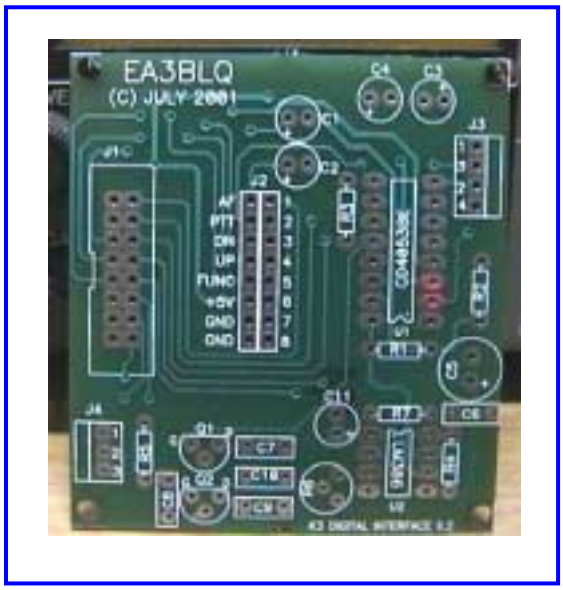
CONSTRUCTION MANUAL FOR THE K2 DIGITAL INTERFACE v.II.2

Mike Configuration Header Extender
and
Rear Panel Data Connector for the K2
(Non battery and/or non KAF2-KDSP2 setups)
and mainly for the Integrated K2/100

(Plus other useful features)



By Paulí Núñez, EA3BLQ

K2 DIGITAL INTERFACE v.II.2

Featuring a Mike Configuration Header Extender and Rear Panel Data Connector

(It includes a buffered, fixed audio output and the cutting of Front Panel mike connector's AF and PTT lines, when transmitting data).

By Paulí Núñez, EA3BLQ © June 2005

Overview

This printed circuit board was designed on July 2001, when I had it installed and working in my K2. At the same time, Jay Rutherford, K1UC, did the field test of the project for me, with good results I might say. Hi Jay, thank you for your invaluable help!

At the time Elecraft had not yet released the KAF2 nor the KDSP2 options an thus there was some room available within the K2 to install the D.I. as I did, but the time came when Elecraft made the KAF2 available and, as I had all the options installed, I ordered it. I constructed the option and I installed it. The KAF2 works fine business but ... Oh dear! ... I had to uninstall my Digital Interface as it collided with the new option. ;-(Latter, I also constructed and installed the KDSP2 with the same results.

My premonitions had come true; the K2 was so stuffed with all its options and cables that there seemed to be little, if any, room left for an alien option or modification.

The leitmotif was still alive in me but the how and where had not been solved yet. I thought about installing the PCB within an external low profile enclosure, together with a selectable RS232 or VOX PTT control and it was on November 2003 when a light was lit in my brain and I found the way on how to install a new design of the Digital Interface, the K2DI v.III, which at the same time gave birth to a daughter board, the Computer Interface K2DI-PCI, featuring a selectable RS232 or VOX PTT control. Both PCBs may be installed within the standard qrp version of the K2 or the split K2-KPA100 set-ups but not so much so in the Integrated K2/100. You may find ample information on those PCBs elsewhere in my web site.

But … what about the Integrated K2/100? I had to find a way to implement my project within the Integrated K2/100. After some days of thought a sudden idea came to life. Why not use the K2DI v.II.2?

Well, to cut a long story short, currently this PCB, the K2DI v.II.2, is valid only for those K2rs that have not installed and do not intend to install the KAF2/KDSP2 options or the internal battery option and last but not least, **it is a very good option for the Integrated K2/100 !!.**

K2 Digital Interface II.2 for the Integrated K2/100.

The following text and pictures are the result of my efforts to reach that goal: *The K2 Digital Interface II.2* that features a Mike Configuration Header Extender and Rear Panel Data Connector, as well as a buffered, fixed audio output and the cutting of Front Panel mike connector's AF and PTT lines, when transmitting data.

Buffered, fixed audio output:

In this version of my PCB and for consistency sake, I decided to copy the Elecraft's original K2 Audio Amplifier circuit to feed U2, the AF amplifier (LM386N) and to control its audio level. The use of a couple of J310 FET (Q1 and Q2), biased through a 3.3 MOhm resistor, as in the K2, is very useful as it allows the disconnection of the AF amplifier from the product detector on data transmission, thus getting the K2's featured clean QSK.

Cutting the Front Panel mike connector's AF and PTT lines and muting the AF amplifier, when transmitting data:

Due to its low current drain and its switching features, I've chosen the use of a CD4053BE CMOS Analog Multiplexer to cut and commute the AF and PTT lines from the Front Panel Mic Connector to the Rear Digital Connector, when transmitting data, and to disconnect U2, the audio amplifier LM386, from the product detector by grounding the gates of Q1 and Q2, following Elecraft's design.

In the circuit schematic shown on next page, by default, the multiplexer mosfets are biased high due to pins 9, 10 and 11 of U1, CD4053BE CMOS, being fed with 5V DC through R3 (a 10K resistor). In this way we have:

a) The ground connected at pin 14 of U1 (a) goes nowhere as pin 13 has no connection.

b) The signal from the AF pin at J1 goes to the AF pin in J2 through pins 15 and 1 of U1 (b) and

c) The signal from the PTT pin at J1 goes to the PTT pin at J2 through pins 4 and 3 of U1 (c), thus the Front Panel AF and PTT lines are enabled.

Because of the DC component (2. 5 V fed through R1 and R2) present in the U1 (b), three 10 µF electrolytic capacitors (one inlet and two outlets of U1) are needed to decouple the DC from the signal.

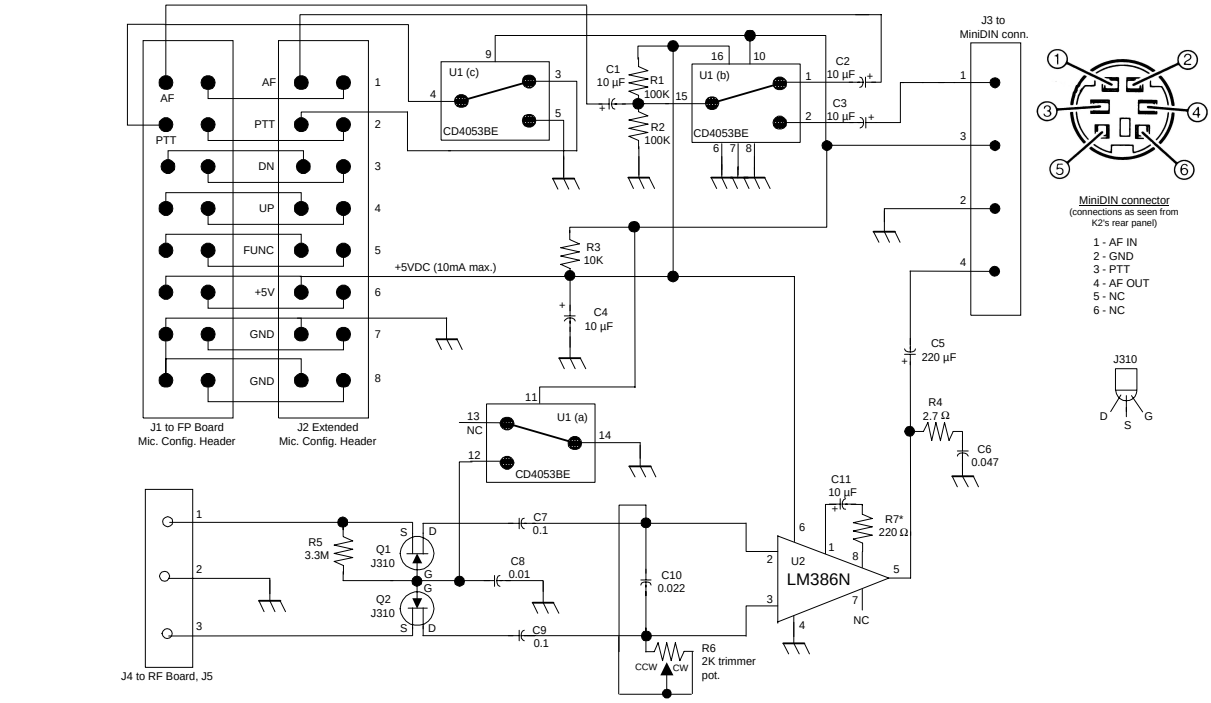
When the PTT is keyed through the Rear Data Connector, because of data transmission, pins 9, 10 and 11 of U1, CD4053BE, are grounded through pin 3 at J3. Then the voltage at those pins drops to 0 V., setting the multiplexer mosfets low and thus three switching operations are activated:

1) U1 (a) - Switches pin 14 from pin 13 to pin 12 and grounds the gates of Q1 and Q2, setting them low and thus disconnecting the AF amplifier.
2) U1 (b) - Switches pin 15 from pin 1 to pin 2, connecting the outgoing AF signal from J1 to pin1 of the MiniDIN connector, through pin 1 of J3. The unwanted signal coming from the AF pin at J2 (if any) has no way out.
3) U1 (c) - Switches pin 4 from pin 3 to pin 5, keying the rig by grounding the PTT pin at J1 and disconnecting the PTT line at J2

CAUTION:

- Avoid triggering the K2 PTT through the KI/O2 by means of some program's CAT facility. If you do, the K2DI v.II.2 WILL NOT be activated and the Digital transmission WILL NOT take place. PTT keying must always be attained by grounding pin 3 at J4 or the chassis MiniDIN connector by means of an external computer interface or the optional K2DI-PCI if installed within the K2/100.

SCHEMATIC



Note: All resistors are 1/4 watt and their value is in ohms; K = 1,000 and M = 1,000,000
Decimal values of capacitance are in microfarads (µF)
NC = No connection
See text for comments on R7*

K2 DIGITAL INTERFACE II.2
Featuring a Mic. Configuration Header Extender and Rear Panel Data Connector
(It Includes a buffered, fixed audio output and the cutting of Front Panel mic. connector's AF and PTT lines, when transmitting data).

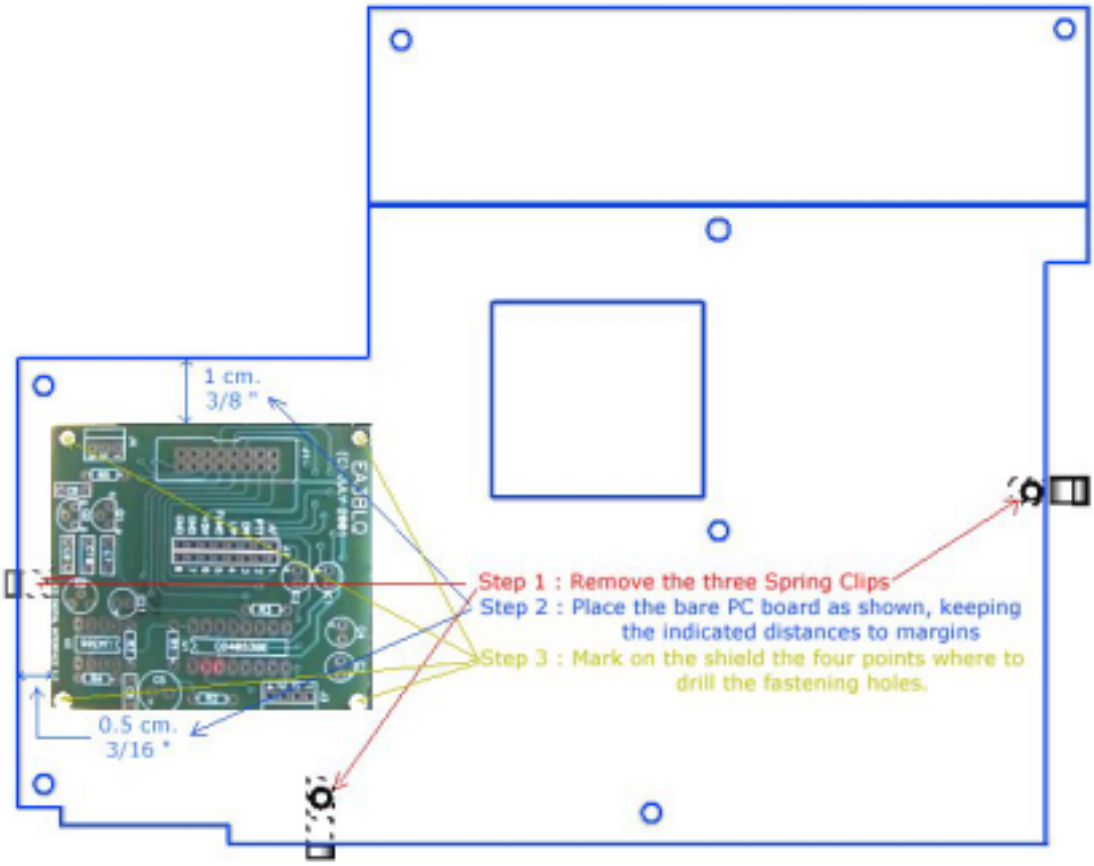
PRINTED CIRCUIT BOARD

Most important:

Before soldering any components to the board please use the bare PCB as a template and place it on the KPA100 shield, allowing some clear space between the edges of the PCB and those of the KPA100 shield (see graphic bellow) and, using a permanent waterproof ink felt-tipped pen, clearly mark the position of the PCB's mounting holes on the shield, where you will have to drill the corresponding holes.

The kit provides 4 Metric3 screws and their nuts to be used, together with the four nylon separators, to secure the PCB to the KPA100 shield. If possible, I strongly recommend that the drilled holes be screw threaded so that the use of nuts becomes unnecessary. In this way, whenever you need or wish to remove the K2DI you will not need to previously remove the shield from the KPA100.

When positioning the PCB on the shield, kindly remember that the J1 and J4 connectors must face the KPA100 internal loudspeaker, while the edge with the "K2 Digital Interface II.2" label is to face the right side edge of the shield. The clearance between the PCB and shield edges is necessary to avoid the interference of the speaker shield and the KPA100 shield's ground spring clips. Please see more images shown in this same document.



ASSEMBLY INSTRUCTIONS

Please note that all the soldering rules, warnings and tips you have learned and used when assembling your K2, are to be applied in the assembly of this circuit too.

Install and solder components in the following order:

a) _R1, _R2 100K resistors (brown-black-yellow)

b) _R3, 10K resistor (brown-black-orange)

c) _R4, 2.7Ω resistor (red-violet-gold)

d) _R5, 3.3Mohm resistor (orange-orange-green)

e) _R6, 2K trimmer pot (3329H202). By factory default, the trimmer pot is set to its midpoint [+/- 1 Kohm] Once installed, setting R6 clockwise (CW) will increase the resistance and thus the volume level of the signal fed to U2 (LM386 audio amplifier). Obviously, to decrease the volume, R6 is to be set counter-clockwise (CCW).

f) _R7, 220Ω resistor (red-red-brown) * See text bellow for notes on this resistor.

g) _C6, 0.047µF (473) capacitor

h) _C7, _C9, 0.1µF (104) capacitors

i) _C8, 0.01µF (103) capacitor

j) _C10, 0.022µF (223) capacitor

k) _Q1, _Q2, J310 FET

l) _J1, Right angle dual raw 16 pin male connector. Note: This connector CANNOT be installed flush with the board. A gap between the base of the connector and the board must be allowed so that the ICD 16 pin female connector with the ribbon cable may be fully assembled with the male connector when installing the PCB on the K2/100. Tip: Before soldering, introduce the male connector already assembled with the ICD female connector. This will show the exact measure of the gap needed.

m) _J2, Dual row connector (16 pin male)

n) _J3, Connector w/locking tab (4 pin male)

o) _J4, Connector w/locking tab (3 pin male)

p) _C1, _C2, _C3, _C4, _C11, 10µF 16/25v electrolytic capacitors

q) _C5, 220µF 16/25v electrolytic capacitor

r) _U1, CD4053BE or HEF4053BP CMOS (16 pins)

s) _U2, LM386 low voltage audio amplifier (8pins)

(*) NOTES ON THE R7 RESISTOR'S VALUE TO CONTROL LM386's GAIN.

The manufacturer's General Description of the LM386 reads: "…The gain is internally set to 20 to keep external part count low, but the addition of an external resistor and capacitor between pins 1 and 8 will increase the gain to any value up to 200."

The factory default gain of +/-20, attained through the inner 1.35Kohm resistor allocated between pins 1 and 8 is too low for our needs.

On the other way if we externally bypass that resistor by inserting a 10µF electrolytic capacitor between those pins (+ lead to pin 1) the gain is increased to 200. Good enough to drive a 4Ω speaker but too high for the sound card, as it gets overdriven.

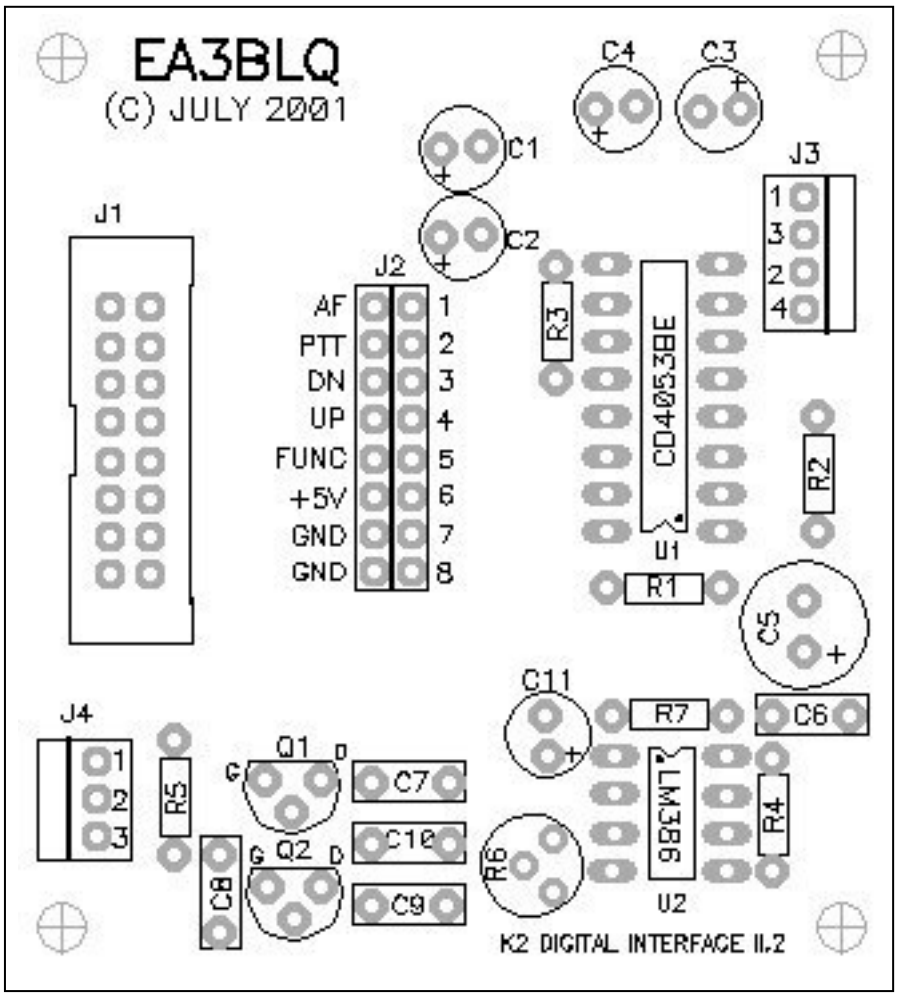
On this account and by inserting one external resistor in parallel with the inner resistor and in series with the electrolytic capacitor, between pin 8 of the IC and the (-) lead of the capacitor, we may set that gain to the level that meets with our needs, within the range of 20-200, .

As a result of some computing, I've got the following options for R7's resistor value:

1) One 1.2Kohm resistor (brown-red-red) will render a gain of about 50 (perhaps a bit on the low side)
2) One 330Ω resistor (orange-orange-brown) will render a gain of about 75
3) One 220Ω resistor (red-red-brown) will render a gain of about 90.
4) One 180Ω resistor (brown-gray-brown) will render a gain of about 100 and
5) One 100Ω resistor (brown-black-brown) will render a gain of about 125

I have chosen option #3, but the builder may choose the option he/she thinks most suitable for his/her needs and/or preferences.

K2DI v.II.2 parts placement.



EA3BLQ's K2Digital Interface v.II.2 Parts List

DESIGNATORS	VALUE	DESCRIPTION	QTY
C1, C2, C3, C4, C10	10µF 16/25v	Electrolytic or tantalum capacitor	5
C5	220µF 16/25v	Electrolytic capacitor	1
C8	.01	Capacitor "103"	1
C10	.022	Capacitor "223"	1
C6	.047	Capacitor "473"	1
C7, C9	.1	Capacitor "104"	2
J1	Right angle dual row header	16 pin male	1
J1 and Microphone. Configuration Header at Front Panel board	IDC Female connector for flat cable.	FC-16P (16 pin female dual row)	2
J2	Dual-row header	16 pin male	1
J3	Right angle connector w/locking tab	4 pin male	1
J4	Right angle connector w/locking tab	3 pin male	1
J5 at the RF board	Male header	3 pin male	1
J4 & J5 at RF board	Housing	3 pin female	2
P2 at KAF2 or KDSP2	Special male-male header(1)	2-3 pin male	1
P2 at KAF2 or KDSP2	Locking tab(1)	For the 2 pin side of the above header	1
P2 at KAF2 or KDSP2	Housing (2)	2 pin female	1
J3, J4 & J5 at RF board & P2 at KAF2 or KDSP2	Hardware	Female crimp pins for the housings	12
Q1, Q2	J310	FET TO-92	2
R4	2.7 Ω	Resistor (red-violet-gold)	1
R3	10K	Resistor (brown-black-orange)	1
R1, R2	100K	Resistor (brown-black-yellow)	2
R5	3.3 MOhm	Resistor (orange-orange-green)	1
R6	2K POT 3329H202 or T7YB	Trimmer pot for audio level adjustment	1
R7 (*)	220 Ω	Resistor (red-red-brown) See text for comments on R7 (*)	1
U1	CD4053BE or HEF4053BP	CMOS (16 pins)	1
U2	LM386N	Low Voltage Audio Amplifier (8 pins)	1
J2	Hardware	Mic Conf. Header Extender Jumpers	8
Separators	Hardware	Nylon or plastic	4
Screws	Hardware	M3 pan head screws 6mm.	4
Nuts	Hardware	M3 nuts	4
MiniDIN	Hardware	4 pin MiniDIN connector	1
Screws	Hardware	Zinc screws for the MiniDIN connector	2
J1 at K2DI and Mic. Configuration Header at the K2's Front Panel Brd.	Miscellaneous	20 cm. flat ribbon cable 16 wires	1
Dig. Interface v.II.2	Miscellaneous	Printed Circuit Board	1

(1) To be used should the AF signal be picked up from P2 at the KAF2 or KDSP2 boards instead of from J5 at the RF board. Please see the pictures section.
(2) To be used in place of one of the 3 pin female housings in case the above option is adopted.

Revision June 2005

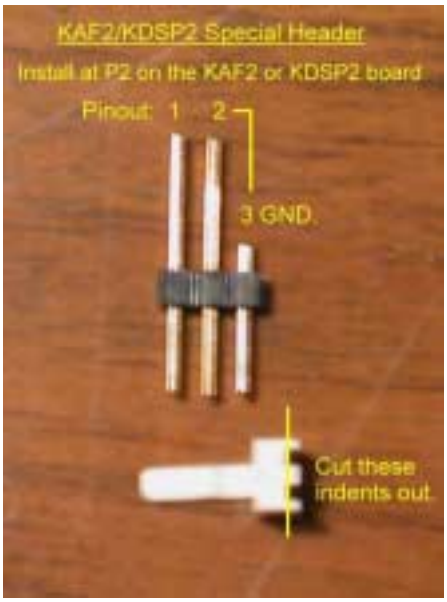
Picking the received AF signal up from P2 at the KAF2 or KDSP2 boards

Caution: If you, to take advantage of the filtering provided by either circuitry of the KAF2 or KDSP2 devices and/or because the connection for the K2DI v III.2 is handier, decide to pick the received AF signal up from the P2 connection at the KAF2 or KDSP2 boards, instead of picking it up from the auxiliary AF connection provided at J5 on the RF board, please bear in mind the following facts:

a.- In both cases the K2's audio circuit is the very same balanced one, but

b.- On the RF board, the 3 pin distribution at J5 correspond to pins 1 and 3 for the audio lines and GND is connected to pin 2.

c.- On the KAF2 or KDSP2 boards, the 3 pin distribution at P2 correspond to pins 1 and 2 for the audio lines while the GND connection is located at pin 3.



Obviously the 3 pin female connector you may prepare to connect J4 at the K2DI to J5 on the RF board *cannot* be used for connection to P2 on the KAF2/KDSP2 boards. It would produce a short.

To avoid this risk I have prepared the special male-male header shown on the image at the right, which is to substitute the one provided by Elecraft with either of their devices.

Should you have the original P2 header already installed you are to desolder it taking outmost care in the process so as not to damage the soldering pads.

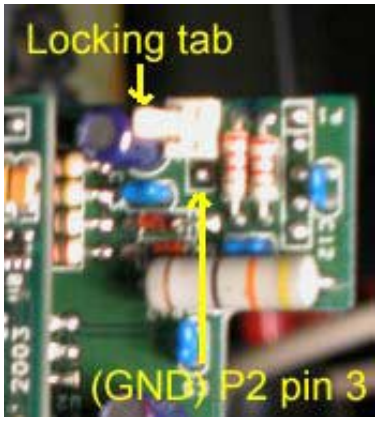
The square soldering pad corresponds to pin 1, near the down board's edge.

The special header is to be introduced for installation into the KAF2 or KDSP2 through the bottom side of the board, taking care to position its pin 1 through the square soldering pad. Check before soldering. The 3 equal pins with the plastic holder go on the bottom side. (See pictures below)

Soldering is done on the top side of the board. Before soldering check the header's positioning once again and, if it is ok, solder only pin 3. Check the positioning once again and see that the plastic holder is flush with the board and that the pins are perpendicular to the board and parallel to those of P1. If any correction is necessary please do so by reheating the pin 3 solder. If it is ok please go on soldering pins 1 and 2, but taking care to use a minimum amount of solder, just the necessary to secure a good contact between the board and the pin. Use a magnifying glass to check the joints.

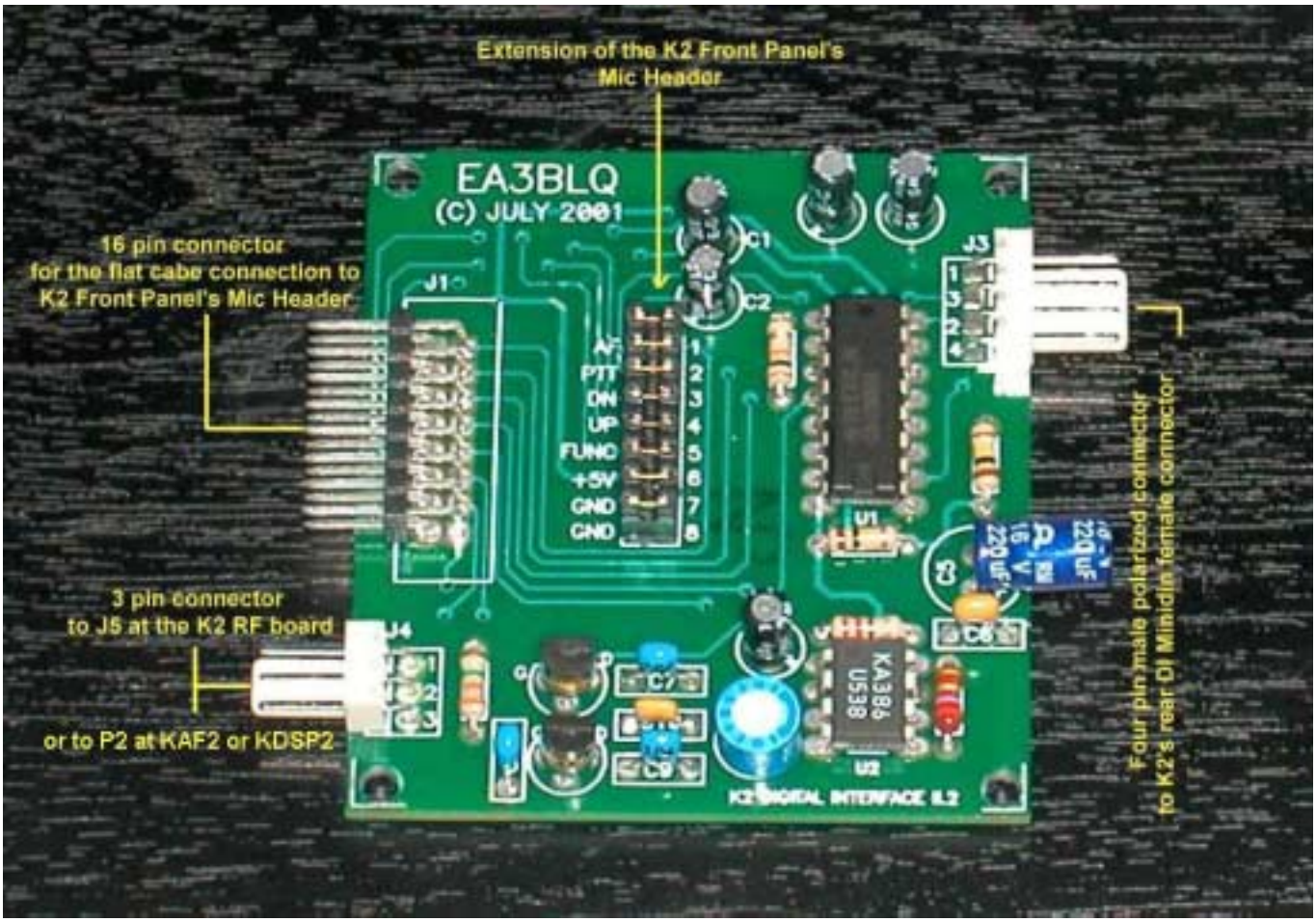
Once finished soldering please prepare the locking tab by cutting out the borders of the indents at its bottom to allow more contact field for the pins and perhaps you will have to shorten its base by a couple millimeters to allow it to sit flush on the board when installed in the two pins.

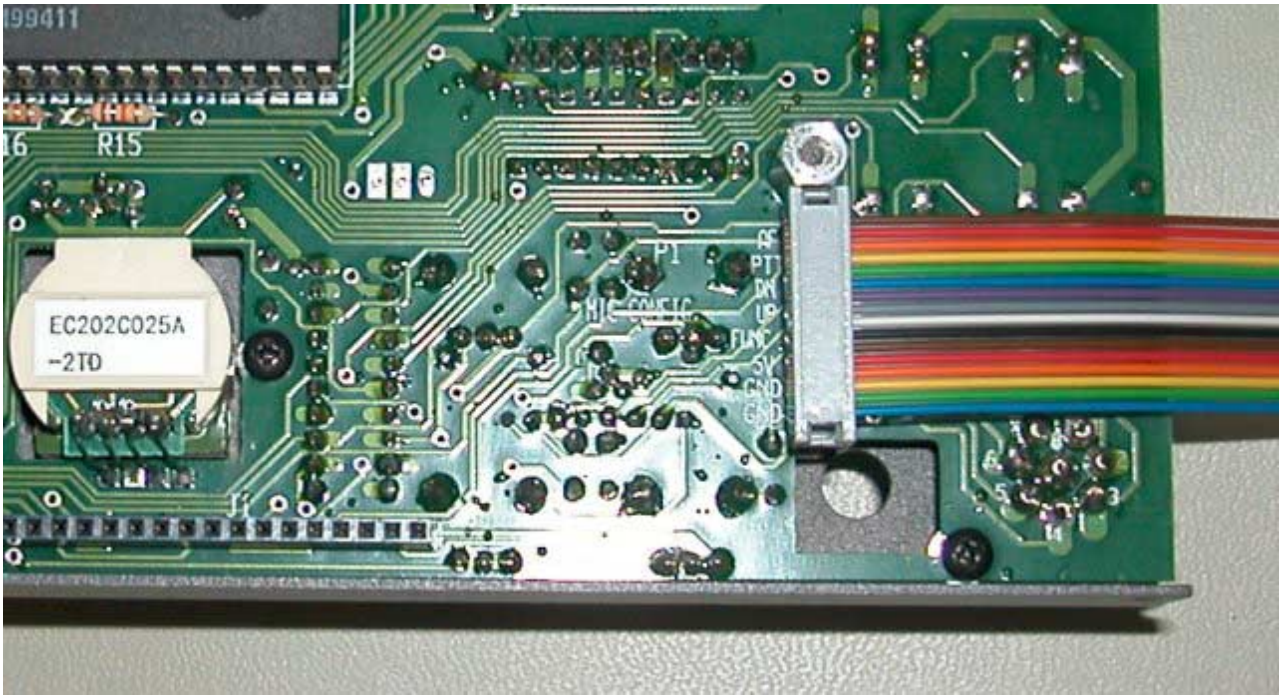
Please see the following pictures showing the KDSP2 with the special header already installed.

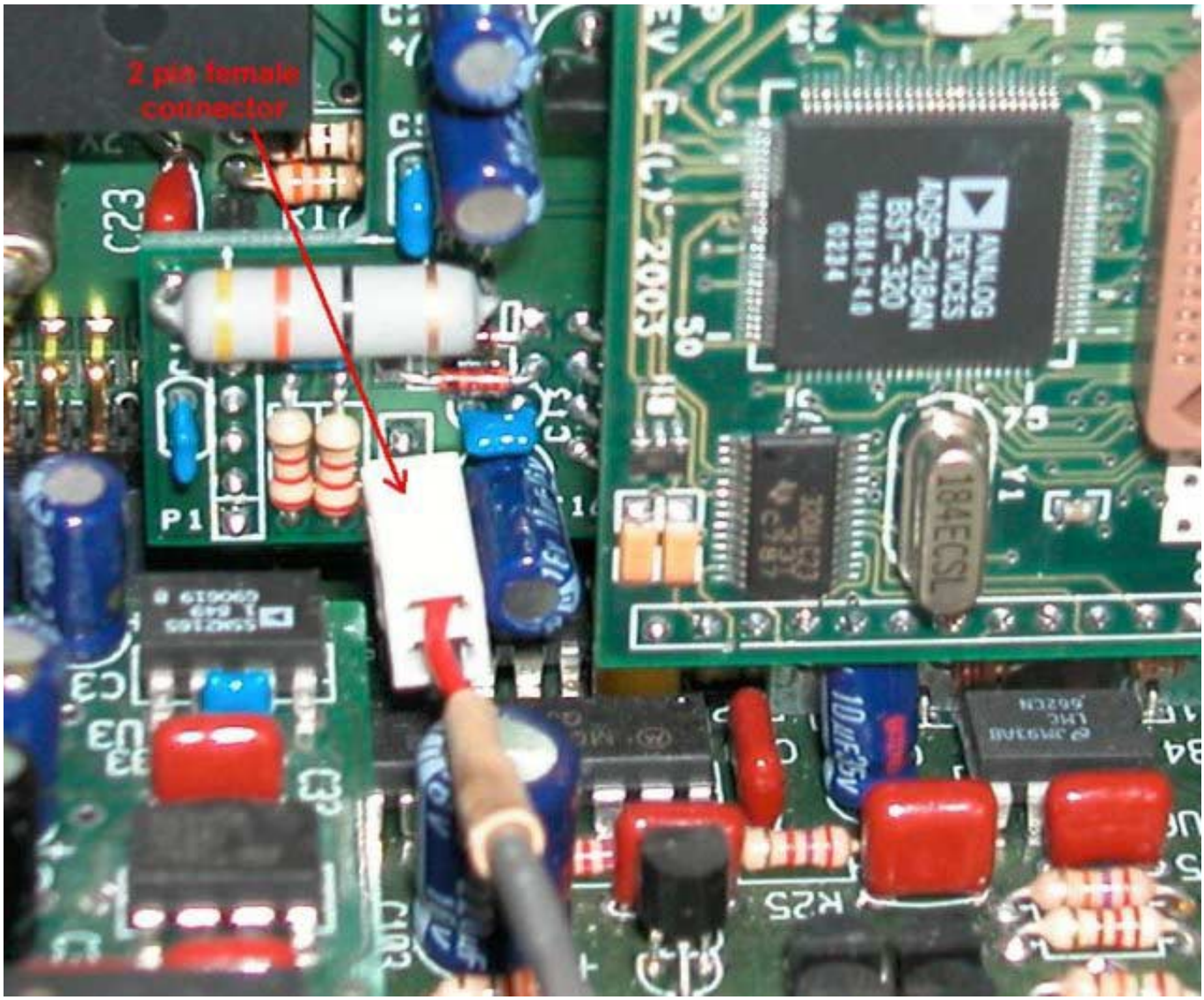


This special header set-up is also valid for the KAF2 audio filter.

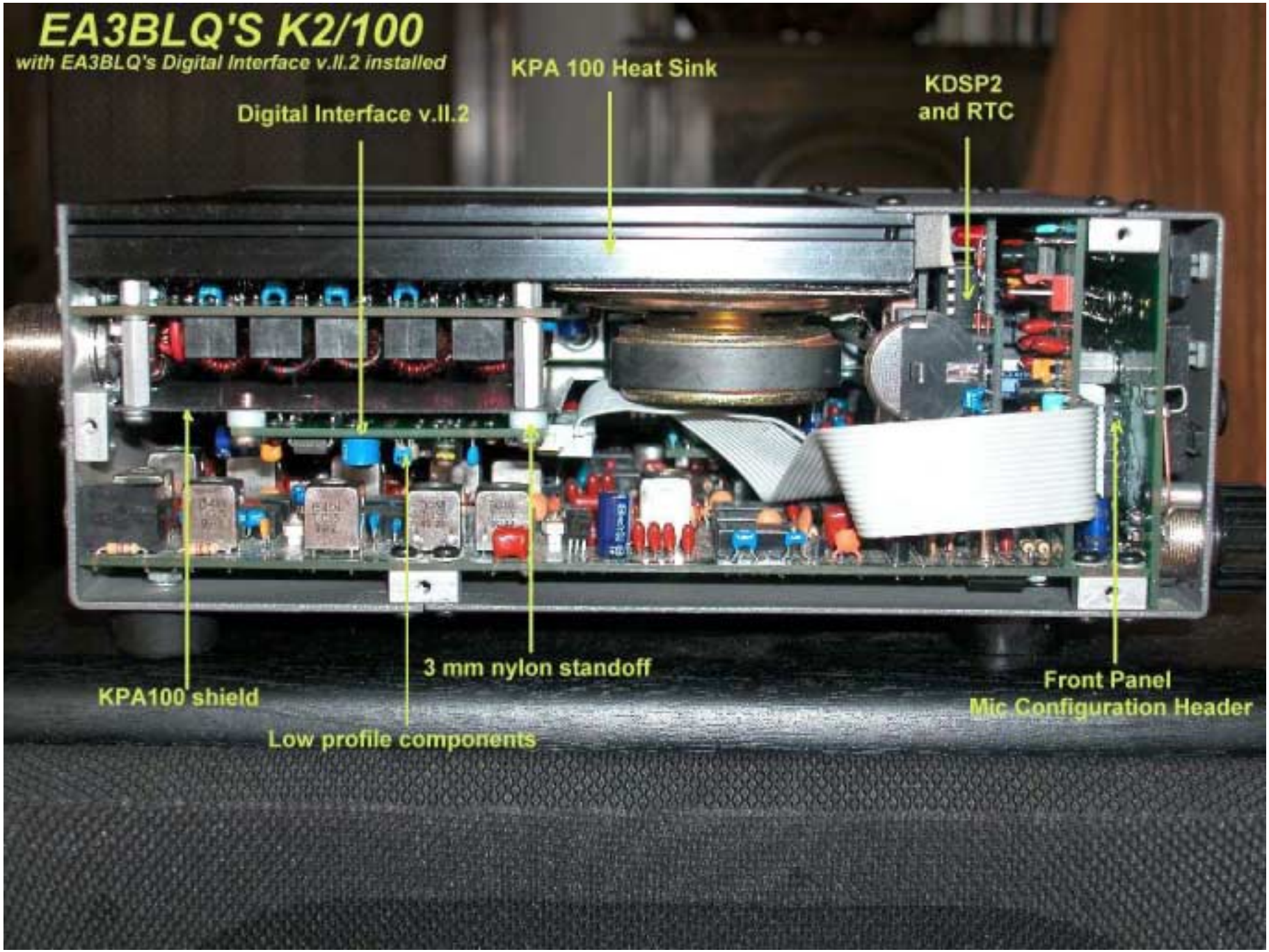
Integrated K2/100 Set-up Option Pictures


Extension of the K2 Front Panel's Mic Header
EA3BLQ
(C) JULY 2001
16 pin connector for the flat cabe connection to K2 Front Panel's Mic Header
3 pin connector to J5 at the K2 RF board
or to P2 at KAF2 or KDSP2
Four pin male polarized connector to K2's rear DI Minidin female connector
J1
J3
J4
C1
C2
C6
C7
C9
U1
U2
PTT
DN
UP
FUNC
+5V
GND
GND
KA3846
U538
K2 DIGITAL INTERFACE II.2


R15
EC202C025A
-2TD


2 pin female
connector
P1
ANALOG
DEVICES
ADSP-218xN
BST-320
184ECSL


EA3BLQ
(C) JULY-2001
K2 DIGITAL INTERFACE II.2
KA386
U538
J1
J2
J3
J4
GND
GND
+5V
TUNE
PTT
DAH
DIT
220


EA3BLQ'S K2/100
with EA3BLQ's Digital Interface v.II.2 installed
KPA 100 Heat Sink
KDSP2
and RTC
Digital Interface v.II.2
3 mm nylon standoff
KPA100 shield
Low profile components
Front Panel
Mic Configuration Header