
Power stabilization photodiode (D2000510-v1, spd4)

Circuit Board Documentation

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Abstract

Power stabilization photodiode based on D1001998-v2 (spd3) the aLIGO inner loop photodiode.

- The bias voltage generation is changed and a negative voltage is used, so the outputs have opposite signs.
- Operational amplifier with standardized pin layout are implemented.

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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 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

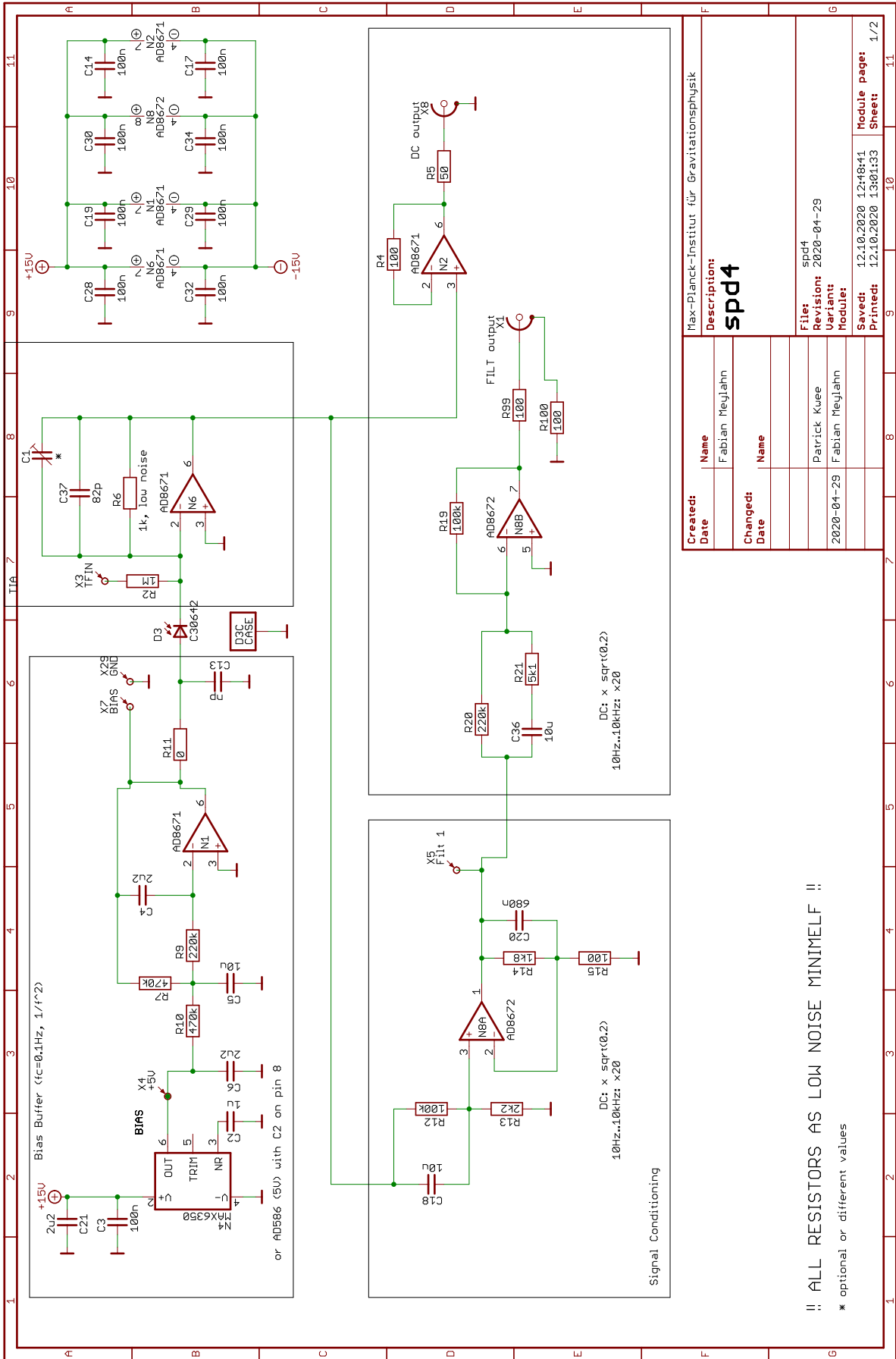
Nehmen Sie vor Aufbau und Inbetriebnahme des Geräts folgende Empfehlungen zur Kenntnis, um die Schaltung korrekt und sicher zu betreiben sowie Schäden und Verletzungen zu vermeiden:



Diese Schaltung 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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Created:	
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Description:	
SPD4	

File:	SPD4
Revision:	2020-04-29
Variant:	
Modder:	
Saved:	12.10.2020 12:48:41
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Module:	SPD4
Page:	1/2

!! ALL RESISTORS AS LOW NOISE MINIMELF !!
 * optional or different values

Figure 1: Project schematics (sheet 1)

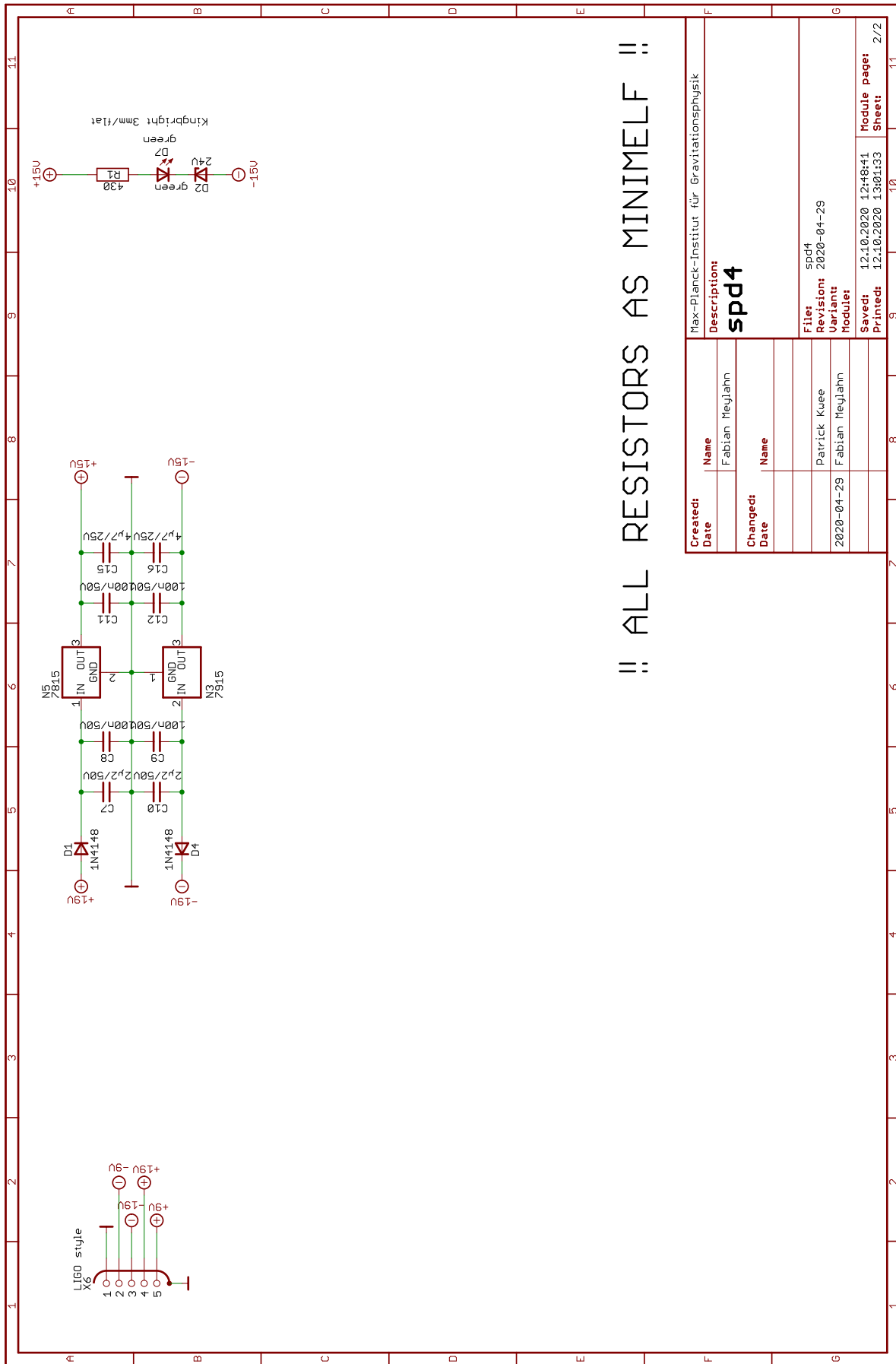


Figure 2: Project schematics (sheet 2)

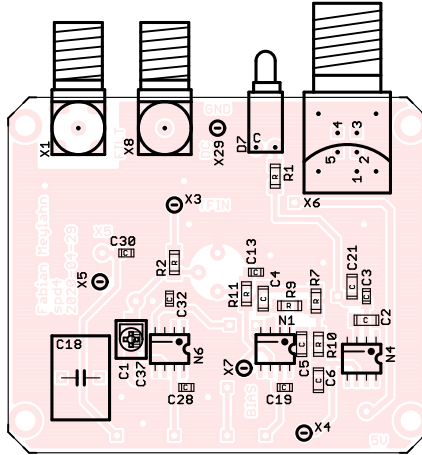


Figure 3: Board top view showing placeplan with component names

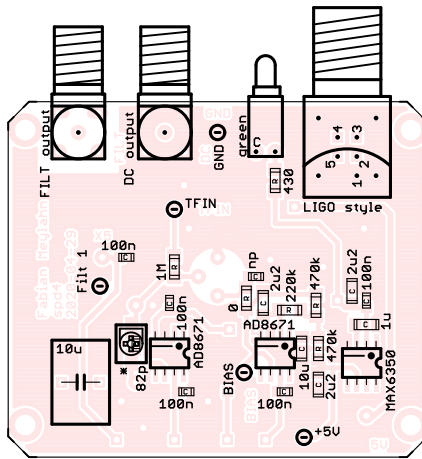


Figure 4: Board top view showing placeplan with component values

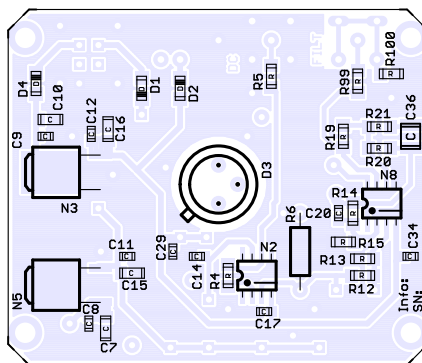


Figure 5: Board bottom view showing placeplan with component names

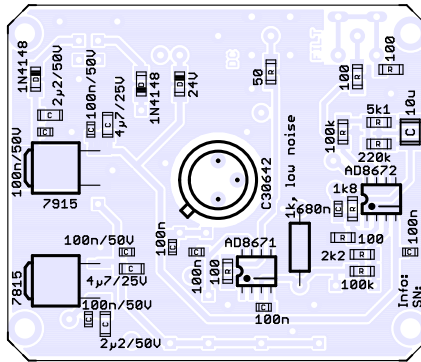


Figure 6: Board bottom view showing placeplan with component values

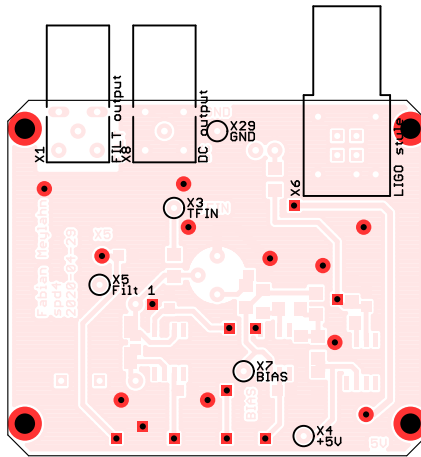


Figure 7: Board top view showing connectors, test points, vias and wired components

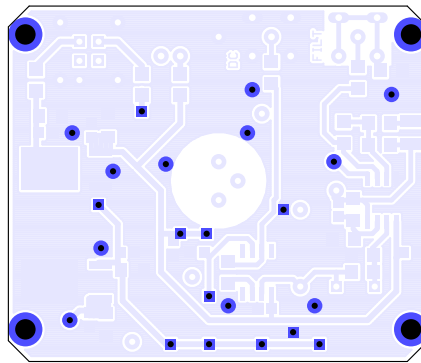


Figure 8: Board bottom view showing connectors, test points, vias and wired components

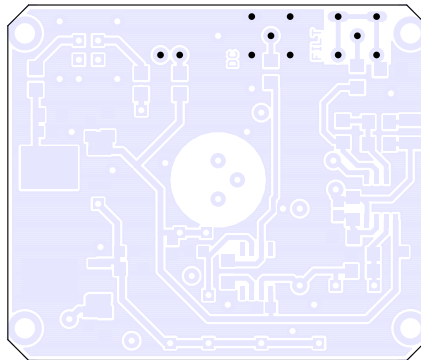


Figure 9: Board bottom view showing drills with ≈ 0.9 mm (≈ 0.03543 in) diameter (12×889 μm)

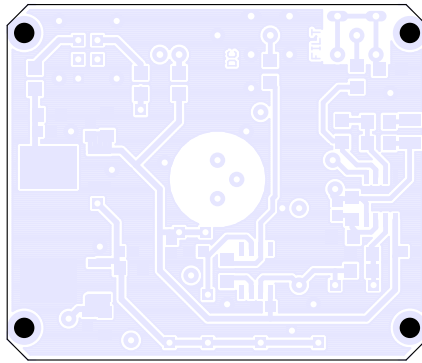


Figure 10: Board bottom view showing drills with 2.7 mm (0.1063 in) diameter
(4 × 2700 μm)

Circuit Lists

Drill list: The following table shows all *final* drill diameters used in the board. When manually drilling the clearance holes, round up to the nearest available drill bit diameter, ensuring that all components fit well. When manufacturing *through-plated* boards, adjust for the additional copper coating by increasing the diameter accordingly.

\varnothing [μm]	\varnothing [mm]	\varnothing [in]	Count	Plan \varnothing [mm]
813	0.813	0.03201	43	—
889	0.889	0.035	12	0.9
2700	2.7	0.1063	4	2.7
			Total:	59

Table 1: Drill diameters used in the board

Standard properties: If not explicitly stated otherwise in the schematics or value and part lists, the circuit components have the following standard properties. Parts with ‘better’ properties can be easily substituted, but care should be taken if the specifications are *not* met.

- Wired resistors: Metal film 0.6 W, 1%, 200 V, TK 100
- SMD resistors: 1%, 150 V, TK 50, MiniMELF in thin film, other packages in thick film technology

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 82p	C-SMD:0805	1	C37 (<i>miscs</i>)
2 100n	C-SMD:0805	9	C3, C14, C17, C19, C28, C29, C30, C32, C34 (<i>miscs</i>)
3 100n/50V	C-SMD:0805	4	C8, C9, C11, C12 (<i>miscs</i>)
4 680n	C-SMD:0805	1	C20 (<i>miscs</i>)
5 1u	C-SMD:1206	1	C2 (<i>miscs</i>)
6 2 μ 2/50V	C-SMD:1206	2	C7, C10 (<i>miscs</i>)
7 2u2	C-SMD:1206	3	C4, C6, C21 (<i>miscs</i>)
8 4 μ 7/25V	C-SMD:1206	2	C15, C16 (<i>miscs</i>)
9 10u	C-SMD:1206	1	C5 (<i>miscs</i>)
10 10u	C-SMD:1210	1	C36 (<i>miscs</i>)
11 10u	C02-MKS2-11.0-R	1	C18 (<i>miscs</i>)
12 *	CT4MM	1	C1 (<i>miscs</i>)
— D —			
13 1N4148	D-SMD:MiniMELF	2	D1, D4 (<i>diodes</i>)
14 24V	D-SMD:MiniMELF	1	D2 (<i>diodes</i>)
15 C30642	TO-5	1	D3 (<i>optos</i>)
16 [ignored]	DL03-ANGLED1-N	1	D7 (<i>optos</i>)
— N —			
17 7815	TO-252	1	N5 (<i>ics</i>)
18 7915	TO-252	1	N3 (<i>ics</i>)
19 AD8671	SO-8	3	N1, N2, N6 (<i>opamps</i>)
20 AD8672	SO-8	1	N8 (<i>opamps</i>)
21 MAX6350	SO-8	1	N4 (<i>ics</i>)
— R —			
22 0	R-SMD:MiniMELF	1	R11 (<i>miscs</i>)
23 50	R-SMD:MiniMELF	1	R5 (<i>miscs</i>)
24 100	R-SMD:MiniMELF	4	R4, R15, R99, R100 (<i>miscs</i>)
25 430	R-SMD:MiniMELF	1	R1 (<i>miscs</i>)
26 1k, low noise	R-wired:0.6W	1	R6 (<i>miscs</i>)
27 1k8	R-SMD:MiniMELF	1	R14 (<i>miscs</i>)

— continued on next page —

Table 1: Value list — continued

	Value	Package	Count	Component names (<i>library</i>)
28	2k2	R-SMD:MiniMELF	1	R13 (<i>miscs</i>)
29	5k1	R-SMD:MiniMELF	1	R21 (<i>miscs</i>)
30	100k	R-SMD:MiniMELF	2	R12, R19 (<i>miscs</i>)
31	220k	R-SMD:MiniMELF	2	R9, R20 (<i>miscs</i>)
32	470k	R-SMD:MiniMELF	2	R7, R10 (<i>miscs</i>)
33	1M	R-SMD:MiniMELF	1	R2 (<i>miscs</i>)
	— X —			
34	[<i>ignored</i>]	LEMO:1p./00/horz.	2	X1, X8 (<i>connectors</i>)
35	[<i>ignored</i>]	LEMO:5p./0B/horz.	1	X6 (<i>connectors</i>)
36	[<i>ignored</i>]	Pin:0.8mm/ceram.	5	X3, X4, X5, X7, X29 (<i>connectors</i>)
	— [unpopulated] —			
37	[<i>undefined</i>]		1	C13 (<i>miscs</i>)

Table 1: Value list

Part list: The following list shows all components that are available in both schematics *and* board (sorted by part *names*) and can be used to quickly locate components. Additional information can possibly be found directly in the schematics. The column *Sheet* shows the position of a gate in the schematics: Sheet number followed by the cell of the surrounding frame (if available). The column *Board* shows the population layer (**T** for top, **B** for bottom) of a component on the board.

Part Gate	Sheet	Board								
— C —										
1 C1	1-A8	T	18 C18	1-D2	T	36	P: 1-B10	55 R11	1-B5	T
2 C2	1-B2	T	19 C19	1-A10	T	37 N2	A: 1-D9	56 R12	1-D3	B
3 C3	1-A2	T	20 C20	1-E4	B	38	P: 1-B11	57 R13	1-D3	B
4 C4	1-B4	T	21 C21	1-A2	T	39 N3	2-B6	58 R14	1-E4	B
5 C5	1-B4	T	22 C28	1-A9	T	40 N4	1-B2	59 R15	1-E4	B
6 C6	1-B3	T	23 C29	1-B10	B	41 N5	2-A6	60 R19	1-D7	B
7 C7	2-A5	B	24 C30	1-A10	T	42 N6	A: 1-B8	61 R20	1-D6	B
8 C8	2-A6	B	25 C32	1-B9	T	43	P: 1-B9	62 R21	1-E6	B
9 C9	2-B6	B	26 C34	1-B10	B	44 N8	A: 1-D3	63 R99	1-E8	B
10 C10	2-B5	B	27 C36	1-E6	B	45	B: 1-E7	64 R100	1-E8	B
11 C11	2-A7	B	28 C37	1-A8	T	46	P: 1-B11	— X —		
12 C12	2-B7	B	— D —			— R —		65 X1	1-E9	T
13 C13	1-B6	T	29 D1	2-A5	B	47 R1	2-A10	66 X3	1-A7	T
14 C14	1-A11	B	30 D2	2-B10	B	48 R2	1-B7	67 X4	1-B3	T
15 C15	2-A7	B	31 D3	A: 1-B6	B	49 R4	1-D9	68 X5	1-D4	T
16 C16	2-B7	B	32	c: 1-B6		50 R5	1-D10	69 X6	2-A1	T
17 C17	1-B11	B	33 D4	2-B5	B	51 R6	1-A8	70 X7	1-A6	T
			34 D7	2-B10	T	52 R7	1-B4	71 X8	1-D11	T
			— N —			53 R9	1-B4	72 X29	1-A6	T
			35 N1	A: 1-B5	T	54 R10	1-B3			

Table 2: Part list