

Measurement of Variable AC Voltage through PLC

N Vinay Saketh

<https://orcid.org/0000-0002-3127-9281>, Senior Electrical Engineer, M/s. Entek Technical Services, Hyderabad, India

Abstract - In Solar Projects and Building Automation Projects the key element is integration of mains supply with solar and diesel generator power supply. Programmable Logic Controllers (PLC) are light-weight, low-cost and self-contained electronic apparatus for a wide range of industrial automation applications, these are widely used to control a simple, repetitive tasks [1]. In this paper we will build circuit, simulate and implement AC Voltage measurement using PLC. Many multi-meters and volt-meters use the same voltage divider to reduce the voltage to safe measuring voltage. Application for this circuit is Energy Management, Building Automation, Smart APFC Panel and Solar Projects.

Key Words: Analysis, EMI, Flux Density, Quick Field Software, Insulation.

1.INTRODUCTION

Measurement of AC Voltage is required in many projects relating to solar and energy management system, for achieving the AC measurement let us draw block diagram as Figure 1.1. Here PLC with HMI is used as a measuring medium for the circuit. The Auto Transformer provides the voltage between 0-270V and in our circuit we have 3 components which are AC-DC Converter, Voltage divider and Low Pass filter.

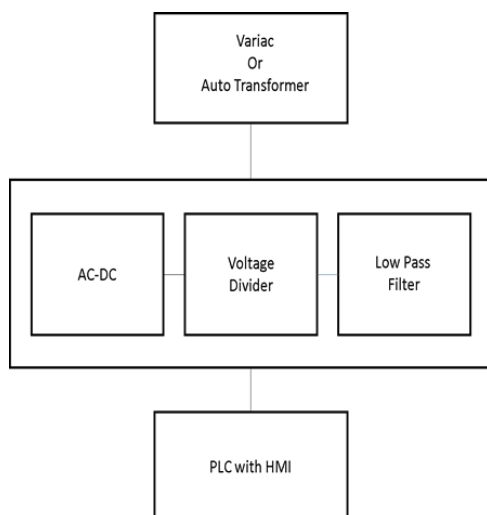


Figure 1.1: Block diagram of Project

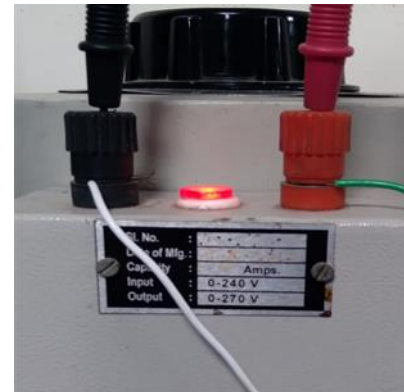


Figure 1.2: Variac

2. Circuit, PLC Simulation and Analysis

Software's used for simulation of circuit is LTSpice and PLC Programming software is selpro 5.3.7

2.1. Circuit Simulation and Analysis:

In circuit 2.2, we are converting the AC Supply to DC and then use a potential divider to reduce the voltage to 5V and then use a low pass filter to block any noise generated due to diodes. Here we are using C1 for sole purpose of isolation of AC Supply Neutral and PLC Analog Input ground, we are also using R3 as discharge resistor for C1.

For safety reasons we are decreasing the voltage from 230V to 12V, Simulation is carried on LT Spice and at the PLC Input node we are plotting the current and voltage. We get the plot as shown in Figure 2.1

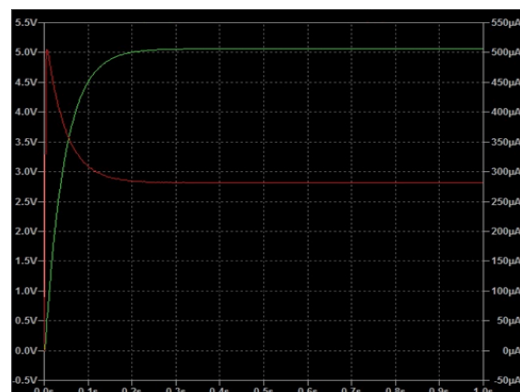


Figure 2.1: Plot of output

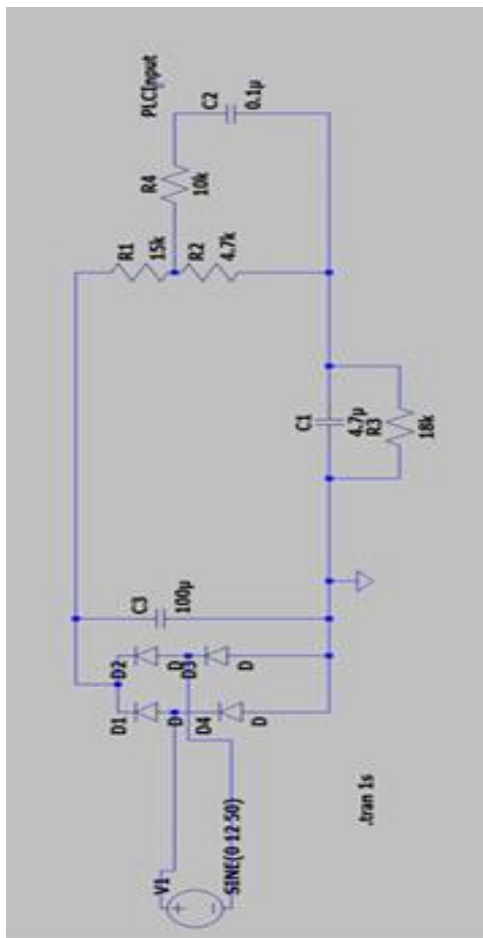


Figure 2.2: AC Measuring circuit

2.2 PLC and HMI Programming and Analysis

We are using Selec MM3030 PLC (with inbuilt HMI) and “selpro 5.3.7” software for programming of PLC, The Selec MM3030 PLC has inbuilt 02Nos configurable analog Inputs, the PLC is configured for 0-10V analog input.

The following are features of MM3030 PLC:

- PLC has
 - 10DI,
 - 8DO,
 - 2AI
- Fast Input and Output programmable logic controller
- PLC with 4-line x 16character LCD display
- Maximum 10 digital Input, 8 Output and 2 Analog input(0-20mA/0-10VDC)

- Max 3 Fast Input and 2 Fast Output Support IO expansion with Mod-bus and Proprietary Protocol



Figure 2.3: PLC with 02 Nos AI and Inbuilt HMI

The figure shows the PLC Ladder diagram for implement the AC voltage reading, here I am using a MUL function block to multiply the ADC input with a constant to make the output linear and scale it to the required value

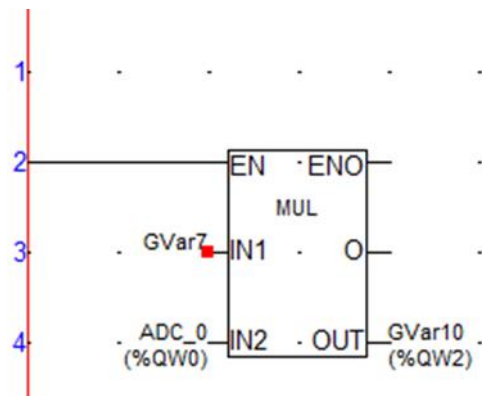


Figure 2.4: Ladder Program of Selec PLC

The figure 2.5 shows the HMI and figure 2.6 shows the configuration done in HMI



Figure 2.5: Final Screen of HMI

Numeric Text	
Tag	GVar10
Leading Zeros	<input type="checkbox"/> Yes/No
Visible Digits	2
Resolution	1
Minimum Value	0
Maximum Value	800
Mul/Div Factor	*1
Read/Write	<input type="checkbox"/> Yes/No
Blink Rate	None
Display Format	Decimal
Rounding	1
String Alignment	Right Align
Array Index	Select Index

Figure 2.6: Configuration window of HMI

ACKNOWLEDGEMENT

I want to dedicate this work to my father Late Shri Nidamarthi Venkata Subba Rao.

REFERENCES

- [1] Aldi, Basavaraj & Kadadevarmath, J & Bannibagi, Np. (2016). Design and Implementation of a PLC based Electricity Supply Switching Control System. IOSR Journal of Electrical and Electronics Engineering 2278-1676. 11. 43-50. 10.9790/1676-1103034350.

3. RESULTS

3.1 Results

In order to vary the input voltage, we have used a variac, the circuit is connected to PLC Analog Input and results are observed in Figures 3.2 and 3.3.



Figure 3.2: Output showing 180V



Figure 3.3: Output showing 240V

4. CONCLUSIONS

Hence by using voltage divider circuit we can easily measure the AC Voltage into PLC.