ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 2, Issue 12, December 2013

Design and development of three Phase AC Voltage Scanner

Somnath Ganguly[1], Joyti Mudi[2], Soumen Paul[3]

Assistant Professor, Electrical Engineering, Bankura Unnayani Inst. Of Engineering.,West Bengal, India [1]

Assistant Professor, Electrical Engineering, Bankura Unnayani Inst. Of Engineering.,West Bengal, India[2]

Assistant Professor, Mechanical Engineering, Bankura Unnayani Inst. Of Engineering, West Bengal, India[3]

ABSTRACT: In this work the device measured voltage (phase to phase & phase to neutral) of sequentially, and give the output in the form of digitally. In this work three step down transformer is used for gets the different load voltage of three phase circuit, this voltage in going analog to digital converter circuit through the bilateral switch. The bilateral switch is operated through decade counter and the counter output is depending on the astable multivibrator. The output of astable multivibrator is controlled through RC constant.

Keywords:Analog to digital converter, bilateral switch ,decade counter, astable multivibrator.

I. INTRODUCTION

Most of the electrical power generated in the world today is three-phase. Three phase power was first conceived by Nikola Tesla. In the early days of electric power generation,Tesla not only led the battle concerning whether the nation should be powered with low-voltage direct current or high-voltage alternating current, but he also proved that three-phase power was the most efficient way that electricity could be produced, transmitted, and consumed.

In our work so far, we have considered both normal and abnormal (short circuit) operations of power system under completely balanced (symmetrical) conditions. Under such operation the system impedance in each phase is identical and the three phase voltage and current throughout the system are completely balanced, i.e. they have equal magnitude in each phase and are progressively displaced in time phase by 120^0(phase a leads/lags phase b by 120^0 and phase b leads or lag phase c by 120^0). In a balanced system analysis can be proceed on the single phase basis. The knowledge of voltage and current in one phase is sufficient to completely determine voltages and currents in the other two phases. Real and reactive powers are simply three times the corresponding per phase values.

The system operation may also become unbalanced when loads are unbalanced as in the +'
46+ presences of large single phase loads. Analysis under unbalanced conditioned has to be carried out on a three phase basis. Due to the unbalanced of the loads of the systems, the value of currents has been changed and also the voltage magnitude has changed. In this work the device measured the differential voltage (phase to phase or phase to neutral) of three phases sequentially, and gives the output in the form of digitally.

II.BLOCK DIAGRAM OF PROPOSAL MEASUREMENT SCHEME

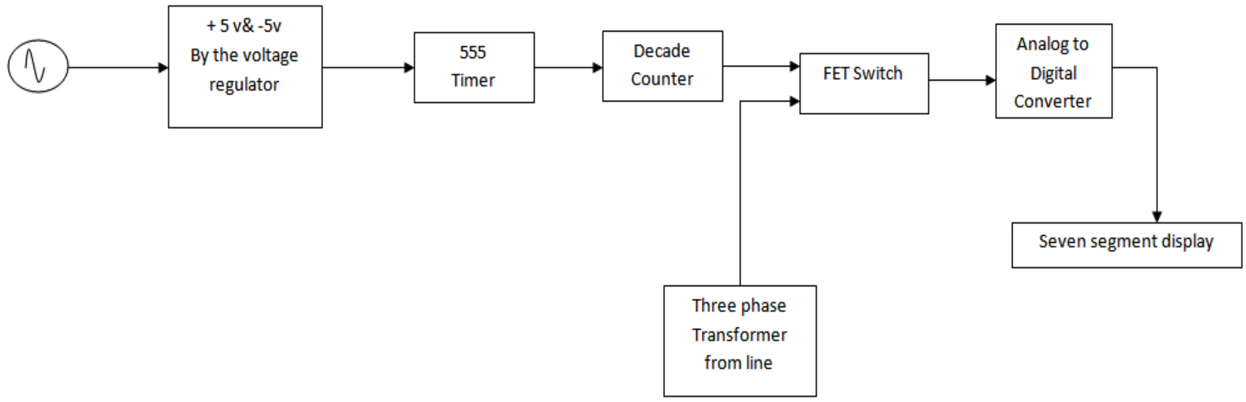
In this voltage measurement scheme the seven block are represents the whole works (fig. 2). The first block is ± 5 V DC converter unit, this converter is converted 220 V AC to ± 5 V DC by the 7805 and 7905 ICs. The second block represent 555 timer in which the Astable Multivibrator is used by the suitable arrangement of the capacitor and register, that timer output is going on next block i.e. decade counter used as 4017 IC. The pulse of decade counter is going on the FET/bilateral switch i.e 4016 IC, that is connect with the three phase step down transformer. The output of 4016 IC is going on Analog to Digital converter in here 40 pin 7107 IC is used which convert analog to digital out puti.e display by the seven segment display. Each component of all blocks are derived in below:

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

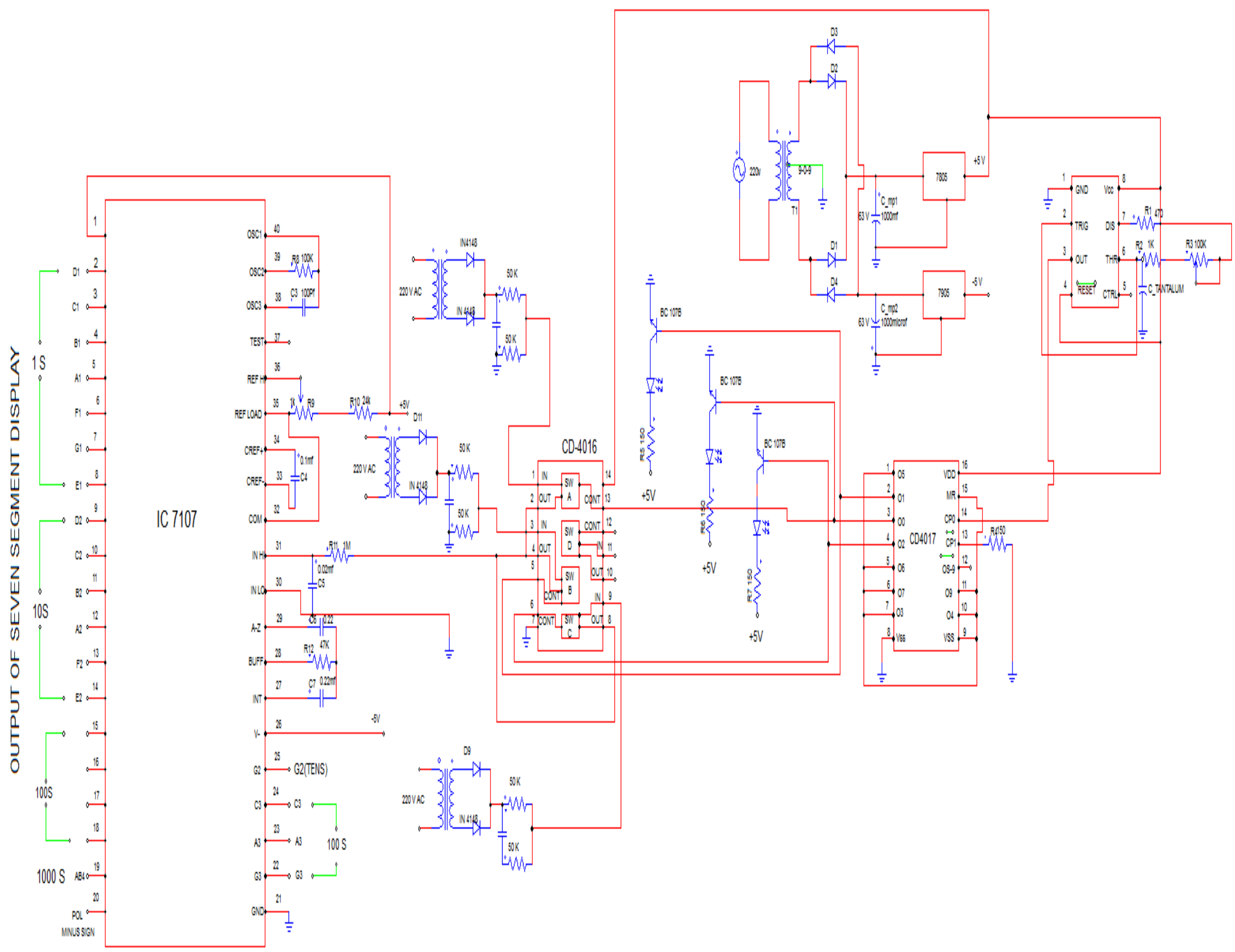
International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 2, Issue 12, December 2013



III. WORKING CIRCUIT DIAGRAM



ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 2, Issue 12, December 2013

IV.RESULT& ANALYSIS OF THREE PHASE VOLTAGE SCANNER

INPUT VOLTAGE OF THE CIRCUIT			OUTPUT VOLTAGE OF THE CIRCUIT			% of Error In output voltage		
R Phase(volt)	Y Phase(volt)	B Phase(volt)	R Phase(volt)	Y Phase(volt)	B Phase (volt)	RPhase=(output-input)/100	YPhase=(output-input)/100	BPhase =(outputinput)/100
232	**234**	**236**	**234**	**236**	**236**	**0.02**	**0.02**	**0.00**
236	**236**	**234**	**239**	**239**	**235**	**0.03**	**0.03**	**0.01**
230	**233**	**227**	**233**	**230**	**229**	**0.03**	**-0.03**	**0.02**
226	**227**	**228**	**227**	**231**	**229**	**0.01**	**0.04**	**0.01**
228	**229**	**230**	**229**	**230**	**231**	**0.01**	**0.01**	**0.01**
230	**235**	**232**	**232**	**235**	**234**	**0.02**	**0.00**	**0.02**
228	**226**	**230**	**230**	**230**	**232**	**0.02**	**0.04**	**0.02**
230	**228**	**228**	**233**	**231**	**231**	**0.03**	**0.03**	**0.03**

When the input voltage of the circuit in R phase,Y phase and B phase are 232 volt,234 V and 236 V then the output voltage may be in R phase,Y phase and B phase are 234 V,236 V and 236 V.The percentage of error are calculated in three phase i.e in R phase,Y phase and B phase are 0.02%,0.02% and 0.00%.similarly when voltage varies in three phase i.e in R phase,Y phase and B phase(R phase 236 V,Y phase 236 V and 234 V) the output voltage of the circuit changes rapidly i.e in R phase,Y phase and B phase(R phase 239 V,Y phase 239 V and 235 V) and the percentage of error are taken as in R phase=0.03%,Y phase=0.03% and B phase=0.01%.similarly observed that changing the input values of R phase,Y phase and B phase,the output value changes and the percentage error increasing or decreaing with the reference of input.

V.OUTPUT ANALYSIS OF THE THREE PHASE VOLTAGE SCANNER

In this works the outputs is analysis through statistical sample analysis.

In A.C voltage measurement are made to evaluate the repeatability of the AC voltage coming out of a seven segment display. The data will compute the mean value and standard deviation for the voltage data listed below.

Measurement	Output of R phase voltage	Output of Y phase voltage	Output of B phase voltage
1	**234**	**236**	**236**
2	**239**	**239**	**235**
3	**233**	**230**	**229**
4	**227**	**231**	**229**
5	**229**	**230**	**231**
6	**232**	**235**	**234**
7	**230**	**230**	**232**
8	**233**	**231**	**231**

The sample mean for R phase is computed to be

$$\overline{V_R} = \frac{1}{8}(234 + 239 + 233 + 227 + 229 + 232 + 230 + 233)V_{ac}$$

$$= \frac{1857V_{ac}}{8}$$

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 2, Issue 12, December 2013

$$= 232.125V_{ac}$$

and the differences between the measured values and the mean value are

$$V_{R_1} - \overline{V_R} = (234 - 232.125)V_{ac} = 1.875V_{ac}$$
$$V_{R_2} - \overline{V_R} = (239 - 232.125)V_{ac} = 6.875V_{ac}$$
$$V_{R_3} - \overline{V_R} = (233 - 232.125)V_{ac} = 0.875V_{ac}$$
$$V_{R_4} - \overline{V_R} = (227 - 232.125)V_{ac} = -5.875V_{ac}$$
$$V_{R_5} - \overline{V_R} = (229 - 232.125)V_{ac} = -3.125V_{ac}$$
$$V_{R_6} - \overline{V_R} = (232 - 232.125)V_{ac} = -0.125V_{ac}$$
$$V_{R_7} - \overline{V_R} = (230 - 232.125)V_{ac} = -2.125V_{ac}$$
$$V_{R_8} - \overline{V_R} = (233 - 232.125)V_{ac} = 0.875V_{ac}$$

The standard division is

$$S_v = \sqrt{\frac{1}{8}[(1.875)^2 + (6.875)^2 + (0.875)^2 + (-5.875)^2 + (-3.125)^2 + (-0.125)^2 + (-2.125)^2 + (0.875)^2]V_{ac}}$$

$$= \sqrt{\frac{101.115}{8}V_{ac}}$$

$$= 3.555V_{ac}$$

And the standard division of the mean value is

$S_{\bar{v}} = \frac{S_v}{\sqrt{8}} = \frac{3.555V_{ac}}{\sqrt{8}} = 1.257V_{ac}$.

The sample mean for **Y** phase is computed to be

$$\overline{V_Y} = \frac{1}{8}(236 + 239 + 230 + 231 + 230 + 235 + 230 + 231)V_{ac}$$
$$= \frac{1862V_{ac}}{8}$$
$$= 232.75V_{ac}$$

and the differences between the measured values and the mean value are

$$V_{Y_1} - \overline{V_Y} = (236 - 232.75)V_{ac} = 3.25V_{ac}$$
$$V_{Y_2} - \overline{V_Y} = (239 - 232.75)V_{ac} = 6.25V_{ac}$$
$$V_{Y_3} - \overline{V_Y} = (230 - 232.75)V_{ac} = -2.75V_{ac}$$
$$V_{Y_4} - \overline{V_Y} = (231 - 232.75)V_{ac} = 1.75V_{ac}$$
$$V_{Y_5} - \overline{V_Y} = (230 - 232.75)V_{ac} = -2.75V_{ac}$$
$$V_{Y_6} - \overline{V_Y} = (235 - 232.75)V_{ac} = 2.25V_{ac}$$
$$V_{Y_7} - \overline{V_Y} = (230 - 232.75)V_{ac} = -2.75V_{ac}$$
$$V_{Y_8} - \overline{V_Y} = (231 - 232.75)V_{ac} = 1.75V_{ac}$$

The standard division is

$$S_v = \sqrt{\frac{1}{8}[(3.25)^2 + (6.25)^2 + (-2.75)^2 + (1.75)^2 + (-2.75)^2 + (2.225)^2 + (-2.75)^2 + (1.75)^2]V_{ac}}$$

$$= \sqrt{\frac{83.384}{8}V_{ac}}$$

$$= 3.228V_{ac}$$

And the standard division of the mean value is

$S_{\bar{v}} = \frac{S_v}{\sqrt{8}} = \frac{3.228V_{ac}}{\sqrt{8}} = 1.141V_{ac}$.

The sample mean for **B** phase is computed to be

$$\overline{V_B} = \frac{1}{8}(236 + 235 + 229 + 229 + 231 + 234 + 232 + 231)V_{ac}$$

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 2, Issue 12, December 2013

$$= \frac{1857V_{ac}}{8}$$
$$= 232.125V_{ac}$$

and the differences between the measured values and the mean value are

$$V_{B_1} - \overline{V_B} = (236 - 232.125)V_{ac} = 3.875V_{ac}$$
$$V_{B_2} - \overline{V_B} = (235 - 232.125)V_{ac} = 2.875V_{ac}$$
$$V_{B_3} - \overline{V_B} = (229 - 232.125)V_{ac} = -3.125V_{ac}$$
$$V_{B_4} - \overline{V_B} = (229 - 232.125)V_{ac} = -3.125V_{ac}$$
$$V_{B_5} - \overline{V_B} = (231 - 232.125)V_{ac} = -1.125V_{ac}$$
$$V_{B_6} - \overline{V_B} = (234 - 232.125)V_{ac} = 1.875V_{ac}$$
$$V_{B_7} - \overline{V_B} = (232 - 232.125)V_{ac} = -0.125V_{ac}$$
$$V_{B_8} - \overline{V_B} = (231 - 232.125)V_{ac} = -1.125V_{ac}$$

The standard division is

$$S_v = \sqrt{\frac{1}{8}[(3.875)^2 + (2.875)^2 + (-3.125)^2 + (-3.125)^2 + (1.125)^2 + (1.875)^2 + (-0.125)^2 + (-1.125)^2]V_{ac}}$$
$$= \sqrt{\frac{48.71}{8}V_{ac}}$$
$$= 2.467V_{ac}$$

And the standard division of the mean value is

$S_{\bar{v}} = \frac{S_v}{\sqrt{8}} = \frac{2.467V_{ac}}{\sqrt{8}} = 0.872V_{ac}$.

VI.CONCLUTION

In this works the device is measured analog a.c voltage value of the three phase system,to convert digital value. In this measurement one analog to digital converter i.c 7107 is used,thisic has 40 pin and output is tuned or calebrated through external RC circuit.Input of the i.c come through the step down transformer through the bilateral switch. The bilateral switch i.c 4016 is operated through decade counter i.c 4017 and the counter output is depending on the astable multivibrator. The output of astable multivibrator is controlled through RC constant.

REFERENCES

[1] Gulati, K., “A low-power reconfigurable analog-to-digital converter” Published in: Solid-State Circuits, IEEE Journal of (Volume:36 , Issue: 12) Page(s): 1900 – 1911 of 2001.
[2] YalinRen, “A mismatch-independent DNL pipelined analog-to-digital converter” Published in: Circuits and Systems II: Analog and Digital Signal Processing, IEEE Transactions on (Volume:46 , Issue: 5) Page(s): 517 – 526 of 1999.
[3] Tritschler, A, “A Continuous Time Analog-to-Digital Converter With 90µW and 1.8µV/LSB Based on Differential Ring Oscillator Structures” Published in: Circuits and Systems, 2007. ISCAS 2007. IEEE International Symposium onPage(s): 1229 – 1232 of 2007.
[4] Mutoh, A, “Noise immunity characteristics of integral analog-to-digital converter including voltage-to-frequency converter for noise on power-supply-lines” Published in: Electromagnetic Compatibility, 2003. EMC '03. 2003 IEEE International Symposium on (Volume:1) Page(s): 497 - 500 Vol.1.
[5] Sing Chang, “A new astable direct-coupled multivibrator” Published in: Proceedings of the IEEE (Volume:58 , Issue: 8) Page(s): 1278 – 1279 of 1970.
[6] Stan, M.R., “Synchronous up/down counter with clock period independent of counter size” Published in: Computer Arithmetic, 1997. Proceedings., 13th IEEE Symposium on, Page(s): 274 – 281,
[7] Ko-Chi Kuo, “A 2.4-GHz/5-GHz Low Power Pulse Swallow Counter in 0.18-µm CMOS Technology” Published in: Circuits and Systems, 2006. APCCAS 2006. IEEE Asia Pacific Conference on Page(s): 214 - 217
[8] Fouad, Laila F., “Temperature effect on the performance characteristics of beta rays open air corona streamer counter ” Published in: Industry Applications, IEEE Transactions on (Volume:32 , Issue: 2) Page(s): 221 – 226 of 1996.
[9] Gupta, V.D. ; Rao, B.S., “Design of an emitter coupled transistor astable multivibrator” Published in: Electronic and Radio Engineers, Proceedings of the Indian Division of the Institution of (Volume:6 , Issue: 2) Page(s): 39 – 47 of 1968.