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VPEB Van Perlo Elektronica & Besturingstechniek

# SHdec

## Manual

Smart electronics for your miniature world

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## Release management

This manual is applicable to:

- Module SHdec Rev00







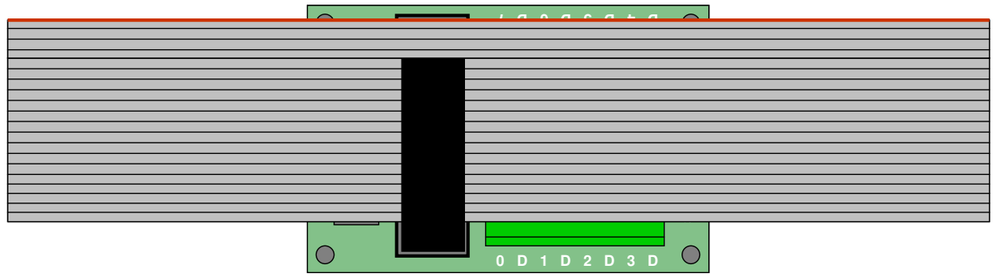


Figure 11: Connecting an SWdec to the 20-pole SHdec cable

## 7 Sensitivity

The SHdec is programmed with two sensitivity levels "Regular" and "High". Sensitivity is selected by a jumper at K6 (see fig 7). Note that for sensitivity=High the jumper is effectively "parked", and connected to one pin only. Do not place the jumper in any other position as the ones indicated in figure 7, since that may damage your sensors or the SHdec.

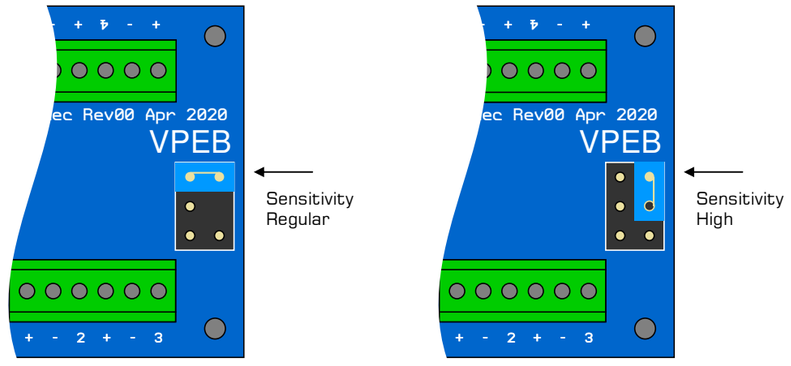


Figure 12: Sensitivity selection

Our tests show that regular sensitivity works well in most cases "out-of-the-box". If you experience small magnets do not trigger the sensor you can try high sensitivity, however, be aware this may cause false detection if strong magnets pass nearby. Also you can tweak switch timing in the UCCI/TM-H settings that may influence your results. Consult the UCCI/TM-H documentation or the DinamoConfig manual for more details about this.

**Never** connect an AC power supply. An AC voltage or reverse DC power supply will destroy your SHdec and likely your sensors. The SHdec can withstand up to +25VDC, however a supply voltage over 12V will heat up the on-board voltage regulator and may cause damage or malfunction.

In stead of soldering and extending wires 1..4, you can also run these flatcable strands around UCCI/TM-H to the power connector and connect them directly. Cut off the excessive length of the other strands in that case.

The cable for sensors 0..63 goes into the 26-pole flatcable connector of UCCI/TM-H. Wire 1 to 4 in your flatcable are for power, so wire 5 of the flatcable goes at pin 1 of the 26-pole connector, wire 20 goes at pin 16. Pins 17..26 remain unused.

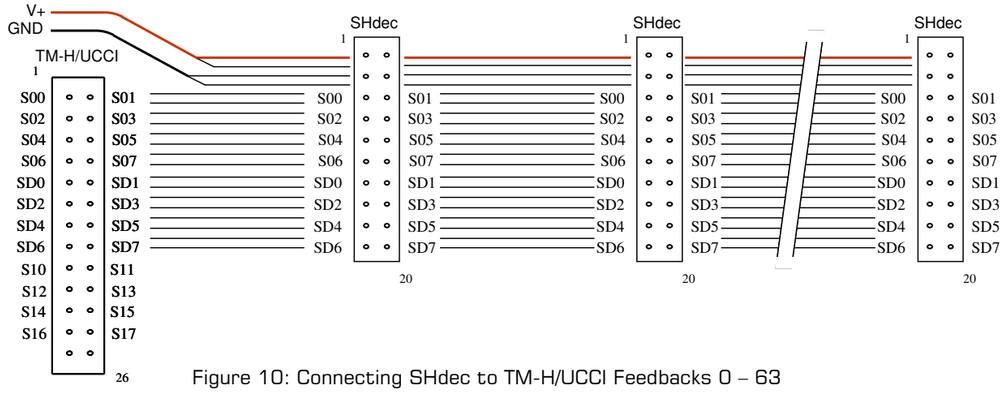


Figure 10: Connecting SHdec to TM-H/UCCI Feedbacks 0 – 63

The cable for sensors 64..127 goes into the 16-pole flatcable connector of UCCI. Wire 1 to 4 in your flatcable are for power, so wire 5 of the flatcable goes at pin 1 of the 26-pole connector, wire 20 goes at pin 16.

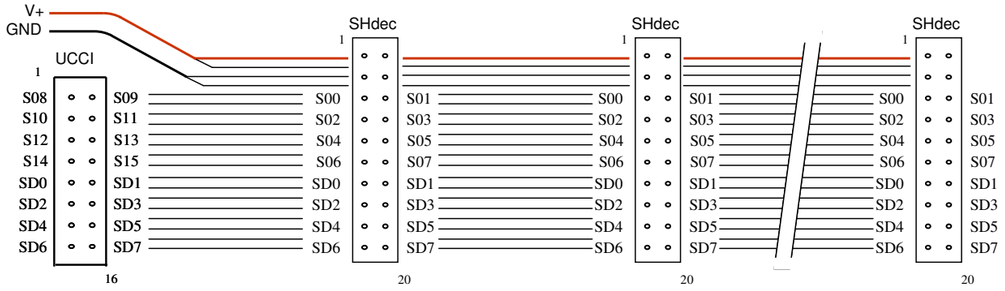


Figure 11: Connecting SHdec to UCCI Feedbacks 64 - 127

Note that we do not describe here how to connect sensors 64..127 to the TM-H. We think that solution will hardly ever be required, so we don't want to complicate this manual by that. If you need it, use the DinamoUsers forum to get directions.

Should you want to use a combination of SHdec and SWdec modules at the same flatcable, this is no problem. Just bear in mind that wires 1-4 carry power and are not connected to the SWdecs. If all SWdecs are at the end of the cable, you can simply cut off wires 1-4 after the last SHdec and carry on with a 16 wire flatcable, the original wire 5 becoming wire 1. If SWdecs need to be in between, separate wires 1-4 from the others, where the 16-pole SWdec connector needs to be placed. Take care that you cut well **between** the wires and not **through** the wires. Now wires 5-20 go in the 16-pole connector for the SWdec, wire 5 at pin 1 (triangle). Wires 1-4 run over the connector (see fig 11).





# Contents

# 1 Introduction

The Dinamo modules TM-H and UCCI have the possibility to read the state of digital inputs. Originally these inputs are typically reed-switches or other dry-contacts. To facilitate the connection of reed-contacts, the SWdec is available.

The SHdec offers the possibility to use Hall sensors as inputs for UCCI and the TM-H. A Hall sensor is an electronic part that is able to detect a magnetic field and to indicate the magnitude and direction of the magnetic field by means of an electrical voltage or- current. The SHdec is a module developed by VPEB to which up to 8 Hall sensors can be connected. Any combination of SHdec and SWdec modules can be connected to an UCCI or TM-H, up to a maximum of 16 in total.

Hall-sensors are an interesting option, especially when used for detection of cars. Nowadays the guiding of the car is usually done by a magnetic strip in the road surface. The cars have a steering magnet that follows the strip. The magnetic strip has a permanent magnetic field and when a steering magnet passes, the magnetic field increases temporarily. The increase of the magnetic field can be used to trigger a reed contact and can be detected by a Hall sensor.

The advantages of Hall sensors in combination with the SHdec are:

- The sensitivity is considerably greater than when using reed contacts and the SWdec. In practice, this means that even the smallest, common steering magnets still provide reliable detection, even when driving with a “floating tug”
- Hall sensors are sturdier than reed contacts and do not break. Installation is therefore easier.
- When reed-contacts are used, these require precise adjustment to achieve maximum sensitivity. The SHdec provides “auto-levelling”. This means that the permanent magnetic field, present as a result of the magnetic strip and other sources, is automatically eliminated. Hall sensors can therefore easily be placed directly under the magnetic strip. No adjustment is necessary. Auto-levelling takes place continuously, so even if, for example, the magnetic field from the magnetic strip decreases over time, operation is guaranteed.

Disadvantages of Hall sensors compared to reed-contacts are:

- Hall sensors need power. This means that the SHdec must be supplied with supply voltage. This is obtained from UCCI or the TM-H and is carried along with the cable to which the SHdecs are connected.
- The solution with Hall sensors and the SHdec is more expensive than using reed contacts with the SWdec.
- Hall sensors are connected with 3 wires to the SHdec instead of 2 for reed contacts and the SWdec. The connection of Hall sensors is polarity sensitive.





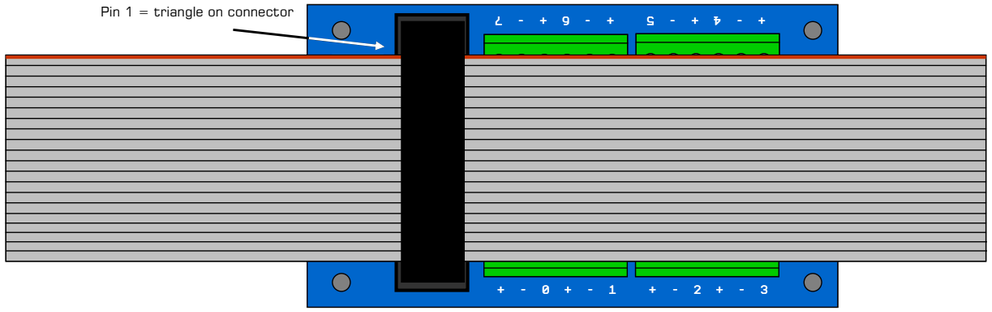


Figure 8: Connecting flatcable to the SHdec

There are special (expensive) tools to mount flatcable connectors onto flatcable. However, you can use a pipe wrench, vise or anything that can squeeze the 2 parts of the connector together in a controlled way, as long as you pay attention: Make sure that the tiny knives that go through the flatcable cut **between** the wires and not **through** the wires. When you use a pipe wrench, make sure that the pressure is evenly distributed over the length of the connector, otherwise it may break when to much force is applied.
The additional strain relief bracket supplied with the connector is of little use (we think) to keep the cable secure, however you can use it to make a strap to pull the connector from the header without having to put stress on the flatcable itself (see figure 9).

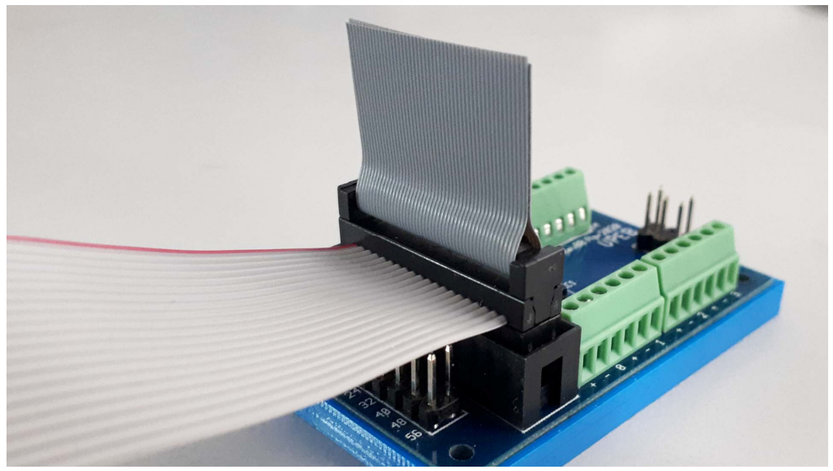

Figure 9: Example for strain relief to pull connector from the header

Wire 1 through 4 are used to carry power supply to the SHdecs and are not connected to the flatcable connector at UCCI or the TM-H. The reason is that UCCI and TM-H are originally not designed for the SHdec and do not supply power to that connector.
The SHdec needs to be powered by a positive 8V..12V DC. This power supply is available at both UCCI and TM-H and can be used for this purpose. At UCCI you can take the power supply from the green 2-pole power connector. At the TM-H 12V should be available at the green 4-pole power connector pins 2 (GND) and 4 (12V).

Near UCCI/TM-H, split wires 1+2 and 3+4 from the flatcable. Strip the insulation from the wire ends and solder a length of ordinary wire onto it (0,25 to 0,5mm$^2$). Use heat-shrink tube to insulate the connection. Connect the wires to the power connector of UCCI/TM-H. 1 and 2 are +, 3 and 4 are 0V/GND.

# 5 Address selection

UCCI and the TM-H support up to 128 feedbacks per module. These feedbacks are signalled over two flatcables, so 64 feedbacks per cable. Feedbacks 0..63 are on one cable while feedbacks 64..127 are on the other. With 8 sensors per SHdec, this means that up to 8 SHdecs can be connected to each cable[1].

The addresses used by the SHdec are selected by a jumper, pointed to in Figure 1 as Address Selection. The jumper can be in 1 of 8 positions. The number next to the jumper indicates the start address the SHdec uses. This is valid for the first flatcable. For the second cable add 64 to the number indicated on the SHdec. This results in the following:

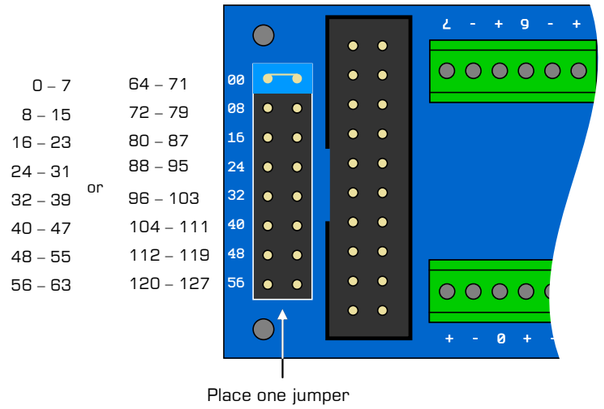


Figure 7: SHdec Address Selection

# 6 Connecting the SHdec to UCCI/TM-H

In paragraph 5 we wrote that one flatcable can connect up to 8 SHdecs to an UCCI or TM-H. To connect the SHdecs you need a 20 pole flatcable of “sufficient length”. Start at the UCCI/TM-H and run the cable past all SHdecs that need to be connected.

Note that there are 4 ways you can place the flatcable in the connector. 2 Of them are correct. Usually flatcable is color coded or has a colored stripe at one edge. When you have the version with colored stripe, we recommend you use the stripe as wire 1, if you have the colored version, choose either side as wire 1 and apply consequently. Wire 1 needs to go at the side of the flatcable connector where you see a triangle. The triangle is at the header on the SHdec and on the connector that goes in to the header. You can run the flatcable right to left or right to left. It does not matter as long as you keep wire 1 at the side of the triangle.

[1] Technically speaking, the number of feedbacks and/or SHdecs that can be connected is not limited. For instance, one may connect two SHdecs, or an SHdec and SWdec having the same address, one deploying sensors 0, 1 and 4 and the other deploying sensors 2, 3, 5, 6 and 7. This will work just fine. One may even connect sensors with duplicate addresses, however the UCCI/TM-H module will then not be able to determine which of the sensor(s) at duplicate addresses are activated. It then works as a “wired or” function.





# 2 SHdec overview

The SHdec is supplied as a ready-to-use module.

In the package you should find:

1x SHdec module
1x Mounting frame
4x Mounting screws 2,2x13mm
1x Flatcable connector 20pole (3 parts)

The SHdec offers the following connections and functions:

- Connection of up to 8 Hall–sensors via screw-terminals, 3 wires per sensor.
- Interconnection to UCCI or the TM-H and other SHdec and/or SWdec modules by a 20-pole flatcable.
- Selection of the address to which the SHdec responds
- Selection of the sensitivity

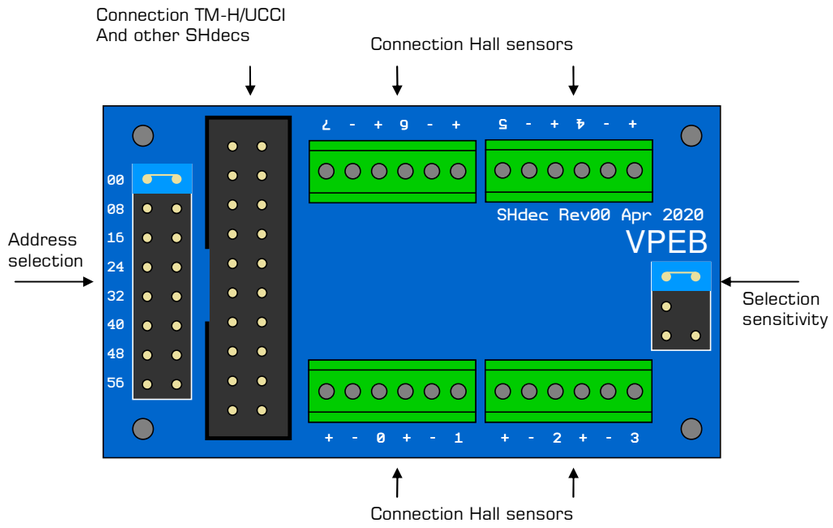


Figure 1: SHdec overview

# 3 Mounting

The SHdec should preferably be mounted as close to the Hall-sensors as reasonably possible. Find a place on a flat surface, preferably wood. Plan some space around the SHdec to connect the wires from the sensors and a path to route the flatcable.

**Always** use the supplied mounting frame under the SHdec to mount the module, since the back of the module contains electronic components that could otherwise be damaged. Use the 4 screws to mount module and frame to the intended surface. Pre-drill the holes when necessary, e.g. when the surface is to hard to screw in to directly.

# 4 Connect sensors to the SHdec

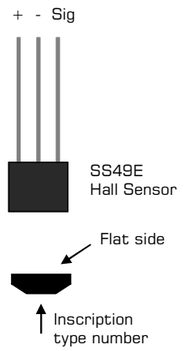


Fig.3: SS49E

The SHdec is designed for a linear Hall sensor and tested with the Honeywell SS49E. Similar sensors may work as well and can be applied at the user's discretion, however the SS49E is easily available and at a very moderate price level.

The SS49E has a flat side and a trapezium shaped side. The SHdec is designed in such a way that the approach of the flat side of the sensor by the south pole of a magnet will activate the sensor. Approaching the trapezium side with a north pole will do the same. The magnetic field of the steering magnets of model cars are standardized with north-pole up. This means that also the magnetic strip shall be layed north-pole up, otherwise the steering will not work. As a consequence of all this, the sensor shall be placed with the flat side up. Put the sensor directly against the magnetic strip. The magnetism of the strip is eliminated anyway and the closer the sensor is to the road surface, the better it works.

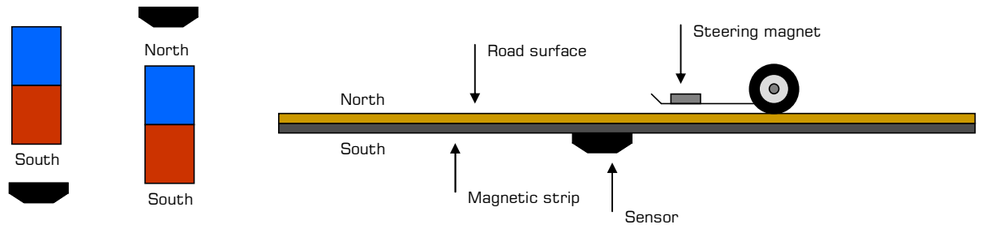


Figure 4: Orientation magnetism

One may think that the sensor can even be placed closer to the steering magnet by cutting the magnetic strip and placing the sensor in the gap. **Don't !!** The sensor will work fine, but the magnetism from the strip will wrap around the corners, created by the gap, resulting in quite strange steering behaviour. The car could even loose track at that spot.

If you try, you will find that the sensor also seems to work when the orientation of the magnetic field is reversed, however in that case the activation occurs when the magnet leaves the sensor and will only do so when the magnet is strong or has been over the sensor for a certain amount of time. So when mounted in reverse, operation will at best be unreliable.

The SHdec automatically measures the permanent magnetic field and eliminates it. Only a temporary increase of magnetism will operate the sensor. When the triggering magnet would remain permanently over the sensor, the SHdec will see that as a "new" permanent magnetic field and compensate for that. In practice this is not a problem, since software is usually designed to see this type of sensor as a momentary device. And it will be very hard anyway to stop a car exactly over the sensor.

The SS49E has 3 wires. As indicated in figure 3 one is plus, one is minus and the third one carries the signal indicating the level of magnetic field. The SHdec comes with 3 terminals per sensor. The SS49E could be inserted flat-side up in the terminal as depicted in fig 5 below. Of course this would hardly make any sense in practice, since you want to place the sensors where something happens, so you need to extend the wires. When you do, make sure that the order of the wires remain the same. When you hold the sensor flat-side up with the leads facing away from you, the order of the wires: left, middle, right being plus, minus, signal, shall be inserted in the SHdec terminal in that order. One way is to use color





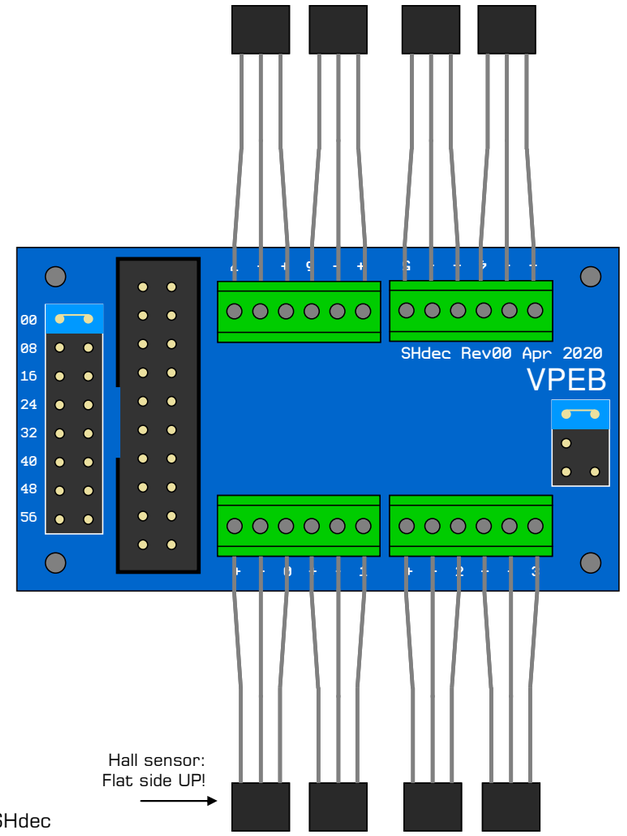


Figure 5: Connection of sensors to SHdec

coded wires. Another practical way is to use 3 strands of flatcable and mark one side of the cable, e.g. with a (permanent) marker. Marked side=up.
When extending the wires from the SS49E, make sure you keep the individual wires bundled together to avoid EMI (ElectroMagnetic Interference). When using strands of flatcable that will be the case. Using a cable with multiple wires will do fine as well. If you use individual wires, twist them together over the full length of the "cable".

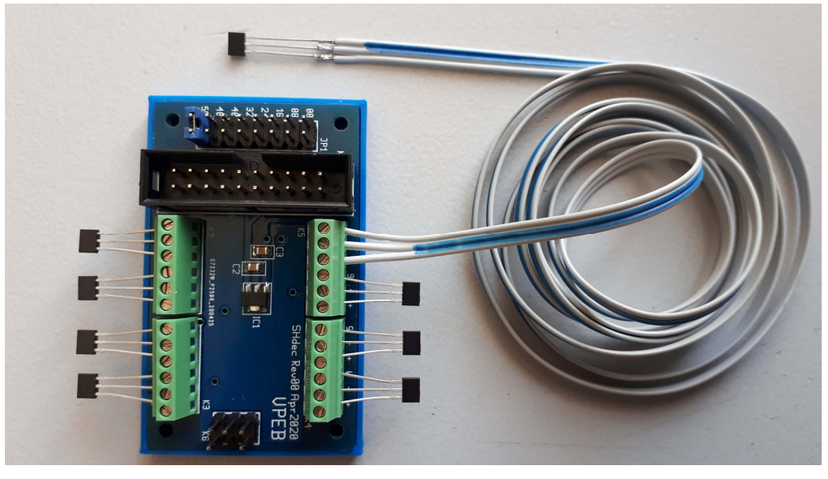


Figure 6: Example using marked flatcable to extend sensor wires