MEASUREMENT ON COMPENSATION CAPACITANCE IN INDUCTIVE NETWORK BY MICROCONTROLLER

Purpose of the paper

- Design and of *a* practically realized on prototype microcontroller circuit for determined on the compensation capacitance in inductive network

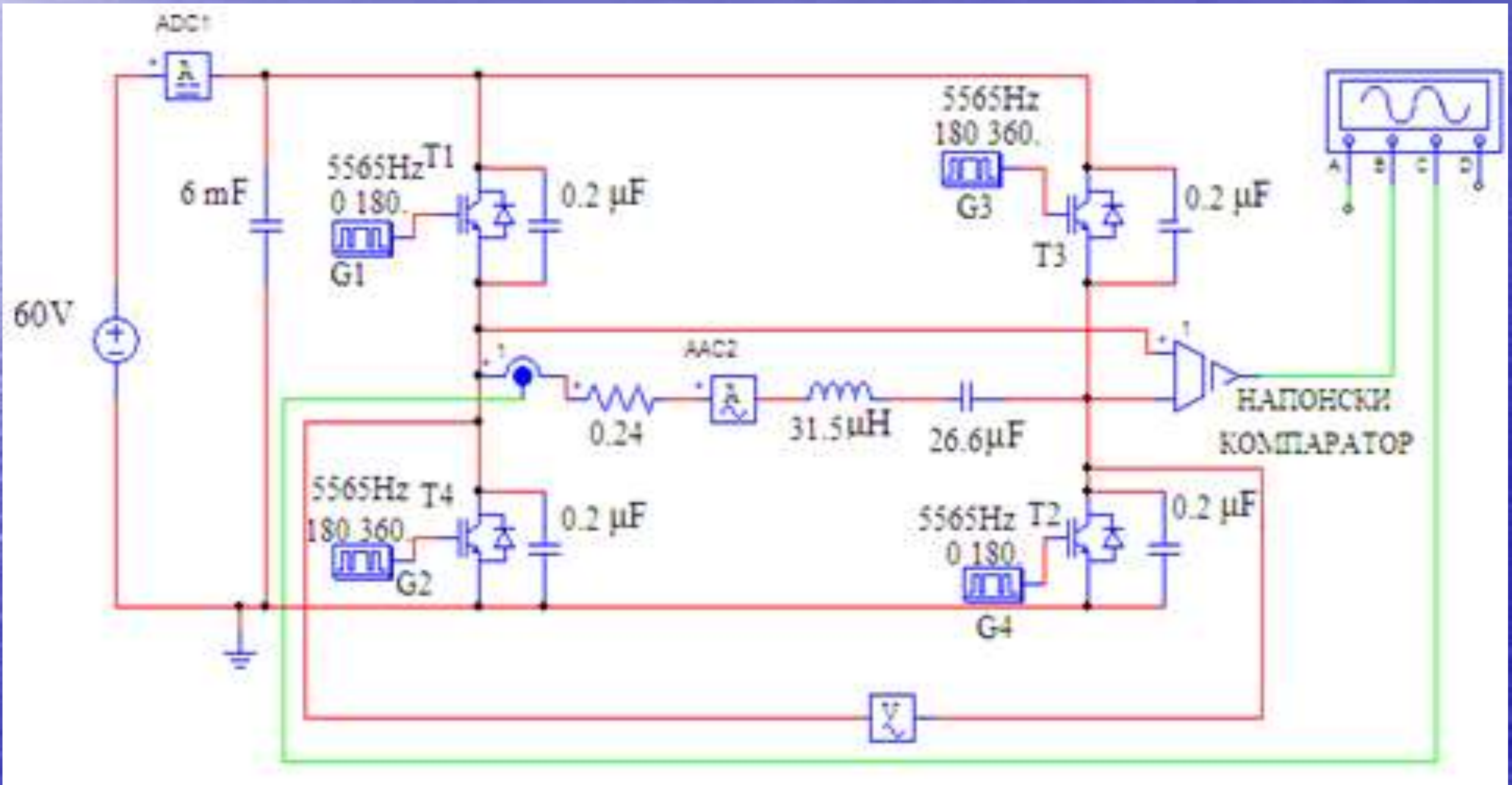
- The realized measuring circuit, in addition to determining the value of the compensation capacitor, determines the current, voltage, active power, active energy and reactive energy

- The circuit is based on Atmega 328 microcontroller and smart power meter PZEM004

- The capacitance value is visualized on an LCD display, and the values of current, voltage, active power, compensation capacitance and power factor are displayed on a serial monitor on the computer

In energy networks with high inductive load the reactive energy is high and therefore these networks operate with a low power factor. In such networks to reduce the reactive energy are installed compensating capacitors. The solution in the paper determines the required capacitance in inductive networks to reduce reactive energy and increase the power factor to one unit

Electrical scheme of inductive actuators which is supply from full bridge converter



Output voltage and current waveforms on full bridge converter loading with inductive load

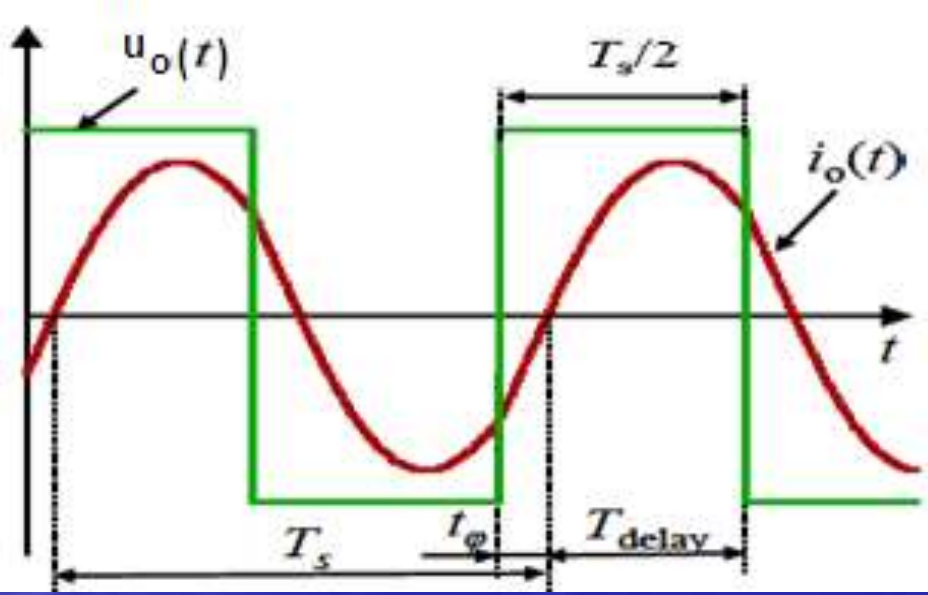


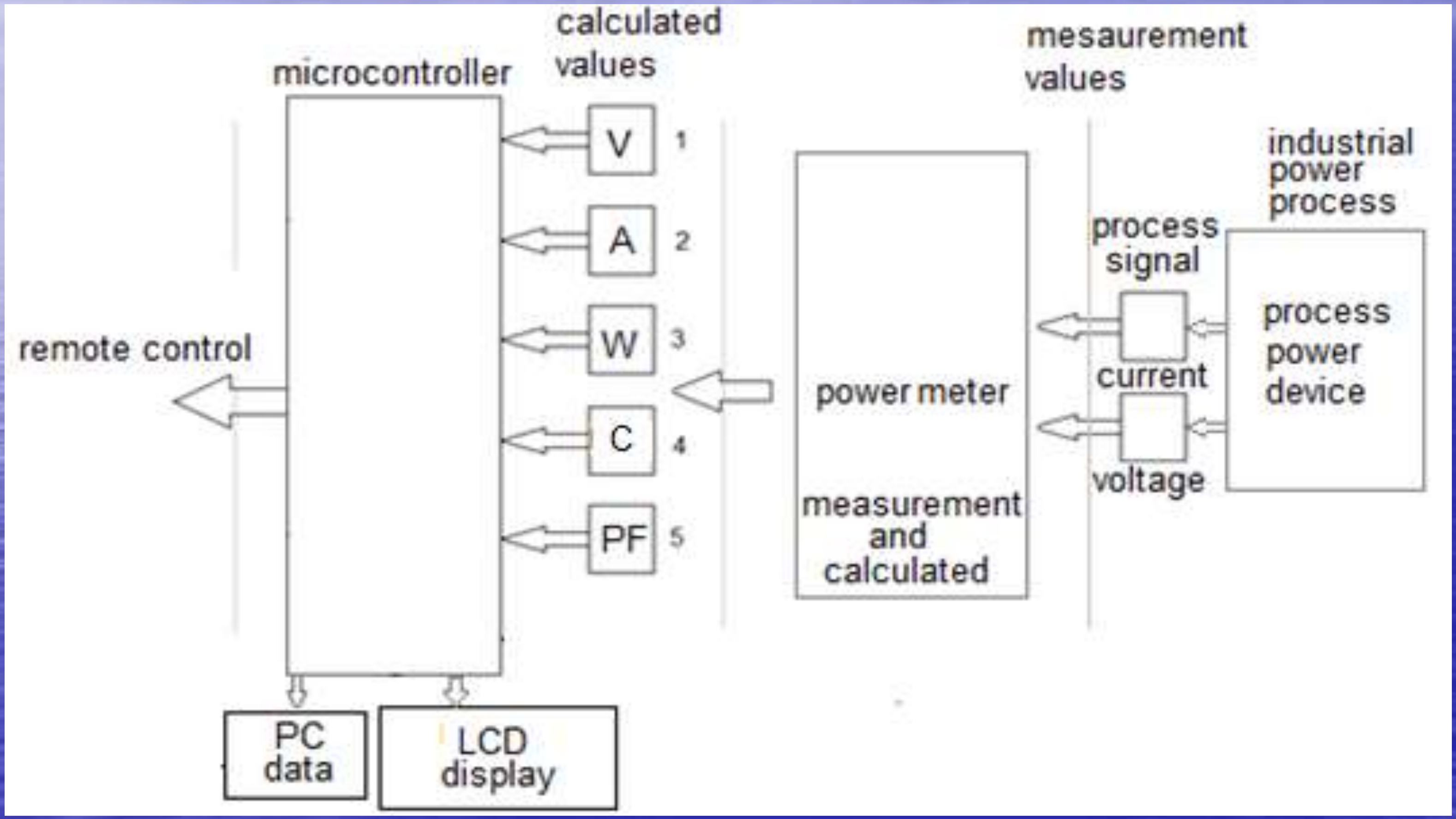
TABLE I: VALUE ON OUTPUT CONVERTER PARAMETERS FOR CHANGE ON INDUCTANCE FROM 20%

L [μH]	R [Ω]	φ_i [°]	f_{sw} [kHz]	I_o [A]	U_o [V]	P_o [kVA]
26,5	0,24	5,00	6.27	208	56	10,7
31,5	0,29	31,34	6.27	145	56	6,16

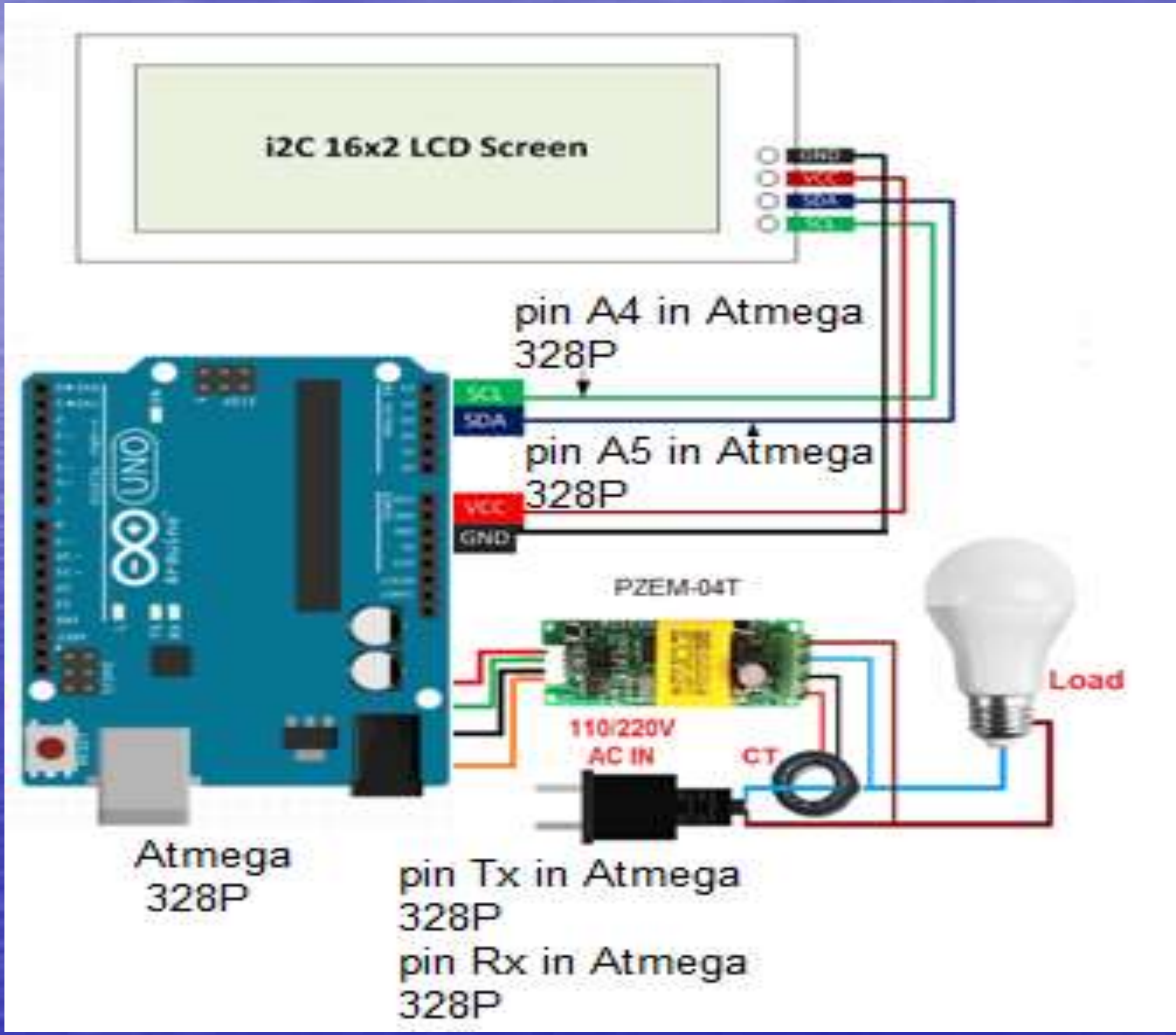
TABLE I: VALUE ON COMPENSATION CAPACITANCE AND POWER

L [µH]	R [Ω]	C [µF]	φ_i [°]	f_{sw} [kHz]	I_o [A]	U_o [V]	P_o [kVA]
26,5	0,24	26.6	5.00	6.27	208	56	10,7
31,5	0,24	21.28	5.00	6.27	208	56	10.7

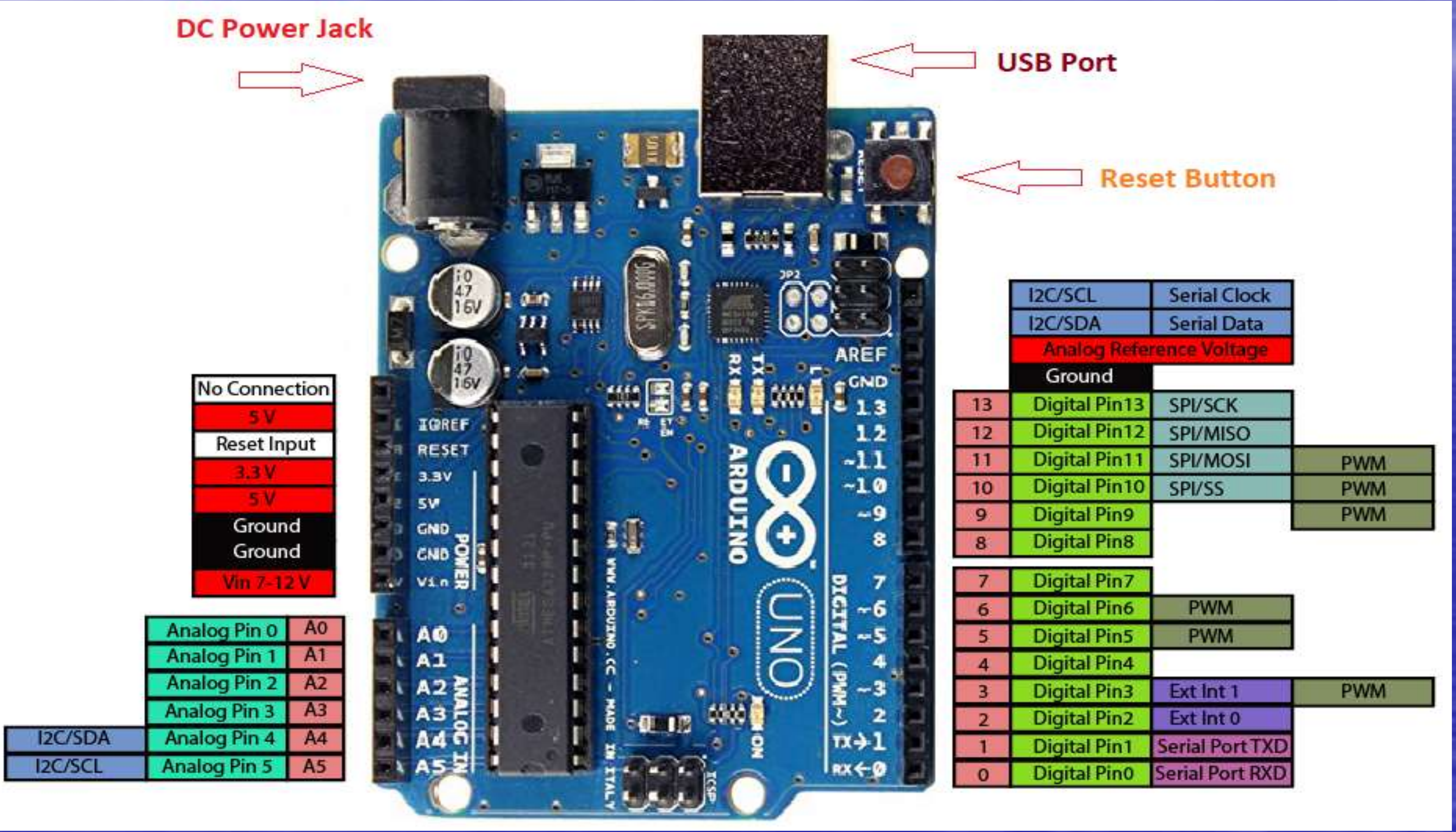
Block diagram of the specific solution of an microcontroller power meter.



Connection diagram of the realized solution

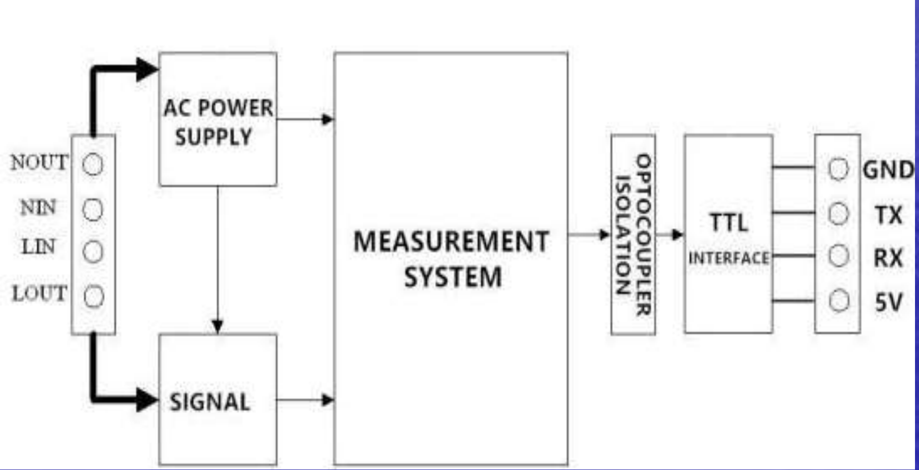


Arduino Uno



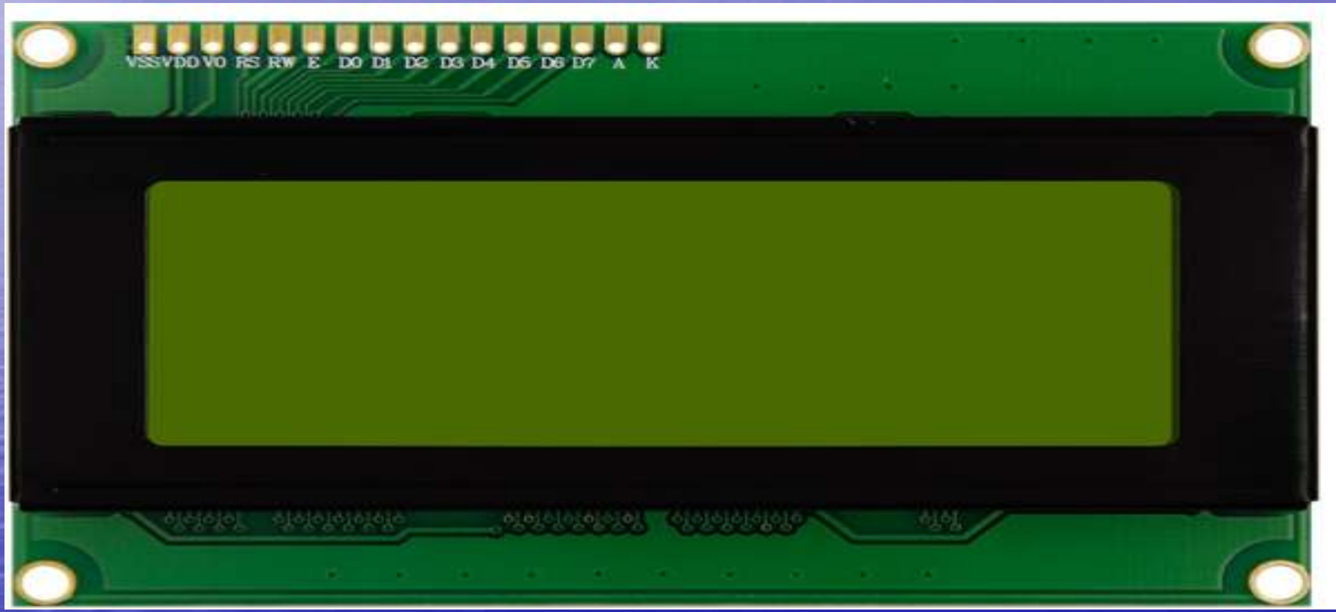
DC Power Jack
USB Port
Reset Button
No Connection
5 V
Reset Input
3.3 V
5 V
Ground
Ground
Vin 7-12 V
Analog Pin 0 A0
Analog Pin 1 A1
Analog Pin 2 A2
Analog Pin 3 A3
I2C/SDA Analog Pin 4 A4
I2C/SCL Analog Pin 5 A5
I2C/SCL Serial Clock
I2C/SDA Serial Data
Analog Reference Voltage
Ground
13 Digital Pin13 SPI/SCK
12 Digital Pin12 SPI/MISO
11 Digital Pin11 SPI/MOSI PWM
10 Digital Pin10 SPI/SS PWM
9 Digital Pin9 PWM
8 Digital Pin8
7 Digital Pin7
6 Digital Pin6 PWM
5 Digital Pin5 PWM
4 Digital Pin4
3 Digital Pin3 Ext Int 1 PWM
2 Digital Pin2 Ext Int 0
1 Digital Pin1 Serial Port TXD
0 Digital Pin0 Serial Port RXD

PZEM-004T board on power mete, and block diagram on this module.



- ***Function description***
- Voltage measuring range is 80～260V.
- Current measuring range is 0～10A(PZEM-004T-10A); 0～100A(PZEM-004T-100A)
- Active power measuring range is 0～2.3kW(PZEM-004T-10A); 0～23kW(PZEM-004T-100A)
- Starting measure power is 0.4W. Resolution is 0.1W.
- Frequency measuring range is 45Hz～65Hz, resolution is 0.1Hz.
- Active energy measuring range is 0～

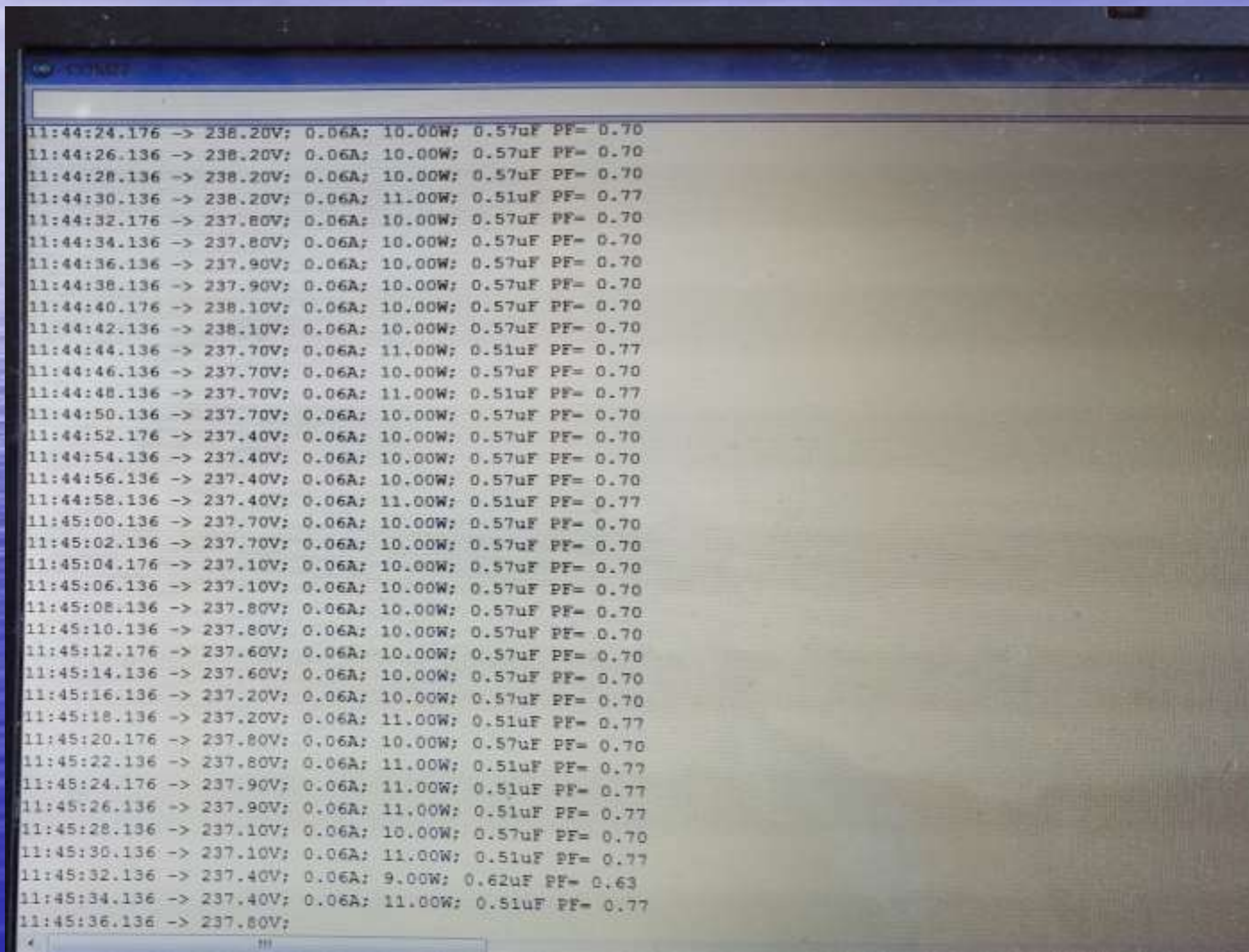
LCD 20x4 display



Experimental results

Prototype on the microcontroller power meter and the complete process microcontroller power meter.

The data for voltage, current, power, capacitance and power factor in serial monitor



Conclusions

- In paper is designed and practically realized microcontroller power meter
- power meter allows data on power, compensation capacitance and power factor to be obtained only by measuring the voltage and current of a process device
  - the required compensatory capacity is visualized on an LCD screen and data for voltage, current, power, capacitance and power factor are sent in serial monitor
- The solution also provides the ability for upgrade to remote control on the process quantities