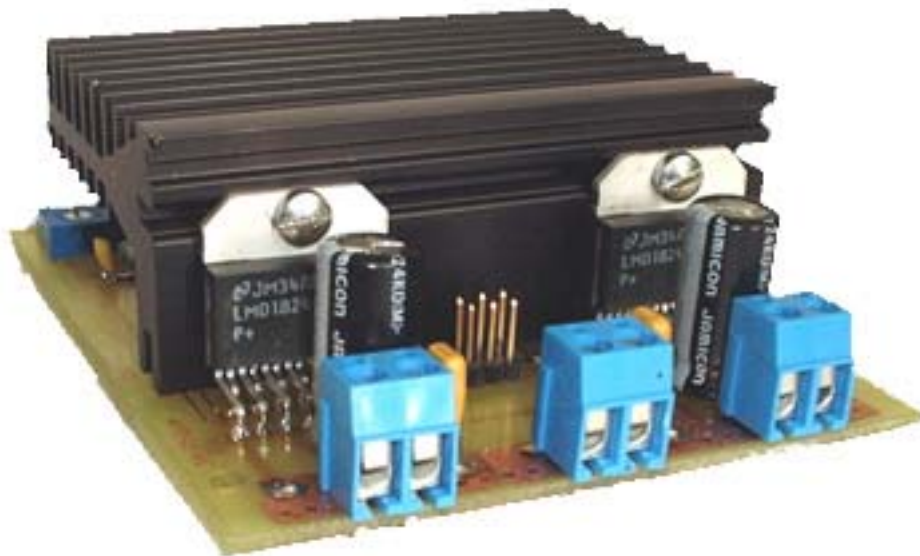


# 3Amps Micro stepper card



## Building instruction



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# SB-Microstep

3Amps Micro stepper card building instruction

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# SB-Microstep

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## 1 Introduction

The SB-Microstepper card is the outcome of different thoughts regarding stepper motor practice. First of all when selecting a card one have to specify which maximum current you need. This mostly depends on the motor you have in mind. But starting a stepper motor project one usually thinks a lot about the price you need to invest to get your idea in practice. This is often the reason to abandon some wishes you have.

In most cases one calculates not only the necessary moment and speed needed but also the maximum amount of money to invest. As the parts are bought and the project is finished and the machine is being tested one often regrets the choices made.

Mostly because the stepper motor isn't strong enough to give the necessary speed and a stronger stepper motor needs a new stepper motor card while the old one isn't usable anymore. So the project is finished but there is no real satisfaction. It all could be better and faster but then you throw away money.

With this in mind we worked on a concept of a stepper motor card that should be upgradeable, so upgrading to a higher plane without throwing away money. The core of the stepper motor card needed to be expandable to a higher current.

This means one can start with a card that can drive medium motors but with an extension it can drive larger and more powerful motors. So one can build his project and when a higher current is needed one does not throw away the money invested in the stepper motor card but simply expand it.

Another thought was the easiness of adapting the card to different stepper motors and needed resolutions and last but not least it should be easy to build and not expensive. This all led to the creation of the SB-Microstepper card.

## 2 Technical data

- Driving Uni- and Bi-polar Stepper Motors
- Standard Up to 3Amps a phase, easy upgradeable to **6Amps** a phase
- Easy adjusting of current and frequency
- Micro stepping (1,2,4,8) up to 1600 steps/rev with standard 200 step motor
- TTL compatible inputs for direction, pulse and reset
- Short circuit protection
- Temperature protection
- Logic supply voltage +5Volt
- Motor supply voltage max.+55Volt
- Based on the proven and reliable LMD18245 chip
- Dimensions 3Amps. 100 x 80 x 35 mm, approx. weight 0,23 kg
- Dimensions 6Amps. 100 x 80 x 75 mm, approx. weight 0,45 kg

## 3 Tools and material needed

Voltmeter  
Soldering iron @ tinning solder  
Small wire cutter  
Screw driver  
Heat flux pasta  
4 M3 screws

### 4 Building the card

1. Start with the small components i.e. resistors, resistor networks (the common of the network is signed with a dot, the dot should be placed in the square i.e. see Fig.1 RP5), the small capacitors and JP15.
2. Then solder the PLCC sockets (check out the flat corner and put it in the right place) and trimmers.
3. Put the heat sink in place (2 3M screws required).
4. Place one LMD (U3 or U4) against the heat sink so the hole in the LMD is centered with the fixation slot of the Heat Sink. Fix one leg (for example leg 1) by soldering it. Adjust the LMD in its final position and fixate an opposite leg i.e. leg 14 by soldering it. Proceed in the same way with the second LMD. Then solder all legs.
5. Finish the card by soldering the big capacitors and the screw terminals on to it.
6. Remove the heat sink.
7. Start with adjusting the card for your specific stepper motor (See Adjusting and checking the card).
8. After adjusting and checking the card place the GALs U1 and U2 in their specific sockets.
9. Put a thin film of heat flux pasta on the LMDs backside and mount the heat sink on the card again and screw the LMDs tight against the heat sink with M3 screws.

3Amps SB Microstepper card

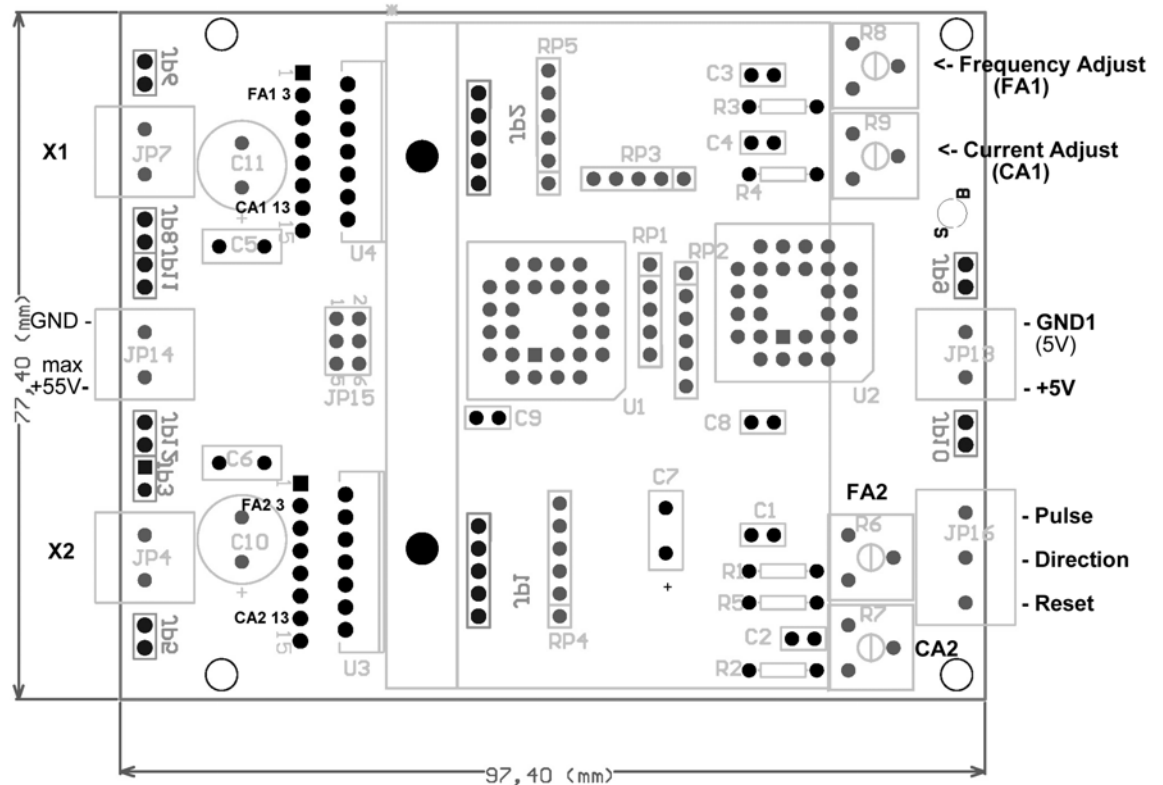


Figure 1



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## 5 Adjusting and checking the card

### 5.1 Frequency Adjustment

- The frequency is calculated as  $F \approx 4.13 \cdot 10^5 / R[\text{k}\Omega]$ . The recommended 20 kHz frequency gives for  $R=20\text{k}\Omega$ . One can experiment with these setting but pay attention to the generated heat inside the LMD. We suggest 20 kHz as frequency.
- Connect a voltmeter between leg 3 of the LMD (FA1 3 or FA2 3 fig.1) and GND1 on the card. Measure the resistance between the connections and adjust it to 20k $\Omega$  by turning R8 (FA1 fig.1) or R6 (FA2 fig.1) depending on which LMD you connected to. Do the same with the other LMD.

### 5.2 Current Adjustment

- The current is adjusted by a resistor. The resistors value depends on the required phase current and is calculated as  $R[\text{k}\Omega] = 20 / I_{\text{phase}}[\text{A}]$ . Example “your motor has in its spec’s that it needs 1 Ampere a phase. The needed resistor value will be  $20/1 = 20\text{k}\Omega$ ”
- Connect a voltmeter between leg 13 of the LMD (CA1 13 or CA2 13 fig.1) and GND1 on the card. Measure the resistance between the two points and adjust it to the needed value by turning R9 (CA1 fig.1) or R7 (CA2 fig.1) depending on which LMD you connected to. Do the same with the other LMD.
- The current a phase can be adjusted from 0.42 Amps up to 3 Amps max.

### 5.3 Selecting the stepper resolution

- The stepper resolution can be selected by short circuit jumper JP15 (fig.1)
- full step      leave JP15 unpopulated
- half step      short circuit pin 1 & 2
- quarter step   short circuit pin 1 & 2 and 3 & 4
- eight step      short circuit pin 1 & 2 and 3 & 4 and 5 & 6

### 5.4 Checking the card

- Check first all power and ground connections of the components.
- Check that you have put the common of the resistor networks in the right place.
- Check if the polarized capacitors are connected in the right way.
- Check that all connections of the LMDs are correct.
- Check that the frequency and current settings for both LMDs are the same.

### 5.5 Ready for take off

- Connect the card to the power sources. The +5Volt and its GND to the +5 Volts and GND1 of the card and the +30...+55 Volt source and its GND to the +55Volt and GND of the card (see fig1).
- Connect the Direction and Pulse to your designated TTL signal generator or Computer.
- Connect the motor phases to the card. Connect motor phase 1 with X1 and motor phase 2 with X2.
- If you don’t use the reset signal connect it to GND1. If you use the signal then use a signal that has standard GND with a positive pulse for reset.
- Put the power source +5Volt on.
- Put the power source +30...+55Volt on.
- The card is now ready for action.



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## 6 Motor and computer connections

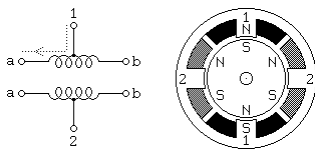
### 6.1 Introduction

The SB-Microstepper card can drive uni- and bi-polar motors. Depending on the type of motor a general explanation of the motor winding and the connection to the card is made. Further detailed information can be found in the link section of this site under the link Jones.

For a connection to the computer one can use directly the outcome of a printer cable connection or buy a simple IO Card. General connection diagrams from cable to card greatly depends on the program used. Because of this only a general description can be given. For further information we refer to the links page of our site.

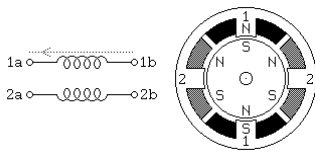
### 6.2 Uni-polar stepper motors

In general Uni-polar stepper motors have six connections. To use a uni-polar motor with a bi-polar stepper motor card the middle connections need to be isolated and not used. The proper connection to the card is: a and b of winding 1 connected to X1 (see fig.1) and a and b of winding 2 to X2. Connections 1 and 2 of the stepper motor need to be isolated.



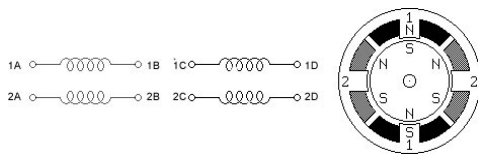
The advance of using a bi-polar driver for uni-polar motors is that all the windings are constant powered. This raises in general the holding torque of the motor. So with the same motor on gets more power.

### 6.3 Bi-polar stepper motors



For stepper motors with four leads it's easy to connect them to the SB-Microstep card. Just connect 1a and 1b with X1 and 2a and 2b with X2 (see fig.1).

For stepper motors with eight leads there are 2 ways of connecting the leads. The first one is the serial connection. In that case the leads 1a and 1d are connected with X1 (see fig.1) while 1c and 1d are connected to each other. In the same way 2a and 2d are connected to X2 while 2c and 2d are connected to each other. Generally this method is used when low torque and high speeds are wanted. The current, in this case, is the same as used for one winding.



Another connection method is the parallel one. In this case 1A and 1C are tied together and 1B and 1D. The tied leads 1AC and 1BD are then connected to X1. In the same way 2A and 2C are tied together and 2B and 2D. The tied leads 2AC and 2BD are then connected to X2. Generally this method is used for high torque and slow speeds. The current in this case is 2 times the current for one winding.

### 6.4 Computer connection

To connect the SB-Microstep card to the computer, the easiest way is the printer cable connection. Get a female or male header depending on the cable you use and solder the needed leads to the header. Connect the soldered leads to the direction and pulse input on the SB-Microstep card, connect the printer cable to your computer and you are ready to step. Further information is available at the link page of our site under parallel port.



# SB-Microstep

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## 7 SB-Microstepper card schematic

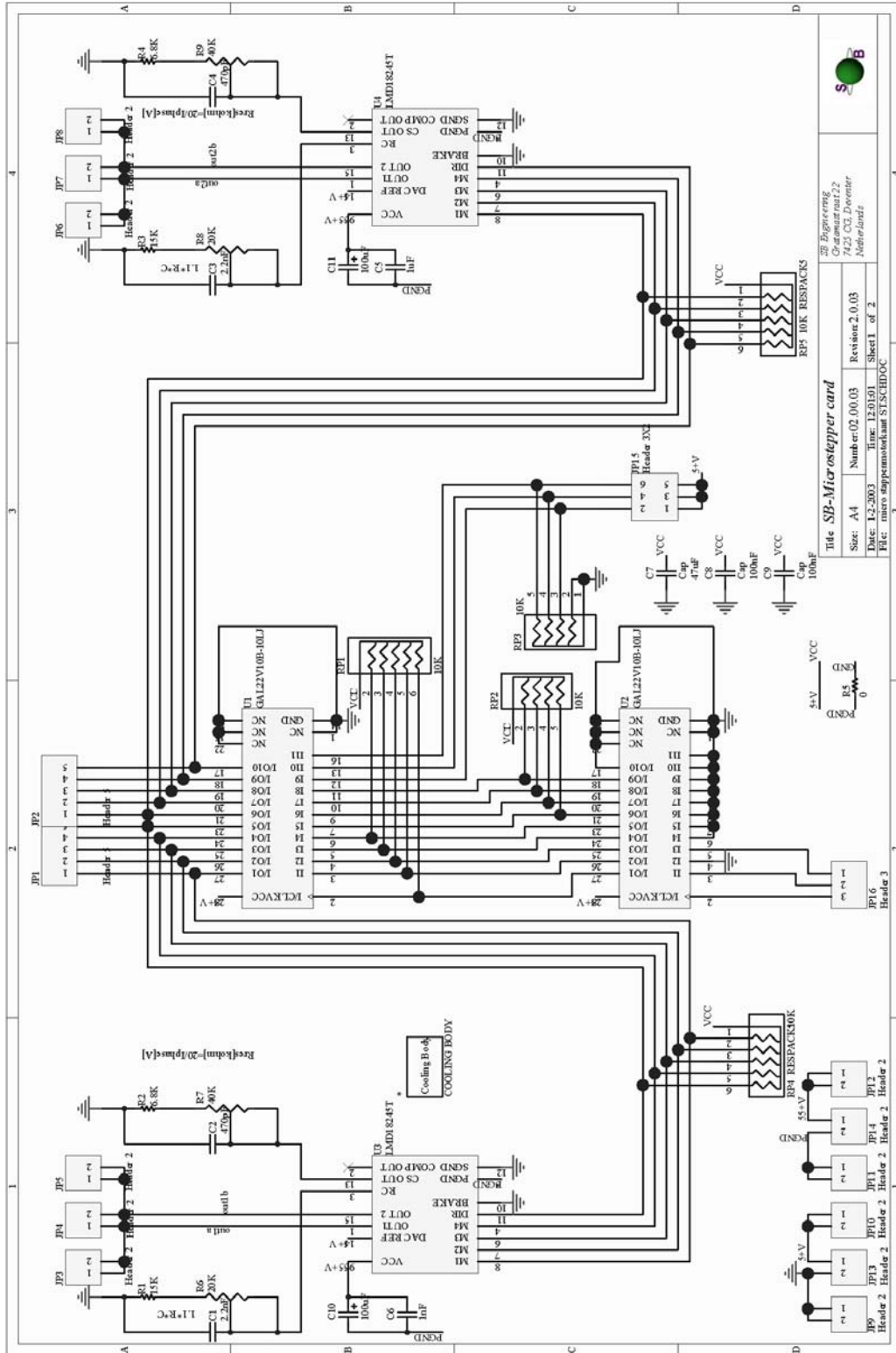


Figure 2



# SB-Microstep

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## 8 SB-Microstepper card parts list

Description	Designator	LibRef	Quantity	Value
		COOLING BODY	1	
Capacitor	C1	Cap	1	2.2nF
Capacitor	C2	Cap	1	470pF
Capacitor	C3	Cap	1	2.2nF
Capacitor	C4	Cap	1	470pF
Capacitor	C5	Cap	1	1uF
Capacitor	C6	Cap	1	1nF
Capacitor	C7	Cap Pol1	1	47uF
Capacitor	C8	Cap	1	100nF
Capacitor	C9	Cap	1	100nF
Polarized Capacitor (Radial)	C10	Cap Pol1	1	100uF
Polarized Capacitor (Radial)	C11	Cap Pol1	1	100uF
Header, 5-Pin	JP1	Header 5	1	Not in this set
Header, 5-Pin	JP2	Header 5	1	Not in this set
Header, 2-Pin	JP3	Header 2	1	Not in this set
Header, 2-Pin	JP4	Header 2 screw	1	
Header, 2-Pin	JP5	Header 2	1	Not in this set
Header, 2-Pin	JP6	Header 2	1	Not in this set
Header, 2-Pin	JP7	Header 2 screw	1	
Header, 2-Pin	JP8	Header 2	1	Not in this set
Header, 2-Pin	JP9	Header 2	1	Not in this set
Header, 2-Pin	JP10	Header 2	1	Not in this set
Header, 2-Pin	JP11	Header 2	1	Not in this set
Header, 2-Pin	JP12	Header 2	1	Not in this set
Header, 2-Pin	JP13	Header 2 screw	1	
Header, 2-Pin	JP14	Header 2 screw	1	
Header, 3-Pin, Dual row	JP15	Header 3X2	1	
Header, 3-Pin	JP16	Header 3 screw	1	
Resistor	R1	Res1	1	15K
Resistor	R2	Res1	1	6.8K
Resistor	R3	Res1	1	15K
Resistor	R4	Res1	1	6.8K
Resistor	R5	Res1	1	0
Tapped Resistor	R6	Res Tap	1	20K
Tapped Resistor	R7	Res Tap	1	40K
Tapped Resistor	R8	Res Tap	1	20K
Tapped Resistor	R9	Res Tap	1	40K
SIP resistor package	RP1	RESPACK5	1	10K
SIP resistor package	RP2	RESPACK4	1	10K
SIP resistor package	RP3	RESPACK4	1	10K
SIP resistor package	RP4	RESPACK5	1	10K
SIP resistor package	RP5	RESPACK5	1	10K
High-Performance E <sup>2</sup> CMOS PLD Generic Array Logic	U1	GAL22V10B-10LJ	1	
High-Performance E <sup>2</sup> CMOS PLD Generic Array Logic	U2	GAL22V10B-10LJ	1	
3A, 55V DMOS Full-Bridge Motor Driver	U3	LMD18245T	1	
3A, 55V DMOS Full-Bridge Motor Driver	U4	LMD18245T	1	