

# 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 worsens the commutation. These effects limit the maximum attainable 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 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

**Dogan Ibrahim**



## **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 ,1991 *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 **Indian Science Abstracts** ,1997-11 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

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*Stepping Motors and Their Microprocessor Controls* Takashi Kenjō, Akira Sugawara, 1994 From reviews of the first edition quality and qulaity 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 constructure make them enimently suitable for digital microprocessor control and they are consequently found in computer hardware disk drives printers etc in clocks in numerically controlled machine books 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 maufacutre **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 the following controllers ULN2003A X113647 L293D L298N TB6600 FQP30N06L MOSFET Wiring circuits with ease

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