TEXTILES SUMMER SCHOOL 2019 eTextiles HANDBOOK

Copper Conductive Fabric

Corrosion proof copper-silver plated polyamide ripstop fabric, Highly conductive.

Producer: Statex

Silver Stretch Fabric

Silver plated knitted fabric, 78% Polyamide + 22% Elastomer plated with 99% pure silver. Highly conductive.

Producer: Statex

High Flex 3981 copper, silver 14/000

Fine copper fiber / silver plated copper fiber, plied with synthetic fiber core. Solderable. Highly conductive.

Producer: Karl Grimm

Elitex

235/34 Polyamid thread plated with silver.

Producer: Imbut GmbH

Shieldex

Silver Plated synthetic thread

Producer: Statex

Bekinox VN

Fine steinless steel fiber plied. Application example: heating element

Producer: Bekaert

15%metal Gimp fantasy

Metal ribbon wrapped arond black non-conductive fibre. Antique embroidery thread. Solderable. Pay attention when connecting as not all the thread surface is conductive.

Producer: Bart and Francis

Linnen & inoXthreads

Linnen thread plied with Inox conductive fibre. 36/2Nm. Pay attention when connecting as not all the thread surface is conductive.

Producer: Bart and Francis

Eeonyx Resistive non-woven

Resistive material, non woven coated with organic conductive pol mers. Application example: Pressure sensor, Bend sensor.

Producer: Eeonyx

Eeonyx Resistive Stretch

Resistive material, knit/ jersey coated with organic conductive polymers. Stretch in both direction. Application example: Pressure sensor, Stretch sensor.

Producer: Eeonyx

Velostat

Carbon impregnated black polyethylene film. Application example: Pressure sensor, Bend sensor.

Producer: 3M

Bekinox W 12/18 (loose fibre)

Wool 82% stainless steel fiber 18%. Resistive material. Suitable for wet and needle felting. Application example: Felted pressure sensor.

Producer: Bekaert

Bekinox Conductive Yarn

Nm50/2 conductive yarn, 80% polyester 20% stainless steel, light grey. Application example: knit pressure sensor, Stretch sensor

Producer: Bekaert

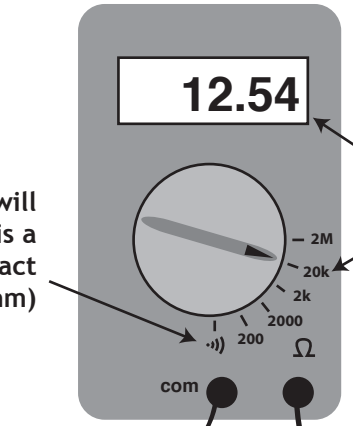
Merino Wool + Inox Yarn
Inox steel fibre plied with Merino wool.

80% Merino Wool, 20% Inox fibre, plied.

v

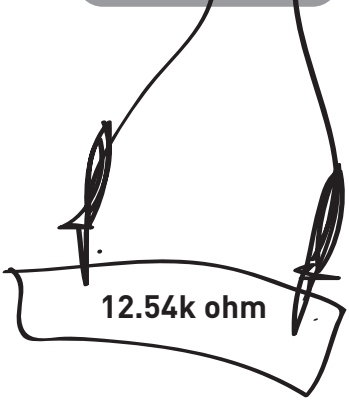
Producer: Bart and Francis

How To Measure Resistance with Manual Multumeter



with this mode, it will beep when there is a direct contact (<150 ohm)

The number on the dial is not a multiplire, but indicates the maximum reading range.
For example, when the dial is on 20K ohm and the reading is 12.54, the measurement result is 12.54k ohm(12,540 ohm)

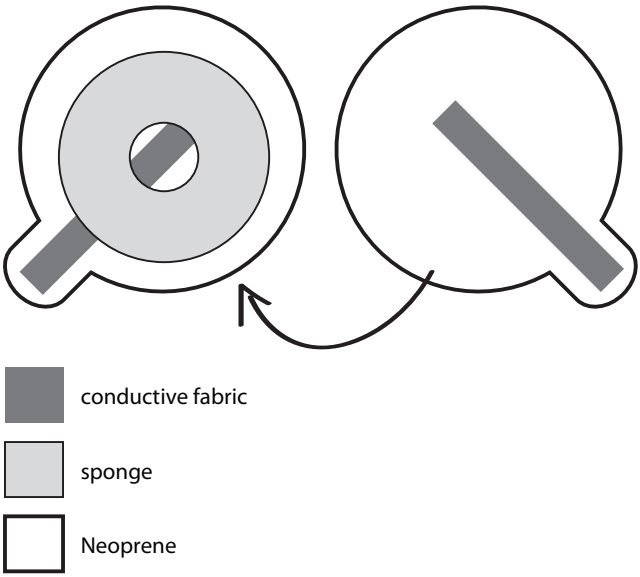


e-textile connection samples

streicht stich, embroidery, sewing machine stitch, fused fabric...
Make samples of different e-textile connection varieties.

Fabric Push Button

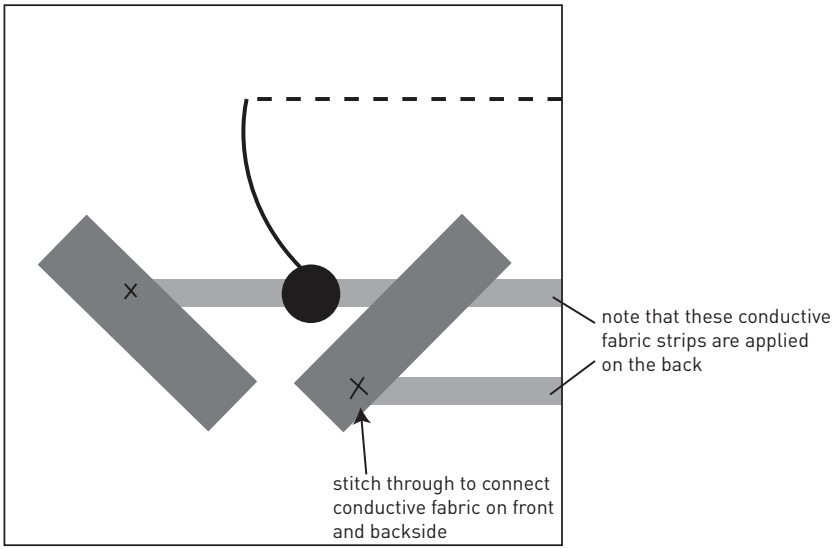
DIGITAL SENSOR, ON/OFF

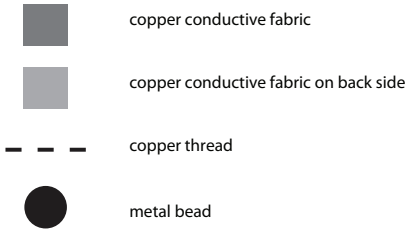


- Cut a pair of the outer layer of the button (i.e. Neoprene) in the shape of the button you like to make.
- apply a stripe of the conductive fabric with fusible on inner side of the outer layer using iron.
- cut the sponge (spacer). this should be slightly smaller than the outer layer. Make a hole in the middle.
- place the spacer between the two outer layers.
- Stitch the edge of the outer layers together with normal thread.

Tilt Switch

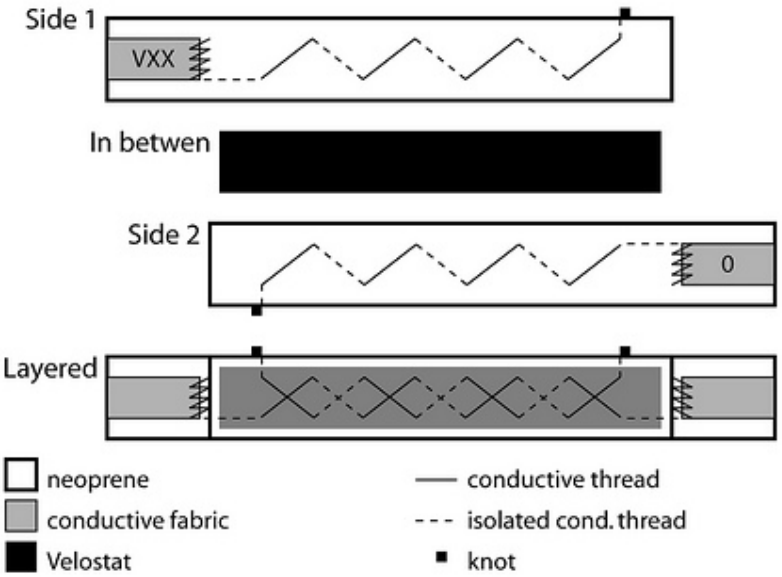
DIGITAL SENSOR, ON/OFF





Fabric Bend Sensor

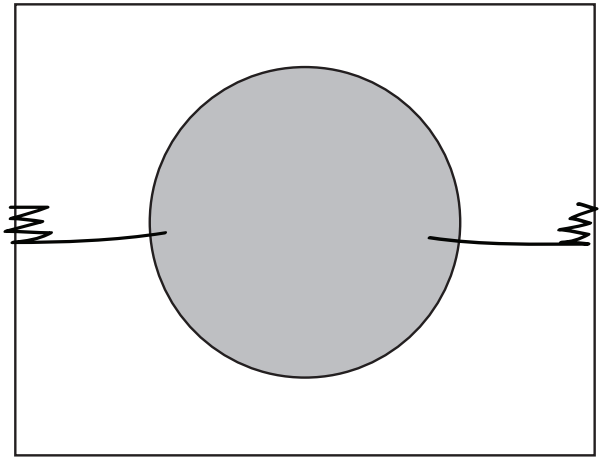
ANALOG SENSOR, Range



- cut a pair of outer layer neoprene.
- add conductive fabric patch on one of the end. You can use conductive fabric with heatbond and use iron to fix on the fabric.
- stitch conductive thread onto neoprene. Note that the doted line in the diagram is going through inside of the neoprene and not the other side of the fabric.
- place eeonyx resistive material or velostat on the stitches and place the other neoprene facing the conductive thread side to the eeonyx/velostat.
- stitch the edges to hold the layers in place

Felt Pressure Sensor

ANALOG SENSOR, Range



conductive wool 50%
felting wool 50%

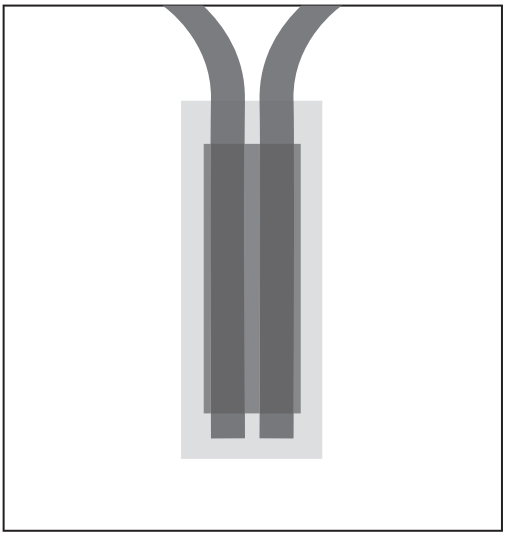
conductive thread

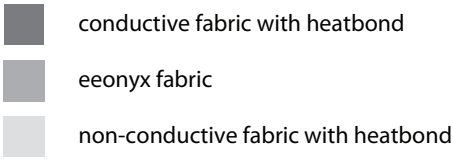
felt base

- mix conductive wool and non-conductive felting wool with roughly 50%/ 50% ratio.
- needle felt the material onto the base felt.
- add conductive thread stitch from the conductive felt to the edge of the base felt on both side. This will be where you can attach the crocodile clip when measuring he sensor.

Bonded Bend Sensor

ANALOG SENSOR, Range

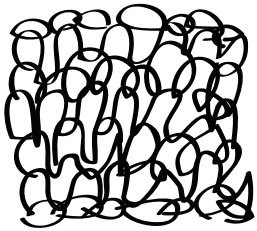


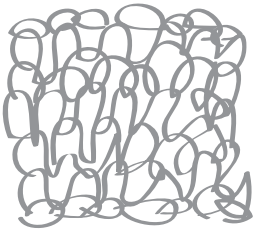


- iron the conductive fabric strip onto the base fabric using iron
- gap between two conductive fabric strips should be around 5mm-1cm
- place eeonyx resistive fabric on the gap of the two conductive fabrics
- place non-conductive fabric covering eeonyx fabric fasing the glue side down toward the fabric. this is to keep the eeonyx in place.
- iron the non-conductive fabric onto the base fabric.

knit Stretch Sensor

ANALOG SENSOR, Range





merino conductive yarn

bekinox conductive yarn
(use 2 strands together)

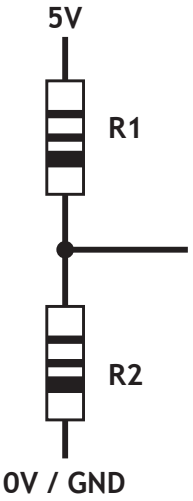
- knit or crochet conductive yarn to make a stretch sensor.
- compare the difference between merino conductive yarn and bekinox conducitve yarn.ing he sensor.
- you can also mix regular yarn to see if it changes the electrical property

Measure the sensors you've made with multimater and write down the value.

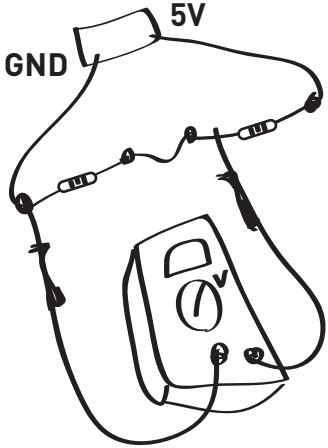
						Arduino Reading	
Sensor	**min (Ω)**	**max (Ω)**	**mean(Ω)**	**min (V)**	**max (V)**	**min**	**max**

- First, measure the resistance of the sensors you've made using ohm (Ω) mode of your multimater. Make sure to add correct multiplier to your measured value when writing down. For example, if you see 1.24 on the display when your dial is set to 20M, then the measured vallue is 1.24 M ohm (1240000 ohm)
- calculate the mean (middle value) of the minimum and maximum of the resistance. For example, if the min is 100 ohm and max is 500 ohm, then the mean is (500 - 100)/2 + 100 = 300 ohm.
- to measure the voltage, you will need to make a voltage divider. After making the voltage divider, use the Volt mode of your multimeter to measure the voltage.

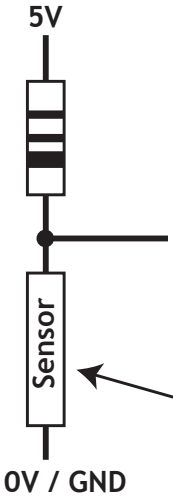
VOLTAGE DIVIDER



you will measure voltage divided by the Ratio of the two resistor. for example, if R1 is 100 ohm R2 is 100 ohm, then you will measure 2.5V. if R1 is 200 ohm, and R2 is 50 ohm, you will measure 1V here

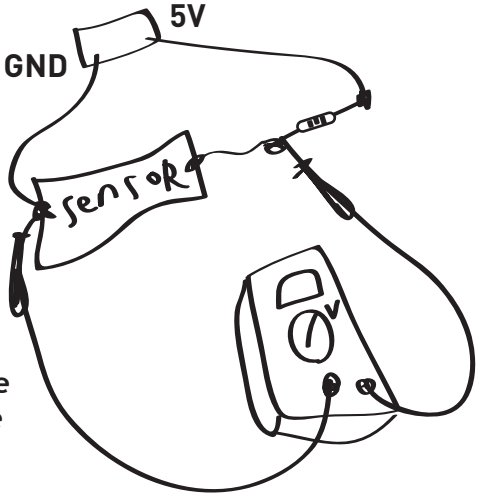


$$5V \times \frac{R2}{R1 + R2}$$

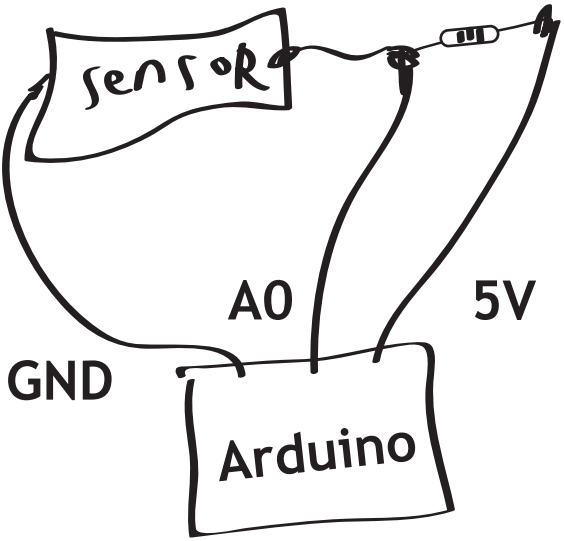


to Analog Input pin of an Arduino. 0v-5v will be mapped into the number range between 0-1023.

the reading number decrease as the resistance of the sensor decreases.



VOLTAGE DIVIDER



- Use combination of a crocodile clip and a jumper cable to connect the pins of Arduino with the rest of the components.
- For simple testing, upload “AnalogReadSerial” from the IDE software “File/Examples/01.Basics/AnalogReadSerial”
- Open the Serial Monitor to see the value Arduino is reading. The range of reading is 0-1023. 0 is 0V and 1023 is 5V.

Transistor Switch

Arduino's pins can output maximum 50mA. For some application such as heating SMA, this is not enough (you will need ~1000mA). In this case you can make a switch with transistor and control the on/off state of the switch with Arduino. There are 2 types of transistors, NPN and PNP (N channel/P channel). The example is NPN transistor switch.