KIT INSTRUCTION PDFs

by Hannah Perner-Wilson
hannah@plusea.at
www.plusea.at

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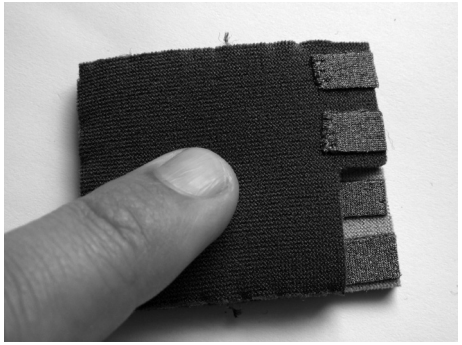
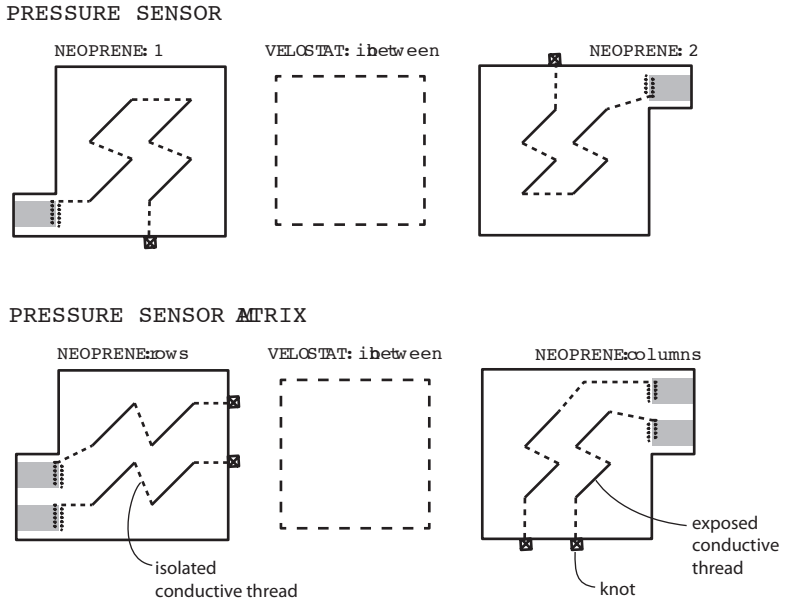
NEOPRENE PRESSURE SENSOR/MATRIX

KIT

This sensor is constructed by layering conductive and piezoresistive materials. Velostat is a piezoresistive plastic film that reacts to stress with a decrease in resistance.



DIAGRAMS



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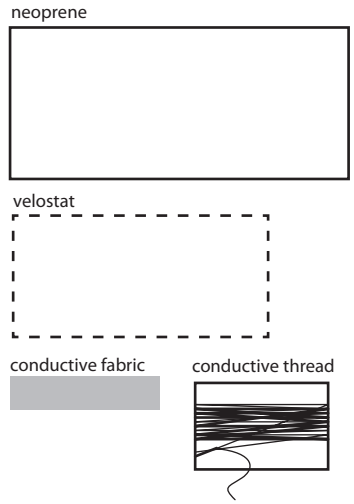

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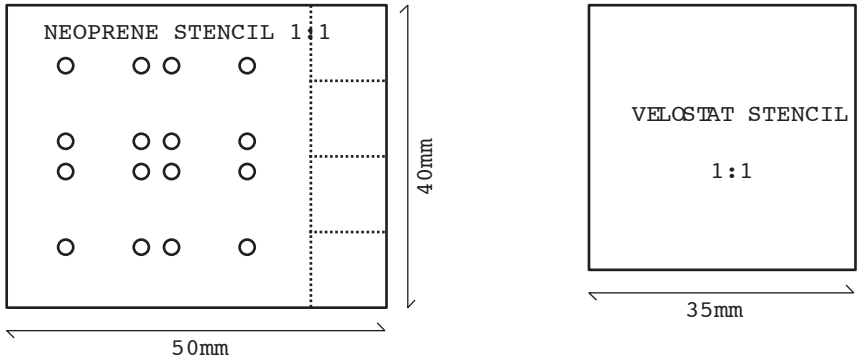
STENCILS



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INSTRUCTIONS

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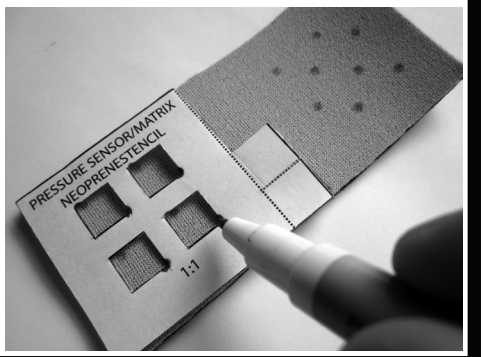
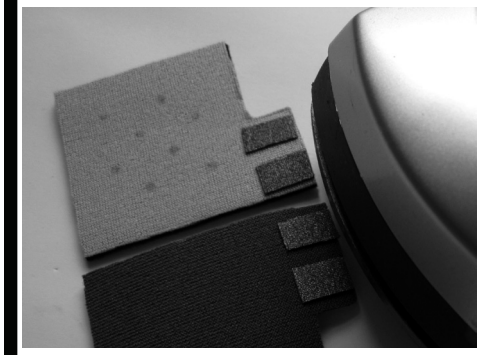
TRACE AND CUT OUT THE STENCILS 1

Decide if you want to make the single sensor or the matrix.
Cut or trace the stencils from the other side of this instruction sheet and transfer them to the apropriate materials. Mark the stitch-holes on both pieces of neoprene with a pen or pencil.



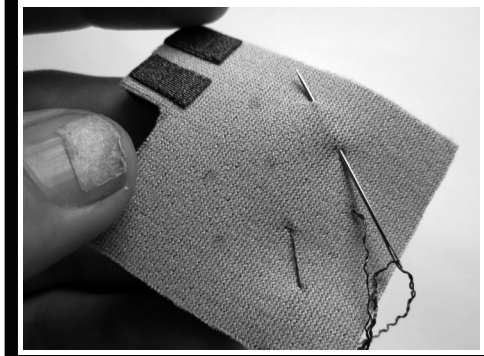
FUSE CONDUCTIVE FABRIC 2

Peel off the paper backing from the conductive fabric. Place the conductive fabric pieces, with the glue side (shiny side) facing the neoprene. Set you iron to a medium heat (too hot will burn the fabric) and iron over the conductive fabric to melt the glue and fuse the fabrics together.



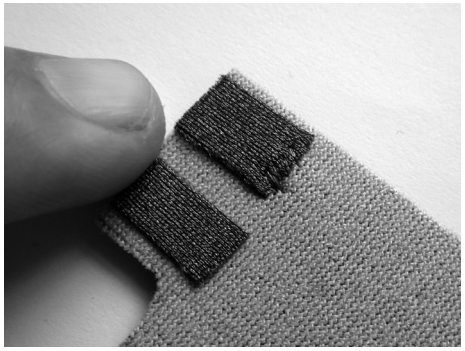
SEW CONDUCTIVE THREAD 3

Thread a needle with conductive thread and tie a knot on one end. Stitch into the neoprene, exposing the thread in diagonal stitches as shown. Make sure that the individual threads do not touch each other.



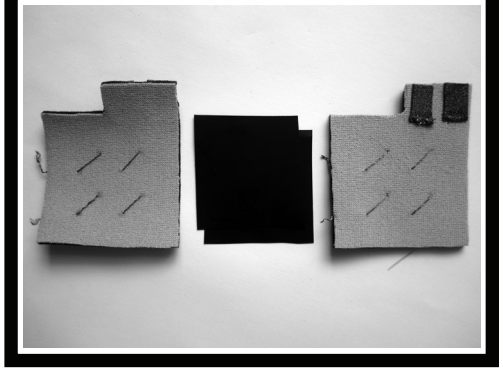
CONNECT THREAD TO FABRIC 4

Finish sewing the conductive thread with 5 to 10 tight stitches along the edge of the conductive fabric.
Cut the conductive thread close to the surface and repeat steps 3 and 4 with the second piece of neoprene.



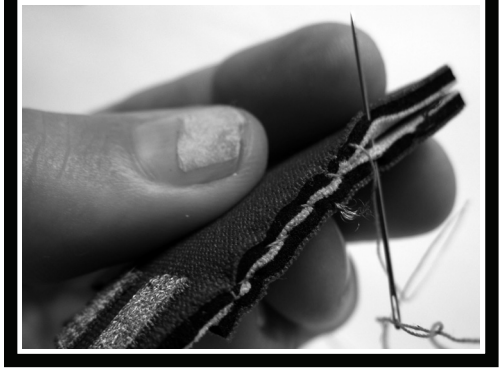
LAYER THE MATERIALS 5

Layer one or two pieces of Velostat between the neoprene with the conductive stitches facing eachother.



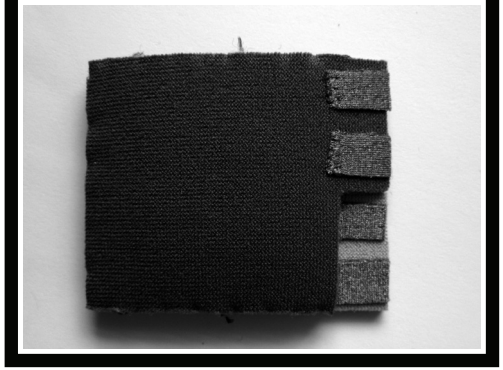
CLOSE THE SENSOR 6

Thread the needle with regular sewing thread. Holding the materials in place. stitch around the edges of the neoprene. Don't sew through the Velostat, but surround it with stitches.



TEST FINISHED SENSOR 7

Connect the ends of your sensor to a multimeter set to measure resitance (Ohm). As you pressure the layers of the sensor together, the resistance should decrease. Depending on the construction of your sensor, the values should range from 2K - 200 Ohm.



KIT

NEOPRENE
BEND SENSOR

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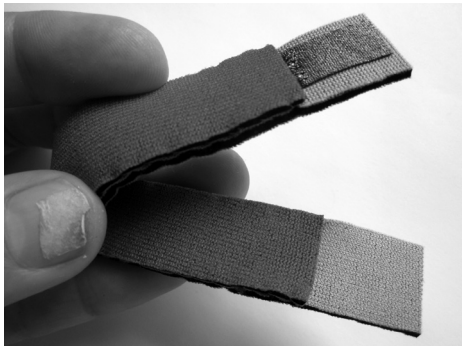

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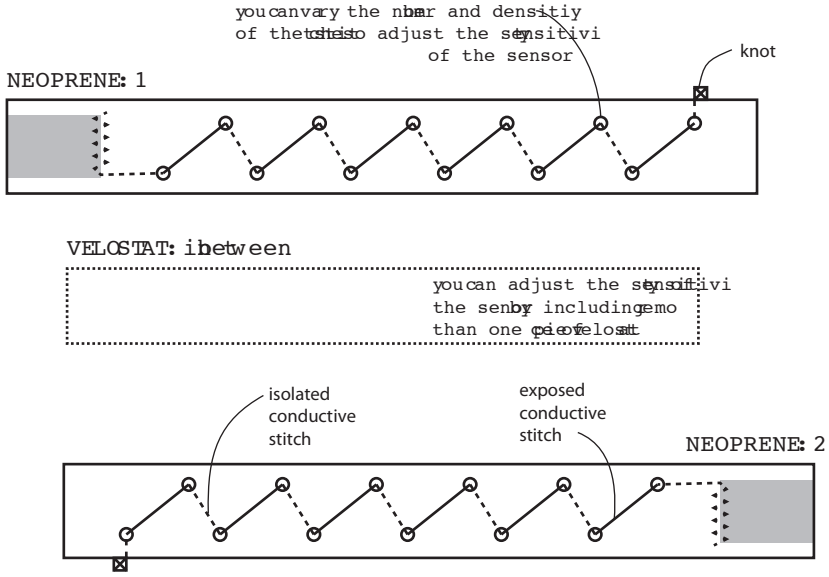

CONTENTS

neoprene

velostat

conductive fabric

conductive thread

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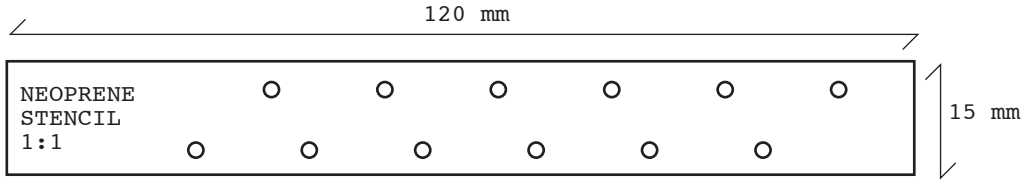

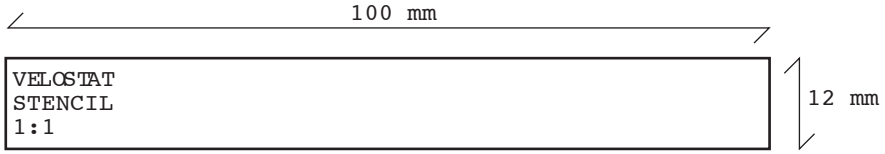

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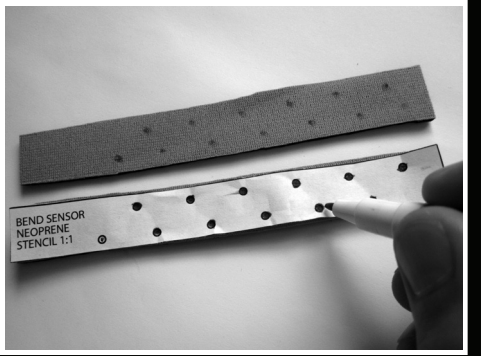
TRACE AND CUT OUT THE STENCILS 1

Cut or trace the stencils from the other side of this instruction sheet and transfer them to the apropriate materials.
Mark the stitch-holes on both pieces of neoprene. Make sure the stencil always faces upwards, do not flip the sencil upsidedown.

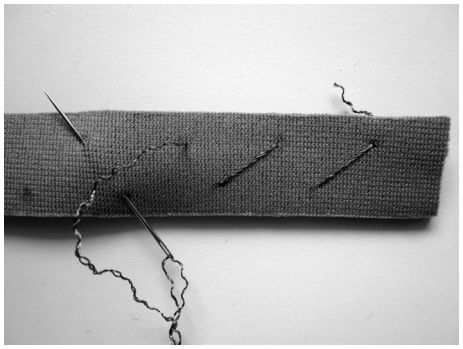


FUSE CONDUCTIVE FABRIC 2

Peel off the paper backing from the conductive fabric. Place the conductive fabric pieces, with the glue side (shiny side) facing the neoprene. Set you iron to a medium heat (too hot will burn the fabric) and iron over the conductive fabric to melt the glue and fuse the fabrics together.

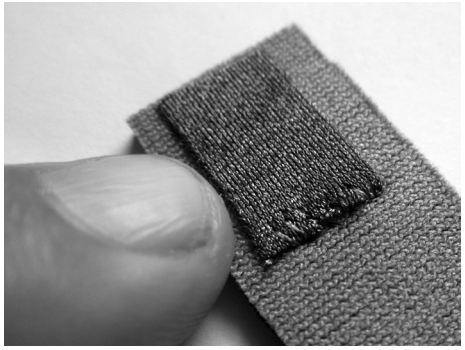
SEW CONDUCTIVE THREAD 3

Thread the needle with conductive thread and tie a knot in one end. Stitch into the neoprene, exposing the thread in diagonal stitches as shown.



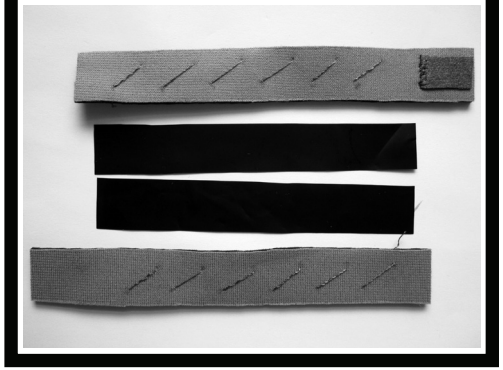
CONNECT THREAD TO FABRIC 4

Finish sewing the conductive thread with 5 to 10 tight stitches along the edge of the conductive fabric.
Cut the conductive thread close to the surface and repeat steps 3 and 4 with the second piece of neoprene.



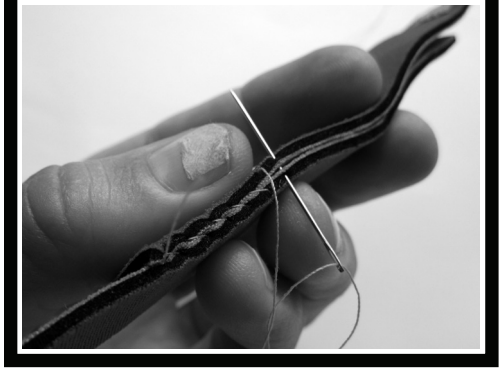
LAYER THE MATERIALS 5

Layer one or two pieces of Velostat in between the two pieces of neoprene, with the conductive stitches facing each other. The conductive fabric tabs should be on opposite ends.
Make sure the conductive thread and the conductive fabric on either side never touch directly, only through the Velostat.



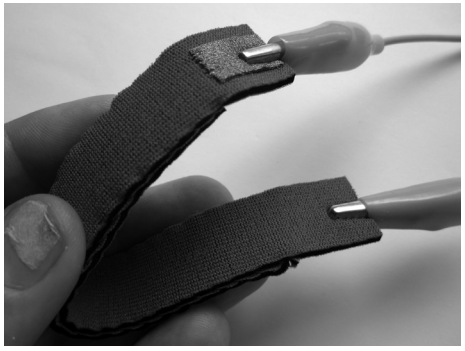
CLOSE THE SENSOR 6

Thread the needle with regular sewing thread. Holding the layered materials in place, stitch around the edges of the neoprene.
Do not sew through the Velostat, but surround it with stitches to keep it in place.



TEST FINISHED SENSOR 7

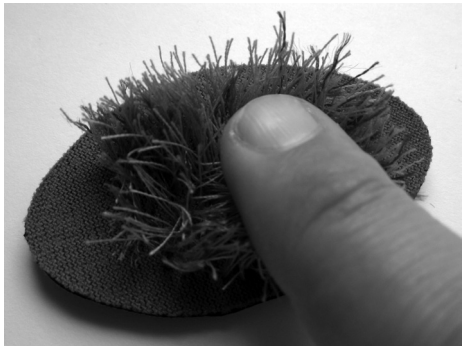
Connect the ends of your sensor to a multimeter set to measure resitance (Ohm). As you bend or pressure the layers of the sensor together, the resistance should decrease. Depending on the construction of your sensor, the values should range from 2K - 200 Ohm.



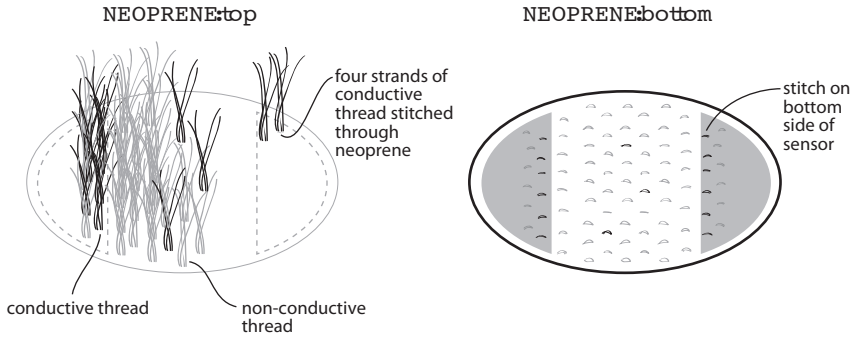
KIT

STITCHED
STROKE SENSOR

Using conductive thread and neoprene to stitch a fabric stroke switch. While tedious to make, the basic construction of this sensor has a wonderful effect.



DIAGRAMS



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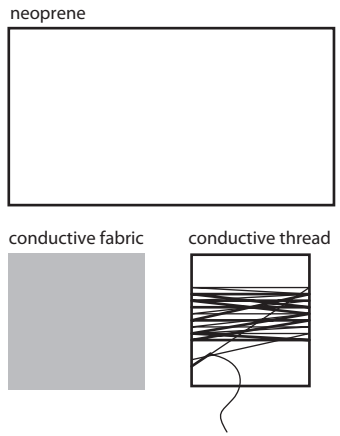

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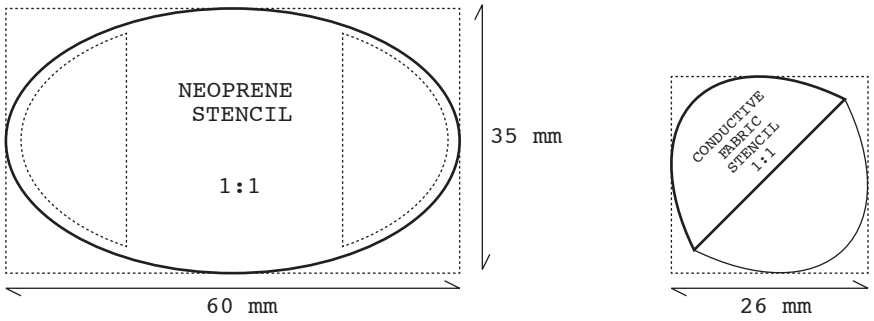

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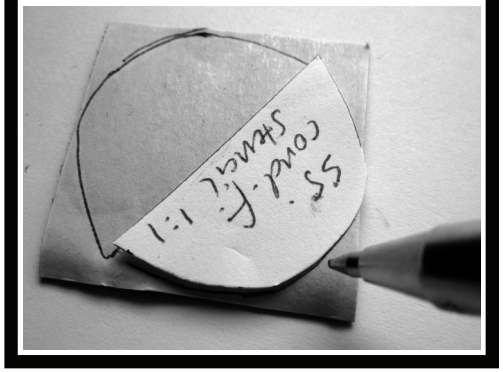
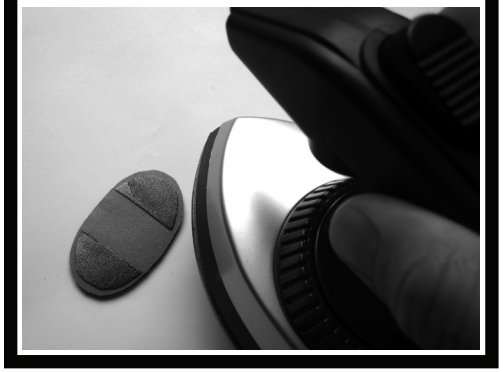
TRACE AND CUT OUT THE STENCILS 1

Cut or trace the stencils from the other side of this instruction sheet and transfer them to the apropriate materials.
Then cut out the shapes from the materials and peel away the paper backing from the conductive fabric.



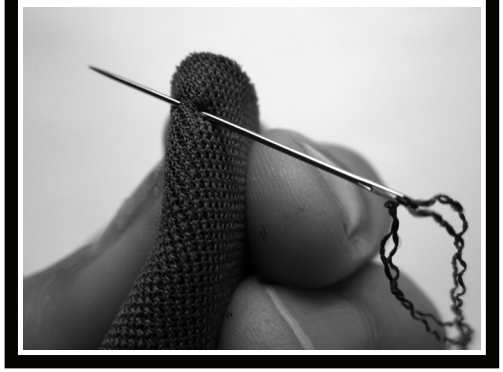
FUSE CONDUCTIVE FABRIC 2

Place the conductive fabric pieces with the glue side (shiny side) facing the neoprene. Set you iron to a medium heat (too hot will burn the fabric) and iron over the conductive fabric to melt the glue and fuse the fabrics together.



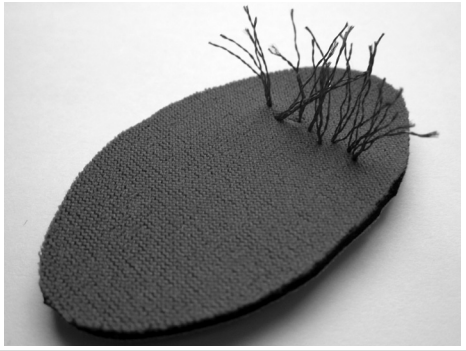
STITCH CONDUCTIVE THREAD 3

Thread the needle with conductive thread, feel free to take the thread double or quadruple.
Stitch into the neoprene from the top side (the side without conductive fabric), but don't pull the thread all the way through.



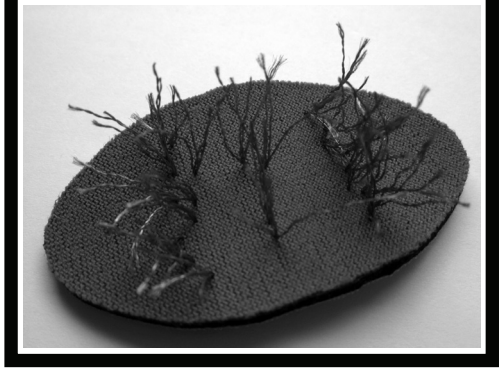
STITCH CONDUCTIVE FUR 4

After stitching cut the thread at desired fur length, roughly 2cm. Repeat 5 or 6 times. Each time the conductive thread should penetrate all the way through the neoprene and make contact with the conductive fabric fused to the reverse side.



STITCH MORE CONDUCTIVE FUR 5

Continue stitching conductive fur to both patches of conductive fabric and then add two or three stitches of fur to the center. When you stroke over the fur, from one side to the other, the conductive threads from one side should touch the center ones, and these in turn should touch those on the other end.

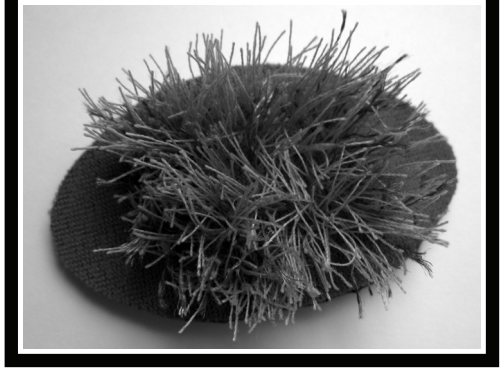


ADD SOME NON-CONDUCTIVE FUR 6

Thread your needle as before, but this time with a non-conductive thread of similar weight. Any colour you like.
Proceed to stitch fur until the sensor is dense and the conductive fur contacts are isolated from one another, yet make contact when stroked.

TEST FINISHED SENSOR 7

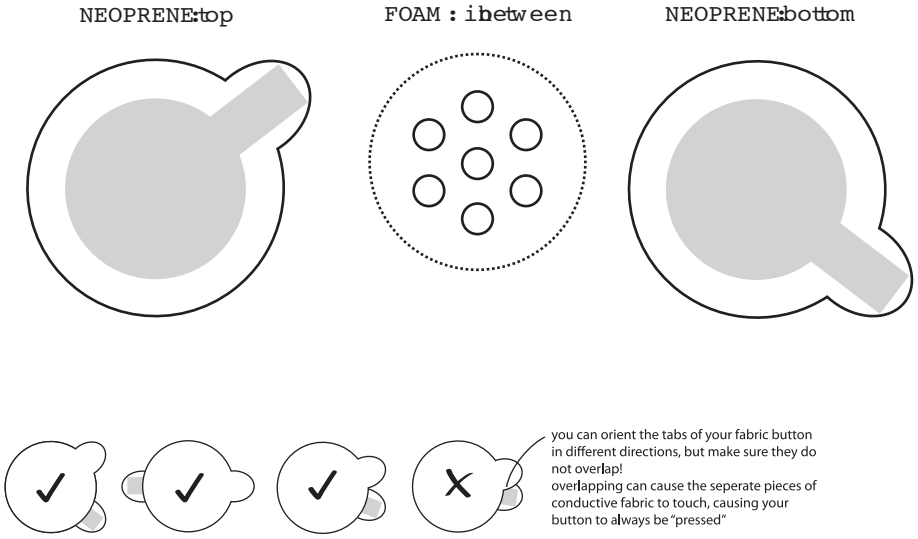
Connect the ends of your sensor to a multimeter set to measure continuity.
As you stroke across the sensor the resistance should sink to near zero Ohm. Flickering is normal. When the sensor is not being stroked the multimeter should mesure no connection. Ruffling of fur may be necessairy at times.



NEOPRENE PUSHBUTTON

Using conductive fabric as the contacts for soft push button and perforated foam as a spacer material, this fabric pushbutton is an extremely basic construction that can be used in many different ways.

DIAGRAMS



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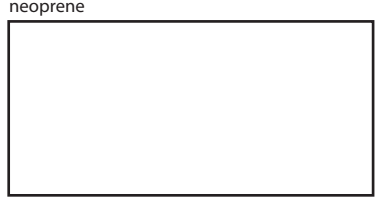
neoprene



conductive fabric

foam

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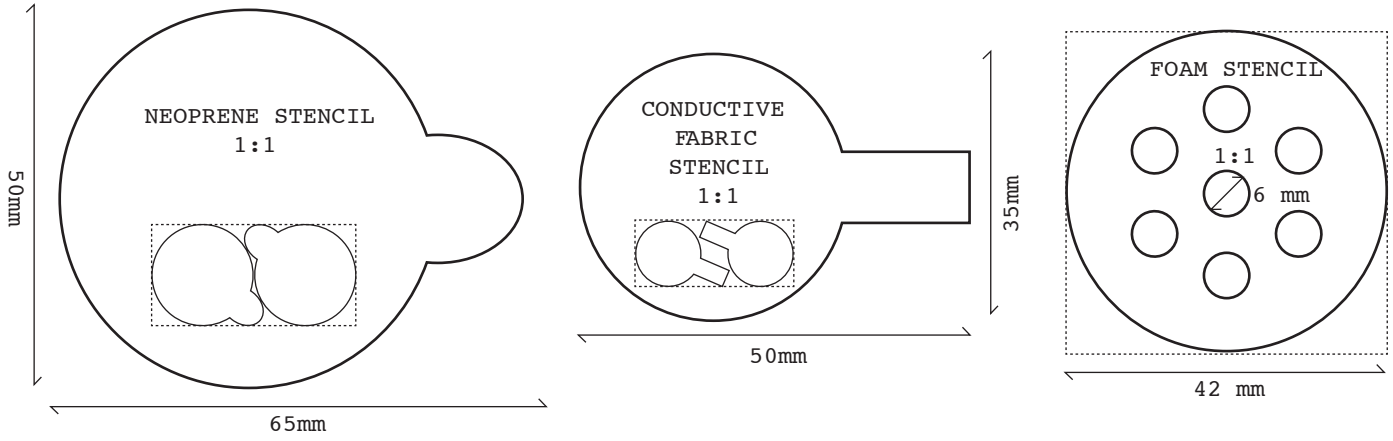

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TRACE AND CUT OUT THE STENCILS 1

Cut or trace the stencils from the other side of this instruction sheet and transfer them to the apropriate materials.

PEEL OFF PAPER BACKING 2

Peel the backing off from the conductive fabric pieces.

FUSE CONDUCTIVE FABRIC 3

Place the conductive fabric pieces, with the glue side (shiny side) facing the neoprene. Set you iron to a medium heat (too hot will burn the fabric) and iron over the conductive fabric to melt the glue and fuse the fabrics together.

PERFORATE THE FOAM 4

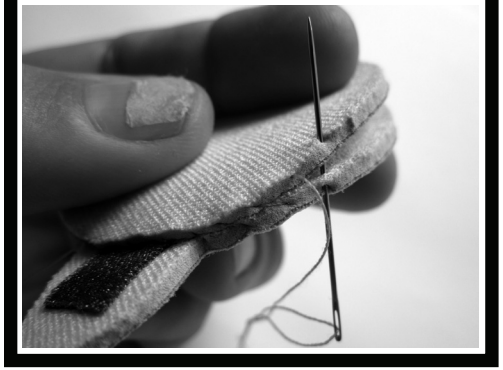
If you don't have a hole maker then you can also make holes in the foam by simply folding it half twice and pinching or cutting of the tip of the triangle.

LAYER THE MATERIALS 5

Layer your materials so that the conductive fabric faces inwards with the perforated foam inbetween.You can arrange the tabs of your fabric button any which way you want so long as the don't overlap.

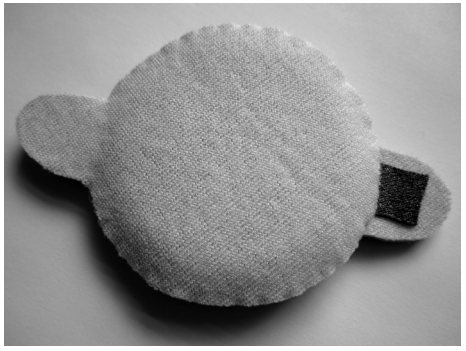
CLOSE THE PUSHBUTTON 6

Thread a needle with regular sewing thread. Tie a knot in one end and proceed to sew around the edge of your sensor. Be sure to stitch both sides of neoprene together, you do not need to include the foam in your stitch, as it will stay in place.



TEST FINISHED SENSOR 7

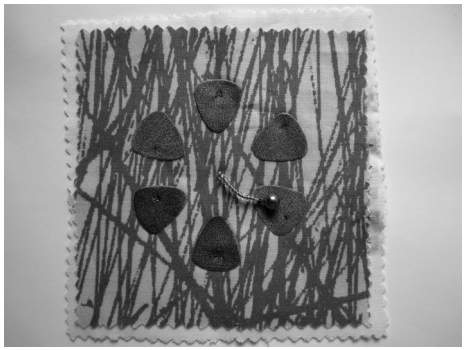
Connect the ends of your sensor to a multimeter set to measure continuity. When you press the pushbutton, your multimeter should read close to zero Ohm. When the button is not touched, the reading should indicate no connection.



KIT

BEAD AND FABRIC
TILT SENSOR

Using a metal bead and conductive fabric petals to construct a six-way digital tilt-switch.



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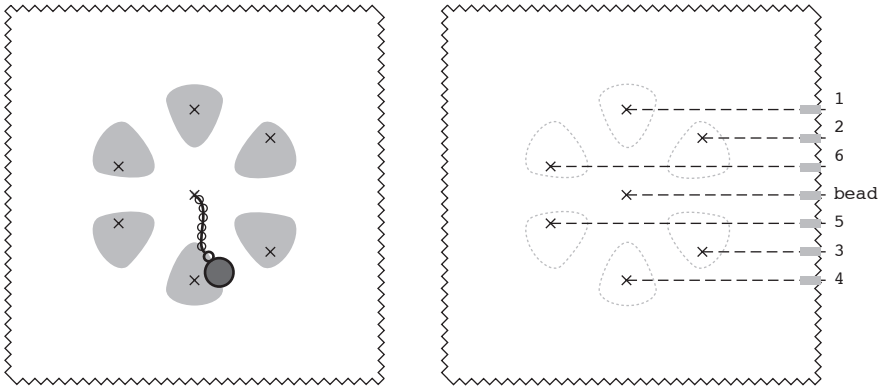

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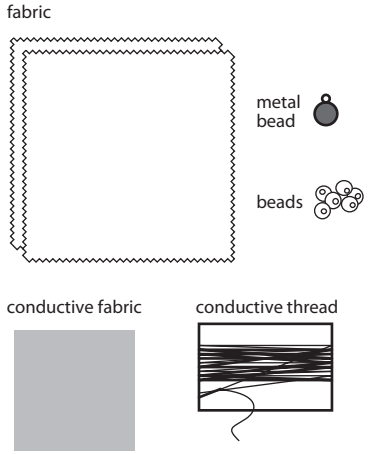

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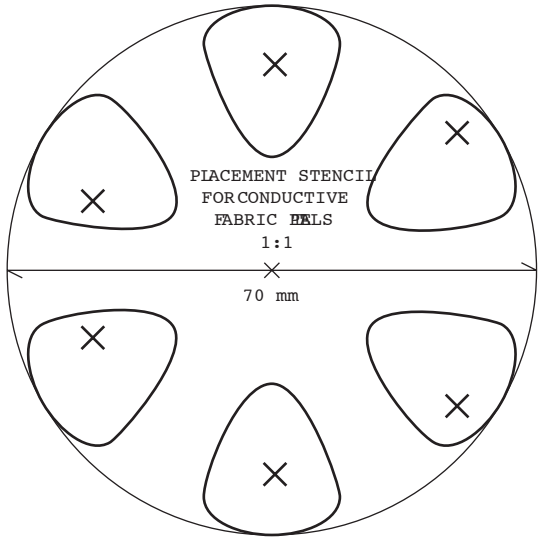

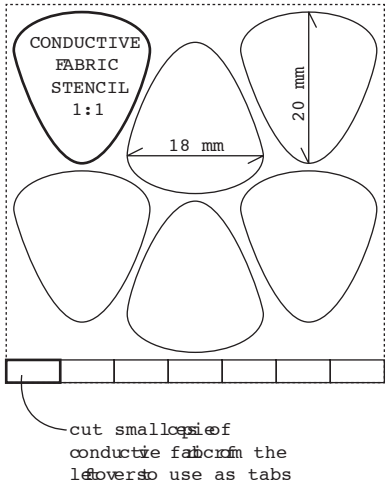

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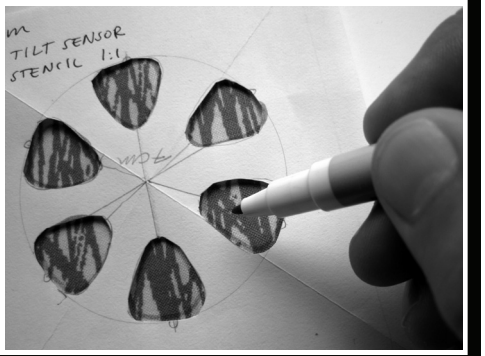
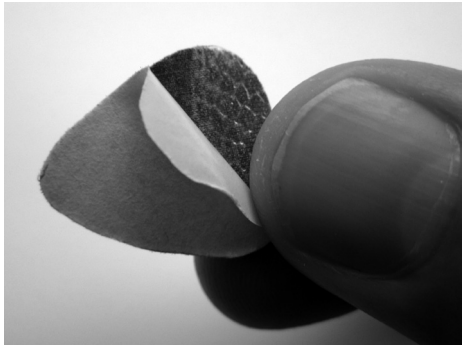
TRACE AND CUT OUT THE STENCILS 1

Cut or trace the stencils from the other side of this instruction sheet and transfer them to the apropriate materials.



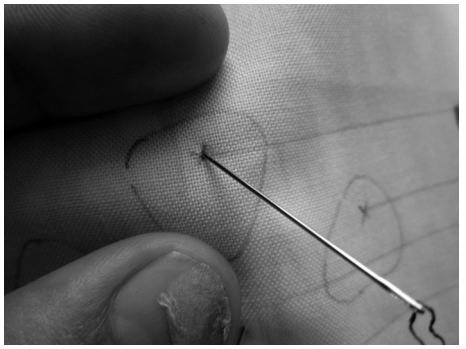
FUSE CONDUCTIVE FABRIC 2

Peel off the paper backing from the pieces of conductive fabric. Place the conductive fabric petals, with the glue side (shiny side) facing the fabric. Set you iron to a medium heat (too hot will burn the fabric) and carefully iron over the conductive fabric petals to melt the glue and fuse the fabrics together.



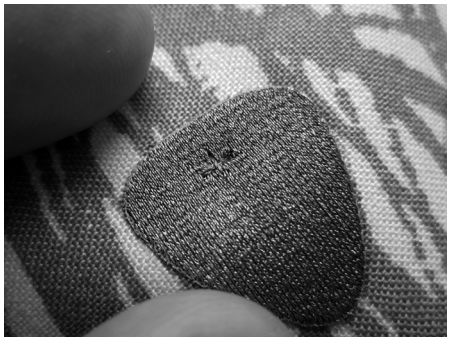
LAYER THE FABRIC 3

Layer the two fabric squares on top of each other, with the petals facing up and the tabs facing the back. Mark the X for each petal on the back of the petal layer. Thread a needle with some conductive thread and tie a knot on one end. From behind, sew into one of the conductive fabric petals where the X is marked.



CONNECT THREAD TO PETAL 4

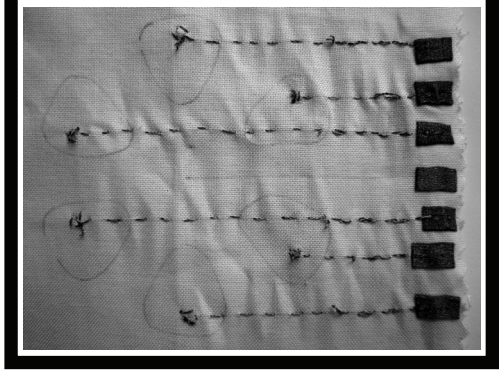
Stitch the conductive thread to the petal 3-4 times in the same spot to insure a good connection. Continue to sew, but only on the back piece of fabric. This way the conductive thread can pass underneeth the other conductive petals without touching them. End your sewing by stitching the conductive thread 5-10 times to the appropriate tab.



REPEAT SIX TIMES 5

Repeat the instructions in step 3 and 4 for all six petals. Make sure that none of the conductive threads touches another.

After connecting all conductive petals to their respective tabs, it is time to connect the metal bead, which explained in the next step.

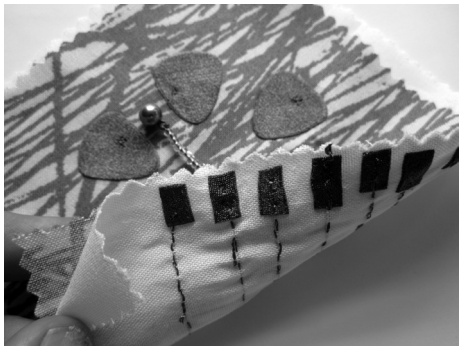


ADD METAL BEAD 6

This time start sewing from the conductive tab to the center of the square. In the center, sew through both pieces of fabric so that you are on the front side. String as many beads as necessairy, then add the metal bead last before sewing back through all the beads. Sew back through both layers of fabric and tie a knot in the thread.

TEST FINISHED SENSOR 7

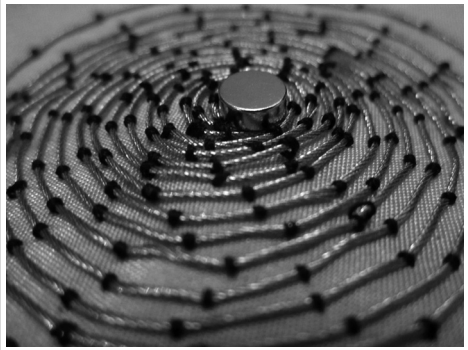
Connect one end of a multimeter set to measure continuity to the center bead connection of your sensor. In turn connect the other end of the multimeter to the other sensor contacts. When the metal bead touches the contact you are connected to, the multimeter should read close to zero Ohm.



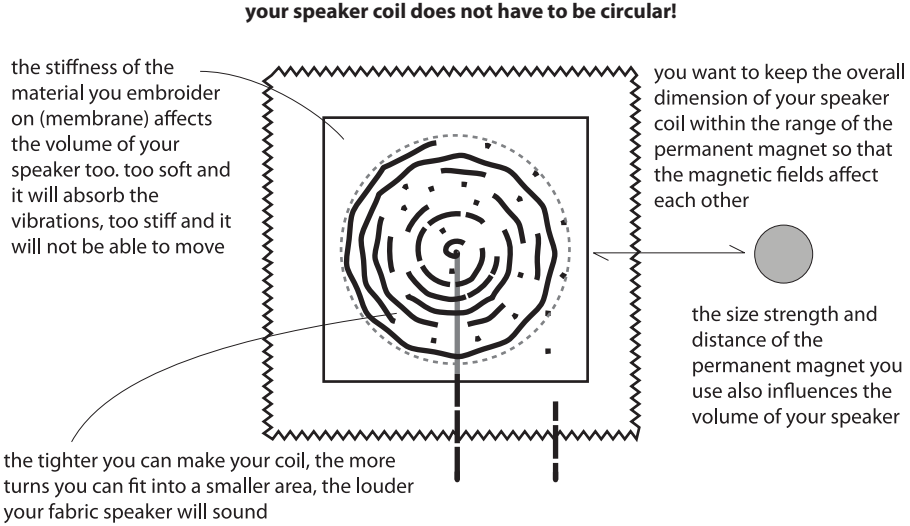
KIT

EMBROIDERED SPEAKER COIL

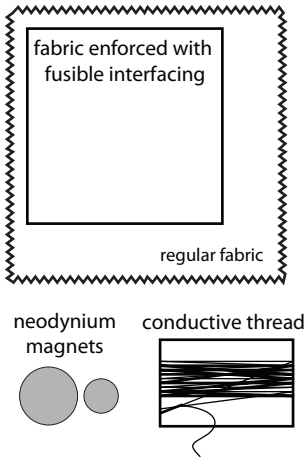
Embroider a highly conductive thread to make a fabric speaker coil. Then run an amplified sound source through it and hold a magnet close to hear it. Sewing the coil takes longer than you might think!



DIAGRAMS

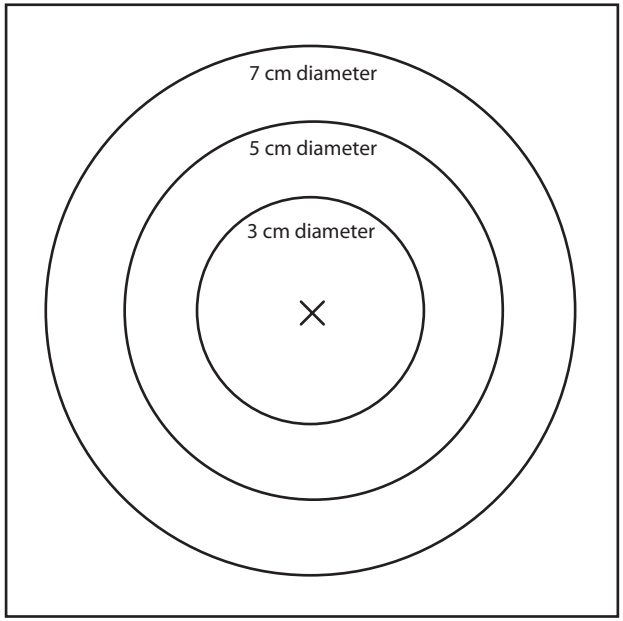


CONTENTS



In addition to the contents listed above, you will need the following items to complete this kit: scissors, an iron, a sewing needle and some regular thread

STENCILS



the speaker coil in this example is roughly 5 cm diameter and makes 16 turns

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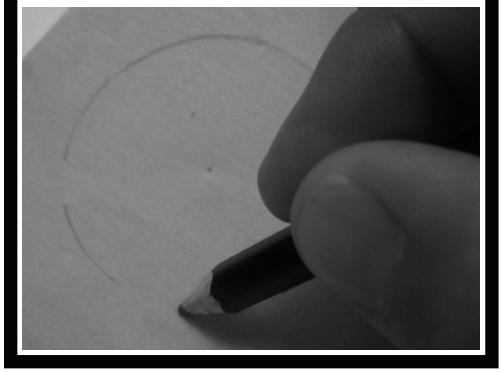
UNDERSTANDING HOW A SPEAKER WORKS 1

A speaker makes sound because an electromagnet (the embroidered coil) is mounted to a membrane (the fabric) with a permanent magnet close by. When an audio signal is connected to either end of the electromagnet (coil) a fluctuating magnetic field forms around the coil, repelling and attracting the membrane from the permanent magnet. These vibrations happen so fast that we can barely see them, but the membrane moves the air around it, translating electrical frequencies into audible waves that we can hear.
Take a good look at the diagram and stencil on the other side of this sheet so that you understand what variables will influence the efficiency (volume) of your speaker coil before designing your own.

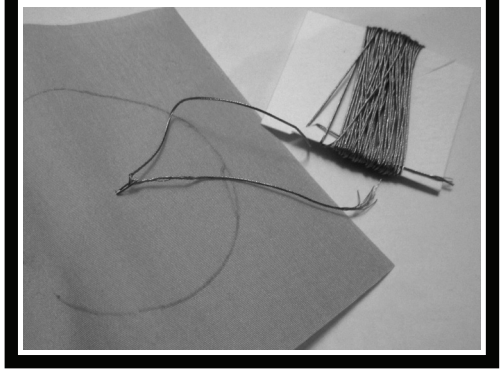
TRACE AND FUSE 2

Peel the paper backing from fusible interfacing adhered to the fabric square and trace the outline of your speaker to the fabric side. Use an iron to fuse the fabric square to the other piece of fabric provided in this kit. This makes the fabric harder to sew, but insures that your coil does not collapse on itself, and results in a stiffer membrane.



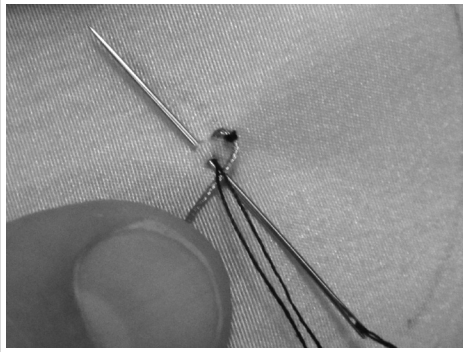
START SEWING CONDUCTIVE THREAD 3

With a sewing needle pull the end of your conductive thread through the center of your coil so that the needle ends up on the back side with the fusible interfacing. Pull as much thread through as you will need to connect the center of your couil to your circuit. Generally 10-20 cm is good. Then remove the thread from the needle.



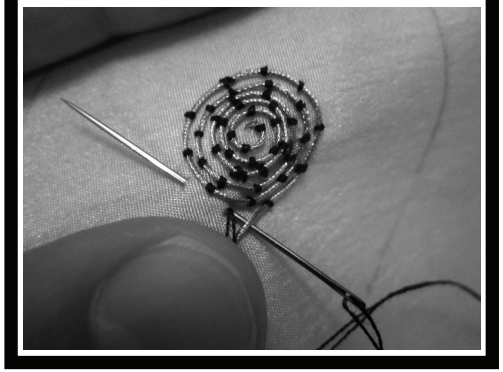
"COUCHING" 4

Thread the needle with regular thread and tie a knot in one end. Insert from the reverse side through the center point of your coil design. Stitch over the conductive thread and back into the fabric, then come back through the fabric a few mm further along your coil path. This embroidery technique is called "couching".



KEEP SEWING YOUR COIL 5

As you are sewing your coil from center to edge, you want the conductive thread to come as close as possible to the previous turn without touching it. If one turn of the conductive thread touches another then the electricity will not be forced to flow around in circles, which is what increases the strength of the magnetic field.

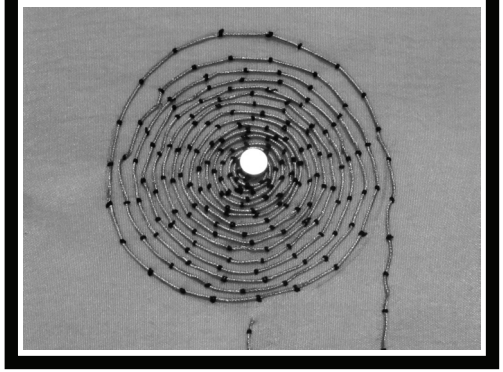


ADD MAGNETS 6

Your kit includes two strong neodymium magnets. For a quick first test of your speaker place the smaller magnet on the front side and the larger on the back of your speaker coil. For your final design you will want to mount your magnet(s) in the center of the coil without having them directly connected to the membrane.

HOOK UP YOUR SPEAKER 7

Connect both ends of your speaker coil to your amplified audio signal. If you can not hear your speaker, try holding it very close to your ear. If it is very quiet then it is working, but you might need to increase your power source or reconsider your coil design to make it more efficient at moving air, which is what makes it louder.

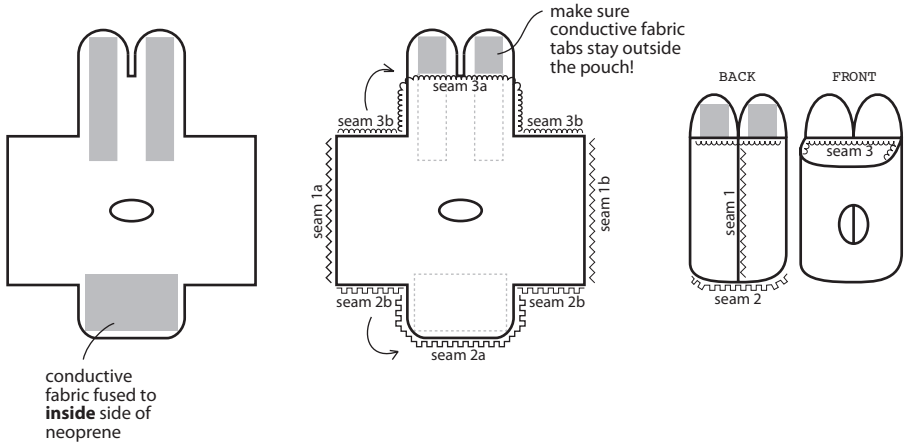


NEOPRENE DOUBLE AA or 9V BATTERY POUCH

KIT

Using neoprene and conductive fabric to construct a tight fitting neoprene pouch that fits two AA bateries or a 9V battery. You can also decide to make a single AA battery pouch.

DIAGRAMS



CONTENTS

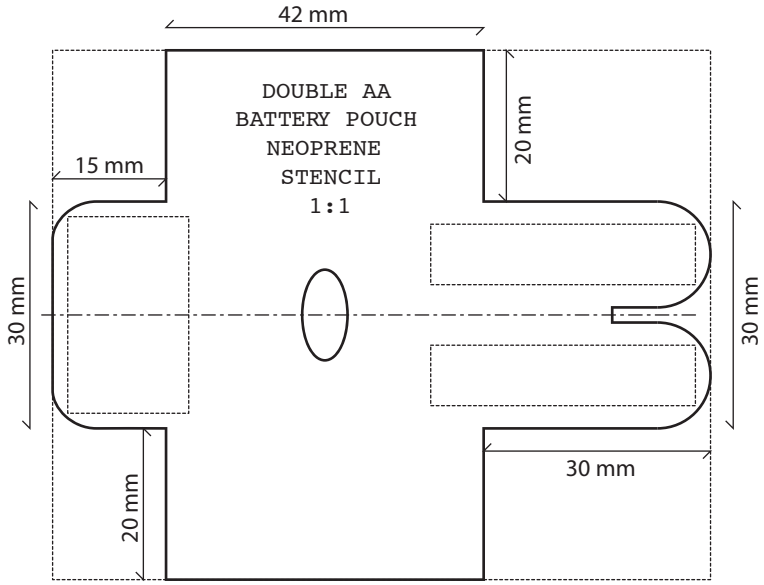
neoprene

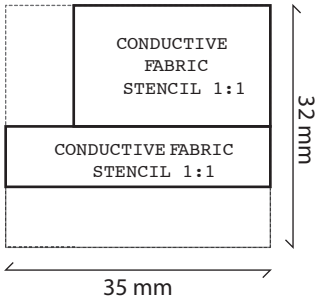
conductive fabric with fusible interfacing

(metal snaps)

In addition to the contents listed above, you will need the following items to complete this kit: scissors, an iron, a sewing needle and some regular thread

STENCILS





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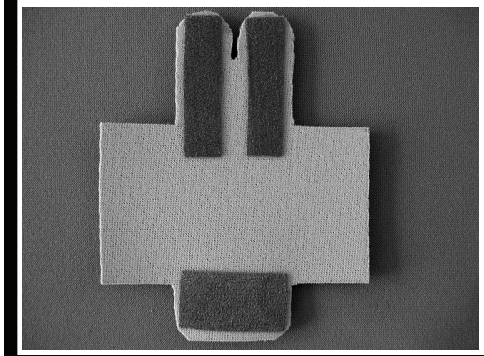
TRACE 1

Cut or trace the stencils from the other side of this instruction sheet and transfer them to the apropriate materials.

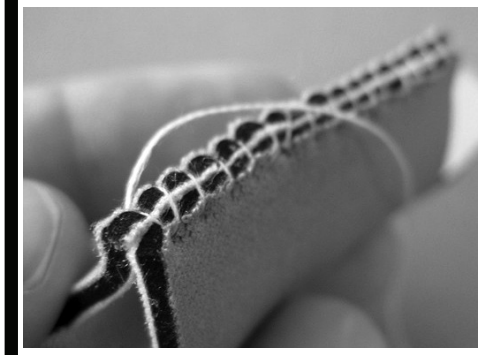
FUSE 2

Peel off the paper backing from the conductive fabric. Place the conductive fabric pieces, with the glue side (shiny side) facing the neoprene. Set you iron to a medium heat (too hot will burn the fabric) and iron over the conductive fabric to melt the glue and fuse the fabrics together.



FOLD AND SEW 3

Thread a needle with regular thread and tie a knot on one end. Fold the neoprene together and sew along seam 1 (see diagram on other side).
Make sure you sew the pouch together with nice tight stitches. The key to making this pouch is that it fits the batteries tight like a body suit, to achieve good electrical contact.

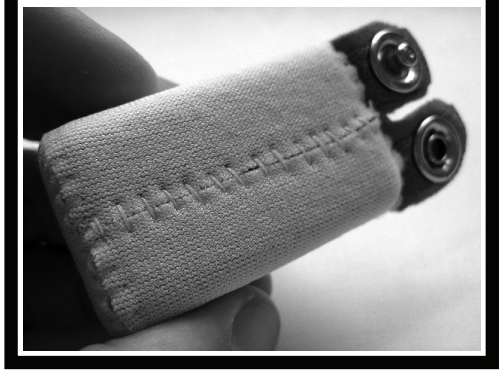


SEW MORE 4

Fold over the bottom pouch tab and sew it to the walls of the pouch along seam 2. Proceede to sew the pouch closed along seam 3. Leaving the conductive "ears" sticking out of the pouch.
Make sure the conductive parts of the ears are not touching. Otherwise you will short your battery out!

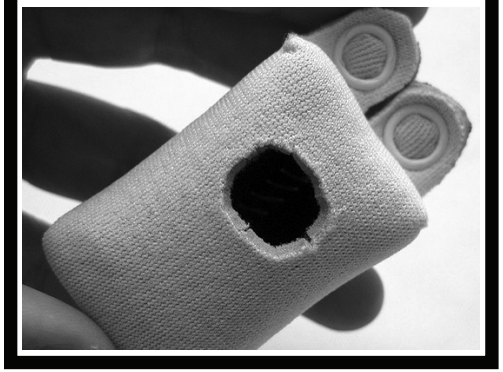
ADD METAL SNAPS/POPPERS 5

If you want to have snap connectors, sew them using regular thread to the conductive fabric side of the battery pouch ears.



CUT HOLE 6

So that you can insert the batteries into the pouch, you need to cut a hole in the front of the pouch. Cut the hole no wider than 1cm diamerter! Neoprene is stretchy and extremely robust, so it can take a lot of force. The batteries will fit in, even if they look like they might not. If the hole is too big, the pouch won't be tight enough.



INSERT BATTERY(S) 7

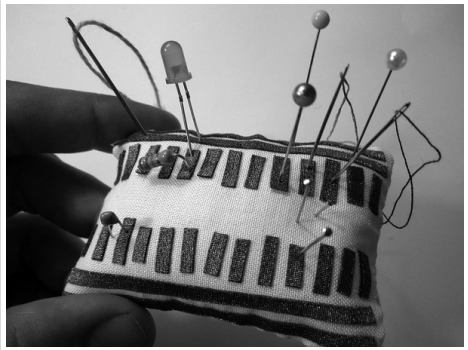
Insert your two AA batteries through the hole, make sure that one battery has plus facing the top and the other has minus facing the top.
Or, insert you single 9V battery into the pouch with the contacts facing up.

MAKE SURE THAT THE CONDUCTIVE EARS NEVER TOUCH!!!

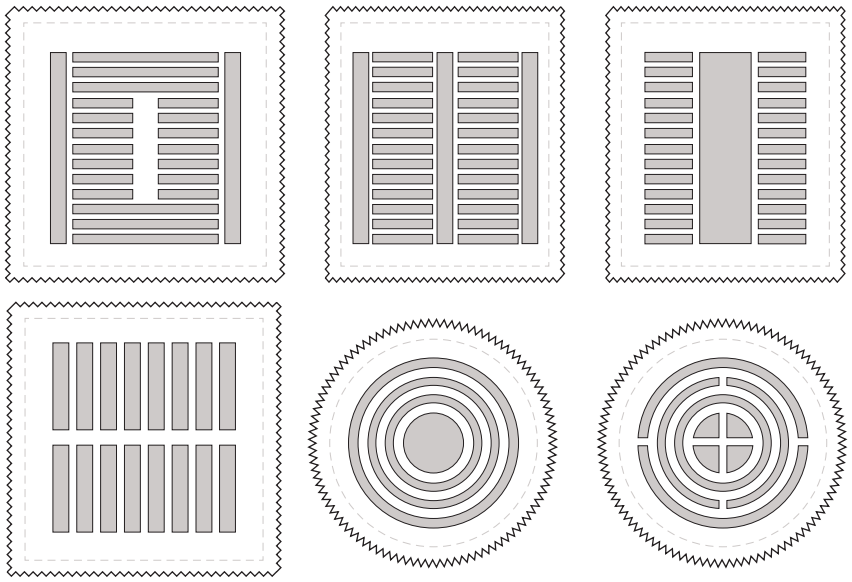
KIT

PINCUSHION BREADBOARD

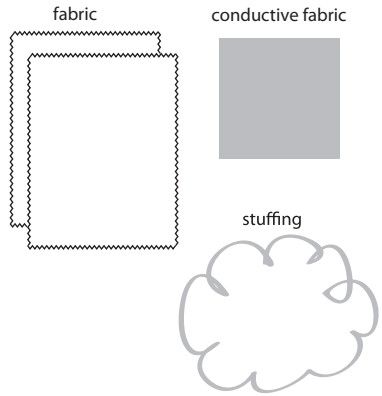
This pincushion doubles as a breadboard, or vice-versa. Pins or component leads that protrude through the strips of conductive fabric adhered to its surface are electrically connected.



DIAGRAMS



CONTENTS



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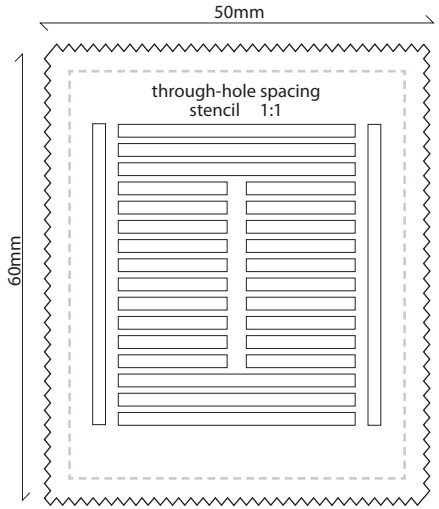
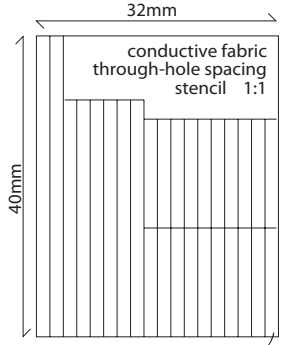
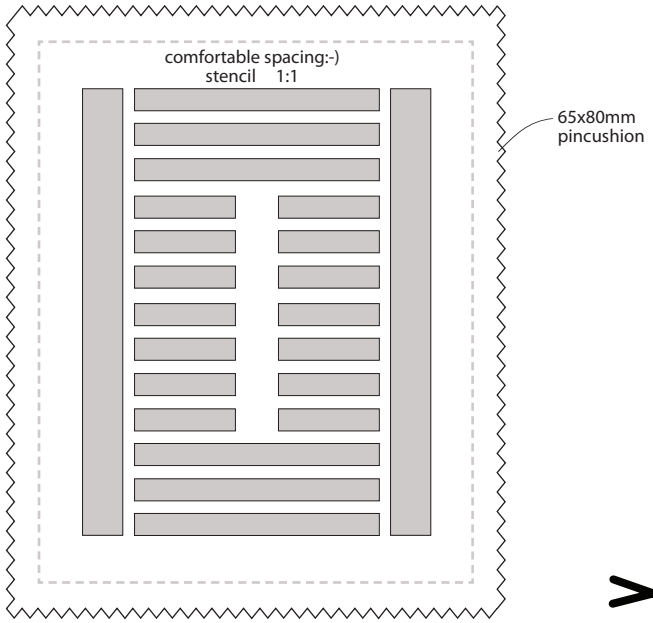




These through-hole pitch traces are 1.7mm wide and can be tricky to cut and place by hand. If you have access to a lasercutter, this can make things easier. Especially since the heat of the laser also singes the edges of the fabric!



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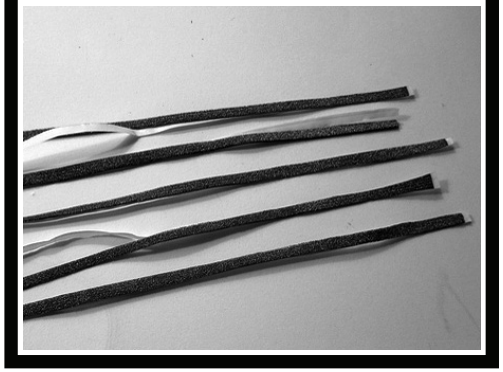
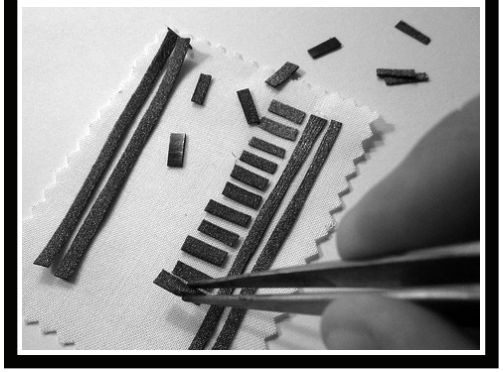
TRACE AND CUT OUT THE STENCILS 1

Decide on a layout for your pincushion breadboard. Since you are making it yourself, you may as well customize it! If you would like to populate it with pitch-sensitive components, then you can use the example stencil provided. Though beware, this is very narrow spacing to cut and arrange by hand. Then trace and cut out the materials.



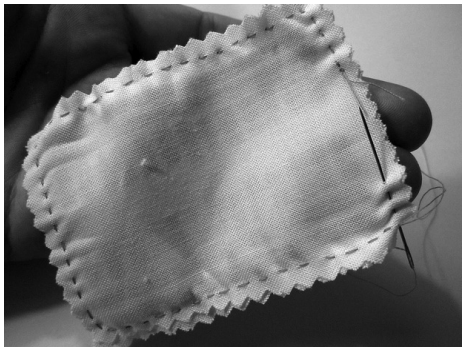
ARANGE AND FUSE CONDUCTIVE FABRIC 2

Peel the paper backing off the conductive fabric. Using a pair of tweezers, arrange the strips of conductive fabric with the glue side facing down.
Set you iron to a medium-high heat and very carefully iron over the conductive fabric to melt the glue and fuse the fabrics together.



SEW TOGETHER 3

Layer the second piece of fabric ontop of the first with the conductive fabric pattern inbetween. Thread a needle with regular thread, tie a knot on one end and sew around the pieces of fabric, leaving a 3-5cm opening along one edge.



TURN INSIDEOUT 4

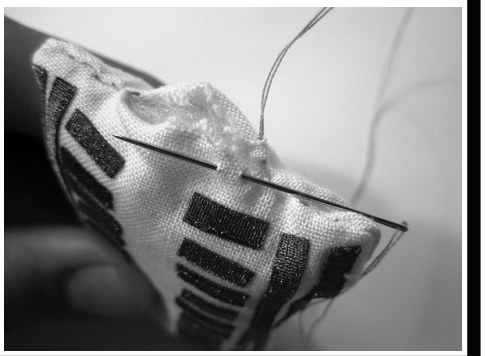
Without cutting the thread you have just sewn with, carefully turn the pouch you have created insideout.

STUFF 5

Stuff the pouch with sufficient stuffing to make it firm. You can use the tweezers to help get the stuffing into the corners and distribute it evenly.

CLOSE 6

Fold over the edges of the gap you left open, and with the remainder of the thread sew the pincushion together.

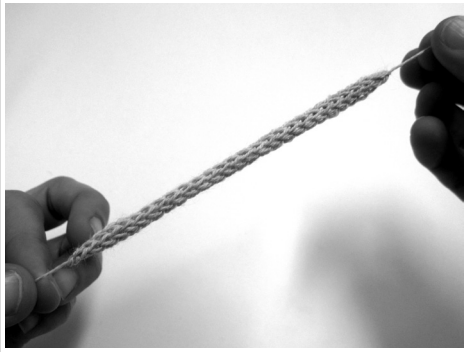


FINISHED 7

Tie a knot in the end of your thread and your Pincushion Breadboard is finished! It is now ready to be populated with pins, needles and electronic components!

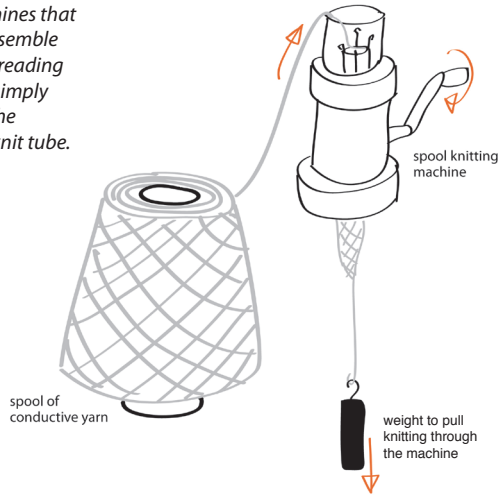
KNIT
STRETCH SENSOR

This stretch sensor is knit from a stainless steel and polyester yarn blend. The stainless steel strands in the yarn are short and compressing the fibers together increses the overall conductivity.

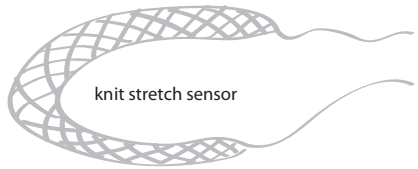


DIAGRAMS

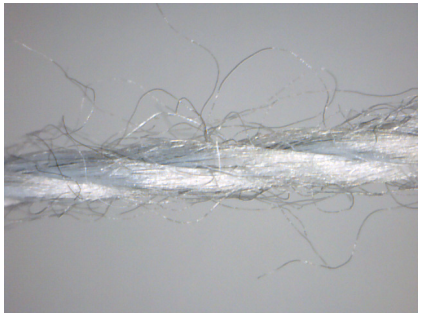
Spool knitters are hand-crank circular knitting machines that have 4 needles and resemble knitting dolls. After threading the spool knitter you simply turn the handle and the machine produces a knit tube.

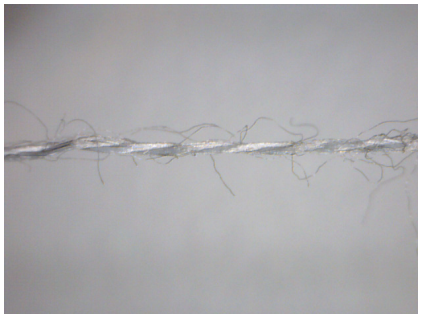


CONTENTS



NOTES





This sensor is knit from a stainless steel and polyester yarn blend. The stainless steel strands in the yarn are short and not continuous, so that stretching the yarn causes a decrease in electrical resistance as the individual conductive fibers make better contact among themselves.

Even without knitting the yarn into a structure you can use it as a stretch sensor by simply pulling it taught or relaxing it. Knitting the yarn into a narrow tube on a spool knitter makes the sensor stretchy and more robust. The knit structure also accumulates more yarn and thus more resistance in less length, giving you greater range.

You can also apply pressure to this yarn to use it as a pressure/squeeze sensor.

When connecting to either end of the knit sensor make sure to connect your measurement contacts to parts of the yarn that will be stretched or are just on the boarder of where the stretch will happen, otherwise you the resistance of the unstretched yarn will be part of your sensor reading.

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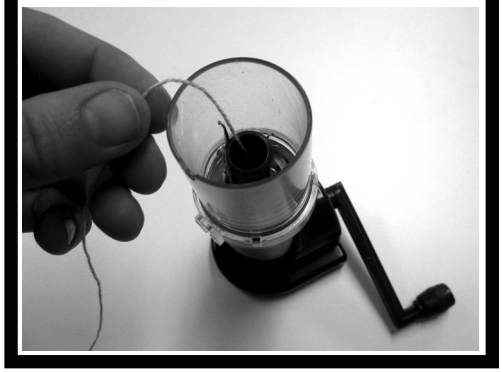
THREAD THE MACHINE 1

Thread the resistive yarn into the knitting machine as shown in the photo.

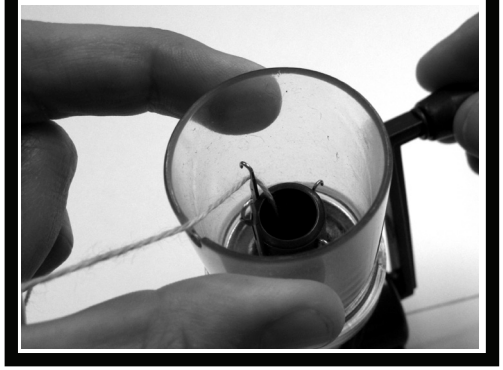


ATTACH WEIGHT 2

Tie the end of the yarn to the hook on the weight. When you are knitting with the machine, always make sure the weight is pulling on the yarn at the other end. Otherwise the knit structure will not be pulled off the needles and will get caught up in the machine.

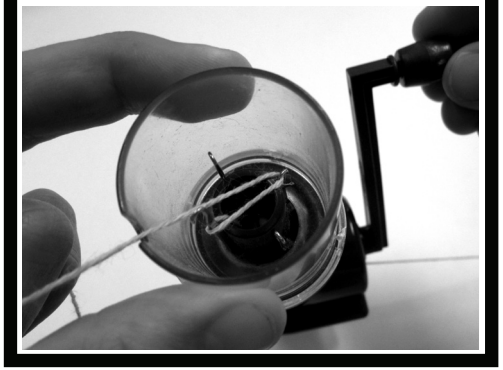
CATCH ON FIRST HOOK 3

Feed the yarn into the machine with one hand, and crank the handle with the other. Catch the yarn on one of the hooks.



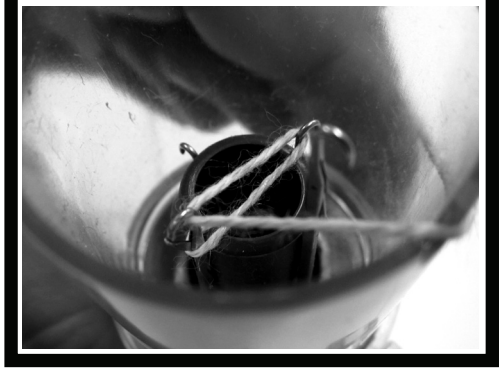
SKIP HOOKS ON FIRST ROUND 4

Skip the second hook and catch the yarn on the hook opposite the first hook that you caught it with. Again, skip the forth hook, and catch the yarn back on the first hook that you started on.



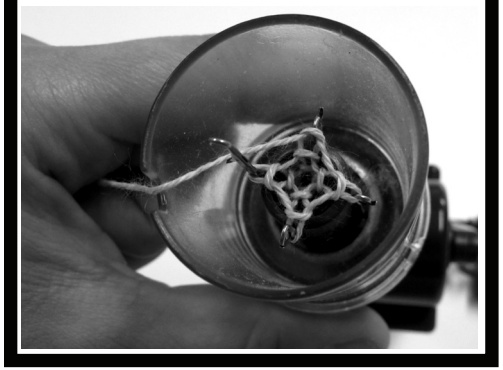
CATCH AGAIN ON FIRST NEEDLE 5

When catching the yarn on the first hook the second time around, make sure that the first yarn goes under the latch and the second yarn stays insidethe hook/latch. As the knitting machine turns it should be pulling the newer yarn through the loop from the previous round. Turn the machine slowly for the first few rounds to make sure.



KEEP KNITTING 6

Once you"ve completed the first few rounds, paying attention that the yarn is hooking correctly, you can crank the machine faster and pay less attention to the needles. Make sure the weight is pulling the knitt structure out the other end, and that the yarn feeds smoothly into the machine.



FINISHING OFF 7

When done, simply cut the yarn feeding into the machine and keep cranking. The knit structure will eventually fall out the back. Pick up the final four loops of the knitting with the loose end of yarn using a large sewing needle. As shown in photo.

KIT

FABRIC
POTENTIOMETER

CON Using neoprene, EeonTex non-woven fabric, conductive thread and stretch conductive fabric to construct a fabric potentiometer. TENTS

DIAGRAMS

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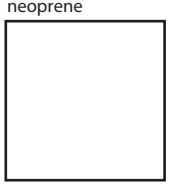
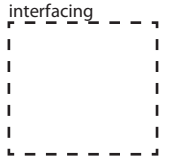
neoprene

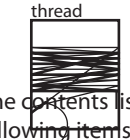


Eeontex with fusible interfacing



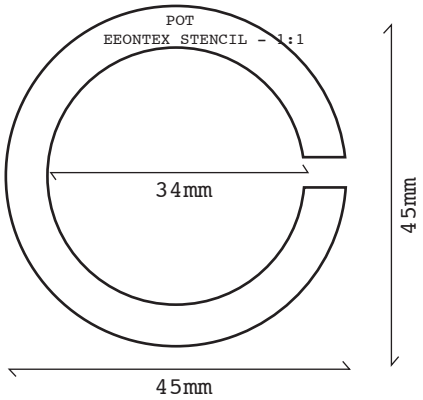
conductive fabric with fusible interfacing

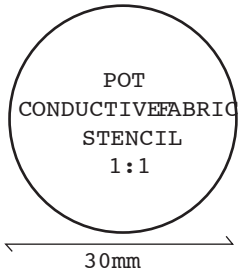
conductive thread



In addition to the contents listed above, you will need the following items to complete this kit: scissors, an iron, a sewing needle and some regular thread

STENCILS





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KIT

POMPOM
SQUEEZE SENSOR

Make a pompom from a blend of real wool and resistive yarn (stainless steel and polyester blend), then felt it using soap and hot water to make a squishy ball that conducts more the harder you squeeze it.

DIAGRAMS

CONTENTS

resistive yarn

regular wool

In addition to the contents listed above, you will need the following items to complete this kit: scissors, an iron, a sewing needle and some regular thread

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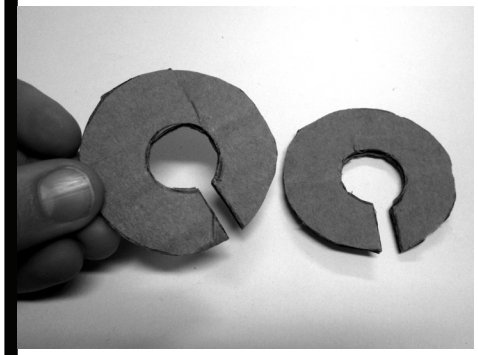
CUT TOOL 1

Before starting to make the pompom you need to make your tool. Cut out two shapes from cardboard as shown in the photo. The side of the outer circle will determine the side of your pompom. The inner circle should only be as big as it needs to be for you to wrap the yarn.



START WRAPPING 2

Blend the resistive yarn (which is a polyester blend) with a real wool yarn if you later want to felt it into a squishy ball. You can control the conductivity of the pompom by adjusting the ratio of resitive to regular yarn.

KEEP WRAPPING 3

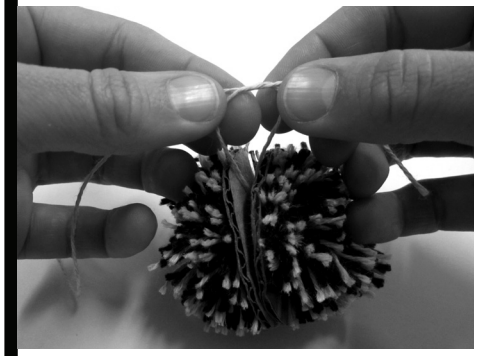
Wrap the yarn around the cardboard until it is full. You can go back and forth multiple times to build up a thick layer of wrapped yarn.

CUT AROUND EDGE 4

When finished wrapping cut around the edges of the circle. As shown in the photo.

TIE YARN AROUND MIDDLE 5

Take a strong yarn or thread and wrap it around the middle of the pompom. Make sure it goes inside between the cardboard pieces. Tie two or more knots that tie the pompom together etightly won't come undone.



REMOVE TOOL 6

Carefully remove the tool from your pompom. The yarn you wrapped around the middle should keep everything in place.

PRUNE (AND FELT) 7

Use a pair of scissors to trim the yarns of the pompom as some may be longer than others.
If you used real wool and want to felt your pompom, add hot water and soap to it and rub it between your hands until the wool fibers felt together, giving it a squishy texture. Also try putting in washing machine.

KIT

KIT INSTRUCTIONS

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