
HOQI-1

Circuit Board Documentation

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Abstract

This circuit is a fieldbox for a homodyne quadrature interferometer. It provides readout of photodiodes for the sine and cosine quadratures and the power, and provides buffered sine, cosine, negative cosine, and negative cosine minus sine signals as outputs. The outputs are provided as single-ended and differential signals for local diagnostics/alignment and CDS respectively.

The design is based on E00190 by David Hoyland of University of Birmingham. Some changes have been made to that design to suite AEI electrical standards and the AEI component library:

- many component values replaced with closest E48 values
- completely different power supply configuration (but same voltage rails)
- different reference IC for photodiode bias signals, and different filtering
- pin 5 of HoQI DSUB9 connector not connected to ground (as per AEI 10 m prototype standard)
- HoQI DSUB9 connector output is female (as per AEI 10 m prototype standard)
- offset trimming potentiometer for signal subtraction circuits

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Safety Instructions

In order to operate the circuit properly and safely, review the following guidelines before installing and using the unit. Failure to do so may result in equipment damage or bodily injury:



This circuit warms up due to its power consumption. To enable proper cooling, observe the following rules:

- Do not block available air vents.
 - Give the unit free access to the room ambient air for convection.
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This circuit was designed as a laboratory equipment to be operated only by trained and qualified technicians in research institutes or development departments. For safety reasons, usage by other persons or in other environments is *not* recommended.



- This circuit uses extra-low voltage ($< 50 V_{AC}$ and $< 75 V_{DC}$) and is therefore exempt from the regulations of the *Low Voltage Directive* (2014/35/EU).
 - The unit does not contain any mechanical drive system. Therefore, the regulations of the *Machinery Directive* (2006/42/EC) do not apply.
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Sicherheitshinweise

Nehmen Sie vor Aufbau und Inbetriebnahme des Geräts folgende Empfehlungen zur Kenntnis, um die Schaltung korrekt und sicher zu betreiben sowie Schäden und Verletzungen zu vermeiden:



Diese Schaltung erwärmt sich aufgrund ihrer Verlustleistung. Zur Gewährleistung einer sinnvollen Kühlung sind folgende Punkte zu beachten:

- Vorhandene Lüftungsöffnungen nicht versperren.
 - Gerät zur Konvektion freien Zugang zur Raumluft ermöglichen.
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Diese Schaltung wurde als Laborausstattung entworfen, die nur von qualifizierten und eingewiesenen Technikern in Forschungsinstituten oder Entwicklungsabteilungen benutzt wird. Aus Sicherheitsgründen wird die Verwendung durch andere Personen oder in anderer Umgebung *nicht* empfohlen.



- Diese Schaltung verwendet Kleinspannung ($< 50 V_{AC}$ und $< 75 V_{DC}$) und unterliegt daher nicht den Bestimmungen der *Niederspannungsrichtlinie* (2014/35/EU).
 - Das Gerät enthält kein mechanisches Antriebssystem – die Bestimmungen der *Maschinenrichtlinie* (2006/42/EG) sind daher nicht anwendbar.
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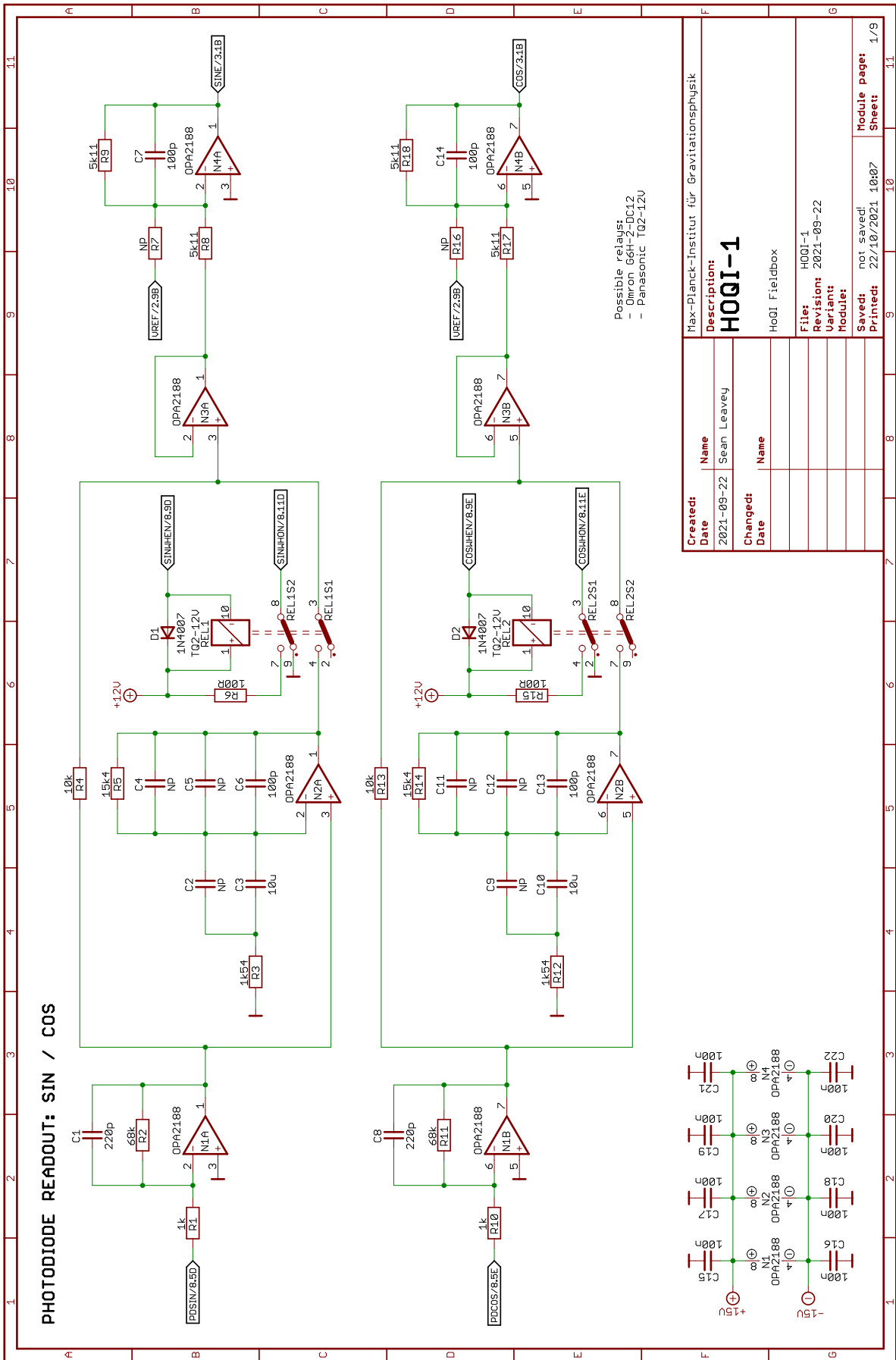


Figure 1: Design schematics (sheet 1)

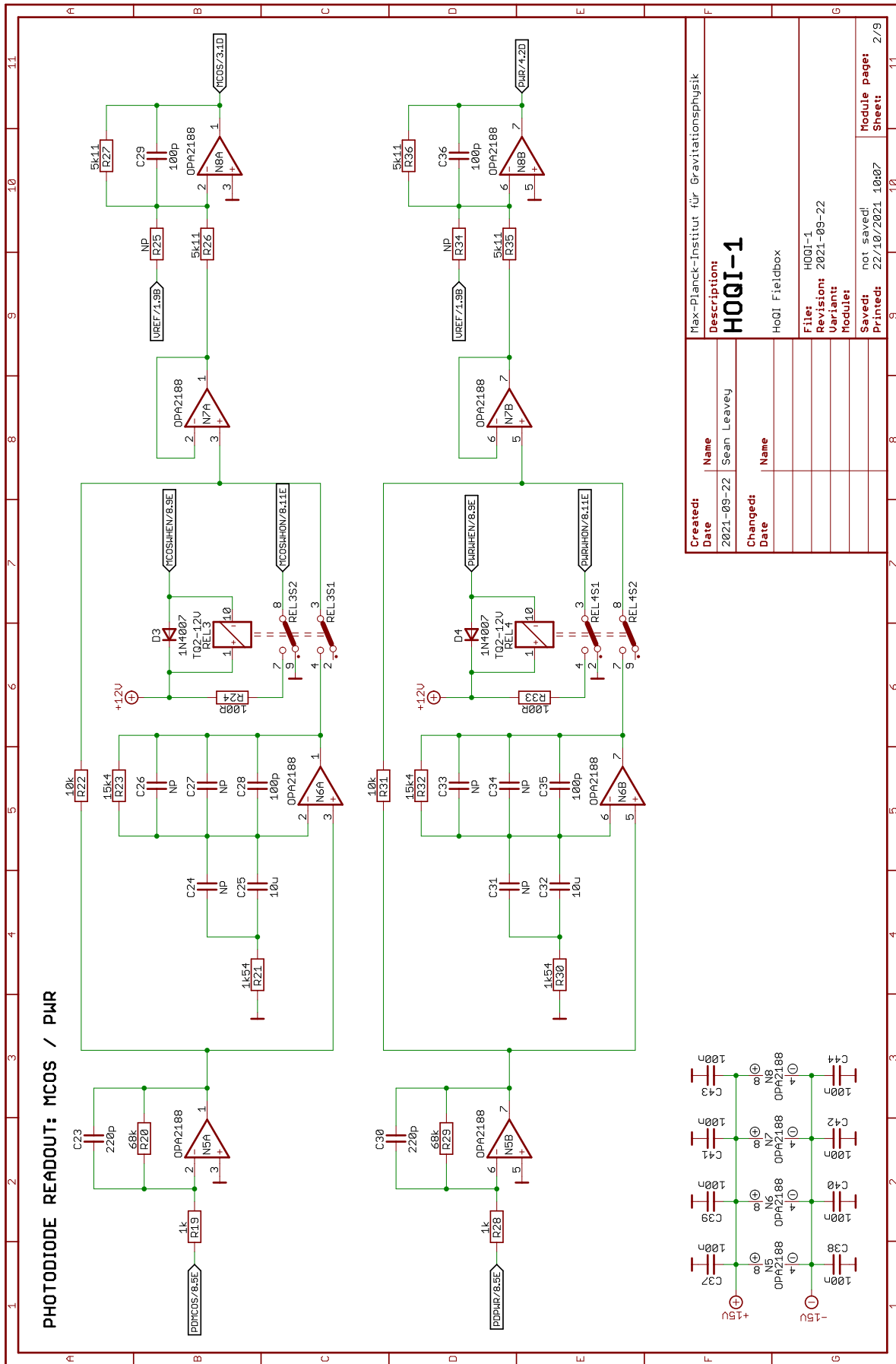


Figure 2: Design schematics (sheet 2)

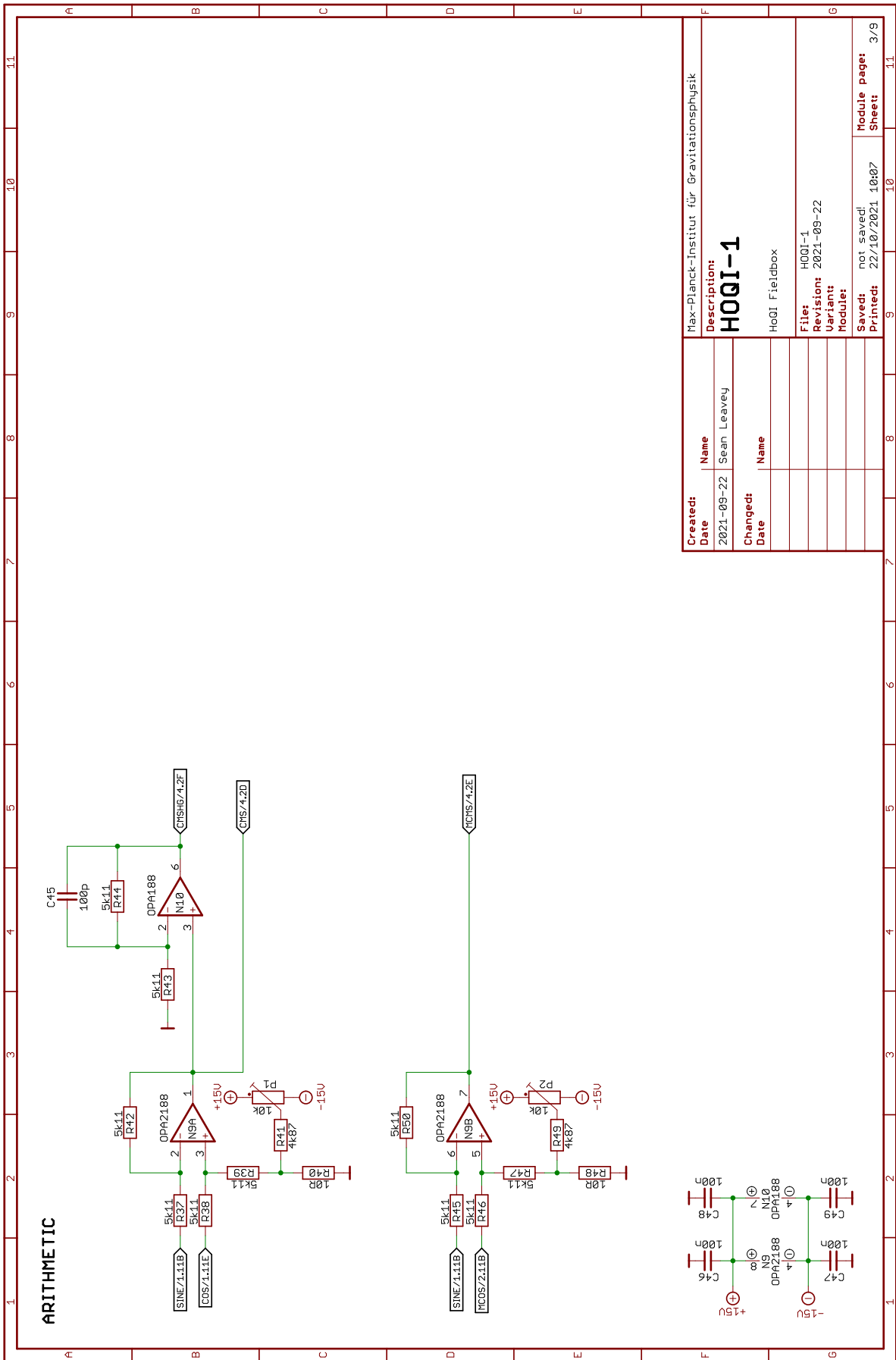


Figure 3: Design schematics (sheet 3)

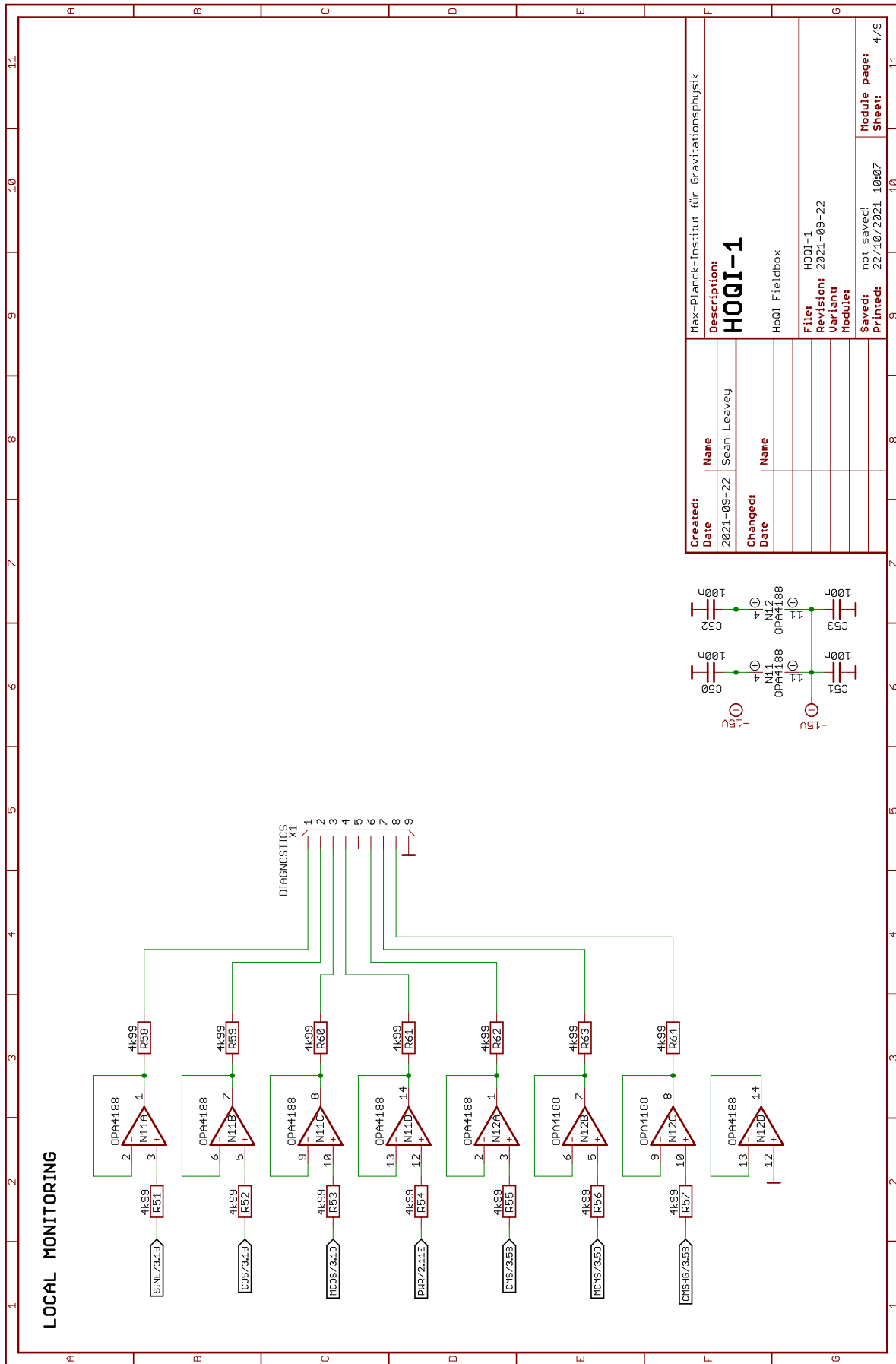


Figure 4: Design schematics (sheet 4)

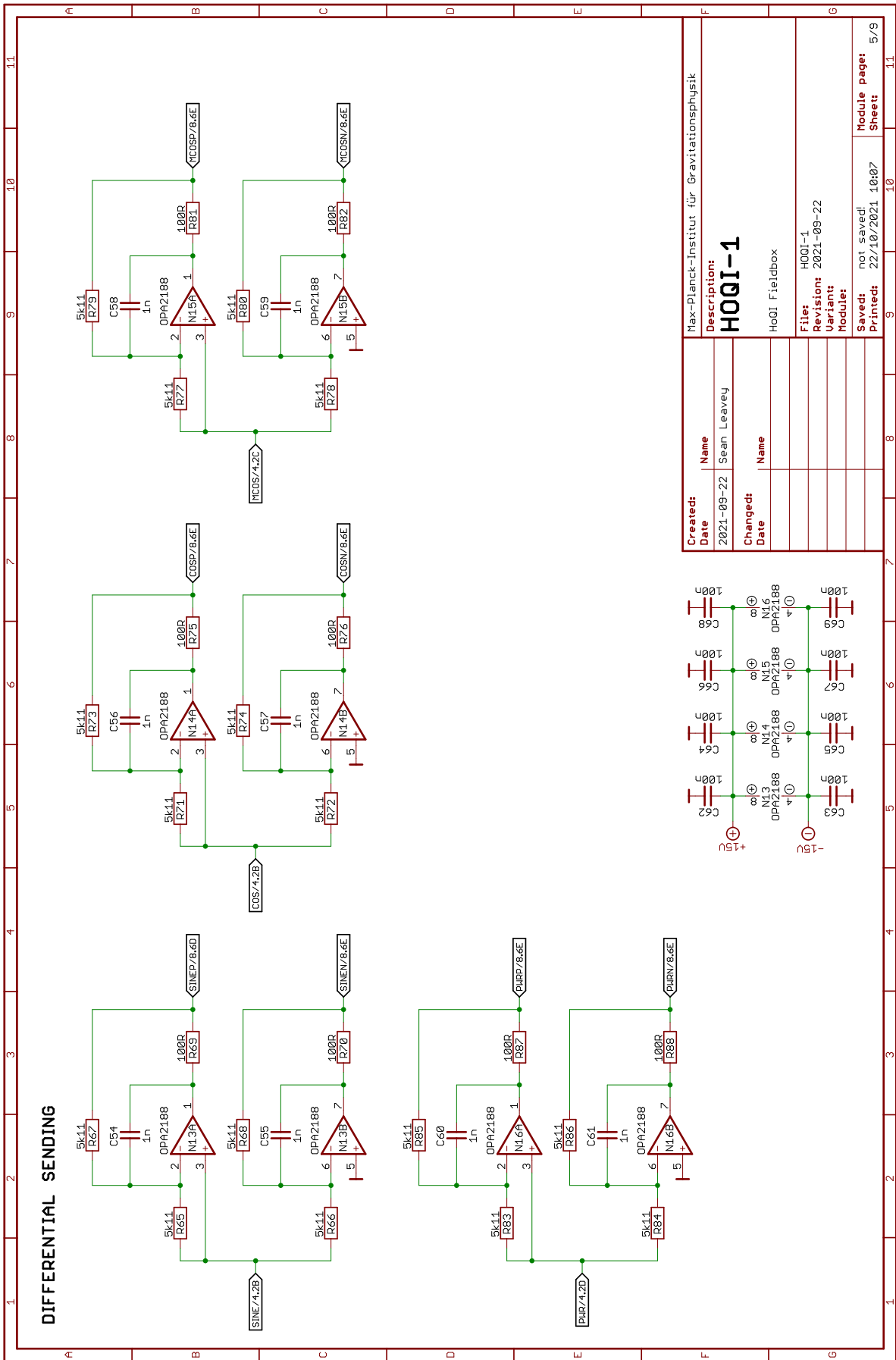


Figure 5: Design schematics (sheet 5)

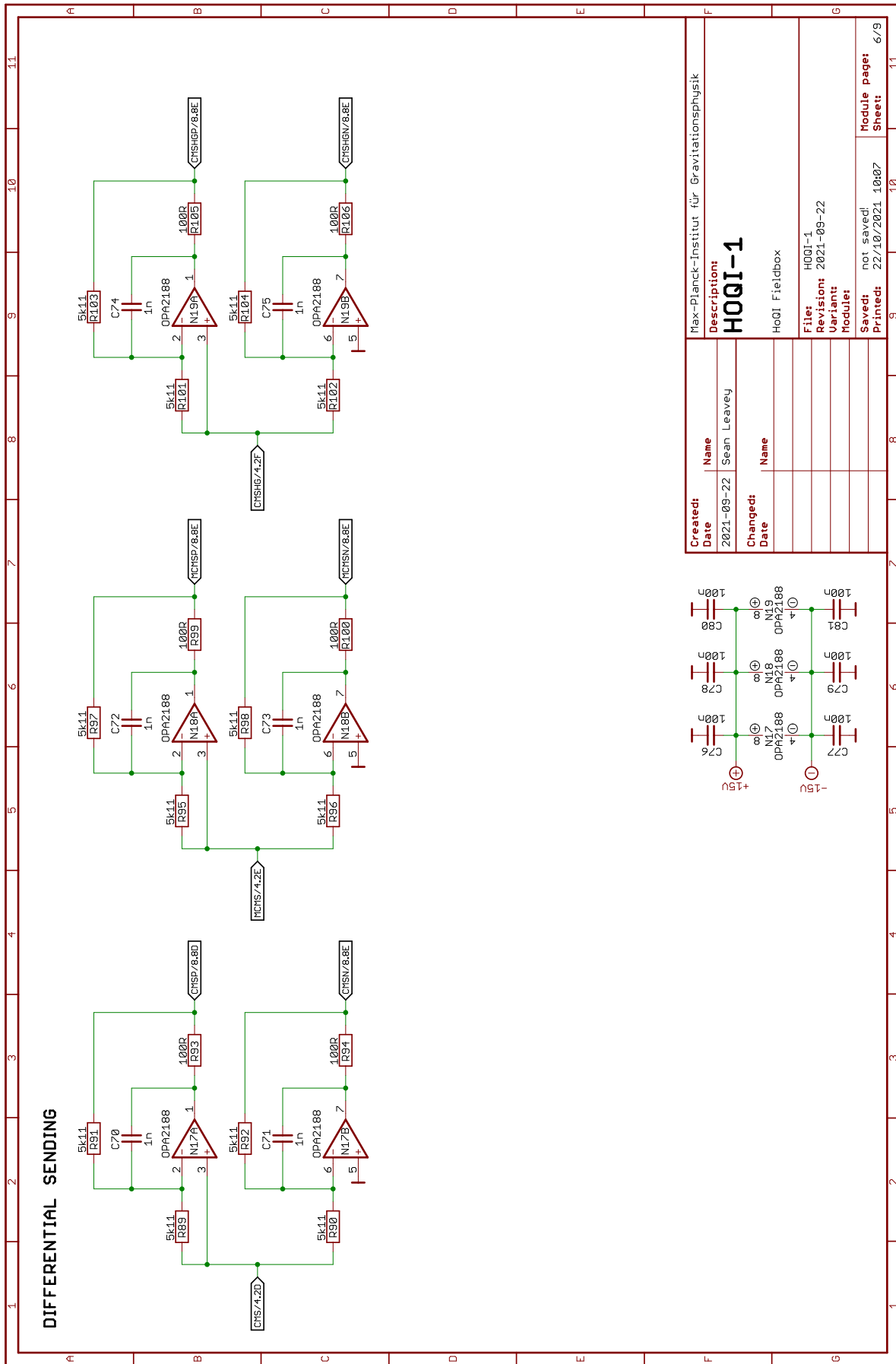


Figure 6: Design schematics (sheet 6)

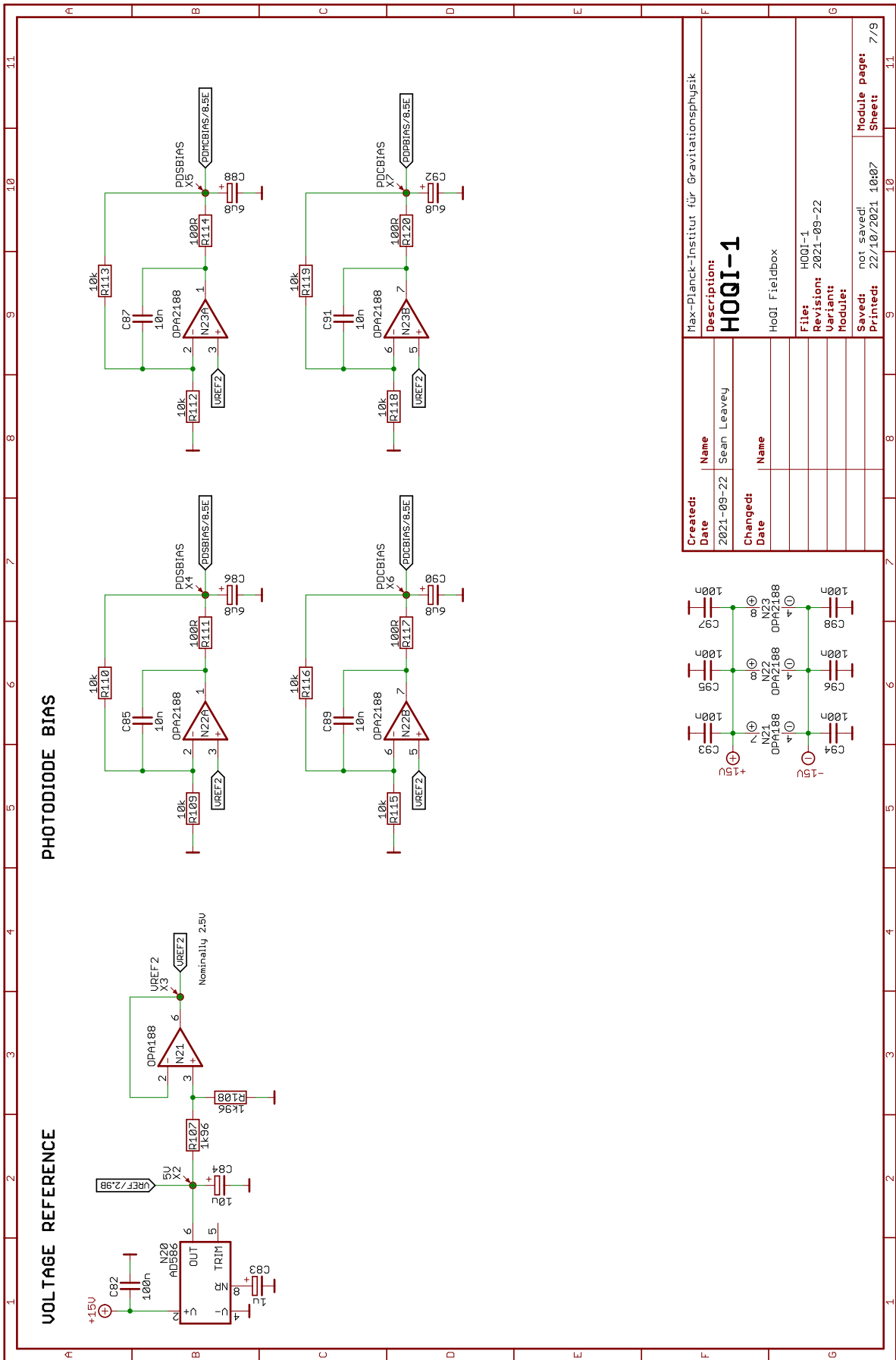


Figure 7: Design schematics (sheet 7)

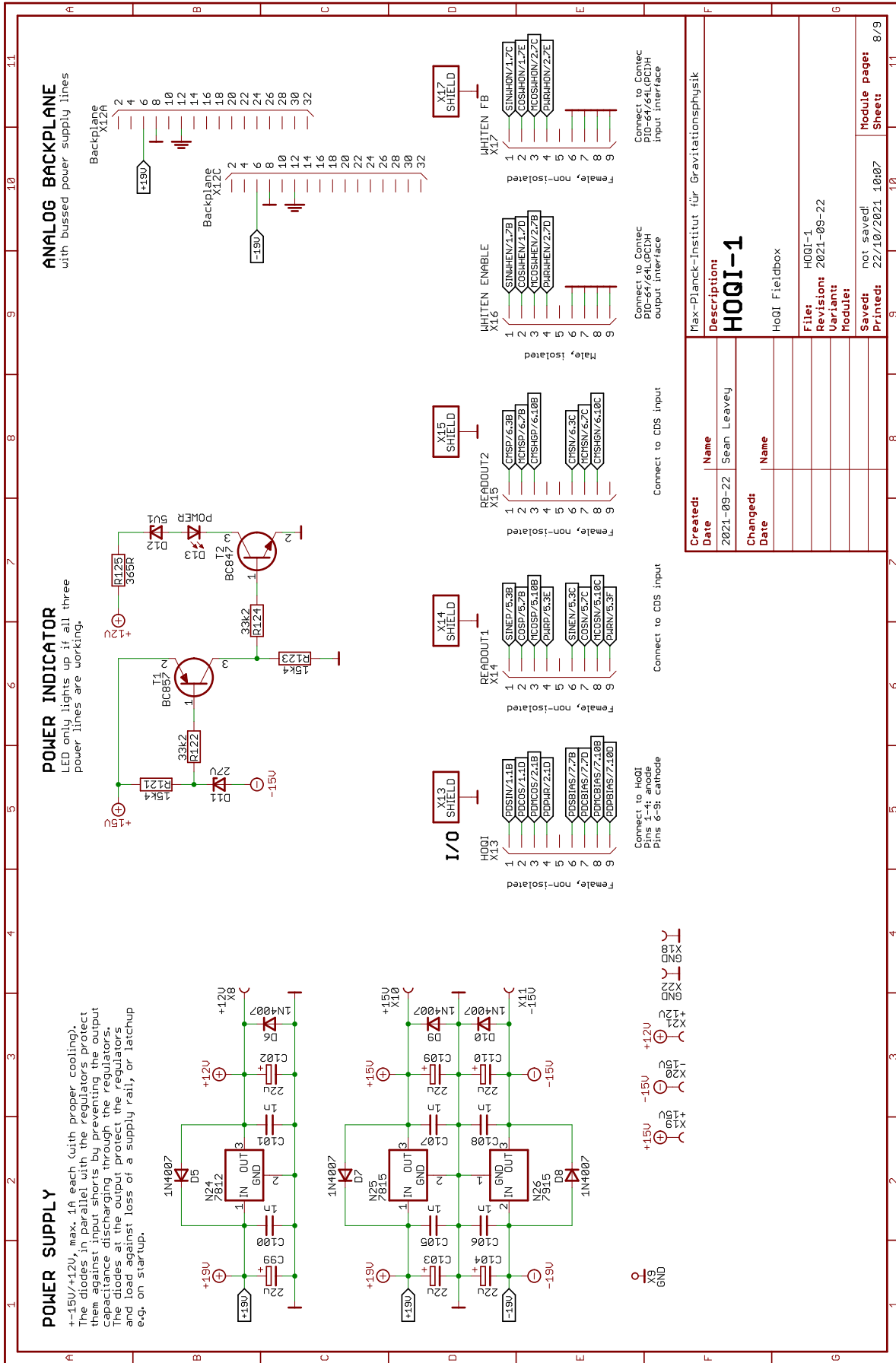


Figure 8: Design schematics (sheet 8)

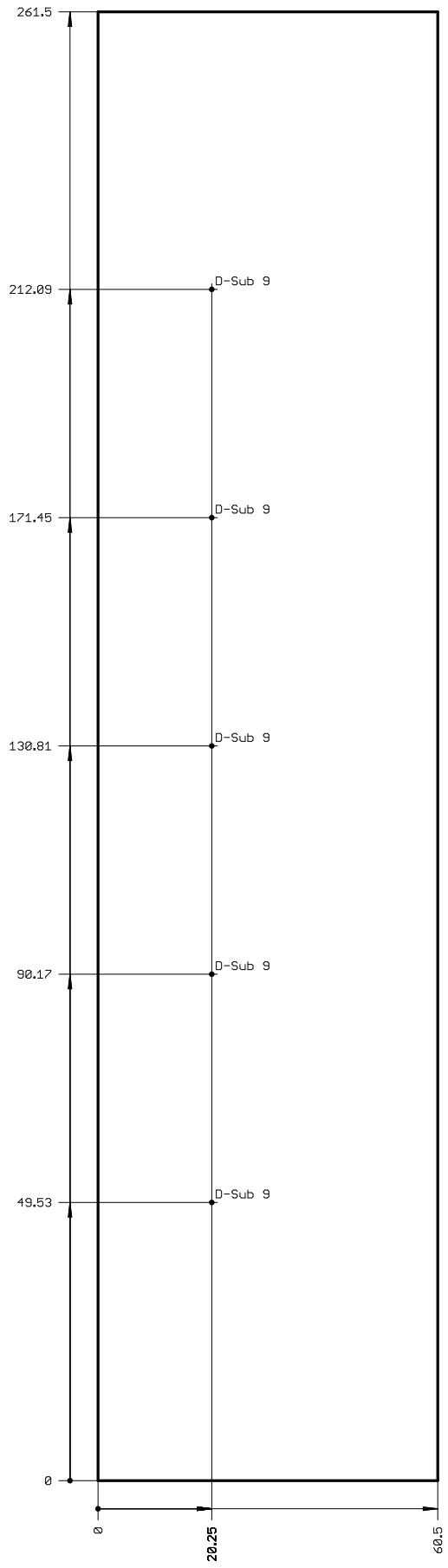


Figure 9: Design schematics (sheet 9)

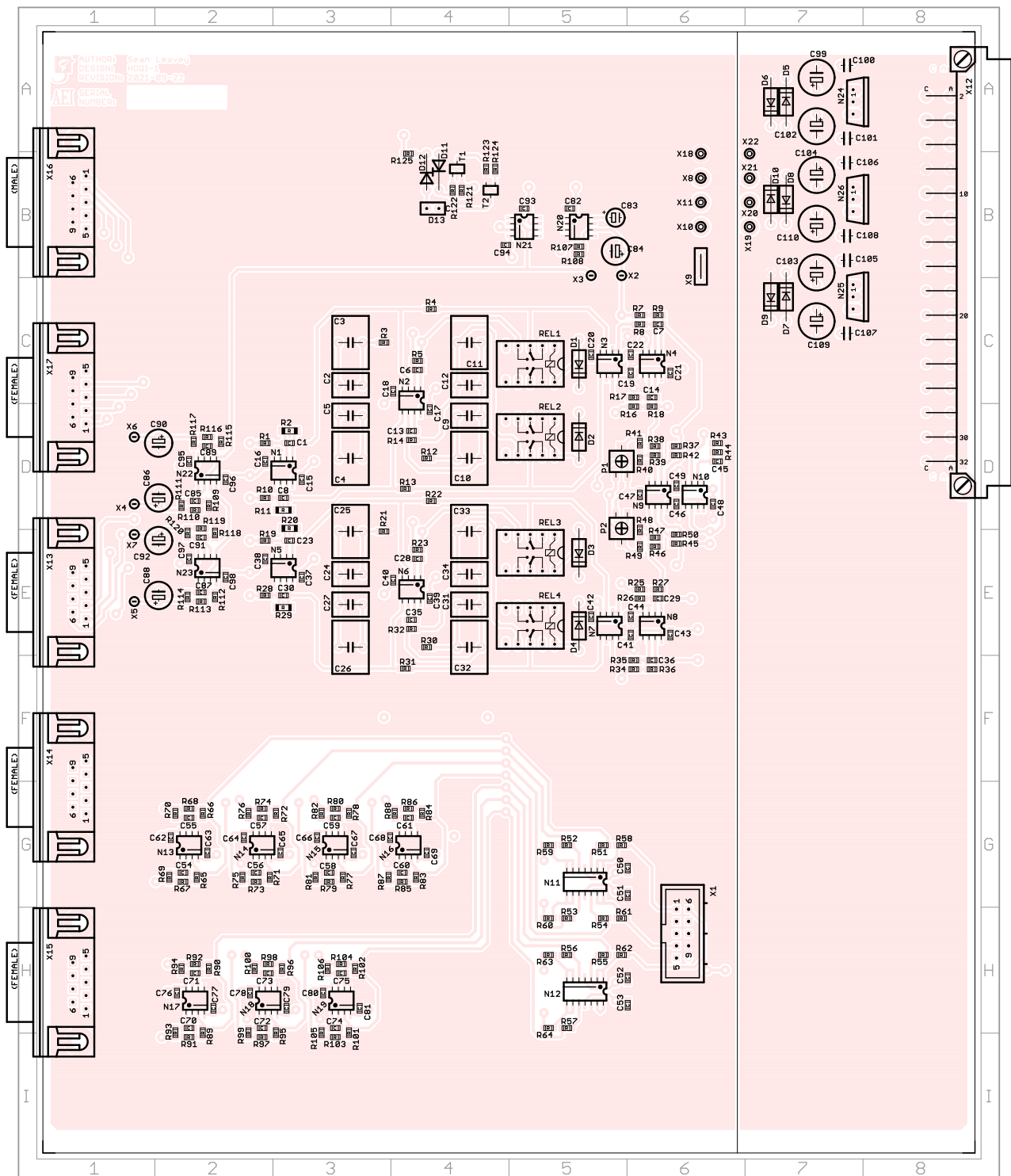


Figure 10: Board top view showing placeplan with component names

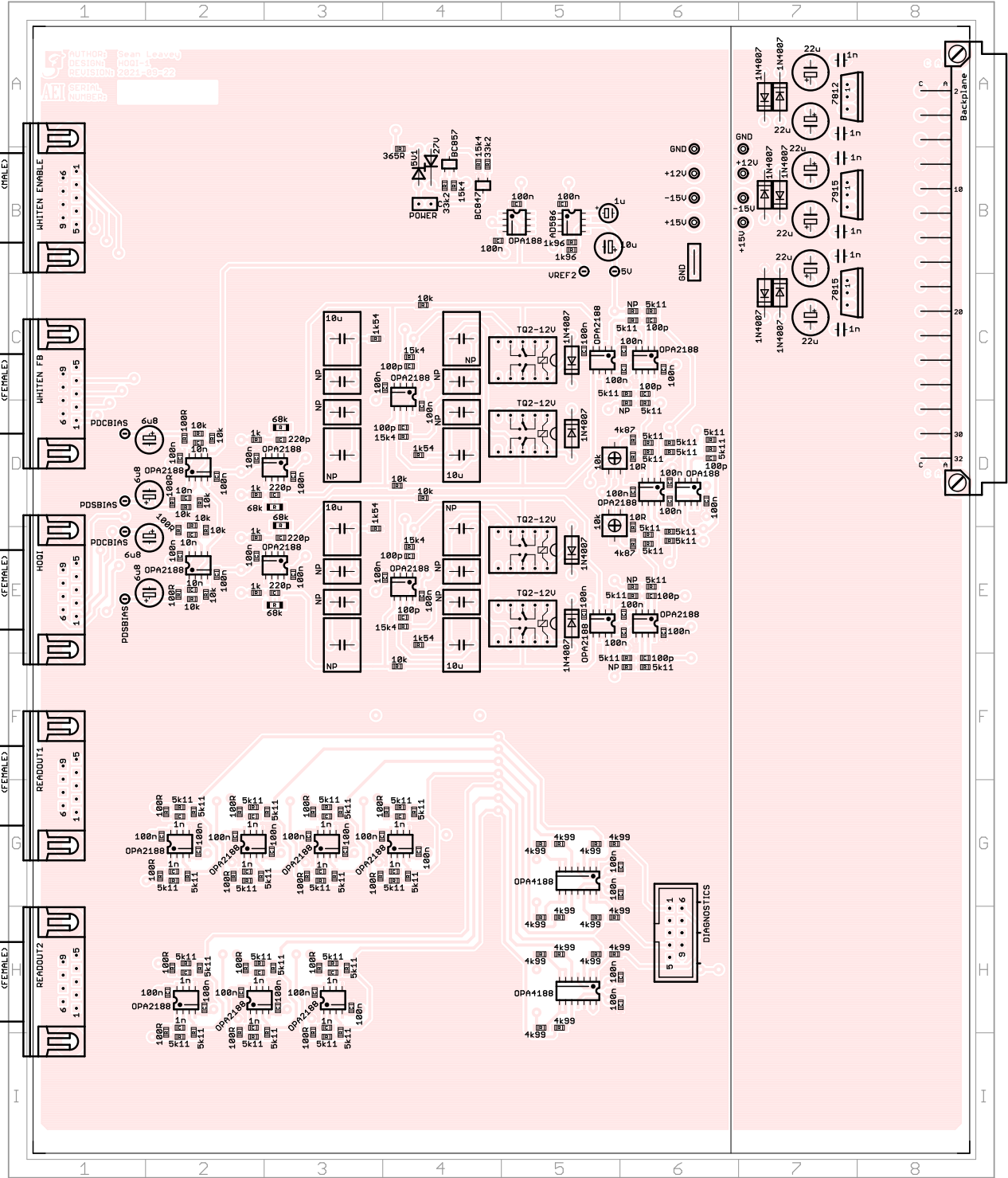


Figure 11: Board top view showing placeplan with component values

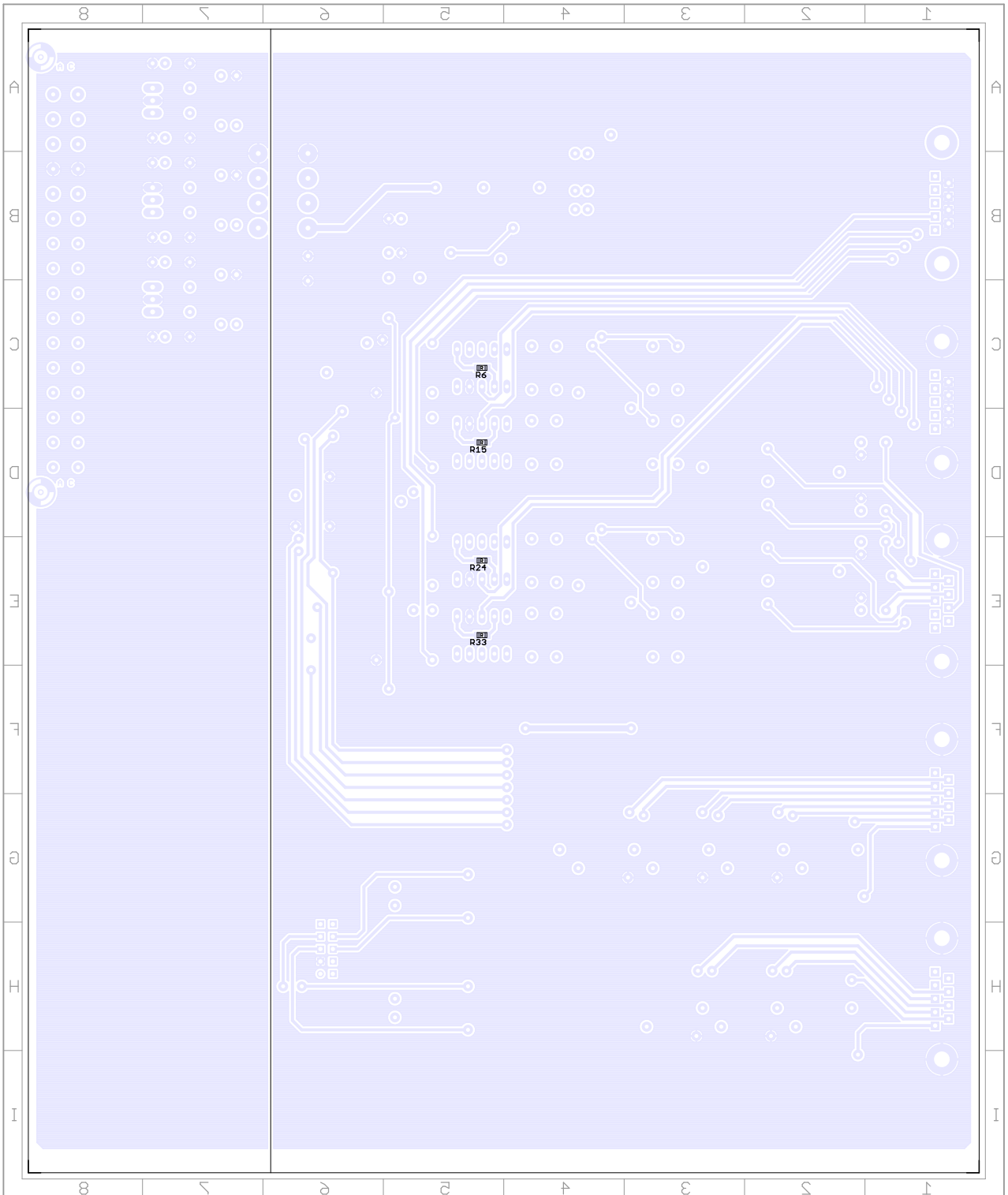


Figure 12: Board bottom view showing placeplan with component names

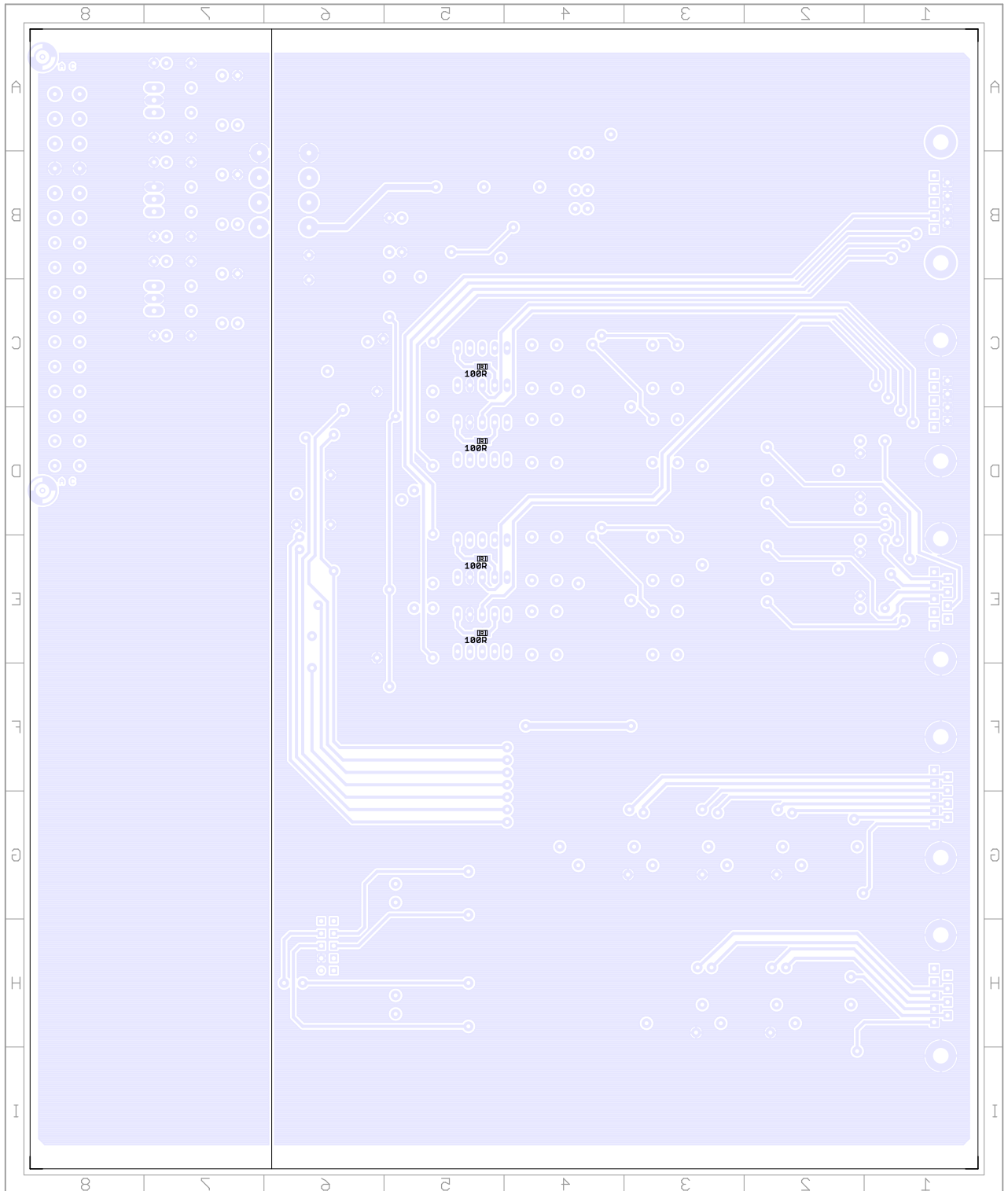


Figure 13: Board bottom view showing placeplan with component values

Circuit Lists

Value list: The following list shows all components available on the board (sorted by part *prefixes* and *values*) and can be used to quickly gather components. Additional information can possibly be found directly on the board (or in the schematics).

	Value	Package	Count	Component names (<i>library</i>)
	— C —			
1	100p	C-SMD:0805	9	C6, C7, C13, C14, C28, C29, C35, C36, C45 (<i>miscs</i>)
2	220p	C-SMD:0805	4	C1, C8, C23, C30 (<i>miscs</i>)
3	1n	C-CERAMIC:0.1"	6	C100, C101, C105-C108 (<i>miscs</i>)
4	1n	C-SMD:0805	14	C54-C59, C60, C61, C70, C71-C75 (<i>miscs</i>)
5	10n	C-SMD:0805	4	C85, C87, C89, C91 (<i>miscs</i>)
6	100n	C-SMD:0805	45	C15-C19, C20, C21, C22, C37-C39, C40, C41-C44, C46-C49, C50, C51-C53, C62-C69, C76-C79, C80, C81-C98 (<i>miscs</i>)
7	1u	CE01-TANTAL-3.7-N	1	C83 (<i>miscs</i>)
8	6u8	CE01-TANTAL-5.7-N	4	C86, C88, C90, C92 (<i>miscs</i>)
9	10u	C-WIMA:MKS2	4	C3, C10, C25, C32 (<i>miscs</i>)
10	10u	CE01-TANTAL-5.7-N	1	C84 (<i>miscs</i>)
11	22u	CE-TANTAL:0.2"	6	C99, C102-C104, C109, C110 (<i>miscs</i>)
	— D —			
12	1N4007	D04N-DO41	10	D1, D2, D3, D4, D5, D6, D7, D8, D9, D10 (<i>diodes</i>)
13	5V1	DZ-0.3"	1	D12 (<i>diodes</i>)
14	27V	DZ-0.3"	1	D11 (<i>diodes</i>)
15	<i>[ignored]</i>	LED:Pinheader	1	D13 (<i>optos</i>)
	— N —			
16	7812	TO-220	1	N24 (<i>ics</i>)
17	7815	TO-220	1	N25 (<i>ics</i>)
18	7915	TO-220	1	N26 (<i>ics</i>)
19	AD586	SO-8	1	N20 (<i>ics</i>)
20	OPA188	SO-8	2	N10, N21 (<i>opamps</i>)
21	OPA2188	SO-8	18	N1, N2, N3, N4, N5, N6, N7, N8, N9, N13-N19, N22, N23 (<i>opamps</i>)
22	OPA4188	SO-14	2	N11, N12 (<i>opamps</i>)
	— P —			
23	10k	PTS-3314G	2	P1, P2 (<i>miscs</i>)
	— R —			
24	10R	R-SMD:0805	2	R40, R48 (<i>miscs</i>)
25	100R	R-SMD:0805	22	R6, R15, R24, R33, R69, R70, R75, R76, R81, R82, R87, R88, R93, R94, R99, R100, R105, R106, R111, R114, R117, R120 (<i>miscs</i>)
26	365R	R-SMD:0805	1	R125 (<i>miscs</i>)
27	1k	R-SMD:0805	4	R1, R10, R19, R28 (<i>miscs</i>)
28	1k54	R-SMD:0805	4	R3, R12, R21, R30 (<i>miscs</i>)
29	1k96	R-SMD:0805	2	R107, R108 (<i>miscs</i>)
30	4k87	R-SMD:0805	2	R41, R49 (<i>miscs</i>)
31	4k99	R-SMD:0805	14	R51-R59, R60, R61-R64 (<i>miscs</i>)
32	5k11	R-SMD:0805	46	R8, R9, R17, R18, R26, R27, R35-R39, R42-R47, R50, R65-R68, R71-R74, R77-R79, R80, R83-R86, R89, R90, R91, R92, R95-R98, R101-R104 (<i>miscs</i>)
33	10k	R-SMD:0805	12	R4, R13, R22, R31, R109, R110, R112, R113, R115, R116, R118, R119 (<i>miscs</i>)
34	15k4	R-SMD:0805	6	R5, R14, R23, R32, R121, R123 (<i>miscs</i>)
35	33k2	R-SMD:0805	2	R122, R124 (<i>miscs</i>)
36	68k	R-SMD:MiniMELF	4	R2, R11, R20, R29 (<i>miscs</i>)
	— REL —			
37	TQ2-12V	REL-G6HN	4	REL1, REL2, REL3, REL4 (<i>miscs</i>)
	— T —			
38	BC847	SOT-23	1	T2 (<i>transistors</i>)
39	BC857	SOT-23	1	T1 (<i>transistors</i>)
	— X —			

— continued on next page —

Table 0: Value list — continued

	Value	Package	Count	Component names (<i>library</i>)
40	<i>[ignored]</i>	Backplane:32p./AC	1	X12 (<i>connectors</i>)
41	<i>[ignored]</i>	D-SUB:9p./US/female	4	X13-X15,X17 (<i>connectors</i>)
42	<i>[ignored]</i>	D-SUB:9p./US/male	1	X16 (<i>connectors</i>)
43	<i>[ignored]</i>	GND-0.2"	1	X9 (<i>connectors</i>)
44	<i>[ignored]</i>	IDC:10p./ribbon	1	X1 (<i>connectors</i>)
45	<i>[ignored]</i>	PIN:0.8mm/ceram.	6	X2,X3,X4,X5,X6,X7 (<i>connectors</i>)
46	<i>[ignored]</i>	Solderpin:1.0mm	8	X8,X10,X11,X18,X19,X20,X21,X22 (<i>connectors</i>)
	— [unpopulated] —			
47	<i>[undefined]</i>		16	C2,C4,C5,C9,C11,C12,C24,C26,C27,C31,C33,C34,R7,R16,R25,R34 (<i>miscs</i>)

Table 0: Value list