

# Photovoltaic System in System LABI

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**Abstract:** There is prepared a new model marked as DE10 to extend the system LABI. It is a photovoltaic system. Utilizing of model is into the field of university studying and as a pilot test system for all external experts. A special part of model are measurement and control system. Mechanical configuration can use a track system to control of position according to run of sun. In the future period new photovoltaic panels can be added into model. The user can study power of sun energy, efficiency of photovoltaic principles, dependence of position on power during day.

**Key-Words:** Sun energy, automation, photovoltaic system, measurement.

## 1 Introduction

The experiment laboratory system LABI [1,2] is extended of a new real system - photovoltaic laboratory experiment system of DE10. These days there are installed a lot of photovoltaic devices to produce electrical energy. The experimental model DE10 is a small photovoltaic system of area about 0,5 m<sup>2</sup>.

The preparing has three aspects. The system is equipped with a specific measurement and control subsystem. Very interesting part of DE10 is a track subsystem for studying the function of rotation. The remote access is realized in the way of Internet through PC or PDA technique.

## 2 Description of the model

The main functions of the DE10 are the control of position of photovoltaic (PV) panel according to position of sun in the day and studying of efficiency of energy production.

The scheme of the system is in fig.1. The one has three parts: solar PV cells as the PV panel, mechanical construction and measurement and control system.

At the present time there is used the PV panel with monocrystal technology and materials. The area is 1x0,45 m and the power 60 W. In the next time there is going to extend the panel area by a panel with concentrated PV cells. Then model DE10 will serve for study two kinds of PV cells.

The mechanical construction is based on a tracker system. It is a two-axis rotation system. The azimuth position is from 0 to +/- 90°. The elevation position is in the range from 0 to 90°. The tracker system is set on two mechanical gearboxes for azimuth and elevation with a ratio 1:80. The motors are for both axes and used step motors. The view of all mechanical system is in fig.2.

The measurement and control system is a main part

of DE10. The one is used to give a measured date, to control of position in different modes and to connect into network of Internet.

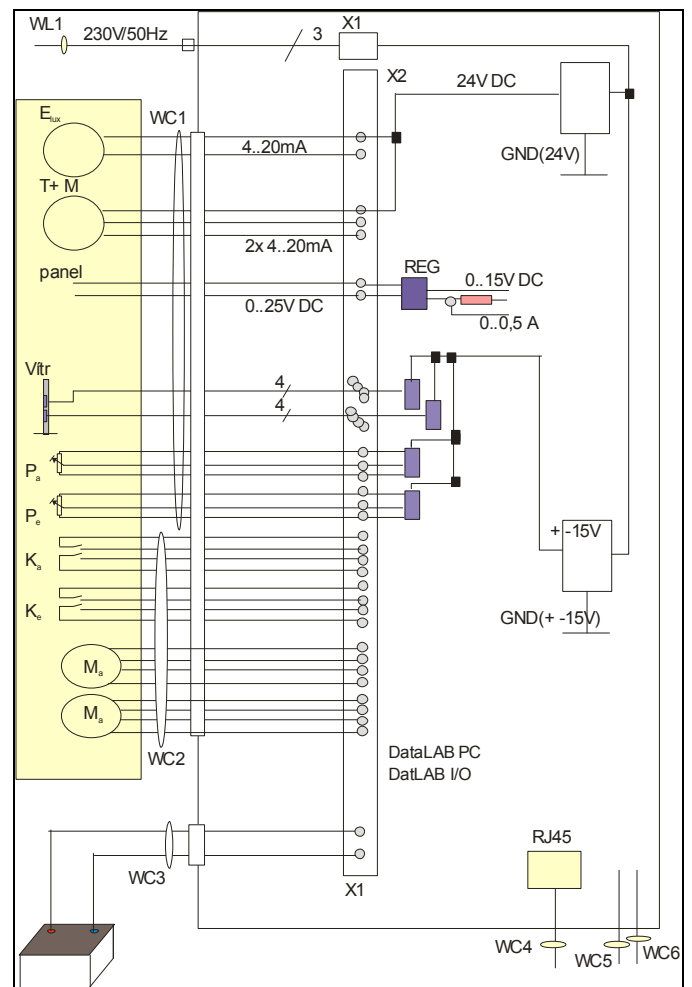


Fig. 1. Scheme of the system DE10

The measured date is:

- Global energy flow from sun radiation for the panel position.
- Direction and force of wind.
- Temperature and moisture of ambient area (range - 40 to +50°C and 0 to 100%).
- Azimuth and elevation position (range 0 to 360° and 0 to 50 km/h).
- End position of azimuth and elevation (range 0 to +/- 90° and 0 to 90°).
- Output voltage of panel and battery (0 to 25 V).
- Current from the PV panel (0 to 3A)

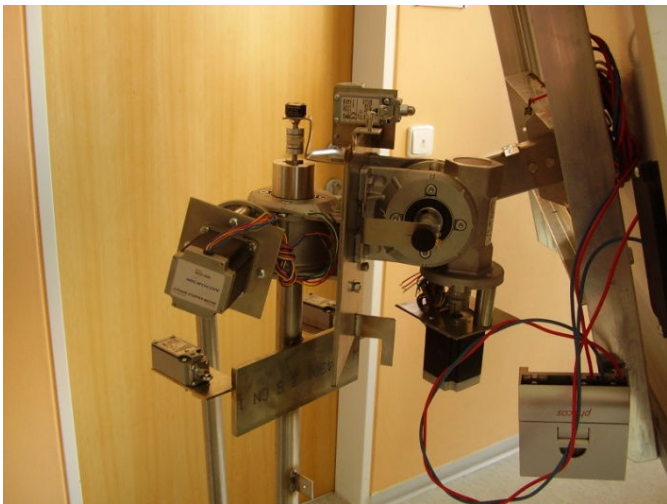


Fig. 2. Photo of the track system of DE10

### 3 Using of the DE10 system

The system DE10 offers the user to study of photovoltaic principle, to test of efficiency of production of electrical energy, to learn the track system according to theoretical side and to practical realization. The all offer is accessed via the Internet.

Combination of hardware and software give the possibility of remote using. The web side [www.labi.fai.utb.cz](http://www.labi.fai.utb.cz) is prepared to access of user.

The first step gives generally information about the system, see fig.3. The user sees the view the automatical regime. It is, the system works automatically according to algorithm of external control.

In the screen the user shows measured date of PV system in the currently time. The one can see two graphs of measured date. There are the time graphs of all value. The date of the automatical function are saved in the system too. The user can download its in his computer and post evaluate in the Excel. The file in format \*.csv is transformed in Excel, date can be calculated in tables, in graphs, according to statistic parameters etc. The results will use in education, in advertising by pilot using.

### 4 Conclusion

The experimental laboratory system is a result of development and solving the experiment laboratory photovoltaic system. Next the local control system is the possibility to connect into the Internet and to remote access. The realized project has using as a pilot plant. The photovoltaic system is built as a new next model DE10 in the system LABI, it is very suited to education of problems of technical means and automation theory. The system will be used in professional field. These days there are very positive experiences of laboratory exercises with remote access.

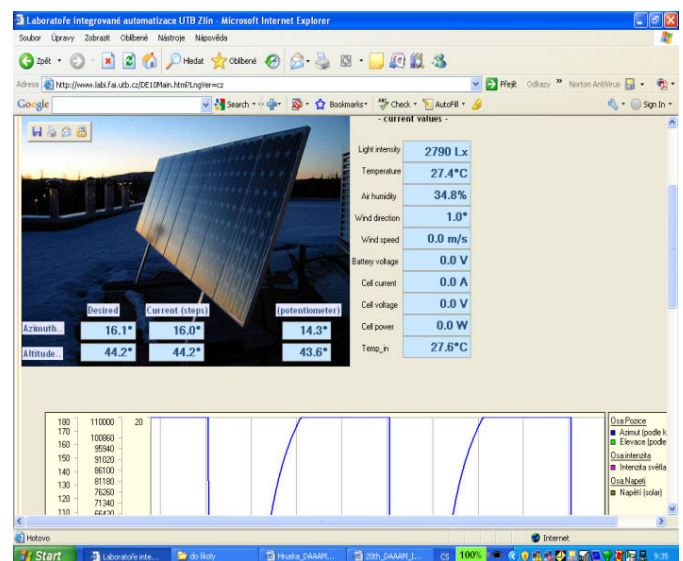


Fig. 3. The first side of URL [www.labi.fai.utb.cz](http://www.labi.fai.utb.cz)

The experiment DE10 has solved several special problems. In the first position there is two axis tracker system for set position of photovoltaic panel according the position of sun. A special development was used for measurement of direction and force of wind. The remote access has developed other function and uses connection in PDA clients.

### Acknowledgement

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