OM Power

Exhibit 11: Tuning procedure and Part list

External Radio Frequency Power Amplifier OM2000A+

Model OM2000A+

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Tuning procedure

Tuning is possible only in the OPR mode.

a. Preliminary Information

Tuning the amplifier involves a procedure of matching the impedance of the antenna and transmission line to the tubes characteristic load resistance. This will ensure maximum plate efficiency and RF gain at nominal output power, with minimal distortion and spurious output. Note that REFLECTED POWER readings depend on the antenna and transmission line impedances only, and not on amplifier tuning. If the load impedance is not a nominally resistive 50 Ohms, the REFLECTED POWER reading will always show a reading, no matter what the tuning settings. Proper tuning is always necessary, however, and will allow you to operate at a high power level, without distortion or any danger to the amplifier. Note also that the real OUPUT POWER presented to the load (the antenna and transmission line) is equal to the difference between the FORWARD and REFLECTED POWER readings. For instance, with a 2.5:1 VSWR, readings of 800W and 150W FORWARD and REFLECTED POWER respectively, the real OUTPUT POWER is 650W. At very high VSWR levels, such as when no antenna is connected or a badly mismatched antenna is used, the FORWARD and REFLECTED reading will be almost equal, while the real OUTPUT POWER (the difference between them) will be zero. The amplifier can operate safely as long as the REFLECTED POWER is LESS THAN 350W. Matching is assured for loads presenting a REFLECTED POWER of up to 350W. Nevertheless, for some loads and bands, matching is possible at even higher REFLECTED POWER levels, but the drive power must be reduced to prevent the REFLECTED POWER from exceeding 350W. Failure to comply with these guidelines will cause the protection circuits to trip. For example, if the antenna VSWR were 5:1, the maximum attainable FORWARD POWER would be 540W, 240W of reflected power and real output to the antenna and transmission line of only 300W. in the event your antenna cannot be adjusted to produce a lower VSWR, an external antenna tuner may be deployed.

CAUTION

At elevated VSWR levels, high voltages and high currents are distributed along the coaxial cable to the antenna, risking internal arcing and heat generation, and likely damage to the cable and any antenna switches that may be used. It is recommended that VSWR levels of more than 2:1 not be permitted with coaxial cable above 14MHz.

It is advisable to adjust amplifier tuning when antennas have been changed, snow has fallen, new objects are in the near field of the antenna, etc. Such changes may affect antenna impedance.

NOTE

If you use more than one antenna on a band, the proper antenna must be selected prior to performing the tuning procedure outlined below.

CAUTION

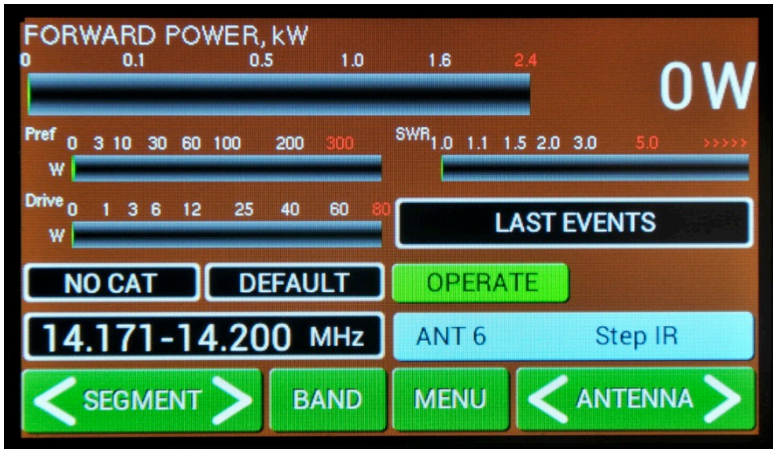
To avoid damage not covered under warranty, do not switch the BAND while transmitting. As discussed above, hot switching will damage the amplifier's band switch.

CAUTION

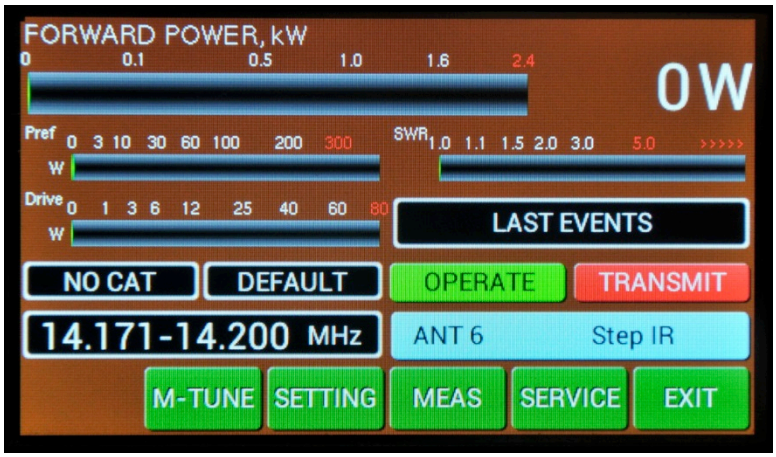
Also, never apply drive longer than one minute continuously without pausing for at least one minute to allow tube to cool.

b. Tuning procedure

OM2000A+ has been design to deliver maximum output power at 50 Ohms load. To deliver maximum output to real load you need to adjust the tuning according to your real antenna impedance.



We are in the operation mode. Press **MENU**



Now try to press PTT (foot switch for example).
We are in the transmit mode (without RF).
We have new button here. **M-TUNE**.

M-TUNE means entry to the manual tuning mode. It allows fine tuning of PA, or in the case if tuning cannot set optimal adjustment of the PA. For proper adjustment we need to show **Screen** current (at least). Prior start M-tune define one bar graph to the Screen current, or define all bar graph as in the next picture.
Press **M-TUNE**. New screen is visible. Slides on the left and right side represent both variable capacitors.
Adjustment process: Move **TUNE** left or right until maximum of **FWD** power reached. Then move **LOAD** carefully so that Ig2 **Screen** current will be not higher than 20mA. **Optimum means maximum FWD power and Screen between 10 – 20mA** for the full power output. Repeat more times.

After adjustment press **SAVE** for writing values to the memory and press **EXIT**.

Repeat adjustment process for other segments / bands

Deviding of bands into segments

Band (MHz)	1,8	3,5	7	10	14	18	21	24	28	50
Width of the segments (kHz)	20	30	30	50	30	60	60	60	70	250

TUNING

The OM2000A+ amplifier is operated in class AB. Thus it's possible to obtain a maximum output power at an excellent linearity. For this purpose the amplifier has to be tuned carefully.
The operation of a mistuned PA will cause malfunctions, the increase of grid current (the GRID-MAX-LED will light up) and problems with TVI/BCI.

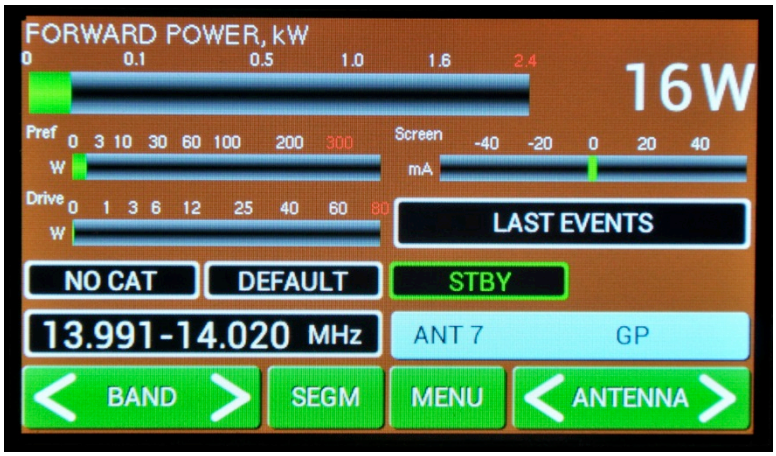
IM-products will be rapidly increased. If a value of + 50mA is exceeded, the safety devices will switch the amplifier to STBY mode.

Please note:
Before starting tuning you have to check if the right antenna or a 50 Ohms load resistance is connected at the antenna output!

Tuning the amplifier to an output of 1500 W

OM2000A will tune automatically to either TRX frequency via CAT interface or by frequency sampled by PA.

1 . Reduce the power output of your transceiver to the **0.**
2. Switch **OPR/STBY** to „**OPR“** position (touch STBY)



3. Press PT and increase driver power to **10W** (OUTPUT power will be abt. 500W)

Please note!

If the input power is higher than 15 W and the power amplifier is not correctly tuned, the safety devices will switch to STBY.
After switching the amplifier to PTT, the amplifier will automatically reset and switch back to OPR mode after approximately 2 seconds.

4. **Adjustment process**: Move **TUNE** left or right until maximum of **FWD** power reached. Then move **LOAD** carefully so that Ig2 **Screen** current will be not higher than 20mA. **Optimum means maximum FWD power and Screen between 10 – 20mA** for the full power output. Repeat more times.

After this procedure the amplifier is tuned correctly and ready to give 1500W output power in all operation modes. At optimal tuning and full output power a positive 50mA current goes through the second grid.

Please note: Should the amplifier demonstrate any malfunctions during tuning or should it not behave in accordance witch the description, interrupt the tuning procedure immediately and check the amplifier!
Be sure to have not done any mistakes in choosing bands or TUNE/LOAD values!
Be sure that SWR is not higher than 1:2 and input power is LOW!
After excluding human mistakes you will be able to work for long time with this amplifier!

OM2000A+ MAIN

Item No.	Type	Description		Qty.
1	switch	Band switch 8x3	8x3 position	1
2	blower	Blower	24V 5,28W PE92252V1-000U	1
3	blower	Blower ebm-papst	24V 14W G1G085-AB05-01	1
4	condensator	Capacitor ceramic	4n7 6kV 15,24mm	4
5	condensator	Cap ceramic disc	2n2 10kV Φ 40mm	1
6	condensator	Cap ceramic disc	330 3,5kV Φ 30mm	1
7	condensator	Cap ceramic disc	1n 12kV Φ 30mm	1
8	condensator	Cap ceramic disc	470 16kV Φ 25mm	1
9	coil	Coil	Stopper coil	1
10	coil	Coil	anode choke on PTFE	1
11	coil	Coil	choke 100uH 2,5A	1
12	coil	Coil	Air coil	1
13	coil	Coil	L coil on ceramics	2
14	coil	Coil	choke coil on PTFE	2
15	filter	Filter EPCOS	250V20A B84771A0020A000	1
16	Fuse	Fuse	F4A 5 x 20mm	1
17	Fuse	Fuse	250mA 5 x 20mm	1
18	Fuse	Fuse	T2A 5 x 20mm	4
19	Fuse	Fuse	1A 5 x 20mm	1
20	Fuse	Fuse	T500mA 5 x 20mm	2
21	Fuse	Fuse	T3,15 5 x 20mm	1
22	Fuse	Fuse	T2A 5 x 20mm	1
23	Fuse	Fuse	10A 5 x 20mm	1
24	Fuse	Fuse 6,3x32mm Slow	T 16A Fuse Slow 6,3x32mm	2
25	switch	Power switch	250V 10A Marquardt	1
26	relay	Relay vacuum	RH4894 Siemens	1
27	Thermistor	Thermistor disk	32A 1Ohm	1
28	Transformer	Transformer	220/230/240V 2410W	1
29	TUBE	TUBE	FU728f	1
30	condensator	Rotating condensator	70 + 250pF	1
31	condensator	Rotating condensator	400 + 400pF	1
32	motor	servomotor		3

OM2000A+ LOGIC

Item No.	Type	Description		Qty.
1	condensator	100n	0805	7
2	condensator	220µF /6V	SMD-C	2
3	condensator	10M ker	0805	1
4	condensator	100n	1206	26
5	condensator	18	0805	2
6	condensator	27	0805	2
7	condensator	100	1206	40
8	condensator	10n	1206	38

9	condensator	100µF / 35V	SMD_R7X7_ELKO	2
10	condensator	470µF /16V	SMD_R8X6,5_ELKO	1
11	condensator	1000µF /10V	SMD_R10X8_ELKO	1
12	diode	BAV99	SOT23/3	14
13	diode	ZD 5V1	SOD80	12
14	diode	ZD 4V3	SOD80	13
15	diode	ZD 12v	SOD80	1
16	diode	MBRS360	SMC	2
17	diode	SK15	SMA	1
18	coil	BLM31AJ601	1206	11
19	connector	DISPLAY	kolik 2x5	1
20	connector	INPUT	T823-120A1R	1
21	connector	SW ON	LH16RA	1
22	connector	HV supply	LH16RA	1
23	connector	Box IO	T823-116A1R	1
24	connector	Motor C1	1X03-90	1
25	connector	Motor C2	1X03-90	1
26	connector	Motor BSW	1X03-90	1
27	connector	OUTPUT	DS1014-10RF1B	1
28	connector	PWR	NSL25-3W	1
29	connector	REZ	DS1014-16RF1B	1
30	connector	ISP	1X06-90	1
31	connector	SUPPLY	NSL25-4W	1
32	coil	100uH	DE1207-100	2
33	coil	22uH	DE0702-22	1
34	quartz	8M	ABM3B-8MHZ	1
35	resistor	32k	SMQ32S	1
36	resistor	10k	0805	9
37	resistor	470	0805	1
38	resistor	10k	1206	22
39	resistor	10	0805	1
40	resistor	4k7	1206	7
41	resistor	100	1206	21
42	resistor	1k	1206	5
43	resistor	2k2	1206	2
44	resistor	18k	1206	1
45	resistor	22k	1206	2
46	resistor	150	1206	1
47	resistor	220	1206	1
48	resistor	47	0805	2
49	resistor	15k	1206	1
50	resistor	51k	1206	4
51	resistor	9k1	1206	1
52	resistor	3k9	1206	1
53	relay	FTR-B3	FTR-B3GA012Z	1
54	Taster	Taster	Tlacitko	1
55	IC	ULN2003D1	SO16	2
56	IC	PIC32MX460F512L	TQFP100	1
57	IC	M25P80	PSOP8	1
58	IC	24AA256-I/SM	SO8	1

59	IC	TSR1-2450	TRACO	1
60	IC	LF33CDT	TO252	1
61	IC	LM2576-ADJ	TO263/5	2
62	IC	74HC04D	SO14	1

OM2000A+ BOX

Item No.	Type	Description		Qty.
1	condensator	1M /16v tantal	1206	4
2	condensator	10n/50V	1206	7
3	condensator	100n/50V	1206	19
4	condensator	10µF /16V	SMD A tantal	3
5	diode	LL4148	MINIMELF	4
6	diode	ZD 33V	SOD80	1
7	IC	MCP23008	SO18	2
8	connector	TCVR	SUB-D_9pol	1
9	connector	PC	SUB-D_9pol	1
10	connector	Print-connector_Pin1,1mm	Jack 3,5	1
11	IC	X-PORT	X-PORT	1
12	connector	LOGIC	LH16S	1
13	connector	CONTROL	SUB-D-15	1
14	connector	ANT+BPF	SUB-D-15-BU-ST	1
15	connector	KEY OUT	CINCH	1
16	connector	KEY IN	CINCH	1
17	connector	2X08-90	2X08-90	1
18	connector	2X08	2X08	1
19	coil	BLM31AJ601	1206	19
20	resistor	10K	1206	21
21	resistor	22	1206	1
22	resistor	1k	1206	1
23	resistor	2k2	1206	1
24	resistor	22k	1206	1
25	transistor	BSS123	SOT23/3	4
26	transistor	BCX55-16	SOT89	1
27	transistor	BC807	SOT23/3	1
28	IC	MAX232CWE	SO16	1
29	IC	74HC257D	SO16	1
30	IC	74HC00D	SO14	1
31	IC	LF33CDT	TO252	1
32	IC	TLC272CD	SO8_SOT96-1	1
33	IC	ICL7660SCPA	SO8_SOT96-1	1
34	IC	MCP4726	SOT23/6	1

OM2000A+ INPUT

Item No.	Type	Description		Qty.
1	condensator	2M2 / 20V	SMD-B tantal	2
3	condensator	100n	1206	11
4	condensator	2,2	1210	1
5	condensator	10	1210	1
6	condensator	47	1206	2
7	condensator	10n	1206	4
8	condensator	59	1210	1
9	condensator	76	1210	1
10	condensator	0	1210	1
11	condensator	10n	grid5,08	2
12	condensator	2n7	2010	1
13	condensator	4,7	1210	1
14	condensator	22	1210	2
19	diode	TS4148	1206-D	3
20	diode	LL4148	MINIMELF_DIODE	4
21	diode	BAT46	MINIMELF	2
22	diode	SM4007	MELF	1
23	connector	INPUT	DS1014-20MF1B	1
24	connector	C1x2	1X02	1
25	connector	INPUT		1
26	connector	OUTPUT		1
27	connector	BIAS	1X01	1
28	connector	1810.4021 4mm Test jack	1X01	1
29	connector	TEMP	1X03	1
31	coil	BLM31AJ601	1206	1
32	coil	air coil	2512	2
33	coil	air coil	L-top	1
34	coil	100µH	0207	1
36	resistor	22k	1206	1
37	resistor	1k	1206	2
38	resistor	10K	1206	3
40	resistor	5,6K	4X12R15,24	1
41	resistor	8k2	1206	1
42	resistor	100	1206	1
43	resistor	22	1206	1
45	resistor	12k	1206	1
46	relay	G6K-2F-12DC	Omron_G6K-2F	3
47	IC	NE592N	SOIC8	1
48	IC	74AHC14	SO14	1

OM2000A+ OUTPUT

Item No.	Type	Description		Qty.
1	condensator	100nF	1206	4
2	condensator	100nF	4X8R5,08	2
3	condensator	100	1206	2
4	condensator	1n	4X8R5,08	2
5	condensator	1n	1206	2
6	diode	SM4001	MELF	1
7	diode	4,7V	MINIMELF_DIODE	2
8	diode	SN020-30	1206	1
9	connector	OUTPUT	LH10S	1
10	connector	Rele OUT	SL-MTA/2.54/2POL	1
11	connector	PROBE	1X01	1
12	connector	ANT SW	1X01	1
13	coil	BLM31	1206	6
14	coil	BLM31	0207	1
15	coil	100uH	0207_MET	1
16	resistor	10K	1206	5
17	resistor	1k	1206	3
18	transistor	BCX53	SOT89	1
19	transistor	BC817	SOT23/3	1
20	IC	74HC14D	SO14	1

OM2000A+ SW ON

Item No.	Type	Description		Qty.
1	diode	DB157S	D70	2
2	diode	S80	SO4	1
3	condensator	100n	1206	21
4	condensator	1mF / 35V	D13R5,08_ELKO	1
5	condensator	47n	5X18_grid15,24	2
6	condensator	10µF / 20V	SMD B tantal	6
7	condensator	2n2	4X9R7,62	1
8	condensator	100nF	4X8R5,08	3
9	condensator	47µF	D13R5,08_ELKO	2
10	condensator	100	1206	2
11	condensator	10nF	1206	4
12	condensator	1nF	1206	3
13	condensator	10uF /25V	SMC tantal	1
14	diode	LL4148	MINIMELF_DIODE	3
15	diode	SKL34	MINIMELF_DIODE	2
16	diode	ZD 5V1	SOD80	1
17	diode	ZD 8V	SOD80	1
18	diode	ZD 3V3	MINIMELF_DIODE	1
19	fuse	T500mA	SICHERUNG	2
20	fuse	T3,15	SICHERUNG-	1
21	fuse	T2A	SICHERUNG-	1
22	fuse	10A	Fuse 3568	1

23	connector	DC 24V	PSS254/3G	1
24	connector	AC 24V	PH4	1
25	connector	256-402_332-000	102K	1
26	connector	256-405	256-405	1
27	connector	256-402_332-000	250-502	1
28	connector	256-405	256-405	1
29	connector	BLOWER	PSS254/4G	1
30	connector	COVER SW	PSS254/2G	1
31	connector	Ext. fan	PSS254/2G	1
32	connector	12V	PSS254/2G	1
33	connector	AC 105 V	SL-MTA	1
34	connector	AC 9V	STIFTLE	1
35	connector	Heat	STIFTLE	1
36	connector	BIAS	PSS254/2G	1
37	connector	SW ON	HD16-S	1
38	connector	HV SUPP	HD16-S	1
39	coil	BLM31AJ601	1206	6
40	resistor	4K7	1206	7
41	resistor	10 / 15w	9X38R50,8	1
42	resistor	1k	1206	4
43	resistor	10k	1206	4
44	resistor	1k2	1206	1
45	resistor	560	4X12R15,24	1
46	resistor	100	1206	6
47	resistor	100k	4X12R15,24	2
48	resistor	2k2 / 3w	4X12R15,24	1
49	resistor	160k	1206	3
50	resistor	100K	1206	9
51	resistor	5K1	1206	1
52	resistor	10k	5X12R15,24	1
53	resistor	33k	0207	1
54	resistor	51k	1206	1
55	resistor	100k	0207	3
56	resistor	100	0207	1
57	resistor	3k9	1206	1
58	resistor	1k3	1206	1
59	resistor	M15	1206	1
60	resistor	5k	TRIMMER_23B	1
61	resistor	2k2	1206	1
62	relay	FTR K1	G2RL-1-E	3
63	transistor	BCX55-16	SOT89	2
64	transistor	BCX53	SOT89	1
66	transistor	MJD127	SOT89	1
67	transistor	BU806	TO220_lying	1
68	transistor	FZT956	SOT223	1
69	supply	47154	MYRRA	1
70	IC	BV2010136	T-EE20-2	1
71	IC	ICL7660ACPA	SO8	1
72	IC	MCP4017T-50k	SC70-6	1
73	IC	LM358AD	SO8_SOT96-1	3
74	IC	TA78L08F	SOT89	1

75	IC	TA78L33F	SOT89	1
76	IC	LM4040-5V	SOT23/3	1

OM2000A+ HV SUPPLY

Item No.	Type	Description		Qty.
1	diode	KBU8J	BRUECKE-KBU_Diotec	4
2	diode	B380C	Bridge_round_grid5,08	1
3	condensator	330µF	D35R10,16_ELKO	8
4	condensator	10nF	6X14R10,16	4
5	condensator	10nF/1kV	6X14R10,16	4
6	condensator	100nF	4X8R5,08	2
7	condensator	3n3	4X8R5,08	1
8	condensator	10n/500V	4X8R5,08	1
9	condensator	10n	4X8R5,08	1
10	condensator	47µF	D17R7,62_ELKO	2
11	condensator	100nF/1kV	4X8R5,08	1
12	diode	BZW06 12B	DO41	1
13	diode	18v	DO41	1
14	diode	20V	DO41	1
15	diode	30V	DO41	1
16	diode	1N5363	DO41	1
17	diode	BZW06 10B	DO41	1
18	Fuse	T2A	SICHERUNG-HALTER-GESCHLOSSEN 26X9,5	4
19	Fuse	1A	SICHERUNG-HALTER-ISOLIERT_5X20	1
20	connector	MOLEX_0952-1086	PH04	1
21	connector	640456-4	SL-MTA/2.54/4POL	1
22	connector	+3000V	1X01	1
23	connector	AC 310V	FEDERKRAFTKLEMME601_2	1
24	connector	HV SUPPLY	HD16-S	1
25	resistor	150k	5X12R15,24	9
26	resistor	4R7 / 15w	9X50R55,88	1
27	resistor	5K	PT10LH	1
28	resistor	3R3 /15w	9X50R55,88	1
29	resistor	1M	4X12R15,24	3
30	resistor	10k	0207	1
31	resistor	10	4X12R15,24	1
32	resistor	220	4X12R15,24	1
33	resistor	100	0207_MET	1
34	resistor	10	0207_MET	1
35	resistor	1k	0207_MET	1
36	resistor	150k	0207	1
37	resistor	10	5X12R15,24	1
38	resistor	1k	4X12R15,24	1
39	relay	SY-12W	RELAIS-SY	1

OM2000A+ SWR

Item No.	Type	Description		Qty.
1	connector	Cinch-connecting-port_2-polar	SO239	1
2	condensator	4,7	C_RM5,08	1
3	condensator	120	C_RM5,08	1
4	condensator	1n	C_RM5,08	6
5	condensator	30	C_RM5,08	1
6	diode	BAT41	DO35	4
7	connector	C1x3	1X03	1
8	coil	1000µH	0207	1
9	resistor	100	R 2W	4
10	resistor	330K	0204	2
11	resistor	68K	0204	2

OM2000A+ G2

Item No.	Type	Description		Qty.
1	condensator	10n/1kV	C_RM5,08	1
2	condensator	1M/450V	C_RM5,08	1
3	condensator	100n	C_RM5,08	3
4	condensator	10n/500V	C_GRID5,08	1
5	SUPRESOR	SUPRESOR		1
6	diode	1N5380	DO201AD	2
7	diode	1N5349	DO201AD	1
8	diode	BZW 06-12B	DO41	2
9	diode	BZW 06-12B	D_RM12,7_DM3	1
10	diode	1N5349	DO201AD	1
11	diode	1N5408	267-03	1
12	Fuse	250mA	Fuse-clip_5x22	1
13	connector	C1x2	1X02	1
14	connector	C1x4	1X04	1
15	connector	C1x1	1X01	2
16	resistor	1k	0206	1
17	resistor	82/2w	R 2W	1
18	resistor	100k	R 2W	1
19	resistor	18k / 10W	0207	1
20	resistor	68/2w	R 2W	1
21	resistor	1M	R 2W	1
22	resistor	33k	0206	1
23	resistor	220/2w	0207	1
24	resistor	100	0207	2
25	resistor	1k	0207	1
26	transistor	IRFPG50PBF	TO247	2
27	opto	PC817	DIL4	1