

# UNIVERSAL CONTROL FOR STEPPER MOTORS

With good-quality stepper motors widely available at reasonable cost, this flexible, computer-driven, control board will make it rather hard to hold on to the belief that stepper motors are the exclusive realm of industrial electronics. If you are suspicious about "universal", just glance at the specifications table below; if you are into industrial electronics, well...

Stepper motors come in an astounding variety of types and sizes, and they are frequently spotted these in electronic machine tools and on hobby robots. Steve Conroy has suggested using a home construction to produce one of a number of its original parts. However the number of steps coming from the device, and the fact that it is often found for more difficult to get going than a simple servo motor, more often than not causes the perplexed owner to carefully put his poor possession in the junkbox, together with other "possibly useful" materials.

In *Stepping Motors*, Cliveur Electronics (April 1980), the general methods were described for the design of stepper motors. Also that article provides a useful discussion of stepper motor terminology used further on in this article.

The main specifications of the proposed control board are contained in the shaded table on this page. The board is readily tailored to suit the user's requirements, but it should be made quite clear at the onset that each of the following sections is to be read closely to be able to decide on the most desirable circuit configuration for a specific application. A detailed discussion of each of the technical features is, therefore, indispensable for a good understanding of the operation of this fully reconfigurable lower-level board between computer and, for instance, robot limbs, a photograph, or a glider.



## Stepper motors: some problems

The following is a necessarily brief discussion of the main difficulties to be overcome when using stepper motors.

**Limited speed range:** The motor windings constitute an inductive load, which limits the maximum speed of the coil current. Also, the winding's permanent magnet rotor causes an inductive voltage which further reduces the responsiveness. These effects limit the maximum achievable step rate (also *pull-in rate*), but can be overcome by utilizing system drive control.

**Resonance:** the undamped character of a stepper motor operating at a relatively low step rate causes its movement to be rather halting. The upper waveforms here in Fig.1 show the considerable overshoot after each step. Should the step frequency equal that of the undamped oscillations, resonant oscillatory motion, resulting in a powerful, jerky movement of the spindle. Mechanical damping devices have been developed to ensure a smoother spindle movement, but these permanent loads typically cause the already low efficiency of the stepper motor to fall below the acceptable level.

The lower waveforms here shown in Fig.1, provide evidence for the proposition that micro-step operation can provide a marked improvement in linear spindle movement,

## Technical specifications

Driver capacity: Max motor types:	one 6 phase bipolar type, two 3 phase bipolar type, and 8 phase unipolar type, two 4 phase unipolar type.
Max output current:	1.250A (max) 1 A (typical) 1.250A (max) 2 A (typical) Inductance-controlled pulse and 50 mA current flow detectors.
Driver type:	Brushless, steady current supplies.
Output I/O:	8 bit data input and 2 bit handshaking or Centronics standard.
Speed:	10 - 25,000 with 1.250A (max) 10 - 40,000 with 1.250A (max) Regulation not required.

# Elektor Stepper Motor Control

**Kathleen Armour**



## **Elektor Stepper Motor Control:**

**308 Circuits** Jan Buiting, 2003 This is the ninth in the 300 series of circuit design books again contains a wide range of circuits tips and design ideas The book has been divided into sections making it easy to find related subjects in a single category The book not only details DIY electronic circuits for home construction but also inspiring ideas for projects you may want to design from the ground up Because software in general and microcontroller programming techniques in particular have become key aspects of modern electronics a number of items in this book deal with these subjects only Like its predecessors in the 300 series 308 Circuits covers the following disciplines and interest fields of modern electronics test and measurement radio and television power supplies and battery chargers general interest computers and microprocessors circuit ideas and audio and hi fi SMPTE Journal Society of Motion Picture and Television Engineers, 1991-07 **Indian Science Abstracts** , 1997-11 **PC Interfaces Under Windows** Burkhard Kainka, Hans-Joachim Berndt, 2001 While it was relatively easy to directly access PC interfaces using a DOS computer under Windows things are not all that simple This book shows you how it can be done The construction and operation of programs and circuits for the following applications are extensively described control circuits measurement equipment analogue digital converters EPROM programmer storage oscilloscope I2C applications making measurements with the Sound card making measurements with a video capture card asynchronous serial data transmission and many more In addition to exact practically oriented descriptions of the traditional PC interfaces what can they do and how they are addressed via software the authors describe the DIY construction and programming of a number of highly interesting circuits all of which can be connected to the PC ports It is not necessary to open up the PC for any of these projects The applications described in this book are based on 32 bit operating systems Windows 95 98 and later The preferred programming languages are Visual Basic and Delphi The CD ROM contains all the example programs in VB5 Delphi 3 or 4 with all source files in executable forms PORT DLL is also included In addition there are two complete application programs COMPUNI EXE a universal interface application program and SSCAN EXE a complete oscilloscope application for the sound card Audio Amateur , 1992 BAV Rundbrief Berliner Arbeitsgemeinschaft für veränderliche Sterne, 1990 Electronics World , 1997 Electrical & Electronics Abstracts , 1988

Motor Control - Projects with Arduino & Raspberry Pi Zero W Dogan Ibrahim, 2017

## **Stepper Motors :**

**Fundamentals, Applications And Design** V. V. Athani, 1997 This Is The First Indian Publication Devoted Solely To Stepper Motors It Covers All Aspects Of Stepper Motors Construction Operation And Characteristics Of Stepper Motors Electronic As Well As Microprocessor Based Controllers For Stepper Motors Stepper Motor Applications In Control Instrumentation Computer Peripheral Devices Cnc Systems Robotics Etc And Stepper Motor Analysis And Design Furthermore The Book Contains Certain Special Features Which Have Appeared Perhaps For The First Time In A Book Of This Nature Such As The Latest Remp Disk Magnet Stepper Motor Micros Tepping Controller Etc Certain Indian Contributions To Stepper Motor

Controller Technology Have Been Highlighted In Microprocessor Based Controllers For Stepper Motor For Practising Engineers And Students Selection And Sizing Of Stepper Motor Has Been Discussed In Detail And Illustrated With Typical Illustrative Examples

**Analysis of a Stepper Motor Control System** Jean-Michel H. Hardy,1963

**Motors for Makers** Matthew Scarpino,2015-11-26 The First Maker Friendly Guide to Electric Motors Makers can do amazing things with motors Yes they re more complicated than some other circuit elements but with this book you can completely master them Once you do incredible new projects become possible Unlike other books Motors for Makers is 100% focused on what you can do Not theory Making First Matthew Scarpino explains how electric motors work and what you need to know about each major type stepper servo induction and linear motors Next he presents detailed instructions and working code for interfacing with and controlling servomotors with Arduino Mega Raspberry Pi and BeagleBone Black All source code and design files are available for you to download from [motorsformakers.com](http://motorsformakers.com) From start to finish you ll learn through practical examples crystal clear explanations and photos If you ve ever dreamed of what you could do with electric motors stop dreaming and start making Understand why electric motors are so versatile and how they work Choose the right motor for any project Build the circuits needed to control each type of motor Program motor control with Arduino Mega Raspberry Pi or BeagleBone Black Use gearmotors to get the right amount of torque Use linear motors to improve speed and precision Design a fully functional electronic speed control ESC circuit Design your own quadcopter Discover how electric motors work in modern electric vehicles with a fascinating inside look at Tesla s patents for motor design and control

Stepping Motors P. P. Acarnley,1982

**Stepping Motors and Their Microprocessor Controls** Takashi Kenjō,Akira Sugawara,1994 From reviews of the first edition quality and quality of illustrations is noteworthy a comprehensive and thought provoking summary of stepping motor technology Times Higher Education Supplement A general textbook on the use of stepping motors a comprehensive guide to the subject Electronics and Power Whenever repeated stop start or incremental controlled motions are encountered there are applications for stepping motors Their basic design and construction make them eminently suitable for digital microprocessor control and they are consequently found in computer hardware disk drives printers etc in clocks in numerically controlled machine tools and in domestic appliances In this successful textbook the authors take a practical approach to stepping motors using many informative diagrams to explain their working principles construction details electronic controls applications and methods of manufacture

*How to Control Stepper Motors* Michael Wright,2016-03-12 Finally a practical easy to understand source for controlling stepper motors You don t have to be an electrical engineer or rocket scientist to learn how to identify wire and program stepper motors for your robotic projects Michael Wright takes the complicated and makes it incredibly easy Whether you are an elementary student high school student or robotics engineer this book is for you This book includes Full Half Stepping for Unipolar Bipolar Motors Microstepping from scratch How to identify all types of stepper motors How to figure out what each wire does How to use

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## **Table of Contents Elektor Stepper Motor Control**

1. Understanding the eBook Elektor Stepper Motor Control
  - The Rise of Digital Reading Elektor Stepper Motor Control
  - Advantages of eBooks Over Traditional Books
2. Identifying Elektor Stepper Motor Control
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Elektor Stepper Motor Control
  - User-Friendly Interface
4. Exploring eBook Recommendations from Elektor Stepper Motor Control
  - Personalized Recommendations
  - Elektor Stepper Motor Control User Reviews and Ratings
  - Elektor Stepper Motor Control and Bestseller Lists
5. Accessing Elektor Stepper Motor Control Free and Paid eBooks

- Elektor Stepper Motor Control Public Domain eBooks
- Elektor Stepper Motor Control eBook Subscription Services
- Elektor Stepper Motor Control Budget-Friendly Options
- 6. Navigating Elektor Stepper Motor Control eBook Formats
  - ePub, PDF, MOBI, and More
  - Elektor Stepper Motor Control Compatibility with Devices
  - Elektor Stepper Motor Control Enhanced eBook Features
- 7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Elektor Stepper Motor Control
  - Highlighting and Note-Taking Elektor Stepper Motor Control
  - Interactive Elements Elektor Stepper Motor Control
- 8. Staying Engaged with Elektor Stepper Motor Control
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Elektor Stepper Motor Control
- 9. Balancing eBooks and Physical Books Elektor Stepper Motor Control
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Elektor Stepper Motor Control
- 10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
- 11. Cultivating a Reading Routine Elektor Stepper Motor Control
  - Setting Reading Goals Elektor Stepper Motor Control
  - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Elektor Stepper Motor Control
  - Fact-Checking eBook Content of Elektor Stepper Motor Control
  - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
  - Utilizing eBooks for Skill Development

- Exploring Educational eBooks

#### 14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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