MERG Knowledgebase

CBUS Modules, supplementary instructions for 12 V DC supply

by Keith Norgrove, Pete Brownlow & Greg Palmer

Revised 23/4/2011, Minor revision 2/6/13, Followed by additional information and an alternative approach from Pete Brownlow added 27/6/13. Updated in light of developments and organised into subheadings - 20/2/15

Revised 26/12/2016 by Greg Palmer, Added CANCMD which is not classified in the introduction.

1. Introduction

Revised designs have been produced for the CBUS modules based on use of a 12V supply throughout.

Users may find it desirable to assemble the existing kits in a compatible form.

The existing kits fall into 3 groups:

1. Modules with a 5V supply and no on-board regulator, CANRS, CANUSB, CANACE8C

These modules require the addition of a 5V regulator, see below. Note that the newer CANUSB4 is designed for 12V DC supply, or can be powered by USB, so no modification is necessary.

2. Modules with an on-board bridge rectifier, CANACC5, CANACC8, CANACE3 and CANLED.

These modules can easily be modified for 12V DC supply. They will of course operate from 12V DC without modification but the combination of voltage drops in the bridge rectifier and, for the CANACC5 and 8 in the LM317 means that the maximum voltage available on the outputs is limited to just over 9V. If the outputs are going to be used for 12V relays or similar usage then it will be better to modify the board to minimise the volt drop. Also removal of the bridge rectifier is desirable on a DC system to keep all the 0V at a common level and minimise problems with interfacing. Details of the required changes are below.

3. Modules which need an output higher than 12V, CANACC4.

This module needs a DC supply on the output of at least 20V to adequately throw solenoid point motors, this module will not work on a 12V supply as is. It is suggested that users of the CANACC4 should continue to use a 14 – 16V AC supply, or a DC supply at a higher voltage, eg 22V.

There is now available from the kit locker a revised kit, kit 94, for a 12V DC CANACC4 which has been renamed the CANSOL (SOL for Solenoid). A voltage doubling circuit added to create the increased DC voltage required. The CANSOL also has been upgraded to use the PIC 18F25K80 and hence uses modified code. Otherwise it is functionally identical. Users wanting to standardise on a 12V supply are advised to use this new kit.

A board, kitlocker 984-2, is available if a 12V DC version is wanted using the original PIC 18F2480.

The CANCDU designed by Pete Brownlow is an alternative PCB layout for the 12V DC version of the CANACC4.

Suggested Modifications by Keith Norgrove

2. Modification of type 2 boards.

All these boards have a similar power section, they can just be supplied with 12V DC without modification but the presence of the bridge rectifier, BR1, offsets the board 0V from the system 0v and this can lead to problems. Hence it is better to remove the bridge rectifier and replace it with a diode in the positive connection to protect against accidental wrong polarity connection, A 1N4002 or similar rated at at least 1.0A should be used. if using a CANACC5 to drive a high current load then supply the output direct from the +12V.

The following illustrations show the changes to schematic and board to remove the bridge rectifier.

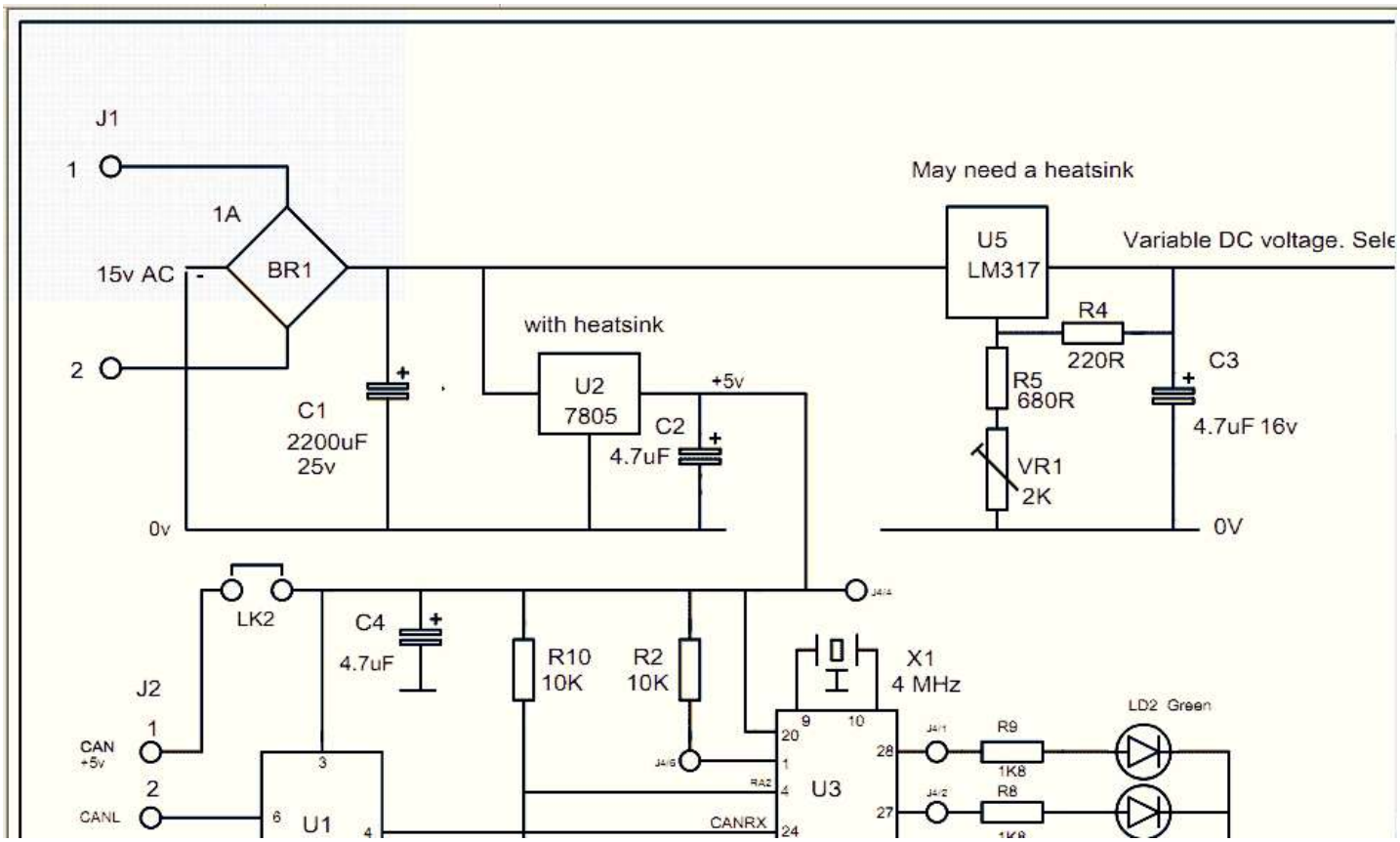


Fig 1. Original power supply schematic

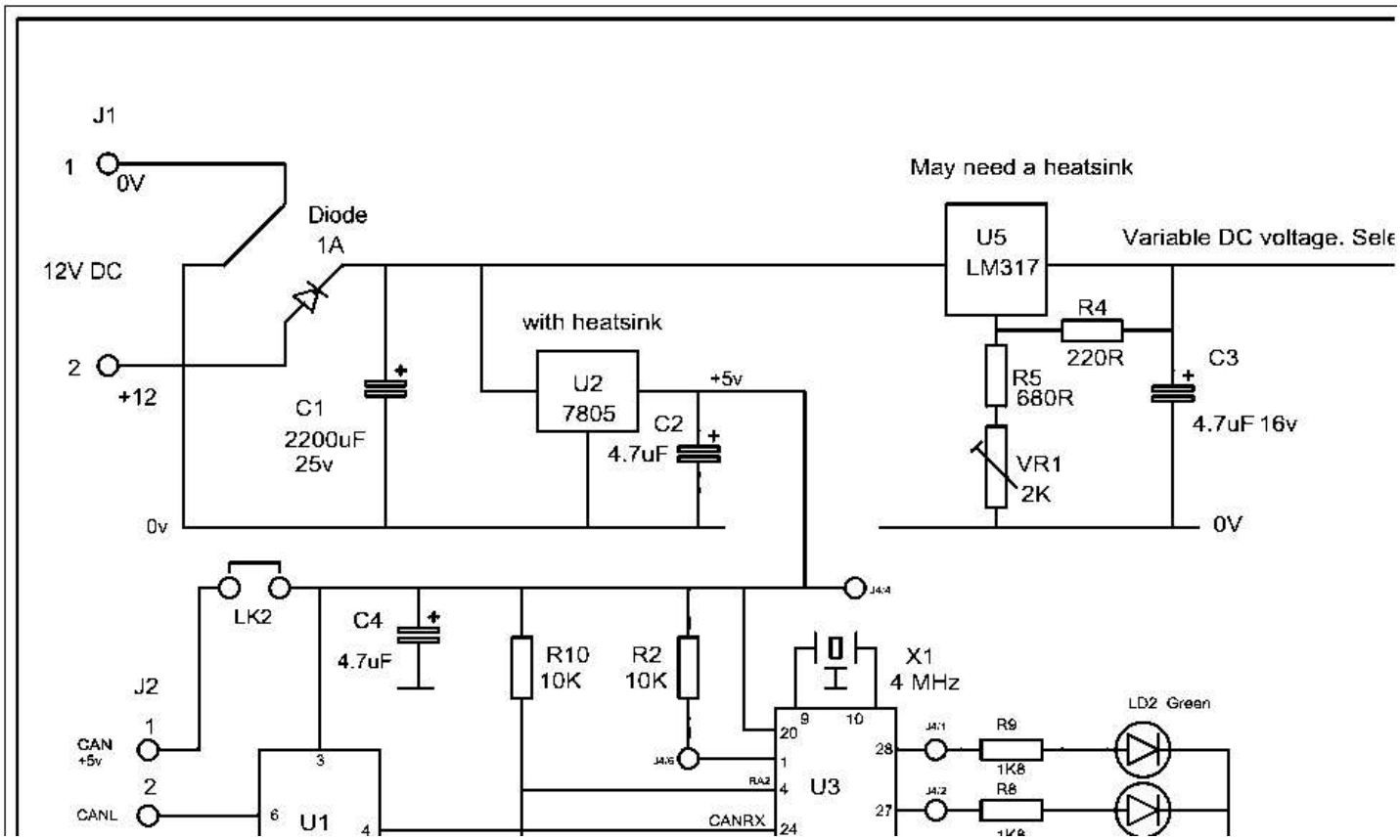


Fig 2. Revised power supply schematic NB. If not using the 5V output to supply another module then leave out LK2 to avoid accidents or use the option by Pete Brownlow below that deletes J1.

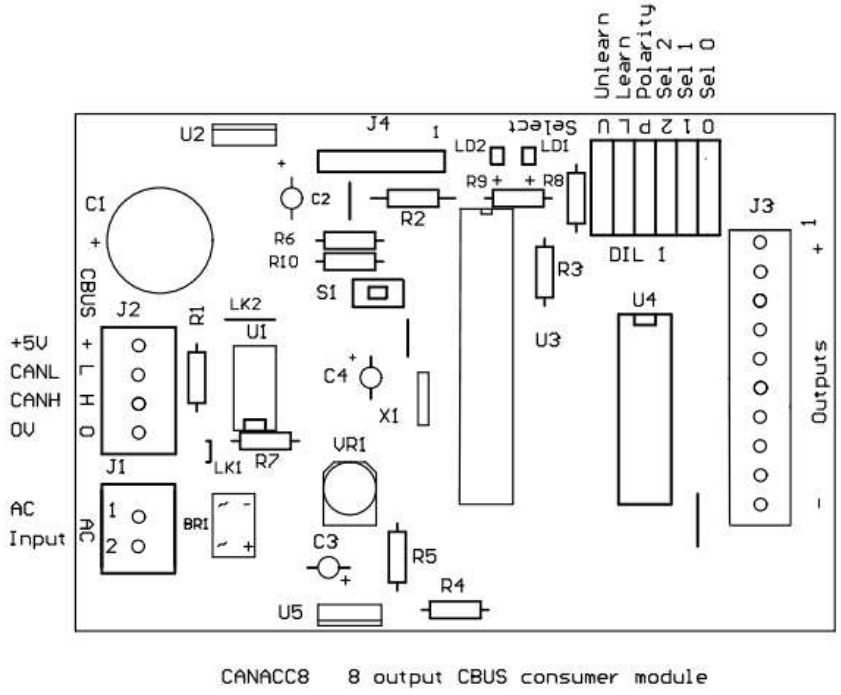


Fig 3. Original Board Layout

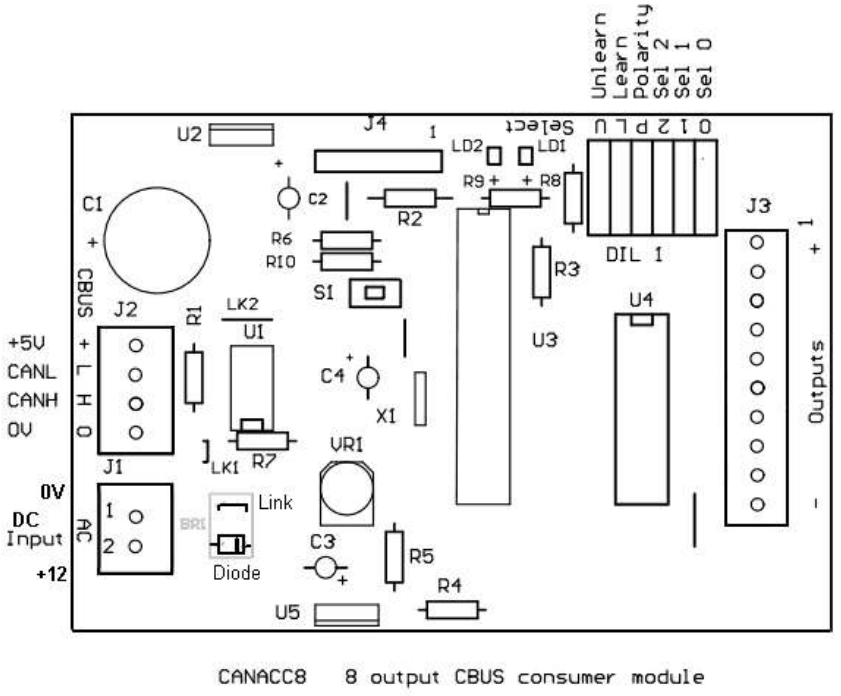


Fig 4. Revised Board layout, removed items shown pale grey.

For the CANACC5 and 8 if using lower voltage outputs, ie between 5V and 9V the LM317 can be retained and used as covered in the instructions. If a higher output voltage is to be used then the LM317 and associated components can be deleted and a link added to the PCB to connect the tracks through.

In the case of the CANACC5, if used with output currents above 1A then the +12V should be linked directly to the output drivers to avoid overheating the protection diode. To do this the simplest solution is to leave out the LM317 and the link mentioned above and supply the +12 to the output drivers via pin 10 of J3.

The following illustrations show removal of the LM317 and the revised circuits.

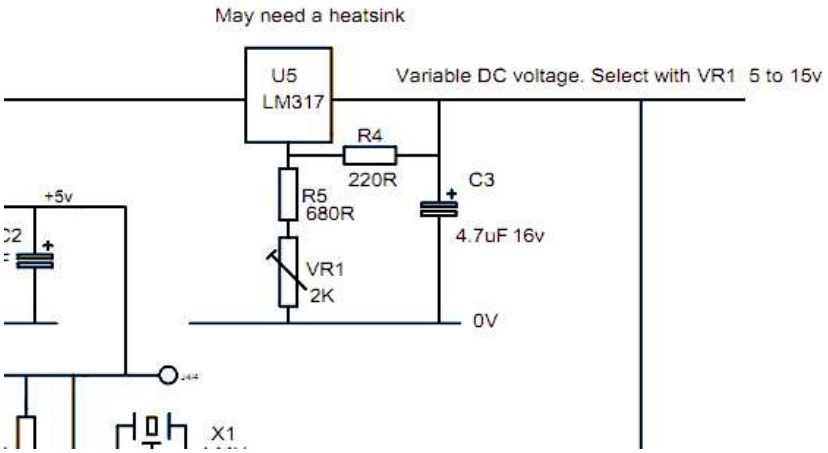


Fig 5. Original LM317 schematic

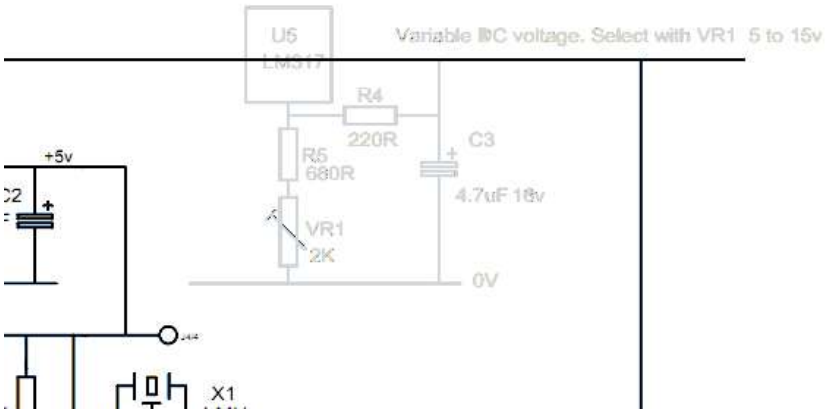


Fig 6. Revised LM317 schematic, removed items shown pale grey

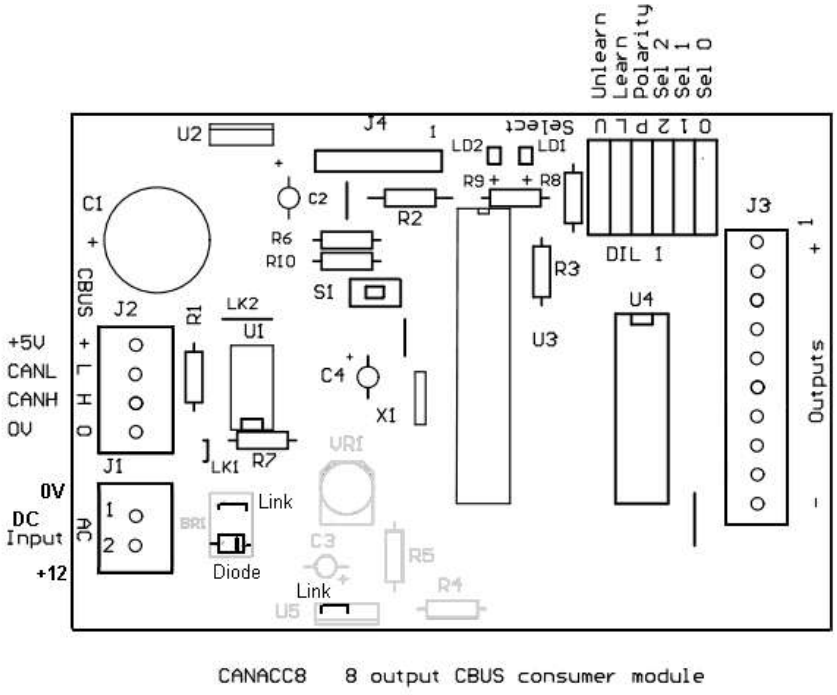


Fig 7. Revised LM317 Board Layout

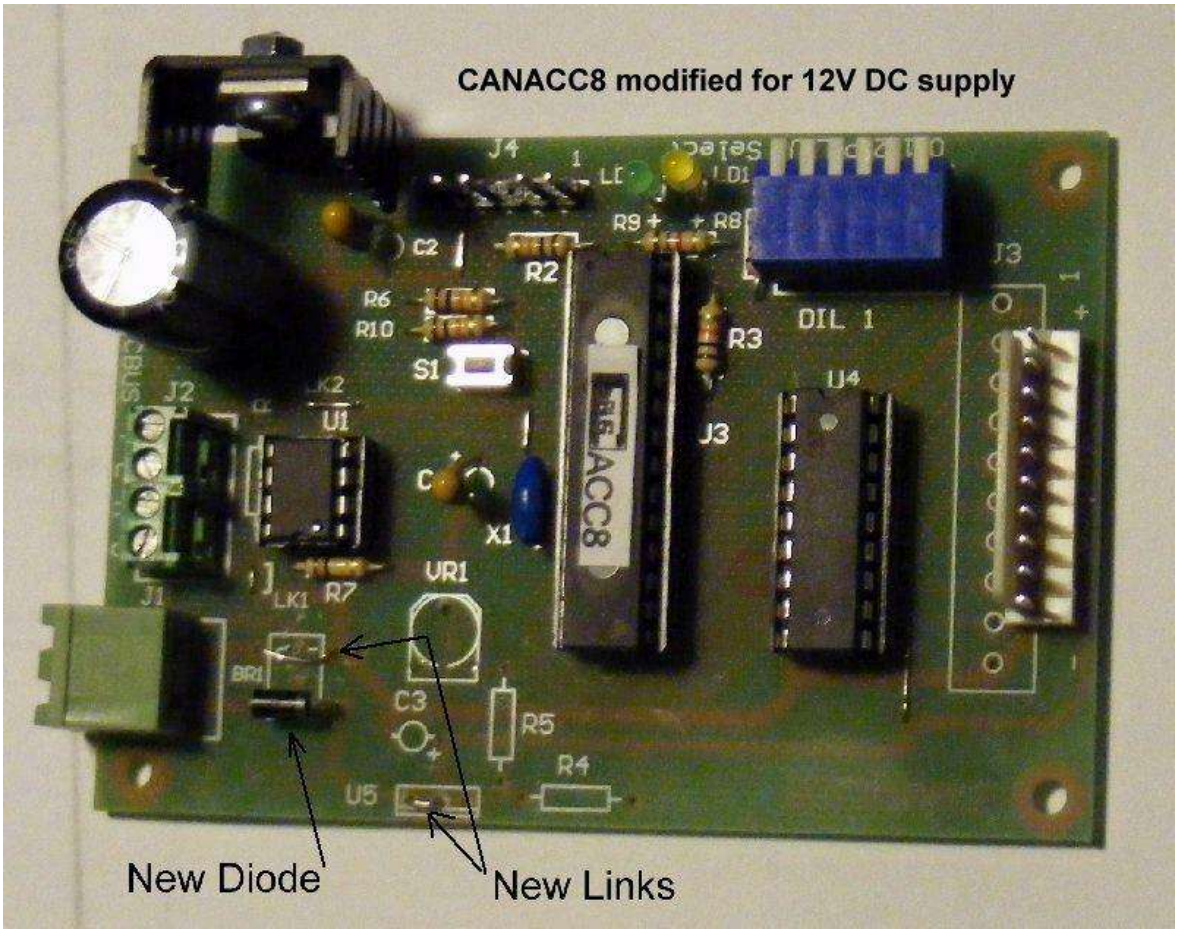


Fig 8

Converting CBUS modules to 12vDC supply, by Pete Brownlow

My mods are very similar to Keith's above, the only real difference is that I do away with the 2 pin connector where the AC supply was previously connected.

Converting the modules this way means that the 4 pin CBUS connector becomes directly compatible with all the newer CBUS designs, where the 2 outer power pins of the 4 pin CBUS connector become +12V DC and 0V throughout instead of +5V DC and 0V as before. This is in line with all the more recent CBUS designs, including the CANSERVO which is available as a PCB from the kit locker. The CANUSB4, CANEther, CANCAN, CANPanel, CANPAN and CANMIO range all follow this convention.

This approach also makes the 4 pins of the CBUS connectors compatible with the cabs which require a 12V DC supply on the outer 2 pins. This should make these converted boards compatible with all CBUS 12V DC kits that come out in the future. The CBUS kits from Rocrail also follow this pinout for the CBUS connector.

I have included mods for the CANACE8C and original CANUSB. These are currently 5V DC as supplied, but it is straightforward to add a voltage regulator so they can be supplied with 12V DC, like all the others.

Note that the newer CANUSB4 is designed for 12V DC supply, or can be powered by USB, so no modification is necessary.

I haven't done a conversion for the CANACC4, instead I have done a new PCB layout which I have called the CANCDU.

The pictures of my mods were all done on early pre-production boards - it is possible that the latest ones from the kit locker might vary a bit.

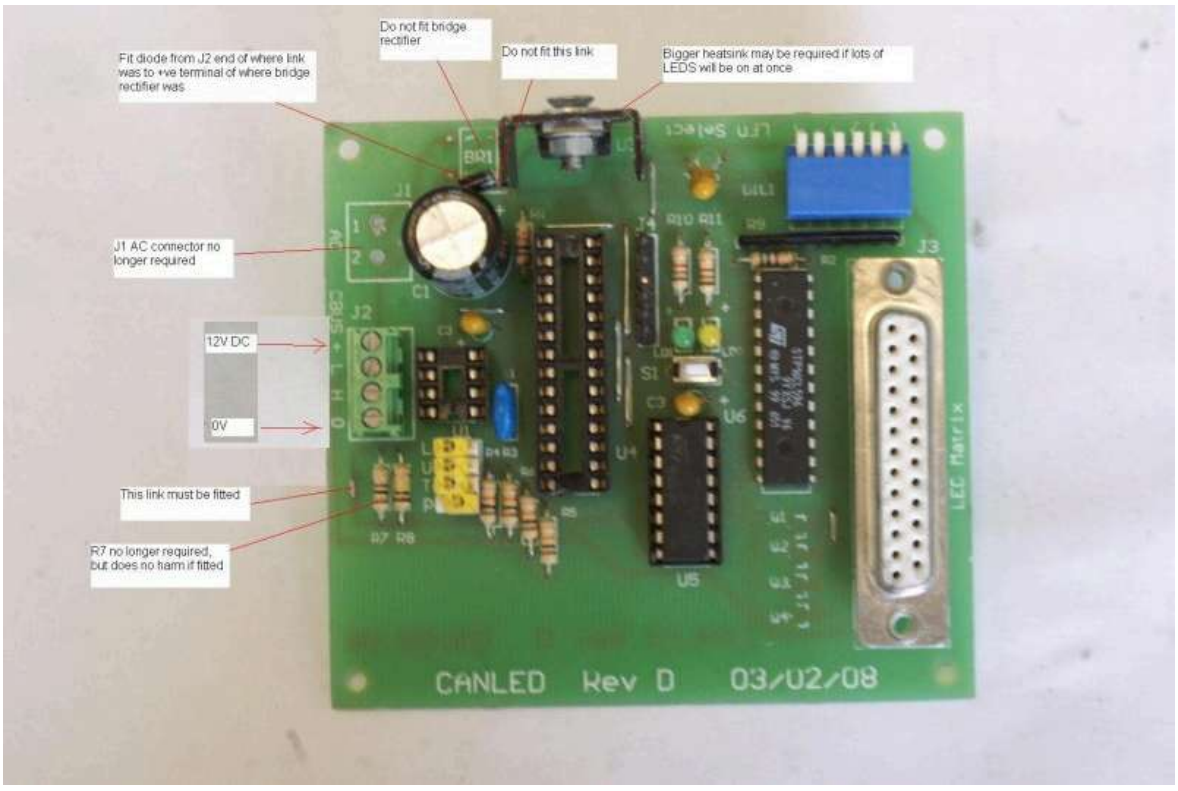
I hope anyone adopting the 12V DC supply option will find this information useful.

CANACE3 (128 switch/push button control panel module)

CANLED (64 LED control panel module) Rev D PCB

See below for Rev E

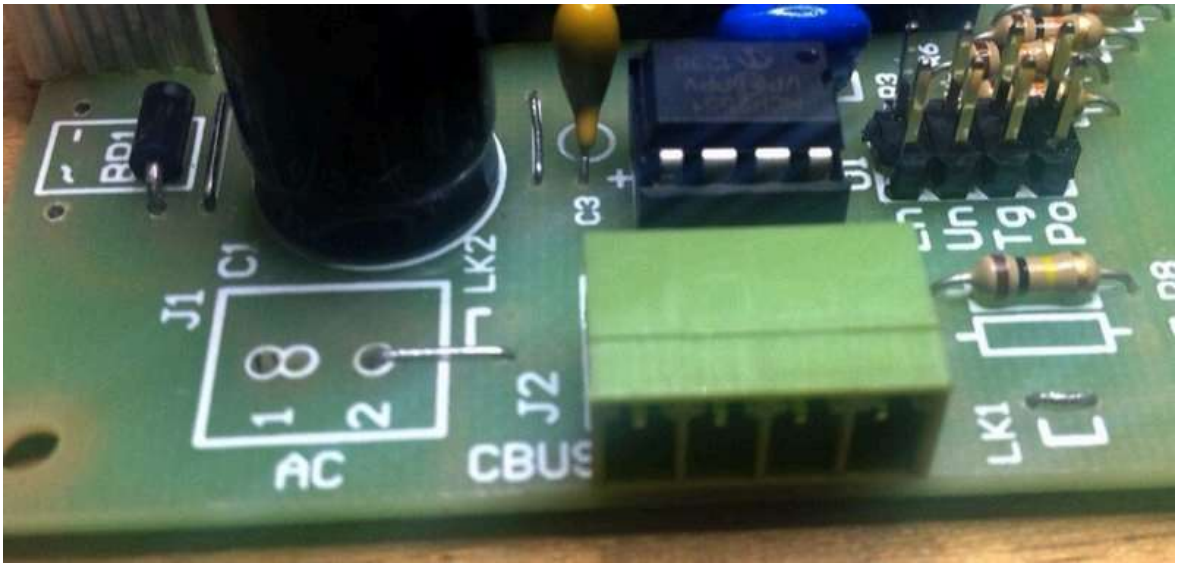
:



CANLED (64 LED control panel module) Rev E PCB

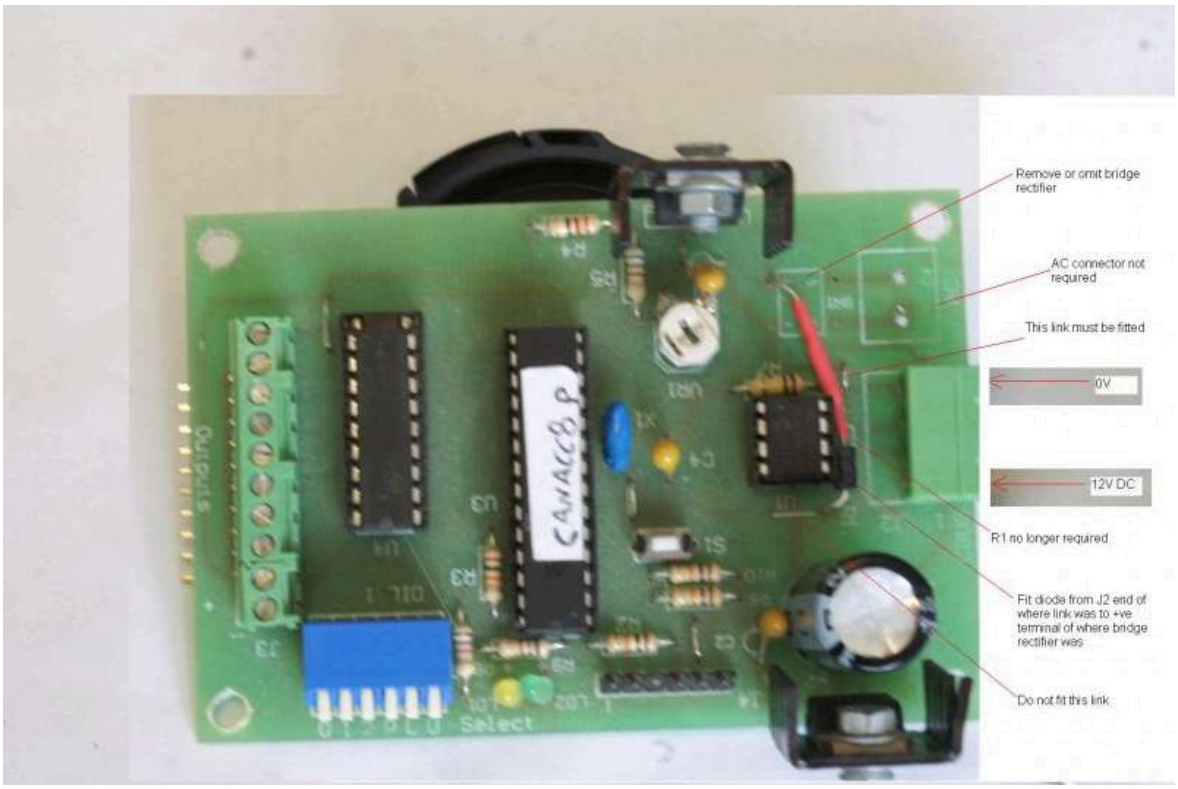
CANLEDs are now supplied with a bigger heatsink, so the comment about fitting a bigger one is probably outdated.

Note that current CANLED kits are revision E and need a variation on the above, just jumper from LK2 to the J1-2 position and fit a diode to the positive side of the intended bridge location as shown in this photo from Greg Palmer.



CANACC8 (8 outputs module)

The CANACC8 is pretty much same mod as CANACE3 (sorry about the blurry picture):



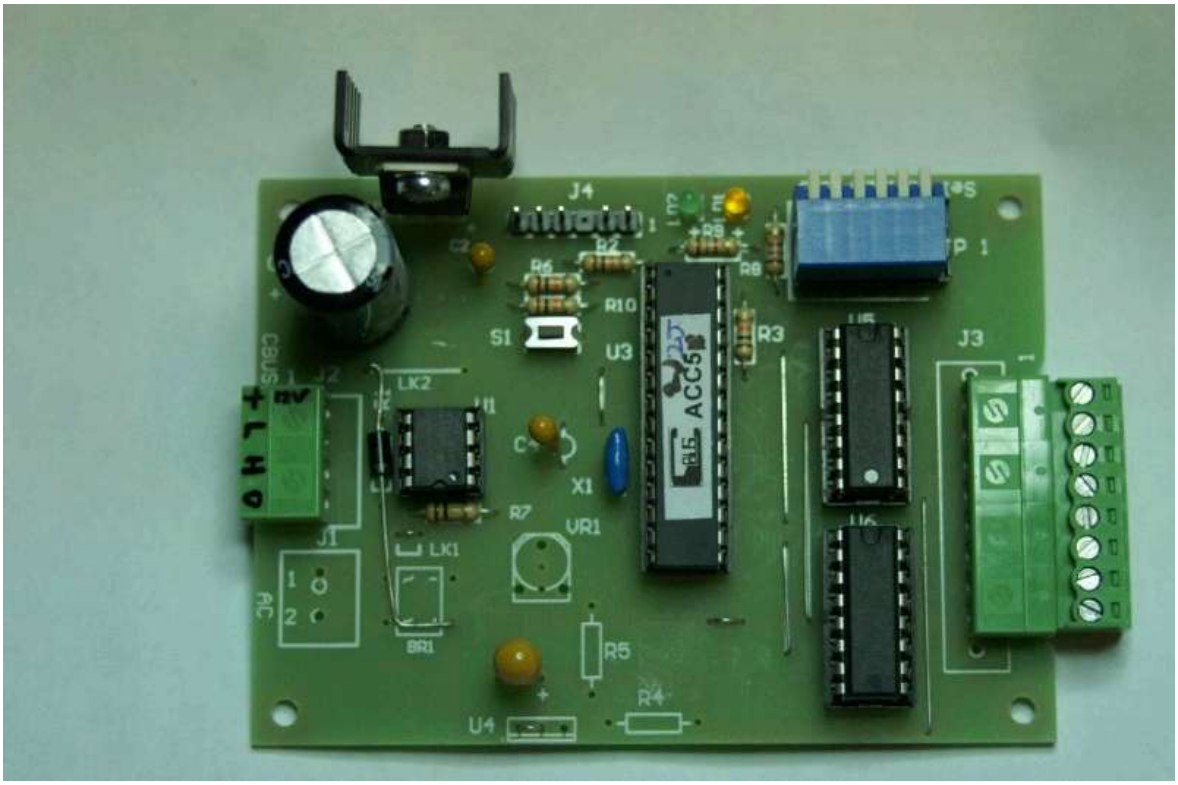
12V mod for CANACC8

As shown, this mod still includes the adjustable output voltage using VR1 and the LM317 voltage regulator.

With the supply at 12V DC, the maximum you will be able to get for the output voltage will probably be less than 11V. This is fine if you are driving LEDs or logic that requires 5V, but if you are driving something that needs the full 12V then you can omit and link out the adjustable voltage circuit so that your output voltage is driven directly by the 12V DC supply. Follow Keith's instructions above to do this.

CANACC5 (Motorised point driver)

The CANACC5 mod is pretty much identical to the CANACC8 shown above, including the comments about the output voltage.



CANACC5 built for 12V DC

The supply mod is pretty much identical to the CANACE3 and CANLED posted earlier. I have also done Keith's suggested mod to omit the adjustable output voltage circuit and just put a link in instead.

As I went along I have done a version of the build instructions which incorporate the 12V DC mods. I also fixed a few inaccuracies and updated some things that have changed whilst I was at it.

85can_acc5bldgins12v-2.pdf

Please note that these instructions contain my personal modifications, they are not from the official MERG kit team and have not been proof read by anyone else.

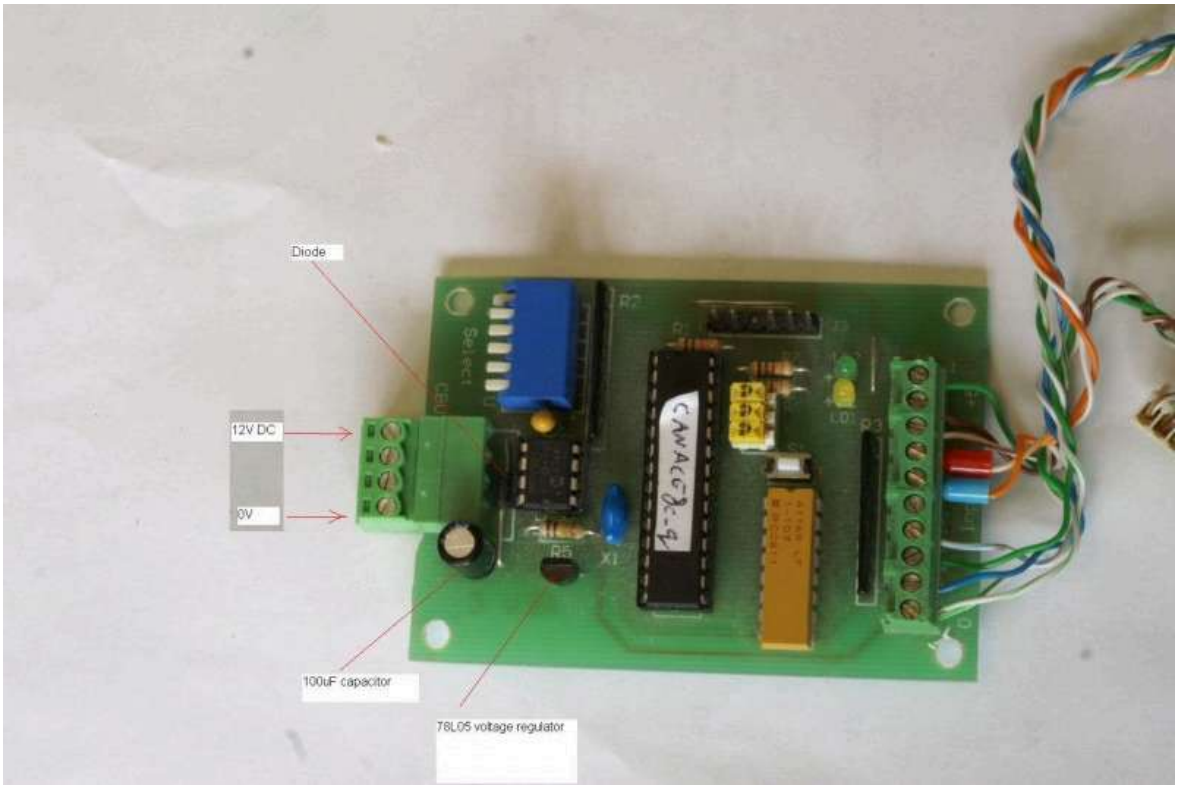
CANACE8c (8 inputs module)

Here is my mod for the CANACE8C (8 inputs module).

As supplied, the CANACE8C has to be supplied with 5V DC and has no regulator on board.

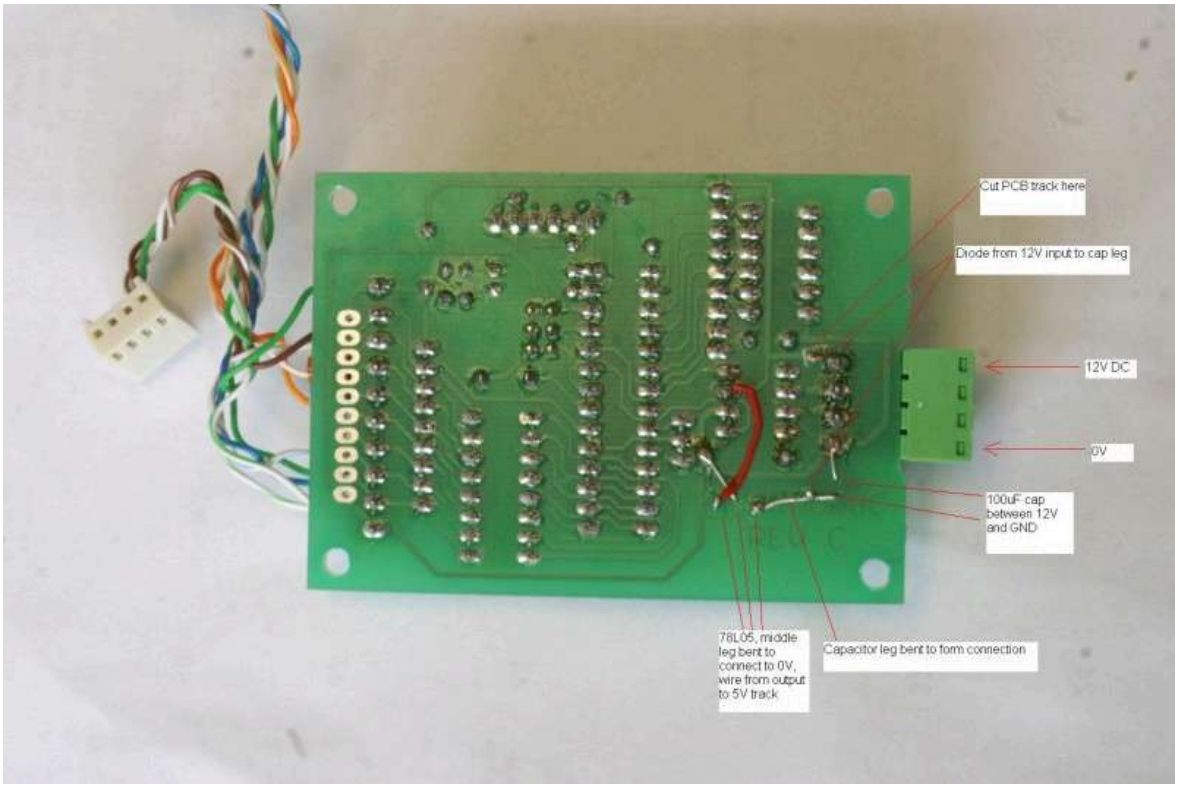
This mod adds a 78L05 regulator. This little regulator is only rated at 100mA, so is only suitable if you are not powering much external circuitry from the I/O connector. I have used it powering several DTC8 block detectors in addition to the circuitry on the canace8c itself, and the regulator does not get noticeably hot. You could easily adapt this mod to use a full sized 7805 if you prefer.

Here is the top side. Additional holes are drilled for the diode, capacitor and regulator.



12V mode for CANACE8C top side

And here is the view of the underside. Note the track that should be cut with a scalpel or similar. I've no doubt you can make a neater job of it than I did!



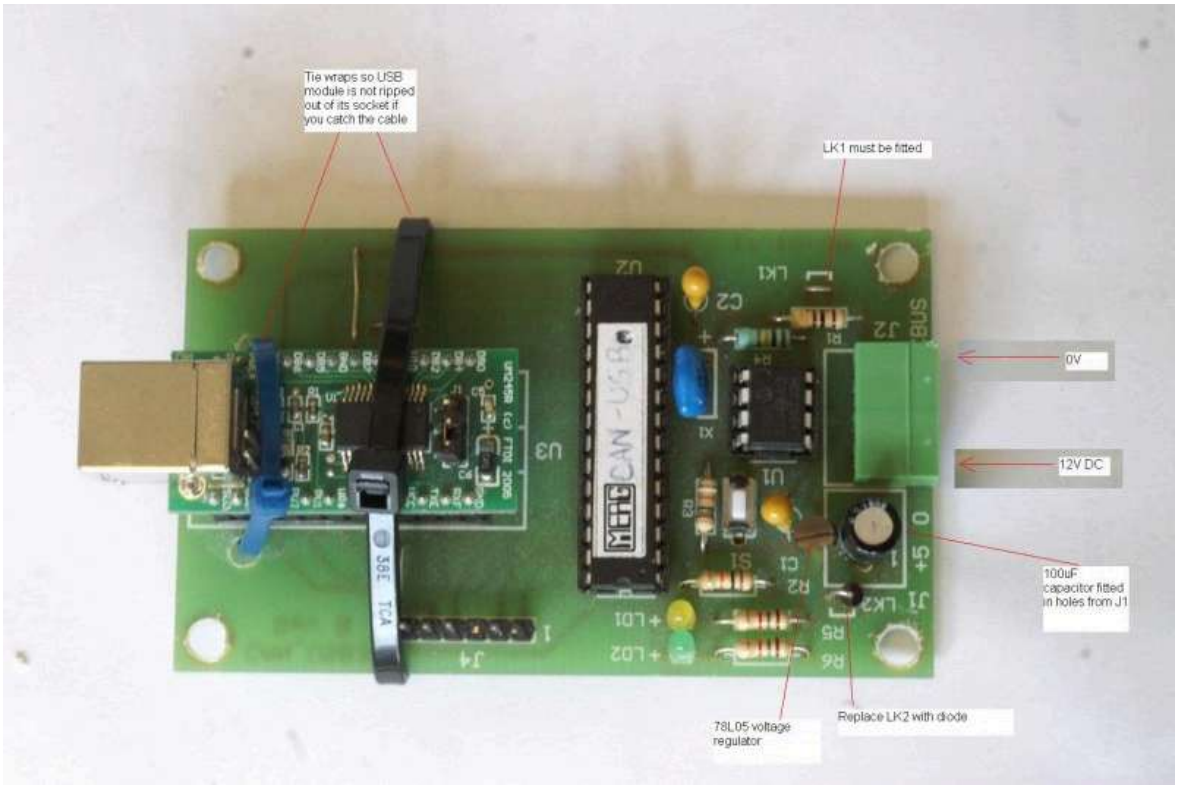
12V mod for CANACE8C, underside

CANUSB (Original USB interface)

This design has now been superseded by the CANUSB4, but if you have one of the original ones you can still modify it for 12V DC operation.

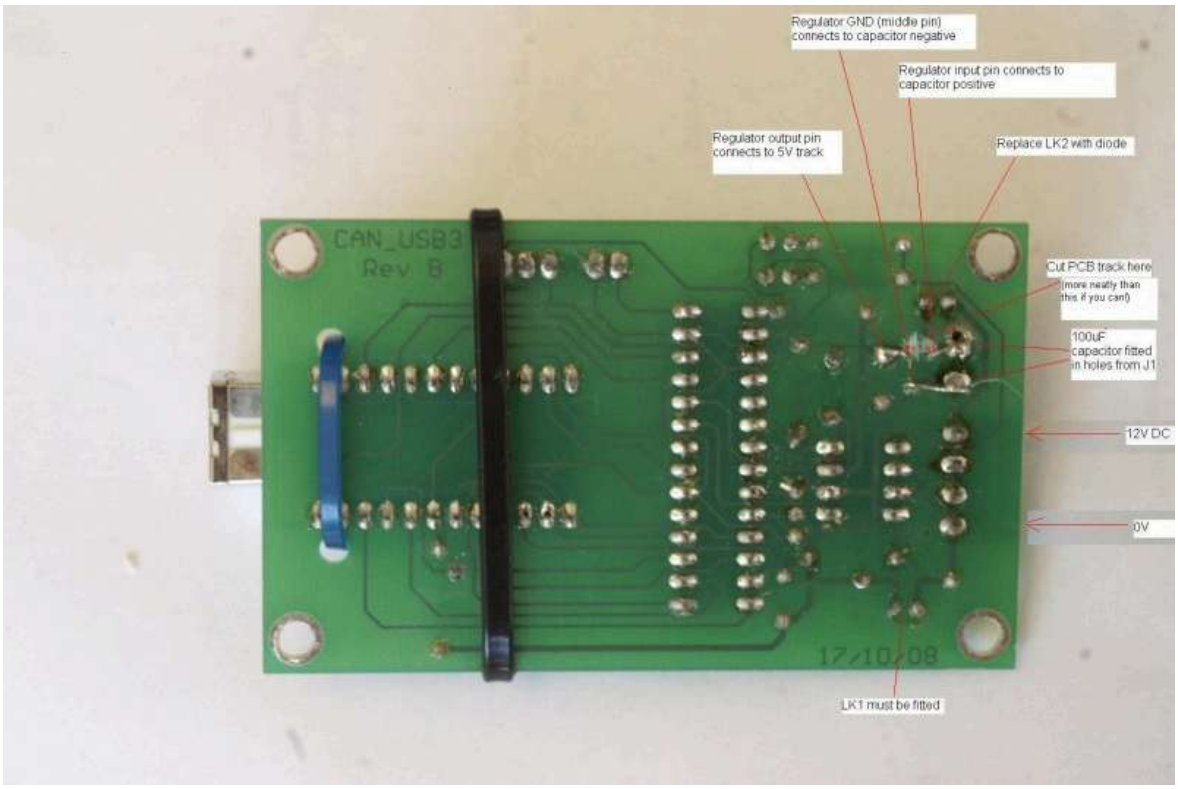
Like the CANACE8c, it needs a voltage regulator adding so it can be supplied with 12V DC. In this case, we can use the holes from the original supply connector for the capacitor and the holes that were for LK2 for the protection diode, so we only need to drill new holes for the voltage regulator.

Here is the top side. I've found the added tie-wraps vital to avoid damage in case the USB cable gets pulled up or down.



12V mod for CANUSB, top side

And here is the bottom. Once again, you can probably do it neater!



12V mod for CANUSB, bottom view

For images that can be enlarged, see this Forum post. [https://merg.org.uk/forum/viewtopic.php?p=17142#p17142]

The CANRS can be modified in the same way.

CANCMD

As originally designed, the CANCMD uses a 15V AC supply in and, the CBUS positive connector, by virtue of jumper selections at LK2, can either:

- supply 12V out;
- supply 5V out; or
- be left not connected.

If using the CANCMD just for DCC without connecting other CBUS modules you can use a 15V DC supply available from the Kitlocker as items 773 and 774, if you are going to use a booster get the 6A version(774) and use it to power both the Booster and the CANCMD. To get the best from this arrangement just replace the bridge rectifier BR1 with

a diode and link exactly as shown for type 2 boards at the top of this page.

LK2 can then be set so that the CBUS connector will supply 12V to power CANCABs.

If you will always be using your CANCMD with a larger CBUS system and hence already have a 12V power supply for the CBUS you can also modify the CANCMD to use the CBUS 12V for its PIc etc. reducing the heating of the LM7805 so you can use a smaller heatsink. This additional modification is covered by Greg's instructions below.

Note that you still need the 15V supply for the DCC power, hence don't do this for a standalone DCC as it means using two power supplies instead of one.

Suggested Modifications by Greg Palmer

As originally designed, the CANCMD uses a 15V AC supply in and, the CBUS positive connector, by virtue of jumper selections at LK2, can either:

- supply 12V out;
- supply 5V out; or
- be left not connected.

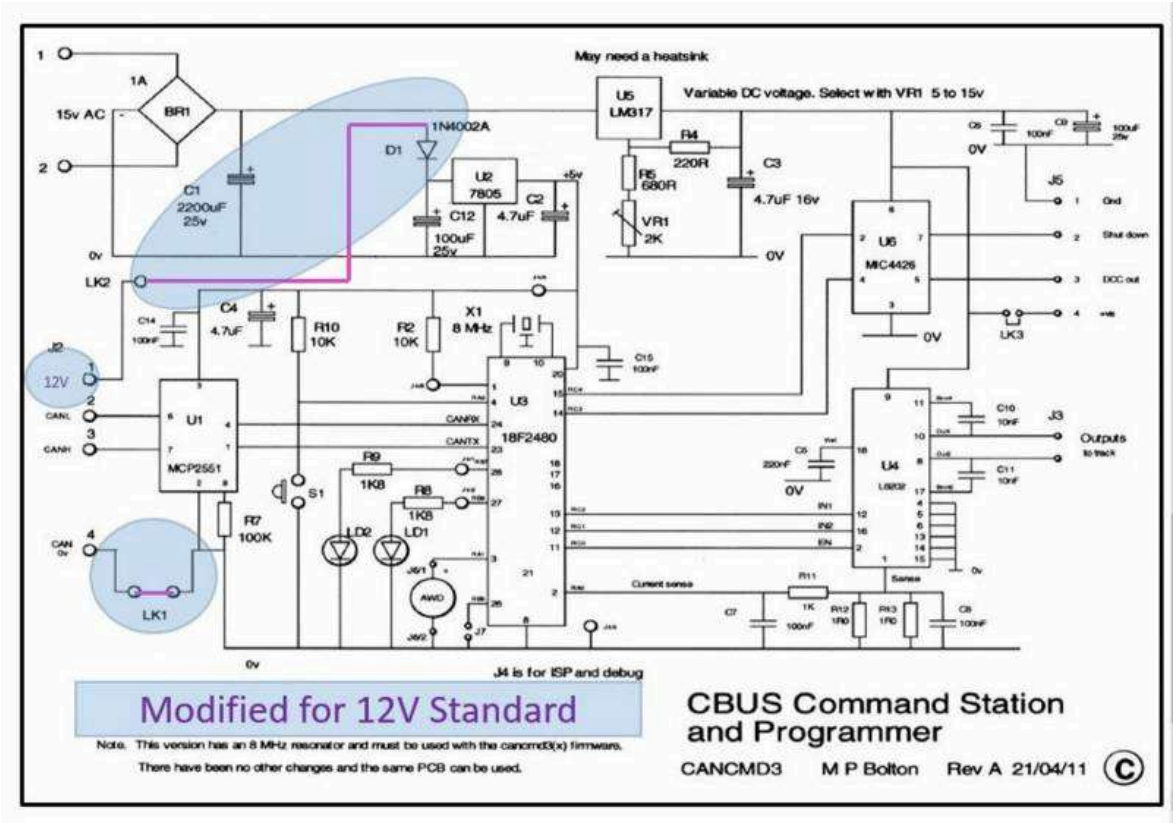
The CBUS 12VDC standard in part means that no module will deliver power to other modules but rather that they will all be powered from an external 12V source. Most modules can use this as their only power source but CANACC4 (Solenoid driver) and CANCMD both require higher voltages to function and a secondary supply is still required. The former due to the voltage required for the capacitive discharge unit to reliably switch solenoid point motors and the later due to the DCC voltage required.

Therefore:

- there is no longer a need for the onboard 12V regulator or associated capacitor on the module; and
- LK2 header can be omitted as there no voltage will be supplied out of this module to the CBUS connector.

Another opportunity presents. As designed, the 7805 regulator is dropping around 14V and therefore requires a heatsink. With the 12V standard, the 7805 can be supplied power from the 12V supply on the CBUS connector and the 7805 will drop around 6.5V and run a lot cooler. As this regulator is only running onboard components the current requirement is also low and the 7805 no longer requires a heatsink.

Revised diagram:



Omit:

- U7 7812,
- C13 4.7uF,
- heatsink for U7,
- heatsink for U2,
- R1 100R, and
- 3 pin header for J2.

Connect D1 anode to centre hole of LK2 instead of original location (easiest to fit D1 on the underside of the board)

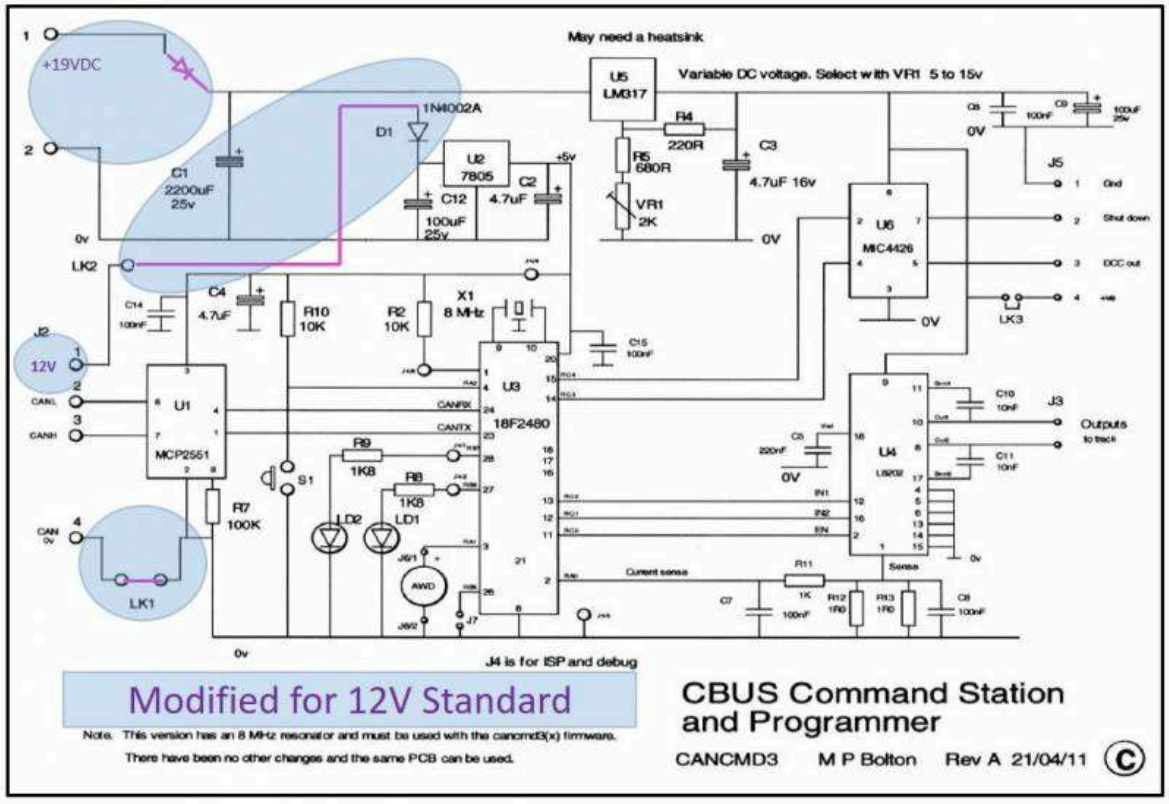
Fit the link at LK1

Another optional change can be made that is not related to the conversion. I choose to use DC supplies with common ground. To deliver 12-15V DCC output we need a couple of volts more than that to allow for the regulation requirements of the LM317T. Many laptops use 19VDC power supplies and these are often readily available if not at hand and can be used to power the module using the AC input without modifying the board. However, replacing the bridge rectifier BR1 with a diode and a link will provide common

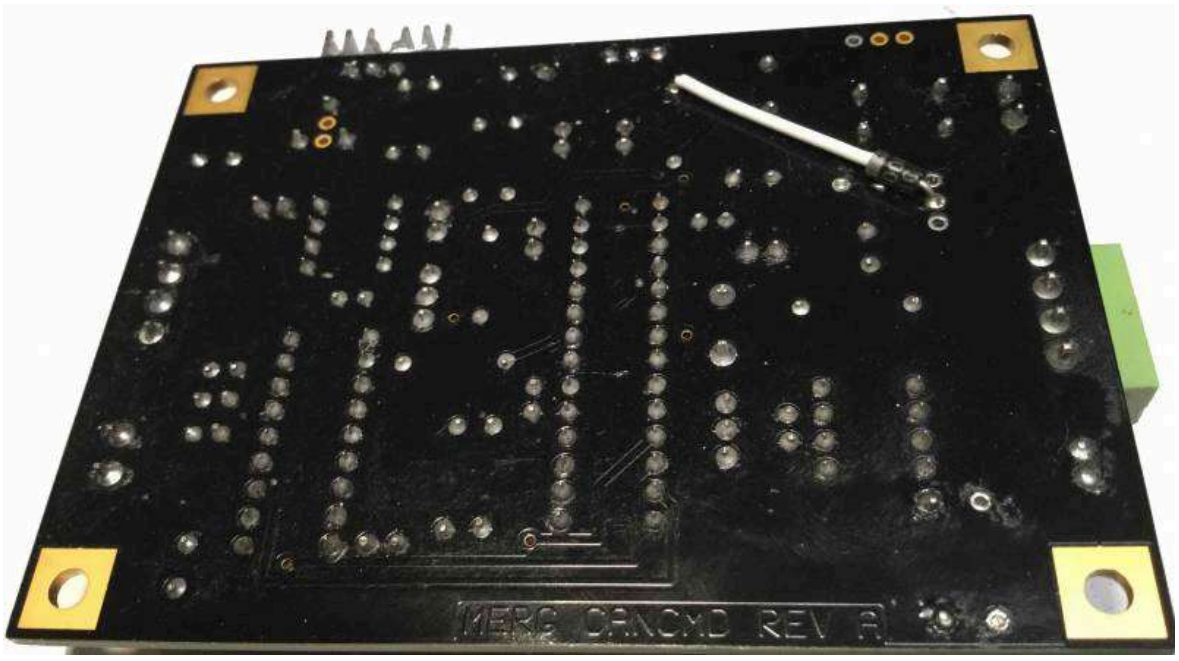
ground for the 12VDC CBUS supply and the 19V DC supply discussed. If you make this additional change then you should not use AC supplies as they would only be half wave rectified.

Common ground DC supply changes:

- Omit BR1
- Replace with 1N400x diode and link as per diagram and pictures below



Now a couple of pictures of these simple changes.



The diode added under the board to feed the 7805 from an external 12V supply connected to the CBUS connector.

You can see:

- the diode and link replacing BR1 for the DC common ground supply usage described a in the top left hand corner;
- the space left from omitting IC7, the 7812, and C13, a 4.7uF capacitor;
- the centre hole of LK2 has the anode lead of diode D1 soldered there;
- link1 LK1 in the lower left hand corner; and
- space where R1 100R was omitted.

The changes are simple. I advise people constructing using one or both of these modifications to put the omitted parts to one side and annotate the build instructions where the changes are required before building.

Note: *If you fit a heatsink on the LM317T that rests on the board, be aware that CANCMD has a resist covered track on the top of the board on the 7805 side of the LM317T that this heatsink will rest on. The heatsink shown above was filed to make a small clearance to that covered track to ensure that no short circuit would occur there even if the resist was scratched.*

cbus, kits, help
