

## UHU FAQ Date 10.5.06

Q: What kind of motors can be controlled by my UHU ?

A: The simple answer is: For brushed DC motors. The details are a bit more complicated.

What you need is a motor with an incremental encoder. There is no support for old style tacho generators.

Professional servo motors are the best choice of course, but they tend to be expensive. A variety of standard DC motors may be used for to be controlled if they are retrofitted with an encoder.

Motors with 4 brushes are much better than those with 2 brushes and a rangy collector helps for smooth operation. If you shorten the leads and turn the shaft, it should turn uniformly without noticeable peaks of force. Most 12V car motors like starters and fans are unsuitable. They are intended for short time usage, have high starting currents and very low impedances.

Q: What are manufacturers of suitable motors ?

A: Just to name a few for your search in eBay: Bautz, Aerotech, Bobolowski, Pittmann, Dunker, Bühler, Parvex, Leroy Sommer, Mattke, Indramat, Engel, GSC, Portescap, Minertia, Sanyo Denki and Yaskawa

Q: What are the current limits of the UHU controller ?

A: The limit is not the controller but the power circuit and the PCB. The common design with IRF540N MosFets does up to 60 V and 20 A, the IRFP260N Version does up to 120V and 35 A.

If you plan to go over 50V, take all necessary precautions (interlock switches, discharge resistors) to avoid any contact with current leading parts. 120V of a 10.000 uF capacitor battery are fatal !

Q: Should I tin-plate my PCB ?

A: Superimposing a thick layer of tin on your PCB will not bring a significant advantage. Applying 0.3mm tin only doubles the possible current of a 35um copper layer. If you need current, use a PCB with 70 um copper.

Q: What motor supply voltage do I need ?

A: First of all it is necessary to look at the specifications of the motor to get the needed current value. The maximum current is not what we should consider as a working limit. Normally it is the demagnetizing current - once exceeded, the motor is dead. The long term rated current is what we should look at. It is the value at which the motor can be run continuously at nominal speed without getting in thermal problems. At lower speeds current must be reduced or a separate cooling system has to be attached to the motor.

The motor voltage must be high enough to allow the needed current to flow through the motor.

Due to the nature of the power stage, the PWM signal is in between 15 % and 85 %. Hence the supply voltage should be chosen 15% higher than the calculated value to get full speed.

BTW those 15% do not reduce efficiency.

Q: Do I need a stabilized motor supply ?

A: No, smoothed supply voltage is OK. Please use a minimum of 1.000 uF per 1 A of peak current.

Don't forget to install a switch or relay in between your capacitor bank and your controller boards to make sure not to have charged capacitors connected to your boards whenever you work at the open chassis.

Q: What encoders are suitable ?

A: These are incremental rotation encoders with two channels and 90 deg. phase shift. Usually these channels are named 'A' and 'B'. Encoders with 250 to 1.000 lines per revolution are best. By decoding all edges of the signals, the controller resolution will be 1000 to 4000 steps per revolution.

The electrical parameters depend on the circuit design. The common PCB needs a 5V TTL Signal.

Other designs may use 5V differential, 11uA or 1Vpp.

Q: What are the speed limits of the UHU ?

A: The maximum proven speed was 303 kHz with activated analyzer function. Using a 512 line encoder this is about 9.000 rev/min. Such a speed however cannot be guaranteed for all operating conditions and is dependent on the recalculation cycle value and the step multiplier.

150.000 steps per second is what you can expect for sure. The speed of the machine is dependent on the mechanical setup (gear, lead screw).

Q: What power supply do I need for the logic part of the circuit ?

A: It has to be stabilized 12 V and it doesn't matter if it is a linear or switched power supply if it provides 2 A per board.

Q: What cables should be used ?

A: My advice is to use shielded cabling for the logic as well as for the motor connection. Try to separate signal lines from motor lines wherever you can. Ferrite cores may reduce noise on the signal lines (like those at computer cables). Inside the chassis all power wires should be as short as possible and as far as possible away from the controller boards. All signal lines inside the chassis should be shielded and separated from power lines.

Q: What connectors should be used ?

A: Out of a wide variety of connectors let me name my favorites: Neutrik XLR for the motor and SubD-9 for the encoder. The XLRs make easily 15 A continuous and 30 A peak current.

Q: May I use other MosFets ?

A: Yes. The IR2184 is powerful enough to switch through all of the MosFets around. But it is your own deal to ensure that R(on) and power dissipation matches. For higher voltages IGBTs might be better than MosFets. Using external transistor modules was not tested and is not recommended. If you do, take care of signal noise on the gate wires.

Q: Why do I need to buy those expensive IR2184 chips ?

A: The used driver circuits provide a high output current to ensure that the MosFets are completely switched through with a minimum delay. Pin compatible substitutes may work - but they will lead to higher power dissipation at the output stage.

Q: What is the secret behind these 24 MHz fundamental crystals ?

A: There are other crystals on the marked oscillation at the 3<sup>rd</sup> overtone which will not work !

The AVR need a crystal oscillating at the fundamental frequency.

Those are somehow hard to find and that's why I offer to send crystals along with the controllers.

Q: I do not understand why the controller output is PWM only and no direction signal. How does this work ?

A: Roughly it works this way: If the motor does not have to provide a torque, the 25 kHz PWM is 50%. The motor cannot follow the high frequency due to his inductance and integrates positive and negative pulses to zero. If a torque has to be provided, the PWM signal becomes asymmetric. The positive and negative pulses integrate to a current which moves the motor.

Q: I tried hard to find my parameters, but the controller cannot stabilize the motor. What's wrong ?

A: The most probable answer is: Your motor is not qualified. See above answer on the motors.

Another source of trouble may be a far too high resolution of the encoder, a much too high motor supply voltage or a motor with an exceptional low moment of inertia.

The latter case might be cleared by reducing the value for the C(Y)cle parameter.

Q: I can find multiple 'good' combinations of parameters. Why isn't that unique ?

A: The parameters do have partly linear and partly nonlinear effect on the control loop. That's why you can find multiple maxima and minima.

Q: I want to program the chip on my own. How to I get the HEX file ?

A: I do not publish the code or the hex file. I ship programmed controllers only, personalized with a serial number and locked.

Q: I want to have specific changes to the controller. How do I get them ?

A: Most probably - you don't. The only way would be a cooperation based on a higher number of controllers. I am just unable to make, test and supply different code versions. In addition, the controller flash rom is full to the last byte. Changes would cause other feature to disappear. Nevertheless I am always interested in your comments.

Q: I plan to develop my own controller board in SMD. Do I get the UHU in SOIC20 ?

A: Yes. But I do not stock them so please allow a few days for delivery.

Q: Why don't you supply complete kits ?

A: Selling kits would definitely kick me in dealing with electronic components with all the connected drawbacks. I would have to care about taxes, invest a lot of capital and lose a lot of money to those guys who never pay their bill. And it is another time consuming activity which does not fit in my calendar.

Q: I am not the electronics freak. May I buy a complete and tested module from you ?

A: Sorry, same as with the kits. But asking nicely in the forums might bring you contact to fellow colleagues who are able to help.

Q: What is better - the DOS or the Windows terminal program ?

A: That's a matter of taste. I love my DOS program which can be run under Win98 in the dos box as well. It does the same job as the Windows program while running on a 133 MHz Pentium instead of a GHz Windows machine.

Q: Why can't I use the DOS version under Win2000 or XP ?

A: It uses direct port access which is not allowed under Win32. Someone managed to run it under XP, but never told me in detail how this was done ... L

Q: I want to modify the terminal program. Might I get the code ?

A: Yes. There are two versions. The DOS version is Turbo Pascal and written by myself. The Windows version was written by Werner Stratmann who allowed me to publish it. Both are not really in good shape in terms of comments.....

Q: How do I control linear motors with the UHU controller ?

A: Show me a brushed linear motor and I'll tell you the needed parameters.... ;-)

Q: Why don't you make the code for the UHU public or open source ?

A: Counter question: Why should I ? The code is developed, fully tested and runs in over 1500 systems. I see no need to provide a source of money to people who just want to copy and multiply without putting any own effort in.

Q: The manual says: Do not use for dangerous machines. What happens if I do ?

A: This all is about legal stuff and liabilities. It is impossible for me to ensure that the controller will work in your setup under all circumstances without any trouble and without bringing up the risk of personal damage connected to dangerous machines. Hence I cannot accept any liabilities. But on the other hand I have no control over what you do in your workshop.

Q: I plan to make my own controller. The motor is already moving - might you help me with the rest...?

A: Much to my regret.....

Q: Why do I get so many good answers on my questions in the forum by others and not by yourself ?

A: Wrong question. You should ask: How can I show my gratitude to those who are willing to support. Myself I have limited time to put into this subject. And this time is needed mostly to program and ship the controllers.

Q: ʌʌ® [™ ]ʌ{ ]Σ ] | ʌ© [ ] [® ] |

A: Yes, I ship the UHU controllers all over the world J