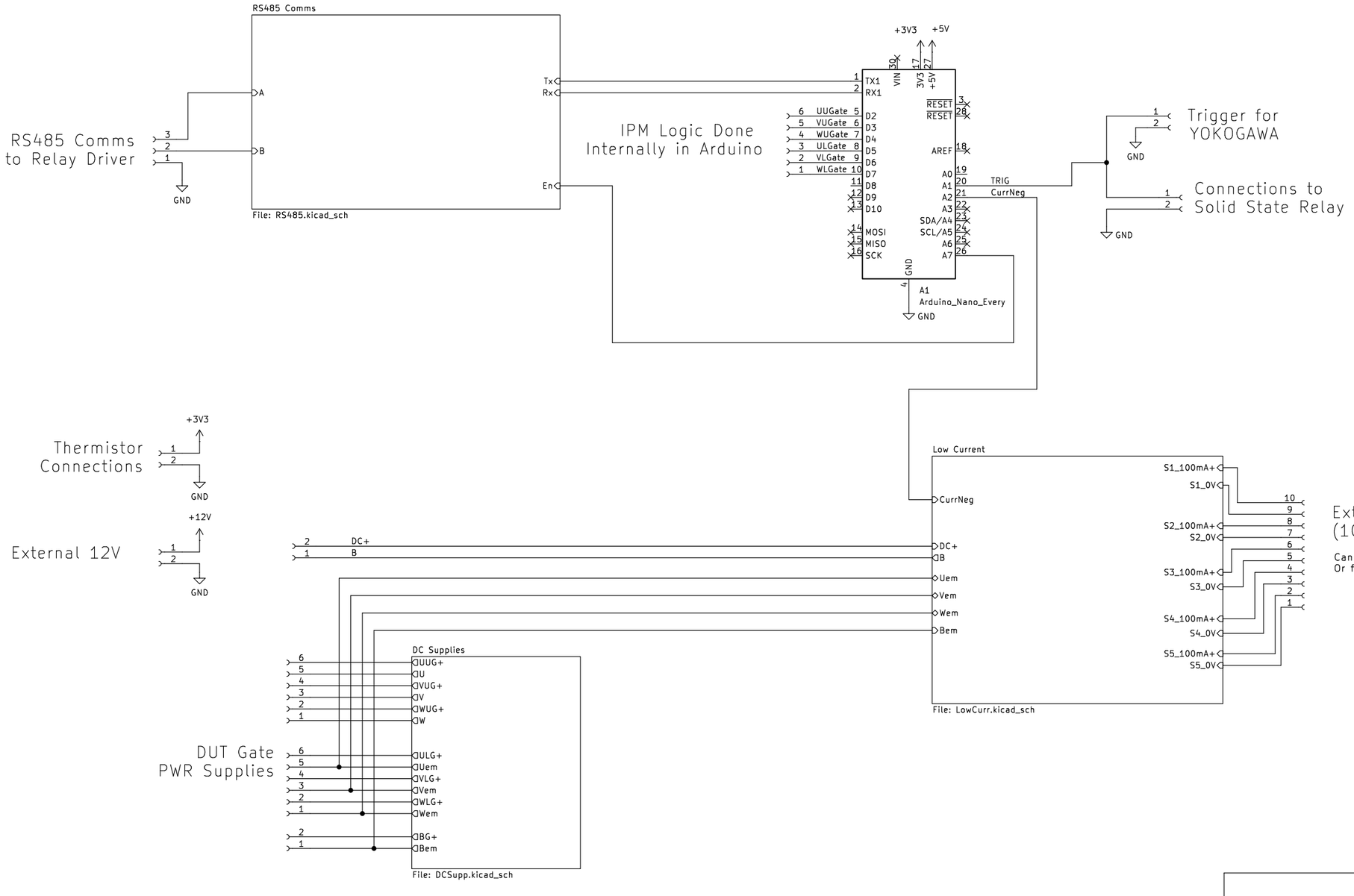
Arduino Draw:

Expected required power for 3V3 external:
Load is 2k2 pull up + 5k nominal NTC resistance
Eff resistance = 1/(1/(2.2k+5k)+1/220)=213 Ohms
I = 3.3/213 = 15mA
Arduino 3V3 pin capcable of 150mA

5V only powers MAX485 and arduino pin capable of 850mA.



GAVIM Main Sheet

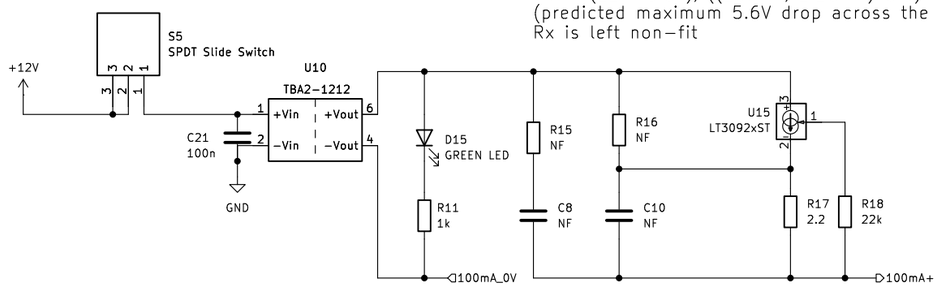
Nidec Drives	
Sheet: /	
File: TEST137.kicad_sch	
Title: GAVIM V4 TEST 137	
Size: A3	Date: 2024-06-25
KiCad E.D.A. 8.0.1	Id: 1/10
	Rev: 00.00

Set Output Current
Isource = 10uA*Rset/Rout
Rset = 100mA/10uA*2.2 = 22k

Supply
12V TBA used as can supply 165mA and 5.6V required
(The 5V version can supply 400mA BUT the Vce of the heated device may reverse bias 5V in extreme conditions).
The drop at maximal current can be as much as 5V (from looking at some 100 A IGBT e.g. IKQ50N120CH3)
So the true maximum voltage is 5.6V (5V drop at 100A + 0.6V drop at 100mA)

LED:
If = 12/1k = 12mA

Reduce Power Dissipation
Rx = Vmax/(200mV/Rout*0.9)
Rx = (12V-5.6V)/((200mV/2.2Ohm)*0.9) = 78.22Ohm = 82Ohm
(predicted maximum 5.6V drop across the relays)- although as this is not consistend
Rx is left non-fit



NF = 220p could be used here to limit thermal noise on output-
risks instability

Low Current Source

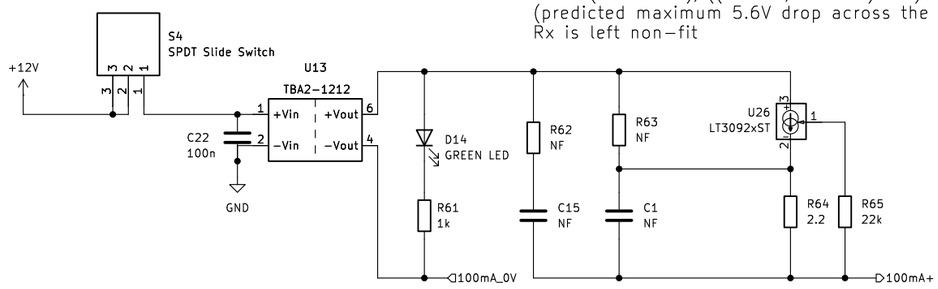
Nidec Drives	
Sheet: /Low Current/S5 100mA Internal/	
File: LowCurrSource.kicad_sch	
Title: GAVIM V4 TEST 137	
Size: A3	Date: 2024-06-25
KiCad E.D.A. 8.0.1	Id: 2/10
	Rev: 00.00

Set Output Current
Isource = 10uA*Rset/Rout
Rset = 100mA/10uA*2.2 = 22k

Supply
12V TBA used as can supply 165mA and 5.6V required
(The 5V version can supply 400mA BUT the Vce of the heated device may reverse bias 5V in extreme conditions).
The drop at maximal current can be as much as 5V (from looking at some 100 A IGBT e.g. IKQ50N120CH3)
So the true maximum voltage is 5.6V (5V drop at 100A + 0.6V drop at 100mA)

LED:
If = 12/1k = 12mA

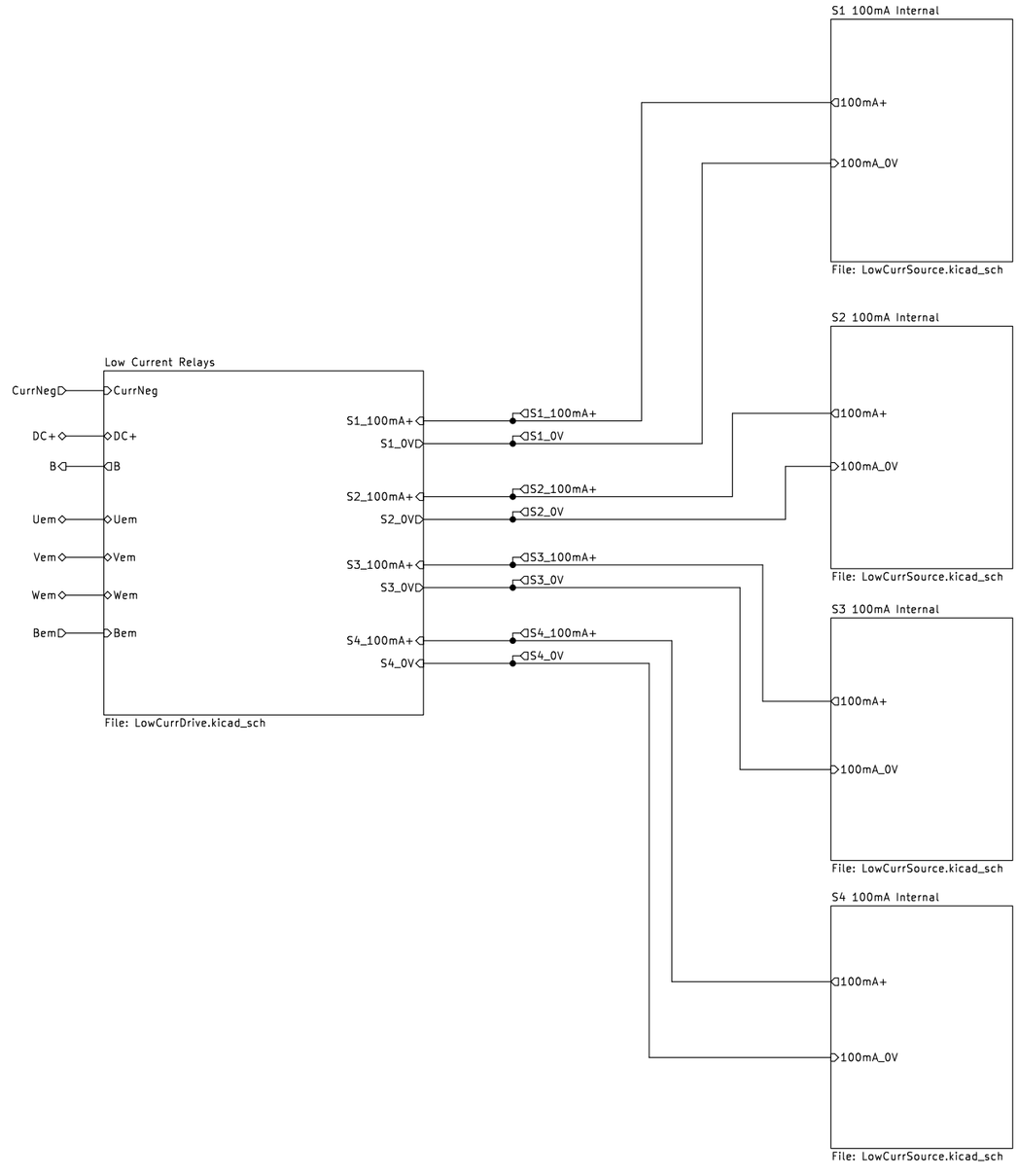
Reduce Power Dissipation
Rx = Vmax/(200mV/Rout*0.9)
Rx = (12V-5.6V)/((200mV/2.2Ohm)*0.9) = 78.22Ohm = 82Ohm
(predicted maximum 5.6V drop across the relays)- although as this is not consistend
Rx is left non-fit

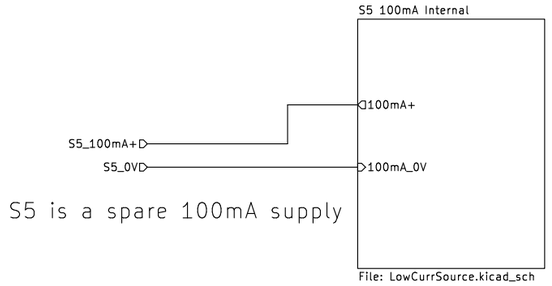


NF = 220p could be used here to limit thermal noise on output- risks instability

Low Current Source

Nidec Drives	
Sheet: /Low Current/S4 100mA Internal/	
File: LowCurrSource.kicad_sch	
Title: GAVIM V4 TEST 137	
Size: A3	Date: 2024-06-25
KiCad E.D.A. 8.0.1	Id: 4/10
	Rev: 00.00





S5 is a spare 100mA supply

Low Current Control

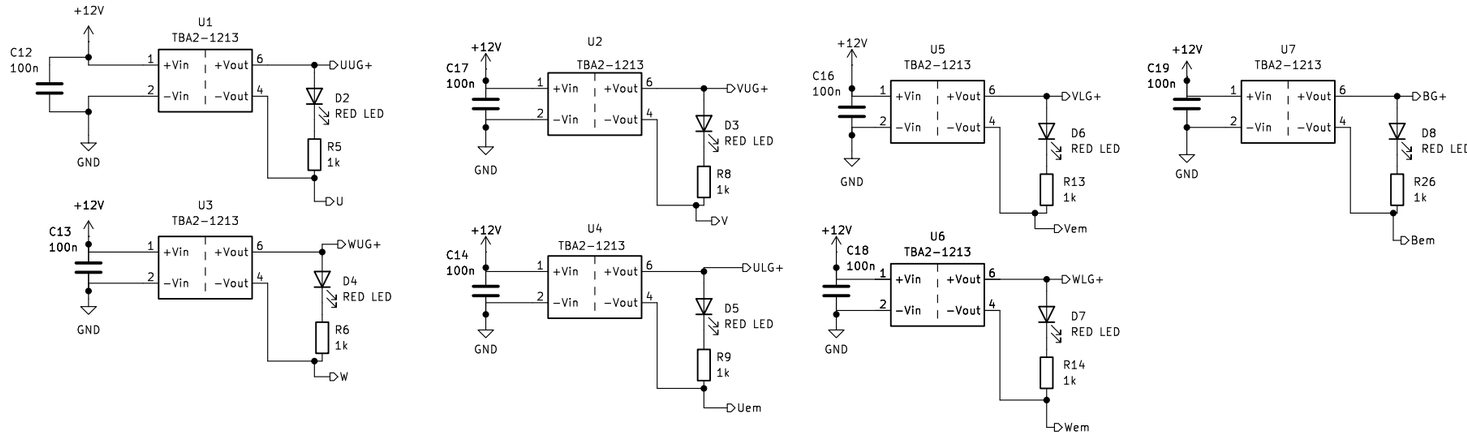
Nidec Drives

Sheet: /Low Current/
File: LowCurr.kicad_sch

Title: GAVIM V4 TEST 137

Size: A3	Date: 2024-06-25	**Rev: 00.00**
KiCad E.D.A. 8.0.1		Id: 5/10

Gate Drivers



LED Resistance
15V/12mA = 1k

DC Supplies

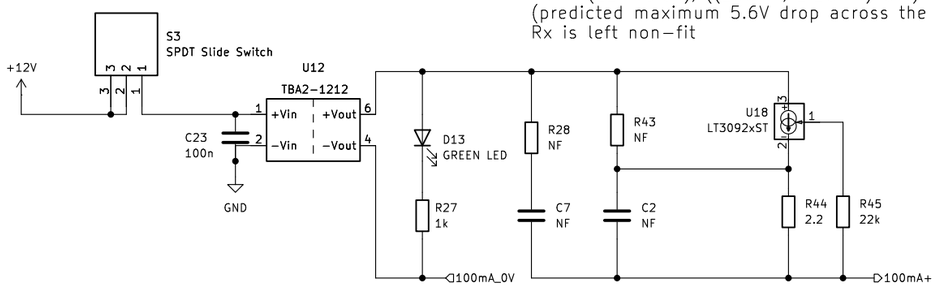
Nidec Drives		
Sheet: /DC Supplies/ File: DCSupp.kicad_sch		
Title: GAVIM V4 TEST 137		
Size: A3	Date: 2024-06-25	**Rev: 00.00**
KiCad E.D.A. 8.0.1		Id: 6/10

Set Output Current
Isource = 10uA*Rset/Rout
Rset = 100mA/10uA*2.2 = 22k

Supply
12V TBA used as can supply 165mA and 5.6V required
(The 5V version can supply 400mA BUT the Vce of the heated device may reverse bias 5V in extreme conditions).
The drop at maximal current can be as much as 5V (from looking at some 100 A IGBT e.g. IKQ50N120CH3)
So the true maximum voltage is 5.6V (5V drop at 100A + 0.6V drop at 100mA)

LED:
If = 12/1k = 12mA

Reduce Power Dissipation
Rx = Vmax/(200mV/Rout*0.9)
Rx = (12V−5.6V)/((200mV/2.2Ohm)*0.9) = 78.22Ohm = 82Ohm
(predicted maximum 5.6V drop across the relays)− although as this is not consistend
Rx is left non−fit



NF = 220p could be used here to limit thermal noise on output−
risks instability

Low Current Source

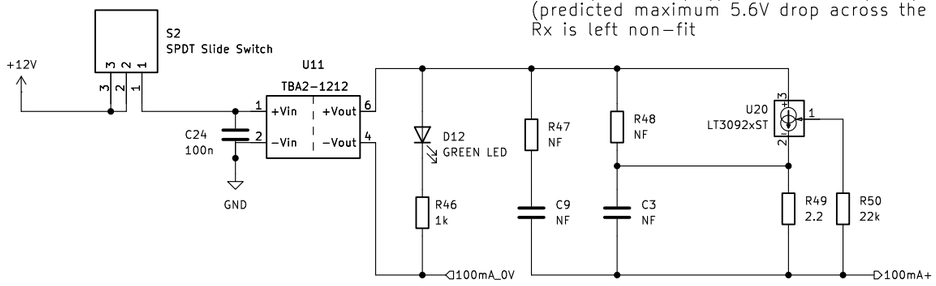
Nidec Drives	
Sheet: /Low Current/S3 100mA Internal/	
File: LowCurrSource.kicad_sch	
Title: GAVIM V4 TEST 137	
Size: A3	Date: 2024−06−25 **Rev: 00.00**
KiCad E.D.A. 8.0.1	Id: 7/10

Set Output Current
Isource = 10uA*Rset/Rout
Rset = 100mA/10uA*2.2 = 22k

Supply
12V TBA used as can supply 165mA and 5.6V required
(The 5V version can supply 400mA BUT the Vce of the heated device may reverse bias 5V in extreme conditions).
The drop at maximal current can be as much as 5V (from looking at some 100 A IGBT e.g. IKQ50N120CH3)
So the true maximum voltage is 5.6V (5V drop at 100A + 0.6V drop at 100mA)

LED:
If = 12/1k = 12mA

Reduce Power Dissipation
Rx = Vmax/(200mV/Rout*0.9)
Rx = (12V-5.6V)/((200mV/2.2Ohm)*0.9) = 78.22Ohm = 82Ohm
(predicted maximum 5.6V drop across the relays)- although as this is not consistend
Rx is left non-fit



NF = 220p could be used here to limit thermal noise on output- risks instability

Low Current Source

Nidec Drives

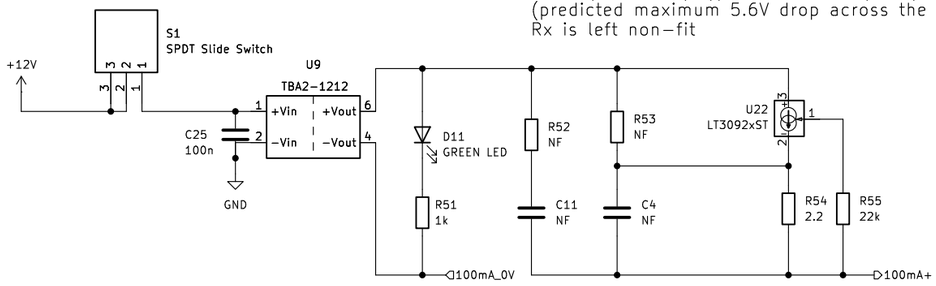
Sheet: /Low Current/S2 100mA Internal/	
File: LowCurrSource.kicad_sch	
Title: GAVIM V4 TEST 137	
Size: A3	Date: 2024-06-25
KiCad E.D.A. 8.0.1	Id: 8/10
	Rev: 00.00

Set Output Current
Isource = 10uA*Rset/Rout
Rset = 100mA/10uA*2.2 = 22k

Supply
12V TBA used as can supply 165mA and 5.6V required
(The 5V version can supply 400mA BUT the Vce of the heated device may reverse bias 5V in extreme conditions).
The drop at maximal current can be as much as 5V (from looking at some 100 A IGBT e.g. IKQ50N120CH3)
So the true maximum voltage is 5.6V (5V drop at 100A + 0.6V drop at 100mA)

LED:
If = 12/1k = 12mA

Reduce Power Dissipation
Rx = Vmax/(200mV/Rout*0.9)
Rx = (12V-5.6V)/((200mV/2.2Ohm)*0.9) = 78.22Ohm = 82Ohm
(predicted maximum 5.6V drop across the relays)- although as this is not consistend
Rx is left non-fit



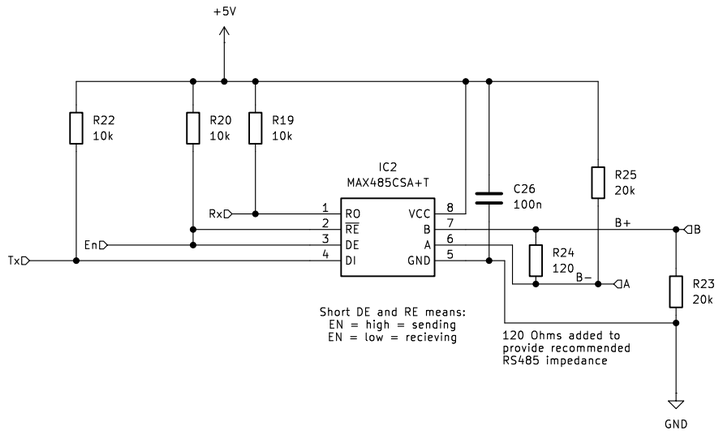
NF = 220p could be used here to limit thermal noise on output-
risks instability

Low Current Source

Nidec Drives

Sheet: /Low Current/S1 100mA Internal/	
File: LowCurrSource.kicad_sch	
Title: GAVIM V4 TEST 137	
Size: A3	Date: 2024-06-25
KiCad E.D.A. 8.0.1	Id: 9/10

Rev: 00.00



Nidec Drives

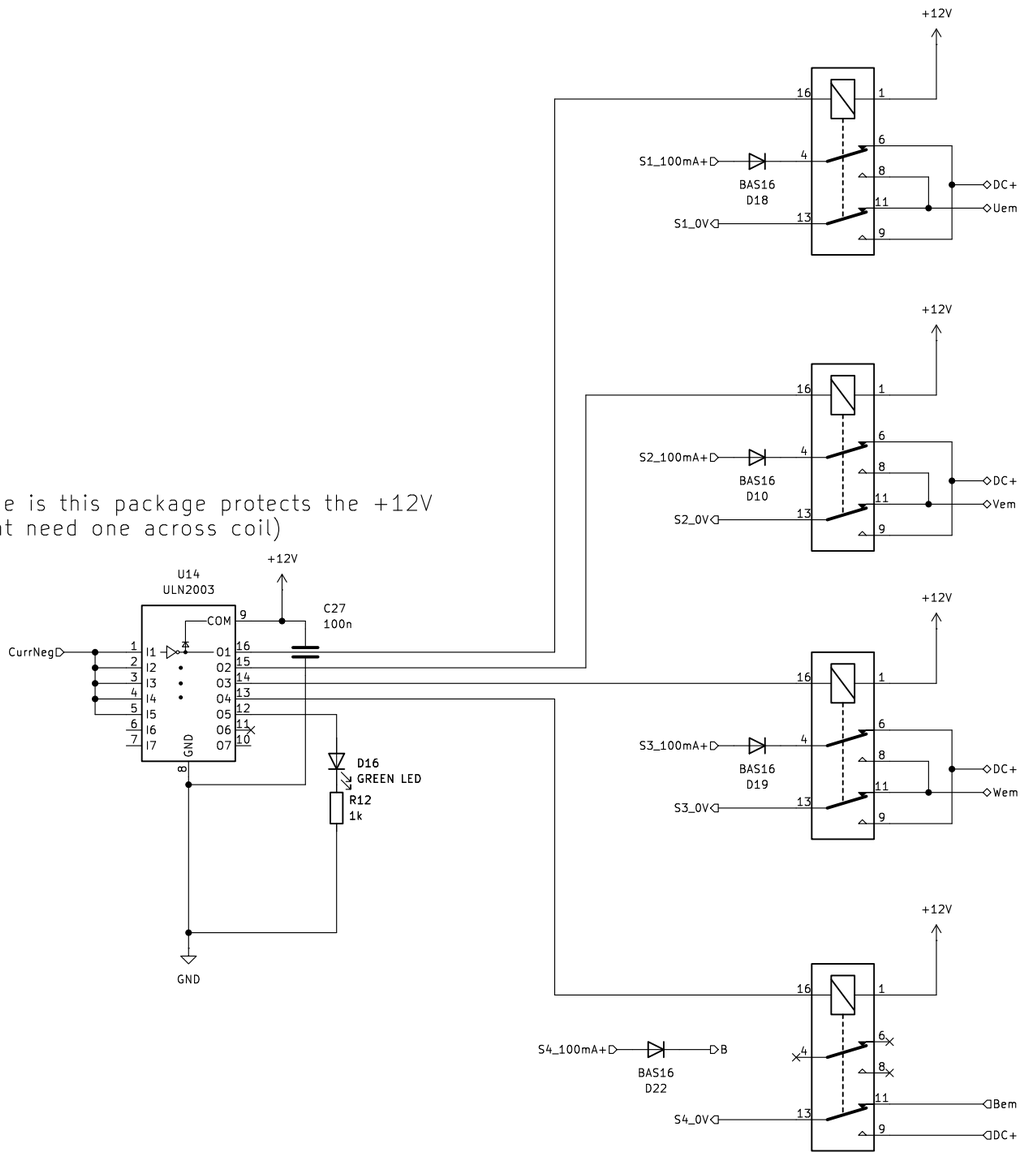
Nidec Drives

Sheet: /RS485 Comms/
File: RS485.kicad_sch

Title: GAVIM V4 TEST 137

Size: A3	Date: 2024-06-25	**Rev: 00.00**
KiCad E.D.A. 8.0.1		Id: 11/10

Diode is this package protects the +12V
(dont need one across coil)



SSR and RLY indicator
If = 12/ 1k = 12mA

Coil current is 100mA
ULN2002 is 500mA per driver

Arduino pin is 20mA
2.7k is base resistor (from datasheet): 5V/2.7k * 4 (for all drivers) = 7.4mA

Low Current Relay Driver

Nidec Drives

Sheet: /Low Current/Low Current Relays/
File: LowCurrDrive.kicad_sch

Title: GAVIM V4 TEST 137

Size: A3	Date: 2024-06-25	**Rev: 00.00**
KiCad E.D.A. 8.0.1		Id: 14/10