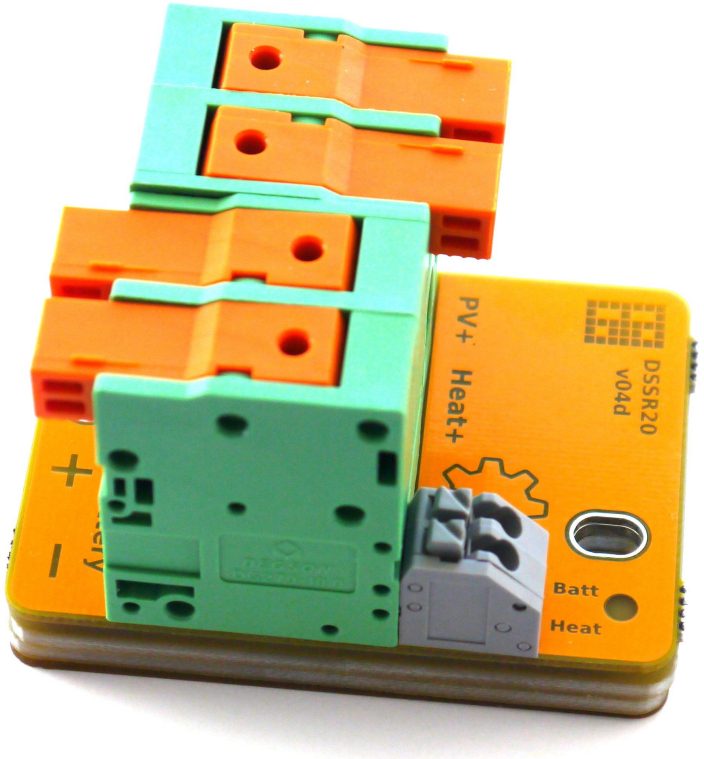
user manual v0.2

DSSR20



DEXT16

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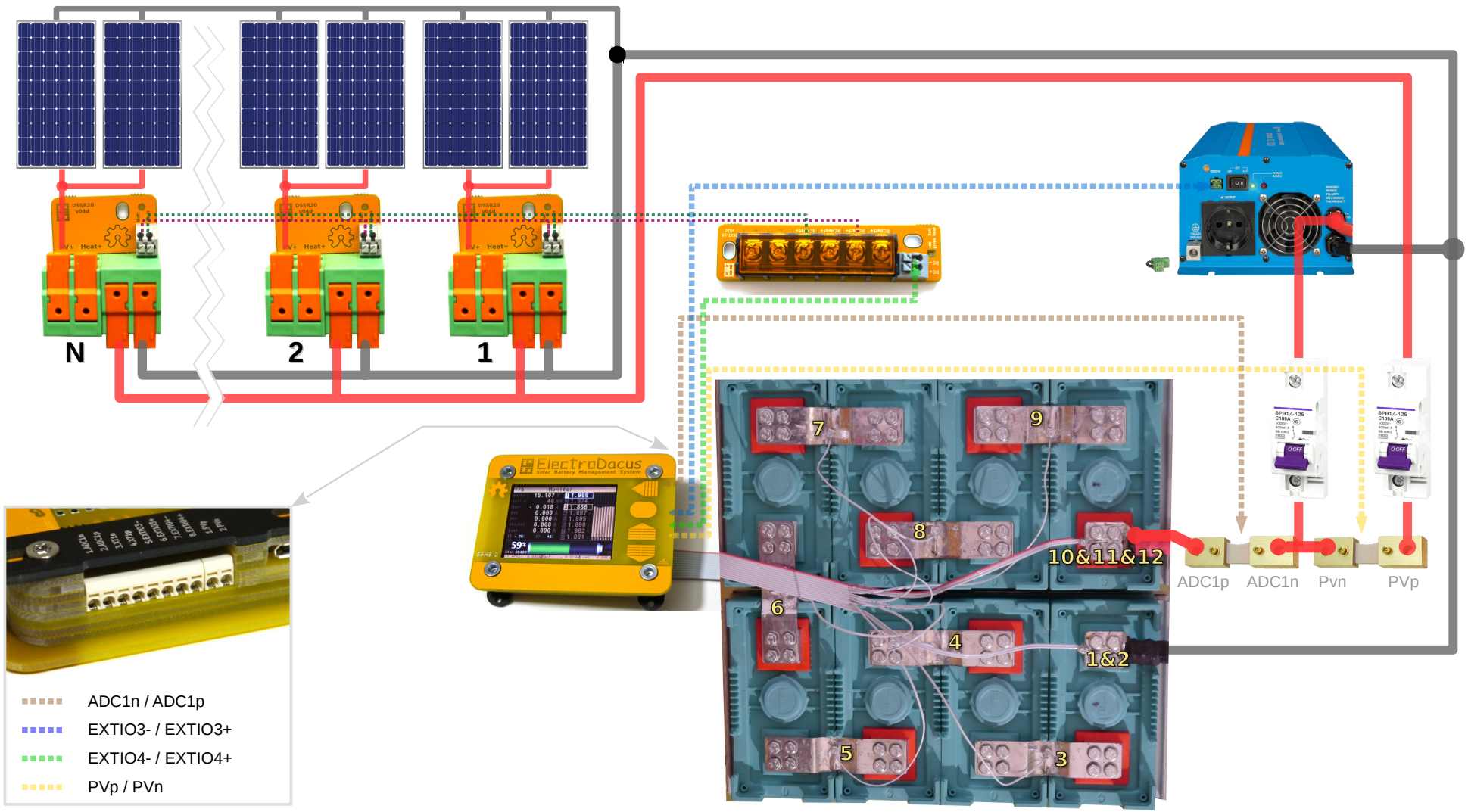
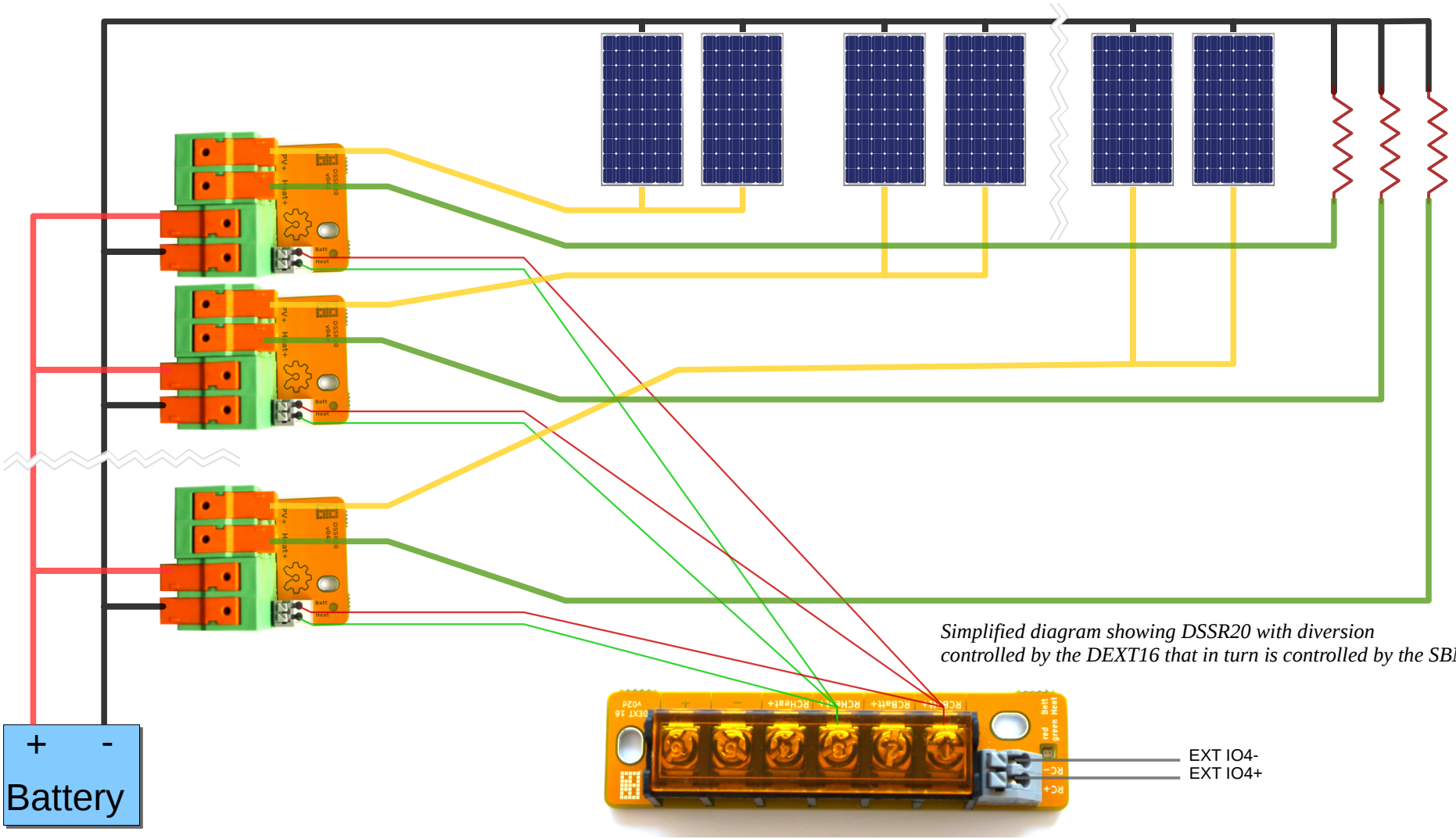


DSSR20 / DEXT16

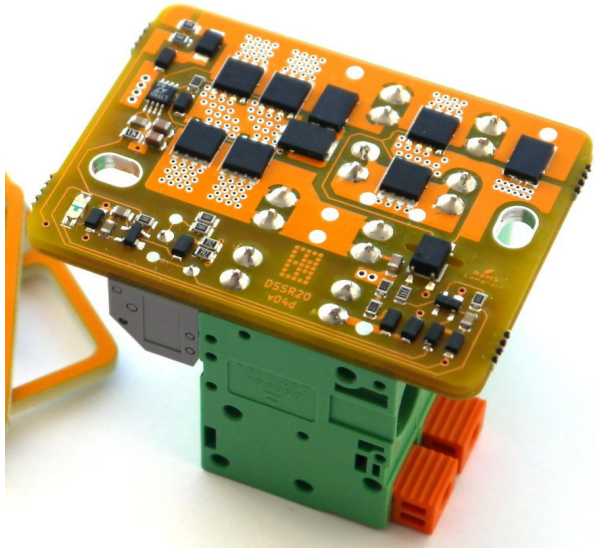
Specification	
DSSR20	Solar PV charge controller when used with SBMS0
Max STC current	20A (max two 60 or 72 cell PV panels for 24V battery, 36 cell panels for 12V)
Batt remote signal	5V to 30V (7kOhm internal so current 1 to 4mA depending on voltage)
Heat remote signal	7V to 30V (10mA)
Max PV+ input	51V (so any 60 or 72 cell PV panel)
DEXT16	For remote control up to 16 DSSR20 with diversion
RCBatt+	Up to 10mA current limited per output so up to 8 DSSR20 on each output
RCHeat+	8.7Vdc with up to 80mA per output total 160mA combined.
Battery supply	10V to 32V



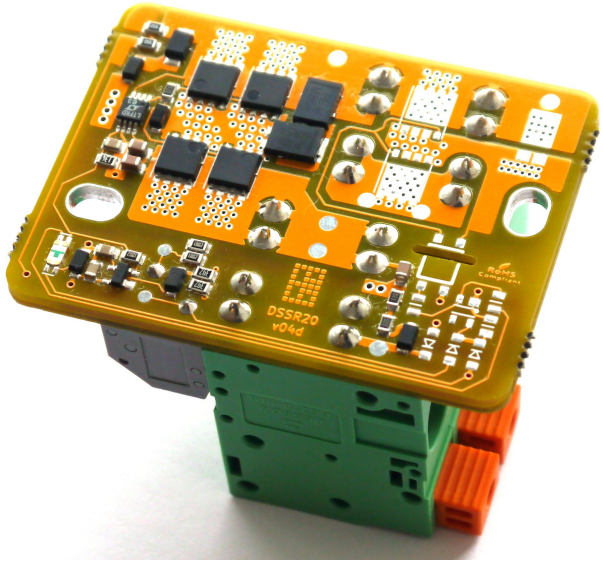
Simplified diagram showing DSSR20 with diversion controlled by the DEXT16 that in turn is controlled by the SBMS0

1 DSSR20

The DSSR20 v04d comes in two variants one with and one without diversion components installed. They both share the same PCB so they look the same other than a few components (see below photos for reference)



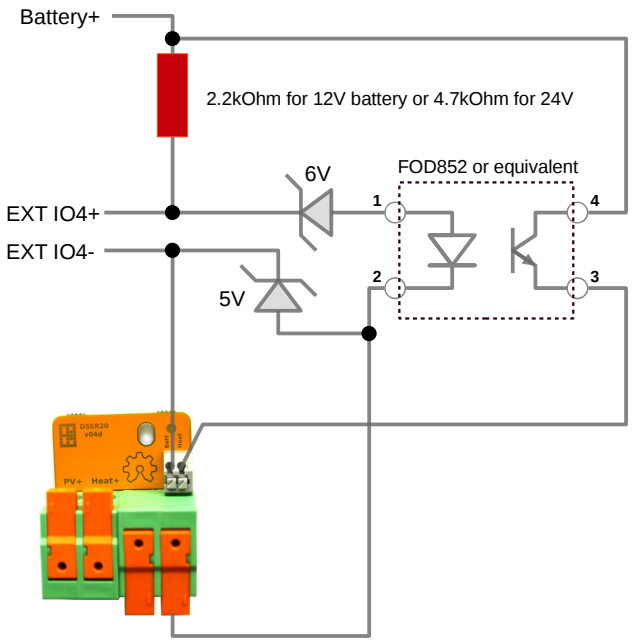
a) DSSR20 with diversion.



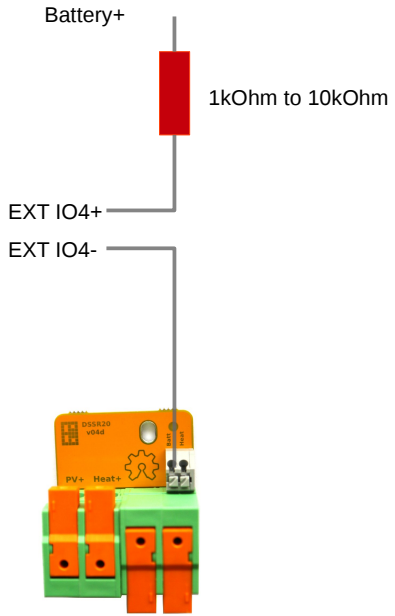
b) DSSR20 without diversion.

1.1 DSSR20

Connecting the remote wires on DSSR20 v04d without diversion is simple just one resistor and with diversion slightly more complicated as you need to invert the signal for the diversion(Heat) so an optoisolator and two zener diodes or if you do not want to deal with that just get the DEXT16 that will do this inversion for you and be more efficient especially when you start to have more than one single DSSSR20 with diversion.



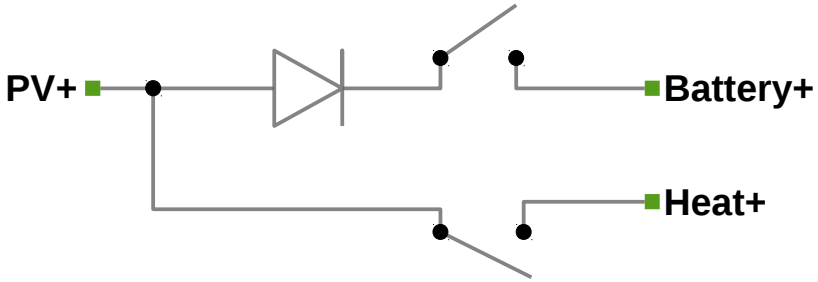
a) DSSR20 with diversion.



b) DSSR20 without diversion.

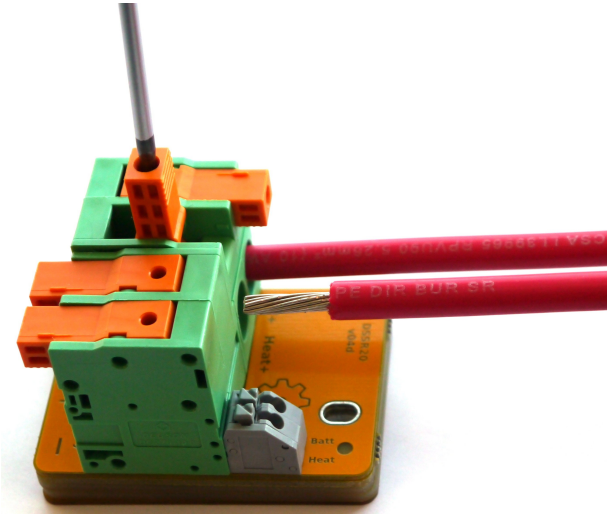
1.2 DSSR20

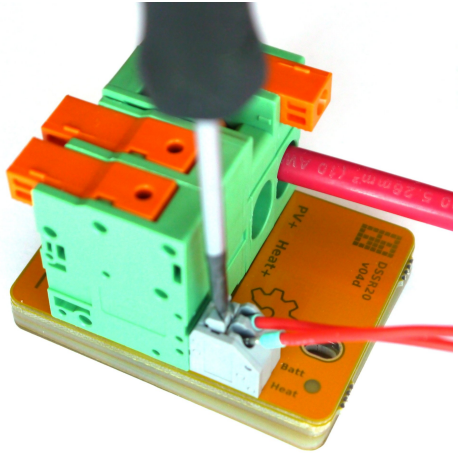
Below there is a simplified diagram of how DSSR20 with diversion works. For the battery charge path there is an ideal diode + a solid state relay while on the diversion side just a a solid state relay.
This means that current can flow only from PV+ to Battery+ and not the other way around and since that is an ideal diode there is almost no voltage drop on it so no heat.
The PV+ to Battery+ path is max 3.5mOhm while the PV+ to Heat+ is 4mOhm max. Voltage drop across any of the paths at 20A will be below 80mV and max drop in the form of heat will be 1.6W
*Assuming a 27V battery voltage * 20A = 540W and at this level 1.4W will be lost as heat thus transfer efficiency is 99.7%*



1.3 DSSR20 Connectors.

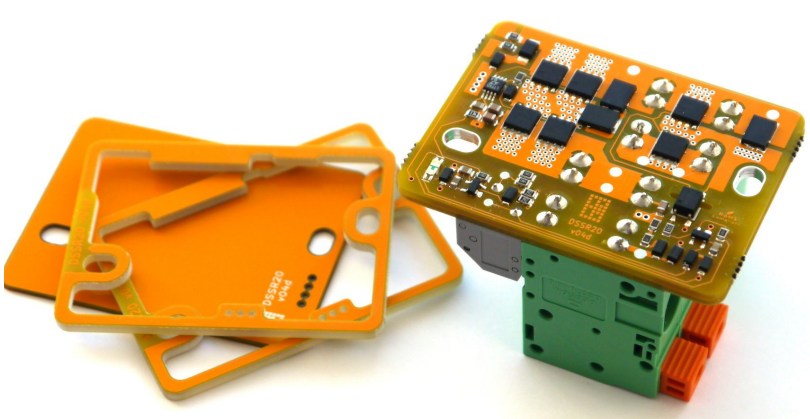
Since spring cage connectors are not as common and people asked on how they worked I included this short pictorial :) showing how they work. The large green connectors have a strong spring you need to insert a lever inside the hole at the end of the orange plastic lever and that can be just a small screwdriver or a small HEX key less that will help you lift that at 90 degree then you can insert the wire and then leave it back down with the help of the same screwdriver else it can pinch your fingers and you do not want that :)
*As for the small gray connector you need to push with a small flat screwdriver on the small button above the place where you insert the wire after wire was inserted you can release the button. A solid core wire can be used with this connectors. Any wire between 0.2mm² (AWG24) and 0.8mm² (18AWG) can be used either solid or stranded in witch case the use of ferrules is recommended. In my example I used 22AWG silicone wire paired with 22AWG ferrules the specific part number **966066-3** is also listed below as not all ferrules are equal and this one fits perfectly.*

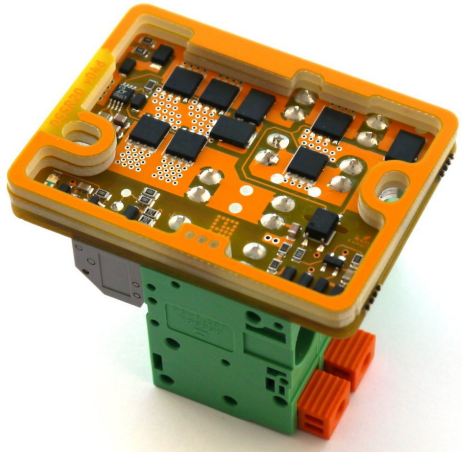


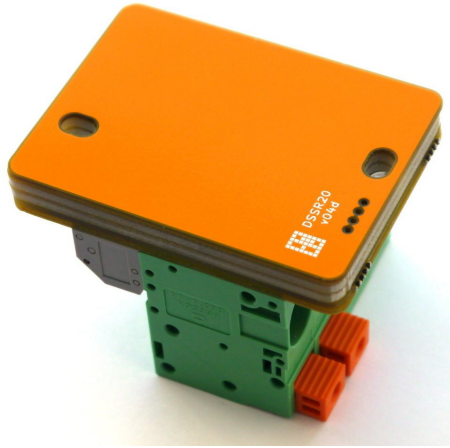


1.4 DSSR20 Mechanical installation.

Size of the DSSR20 v04d is 58x43mm and a height of 38mm for the one without diversion and 40mm for the one with diversion.
There will be two spacers included with all DSSR20 with diversion please install both and just one spacer for the one without diversion as there is just one component taller than 2mm and that is only present on the model with diversion so only for that the second spacer is needed.
The DSSR20 can be fixed on almost any surface using two M4 bolts and nuts (not included).

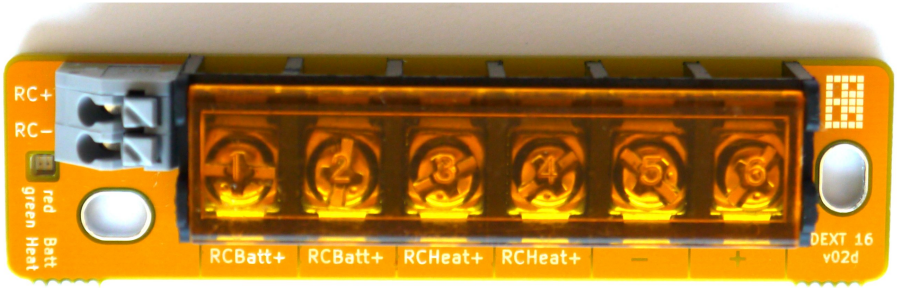


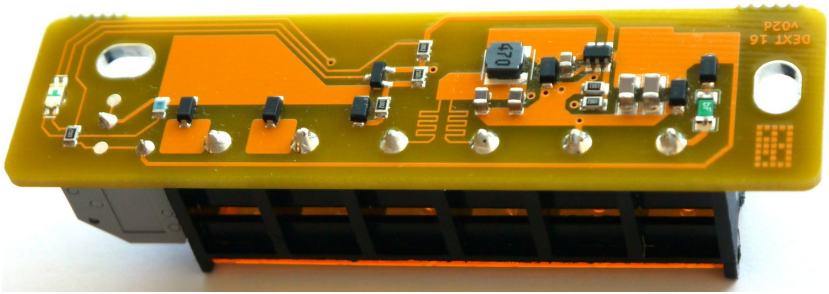




2 DEXT16

DEXT16 is an adapter allowing to control up to 16 DSSR20 with diversion and it is not needed for the DSSR20 model without diversion unless is just as cable management as for those can be directly controlled by the SBMS0 EXT IO4.



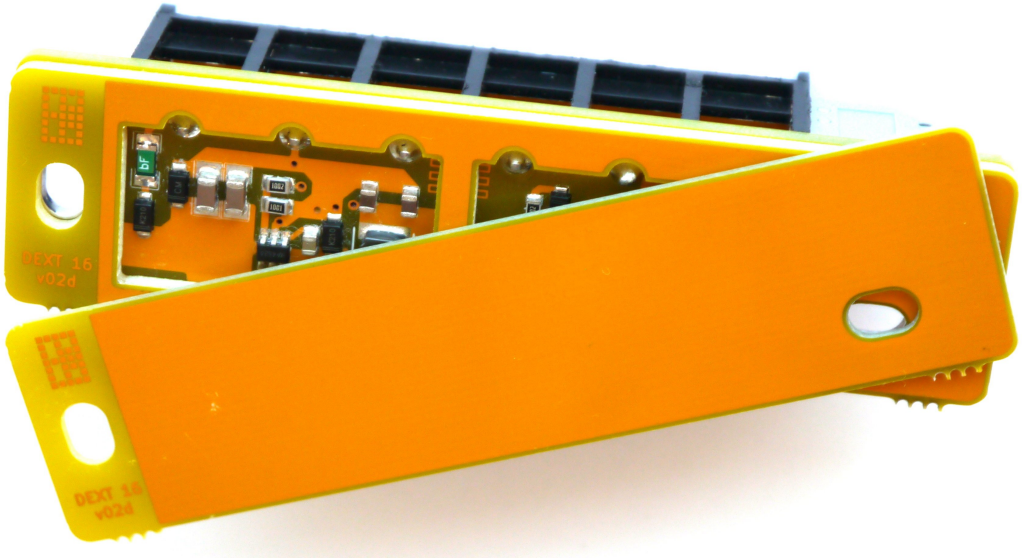


- *Two pin grey connector will connect to SBMS0 EXT IO4 set as type 1 or also EXT IO5 for the dual PV array setup RC+ to EXT IO4+ and RC- to EXT IO4-.*
- *RCBatt+ supports up to 8x DSSR20 and since there are two of this connections total max is 16. Output is current limited internally to 10mA.*
- *RCHeat+ supports up to 8x DSSR20 again two of this connections for max 16. Output is 8.7V and up to 80mA per output.*
- *Battery negative and positive connections are marked with – and + and are the last two connections. You should fuse the positive wire with a 500mA or 1A fuse depending on what wire you will be using current will be way lower than this is just to protect the wire in case is shorted somewhere.*

The functionality is very simple where while battery charging is needed the RCBatt+ will be active while RCHeat+ will be 0V as DC-DC converter is disabled then when battery is full the RCBatt+ will be 0V and the RCHeat+ will be 8.7V enabling the DSSR20 diversion diverting that unused PV energy to a heating element or a peltier element for cooling or anything else that can handle the PV open circuit voltage and the intermittent operation as this will be active only when battery charging is not needed.
There is a two color LED that will be illuminated Red when battery charging is enabled and Green when diversion is enabled.

2.2 DSSR20 Mechanical installation.

When you order the DEXT16 you will receive the assemble board and two separate PCB's one is a spacer and the other a back plate that you will use both when installing the DEXT16 on to a board so that components are mechanically and electrically protected. You can use the back plate as a template to mark the two mounting holes that are designed for M4 bolts and nuts.

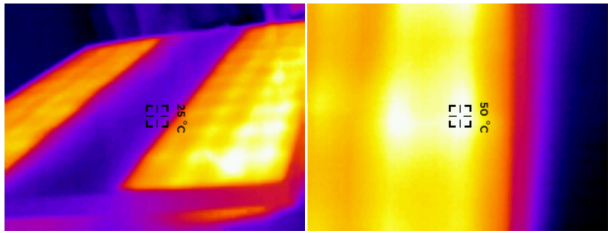


3 Options for diversion.

In case of using a Heating element or even cooling you may need a thermostat depending and when that is the case the thermostat could just switch open circuit the signal wire so you can connect the isolated contacts of the thermostat in series with the RCHeat+ signal so between the RCHeat+ and the Heat remote connection on the appropriate DSSR20.
If all DSSR20 heat the same space or water then only a thermostat will be needed but you can have multiple thermostats is each DSSR20 heats or cools something else. The signal is just 8.7V and each DSSR20 will use about 10mA so the contacts on the thermostat do not have any special requirements even an optoisolator can be used in case of digital thermostats.
I have not found a good low power digital thermostat that I can recommend. There is a review of few on my forum
http://electrodacus.com/solarforum.html?place=msg%2Felectrodacus%2FKIXOkeAMImc%2F27qRzPs4BgAJ
When I find a good one I will add it here.

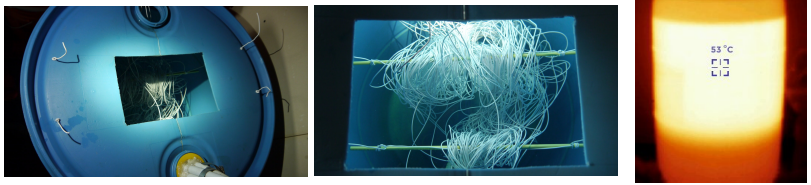
3.1 Options for diversion heating.

For standard water tanks look for 36V usually 1200W rated heating element they have two 600W heating elements in parallel so idea for two DSSR20 each with two large 60 cell PV panels.
Another option for open barrel water heater is just a calculated 18AWG wire calculated long enough to have 2Ohm.
A PV panel used as heater is also a very nice solution with the advantage that it always naturally works at max power point unlike restive heating. I experimented with two 60 cell 240W rated panels bypassing a group of 20 cells so that 40 cells in series are used to heat from two 60 cell PV panels exposed outside. Multiple diodes in series can also be used in the same way as PV cells are basically large diodes.



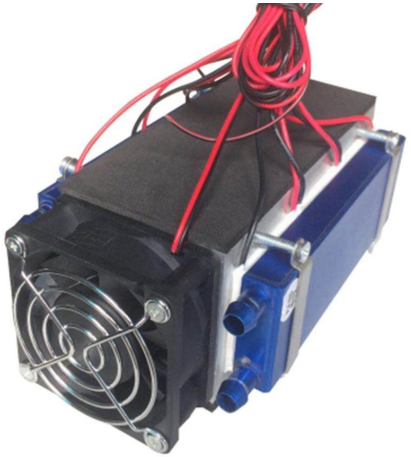
Above photos are of the two PV panels I use as heaters since November 2019 and they work great as expected.
You can see the yellow wire soldered in the PV panel connection box to disable the middle 20 cells of the panels leaving the ideal 40 cells in series.
Max PV panel temperature here is 50C but the most I see was about +55C so very reasonable.

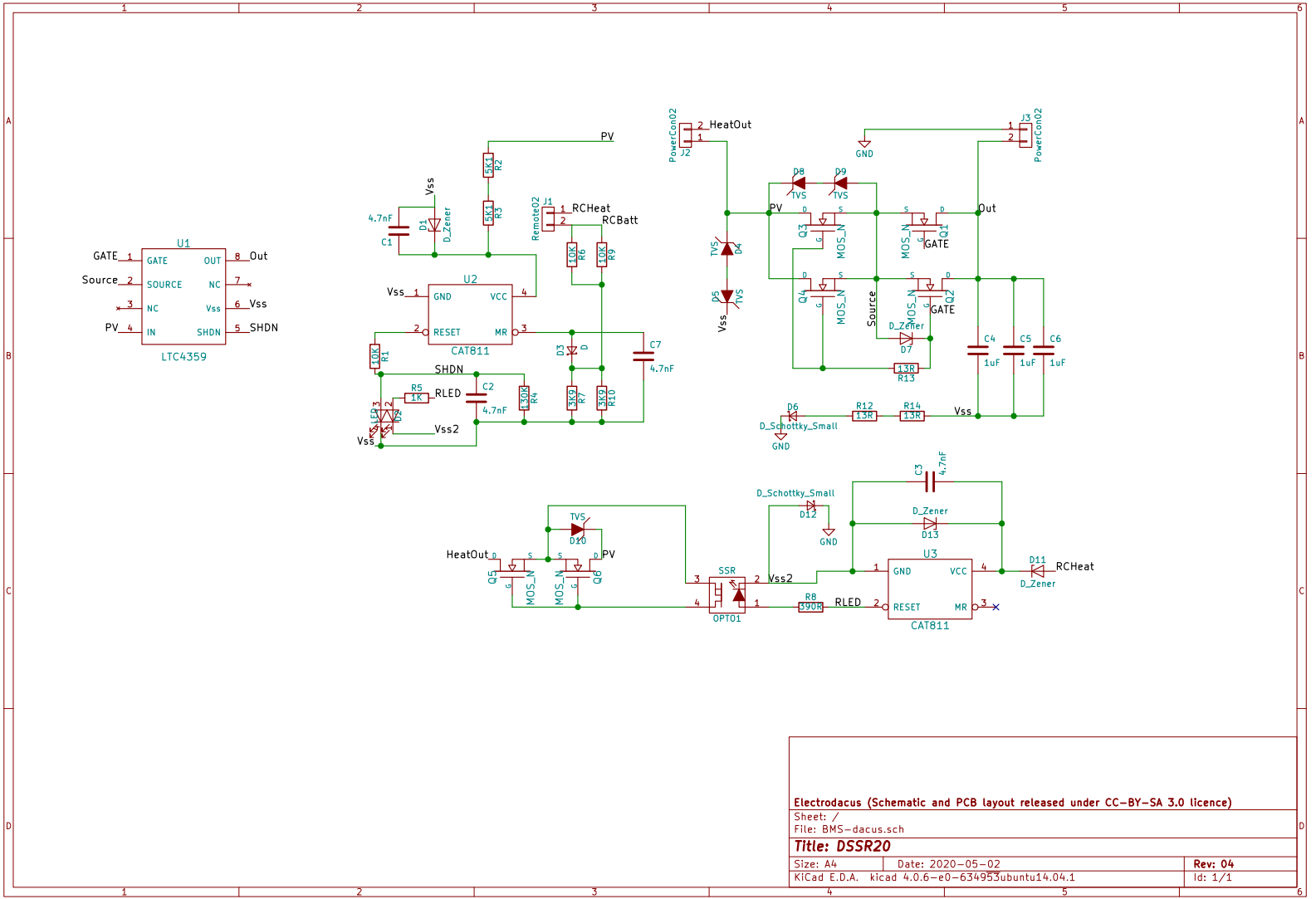
The lower 3 images are of my older experiment with a 200liter (55gallon) plastic barrel filed with water and heated to max 55C using three 18AWG loops of wires tho the water was circulated trough a long loop heating my concrete floor that before I installed heating elements directly in to floor.



3.2 Options for diversion cooling.

For cooling peltier elements can be used tho I did not had time to experiment with they should work tho it will involved quite a lot of DIY work as there is nothing quite close to what is needed to do this properly.
The closest thing you will find is in the photo below a set of 6 peltier probably 12706 and you will connect all of them in series so you get 5 to 6V above them to work efficient then this will take about 2A meaning that you will need about 4 of this sets for one 60 cell PV panel and 8 of them for two 60 cell PV panels.
The small fan will be fairly loud and ineffective so you may want this outside and then have isolated pipes moving the cold liquid inside (I will use some glycol mix just in case so it will not freeze).
Assuming a max of 500W from the two panels with a COP of 1 attainable you will have 500W of cooling power and on the hot side 1000W of heat will need to be dissipated tho it will be loud and with this small high speed fans thus a custom solution may be better.





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PV
Out
Vss
SHDN
U2
CAT811
GND
VCC
RESET
MR
RCHeat
RCBatt
RLED
Vss2
HeatOut
PowerCon02
J2
J3
Q1
Q2
Q3
Q4
Q5
Q6
MOS_N
D_Zener
D_Schottky_Small
SSR
OPTO1
U3
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Title: DSSR20
Size: A4
Date: 2020-05-02
Rev: 04
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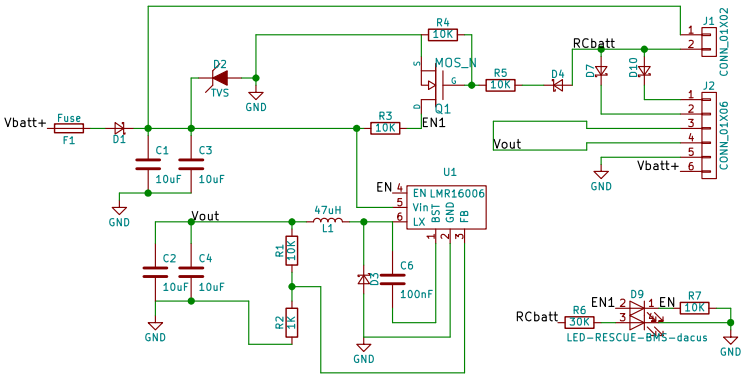
Id: 1/1



Electrodacus (Schematic and PCB layout released under CC-BY-SA 3.0 licence)

Sheet: /
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Title: DEXT16

Size: A4	Date: 2020-05-02	Rev: 02
KiCad E.D.A. kicad 4.0.6-e0-634953ubuntu14.04.1		Id: 1/1

HW files for DSSR20 and DEXT16 (soon to be available).

HW :