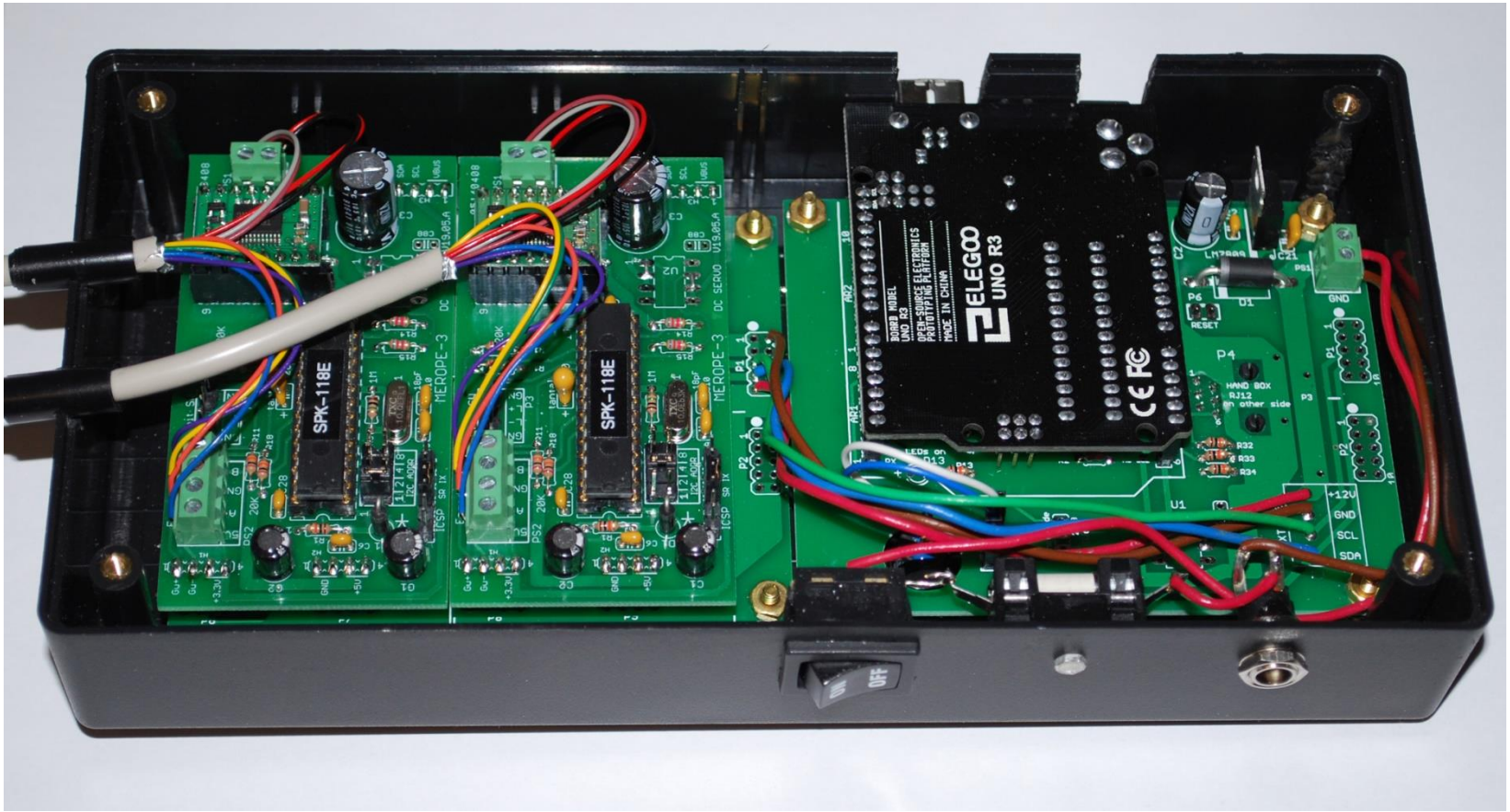
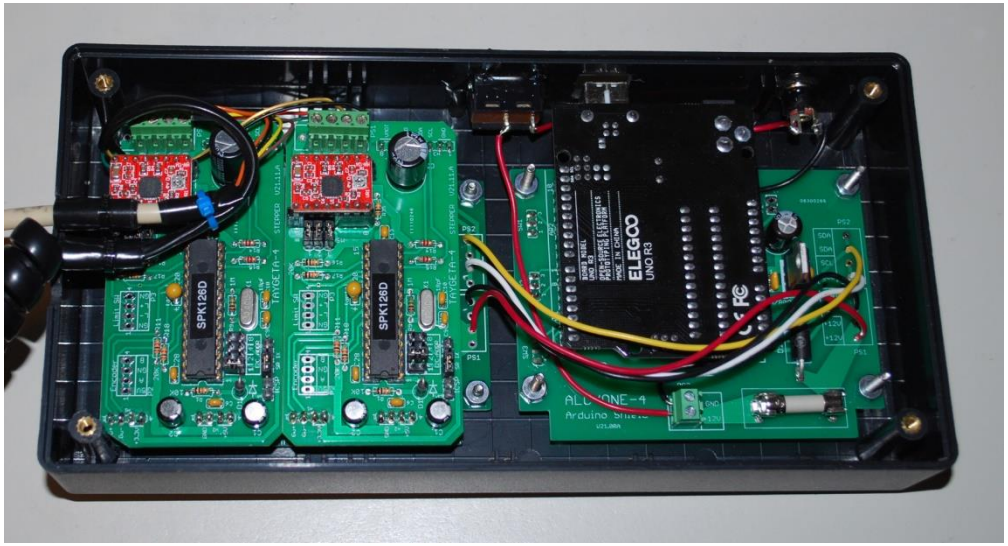
PLEIADES SET OF BOARDS



Revision 23.01.22



PLEIADES SET

The boards in this set are made to simplify mounting since they already contain many elements that you do not need to install:

- connector simple handbox,
- connector for autoguiding camera,
- buttons to set the tracking speed in autonomous mode,

All you need to add are cables to connect the motors, an ON-OFF button, a power plug and a fuse.

For the rest, just drill the holes in the right places in a case large enough to hold the boards.

With the Pléiades boards, you could control, from an Arduino, up to 4 different motors, which can be DC motors with encoder or bipolar or unipolar stepper motors.

Additionally, with the right choice of boards, motors can be powered with voltage between 12 volts and 24 volts and current up to 2.7 amps.

PLEIADES SET OF BOARDS

R.A. and decl. cables

Autoguiding camera socket

ON-OFF switch

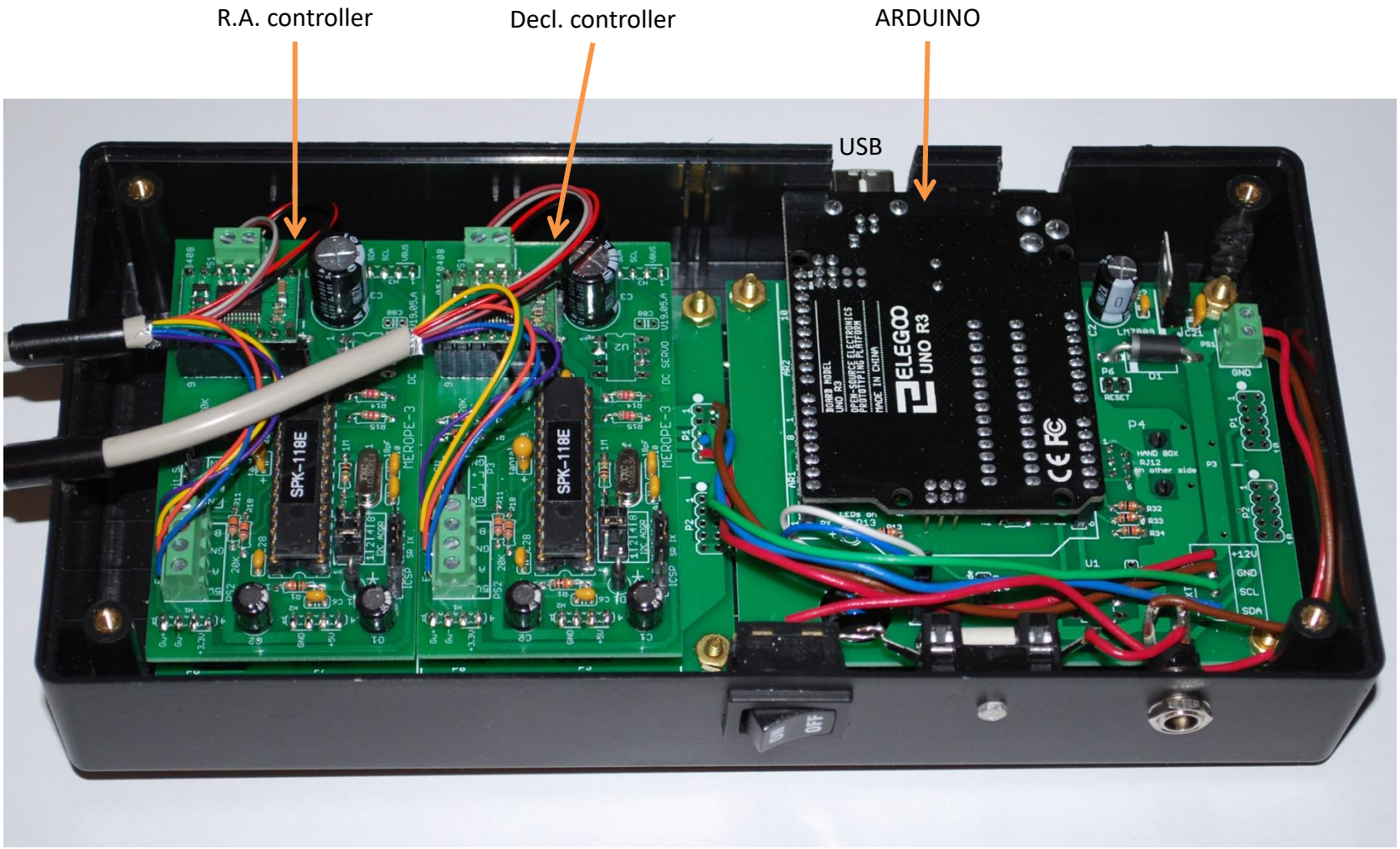
Tracking setting in autonomous mode

12 volt DC power input
Center positive
2.5-5.5mm jack

Simple handbox socket

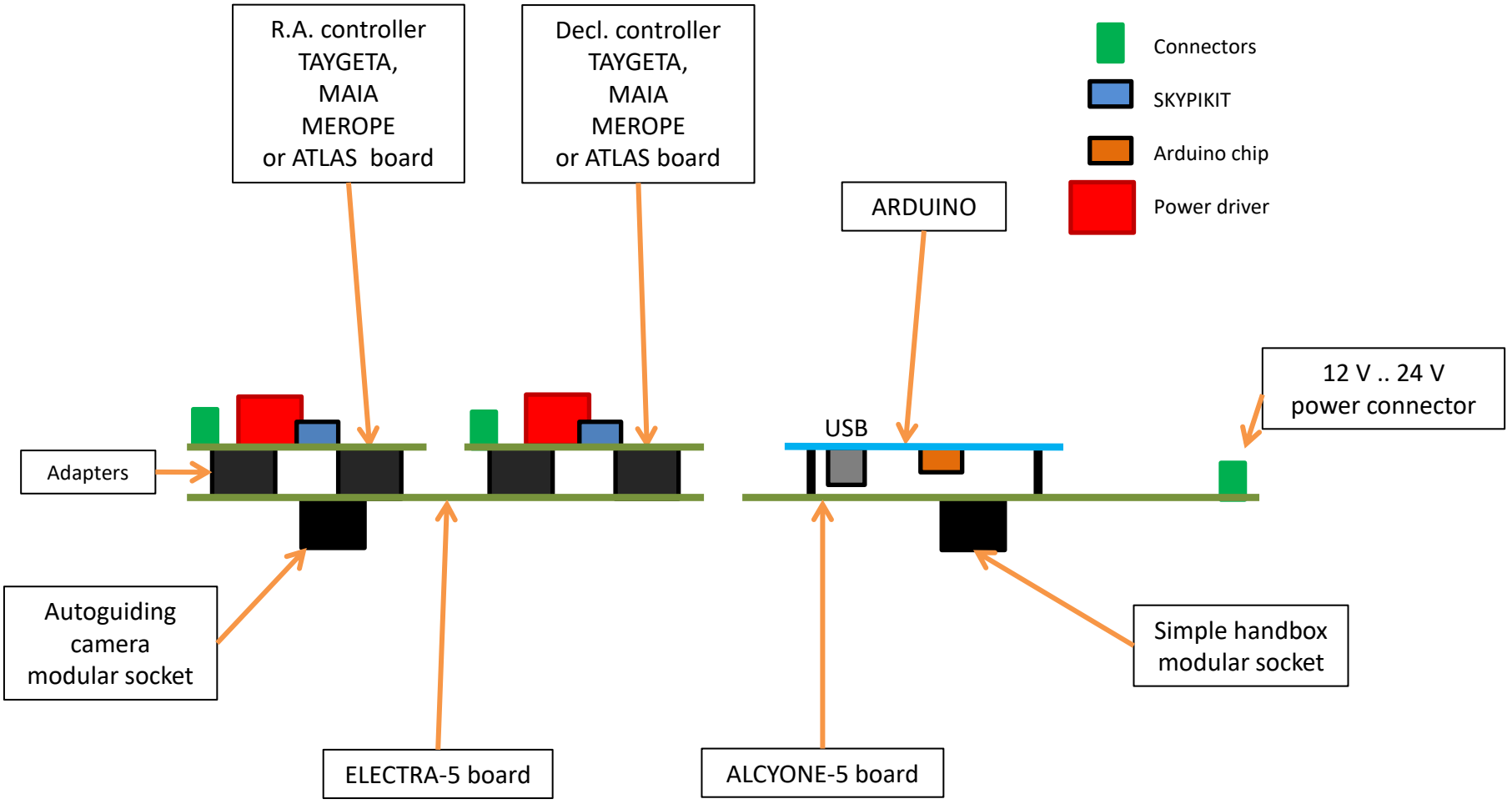
External control box (front view)

PLEIADES SET OF BOARDS



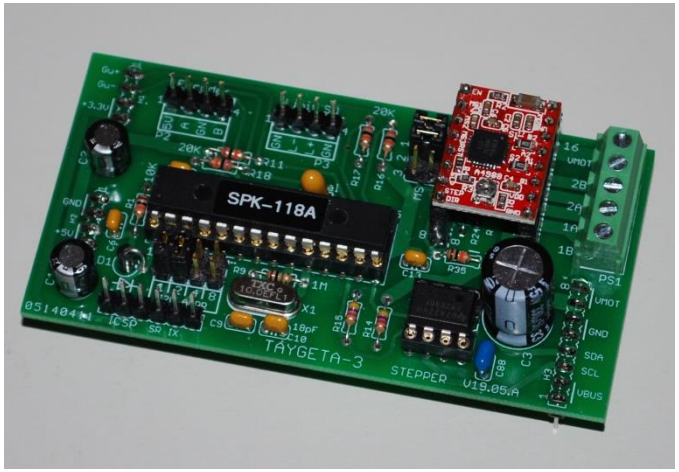
External control box (interior view)

PLEIADES SET OF BOARDS

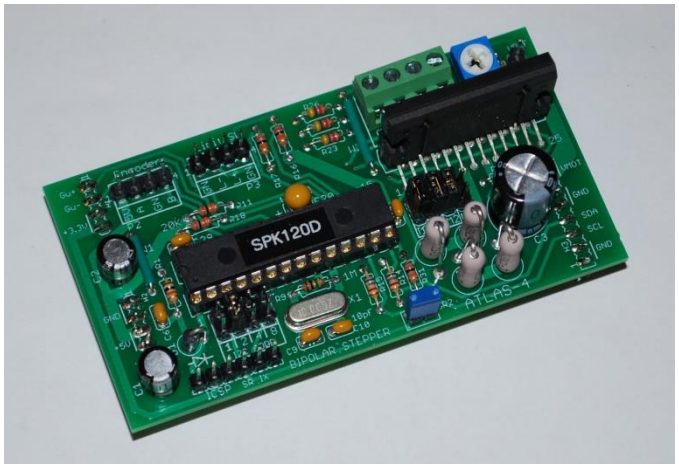


PLEIADES SET OF BOARDS

Boards for bipolar stepper motors



TAYGETA-3 with A4988 driver for stepper motors operating with a maximum current of 800 mA per phase and a voltage of up to 14 volts.

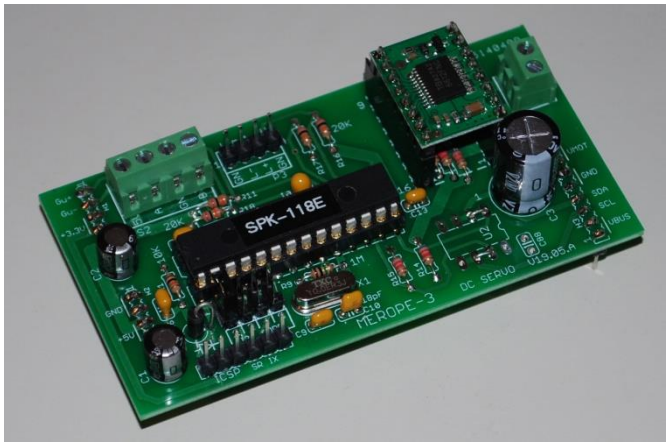


ATLAS-4 with TB6600HG driver for bipolar stepper motors operating up to 24 volts and 2.7 A.

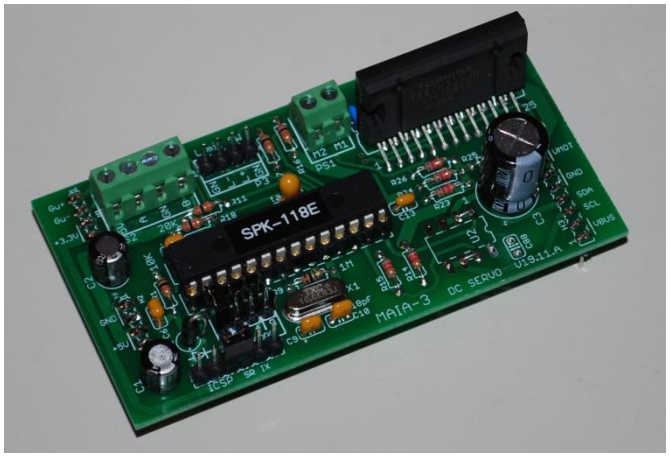
Board for unipolar stepper motors

TAYGETA-3 with TB67S142NG driver for unipolar stepper motors, up to 14 volts and 800 mA.

Boards for DC motor with encoder

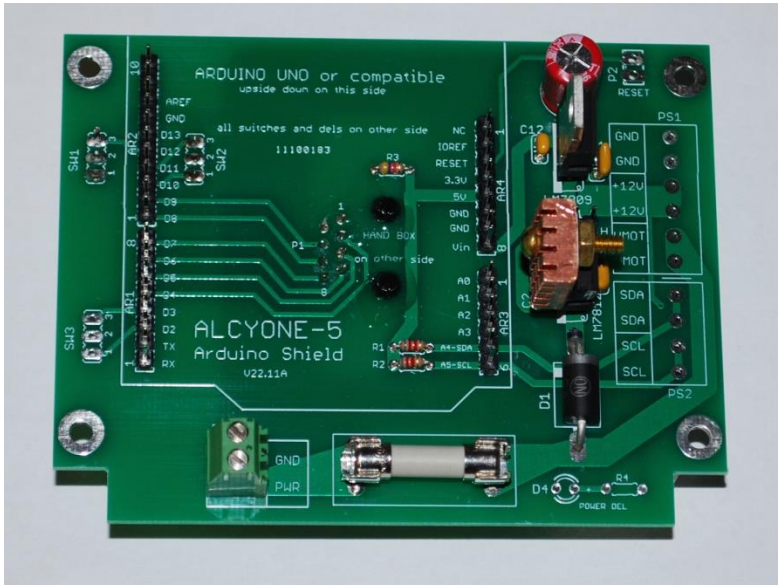


MEROPE-3 with TB6612 driver for up to 800 mA and 12 volts for most small telescope motors.

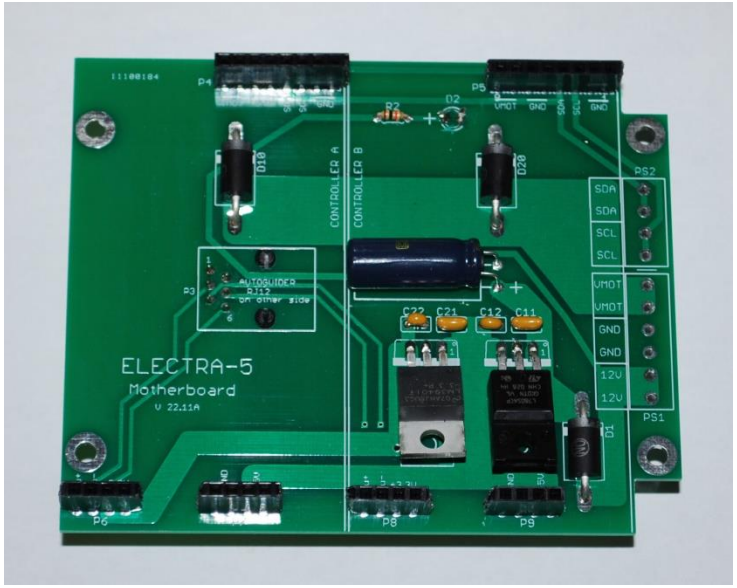


MAIA-3 with TB67H303HG driver for up to 2.7 A and 24 volts for more powerful motors (Pittman, Maxon ...).

PLEIADES SET OF BOARDS



ALCYONE-5: Arduino shield and power supplies



ELECTRA-5: Motherboard to power and insert the motor control boards

ALCYONE-5 BOARD

ARDUINO SHIELD AND POWER SUPPLIES

PRESENTATION OF THE BOARD

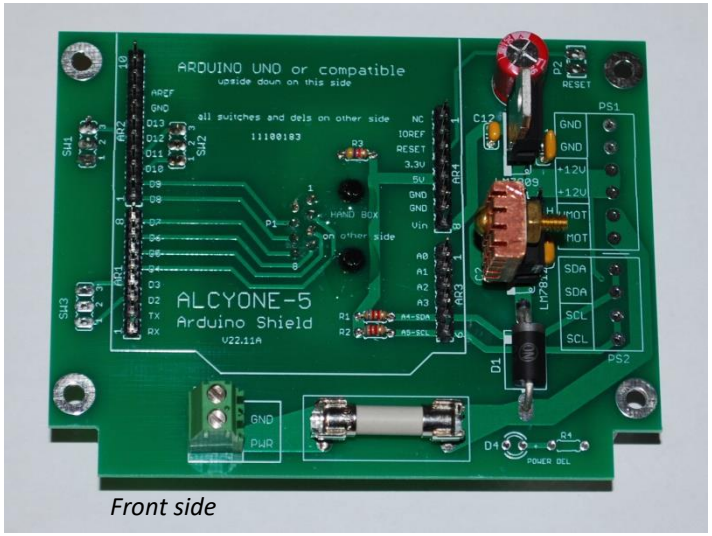
This board is first of all an ARDUINO shield (Arduino Shield), that is to say that the ARDUINO UNO board can be directly connected to it.

The ALCYONE-5 board receives the main power supply which can be between 12 volts and 24 volts, and contains a fuse, a 12 volt voltage regulator to power the driver boards and a 9 volt voltage regulator to power the ARDUINO UNO.

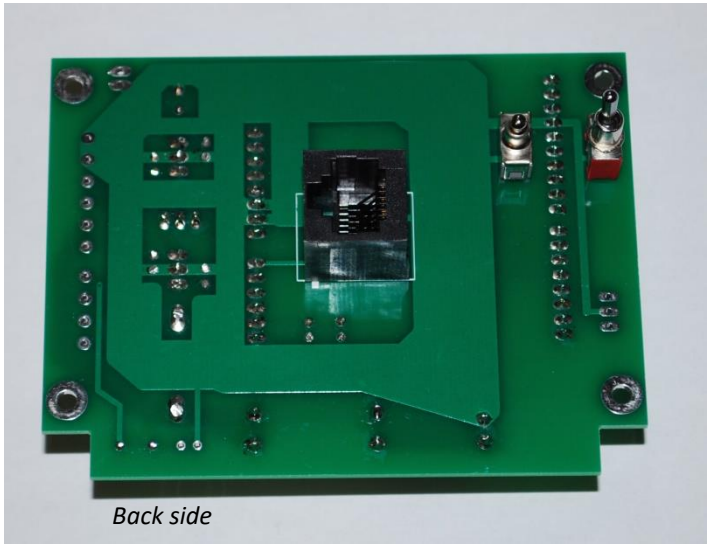
On the rear face, the board contains an 8-position RJ45 connector to connect the simple handbox.

You can also install three mini SPDT switches(one ON-OFF and two ON-OFF-ON) to set different functions, for example for tracking speeds in autonomous mode.

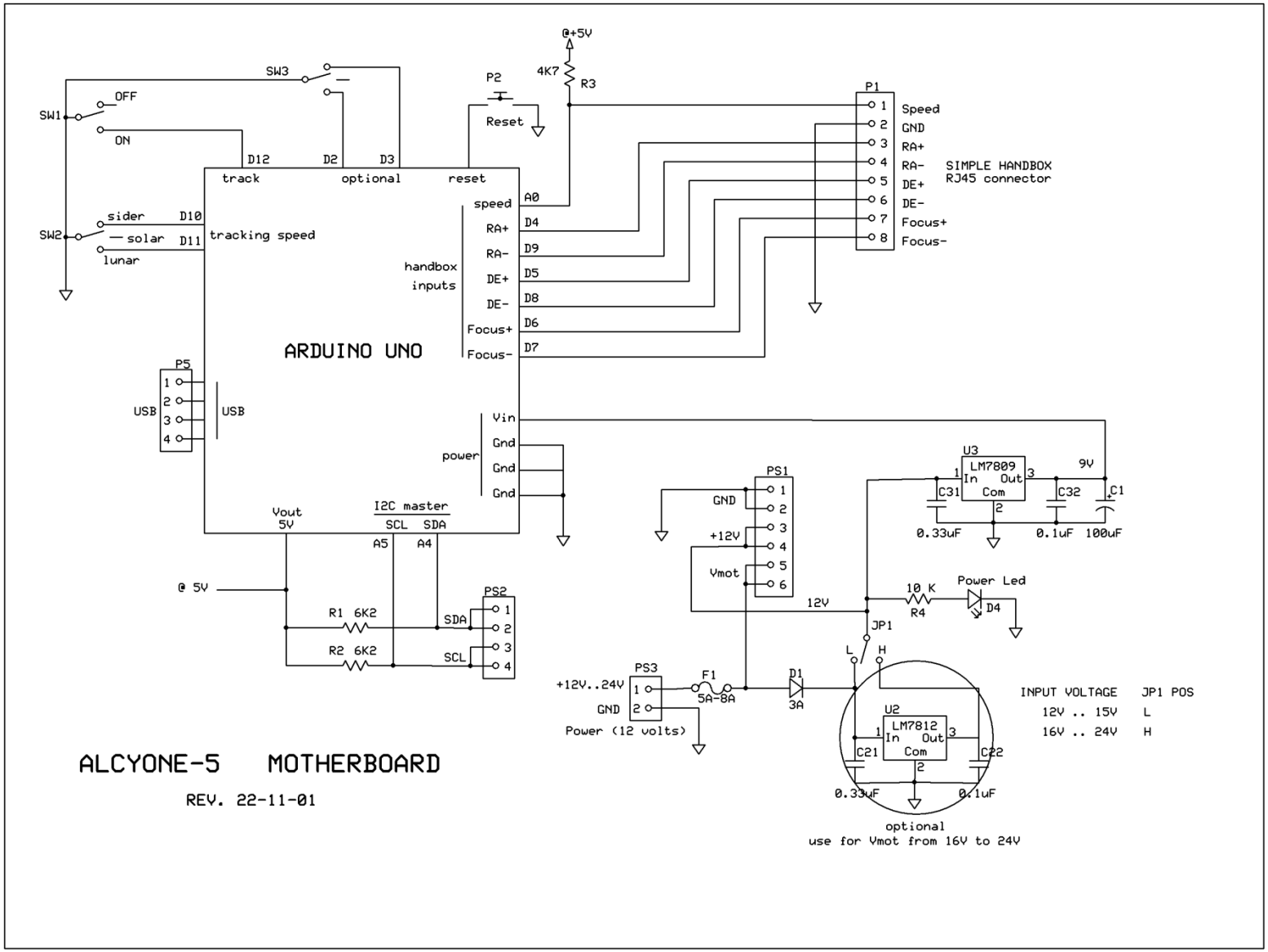
The ALCYONE-5 board contains the two connectors PS1 and PS2 where you can install screw connectors or simply solder wires to interconnect the power supplies and I2C signals to the ELECTRA-5 boards.



Front side

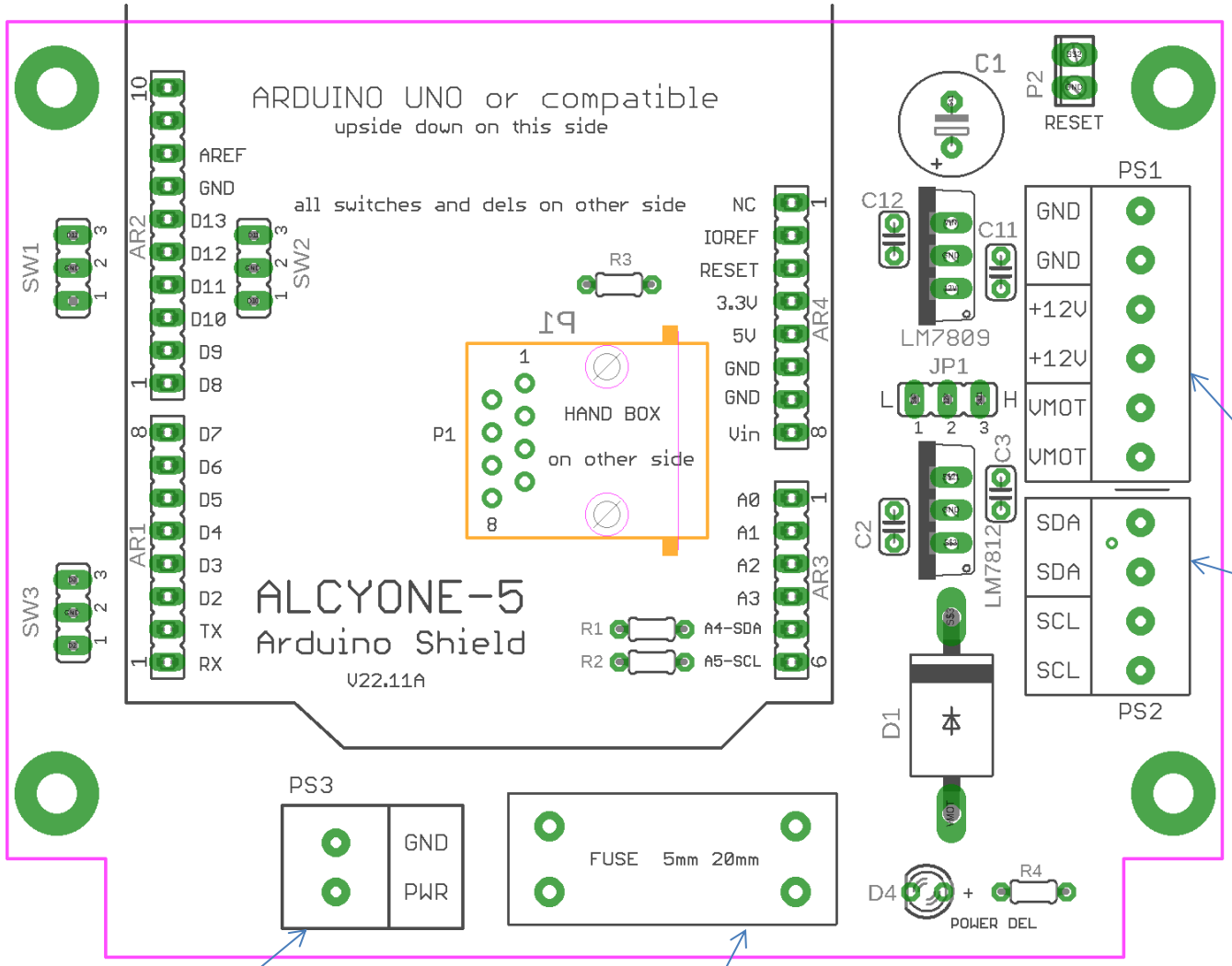

Back side

ALCYONE-5 BOARD



Electronic diagram of the ALCYONE-5 board

ALCYONE-5 BOARD

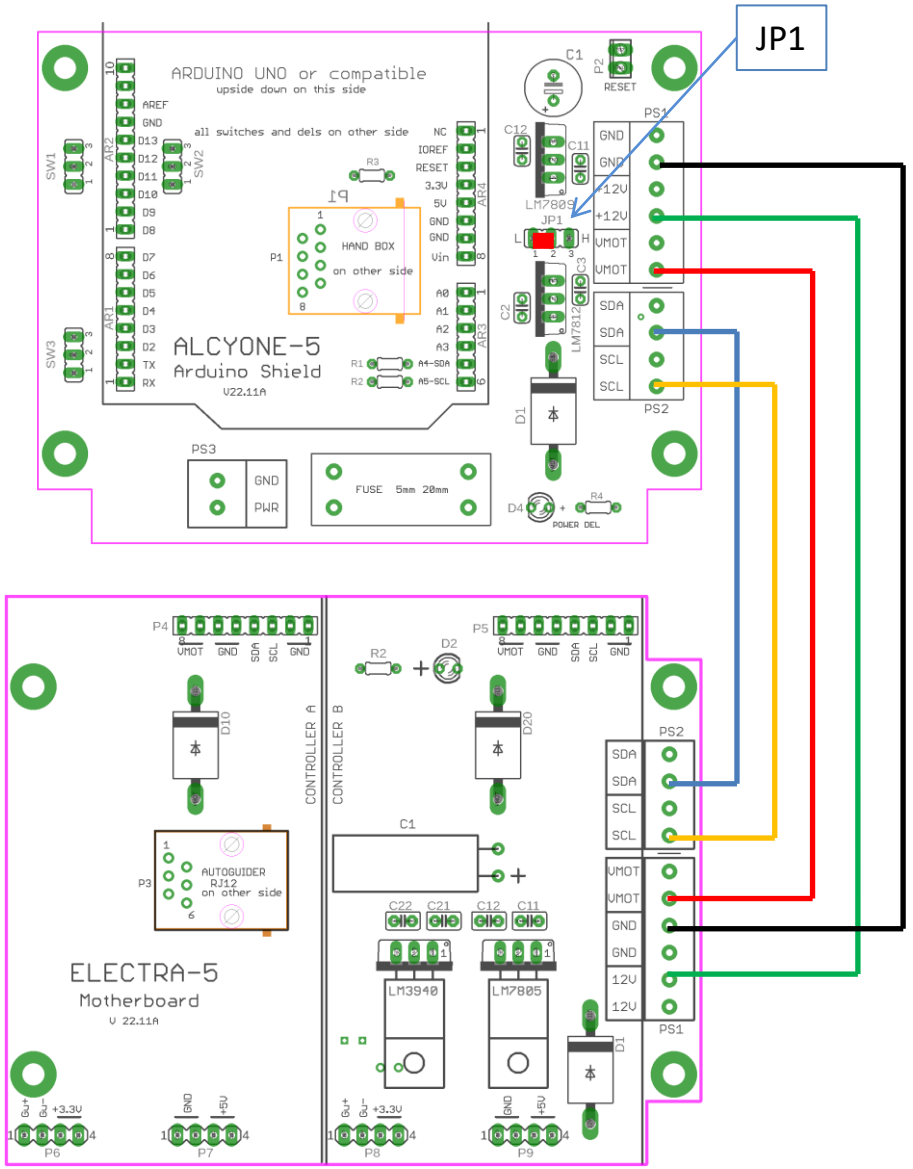


Connections to the ELECTRA boards and a fan if required

12 .. 24 volts DC supply to connect here

5 to 8 fuse according to the powers of the motors

ALCYONE-5 BOARD



The PS1 and PS2 connectors allow the connections of the GND, VMOT and 12V power supplies between the ALCYONE and ELECTRA boards.

It is possible to connect up to two ELECTRA boards on the same ALCYONE board, to be able to control up to 4 motors.

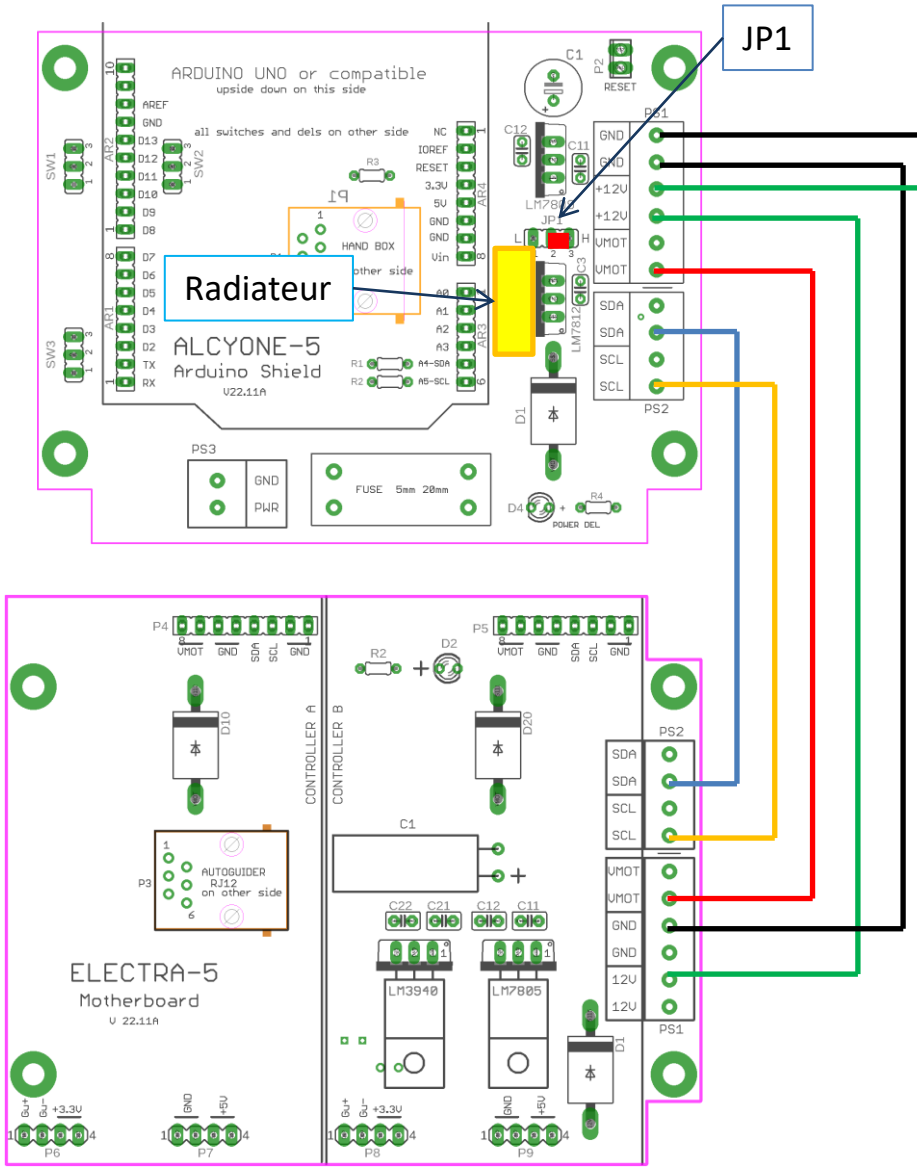
There are two possible power supply configurations:
LOW: 12 volts to 14 volts
HI: 15 volts to 24 volts

The configuration shown on this page is the LOW configuration.

In this configuration, with a power supply between 12 volts and 14 volts, a jumper must be placed at position L (as shown) on connector JP1.

Board connections for 12 volt to 14 volt power supply

ALCYONE-5 BOARD



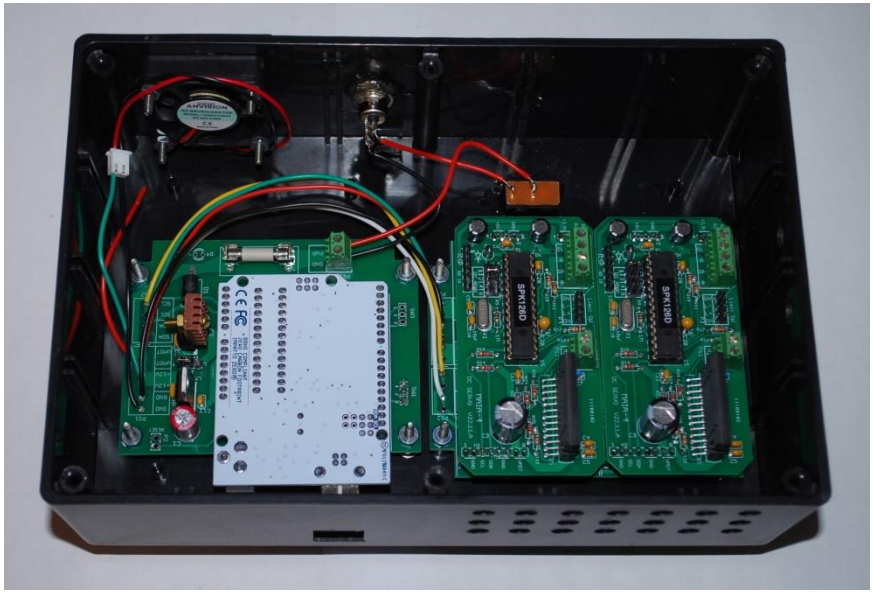
If the power supply is between 15 volts and 24 volts, we are in the HI configuration.

In this configuration, a jumper must be installed at position H of the JP1 connector (as shown.

In this configuration, a heatsink must also be installed on the LM7812 12-volt regulator, and ventilation holes drilled on the housing box.

In addition, if the supply voltage is between 19 volts and 24 volts, a mini fan operating at 24 volts must be added, connected to GND and VMOT (or +12V to reduce noise). Direct the fan flow to the 12 volt regulator heatsink.

ALCYONE-5 BOARD

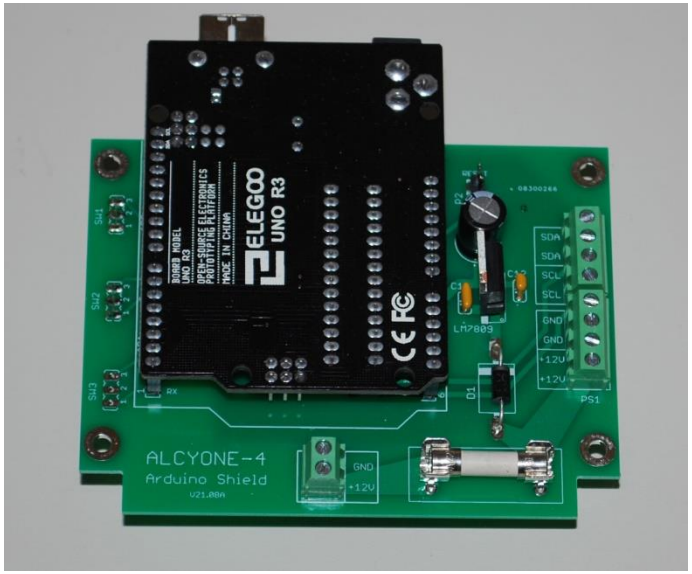


To use PLEIADES boards with motors powered between 19 and 24 volts, the boards must be installed in a box large enough to also contain a mini fan.

These pictures show the fan and the vent holes on the side opposite the fan. The cables to the motors are not installed in these images

Example of installation for motors operating between 19 and 24 volts

ALCYONE-5 BOARD



The ARDUINO connects upside down on the ALCYONE-4 board.

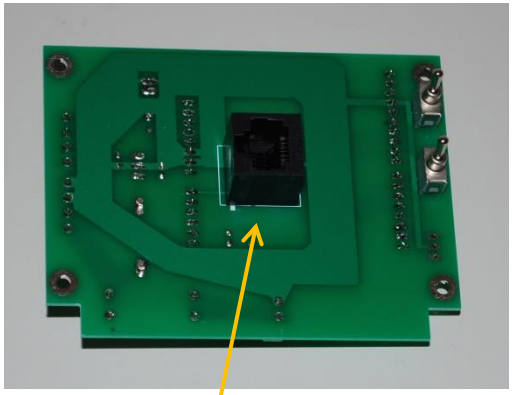
The ARDUINO is powered with 9 volts by its Vin pin.

Never use the ARDUINO power jack connector.

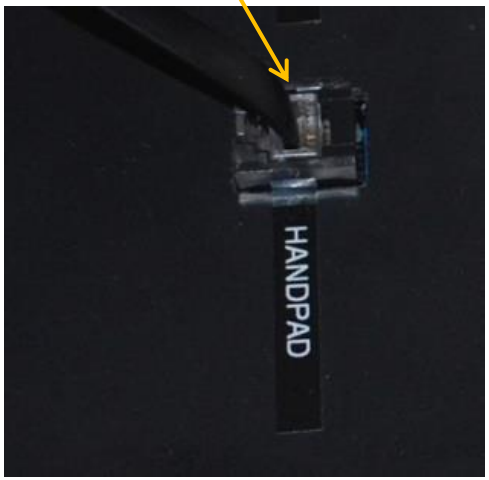
The ARDUINO contains the program (sketch) which allows communication with the computer via USB.

The ARDUINO also communicates with the motor controllers by I2C link (pins A4-SDA and A5-SCL).

ALCYONE-5 BOARD



RJ45 connector
for the simple handbox

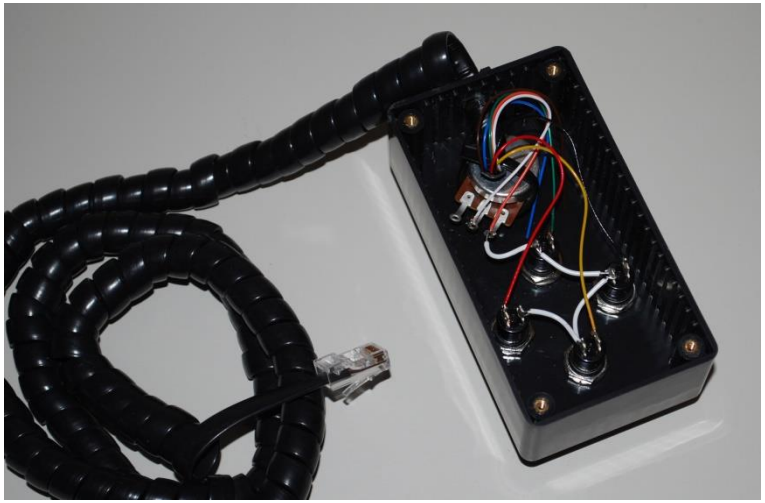


The ALCYONE-4 board contains an 8-pin RJ45 connector to connect the simple handbox which is used to move the telescope and the focuser in autonomous mode.

Respect the positions of the wires of the RJ45 cable when mounting the handbox:

Pin number	Usage
1	Speed
2	GND
3	RA+
4	RA-
5	DE+
6	DE-
7	Focus+
8	Focus-

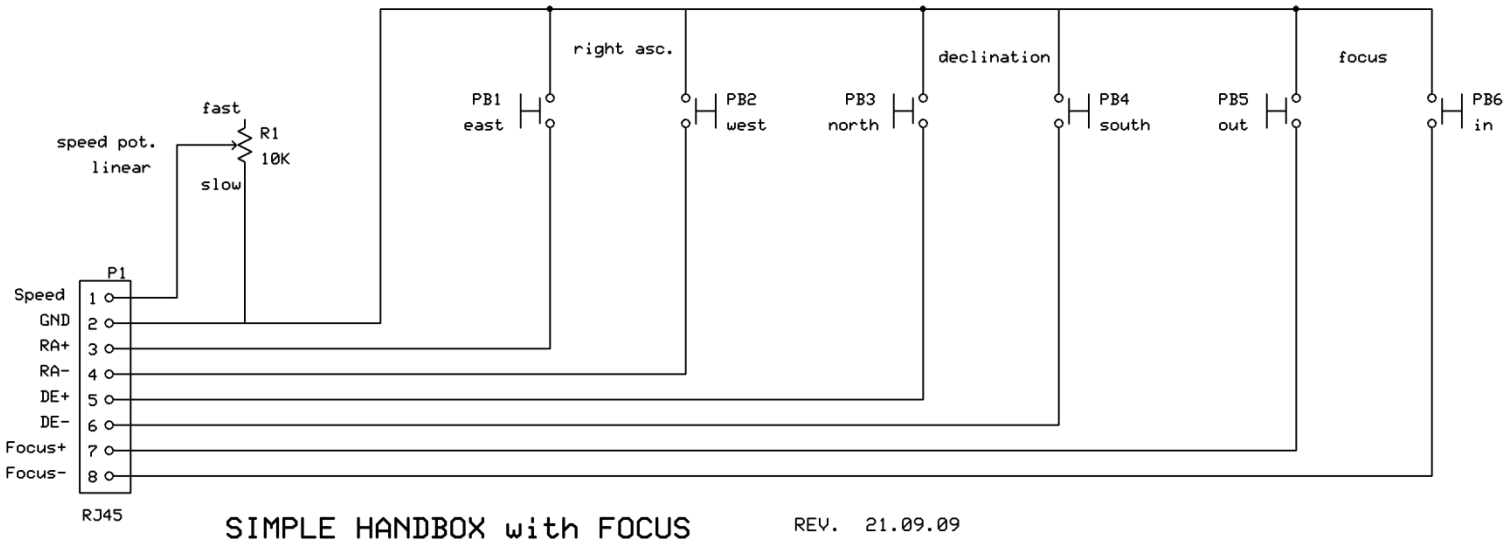
Simple handbox without focuser control



Simple handbox with focuser control

Photos of the two types of simple handboxes (with and without focuser control)

ALCYONE-5 BOARD



Simply remove the PB5 and PB6 buttons sections if there is no focuser control.

ELECTRA-5 BOARD

MOTHERBOARD FOR THE CONTROLLERS

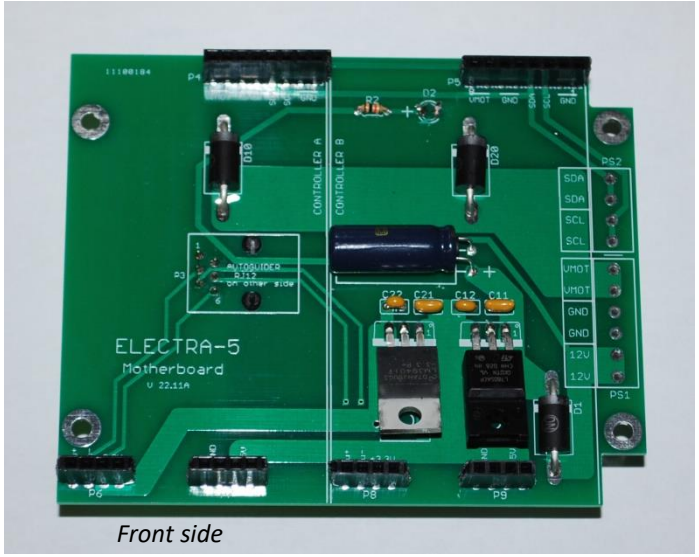
PRESENTATION OF THE BOARD

The ELECTRA-5 board is a motherboard whose main purpose is to insert one or two motor control boards (MEROPE, MAIA, TAYGETA or ATLAS) into it. It contains the female adapters to insert these boards.

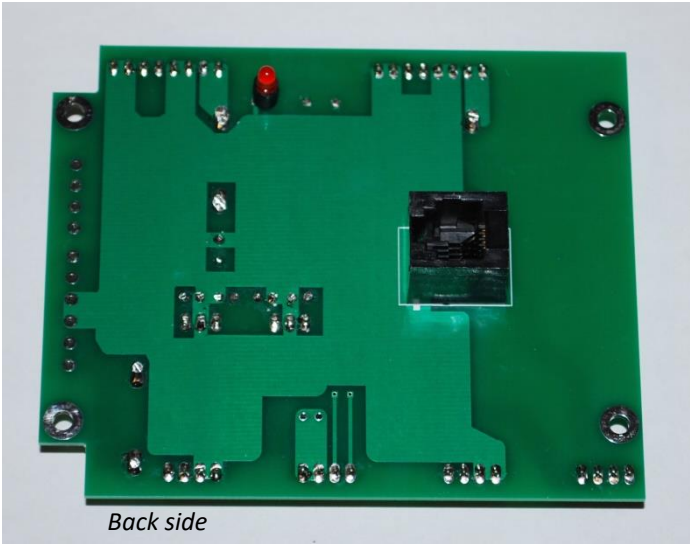
The board contains the 5 volt and 3.3 volt regulators to power the motor control boards.

It also contains a 6-pin RJ12 connector for connecting an autoguiding camera.

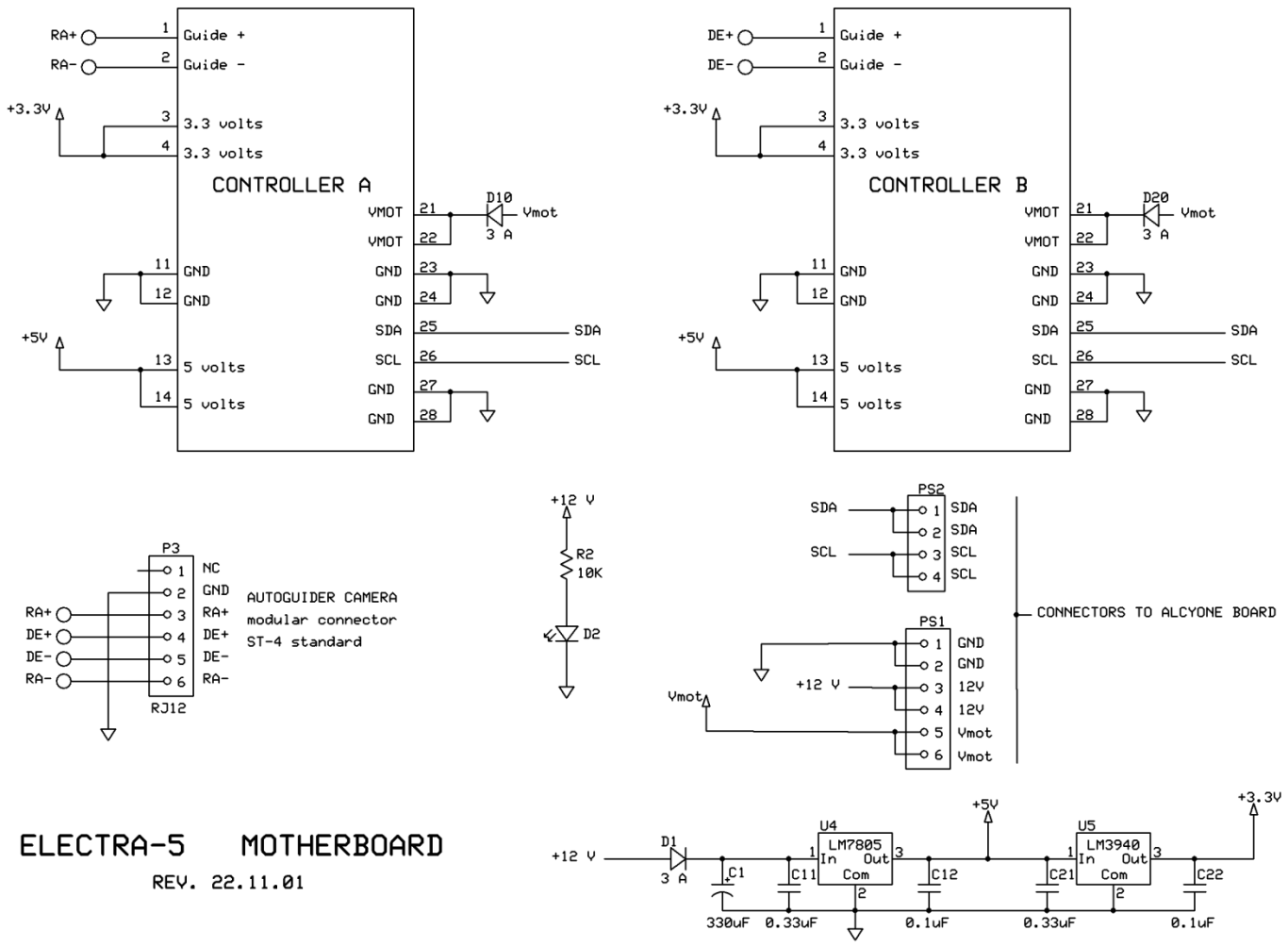
Finally, it contains two connectors so that it can be connected to an ALCYONE-5 board using a 10-conductor flat cable or some wires. One or two ELECTRA-5 boards can be connected to an ALCYONE-5 board.



Front side


Back side

ELECTRA-5 BOARD

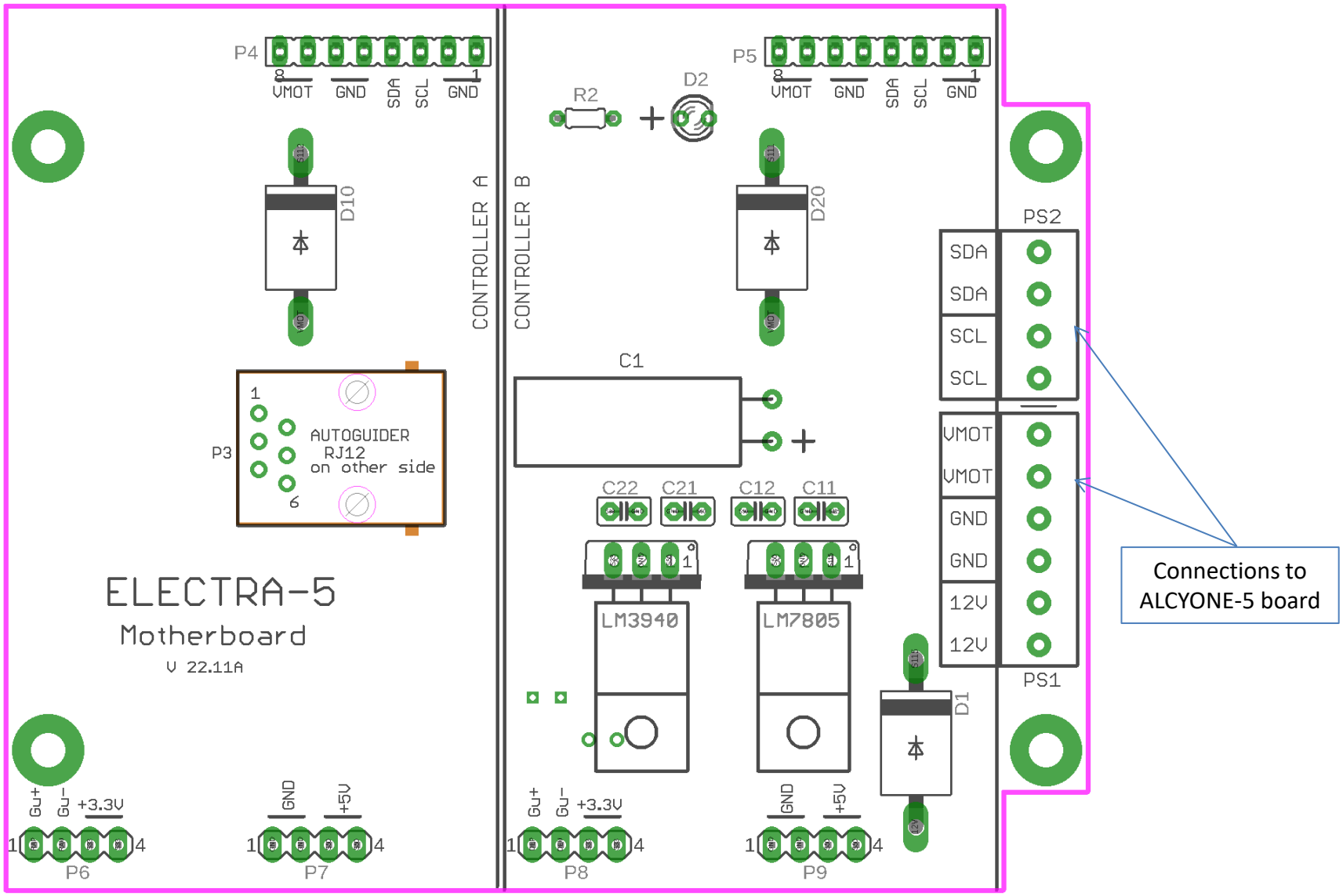


ELECTRA-5 MOTHERBOARD

REV. 22.11.01

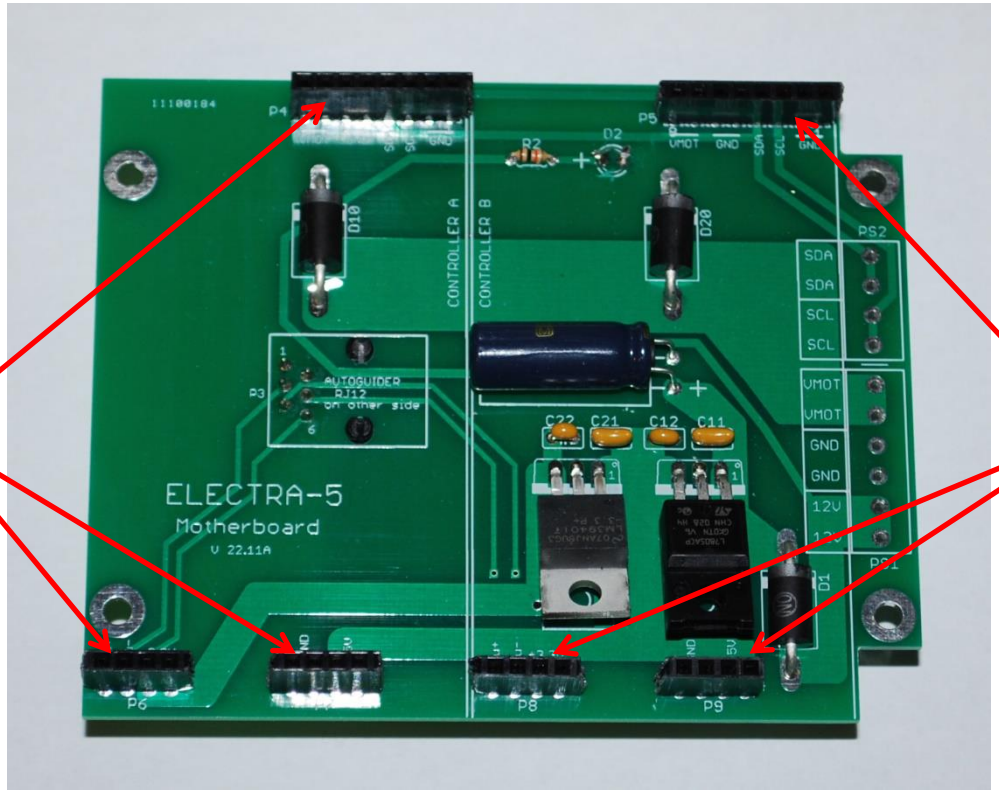
Electronic diagram of the ELECTRA-5 board

ELECTRA-5 BOARD



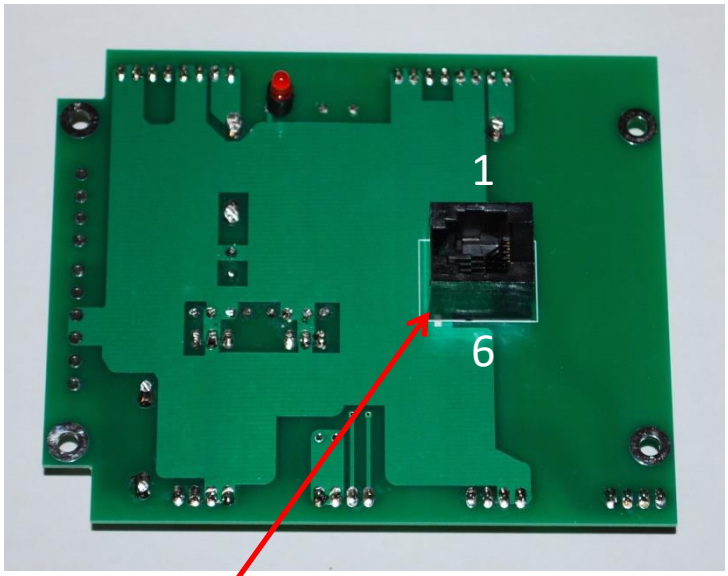
ELECTRA-5 BOARD

Connectors for controller A (right ascension or other) (TAYGETA, MAIA, ATLAS or MEROPE board)



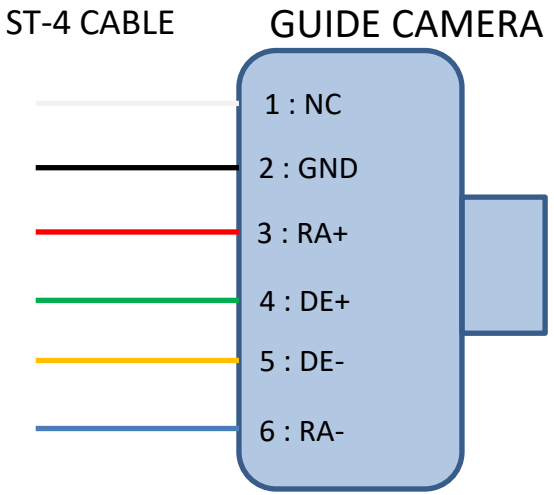
Connectors for controller B (declination or other) (TAYGETA, MAIA, ATLAS or MEROPE board)

ELECTRA-5 BOARD



Autoguiding connector

The autoguiding cameras are supplied with a modular 6-wire RJ12 cable, according to the ST-4 standard. The wires have colors in a specific order. Be careful to respect the order of the connections.

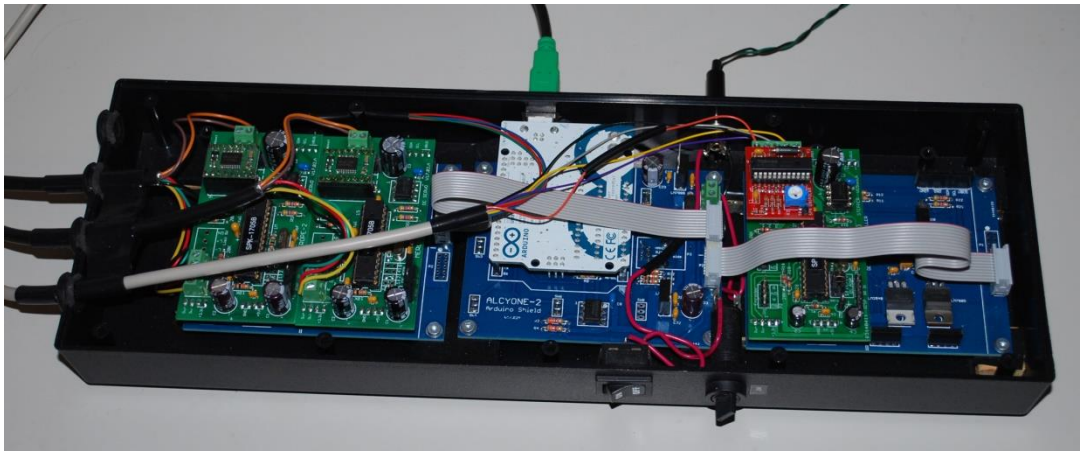


Wire #	Color	Assignment
1	white	NC (not connected)
2	black	GND (Ground)
3	red	RA+ (R.A. correction towards East)
4	green	DE+ (DECL. correction towards North)
5	yellow	DE- (DECL. Correction towards South)
6	blue	RA- (R.A. correction towards West)

ELECTRA-5 BOARD

Case where only one ELECTRA board is connected to an ALCYONE board with a 10-conductor flat cable. The ELECTRA board contains two controller boards, a controller for right ascension and one for declination.

The flat cable is used to supply power (12V and GND) to the ELECTRA-3 boards. It also transmits I2C signals (SDA and SCL).



Case where two ELECTRA boards are connected to an ALCYONE board with two 10 conductors flat cables. The second ELECTRA board contains a controller for a motorized focuser.

Electra-2 and Alcyone-2 boards shown here on these photos

TAYGETA-3 BOARD

STEPPER MOTOR CONTROLLER
UNIPOLAR WITH TB67S142NG DRIVER
OR BIPOLAR WITH A4988 DRIVER

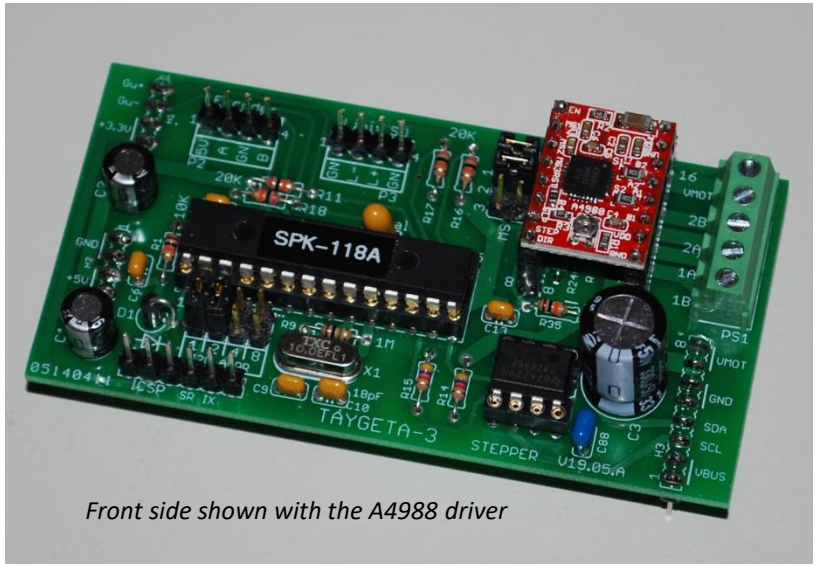
PRESENTATION OF THE BOARD

The TAYGETA-3 board contains the circuits necessary to control a stepper motor operating at 12 volts and requiring a maximum of 800 mA.

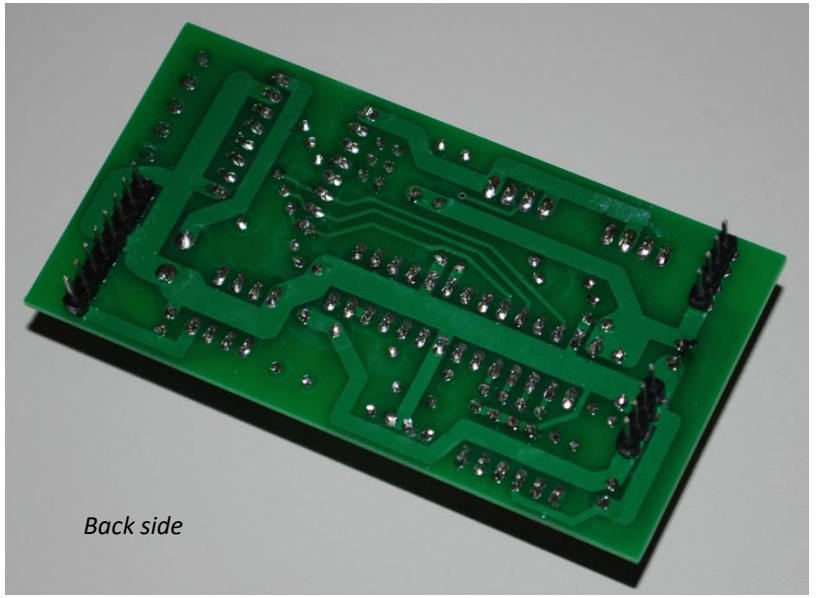
You can connect two power driver models to this board: either the A4988 power driver if you want to control a bipolar stepper motor, or the TB67S142NG power driver if you want to control a unipolar stepper motor.

As installed, these drivers can supply up to 800 mA to the motor coils. Use the ATLAS board instead if you have motors that require more current.

This board is connected to the ELECTRA motherboard using its connectors located on the rear face.

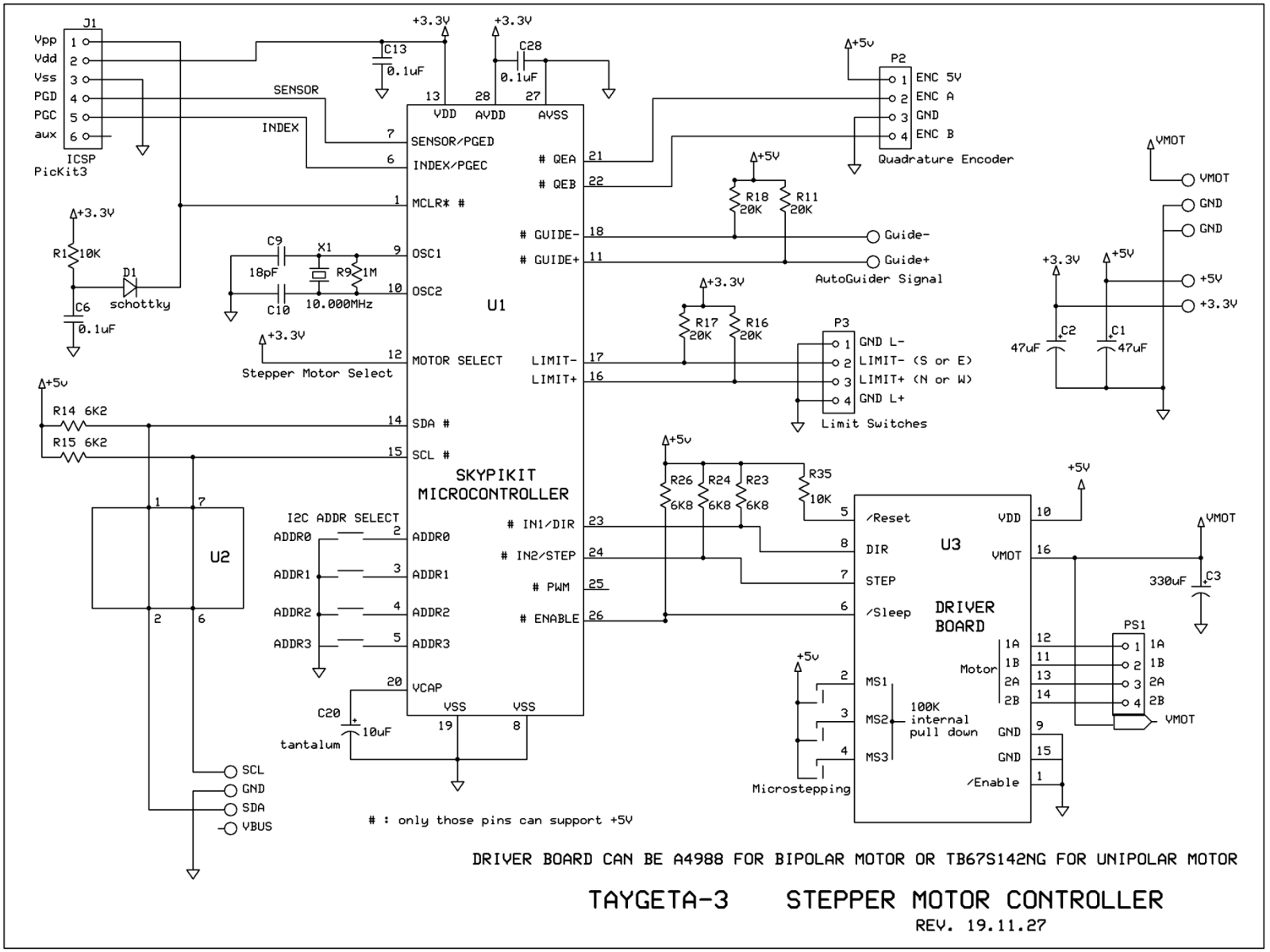


Front side shown with the A4988 driver

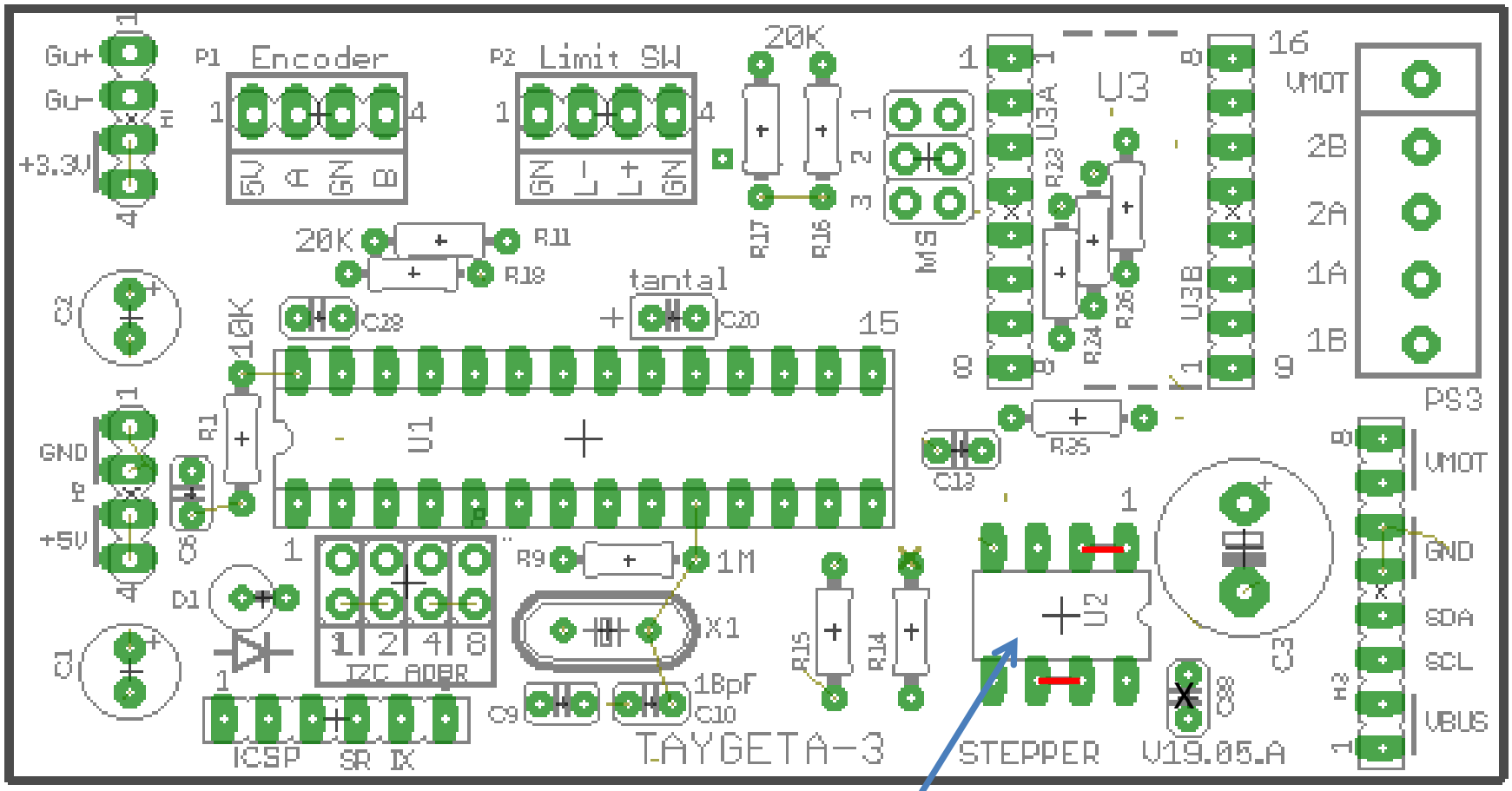


Back side

TAYGETA-3 BOARD



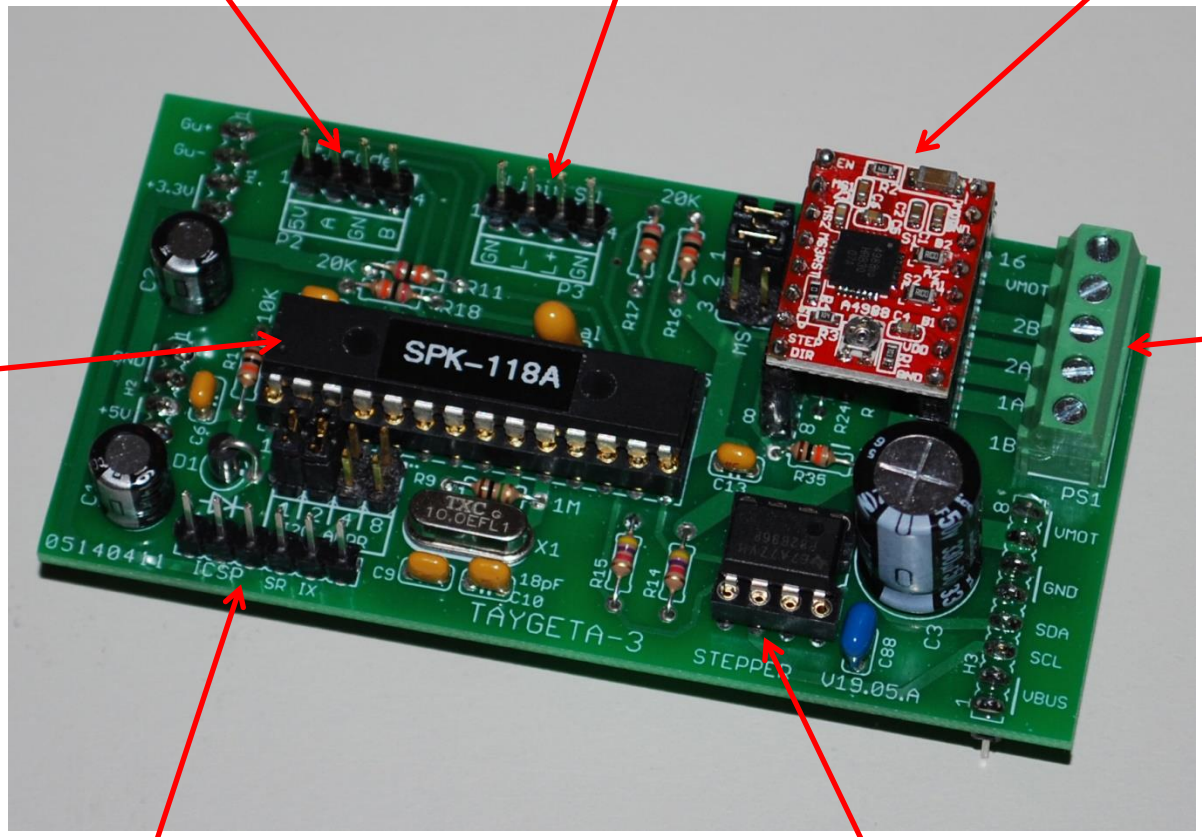
TAYGETA-3 BOARD



Items marked with an X are not installed because they are not used

Install two bridges, between the pins: 1-2 and 6-7 of U2

TAYGETA-3 BOARD



CONNECTOR TO AN ENCODER (optional)

CONNECTOR TO LIMIT SWITCHES

STEPPER MOTOR DRIVER

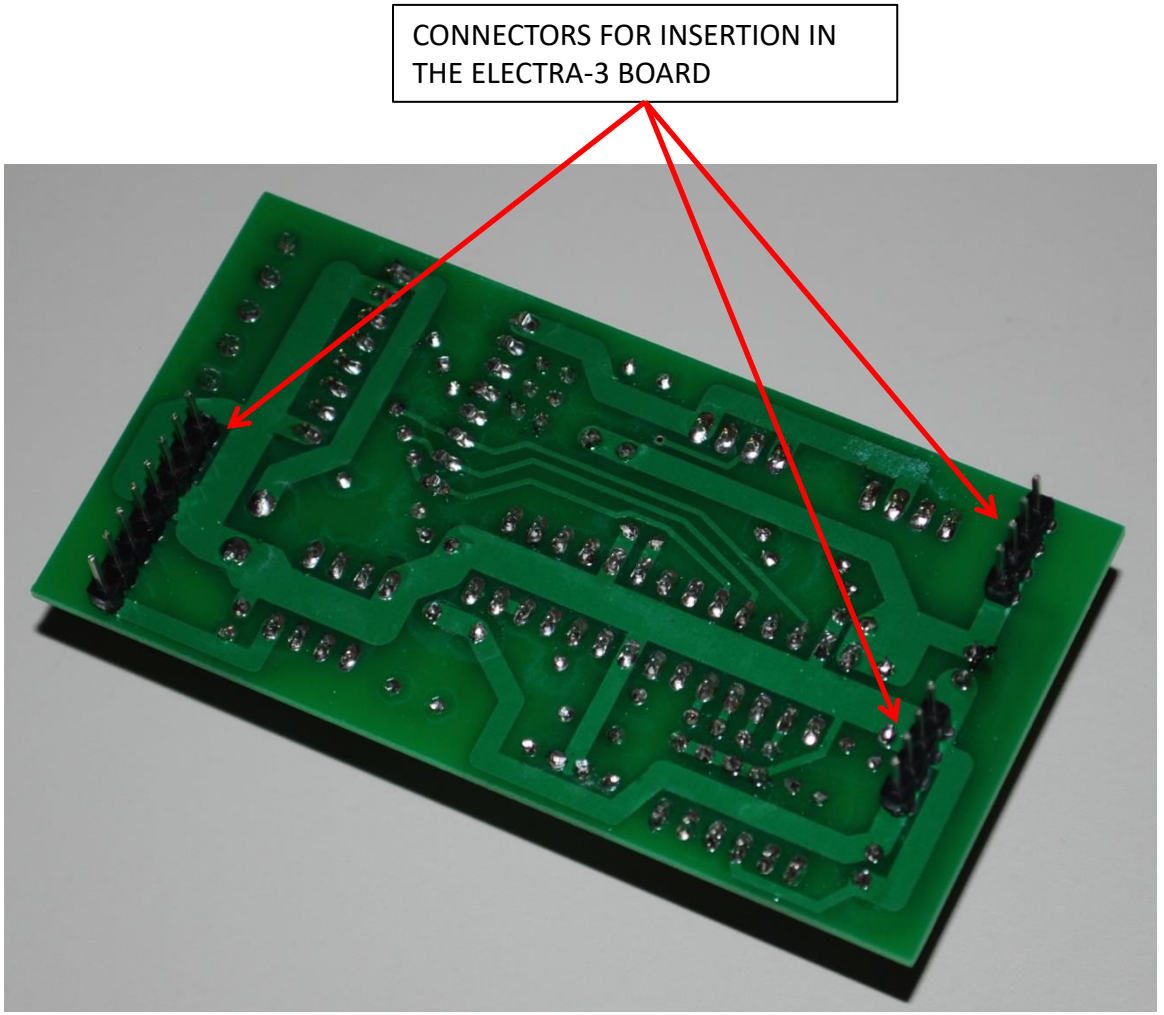
SKYPIKIT

CONNECTOR TO MOTOR COILS

CONNECTOR FOR ICSP, INDEX AND SENSOR

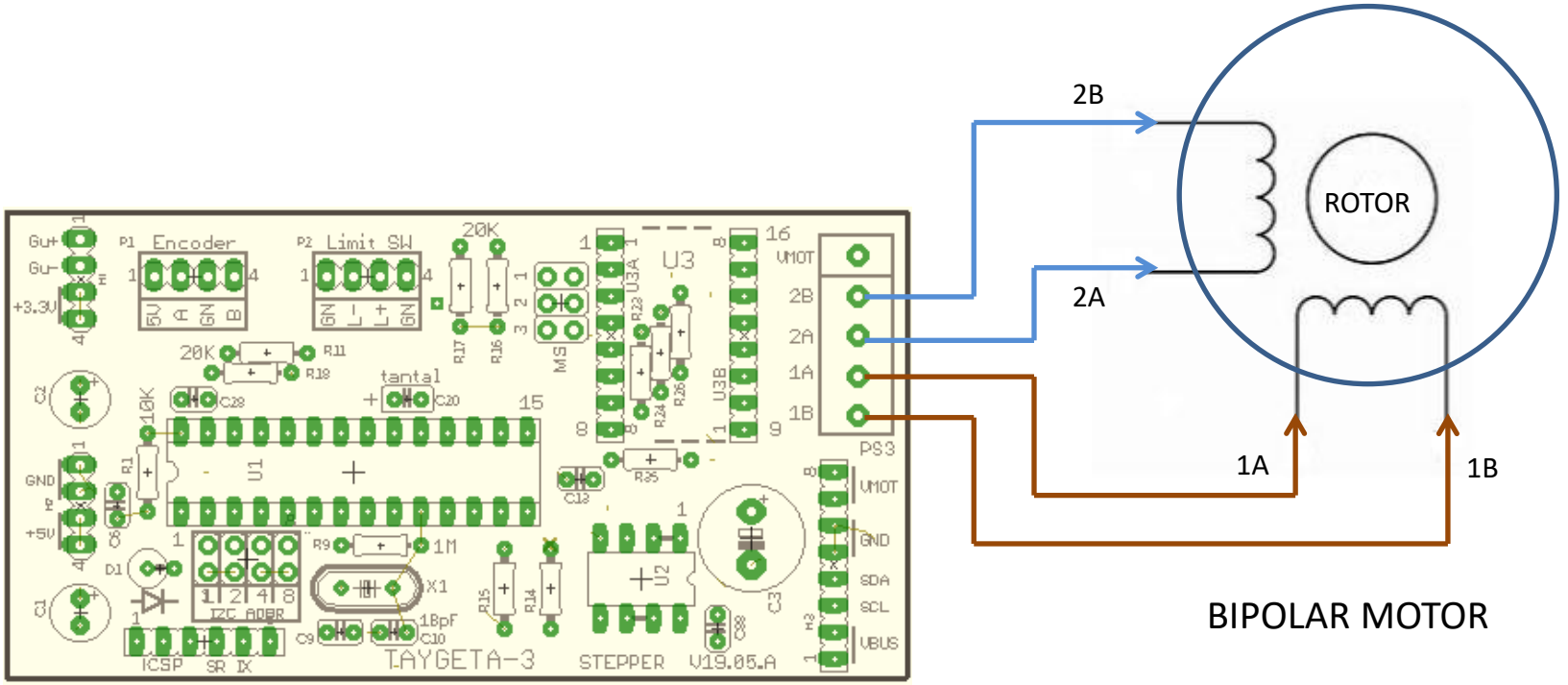
I2C BOOSTER not used with new versions

TAYGETA-3 BOARD



Back side of the TAYGETA-3 board

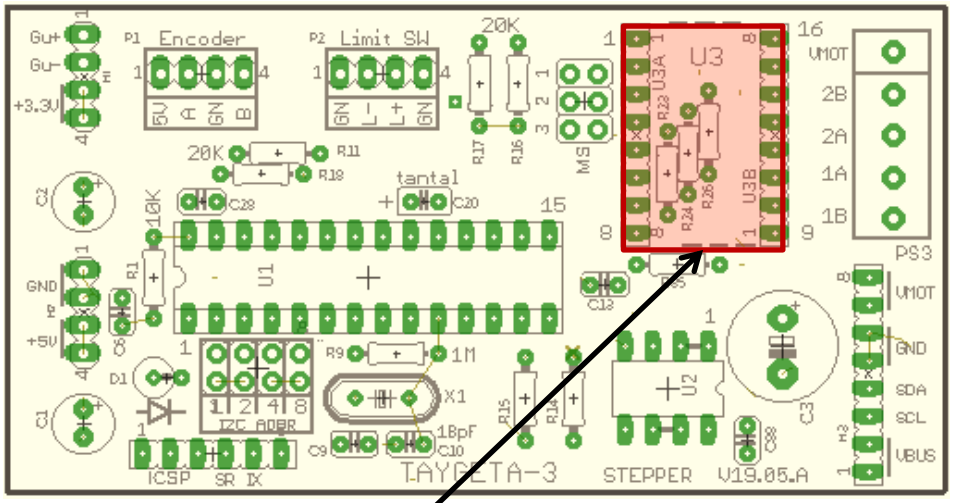
TAYGETA-3 BOARD



A bipolar stepper motor contains two coils, coil 1 and coil 2. We recognize a bipolar motor because it has four wires.

You can use a multimeter on the ohm scale to find which terminals are the ends of each coil. If your multimeter indicates a measurable resistance (usually between 5 and 100 ohms), you are connected to the ends of a coil. Take the opportunity to note the value of the resistance of each coil. This will be useful for adjusting the current limit of the A4988 driver (see next page).

TAYGETA-3 BOARD



A4988

Vref is directly measured on the potentiometer while turning it with a little screwdriver.

Adjusting potentiometer

With the A4988 module, a higher voltage than the nominal motor voltage can be used, since this circuit can actively limit the current in the coils. This allows the motor to run much faster than if only the nominal voltage were used.

The maximum current that can pass through each motor coil is equal to the nominal motor voltage indicated by the manufacturer divided by the resistance of the coil which you can measure with a multimeter:
Imax = Vnominal / Rcoil

For example, if you measure 60 ohms across each coil of a 6-volt stepper motor, the maximum current allowed will be 6 volts / 60 ohms, or 0.1 amps or 100 mA.

The maximum current is adjusted with a small current limit potentiometer located on the A4988 module.

To know the adjusted current limit, you must use a multimeter on the 200 millivolt scale, and measure a voltage Vref proportional to this current using the following formula:

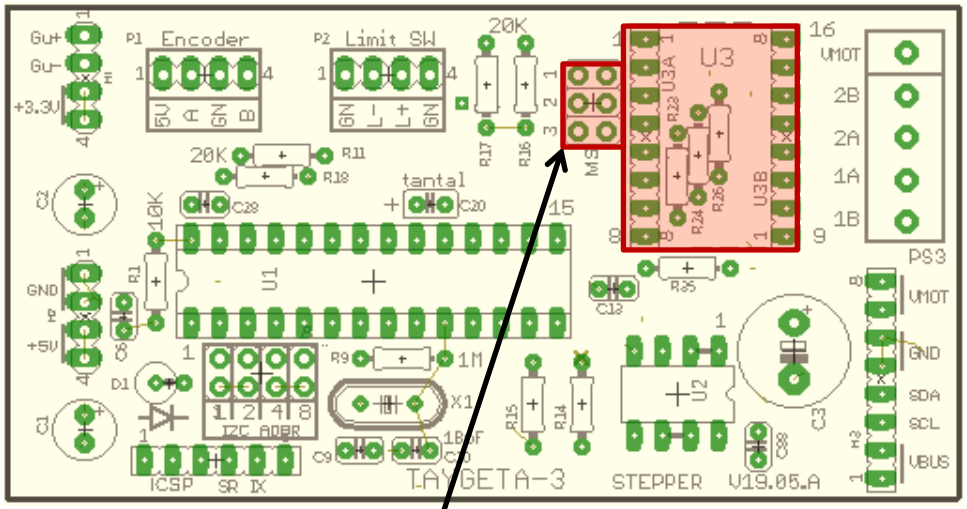
Vref **=** 8 **X** Rcs **X** Imax

where Imax is the maximum wanted current and Rcs a resistance whose value is 0.1 ohm for the A4988 modules distributed with the boards.

For example, for a wanted current of 100 mA, we obtain
Vref = 8 X 0.1 ohm X 100 mA = 80 mV.

If the motor is noisy with the current limit obtained, you can make tests by slightly reducing this limit.

TAYGETA-3 BOARD



MS1	MS2	MS3	Resolution
			Full Step
—			Half Step
	—		4 micro-steps / step
—	—		8 micro-steps / step
—	—	—	16 micro-steps / step

The table shows the positions where bridges must be installed for each configuration.

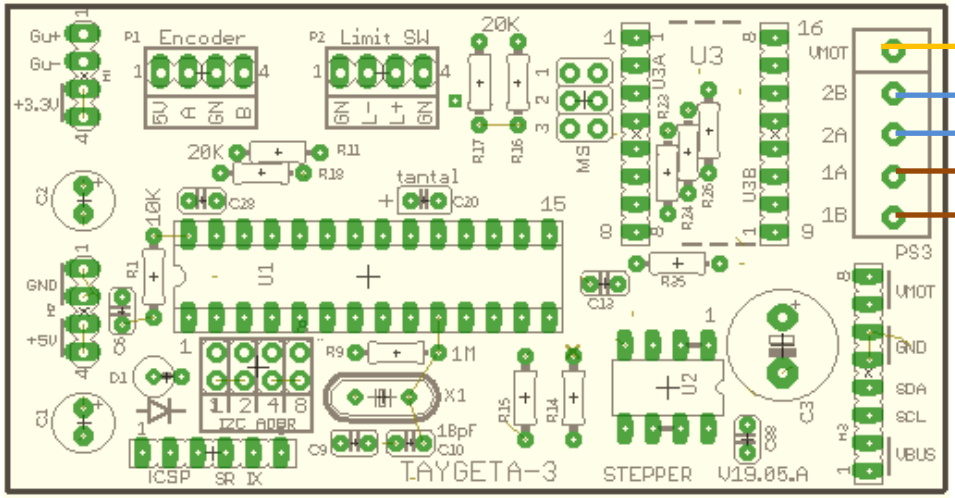
The A4988 power driver can be configured to operate with different micro-steps per step values.

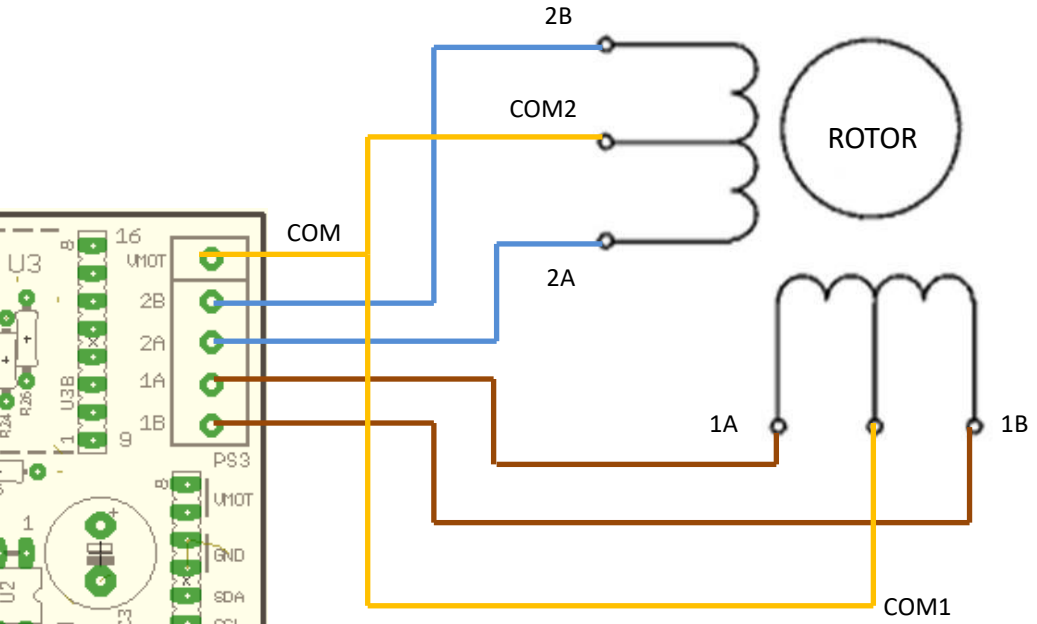
The board is delivered with the configuration to have 16 micro-steps per step, which is recommended, with bridges already installed in positions MS1, MS2 and MS3.

If you want to modify this configuration, you can do so by removing some bridges according to the positions given in the table.

Check the results using the SKYPIKIT MOTOR TESTER TUNER app.

TAYGETA-3 BOARD



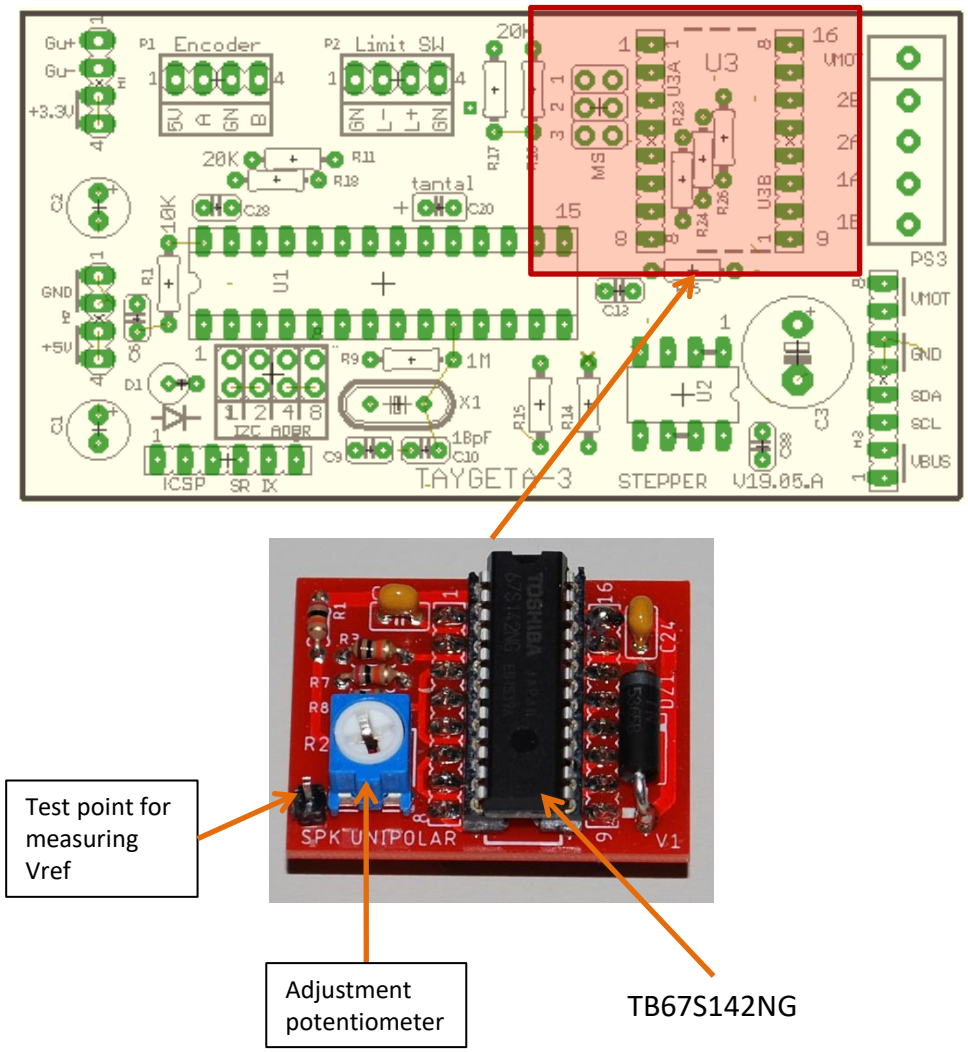


5-WIRE UNIPOLAR MOTOR

A unipolar stepper motor contains four coils. The COM1 and COM2 terminations of the coils are connected together inside the motor, so that 5 wires exit from the motor.

Connect the COM wire to the VMOT terminal of the PS3 connector.

TAYGETA-3 BOARD



With the TB67S142NG module, a higher voltage than the nominal motor voltage can be used, since this circuit can actively limit the current in the coils. This allows the motor to run much faster than if only the nominal voltage were used.

The maximum current that can pass through each motor coil is equal to the nominal motor voltage indicated by the manufacturer divided by the resistance of the coil which you can measure with a multimeter:
Imax = Vnominal / Rcoil

For example, if you measure 60 ohms across each coil of a 12-volt stepper motor, the maximum current allowed will be 12 volts / 60 ohms, or 0.2 amps or 200 mA.

The maximum current is adjusted with a small current limit potentiometer located on the TB67S142NG module.

To know the adjusted current limit, you must use a multimeter on the 2000 millivolt scale, and measure a voltage Vref proportional to this current using the following formula:

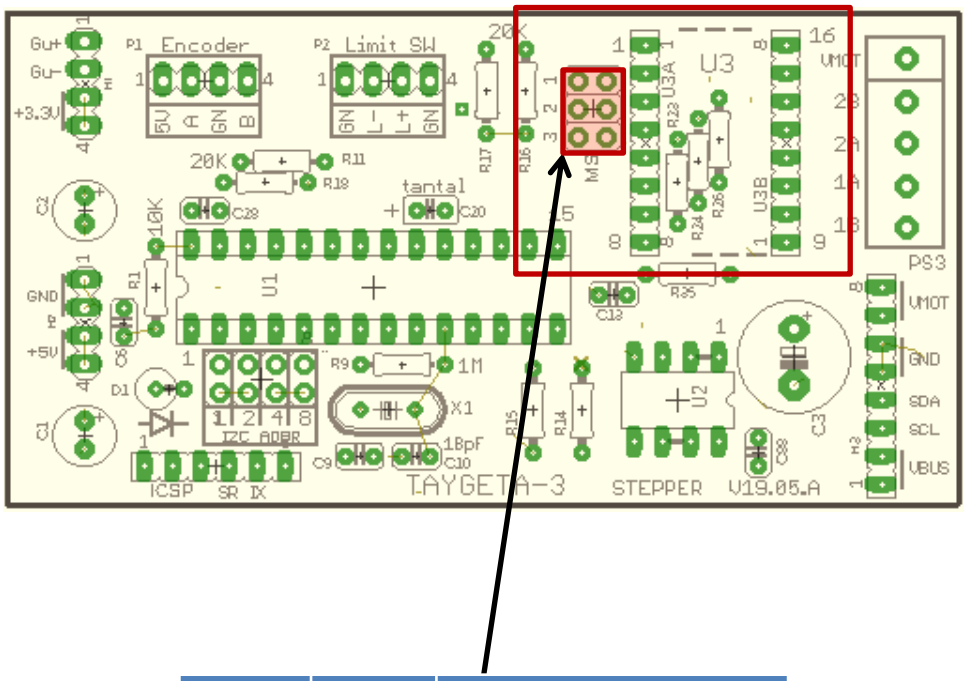
Vref = 1.33 **X** Imax

where Imax is the maximum wanted current.

For example, for a wanted current of 100 mA, we obtain
Vref = 1.33 mV / mA X 100 mA = 133 mV.

If the motor is noisy with the current limit obtained, you can make tests by slightly reducing this limit.

TAYGETA-3 BOARD



MS1	MS2	Resolution
		OFF (motor free)
	—	Full Step
—		Half Step
—	—	4 micro-steps / step

The table shows the positions where bridges must be installed for each configuration.

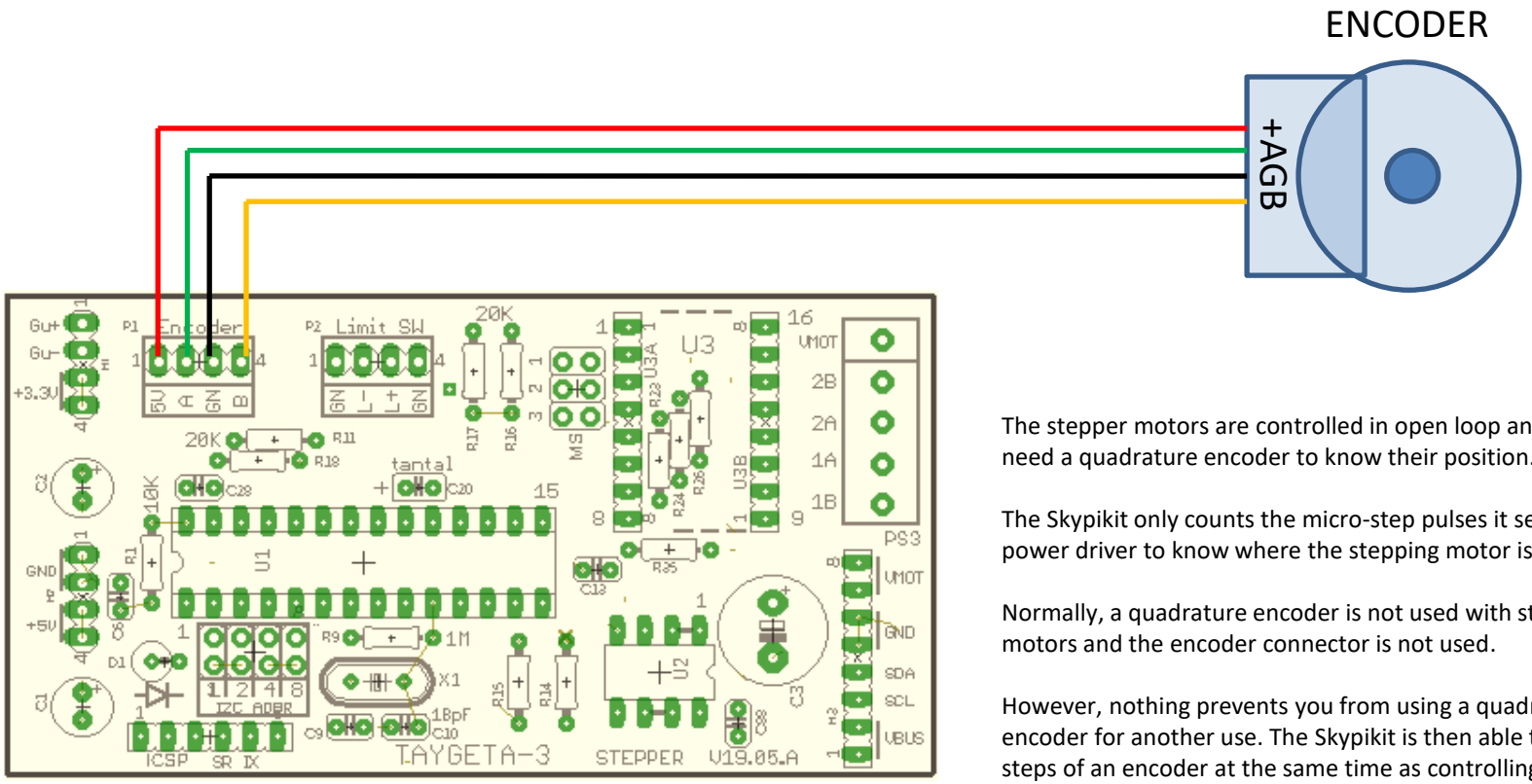
The TB67S142NG power driver can be configured to operate with different micro-step values in steps.

The board is delivered with the configuration to have 4 micro-steps per step, which is recommended, with bridges already installed in positions MS1 and MS2. The MS3 bridge is not used.

If you want to modify this configuration, you can do so by removing some bridges according to the positions given in the table.

Check the results using the SKYPIKIT MOTOR TESTER TUNER app.

TAYGETA-3 BOARD



The stepper motors are controlled in open loop and do not need a quadrature encoder to know their position.

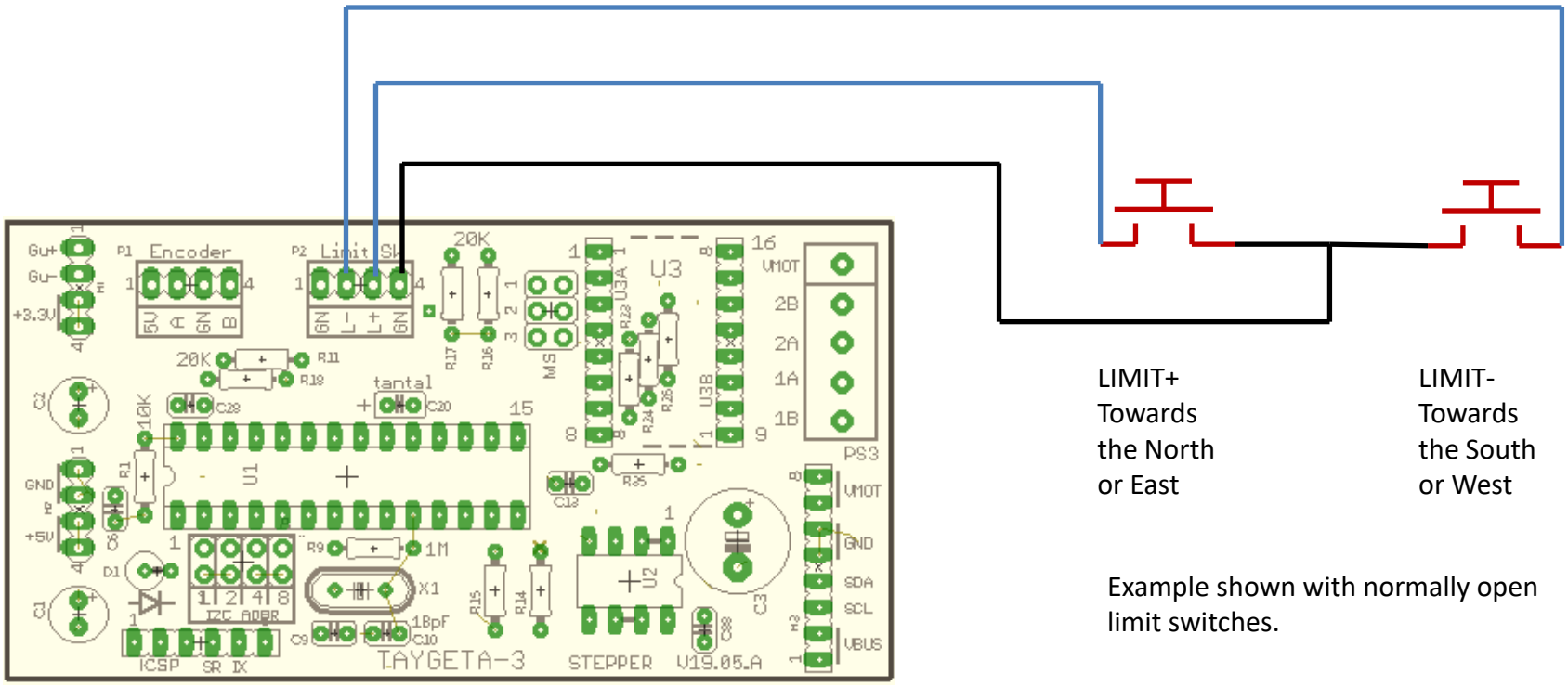
The Skypikit only counts the micro-step pulses it sends to the power driver to know where the stepping motor is positionned.

Normally, a quadrature encoder is not used with stepper motors and the encoder connector is not used.

However, nothing prevents you from using a quadrature encoder for another use. The Skypikit is then able to count the steps of an encoder at the same time as controlling an open-loop stepper motor.

Please note: the encoder must operate on a 5-volt supply.

TAYGETA-3 BOARD



Example shown with normally open limit switches.

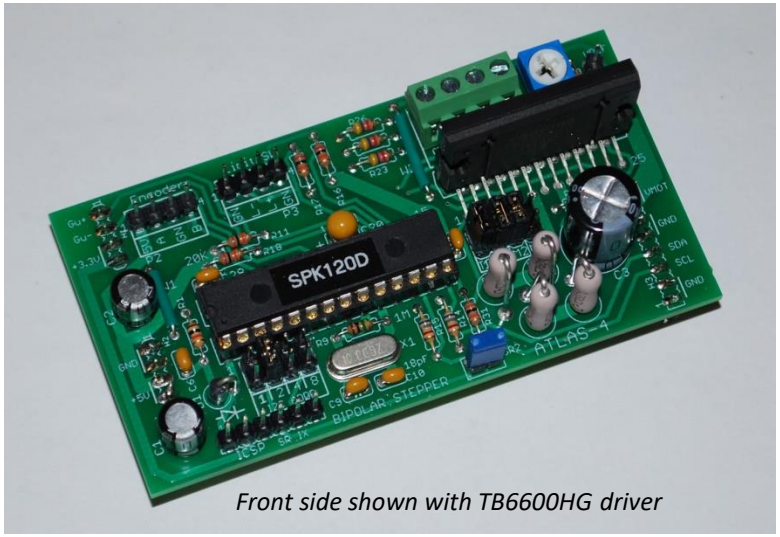
ATLAS-4 BOARD

BIPOLAR STEPPER MOTOR CONTROLLER
WITH TB6600HG DRIVER

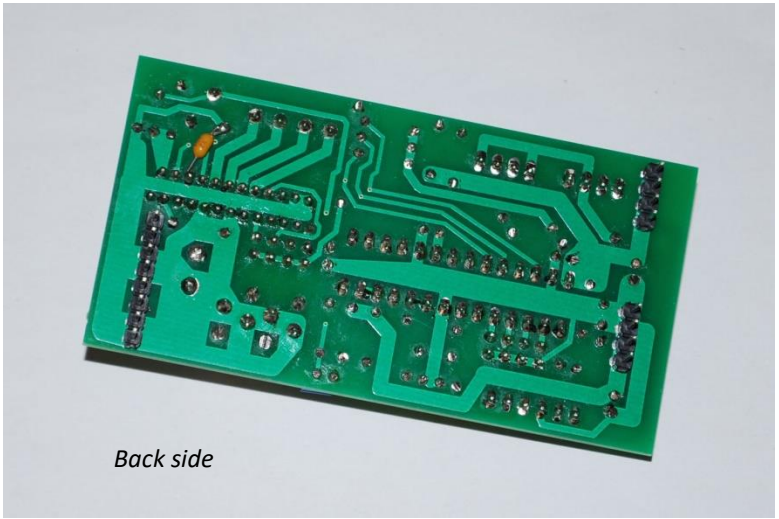
PRESENTATION OF THE BOARD

The ATLAS-4 board contains a TB6600HG power driver to control a stepper motor operating with a supply of up to 24 volts and a current of up to 2.7 amps, for example a NEMA 23 or larger motor.

This board is connected to the ELECTRA motherboard using its connectors located on the rear face.

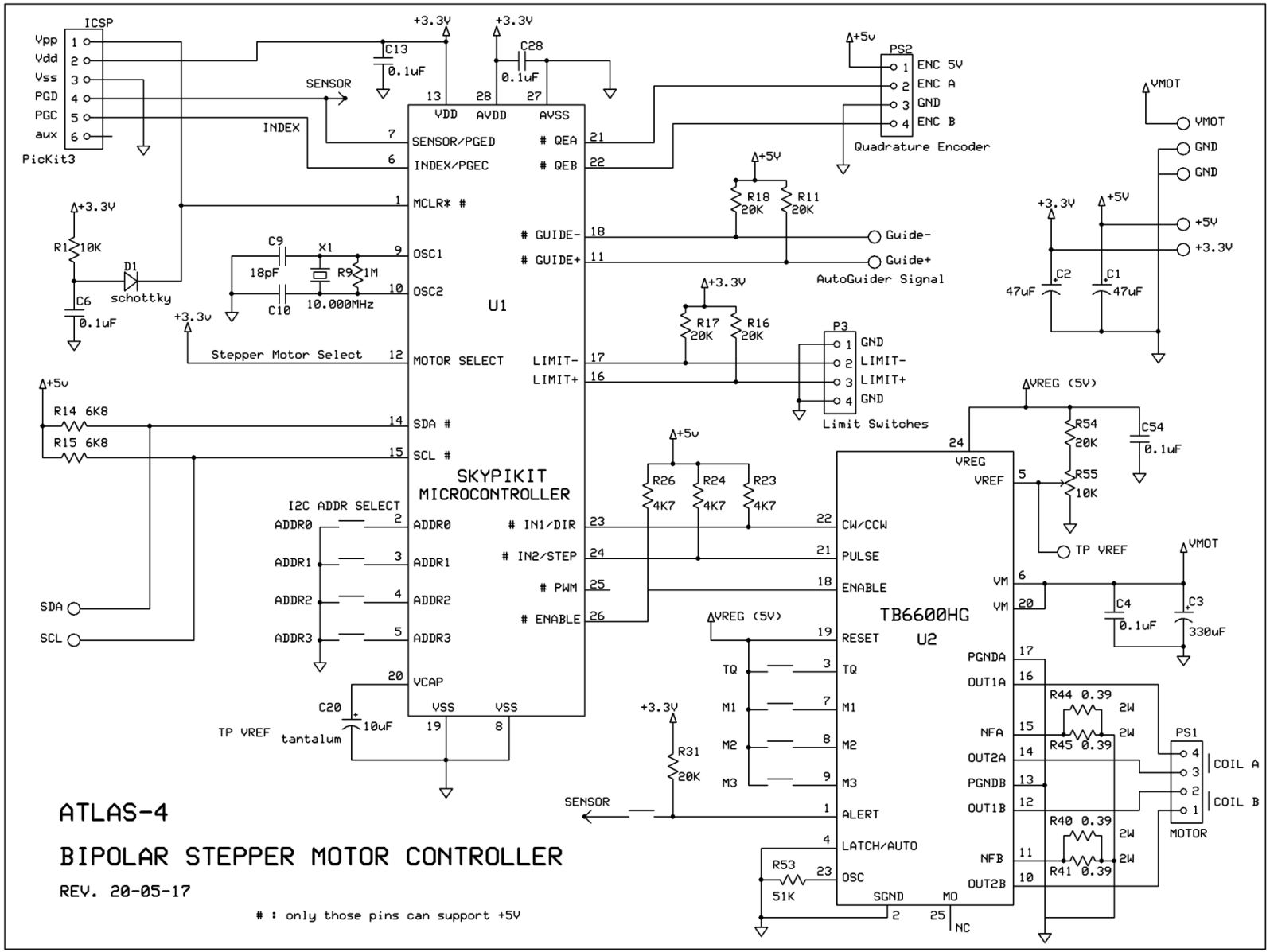


Front side shown with TB6600HG driver

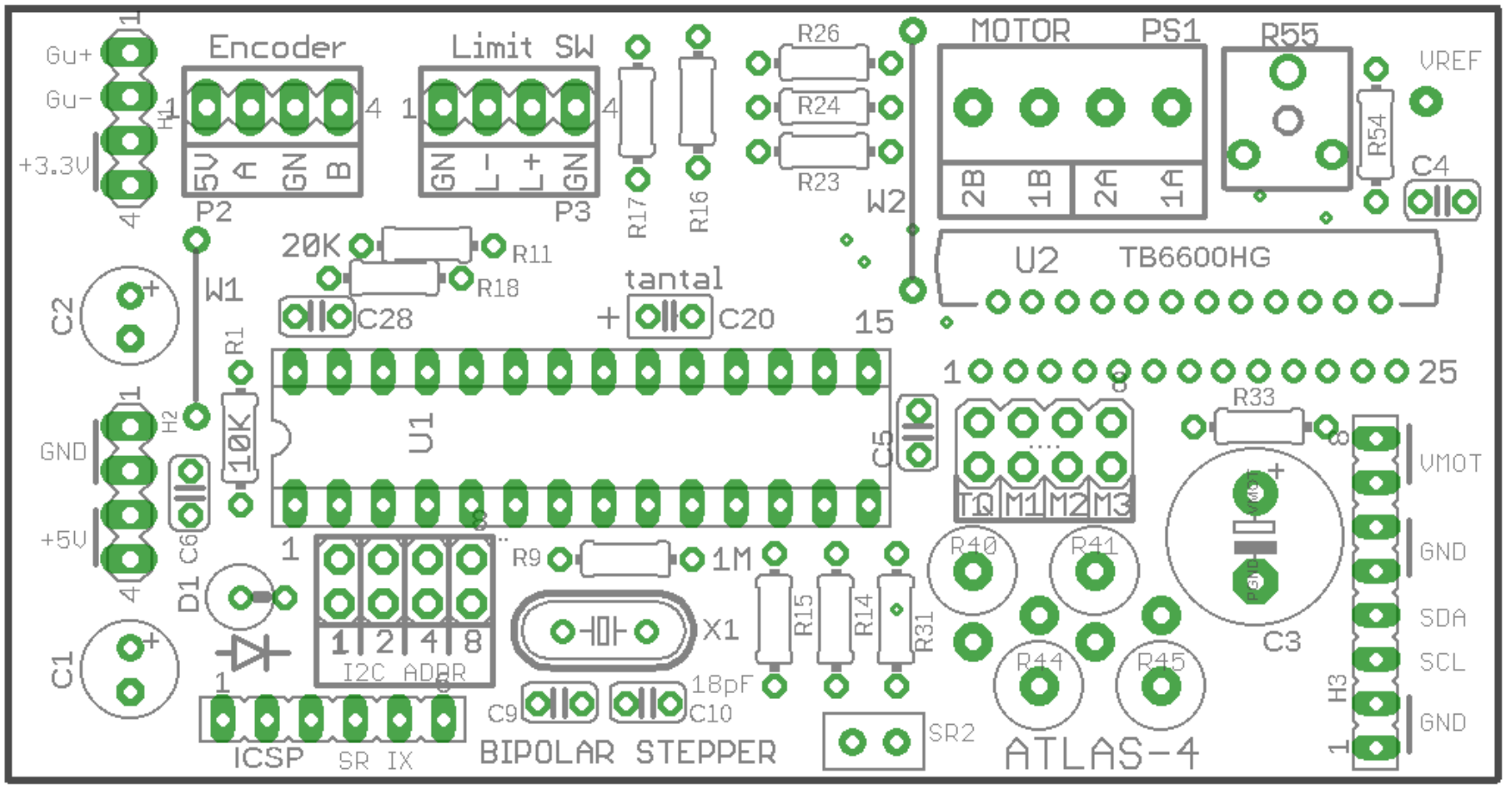


Back side

ATLAS-4 BOARD



ATLAS-4 BOARD



ATLAS-4 BOARD

CONNECTOR TO AN ENCODER (optional)

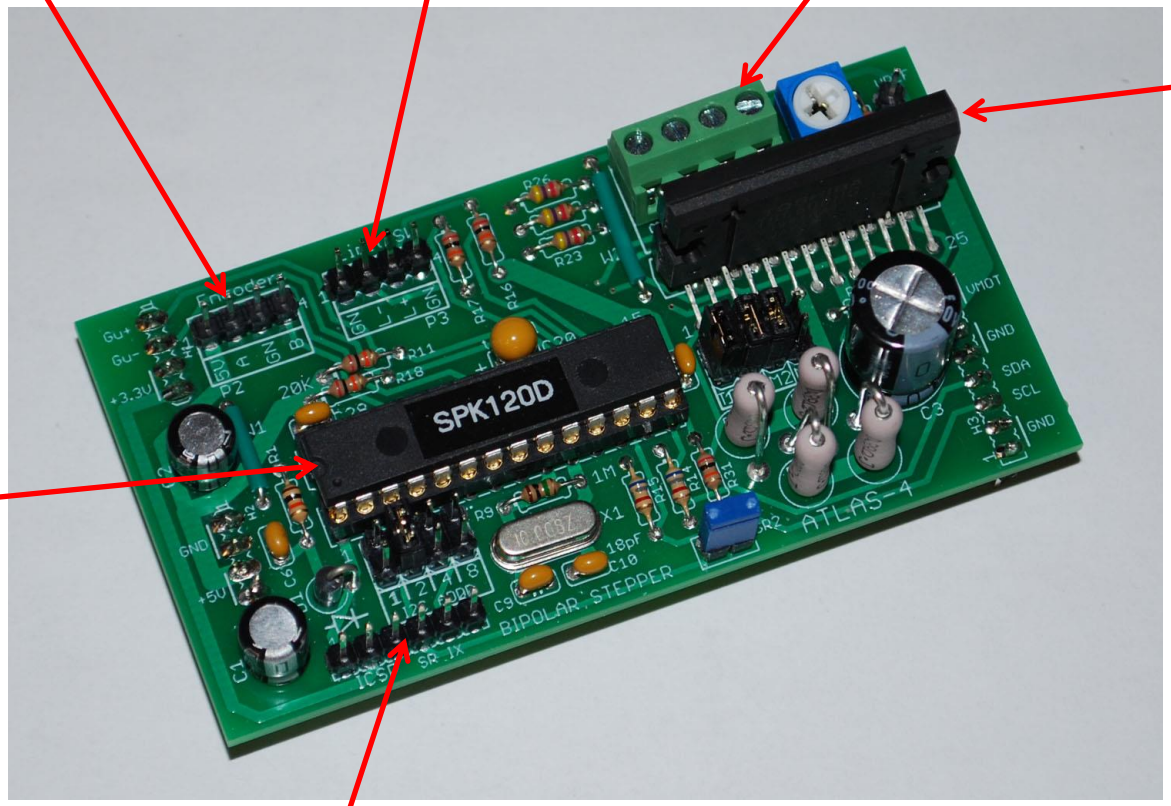
CONNECTOR TO LIMIT SWITCHES

CONNECTOR TO MOTOR COILS

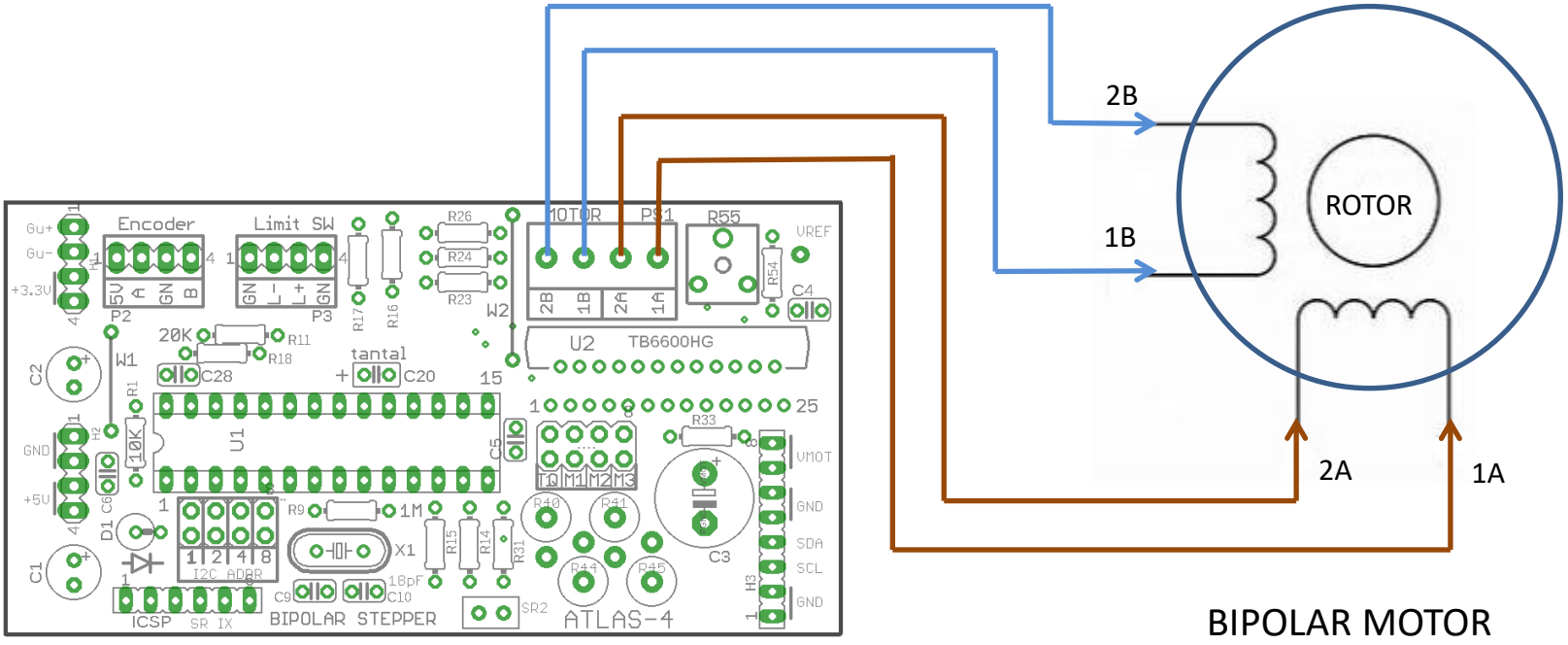
STEPPER MOTOR DRIVER TB6600HG

SKYPIKIT

CONNECTOR FOR ICSP, INDEX AND SENSOR



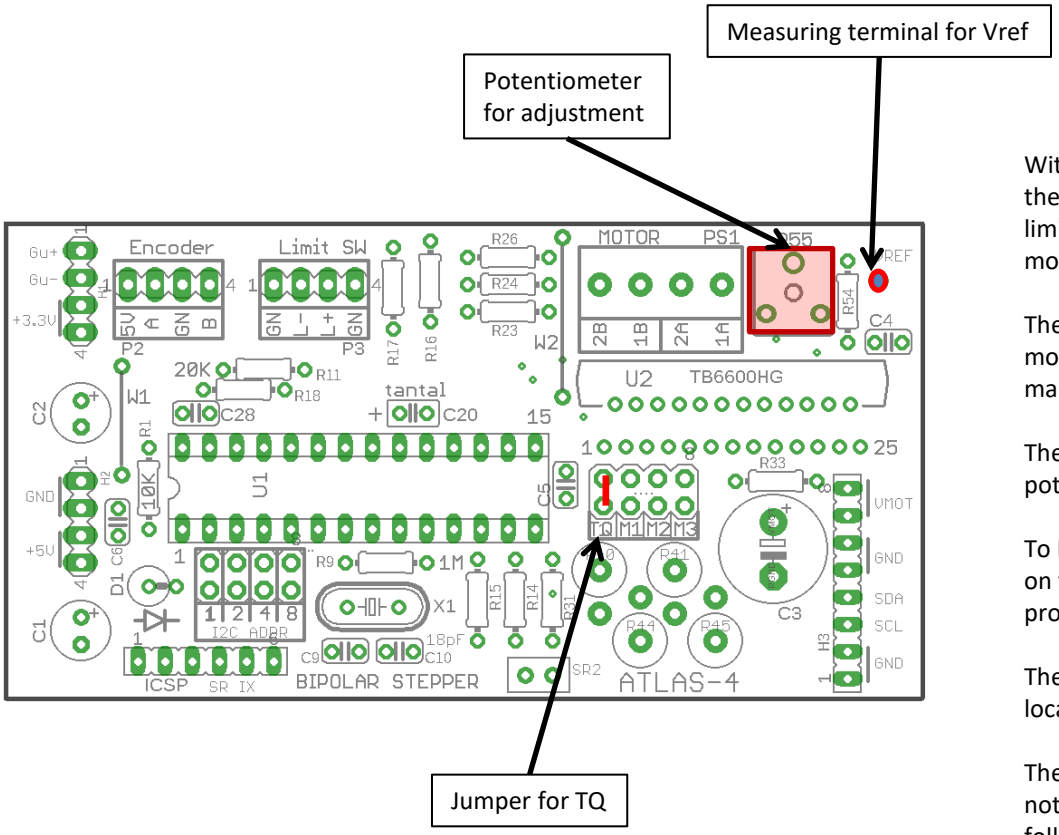
ATLAS-4 BOARD



A bipolar stepper motor contains two coils, coil A and coil B. You can recognize a bipolar motor because it has four wires.

You can use a multimeter on the ohm scale to find which terminals are the ends of each coil. If your multimeter shows a measurable resistance (usually between 5 and 100 ohms), you are connected to the ends of a coil. Take the opportunity to take note of the resistance value of each coil. This will be useful for adjusting the current limit of the TB6600HG driver (see below).

ATLAS-4 BOARD



With the TB6600HG module, one can use a voltage higher than the rated voltage of the motor, since this circuit can actively limit the current in the coils. This makes it possible to run the motor much faster than if only the nominal voltage were used.

The maximum current that can pass through each coil of the motor is indicated in the motor specifications provided by the manufacturer.

The maximum current is adjusted with a current limit potentiometer located on the board.

To know the adjusted current limit, you must use a multimeter on the 2000 millivolt scale, and measure a voltage Vref proportional to that current.

The voltage Vref is measured on a measurement terminal located on the board.

There are two measurement scales depending on whether or not a jumper is installed in the TQ position.The table on the following page indicates the maximum current Imax as a function of the voltage Vref.

Imax (mA)	Vref (mV) TQ=0	Vref (mV) TQ=1
50	100	
100	200	
150	300	
200	400	
300	600	
400	800	235
500	1000	294
600	1200	353
700	1400	412
800	1600	471
900		529
1000		588
1200		706
1400		824
1600		941
1800		1059
2000		1164
2200		1294
2400		1412
2600		1529
2800		1647
2850		1667

The table on the left gives the current Imax in the motor coils as a function of a measured voltage Vref.

There are two scales of measurement depending on whether or not a bridge is installed in the TQ position.

For small motors which require a low current, it is suggested to use the scale with TQ = 0, ie with the bridge not installed.
In this case, we obtain the following formula:
Imax = 0,5 X Vref

Where Imax is in mA and Vref in mV.

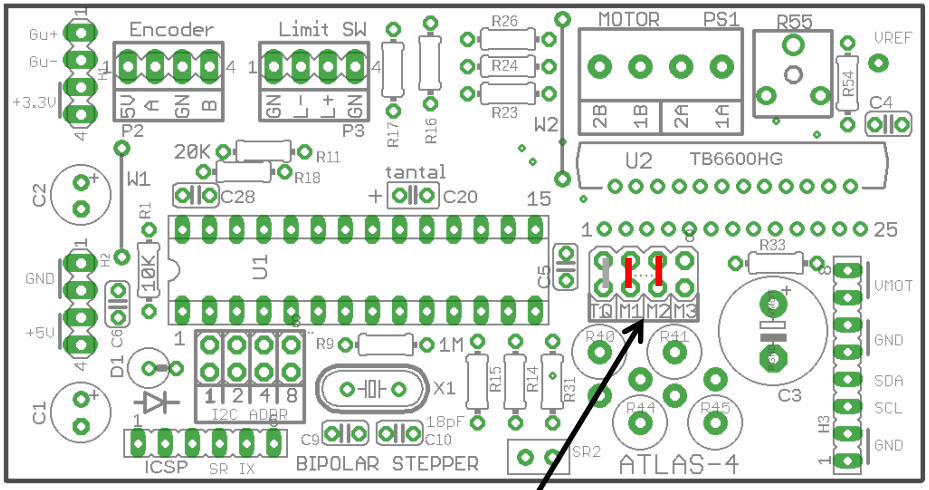
For larger motors which require a higher current, it is suggested to use the scale with TQ = 1, ie with the bridge installed.
In this case, we obtain the following formula:
Imax = 1,7 X Vref

Where Imax is in mA and Vref in mV.

Vref can vary from 0 mV to approximately 1667 mV, when adjusting potentiometer R55.

NOTE: It is always recommended to use the smallest Imax current possible for the motor to run smoothly.

ATLAS-4 BOARD



M1	M2	M3	Resolution
			Motor at FREE
		—	Full step
	—		Half step
—			4 micro-step/full step
—		—	8 micro-step/full step
—	—		16 micro-step/full step
—	—	—	Motor at FREE

The table shows the positions where bridges should be installed for each configuration.

The TB6600HG power driver can be configured to operate with different micro-step by step values.

The board comes configured to have 16 micro-steps per step, which is recommended, with bridges already installed at positions M1 and M2.

If you want to change this configuration, you can do so by moving some bridges according to the positions given in the table.

Check the results using the SKYPIKIT MOTOR TESTER TUNER app.

See the description of the TAYGETA-3 board for connections to limit switches and an optional encoder.

MEROPE-3 BOARD

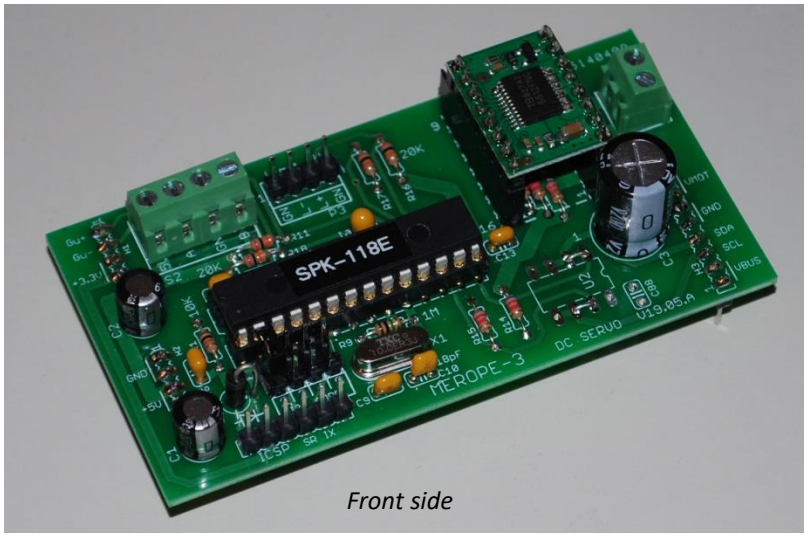
CONTROLLER FOR DC MOTOR WITH ENCODER
USING THE TB6612 DRIVER

PRESENTATION OF THE BOARD

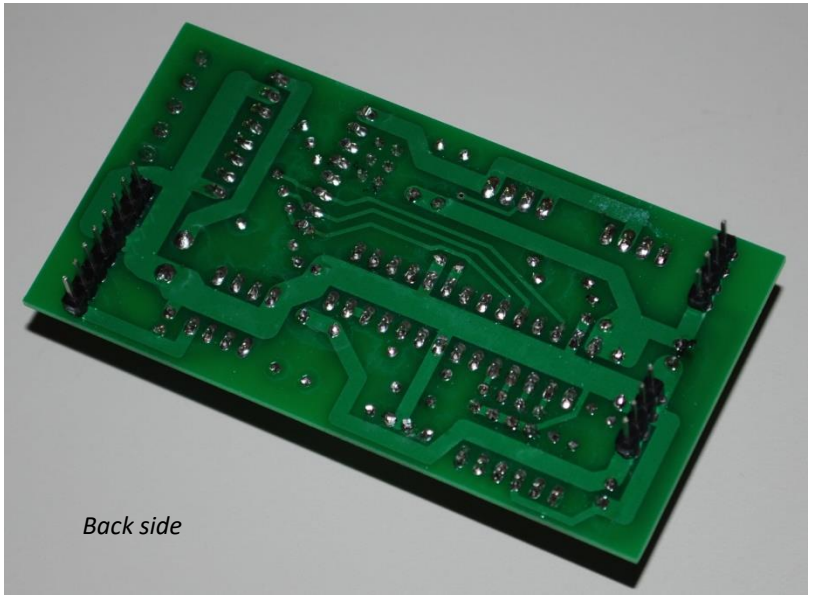
The MEROPE-3 board contains the necessary circuits to control a DC motor with encoder.

This board uses Polulu's TB6612 power driver which can supply a maximum of 800 mA to the motor as installed (without heatsink). The voltage supplied to the motor must be 12 volts with this board. Instead, use the MAIA board if you have a motor that requires more current (up to 2.7 A).

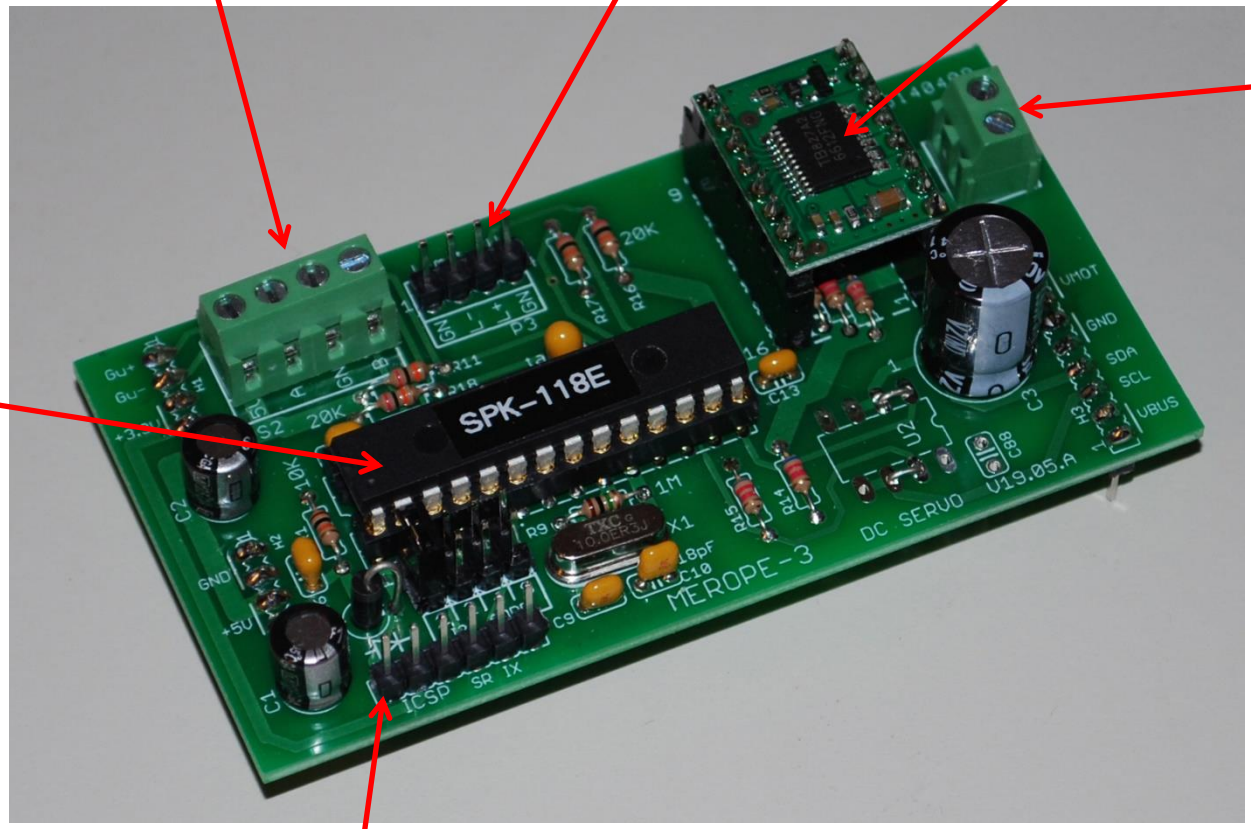
This board is connected to the ELECTRA motherboard using its connectors located on the rear face.



Front side


Back side

MEROPE-3 BOARD



CONNECTOR TO THE ENCODER OF THE DC MOTOR

CONNECTOR TO LIMIT SWITCHES

TB6612 DRIVER FOR THE DC MOTOR

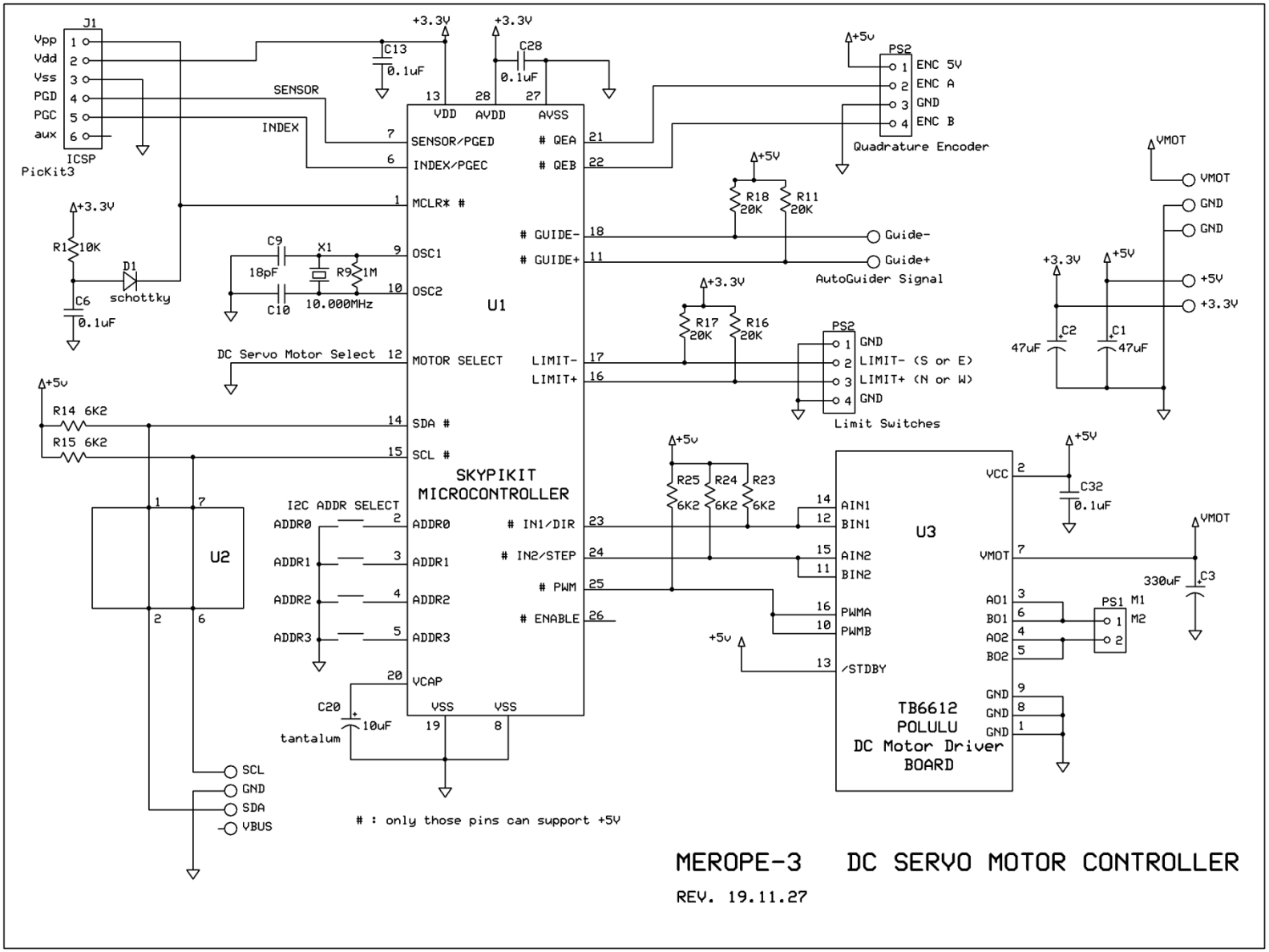
CONNECTOR TO THE COILS OF THE DC MOTOR

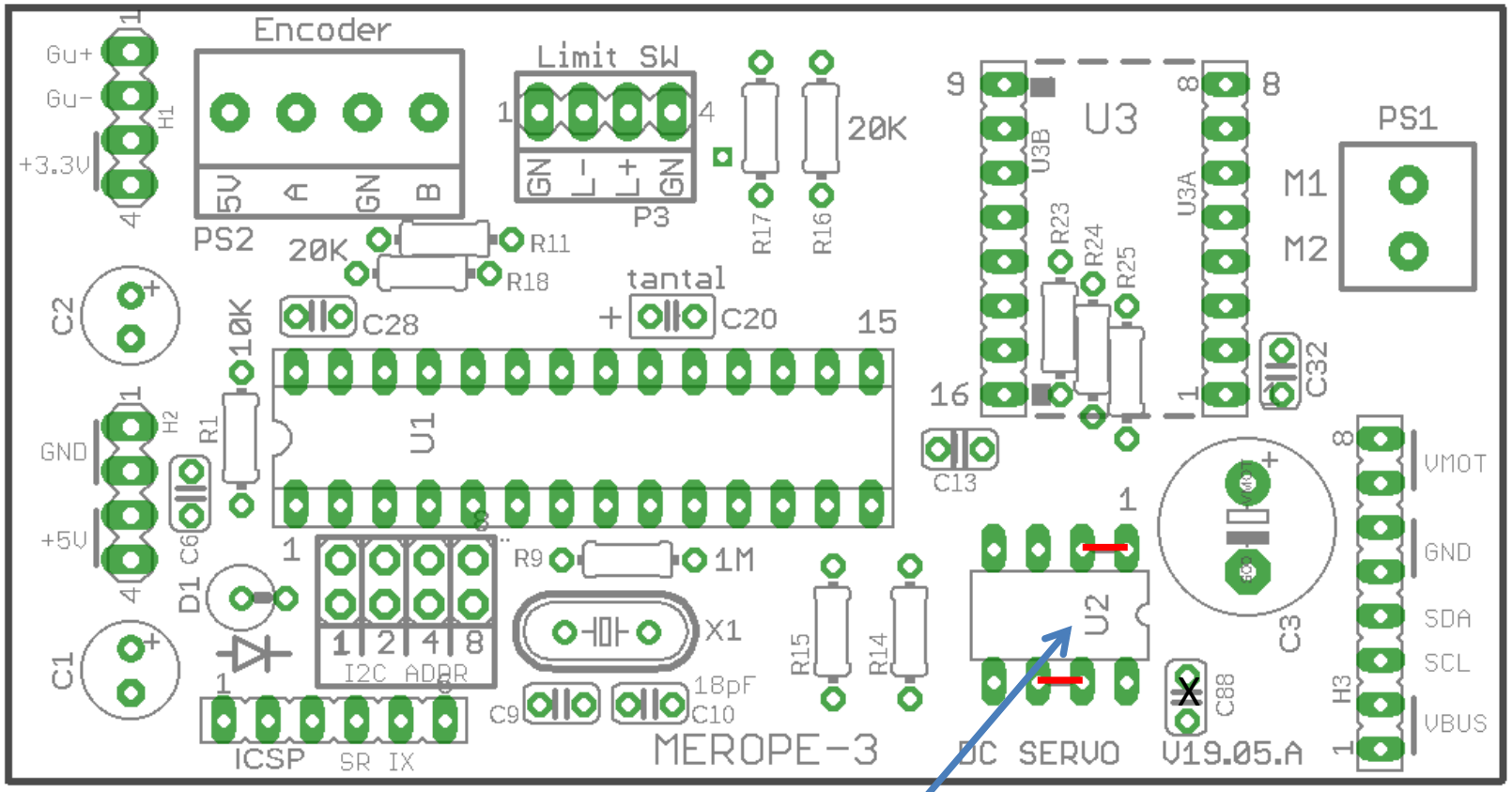
SKYPIKIT

CONNECTOR FOR ICSP, INDEX AND SENSOR

Front side of the MEROPE-3 board

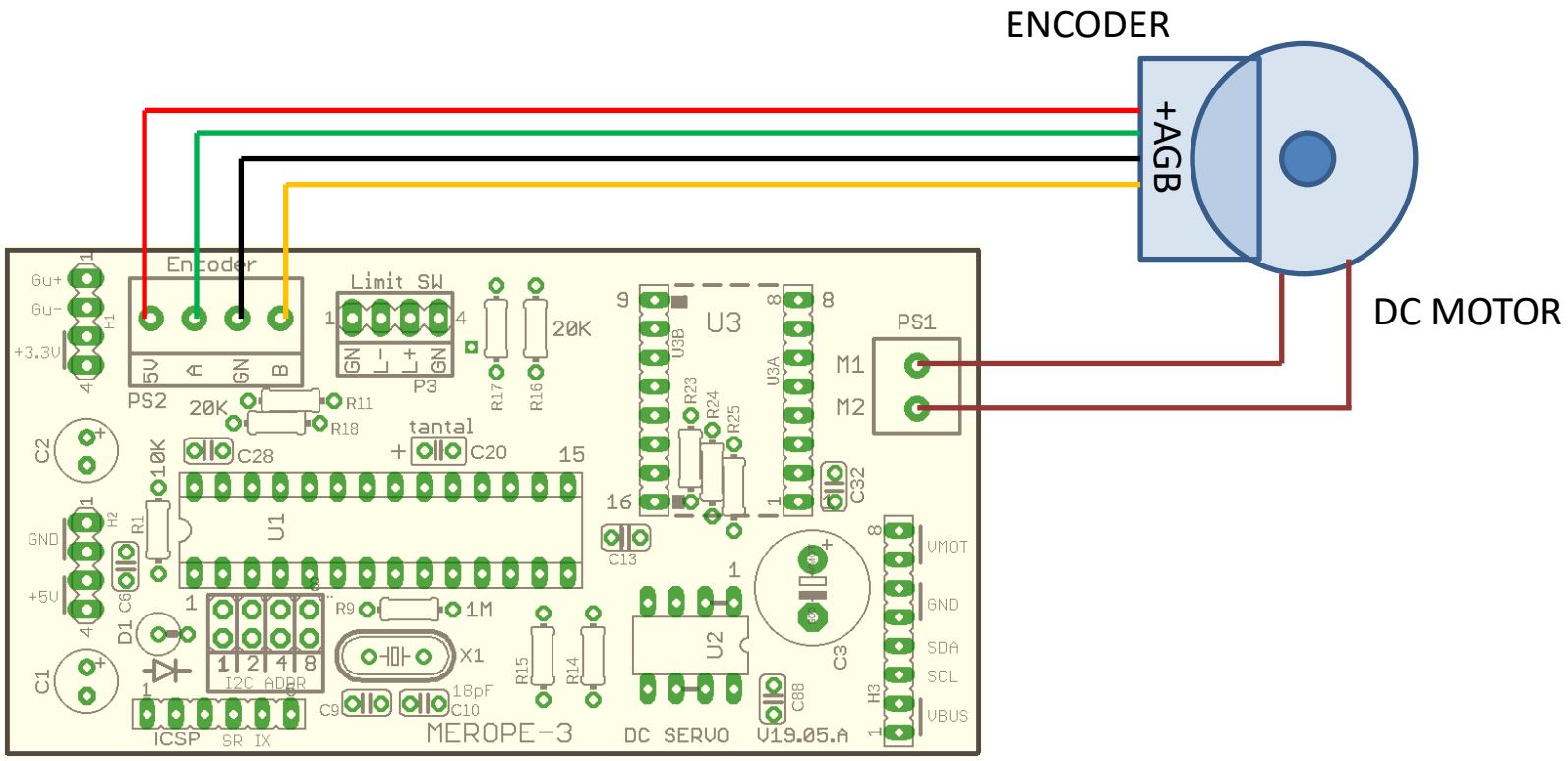
MEROPE-3 BOARD





Items marked with an X are not installed because they are not used

Install two bridges, between the pins: 1-2 and 6-7 of U2



The DC motor is closed loop controlled and needs a quadrature encoder so the Skypikit can know its position and speed.
Warning: the encoder of the chosen motor must work with a 5 volt supply.

See the description of the TAYGETA-3 board for the connections to limit switches and for the connectors on the back side.

MAIA-3 BOARD

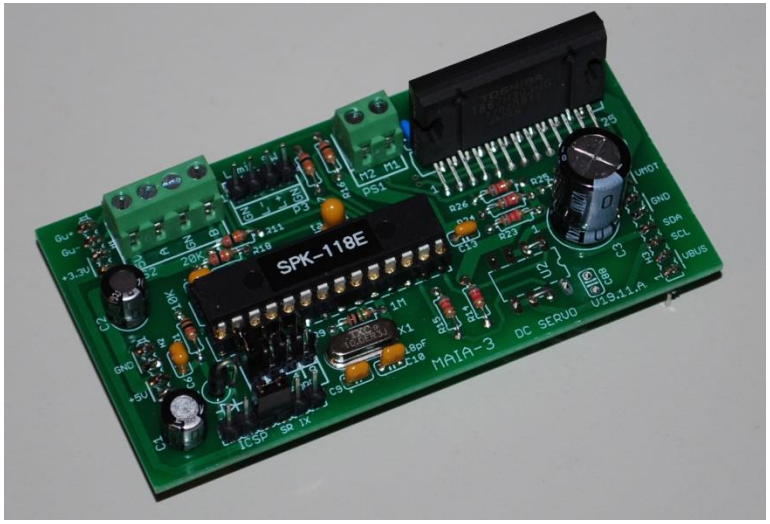
CONTROLLER FOR DC MOTOR WITH ENCODER
USING THE TB67H303HG DRIVER

PRESENTATION OF THE BOARD

The MAIA-4 board contains the necessary circuits to control a DC motor with encoder.

This board uses a Toshiba TB67H303HG power driver that can supply up to 2.7 amps of current to the motor, with voltage up to 24 volts.

This board is connected to the ELECTRA motherboard using its connectors located on the rear face.



MAIA-3 BOARD

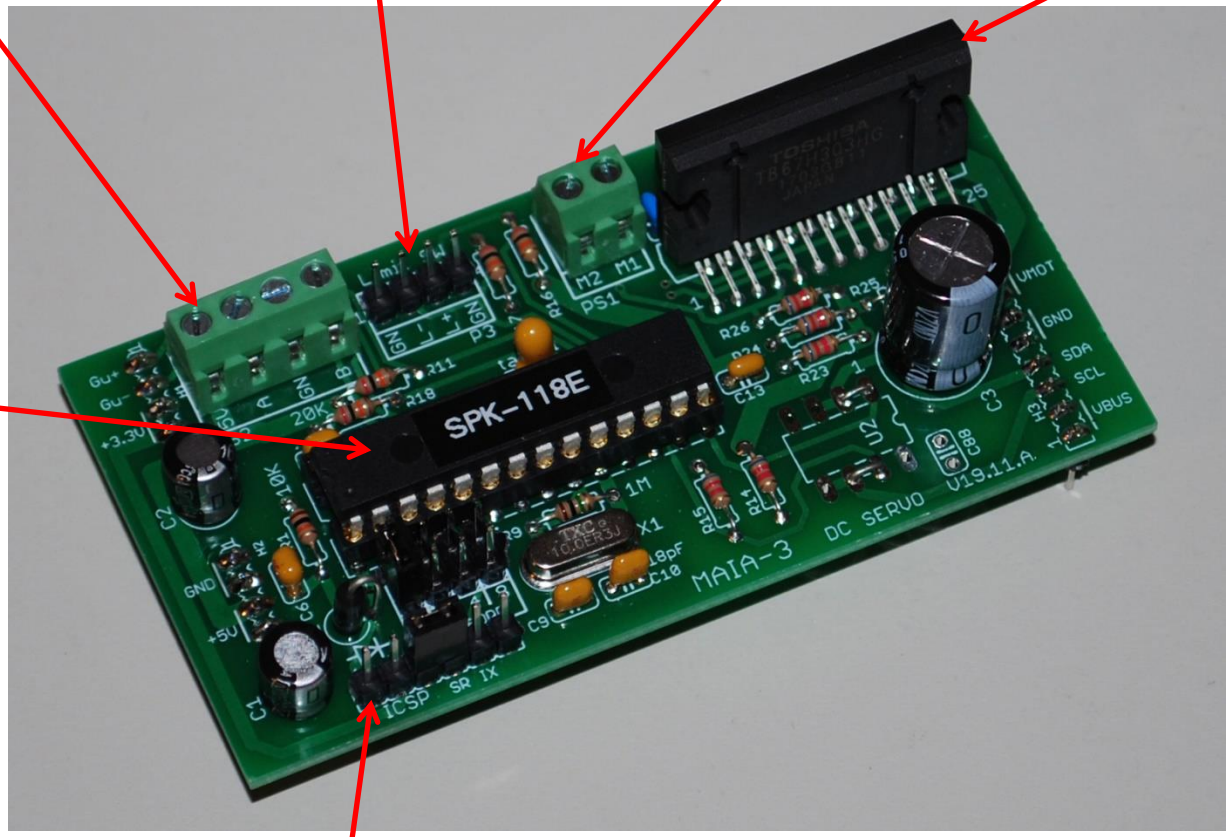
CONNECTOR TO THE ENCODER OF THE DC MOTOR

CONNECTOR TO LIMIT SWITCHES

CONNECTOR TO THE COILS OF THE DC MOTOR

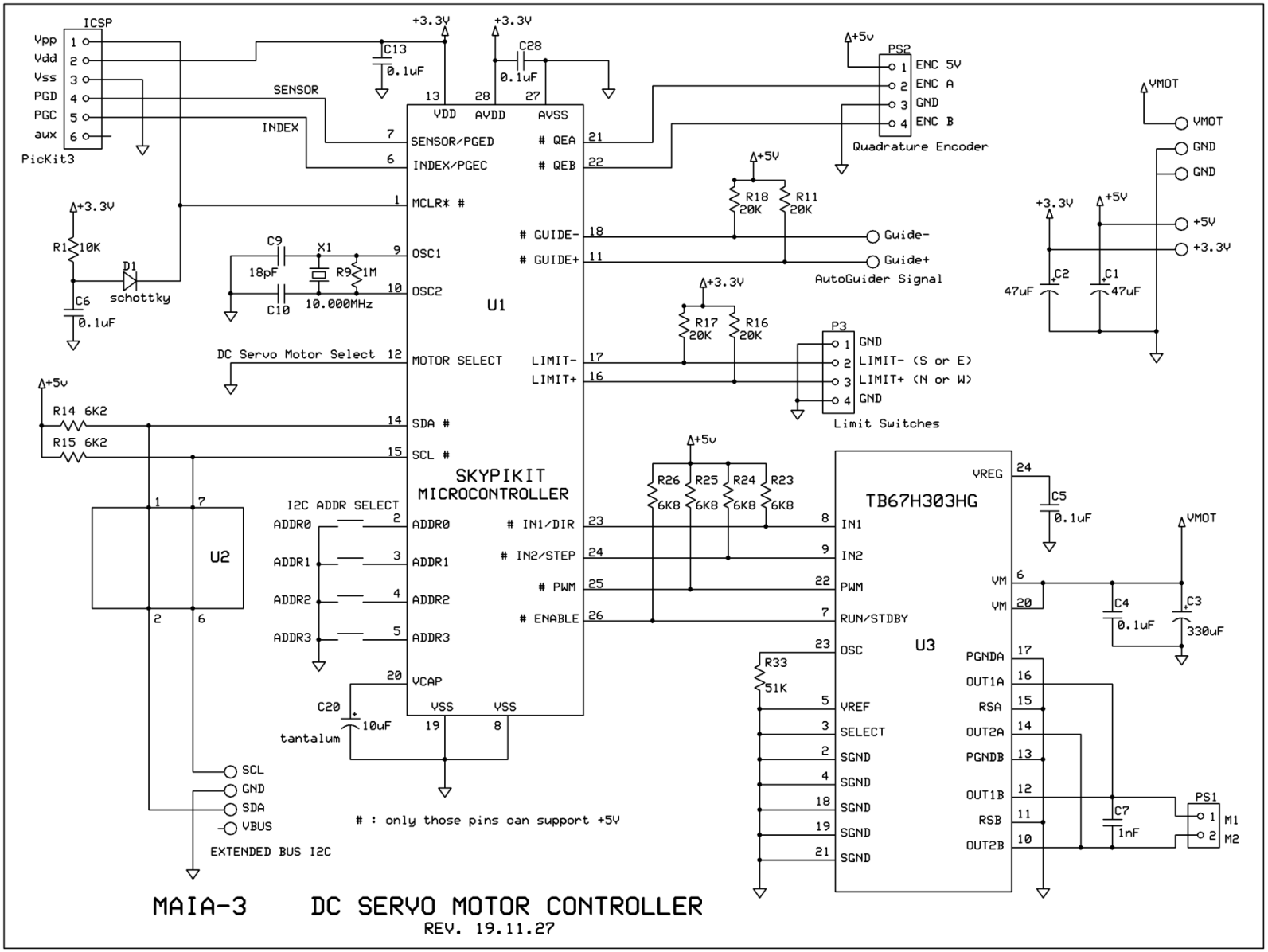
TB67H303HG DRIVER FOR DC MOTOR

SKYPIKIT



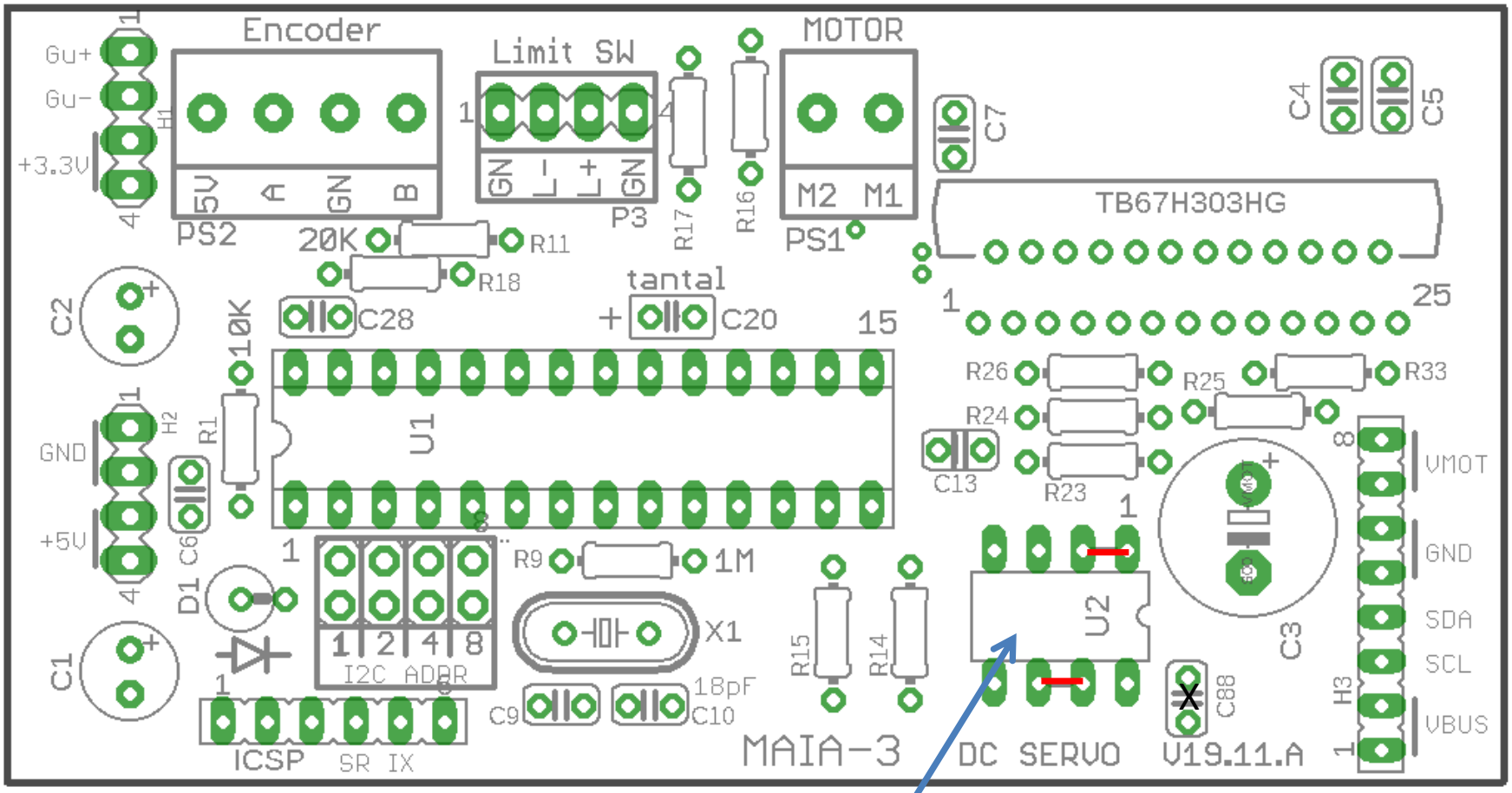
CONNECTOR FOR ICSP, INDEX AND SENSOR

MAIA-3 BOARD



Electronic diagram of the MAIA-3 board

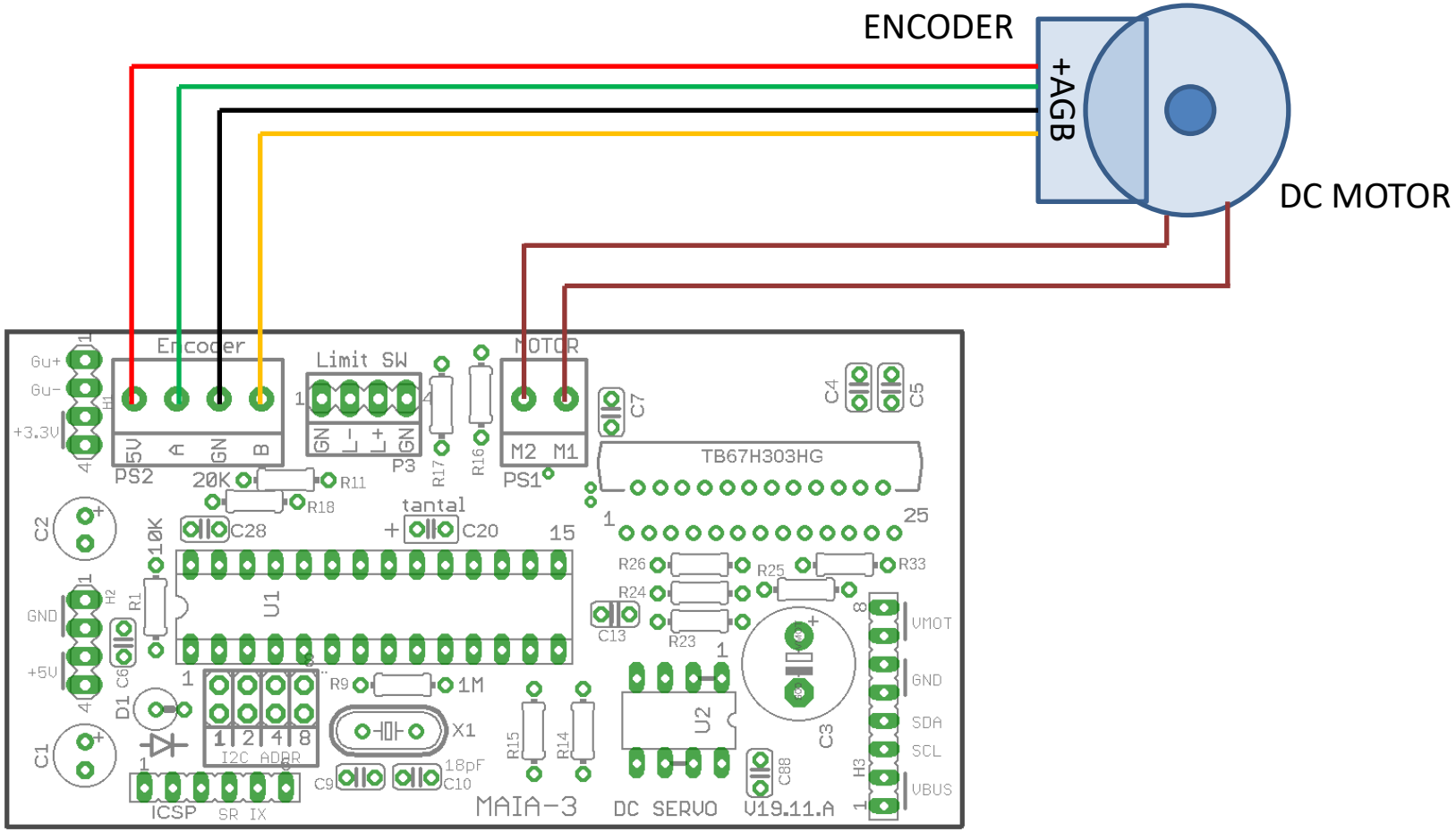
MAIA-3 BOARD



Items marked with an X are not installed because they are not used

Install two bridges, between the pins: 1-2 and 6-7 of U2

MAIA-3 BOARD



The DC motor is closed loop controlled and needs a quadrature encoder so the Skypikit can know its position and speed.
Warning: the encoder of the chosen motor must work with a 5 volt supply.

See the description of the TAYGETA-3 board for the connections to limit switches and for the connectors on the back side.

END