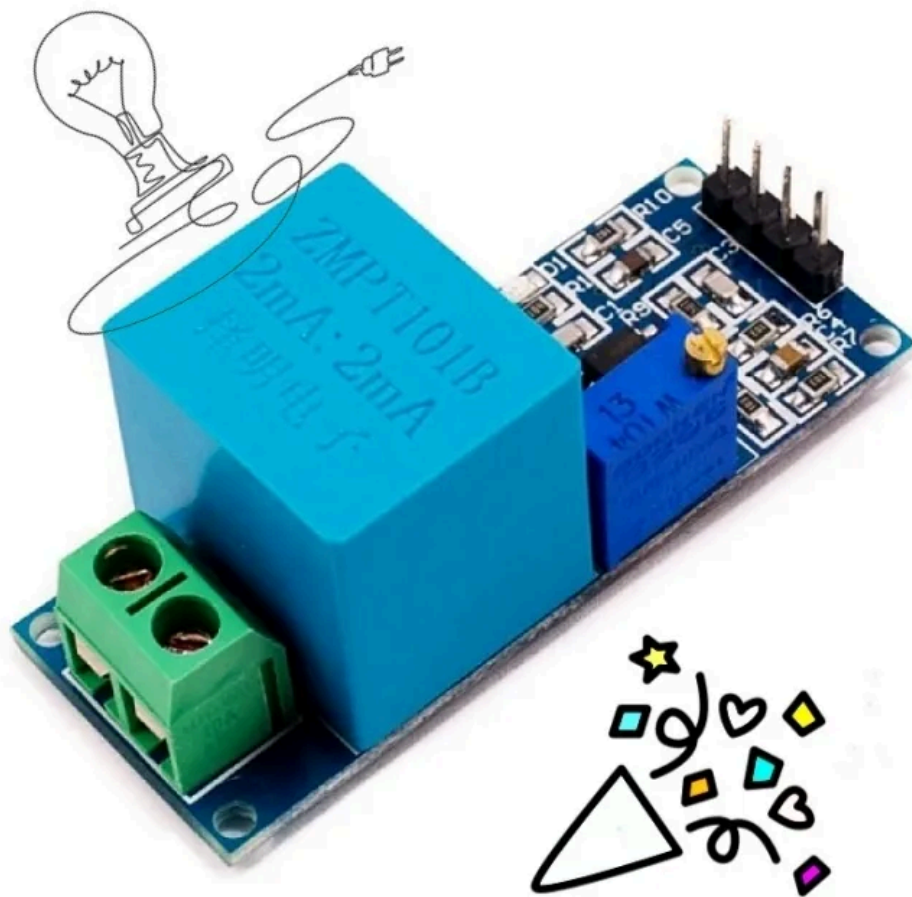
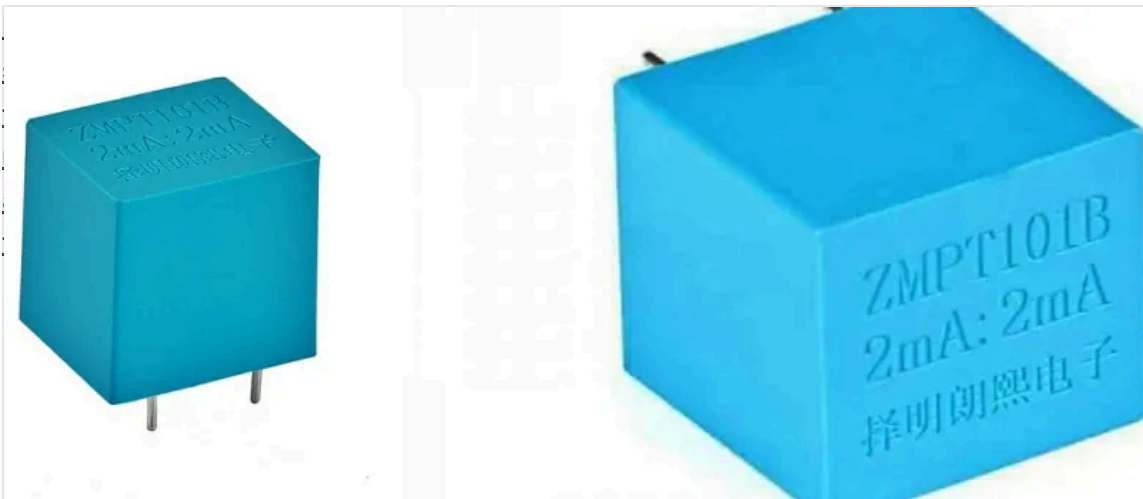


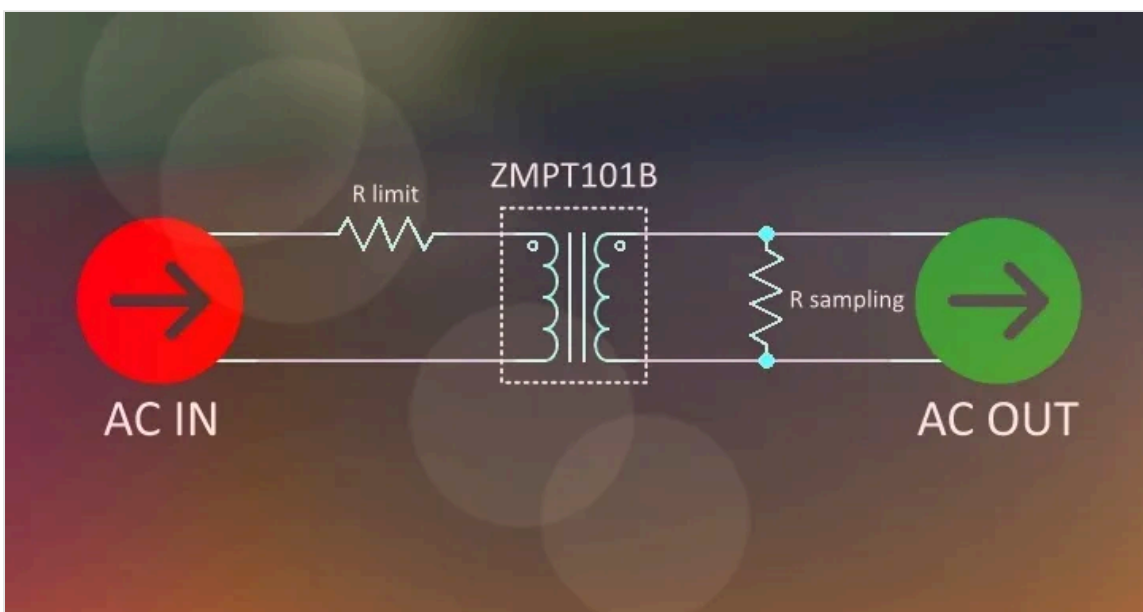


ZMPT101B Transformer & ZMPT101B Module

The ZMPT101B module is a compact single-phase AC voltage sensor module based on the minuscule 2mA/2mA precision voltage transformer ZMPT101B made by Qingxian Zeming Langxi Electronic (www.micro-transformer.com < <http://www.micro-transformer.com> >).



Considering the ZMPT101B transformer alone, the setup is simple as it only needs a limit resistor on the primary side and a sampling resistor on the secondary side (see below).



The below table gives an overview of the little transformer (re-created from its datasheet).

Model	ZMPT101B
Rated input current	2mA
Rated output current	2mA
turns ratio	1000:1000
phase angle error	$\leq 20'$ (input 2mA, sampling resistor 100 Ω)
operating range	0~1000V 0~10mA (sampling resistor 100 Ω)
Permissible error	$-0.3\% \leq f \leq +0.2\%$ (input 2mA, sampling resistor 100 Ω)
isolation voltage	4000V
application	voltage and power measurement
Encapsulation	Epoxy
installation	PCB mounting (Pin Length>3mm)
Operating temperature	-40 $^{\circ}\text{C}$ ~ +60 $^{\circ}\text{C}$

ZMPT101B
Current-type Voltage Transformer

Qingxian Zeming Langxi Electronic
www.micro-transformer.com

– ZMPT101B Transformer Datasheet

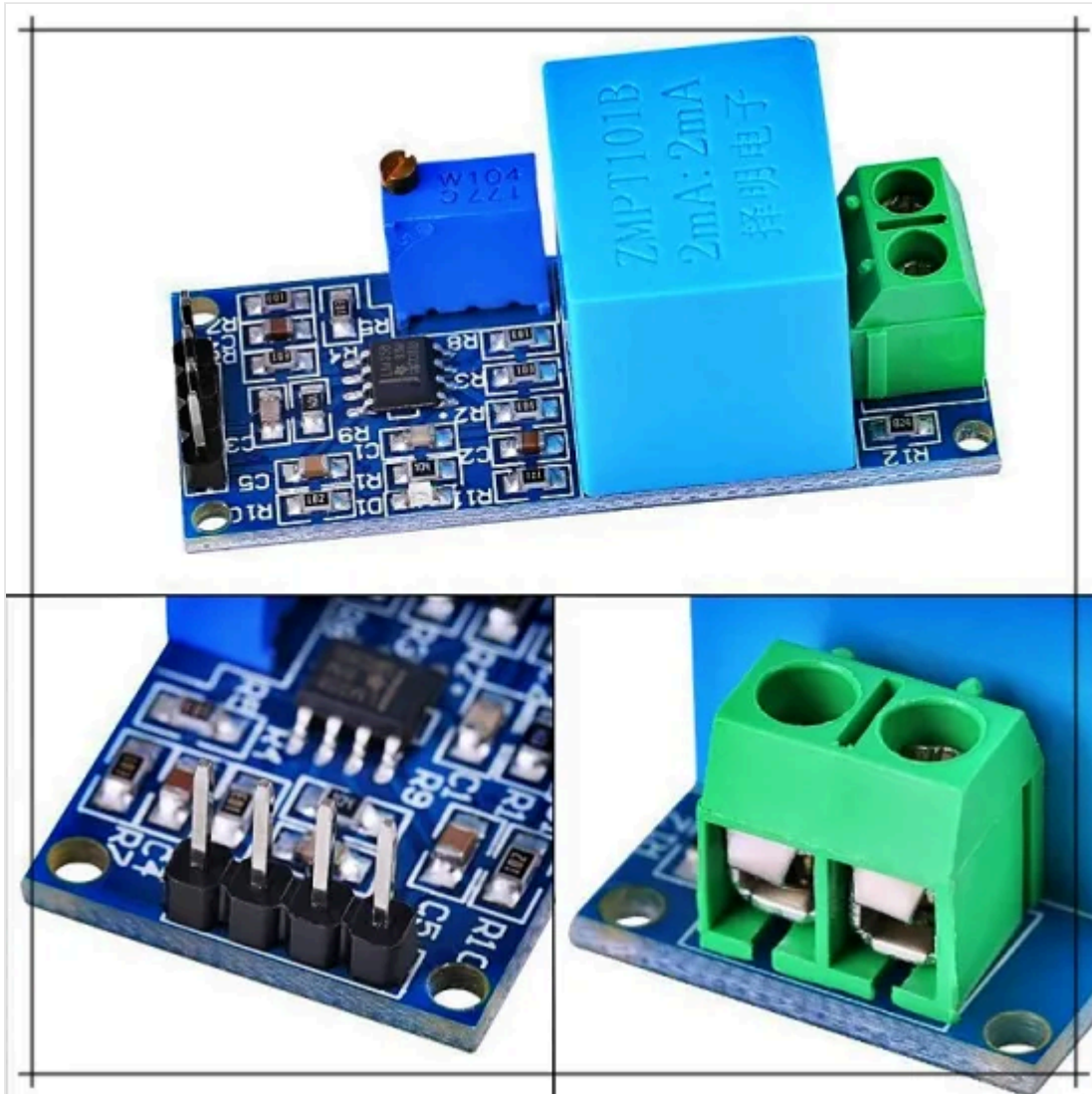
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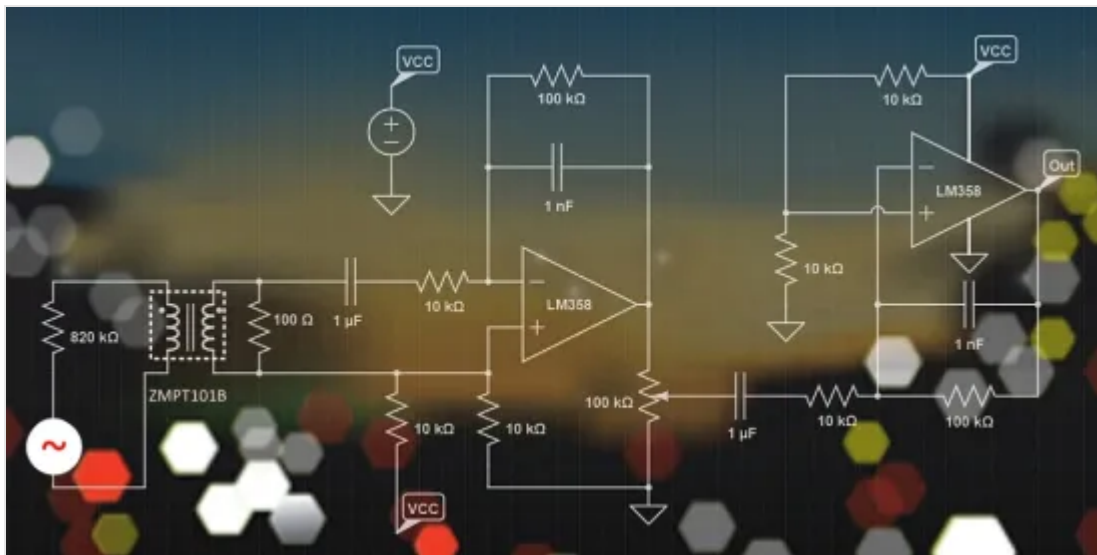
The primary and secondary coils of this transformer have a DC resistance close to 110 Ω at 20 $^{\circ}\text{C}$.

Coming back to the ZMPT101B module, it can handle AC voltages up to 250V (50Hz/60Hz). Its secondary circuitry, centered on the LM358 dual op-amp chip, also allows tweaking the isolated analog output via an onboard multiturn trimpot. The recommended operating voltage of the module is 5VDC.

- LM358 IC Datasheet <https://www.onsemi.com/pdf/datasheet/lm358-d.pdf> <
<https://www.onsemi.com/pdf/datasheet/lm358-d.pdf>>



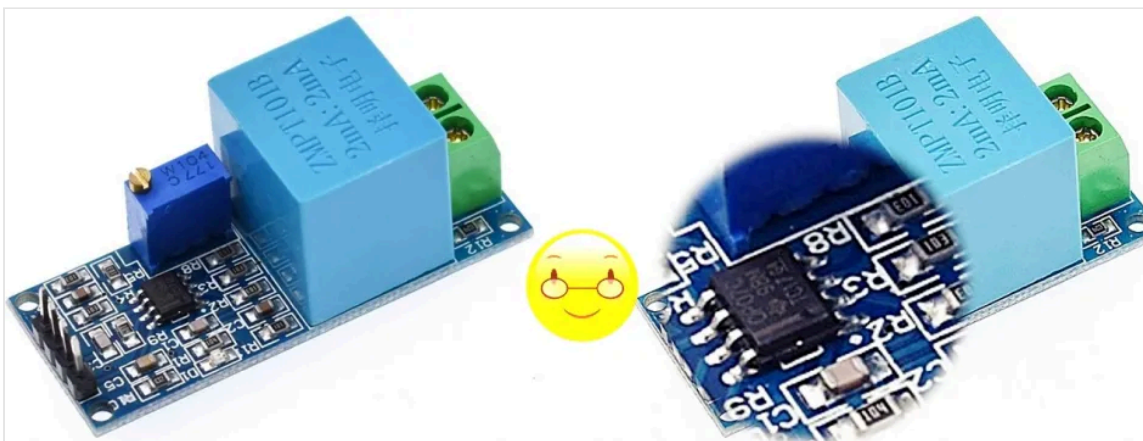
The following is believed to be the correct schematic of the module in my hand (HW-697). I took it from the web and touched it up for better clarity!



As a side note, you may find photographs of identical modules with OP07C

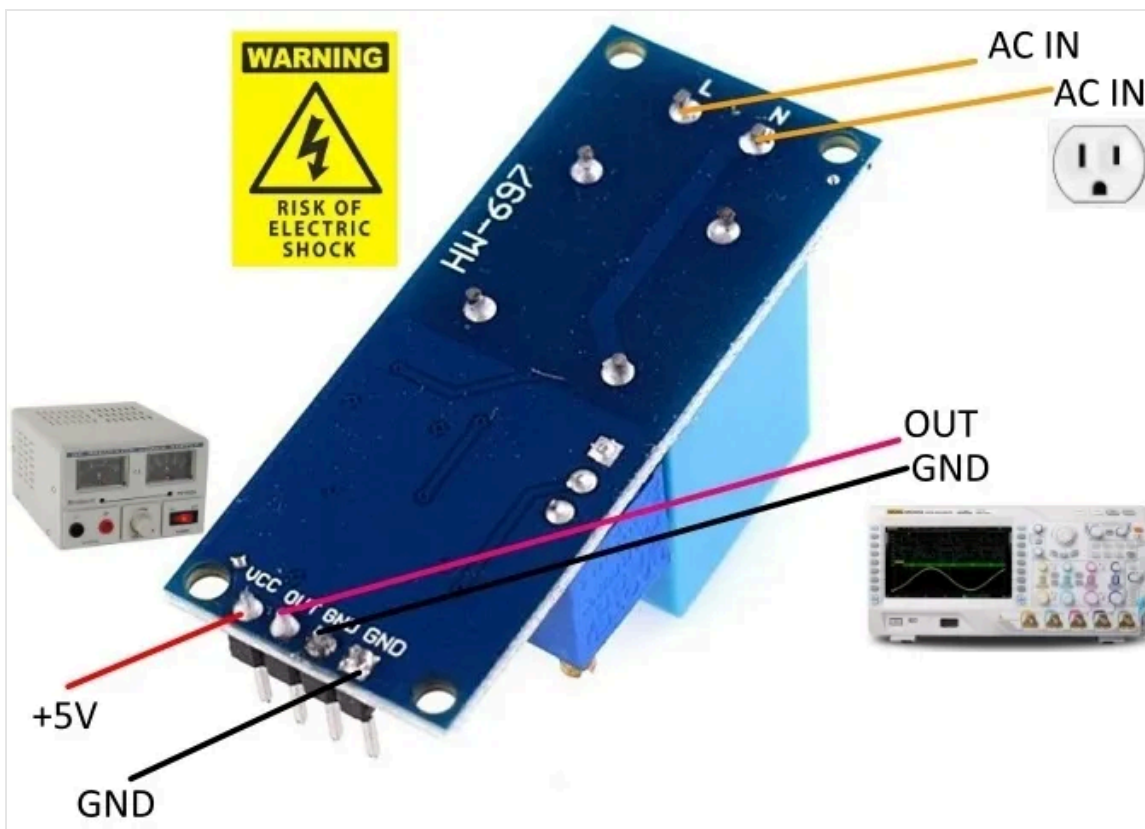
(<https://www.ti.com/lit/ds/symlink/op07c.pdf> < <https://www.ti.com/lit/ds/symlink/op07c.pdf>>.)

op-amp chip somewhere on the web. Originally the PCB layout of the module was for LM358 chip, so those odd modules (with the wrong part) will not work as claimed (I don't know the real facts behind this serious flaw).



ZMPT101B Module & Quick Test AC230V

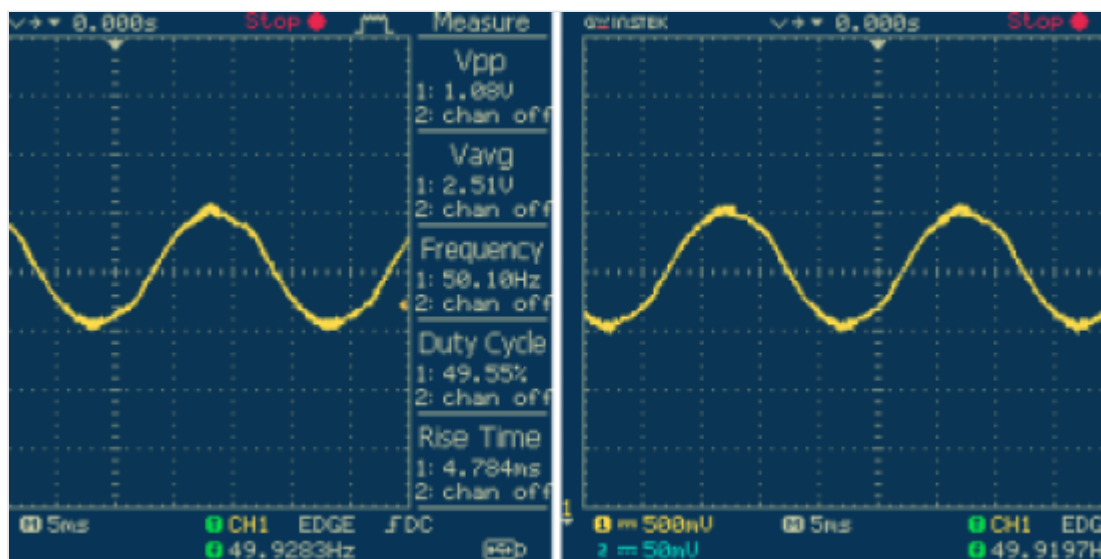
So, the next step is the quick test of the ac voltage sensor module. For the test I'm using AC230V/50Hz domestic power through the simplistic setup shown below.



Warning ! You're now going to deal with a fatal high voltage source. It's assumed that you have electrical knowledge and know what you are dealing with!

See I got a sensible analog output. Yup, it worked!

As you can see, the output displayed at that time was around 1.1Vpp with 225VAC (50Hz) input. Note at this point that the analog output has an offset ($V_{cc}/2$). That is, if nothing is wired to the input and the supply voltage of the module is 5VDC, the idle output of the module will be around 2.5VDC.



Oh, I forgot to mention, I used my trusty digital AC volt and current meter (AC230V/100A) module for the AC input voltage measurements.

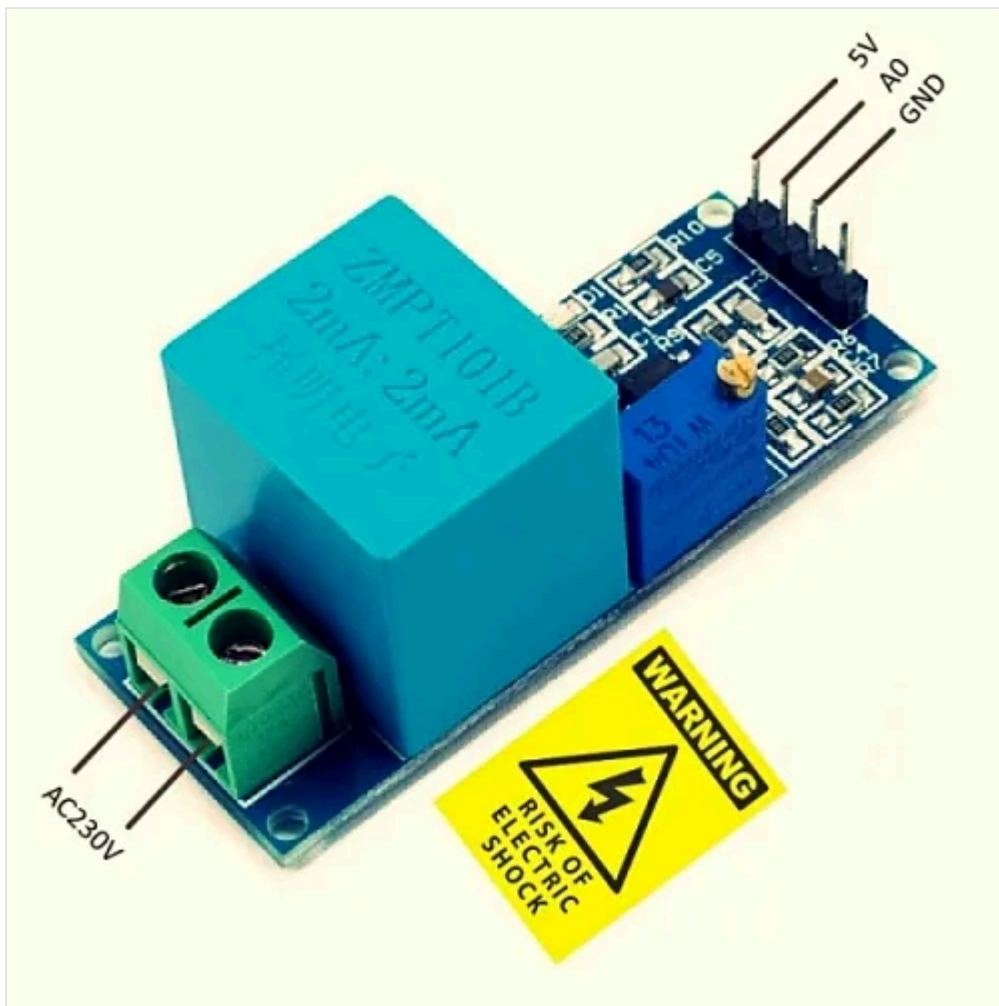


ZMPT101B Module & Initial Output Signal Tweaks

In principle, the analog output signal of the module fluctuates up and down within predefined limits (when no ac input voltage is detected, it will deliver an output at half the supply voltage). Pay attention to ensure that the module's output is a complete sinewave. If the waveform is clipped, you must refine the output to head off potential measurement errors (naturally each module has its own deviations, so the onboard amplitude adjust trimpot will be a helpful inclusion). You need to keep an eye on the output waveform before first use.

ZMPT101B Module & Arduino Uno Serial Plotter

Arduino Uno can measure voltages through its analog inputs. An analog input pin, by default, will map analog input voltages between 0V and 5V into integer values between 0 and 1023 with a resolution of 4.9mV per unit ($5.00\text{V}/1023$ units).



To “see” the output of your ZMPT101B module, just follow the wiring scheme shown above, and upload below code to your Arduino Uno.

```
void

setup() {

    Serial.begin(9600);

}

void

loop()

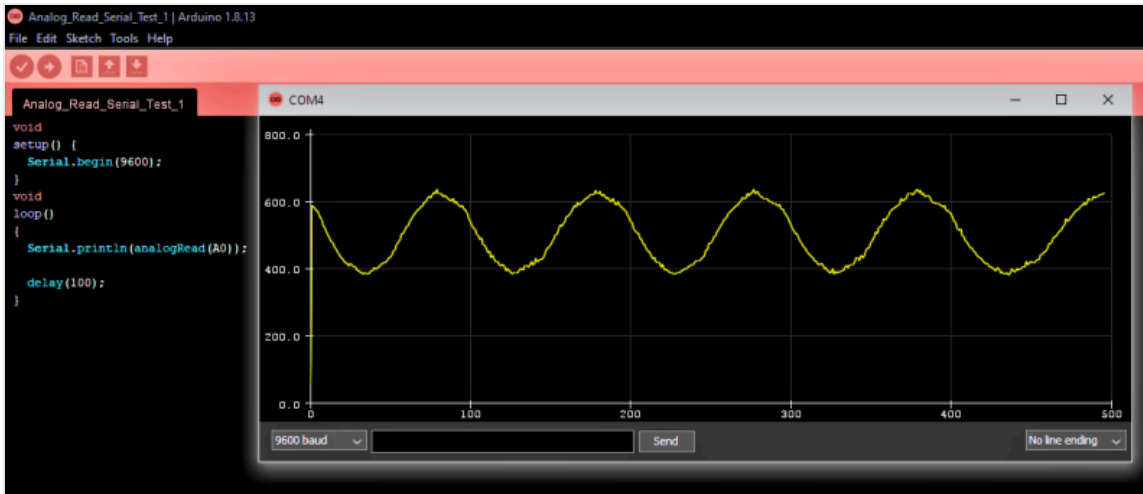
{

    Serial.println(analogRead(A0));

    delay(100);
```

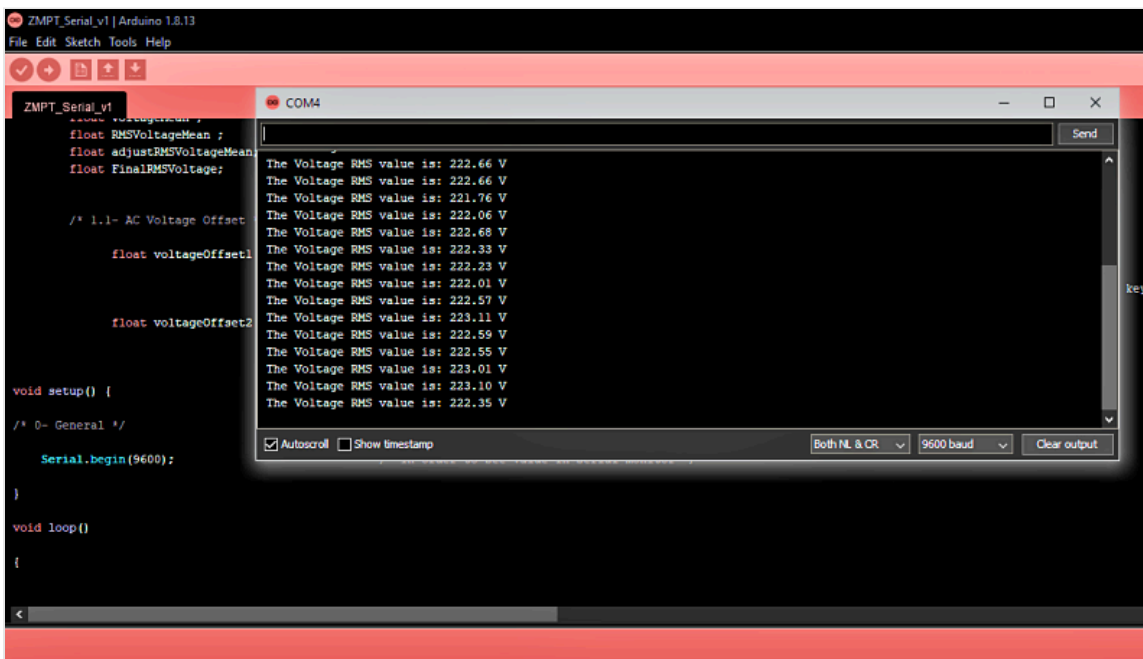
}

And then open the Serial Plotter window from the Tools menu. If you apply grid power to your module's input, you will see something like this on the Serial Plotter.



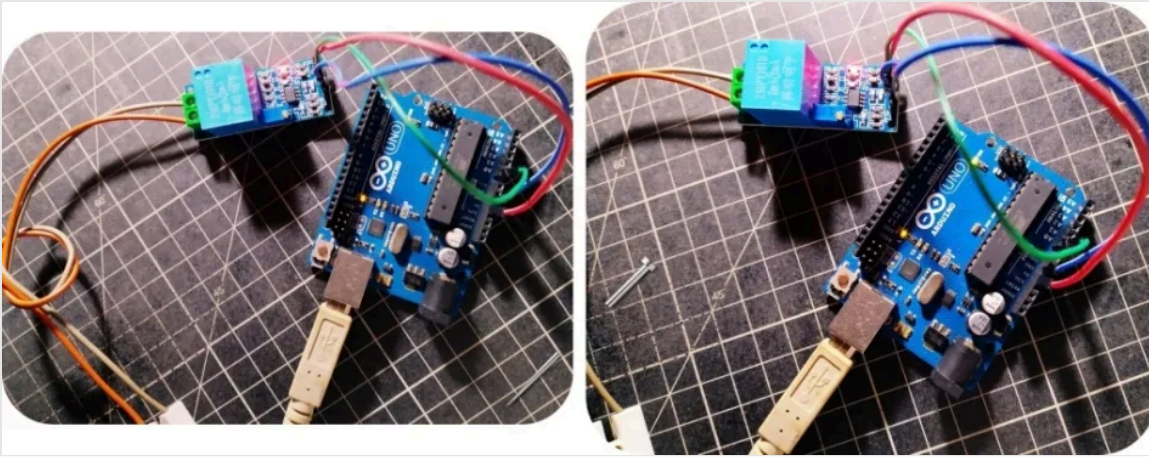
ZMPT101B & Arduino AC Voltmeter Blueprints

I don't see people playing with ZMPT101B much on the internet. Luckily, I got better results thru the "serial monitor" code adapted from here <https://solarduino.com/how-to-measure-ac-voltage-with-arduino/> < <https://solarduino.com/how-to-measure-ac-voltage-with-arduino/>> (my code is just something quick and dirty to check that it worked).



What's Next?

Now it's your turn! However, your microcontroller, sensor module, operating voltage and high-voltage input might be different. So, you will need to refine your code to get accurate results. Once you have your entire setup finetuned, simply leave it to do its job.



Note that this writeup is only a primer. I'll continue working on this concept and share my thoughts when I'll make a notable progress. Finally, I'd be interested to see if anyone's done something new with this sensor module already. Expertise is for Everyone!

The ZMPT101B is an AC voltage sensor module designed to measure the voltage of an alternating current (AC) power supply. It is commonly used in electronic projects, energy monitoring systems, and applications where measurement and monitoring of AC voltage are necessary. Here are some key features and details about the ZMPT101B AC Single Phase Voltage Sensor Module:

1. Voltage Measurement:

- The ZMPT101B is specifically designed for measuring AC voltage in a single-phase system. It typically provides a voltage output proportional to the measured AC voltage.

2. Input Voltage Range:

- The module is designed to work with a specific input voltage range. It's important to choose a module variant that matches the voltage levels in your application. Common variants include modules suitable for measuring voltages in the range of 0-250V or 0-500V AC.

3. Non-Invasive Measurement:

- The ZMPT101B is a non-invasive voltage sensor, meaning it does not require direct electrical contact with the live wires. This makes it safer and more convenient for measuring AC voltage without disrupting the circuit.

4. Voltage Output:

- The module typically provides a voltage output that is proportional to the AC voltage being measured. The output may be an analog voltage signal, making it compatible with microcontrollers like Arduino.

5. Isolation:

- Some variants of the ZMPT101B may include isolation features to enhance safety by isolating the measurement circuit from the main AC voltage.

6. Frequency Response:

- The sensor module is designed to work within a specific frequency range. It is typically suitable for standard power system frequencies, such as 50Hz or 60Hz.

7. Accuracy:

- The accuracy of the ZMPT101B depends on the specific model and its calibration. Calibration may be required to ensure accurate voltage measurements.

8. **Power Supply:**

- The module may require a separate power supply for its internal circuitry. Ensure that the power supply voltage matches the module's specifications.

9. **Applications:**

- The ZMPT101B is commonly used in applications such as energy monitoring systems, smart home projects, and industrial automation where monitoring and control of AC voltage are necessary.

10. **Interface with Microcontrollers:**

- The module can be interfaced with microcontrollers (e.g., Arduino) for further processing, data logging, or integration into larger control systems.

11. **Datasheet and Documentation:**

- Refer to the datasheet and documentation provided by the manufacturer for detailed technical information, specifications, and usage guidelines.

When using the ZMPT101B AC Single Phase Voltage Sensor Module, follow safety guidelines, refer to the manufacturer's documentation, and ensure proper calibration for accurate voltage measurements.

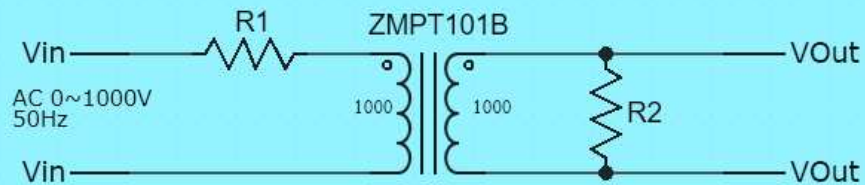


ZMPT101B

MICRO PRECISION VOLTAGE TRANSFORMERS

InnovatorsGuru | Sensor | © InnovatorsGuru.com

ZMPT101B schematic/ Wiring Diagram



Vin : Input Voltage R1 : Limiting Resistor
VOut : Output Voltage R2 : Sampling Resistor

$$V_{out} = (V_{in}/R1) \times R2$$

Description

ZMPT101B AC Voltage Sensor is the best for the purpose of the DIY project, where we need to measure the accurate AC voltage with voltage transformer. ZMPT101B is an ideal choice to measure the AC voltage using Arduino/ESP8266/Raspberry Pi like an opensource platform. In many electrical projects, engineer directly deals with measurements with few basic requirements like

- High galvanic isolation
- Wide Range
- High accuracy
- Good Consistency

ZMPT101B is a high precision voltage Transformer. This module makes it easy to monitor AC mains voltage upto 1000 volts. A tiny little thing the size of a bouillon cube. Holds up

to 4kV per breakdown voltage, the ratio of turns is 1: 1, but this is a current transformer of 2mA: 2mA. That is, we feed it a current and remove the current. The input current is simply set by the resistor in series R1, and a sampling resistor R2 is used in parallel to obtain the output voltage.

ZMPT101B Calculation

R1 is chosen so that the current through the winding does not exceed 2mA, it holds a maximum of 10mA, but after 2mA linearity is lost and the output will be clear that.

Step 1: Determination of maximum output rms voltage

VOutmax is decided by the ADC peak voltage in the sampling loop of Microcontroller.

For Bipolar ADC

$$V_{Outmax} = \frac{\text{Peak Voltage}}{\sqrt{2}} \text{ For example}$$

As for $\pm 5V$ ADC, the maximum rms voltage of the transformer:

$$V_{Outmax} = \frac{\text{Peak Voltage}}{\sqrt{2}} = \frac{5V}{\sqrt{2}} = 3.53V$$

For Unipolar ADC

$$V_{Outmax} = \frac{\text{Peak Voltage}}{2\sqrt{2}}$$

For example

As for 0-3.3V ADC, the maximum rms voltage of the transformer:

$$V_{Outmax} = \frac{\text{Peak Voltage}}{2\sqrt{2}} = \frac{3.3V}{2\sqrt{2}} = 1.16V$$

Step 2: Determination of input current-limiting resistor R1

Current-limiting resistor

$$R1 = \frac{V_{in}}{I}$$

Where

V_{in} : Rated input voltage

I : Rated operating current (when Coil resistance is compared with current-limiting resistor R1, it can be ignored.)

ZMPT101B usually working at rated current: **1~2mA**.

When Rated input voltage $\leq 100V$, Usually choosing the operating current $I=2mA$;

When Rated input voltage $\geq 220V$, To reducing the resistor power, usually choosing the operating current **$1\text{ mA} \leq I \leq 2\text{ mA}$** .

for example: $V=100V$, $I=2\text{ mA}$,

$$R1 = \frac{V_{in}}{I} = \frac{100}{0.002} = 50k\Omega$$

for example: $V=220V$, $I=1.1\text{ mA}$,

$$R1 = \frac{V_{in}}{I} = \frac{220}{0.0011} = 200k\Omega$$

To improve reliability, the current-limiting resistor selected usually is greater than its 4times the rated power, and generally use a high temperature coefficient metal film resistor.

Step 3: Determination of the sampling resistor R₂

$$R_2 = \frac{V_{Outmax}}{I} = \frac{V_{Outmax}}{V_{in}} \times R_1 \ \Omega$$

for example: $V_{outmax} = 3.53V$, $V_{in} = 100V$

$$R_2 = \frac{V_{Outmax}}{I} = \frac{V_{Outmax}}{V_{in}} \times R_1 = \frac{3.53}{100} \times 50 \text{ k}\Omega = 1.765 \text{ k}\Omega$$

- Above formula is also suitable for the two ways of active and passive output.
- When selecting the sampling resistor, Resistor should not exceed

$$R_2 = \frac{V_{Outmax}}{I} = \frac{V_{Outmax}}{V_{in}} \times R_1 \ \Omega$$