Development and investigation of an electronic system for managing of independent single - phase inverters

Svetoslav Bachiyski, Snezhinka Zaharieva

Development and investigation of an electronic system for managing of independent single-phase inverters: *The developed electronic system has good output parameters, high quality and low price. The facts confirmed that of the developed electronic system has workability in laboratory and industrial circles. The developed device is easily constructible and easy to maintain which is excellent for the needs of the mass market. The main advantage of the developed electronic system is a low cost of logic and electronic components, and the absence of microprocessor systems further contribute to the reduction of the price.*

Key words: *inverter, single-phase inverter, electronic system for managing single-phase inverters*

INTRODUCTION

With the development of technology and renewable energy sources more often needs requires the use of inverters. Especially they apply within photovoltaic system, as their price falls more and they enter mass at ordinary consumers. The needs of high-quality and cheap inverters increases with each passing day, which pushes the boundaries in the development of this type of electronic devices [1,2].

BLOCK SCHEME OF AN ELECTRONIC SYSTEM FOR MANAGING OF INDEPENDENT SINGLE - PHASE INVERTERS

The block scheme of the developed electronic system for managing of independent single - phase inverters is shown of fig.1.

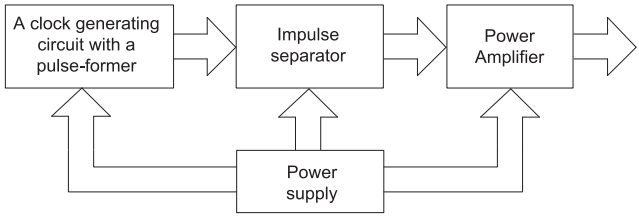

Fig.1 Block scheme of an electronic system for managing of single - phase inverters

Description of the main blocks: *A clock generating circuit with a pulse-former* – highly stable device for generating accurate oscillation with special form; *Impulse separator* – it separates impulses from the clock generator to even and odd series needed for next devices; *Power Amplifier* – amplifies the signal and separates power devices from the control devices; *Power supply* – supplies highly fixed-voltage needed for the control system.

SIMULATION RESEARCH OF THE MAIN BLOCKS OF AN ELECTRONIC SYSTEM FOR MANAGING OF INDEPENDENT SINGLE - PHASE INVERTERS

Simulations on the work of all main blocks are made in Micro-Cap.

- **Simulation research of the clock generating circuit with a pulse-former**

On fig.2 is shown principal scheme of the clock generating circuit with a pulse former, realized with integrated circuit LM555. The electronic system for managing single-phase inverters is designed to work at frequency f = 50 Hz (20ms). Necessary frequency from the generator for normal work of the system is 2f (10ms), because every pulse formed a half

period. For the system is used standard capacitor C = 1μF.

On fig.3 is shown simulation output of the clock generating circuit with a pulse-former, which accurately match with the calculated values (1), (2), (3).

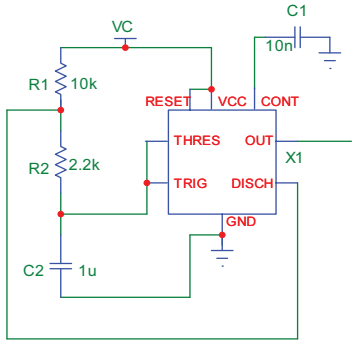

Fig.2 Principal scheme of the clock generating circuit with a pulse-former

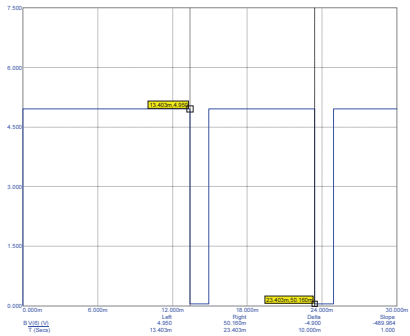

Fig.3 Simulation output of the clock generating circuit with a pulse-former

A duty cycle of δ = 0,85 is used in the device to work as a pulse-former.

$T = t_1 + t_2$ (1)

where: t_1 – Time to charge;

t_2 – Time to discharge.

Defining the time to charge and discharge:

$t_1 = T.\ \delta = 10.0{,}85 = 8{,}5$ ms (2)

where: δ – a duty cycle

$t_1 = T\ (1 - \delta) = 10\ .\ 0{,}15 = 1{,}5$ ms (3)

- ***Simulation research of the impulse separator***

The impulse separator is shown on fig.4, it is a logic gate which separate pulses with a set order to the next device.

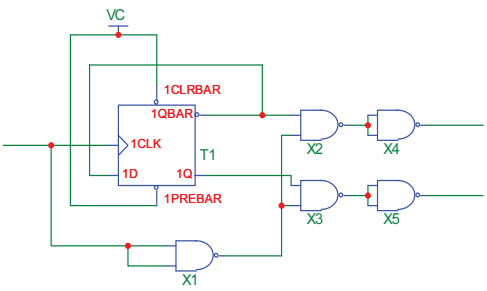

Fig.4 Principal scheme of the impulse separator

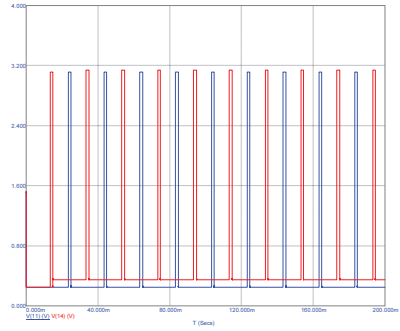

Fig.5 Simulation output of the impulse separator

Main function of the device is to group pulses from the generator to even and odd series on two outputs [3].

On fig.5 are shown output pulses from the separator which are grouped as even – blue and odd – red.

- ***Simulation research of the power amplifier***

Power amplifier (fig.6) increases the level of the signal and separates power devices from the control devices. For the need of the electronic system for managing single-phase inverters power amplifier is designed with two transistors.

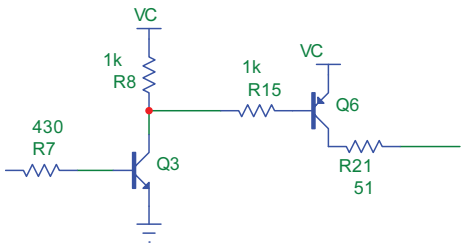

Fig.6 Principal scheme of the power amplifier

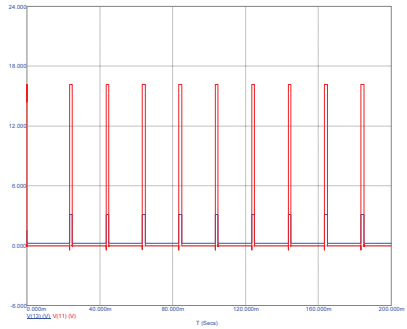

Fig.7 Simulation output of the power amplifier

On fig.7 is shown output characteristics of the power amplifier with red color while with blue is shown input signal.

The results of the simulation research accurately match with tested ones.

The developed electronic system for managing single-phase inverters and work of inverters is shown on fig. 8.

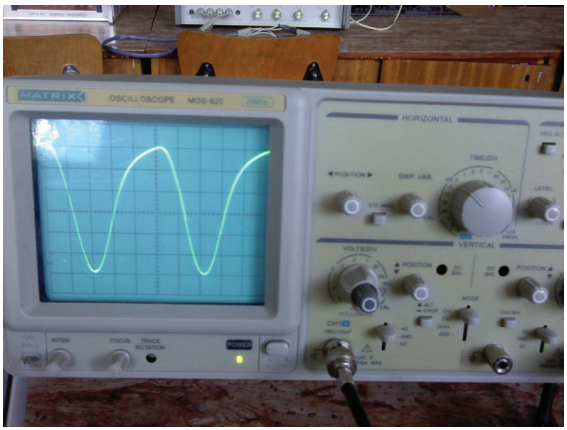

Fig.8 Photos of the developed electronic system for managing single-phase inverters

CONCLUSION

The developed electronic system for managing single-phase inverters has good output parameters, high quality and low price. The facts confirmed that of the developed electronic system has workability in laboratory and industrial circles.

The developed device is easily constructible and easy to maintain which is excellent for the needs of the mass market.

The main advantage of the developed electronic system is a low cost of logic and electronic components, and the absence of microprocessor systems further contribute to the reduction of the price.

References

[1] Evstatiev I., A.Levi. Analogue electronics. University of Ruse “Angel Kanchev”, Ruse, 2013.

[2] Evstatiev I. Operation algoritham and structure of an electronic system for control of an autonomous PV installation. Proceedings Electrical Engineering, Electronics, Automation of University of Ruse “Angel Kanchev”, Ruse, 2011.

[3] Nikolov N., M. Bobcheva. Industry electronics. Tehnika, Sofia, 2005.

Contacts:

Eng. Svetoslav Bachiyski, University of Ruse “Angel Kanchev”, Department of Electronics, e-mail: iper1990@abv.bg

PhD M.Eng. Snezhinka Zaharieva, University of Ruse “Angel Kanchev”, Department of Electronics, tel.: +35982888518, e-mail: szaharieva@uni-ru.acad.bg

"Този доклад е публикуван с финансовата подкрепа на проект по ФНИ 13-ФЕЕА-03"

Докладът е рецензиран.