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AC Digital Multifunction Meter

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Abstract: ***The measurement of electrical parameters that is voltage, current are very much important in the field of measurements. Measuring devices has a history of some hundred years and are kept evolving from analog based to a digital form. Electronic and digital techniques have paid way for the development of very high accuracy digital meters which are used for measuring of electrical parameters such as voltage and current.AC digital multifunction meter is a device used to measure various electrical parameters such as voltage, current, power, frequency, energy and power factor.***
Keywords: AC Digital multifunction meter, Arduino, PZEM-004T, 16*2 LCD, Voltage measurement, Current measurement, Power measurement, Power factor measurement, Frequency measurement, Energy measurement.

I. INTRODUCTION

AC digital multifunction meter is an instrument that is used to measure electrical parameters between two points of an electrical circuit. AC digital multifunction meter is intended to be operated at a low cost with in the following specification. AC digital multifunction meter is drawn in this fashion which is capable of reading voltage, current, power, power factor, energy in a single device-, and display them synchronously. AC digital multifunction meter is of great beyond in the applications of measuring residential electric consumption, factory electrical consumption and laboratory measurements of voltage, current, power, power factor, energy-, and frequency.
Here construction & development of Arduino and other microcontrollers is depended on a digital multifunction meter with the following capabilities:

A. AC Voltage Measurement: 80-260V.
B. AC Current Measurement: 100A.
C. Frequency Measurement: 45-65Hz.
D. Power Measurement: 22000W.
E. Power factor Measurement depends on load and time.
F. Energy Measurement depends on load and time.
G. Accuracy: 1.0.

AC Digital multifunction meter is a much needed instrument in an electrical workshop. Because separate meters are required to measure different parameters but the multi function meter is alone enough to measure voltage, current, power, power factor, energy-, and frequency and to display them synchronously. Multimeter can measure voltage, current, frequency but it cannot display all of these synchronously, but whereas the AC multifunction meter is of great beyond in measuring and monitoring the voltage, current, power, power factor, energy and frequency.

II. CIRCUIT DIAGRAM

The circuit diagram of is as shown in fig.1The physical dimensions of the PZEM-004T board are 3.1×7.4 cm, the pzem-004t module is bundled with 3 mm diameter current transformer coils. The most a part of the PZEM-004T module is the SD3004 chip from the SDIC Microelectronics Co., Ltd. additionally, the board having the EEPROM from Atmel(now microchip) 24C02C which could be a 2K bit Serial Electrically Erasable PROM with a voltage range of 4.5V to 5.5V. With quite 1 Million Erase/Write Cycles and 200+ Years Data Retention. Two opto-couplers PC817, providing galvanic isolation of the serial interface and circuit diagram is as shown in Fig.1.

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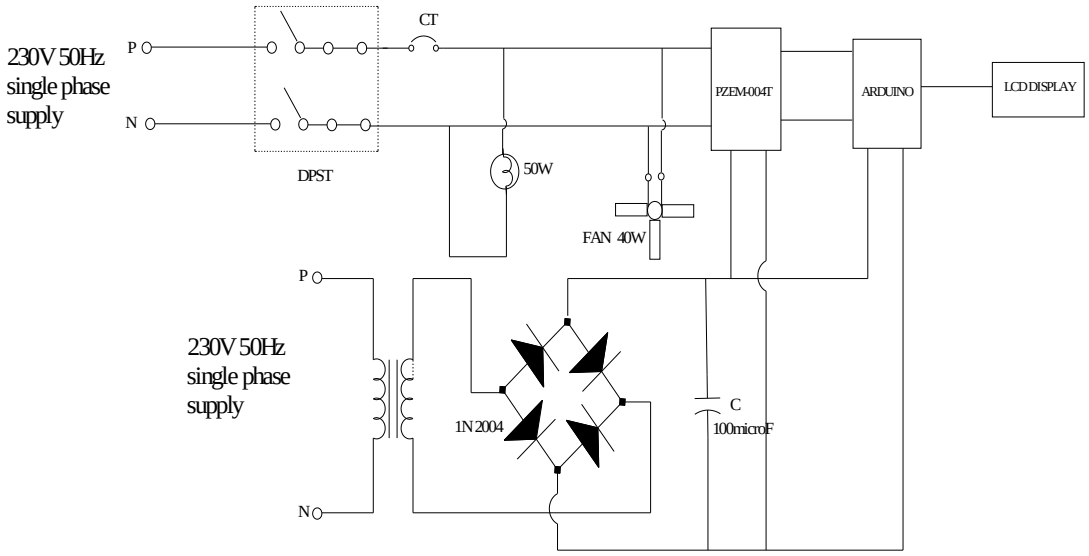


Fig. 1 shows circuit diagram of AC Digital multifunction meter

A. Methodology

AC Digital multi function meter makes use of ARDUINO-UNO as microcontroller to read the input from PZEM-004T and display a voltage, current, power, power factor, energy and frequency on the 16*2 LCD.

PZEM-004T is used for measuring AC voltage, current, power, power factor, energy, and frequency of single phase power supply power circuit. The PZEM-004T works on 5V DC power supply. It is interfaced with Arduino nano or uno to read and display the parameters, and current transformer is connected to that to read current, and on power side maximum operating current is 100A. Rated voltage 220V, output voltage is 220V and power range is 22000W.

We have a transformer and rectifier circuit to power Arduino uno or nano.AC digital smart meter has 80W, 260V AC at 45 to 65Hz frequency and PZEM-004T.

When load circuit is switched on, depending upon the load the current starts flowing in the load circuit. The current flowing in the load circuit is sensed by the current transformer and the current is read by the power side circuit of PZEM-004T. The PZEM-004T in turn sends a command to Arduino in order to display the current flowing through the load circuit. Similarly, voltage is read by PZEM-004T and commands Arduino to display. Based on the current flowing and voltage across the load the power factor of the load circuit, power, and energy are displayed. And the power factor and frequency of the supply are displayed by the Arduino. Arduino and PZEM-004T work at lower voltage of DC supply i.e., 7 to 12V.

III.FLOW CHART

PZEM-004T is capable of measuring four interrelated electrical variables such as voltage, current, power, and energy. Arduino and other hardware can easily be interfaced with PZEM-004T using the code library. Power the board with a power supply (or we can use the AC source we are measuring) and connect the circular sensor to the board. Run the wire through the circular sensor, and it's ready to start measuring the voltage, current, and power. The current transformer senses the current flowing in the load circuit and the current is read by power side circuit of PZEM-004T. The PZEM-004T in turn sends command to Arduino. Similarly, the voltage is detected by PZEM-004T and sends command to Arduino.

Tasks can be performed by Arduino functions as it allows structuring of the programs in segments of code. The typical case for creating a function is when one must perform equivalent action multiple times during a program. Functions helped the programmer stay organized. It is special sorts of processor which is somewhat flexible so program will run faster. It has a greater speed because of integrated processor. The Arduino-UNO is used as a microcontroller to read input from PZEM-004T and display a voltage, current, power, power factor, energy and frequency on the 16×2 LCD.

A 16×2 LCD is a module which is common in various devices and circuits. In each line 16 characters can be displayed and there are 2 such lines. In LCD, an electrical current is employed to modify segments of liquid crystals from a transparent phase to a cloudy phase, each segment forming a part of variety or letter.

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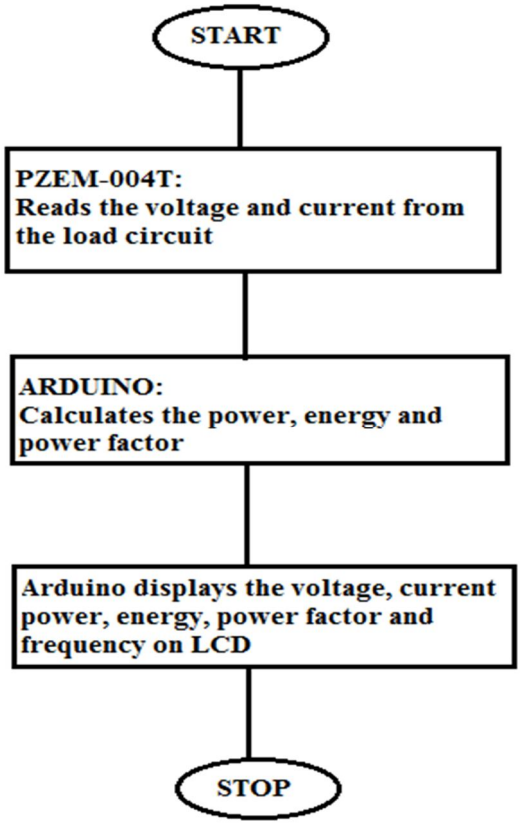


Fig. 2 shows flow chart of AC Digital multifunction meter

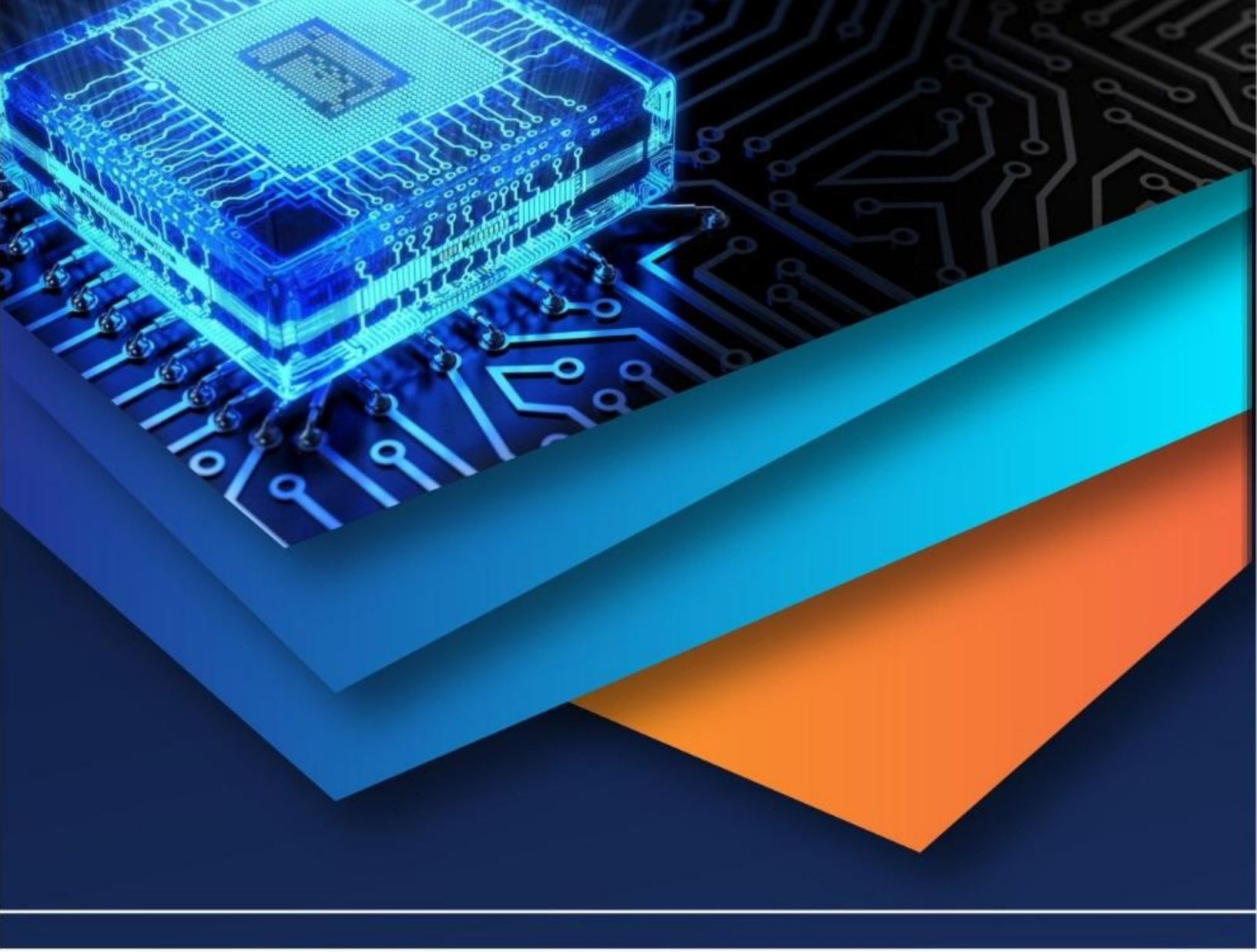
IV. CONCLUSIONS

AC Digital multi function meter is of great benefit in measuring and monitoring the voltage, current, power, power factor, energy and frequency. Different meters are used for measuring different electrical parameters, but with the design of AC Digital multi function meter it helps to measure all the electrical parameters in one unit. Thereby we can save the amount invested on different meters.AC digital multifunction meter have a greater accuracy. It is smaller in size and is a portable meter. The meter is capable of reading high ranges of current and voltage.

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