L3-3 CARDS

These cards are used in our company to test tubes with the L3-3 Tester. Though they probably work on previous versions as well, we tested them only on L3-3.

HOW TO

How these cards are used is explained in more detail on the JACMUSIC website.

WHAT DO YOU RECEIVE

As pdf file:

1. All our Tube Test cards
2. All our Technical Cards
3. A copy of all original Russian cards
4. All manuals for as far as we have them.
5. Some extra data files you may like.

DISCLAIMER

Please use these cards only to SEE how we test our tubes. Using these cards on your own tester is on your own risk, and we do not guarantee their good functioning. Even so, we say, these cards may have, and probably will have errors.

UPGRADES

Buyers of the CD, or the download link, have a few options:

- If you need any of the cards which are not included in an older package, please ask. Probably we send them for free by email.
- Within a period of 3 years after purchase, you can upgrade one time for half the price,
- EML Index testing is included in V58 or higher.

GENERAL INFORMATION ABOUT THE L3-3 TUBE TESTER

Revised text version, of Febr 21st. 2024 - **Cards Version V58**

- **Quality** of the L3-3 is a dream. It has no known design errors or weakness. The deck can be opened, like the lid of a box, and there is easy access to all if its internal parts, also from the side panels. Circuitry is from the school books, without compromise on quality. If something would be "better", you name it, and L3-3 has it. Which even includes a sharp band filter to remove tube hum and tube distortion from the Gm measurement, and a tube based DC nano ampere meter. Most of all, these circuits all work flawless, and seem to need no service of repair, still after all those years.
- **Electrical safety**. This is a subject for itself, and you need to be aware, the tube sockets, and also card pins, can be under lethal voltage. The intended use of L3-3 was in the 1980's, for technical specialists who know how to deal with this. Today of course, such a product would require modern safety standards, which the L3-3 does not have. So regard this text a safety warning, in addition the manufacturer instructions.
- **For legal reasons**, we have to express the following. Hopefully you understand the reasons for it. The cards we offer, we do not sell those as a safe to use product. It is possible there is an issue with the cards we may not be aware of. For these reasons, we offer those cards only, so you can see, what we use internally at the JACMUSIC company.
- **How we use those cards at our company:** Never plug or unplug card pins or tubes, when the tester is switched on. It is not ideal for the tubes inside, switching on and off the tester every time, but some of the card pins have very dangerous voltages on them, up to 1100 Volts AC between some of the card pins.
- Moreover, when plugging a card pin by pin, with the tester switched on, at some point there is a situation with half of the pins missing, and nobody can say how the tester will respond to such a (crazy) programming situation. For that reason alone, the tester should always be switched off before plugging or unplugging a card.
- When the card is plugged, first the voltage settings has to be done, before inserting a tube.
- Before using self-made cards, be sure you are fully confident with the L3-3 as it is. This is done by practicing with the original Russian cards, supplied with the tester.
- Moreover, you should carefully read the manufacturer manual of the L3-3, and not self-study the use of this tester, like learning by doing.

SOME NOTES ABOUT GM TESTING

- **Gm Testing.** Tubes have not just one Gm value, because Gm changes quite a lot, when plate current changes. To measure the Gm value of a tube, is only possible if the plate current which belongs to it, is specified. If the plate current is random, measuring an accordingly random Gm value makes no sense. In the same way, it is totally wrong take the "average grid voltage" and by this allow the plate current to have any random value, anywhere from 70% to 140%, and measure Gm like this. This is essentially wrong, and you will find this method in no literature or data sheet, for obvious reasons. Curiously however some digital tube testers work this way, but nobody seems to know why this was done.

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EMISSIONLABS is our tubes brand

- **TOLERANCE.** Factory new tubes, with 100% emission, do NOT have tolerance of Plate Current, but what you see is tolerance of the grid voltage, causing plate current to change. This is not a matter of "how you see it" because if at the SPECIFIED plate current, the tube has the SPECIFIED Gm, it is nicely up to the specifications, Whereas at fixed grid voltage, the plate current will be random, and so you will find random Gm. Read also the next text part about Emission, where this comes in more depth.

WHAT IS EMISSION?

Please note, we have added a special emission test to all cards where this is possible.

Emission is the maximum current capacity of the cathode, regardless any overload. This is done in the tube factory, and it may be done only once, and very short. This test may not be repeated.

So any emission test, at a later moment, is always an approximation of the above, using normal test conditions. I think we found quite a good way here, at the our company, and we have included it in these test cards, by the end of 2023. This method has resulted from analyzing 1000's of Emissionlabs tubes, of which we have collected the tube data in an Excel file, over 25 years of production, allowing to analyze what gives the best information about the emission of the tube. Also we listened very well to the historic words of Max Funke, in his blue book. He basically says, a used tube was found to be good by the tube factory when it was made. All we need to know, is the emission still the same. If yes, the tube is unchanged, and for that reason still good. Provided, it is a REAL emission test. It should be no fake emission test, such as measuring plate current at fixed grid voltage, which is pure nonsense.

When is a tube bad? Well, a good tube works without problems, and a bad tube will not. The question is rather about the remaining life time of a good, but used tube. It stays a fact that the hours it has run before, are permanently gone. How much lifetime is left, is best recognized by the emission, and not very good by any other factor. The most useless factor of all, is plate current at fixed grid voltage. Though people LOVE to do this, but really it is of little value. This method can not keep used and new tubes apart very well.

During tube wear out, at first Gm begin to decrease, which is normal. This will cause no problem, as long as tube gain is still good. Loss of Gm is compensated by the plate impedance (Rp) going up, since

Gain = Rp * Gm

Tubes with some loss of Gm will work normal, until the point has come that gain begins to drop as well. This definitely ends the use of the tube.

The advantage of the emission test is, it can not be fooled by the gain staying constant, or by anode current being higher or lower. If you look at the formula below, you will not find plate current in there and also not gain. We have not patented this, but it works so well!

We called it the Emission Level (EML) Index.

The formula for this is:

Emission (%) = Gm * -Grid Voltage * CF.

CF is a correction factor, which is calculated specifically for each tube. For instance for 6SN7 the formula is:

Emission (%) = Gm * -Ug * 5.048.

Gm and Ug for this formula have to be tested at the specified data sheet plate current. Gm expressed in mA/V.

The test cards have the specific correction factor printed on it, for each tube.

Here are some numeric examples for 6SN7, using this formula:

Unused 6SN7 by the RCA data sheet, needs Ug=-8V, to have 9mA at 250V, and Gm is 2.6m/V. Entering this data gives: 2.6 * 8 * 5.048 = 105%. The result is 105%, because new tubes have a small over-performance.

The formula for each tube, is printed on the card. Measure Ug and Gm as you should, and enter these numbers in the formula, the result is directly the emission in percent.

LIFETIME TESTS

In addition, we have also made "Lifetime Test" cards for many tubes, which is a more easy and fast method, which needs only a short warm up period and only little adjustment. So you can just replace one tube by the other, and get results quickly. You can already see the result while the tube is warming up, and when the needle becomes stabile, you can read the result. There is no faster way. Apart from that, lifetime test cards can also be used for burn in, because they work with auto bias, and need less attention.

In honor to Max Funke once more, we have made a simulation of some of his W19 cards. (W19 was the last model). So result are like: "*Good if plate current is above …*". Just to demonstrate this genius method, but these are good, and working cards. You can compare it with the results of the usual cards of the L3-3.

CARD PRINTING

- For convenience, each card has its own pdf file.
- No printer prints exactly at the intended size. Most of them will print some 3% too small or too large. To solve this, use the scaling factor of your printer, to adapt the card size exactly. For instance print at 103% of the size, to make the cards 3% larger.
- Initially, just print the cards on office paper, and pick the test pins through the paper. You can test if the card works well. If you like a specific card, print it on photo paper, or 120 Gramm paper, or plastify a printed office paper card.

CARD HOLE PUNCHING

Use a 3mm hole punch tool. With 3mm, the punch holes do not need to be positioned very precise, and yet the card plugs fit nice. Two addresses for good hand cutter tools are supplied with the CD. Alternatively, you can buy simple 3mm punch tool on Ebay, of the kind which needs a hammer. These cost just 3 Euro or so, it works slower than a hand-cutter, but is ok for a start.

TUBE TEST CARDS. VERSION V57 OR HIGHER

0B2 #082 Voltage Reference Tube

0B2 #082 Voltage Reference Tube
0C3 #033 Voltage Stabilizer Tube
0G3 #053 Voltage Reference Tube
2A3 (on 2.5V tap) #001 Adjustable Bias
2A3 (on 3V tap) #119 Adjustable Bias
2A3 (on 2.5V tap) #106 Auto Bias, Life Test
2A3 (on 3V tap) #120 Auto Bias, Life Test
2A3 (on 2.5V tap) #107 External Bias
2A3 #121 External / 3V tap
2A3 Grid cleaning #171 Rejunivation Card
2C22 #063 Adjustable Bias
5U4G #039 Limited Test Time!
5Z3 #083 Limited Test Time!
6AS7 #099 Adjustable Bias
6BR7 #062 Adjustable Bias
6C19 #076 Adjustable Bias
6C19 #075 Mixed Bias
6C45-EH-G #002 Adjustable Bias
6CG7 #199 Adjustable Bias
6CG7 #200 Auto Bias, Life Test
6H30 #003 Adjustable Bias
6L6 #004 Adjustable Bias
6L6 #087 Auto Bias, Life Test
6N6P #143 Adjustable Bias
6SJ7 #155 Adjustable Bias
6AH4 #141 Adjustable Bias
6SL7 #005 Adjustable Bias
6SL7 #090 Auto Bias, Life Test
6SN7 #006 Adjustable Bias
6SN7 #072 Auto Bias, Life Test
6SN7 #103 Rejunivation Card
6WG7 #181 Adjustable Bias
6X4 #146 Forward Voltage Test
6X4 #043 Limited Test Time!
6X5 #175 Forward Voltage Test
6X5 #177 Limited Test Time!
6X5 #176 Limited Test Time!
7F7 #163 Adjustable Bias
7F7 #164 Auto Bias, Life Test
7N7 #165 Adjustable Bias
7N7 #166 Auto Bias, Life Test
10, 10Y #092 Adjustable Bias, 250V
10, 10Y #100 Adjustable Bias, 425V
10, 10Y #110 External Bias
12AY7 #187 Adjustable Bias
12BH7 #147 Adjustable Bias
12SJ7 #126 Adjustable Bias
12SL7 #156 Adjustable Bias
12SL7 #157 Auto Bias, Life Test
12SN7 #158 Adjustable Bias
12SN7 #159 Auto Bias, Life Test
14F7 #161 Adjustable Bias
14F7 #162 Auto Bias, Life Test
20B #093 Adjustable Bias
20B-V4 #094 Adjustable Bias
45 #008 Adjustable Bias
45 #108 External Bias
71A #061 Adjustable Bias
83 Pre-Heat #136 Limited Test Time!
83 Final Test #137 Limited Test Time!
101D #045 Adjustable Bias
102D #049 Adjustable Bias
205D #048 Adjustable Bias
211 #129 Adjustable Bias

211 and 845 #131 Rejunivation Card1
211 and 845 #132 Rejunivation Card2
274A and 80 #040 Limited Test Time!
274B #041 Limited Test Time!
300B #009 Adjustable Bias
300B #122 Auto Bias, Life Test
300B #109 External Bias
300B Grid cleaning #172 Rejunivation Card
408A #014 Adjustable Bias
717A #010 Adjustable Bias
807 #134 Adjustable Bias
845 #130 Adjustable Bias
1626 #196 Adjustable Bias
4654 #115 Adjustable Bias
5687 #012 Adjustable Bias
5687 #104 W19-Emission Test
5751 #013 Adjustable Bias
5751 #007 Auto Bias, Life Test
6414 / 0528 #186 Adjustable Bias
6414 / 0528 #185 Auto Bias, Life Test
6414 / 0528 #176 W19-Emission Test
6550 #011 Adjustable Bias
6550 #084 Adjustable Bias
18042 #212 Mixed Bias
18042 #213 Adjustable Bias
AD1 #015 Adjustable Bias
AZ1 #194 Limited Test Time!
AZ4 #195 Rectifier, limit test time!
C3g #074 Adjustable Bias
C3g #054 Auto Bias, Life Test
C3m #055 Adjustable Bias
C3m #017 Auto Bias, Life Test
C3o #097 Adjustable Bias
C3o #098 Auto Bias, Life Test
D3a #138 Adjustable Bias, Pentode
D3a #140 Adjustable Bias, Triode
D3a #139 Auto Bias, Triode
E80CC #113 Adjustable Bias
E83CC #066 Adjustable Bias
E83CC #067 Auto Bias, Life Test
E83F #208 Mixed Bias
E83F #211 Adjustable Bias
E88CC #023 Adjustable Bias
E88CC #056 Auto Bias, Life Test
E88CC #070 W19-Emission Test
E182CC #065 Adjustable Bias
E182CC #127 Cut Off Test
E188CC #044 Adjustable Bias
E283CC #050 Adjustable Bias
EC86 #160 Adjustable Bias
EC8010 #173 Adjustable Bias
ECC32 #111 Adjustable Bias
ECC33 #169 Adjustable Bias
ECC81 #018 Adjustable Bias
ECC81 #088 Auto Bias, Life Test
ECC81 #153 W19-Emission Test
ECC82 #019 Adjustable Bias
ECC82 #091 Auto Bias, Life Test
ECC82 #154 W19-Emission Test
ECC83 #020 Adjustable Bias
ECC83 #081 Auto Bias, Life Test
ECC83 #085 W19-Emission Test
ECC84 #021 Adjustable Bias
ECC85 #022 Adjustable Bias

ECC99 #086 Adjustable Bias
ECC801S #089 Auto Bias, Life Test
ECC802S #101 Auto Bias, Life Test
ECC808 #128 Adjustable Bias
EF86 #102 Adjustable Bias
EL8 #024 Adjustable Bias
EL11 #025 Adjustable Bias
EL34 #027 Adjustable Bias 25W
EL34 #116 Adjustable Bias 25W
EL34 #026 Adjustable Bias 17.5W
EL34 #028 Auto Bias 25Watt
EL84 #029 Adjustable Bias
EL84 #118 Adjustable Bias
EL84 #030 Auto Bias 9W
EM34 #105
GU50 #031 Adjustable Bias 35 Watt
GZ34 #042 Limited Test Time!
KT66 #069 Adjustable Bias
KT66 #112 Adjustable Bias
KT66 #114 Auto Bias, Life Test
KT88 #032 Adjustable Bias
KT88 #125 Adjustable Bias
KT88 DEMO CARD #206 Adjustable Bias
KT88 #079 Adjustable Bias 25W
KT88 #135 Cut off Test, TESLA
KT88 #080 Auto Bias 40Watt
KT88 #073 Auto Bias, Life Test
Lab Card1 #181 With current limiting
Lab Card2 #182 UNTESTED
Lab Card3 #167 For EE12 Board, 6.3V
Lab Card4 #168 For EE12 Board, 12.6V
PC86 #047 Adjustable Bias
PCC88 #148 Adjustable Bias
PCC88 #149 Auto Bias, Life Test
PCC88 #150 W19-Emission Test
PX4-UX4 #034 Adjustable Bias
PX4-UX4 #209 Adjustable Bias
PX25 #035 Adjustable Bias
PX25-UX4 #210 Adjustable Bias
RE084 #036 Adjustable Bias
RE134 #037 Adjustable Bias
RE604 #205 Adjustable Bias
REN904 #202 Adjustable Bias
REN1004 #201 Adjustable Bias
REN1104 #203 Adjustable Bias
REN1814 #207 Adjustable Bias
REN1822 #204 Adjustable Bias
RES094 #197 Adjustable Bias
RES964 #198 Adjustable Bias
RGN1064 #038 Limited Test Time!
RS242 #037 Adjustable Bias
RS282 #144 Adjustable Bias
RS282 #145 Diode Mode
VT25A #095 Adjustable Bias

VT52 #096 ADJUSTABLE BIASTECHNICAL CARDS

Lab Card1 #121 With current limiting
Lab Card2 #xxx UNTESTED
Lab Card3 #167 For EE12 Board, 6.3V
Lab Card4 #168 For EE12 Board, 12.6V
211 and 845 #131 Rejunivation Card1
211 and 845 #132 Rejunivation Card2
6SN7 #103 Rejunivation Card

UNIVERSAL CARD in color, with text.
Instruction Card #3. Grid Leakage Test
Instruction Card #4. Cathode to heater Test
Self-Test Card #5. Transformer test Part1
Self-Test Card #6. Transformer test Part2
Self-Test Card #7. Reference Voltages, and oscillator test.