# Raspberry Pi Measurement Electronics: hardware and software

*By Yury Magda*

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A popular Raspberry Pi miniature computer is often used for designing measurement and control systems by professionals and hobbyists. Such systems can be driven via a general-purpose input/output port (GPIO) with pins accessible through header J8 on the Raspberry Pi board. With GPIO, user applications can process signals from various sensors and control external loads (relays, motors, etc.).

This book is thought as a highly practical guide which can help the readers to design measurement and control systems based upon the Raspberry Pi. These systems can comprise external electronic circuits controlled by programs written in Python. Projects described in the book illustrate processing digital and analog signals and using I/O expanders. Since many measurement systems process analog signals, the guide contains a brief theory and practical applications dedicated to use of popular high-resolution Analog-To-Digital converters. The guide contains projects which illustrate processing small signals with instrumentation amplifiers and measuring frequencies of digital and analog signals using high-precision Frequency-To-Voltage converters.

The material of the book also covers digital signal synthesis with digital potentiometers and Digital-To-Analog converters. The readers will find practical designs of digitally programmable wide-band oscillators, signal amplifiers and PWM circuits. The guide describes practical aspects of interfacing and programming high-precision wide-band sinusoidal, triangular and rectangular waveform generators using popular high-resolution Direct Digital Synthesizer chips AD9833 and AD9850.

Part of the material of the book is dedicated to designing real-time applications using a Raspberry Pi board and very low-cost but highly effective MSP-EXP432P401R™ LaunchPad by Texas Instruments. The book contains practical examples of applications processing digital and analog signals in real time.

Most projects described in the book can be improved or modified if necessary. Each project includes the circuit diagram accompanied by the source code with the detail explanation. All projects were designed using Raspberry Pi Model B Rev.2 and Raspberry Pi 2 boards running Raspbian OS. The program code for MSP-EXP432P401R LaunchPad was developed using free Energia MT IDE.

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