AYAB-Shield Soldering Instructions

ayab-knitting.com

Important! Please read before usage!

Damages which were caused by not following the operation manual are not covered by any warranty. For consequential damages, we do not accept liability.

Contents

1. Operating conditions

- This kit is not intended for usage in life-sustaining or life-saving systems or similar applications! Do not use this kit in applications, where a malfunction may lead to physical damage!
- The kit may only be put into operation when safely built into an enclosure and safe from being touched.
- This kit is suitable for operation in dry and clean environment only. The usage in vicinity to flammable items, water or high humidity is dangerous and prohibited.
- This kit must not be used with or in vicinity of flammable liquids.
- Do not exceed the electrical ratings given in this manual.
- Assembling and operating this kit in schools or other educational environments requires supervision by skilled personnel.
- This kit is not a toy and may be dangerous for small children! (Small parts, electrical dangers)
- Modules and parts have to be kept away from children!
- The kit shall only be assemblied under supervision of a skilled adult.
- A repair of the device shall only be conducted by an expert!
- If there is any liquid spilled over or into the device, it may be damaged. In this case, the device has to be checked by an expert.

2. Intended Use

The intended use of this kit is the control of Brother knitting machines, KH-9xx series. It is only allowed to be used as a substitute for the original mainboard. An operation in parallel to the existing mainboard is not supported.

Any other usage than described above is prohibited!

3. Safety Notes

When working with products which are powered by electrical energy, you shall follow the electrical safety regulations which are applicable for your country.

- Before opening a device, always disconnect the mains connector or make sure it is disconnected.
- Electrical parts, modules or devices shall be properly encased before being brought into operation. The case/enclosure shall prevent electrical parts from being touched.
- Before using tools on parts, modules or devices, it has to be made sure that the power supply is disconnected and any energy storing parts are discharged.
- Energized cables or wires which are connected to a part or module, always have to be checked for isolation faults or any other damages. If there is an isolation fault or any other damage, the device has to be taken out of service immmediately.
- When using electrical parts or modules, the electrical and mechanical key figures shall always be regarded!
- If electrical data does not come out clear from the manual, please contact an expert!
- Before using a device, it shall be checked, whether this device is applicable to be used for intended application. If not sure, please contact the manufacturer or an expert!
- Please note that usage and connection errors are out of our reach.
  Therefore, we cannot take liability for any damaged caused by such.

- In case of a malfunction, kits shall be sent back with a detailed description of the failure. Kits which have been been built up are excluded from return.
- Devices which operate with a voltage above 24 V have to be connected by an expert.
- It is only allowed to switch on a device, when it is properly encased and electrical parts cannot be touched during operation.
- All wiring work shall only be carried out in non energized state of the machine.

4. Product Description

The goal of the AYAB project is to provide an alternative way to control the famous Brother KH-9xx range of knitting machines, e.g. KH-910 and KH-930.

Normally, the KH-910 is programmed using semi transparent picture cards which are scanned by the machine line by line. Using this information, the machine sets the needles accordingly to achieve the knitting of the picture shown on the picture card. Probably due to memory restrictions (the machines are quite old today), the machine only supports pictures with a max of 60 needles (= pixels) width, although the machine has a total width of 200 needles. But at least, it is possible to "copy and paste" the scanned image multiple times to achieve a banner-like usage of the scanned data (useful for Norwegian patterns).

The control of the needles and the needed identification of the current position and direction of movement of the knitting carriage are supplied by a cheap and well-known Arduino microcontroller, combined with a custom developed shield (the name for an "interface" in the Arduino world) for the knitting machine. You actually only need to open up one part of your knitting machine (warranty is void anyway for some years now…) and simply replace the existing control board (the one with all the switches and LEDs on it) with the AYAB controller, then link the Arduino part of this interface (shield) with your computer and start knitting!

The installation of AYAB is fully reversible. By installing the original control board again, the knitting machine is back in original state.

The Arduino has to be flashed with the current version of the AYAB firmware. A precompiled version of the firmware is shipped with the AYAB GUI (choose the right Arduino type). For flashing instructions, check the tutorial video.

The AYAB project is free and open source soft- and hardware. Source code and schematics are available freely available and free for customization. Of course, we are always happy about feedback and participation in the project!

Properties

Supported Models: Brother KH-910, Brother KH-930 (further models will be officially added soon)

- Maximum Pattern Width: 200 Needles
- Maximum Pattern Length: unlimited
- Maximum Colors: 2 (up to 6 experimental)

Note

Please take care to chose the right machine model when ordering a shield to make sure the right connectors are shipped.

5. Technical Data

Supply Voltage	5.0 V
Switching Voltage	7.5V - 16.0V
max. Current Consumption	500 mA
max. Switching Current	1500 mA
Dimensions (l x w x h)	69 mm x 54 mm x 20 mm

6. Before you start

Before you start with the installation, please read this manual completely - especially the section about error sources and the safety notes. After this, you will know about common problems and how to avoid errors which can only be solved with high effort!

Please do soldering and wiring work clean and precisely. Do not use acidic solder or soldering flux. Please make sure that all solder joints are working correctly. Unclean or bad solder joints and loose contacts may lead to an elaborate and time-consuming fault analysis. It may also lead to the destruction of parts, which may also harm other modules or even the knitting machine.

For assembling this kit, basic knowledge about handling of electrical parts and soldering is necessary.

General Notes

You can reduce the possibility of a malfunction drastically by doing a clean and precise assembly. Please double check each solder joint and working step before proceeding. Please stick to this manual! 90% of malfunctions are caused by erroneous soldering.

This kit was built and tested many times before going into production.

7. Assembling the parts on the board

Note

While working, please stick to this manual and always keep an eye on the assembly diagram in parallel.

Please pay attention to the polarity/orientation of the three LEDs.

Please pay attention to the marking notch of the ICs. The orientation has to match with the assembly diagram.

Double check the position and orientation of all parts before initial operation.

Please pay attention to solder all parts directly onto the board (without any air gap). All projecting pins and leads have to be cut of directly above the soldering joint.

Because there are some small soldering joints to do, this kit may only be soldered with a soldering iron with appropriate soldering tip. Please take care to avoid short-circuits.

Solder instruction

If you are not used to solder wired components, please read a solder guide for wired components. You can find such in the Internet or on our homepage.

`http://ayab-knitting.com`

Please note that some parts (especially the ICs) are temperature sensitive. Do not overheat them during soldering!

Step 1: LEDs

Name	Color
LED1	red
LED2	yellow
LED2	green

Place the three LEDs (red, yellow, green) according to the figure 1 on the board. Please double check the polarity and have a look at the silkscreen. The top of the LED has a flat side and a round side. Flat side goes facing the word "LED", round side with long leg next to the holes for the resistor.

After placing the LEDs, please solder them on the bottom side of the board.

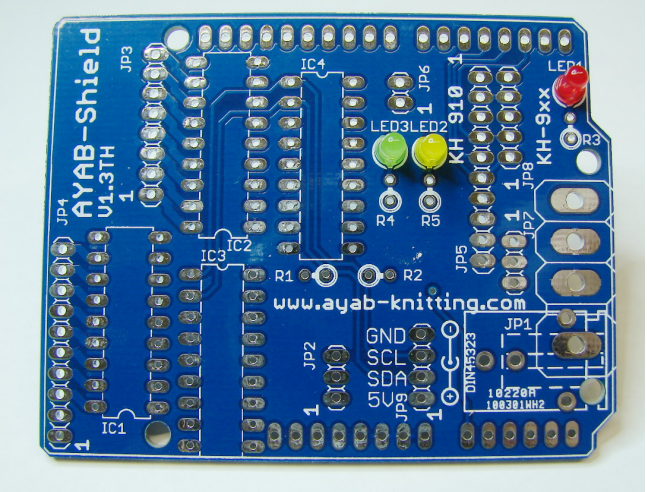

Figure 1. LEDs

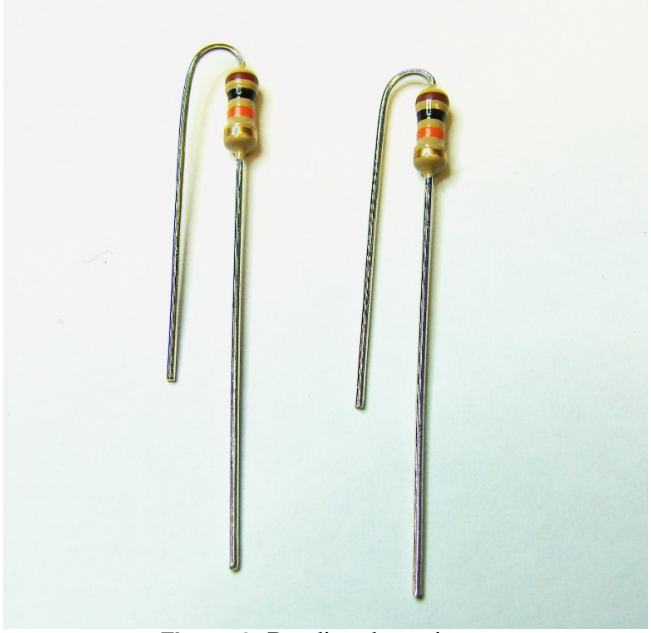

Figure 2. Bending the resistors

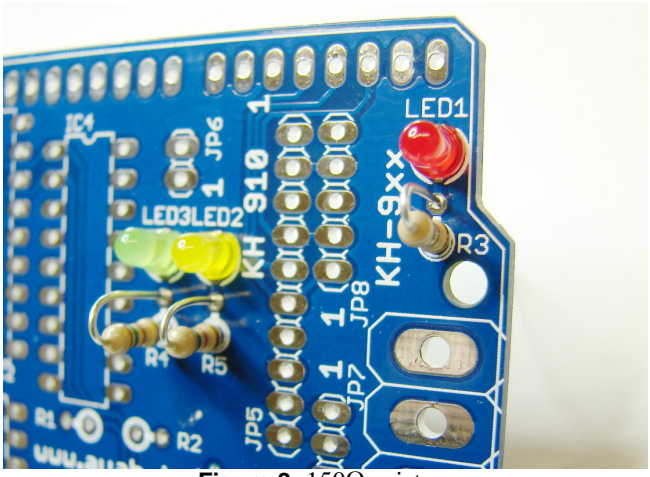

Figure 3. 150Ωresistors

Step 2: Resistors

The AYAB shield kit contains two types of resistors

Name	Value	Colors
R1	10kΩ	br-bk-or-gd
R2	10kΩ	br-bk-or-gd
R3	150Ω	br-gr-br-gd
R4	150Ω	br-gr-br-gd
R5	150Ω	br-gr-br-gd

Please bend all resistors according to figure 2.

Place the 150Ωresistors according to figure 3 and solder them. Next, please place the 10kΩresistors according to figure 4 and solder them.

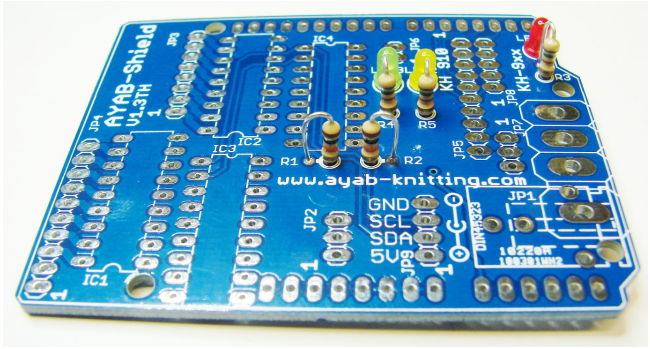

Figure 4. 10kΩresistors

Step 3: Machine connectors

WARNING! This section is handled differently, based on your machine model.

KH-910 / KH-950:

Name	Pin count	Type
JP3	8	angle
JP4	10	angle
JP5	10	straight
JP9	4	straight

Please solder connectors JP3, JP4 and JP5 according to figure 5. Please take care to solder JP3 with a small gap (figure 6), to ease the connection with the knitting machine. You can help yourself by putting a washer below the connector while soldering.

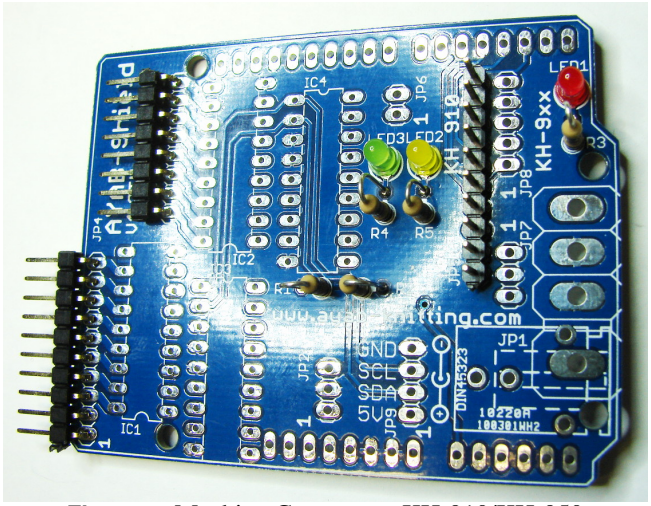

Figure 5. Machine Connectors KH-910/KH-950

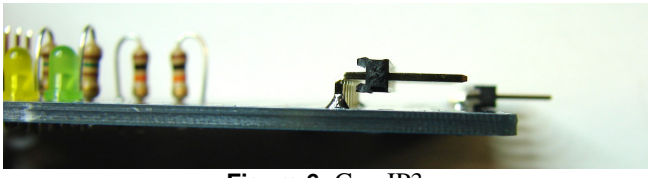

Figure 6. Gap JP3

Optionally, you can solder the expansion connector JP9 (figure 7). In the future, this connector can be used to connect i.e. an optional color changer

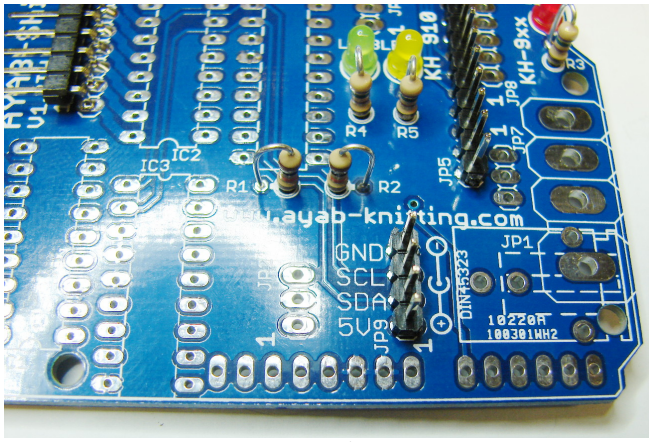

Figure 7. Expansion connector

KH-930:

Name	Pin count	Type
JP3	8	Molex 2.5mm
JP4	10	Molex 2.5mm
JP2	3	Molex 2.5mm
JP8	5	Molex 2.5mm
JP9	4	straight

Solder the connectors JP3, JP4, JP2 and JP8 according to figure 8. Please double check the correct orientation of the connectors!

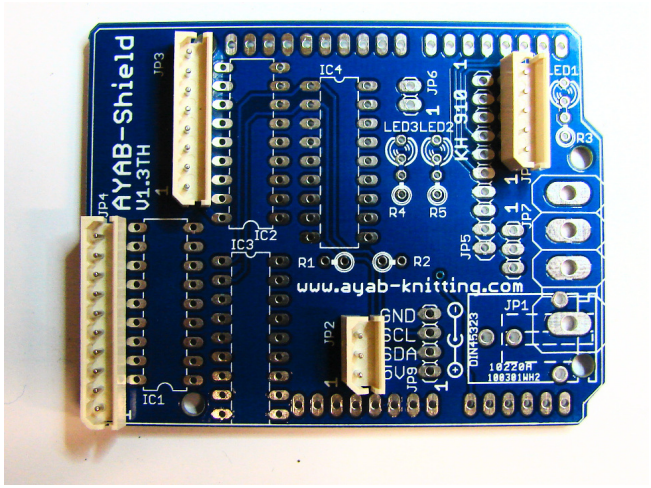

Figure 8. Machine connectors KH-930

Optionally, you can solder the expansion connector JP9 (figure 7). In the future, this connector can be used to connect i.e. an optional color changer

Step 4: Beeper connector

Now, you can solder the connector for the beeper, like shown in figure 9. As before, please double check the orientation of the connector and avoid a gap between the connector and the board.

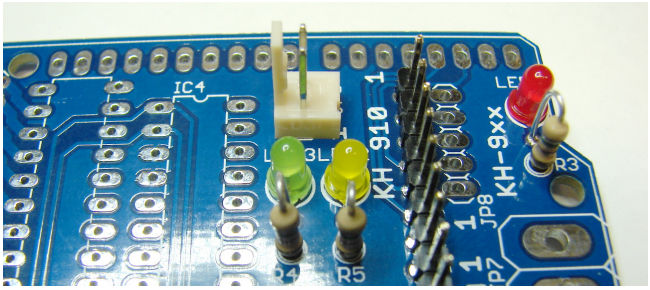

Figure 9. Beeper connector

Step 5: Arduino connectors

Arduino not included in kit

The following connectors are needed:

Name	Pin count	Type
ARD1	10	straight
ARD2	8	straight
ARD3	8	straight
ARD4	6	straight

Tip! Put the four connectors into the Arduino as a soldering aid (figure 10) and place the shield onto (figure 11). This eases the soldering work significantly and makes sure everything fits right.

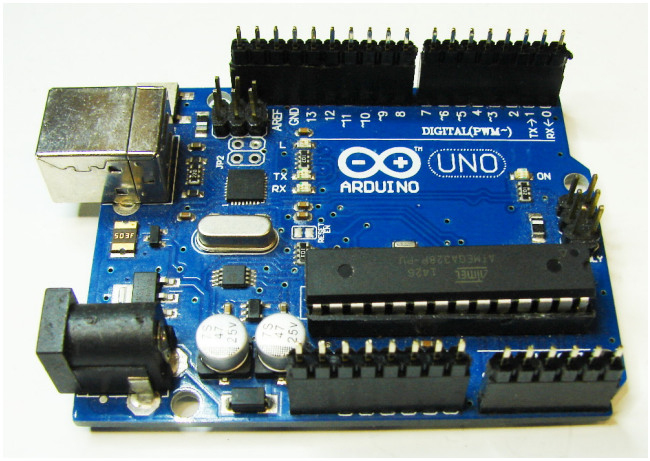

Figure 10. Soldering aid

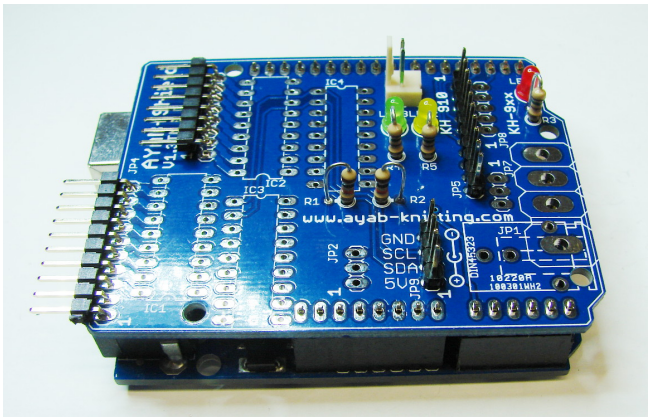

Figure 11. Arduino connectors

Step 6: ICs

WARNING! Please double check the orientation of the ICs. The markings have to be oriented according to figure 12. Pay attention that IC1 and IC2 have different orientation as IC3 and IC4! Be careful when inserting the ICs into the board. Do not overheat the ICs!

Name	Type
IC1	ULN 2803 L
IC2	ULN 2803 L
IC3	MCP 23008
IC4	MCP 23008

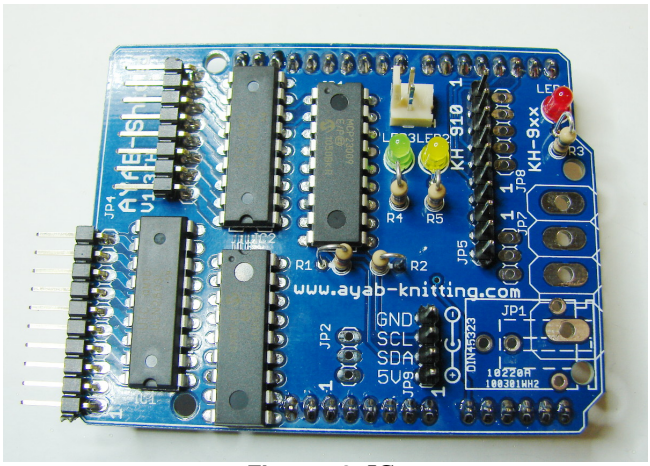

Figure 12. ICs

Step 7: Sensor wires

WARNING! This section is handled differently, based on your machine model.

KH-910 / KH-950:

Strip the insulation of the ribbon cable according to figure 13.

Tin-coat the wire endings and the 3 pin connector (figure 14) and solder them together (figure 15). Double check for

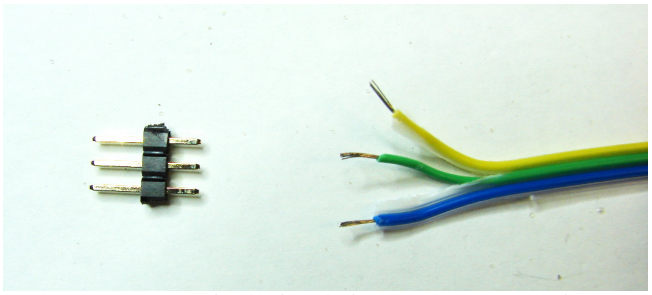

Figure 13. Strip the insulation (KH-910/KH-950)

mechanical stability and potential short circuits. It is recommended to use shrinking tube for better stability and short circuit avoidance.

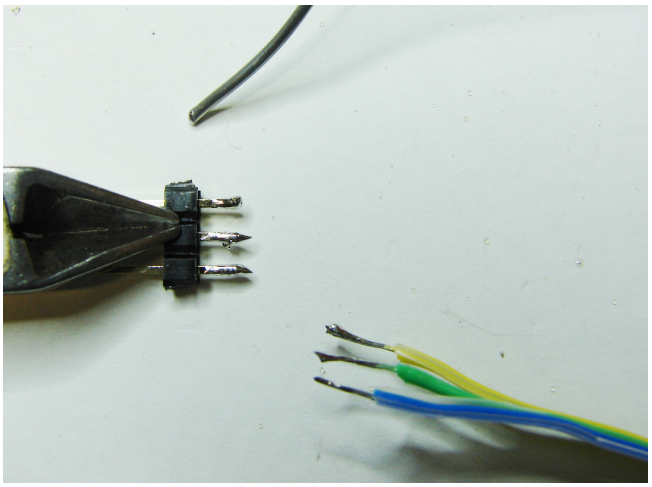

Figure 14. Tin coating (KH-910/KH-950)

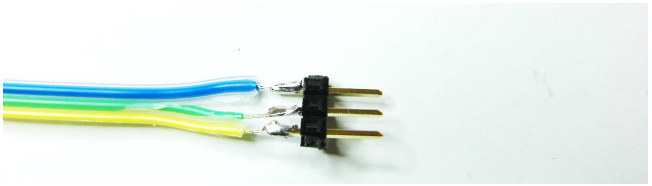

Figure 15. Soldered wire ends (KH-910/KH-950)

Now solder the other end of the ribbon cable like shown in figure 16 to JP2 and mark the top side of the connector like shown in figure 17. This helps when installing the shield into the machine.

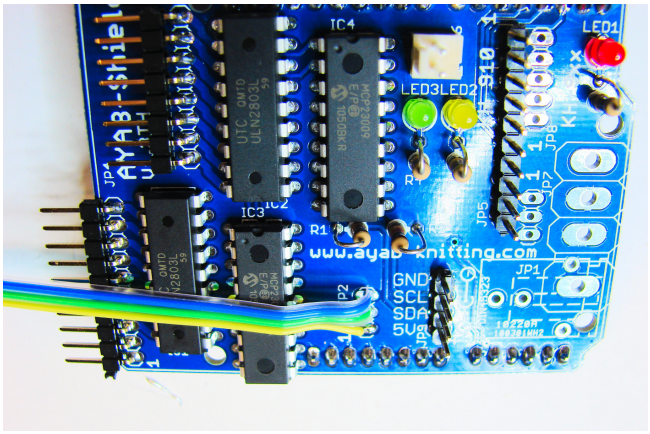

Figure 16. Connection to board (KH-910/KH-950)

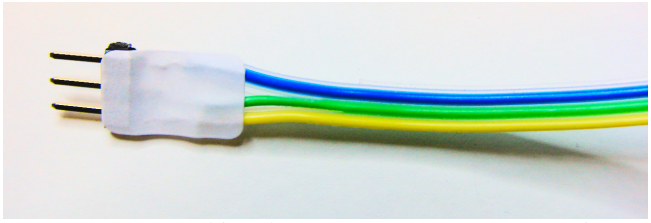

Figure 17. Marking the connector (KH-910/KH-950)

KH-930:

Strip the insulation of the ribbon cable according to figure 18.

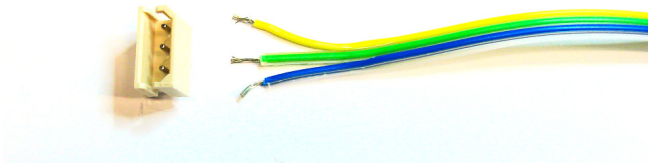

Figure 18. Strip the insulation (KH-930)

Tin-coat the wire endings and the 3 pin Molex connector and solder them together. Double check for mechanical stability and potential short circuits. It is recommended to use shrinking tube for better stability and short circuit avoidance.

Now solder the other end of the ribbon cable like shown in figure 19 to JP7. Double check the orientation of the connector. The markings of the connector have to point **to** the red LED (in contrast to the other machine connectors).

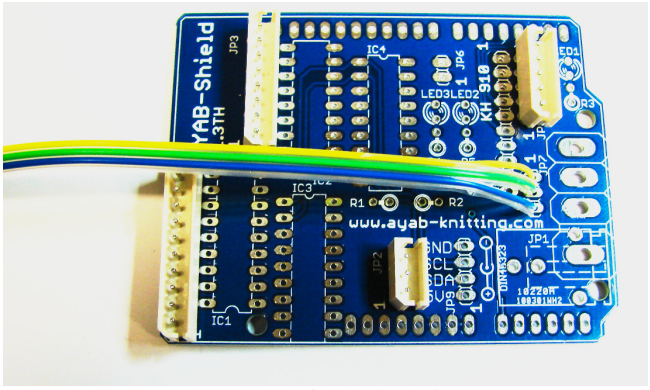

Figure 19. Connection to board (KH-930)

Step 8: Power connector

WARNING! This section is handled differently, based on your machine model.

KH-910 / KH-930 / KH-950 / CK-35:

Please mount and solder the 4 pin connector according to figure 20. Please take care of uniform height of all pins and correct carefully, if necessary.

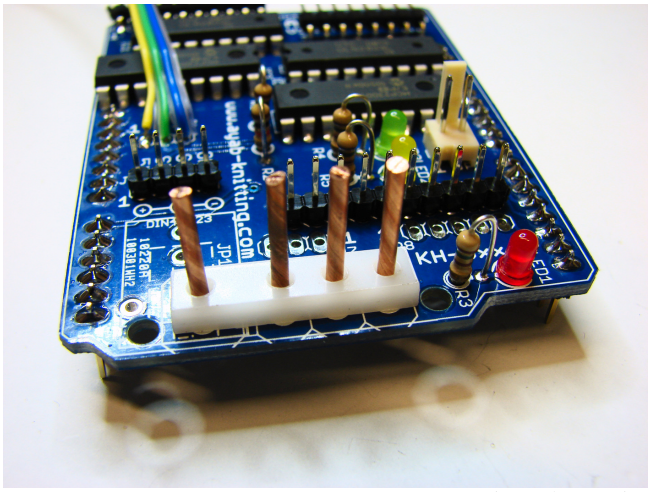

Figure 20. Power connector KH-910/930/950 and CK35

Now, on the bottom side of the board, the pins have to be cut of as near as possible to the board (see figures 21 and 22) to avoid short-circuits with the ISP pins of the Arduino. Additionally, the pins can be insulated using insulating/duct tape

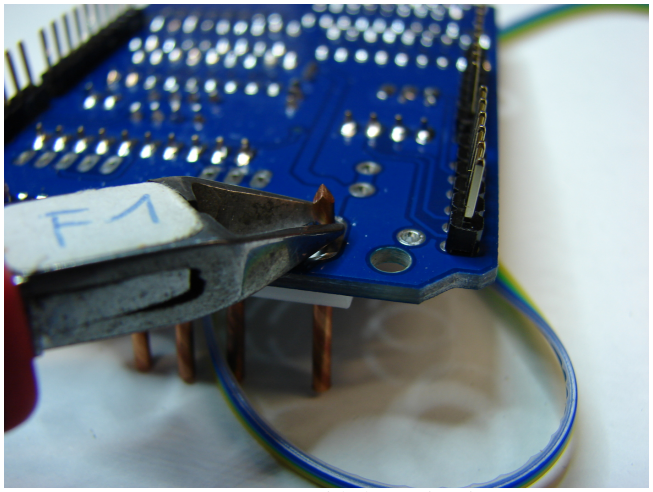

Figure 21. Avoid short-circuits

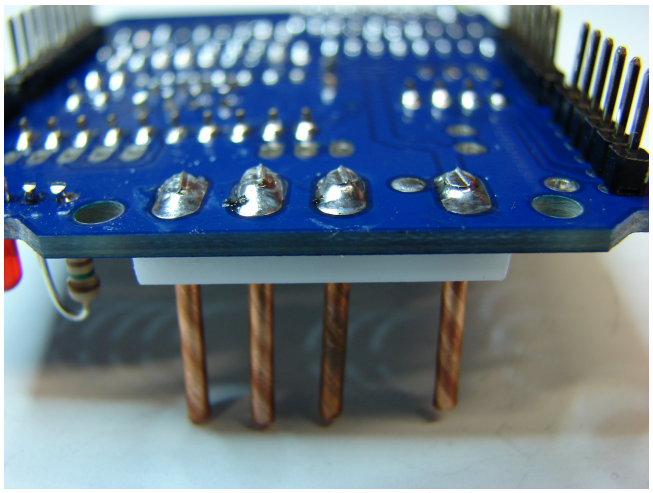

Figure 22. Avoid short-circuits

KH-900 / KH-965:

KH-900 and KH-965 are not officially supported, yet.

Last step

Please double check the orientation and polarity of all parts. Check for short-circuits and the quality of the soldering joints. Check if all projecting wires on the bottom side of the board have been cut off to avoid short-circuits with the Arduino.

8. Test and initial operation

Checklist

- ☑ All parts (especially the ICs and the connectors) have the right orientation.
- ☑ No remains of solder on the shield or any pin of a part.
- ☑ No remains of wire on the shield.
- ☑ No short-circuits visible.
- ☑ Soldering joints look proper.

If all of these points are ok, you can put the shield into the Arduino and connect the Arduino to the USB port of a computer. Now, the red LED on the shield should light up.

If not, it is likely that there is a short-circuit or a broken soldering joint - please double check your soldering.

If yes, you can start with the installation of the shield according to the videos on

`http://ayab-knitting.com`.

Errors

If it is likely that a safe operation of the device is not longer possible, the device has to be put out of operation and be saved against unintentional operation.

This is the case when:

- The device has visible damage.
- The device is not functional any longer.
- Any part of the device is loose.
- Wiring is obviously damaged.

If the device has to be repaired, you shall only use original spare parts. Usage of third party spare parts may lead to serious physical injury!

The device may only be repaired by an expert!

9. Warranty/Disclaimer

As we do not have any influence on the correct and appropriate installation of this kit, we only can ensure the completeness and quality of the supplied parts.

Any further claims are excluded.

We do not take any liability for damage or secondary damage related to this product.

We do not have any liability in case of:

- acid based solder, flux, etc. was used for soldering.
- the kit was not soldered correctly.
- modifications of the device or attempted repair of the device.
- custom modification of the shield.
- attaching, removing or extending any parts on the shield.
- usage of any parts which where not part of the kit.
- destruction of any circuit path or solder pad.
- wrong assembly/placement of parts.
- overloading the circuit.
- damages caused by third party.
- damages caused by inobservance of the manual and the assembly plan.
- connection to a wrong voltage or wrong polarity.
- misusage or damage through careless usage or misusage.
- defects caused by usage of wrong fuses or overriden fuses.

Kits which have been started to be built up or are already built up are nonreturnable.

When working with products which are powered by electrical energy, you shall follow the electrical safety regulations which are applicable for your country!

10. Appendix

Bill of Materials

Basic Shield

The basic shield contains all parts which are not related to specific machine models.

Name	Type	Value
PCB	-	-
R1/R2	Resistor 5%	10kΩ
R3/R4/R5	Resistor 5%	150Ω
LED1	LED wired	red
LED2	LED wired	yellow
LED2	LED wired	green
IC1/IC2	Darlington Array	ULN2803
IC3/IC4	I2C Port Expander	MCP23008
JP6	Molex	2-Pin
JP9	2.54mm Pin Header	4-Pin
Beeper	Piezo Beeper	4-8V
Arduino-Connector	2.54mm Pin Header	-

Connectors KH-910/KH-930

Name	Type	Value
JP1	Power connector	proprietary
JP2	2.5mm Pin Header	3-Pin
JP3	2.5mm Pin Header	8-Pin
JP4/JP5	2.5mm Pin Header	10-Pin
Extension cable	30cm ribbon cable	3-Pin

Connectors KH-930

Name	Type	Value
JP1	Power connector	proprietary
JP2/JP7	2.5mm Molex	3-Pin
JP3	2.5mm Molex	8-Pin
JP4	2.5mm Molex	10-Pin
JP8	2.5mm Molex	5-Pin
Extension cable	30cm ribbon cable	3-Pin

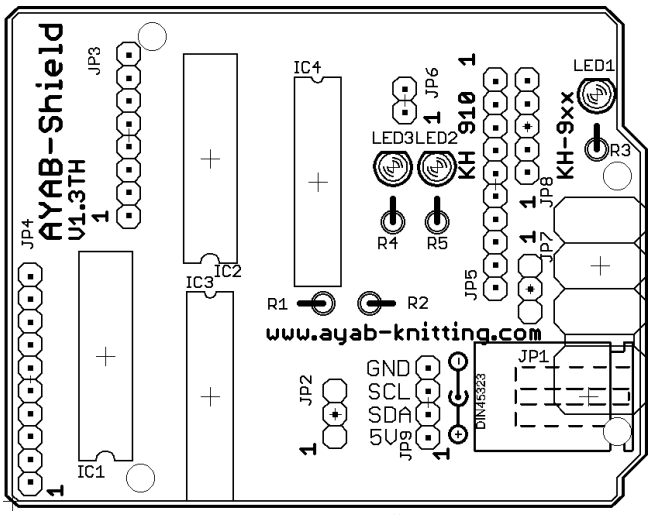

Figure 23. Layout diagram

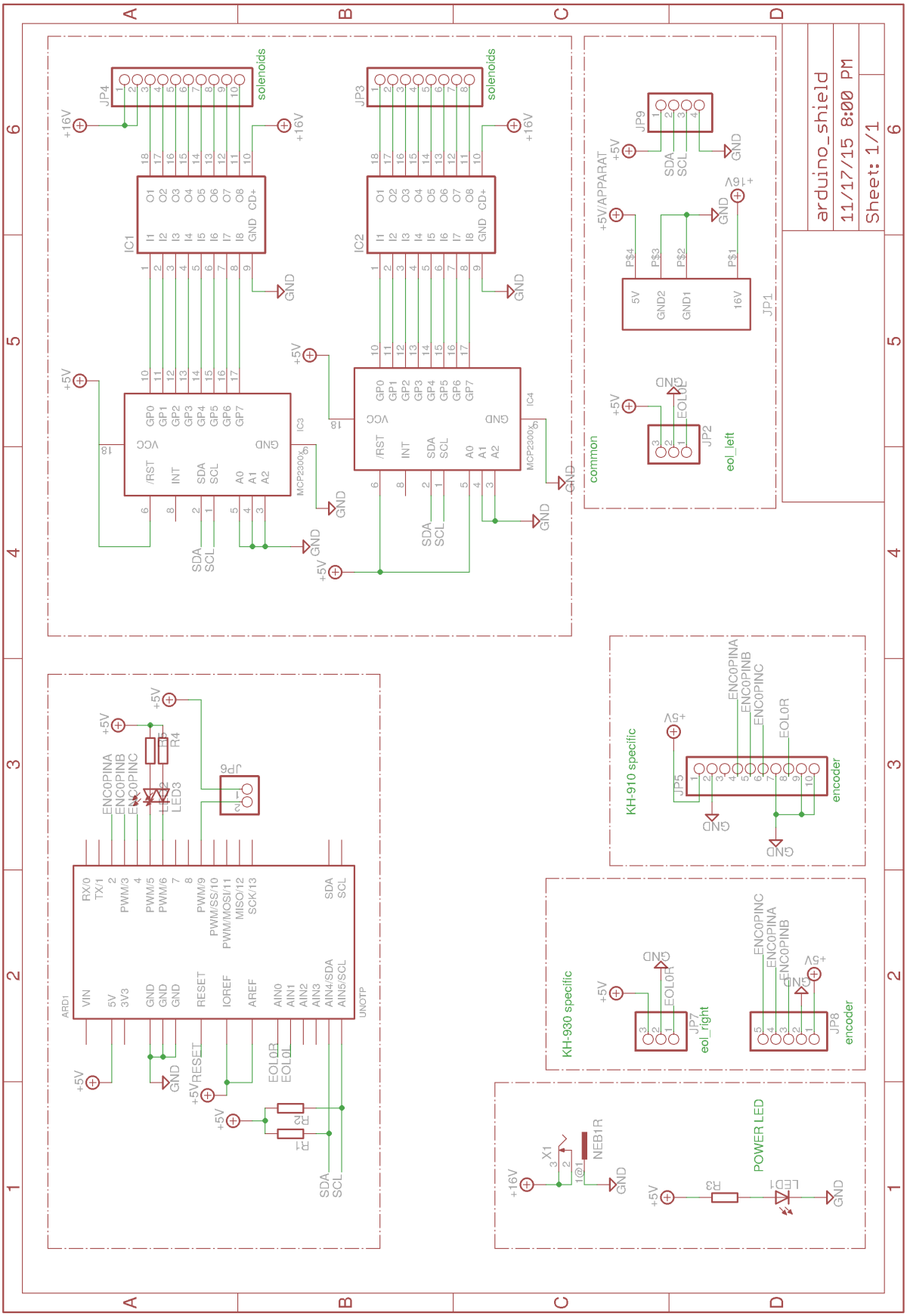

Figure 24. Schematic diagram

Imprint

Address:
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Tuerkenstrasse 21
80799 Munich
GERMANY
http://thinkstack.de