> If it is not linear, it may be because the different sizes of the ring and the work. That may  
complicate the simple equation that I sent you. Need to look in to that.  
>>>>>>  
>>>>>> Congrats - looks promising.  
>>>>>>  
>>>>>> On Mon, Sep 7, 2015 at 4:42 PM, Klemen Živkovič <[klemen.zivkovic@gmail.com](mailto:klemen.zivkovic@gmail.com)> wrote:  
>>>>>>>  
>>>>>>> Sorry my mistake. Here is right one:  
>>>>>>> <https://youtu.be/RV-y1Z-Z4b4>  
>>>>>>>  
>>>>>>> Regards  
>>>>>>>  
>>>>>>> On Sep 7, 2015 22:41, "Aidan Williamson" <[aidan.d.williamson@gmail.com](mailto:aidan.d.williamson@gmail.com)> wrote:  
>>>>>>>>  
>>>>>>>> please re-send link. you sent me to your account page and it takes me to my account page  
>>>>>>>>  
>>>>>>>> On 9/7/2015 3:46 PM, Klemen Živkovič wrote:  
>>>>>>>>>  
>>>>>>>>> Hi Aidan,  
>>>>>>>>>  
>>>>>>>>> I just made test and you can check my video on YouTube:  
>>>>>>>>> [https://www.youtube.com/edit?o=U&video\\_id=RV-y1Z-Z4b4](https://www.youtube.com/edit?o=U&video_id=RV-y1Z-Z4b4)  
>>>>>>>>>  
>>>>>>>>> regards,  
>>>>>>>>> Klemen  
>>>>>>>>>  
>>>>>>>>> On Mon, Sep 7, 2015 at 6:18 PM, Aidan Williamson <[aidan.d.williamson@gmail.com](mailto:aidan.d.williamson@gmail.com)>  
wrote:  
>>>>>>>>>>  
>>>>>>>>>>> I think that should work! Make sure the the shielding and the coax center wire is not  
shorting - no continuity between shield and center wire. Make the coax cable AS SHORT AS  
POSSIBLE!.  
>>>>>>>>>>>  
>>>>>>>>>>>> I don't really know what else to say because you are already as far as I got. I'm not sure if I  
ever got good data out of the device because my work was interrupted and unfortunately I did not leave  
extremely detailed notes.  
>>>>>>>>>>>>

>>>>>>>> Let me know if you get any data that shows a linear relationship between the distance between the sense and the work...  
>>>>>>>>  
>>>>>>>> It should be linear:  
>>>>>>>>  
>>>>>>>> From Wikipedia:  
>>>>>>>>  
>>>>>>>> where  
>>>>>>>>  
>>>>>>>> C is the capacitance, in Farads;  
>>>>>>>> A is the area of overlap of the two plates, in square meters;  
>>>>>>>>  $\epsilon_r$  is the relative static permittivity (sometimes called the dielectric constant) of the material between the plates (for a vacuum,  $\epsilon_r = 1$ );  
>>>>>>>>  $\epsilon_0$  is the electric constant ( $\epsilon_0 \approx 8.854 \times 10^{-12} \text{ F}\cdot\text{m}^{-1}$ ); and  
>>>>>>>> d is the separation between the plates, in meters;  
>>>>>>>> Aidan  
>>>>>>>>  
>>>>>>>>  
>>>>>>>>  
>>>>>>>> On Mon, Sep 7, 2015 at 11:55 AM, Klemen Živkovič <klemen.zivkovic@gmail.com> wrote:  
>>>>>>>>  
>>>>>>>> Hi Aidan,  
>>>>>>>>  
>>>>>>>> thank you very much for reply. Today I received coaxil RG6u cabel from farnell.  
>>>>>>>> My setup will be as follows:  
>>>>>>>> 3m coax cable at one end 3 pin connector (2.54mm raster) to ad7747 board, at other end coax circular wire made from same coax cable. Please check picture and tell me if you see something wrong with my setup that could lead to wrong or bad results.  
>>>>>>>>  
>>>>>>>>  
>>>>>>>>  
>>>>>>>> I don't have test rig - but I have CNC6040 that I will use to retrieve or take precise Z axis versus capacity measurement data.  
>>>>>>>>  
>>>>>>>> I will connect metal piece (toward end of coax cable will be moving) to the ad7747 GND - is this OK?  
>>>>>>>>  
>>>>>>>> When I will have this data I will send you result for discussion.  
>>>>>>>>  
>>>>>>>>  
>>>>>>>> Regards,  
>>>>>>>> Klemen  
>>>>>>>>  
>>>>>>>>  
>>>>>>>> On Sat, Aug 29, 2015 at 8:41 PM, Aidan Williamson <aidan.d.williamson@gmail.com> wrote:  
>>>>>>>>  
>>>>>>>> Hi Klemen,  
>>>>>>>> Temperature compensation is farther down the line. First we need to get the chip to accurately read the capacitance of a known capacitor. I made a basic 3cm parallel plates "capacitor" which you can see on this video: <https://www.youtube.com/watch?v=NZqa3A80I5Q>.  
>>>>>>>> If I were you, I would make something similar and get the board to give you good, repeatable results.  
>>>>>>>>  
>>>>>>>> From Paul Log:  
>>>>>>>> Use RG6U cable. The shield of this cable connects to the Shield terminal of J2 pin 1 or 3, the inner conductor connects to the CapSense terminal of J2 pin 2. For plasma cutting additional ferrite will have to be added to the cables and to the entrance and exit of the metal board housing. Grab

some of that cable and put a female header pin on the center conductor and just push the shield wires around the other two pins.

>>>>>>>>>>

>>>>>>>>>> Yes, ground to work piece and sense line to ring or sensor if I remember correctly. I just used an alligator clip from the board's ground plane to one plate of the capacitor.

>>>>>>>>>>

>>>>>>>>>> As for a probe, they say you should use a ring around the torch as seen here:

[http://opensourceecology.org/wiki/Sensing\\_Distance\\_from\\_Work\\_Piece#Oxyfuel\\_Torch\\_Technology](http://opensourceecology.org/wiki/Sensing_Distance_from_Work_Piece#Oxyfuel_Torch_Technology)

>>>>>>>>>> This is UNTESTED! You will have to see what you can come up with. Please share your findings if possible! You can easily add to the OSE wiki by signing up and making a log.

>>>>>>>>>> [http://opensourceecology.org/wiki/Klemen\\_Log](http://opensourceecology.org/wiki/Klemen_Log) Create that page and put in your video!

>>>>>>>>>>

>>>>>>>>>>

>>>>>>>>>> Good luck,

>>>>>>>>>> Aidan

>>>>>>>>>>

>>>>>>>>>>

>>>>>>>>>>

>>>>>>>>>> On 8/29/2015 4:43 AM, Klemen Živkovič wrote:

>>>>>>>>>>

>>>>>>>>>> You can check my video of thing in operation at:

>>>>>>>>>> <https://plus.google.com/+KlemenZhivko/posts/69LMqBf6V29>

>>>>>>>>>>

>>>>>>>>>> So what cable do I need to pick up for this to work as good as possible?

>>>>>>>>>>

>>>>>>>>>> If I understand correctly GND needs to go to work piece that probe will sense its distance from? Yes?

>>>>>>>>>> Do you have some instructions how to build probe and isolate it from emf as much as possible?

>>>>>>>>>>

>>>>>>>>>> The code i USE NOW IS:

>>>>>>>>>>

>>>>>>>>>> void readAD7747()

>>>>>>>>>> {

>>>>>>>>>> // [http://opensourceecology.org/w/images/e/ec/Cap\\_Sensor\\_Email\\_Chain\\_7-11-2014.pdf](http://opensourceecology.org/w/images/e/ec/Cap_Sensor_Email_Chain_7-11-2014.pdf)

>>>>>>>>>> // [http://opensourceecology.org/wiki/Paul\\_Log](http://opensourceecology.org/wiki/Paul_Log)

>>>>>>>>>>

>>>>>>>>>> system\_soft\_wdt\_feed();

>>>>>>>>>>

>>>>>>>>>> Wire.begin(); //sets up i2c for operation

>>>>>>>>>> Wire.beginTransmission(0x48);

>>>>>>>>>> Wire.write(0xBF);

>>>>>>>>>> Wire.write(0x00);

>>>>>>>>>> Wire.endTransmission();

>>>>>>>>>> delay(4);

>>>>>>>>>> Wire.beginTransmission(0x48); // begins write cycle

>>>>>>>>>> Wire.write(0x07); //address pointer for cap setup register

>>>>>>>>>> Wire.write(0xA0); //b'10100000' found from datasheet page 16

>>>>>>>>>> Wire.endTransmission(); //ends write cycle

>>>>>>>>>> delay(4); // Wait for data to clock out? I'm not 100% sure why this delay is here (or why it's 4ms)

>>>>>>>>>> Wire.beginTransmission(0x48); //begins transmission again

>>>>>>>>>> Wire.write(0x09); //address pointer for capacitive channel excitation register

>>>>>>>>>> Wire.write(0x0E); //recommended value from datasheet

>>>>>>>>>> Wire.endTransmission();

>>>>>>>>>> delay(4);

>>>>>>>>>> Wire.beginTransmission(0x48);

```

>>>>>>>>>>> Wire.write(0x0A);          //address pointer for the configuration register
>>>>>>>>>>> Wire.write(0x21); //b'00100001' for continuous conversion, arbitrary VTF setting, and
mid-range capacitive conversion time
>>>>>>>>>>> Wire.endTransmission();
>>>>>>>>>>> Wire.beginTransmission(0x48);
>>>>>>>>>>> Wire.write(0x0B);          //CAP DAC A Register address (Positive pin data)
>>>>>>>>>>> Wire.write(0x80);          //b'10111111' for enable Cap DAC A
>>>>>>>>>>> Wire.endTransmission();
>>>>>>>>>>> Serial.println("Loop will start"); //test to make sure serial connection is working
>>>>>>>>>>> //WDT.alive();
>>>>>>>>>>> //system_soft_wdt_restart();
>>>>>>>>>>>
>>>>>>>>>>> while (true)
>>>>>>>>>>> {
>>>>>>>>>>> Wire.beginTransmission(0x48); //talking to chip
>>>>>>>>>>> Wire.write(byte(0x00)); //status register address
>>>>>>>>>>> Wire.endTransmission();
>>>>>>>>>>> Wire.requestFrom(0x48, 1); //request status register data
>>>>>>>>>>> int readycap;
>>>>>>>>>>> //Serial.println(" Trying read..."); //try read
>>>>>>>>>>> readycap = Wire.read();
>>>>>>>>>>> if ((readycap & 0x1) == 0)
>>>>>>>>>>> {           // ready?
>>>>>>>>>>> //Serial.print(system_get_time());
>>>>>>>>>>> //Serial.println(" Data Ready");
>>>>>>>>>>> //delay(10);
>>>>>>>>>>> Wire.beginTransmission(0x48); //arduino asks for data from ad7747
>>>>>>>>>>> Wire.write(0x01); //set address point to capacitive DAC register 1
>>>>>>>>>>> Wire.endTransmission(); //pointer is set so now we can read the
>>>>>>>>>>>
>>>>>>>>>>> //Serial.print(system_get_time());
>>>>>>>>>>> //Serial.println(" Data Incoming");
>>>>>>>>>>> //delay(10);
>>>>>>>>>>> Wire.requestFrom(0x48, 3,false); //reads data from cap DAC registers 1-3
>>>>>>>>>>> while (Wire.available())
>>>>>>>>>>> {
>>>>>>>>>>> //Serial.print(system_get_time());
>>>>>>>>>>> //Serial.println(" Wire available.");
>>>>>>>>>>> unsigned char hi, mid, lo; //1 byte numbers
>>>>>>>>>>> long capacitance; //will be a 3byte number
>>>>>>>>>>> float pf; //scaled value of capacitance
>>>>>>>>>>> hi = Wire.read();
>>>>>>>>>>> mid = Wire.read();
>>>>>>>>>>> lo = Wire.read();
>>>>>>>>>>> capacitance = (hi << 16) + (mid << 8) + lo - 0x800000;
>>>>>>>>>>> pf = (float) capacitance * -1 / (float) 0x800000 * 8.192f;
>>>>>>>>>>> //Serial.print(system_get_time());
>>>>>>>>>>> //Serial.print(" ");
>>>>>>>>>>> Serial.println(pf, DEC); //prints the capacitance data in decimal through serial port
>>>>>>>>>>> }
>>>>>>>>>>> //Serial.println();
>>>>>>>>>>> }
>>>>>>>>>>> //Serial.print(system_get_time());
>>>>>>>>>>> //Serial.println(" Loop Done");
>>>>>>>>>>> system_soft_wdt_feed();
>>>>>>>>>>> }
>>>>>>>>>>> }
>>>>>>>>>>>>

```



