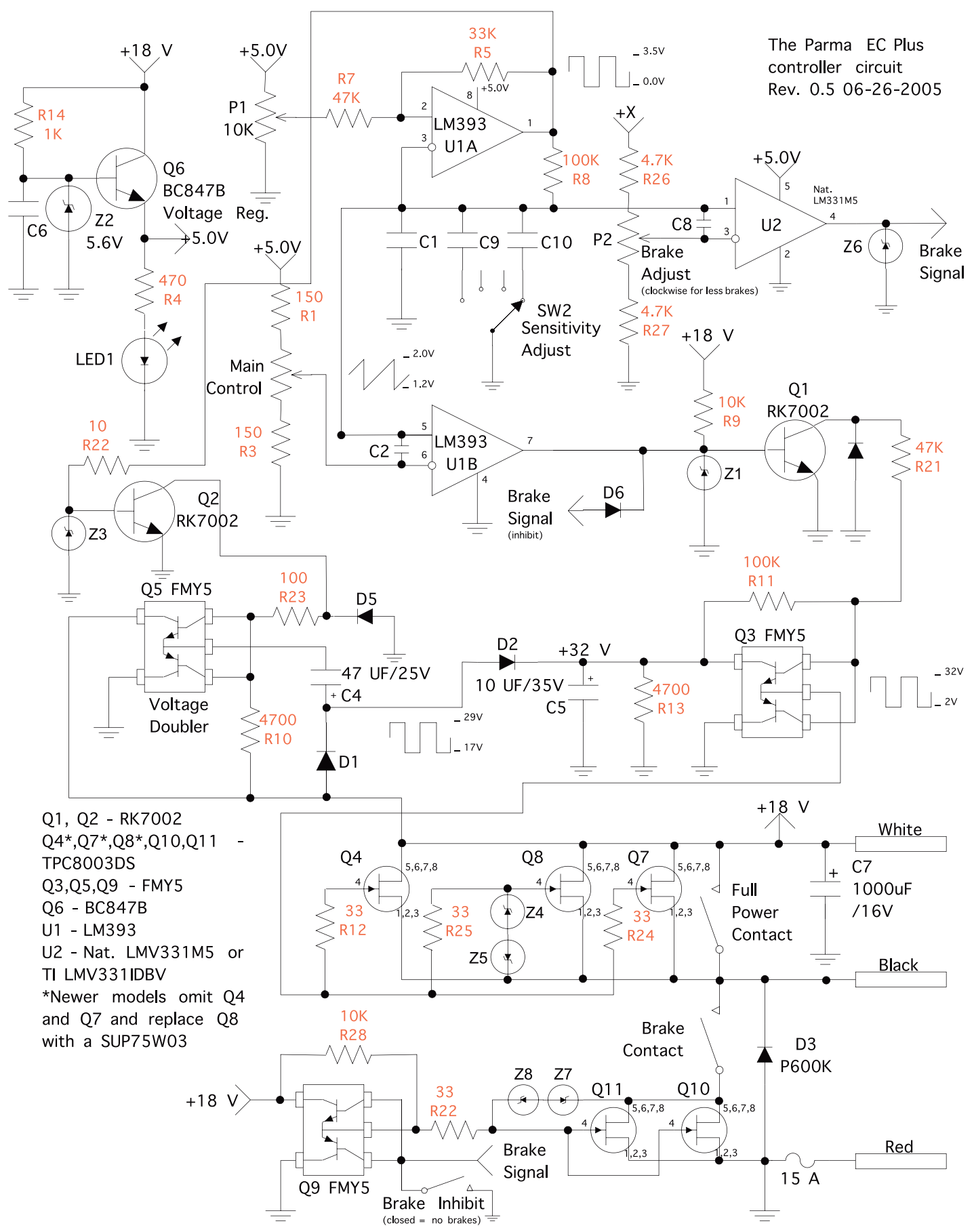


The Parma EC Plus controller circuit  
Rev. 0.5 06-26-2005



- Q1, Q2 - RK7002
- Q4\*, Q7\*, Q8\*, Q10, Q11 - TPC8003DS
- Q3, Q5, Q9 - FMY5
- Q6 - BC847B
- U1 - LM393
- U2 - Nat. LMV331M5 or TI LMV331IDBV
- \*Newer models omit Q4 and Q7 and replace Q8 with a SUP75W03



4) The controller employs a voltage doubler circuit to obtain the necessary VGS voltage (about 4 volts) for completely switching on the driving FETs.

5) The sensitivity adjustment is a three position switch which switches capacitors for controlling the time constant of the ramp generating circuit used to ultimately create PWM square waves. Each position changes the slope and frequency of the ramp voltage. Personally, I don't see how this would change anything except the frequency of the output PWM square waves. I suspect that the duty cycle will not be changed. This adjustment has dubious value in my opinion.

6) There appears to be two minor but definite screw ups. Two capacitors on the circuit board are rated at 16 volts. This is a problem given that HO slot cars commonly employ 18 volts. Except for this (and the questionable #5 item); the Parma controller design cuts no corners. Overall, they did an awesome job. Perhaps these controllers were really designed for 12 volt slot cars.

Anyway, the two problematic capacitors are

C7 1000 uF/16V

C6 1 uF/16V

You can replace C7 with a 470 uF/35 V capacitor found at Radio Shack.

C6 is a very small tantalum surface mount capacitor that I believe is 1 uF. A 35 volt replacement can be found here:

[http://www.mouser.com/index.cfm?handler=displayproduct&lstdispproductid=444503&e\\_categoryid=324&e\\_pcodeid=58106](http://www.mouser.com/index.cfm?handler=displayproduct&lstdispproductid=444503&e_categoryid=324&e_pcodeid=58106)

By the way, if you look in the upper right corner of the picture, you will see a butterscotch-colored rectangular-shaped capacitor. That is the C6 which often fails.

7) Not all components could be determined. Some of these tiny surface mount devices bear few identifying numbers. I tried my best. Perhaps you can help identify more.

8) The +18 Volt signal is based on the assumption that the controller is operating on 18 volts. Your usage may be different.

9) Many parts are available from Mouser Electronics:

<http://www.mouser.com>

I found the comparator at DigiKey:

<http://www.digikey.com/>

U1 is an LM393:

<http://www.national.com/ds.cgi/LM/LM193.pdf>

U2 is a National LMV331:

<http://www.national.com/ds.cgi/LM/LMV331.pdf>

or a TI LMV331IDBV:

<http://focus.ti.com/docs/prod/folders/print/lmv331.html>

Q1, Q2 – RK7002:

<http://www.rohm.co.uk/downloads/Standard%20Transistors.pdf>

Q4,Q7,Q8,Q10,Q11 are TPC8003 devices:

[http://www.semicon.toshiba.co.jp/td/en/Transistors/Power\\_MOSFETs/en\\_20030307\\_TPC8003\\_datasheet.pdf](http://www.semicon.toshiba.co.jp/td/en/Transistors/Power_MOSFETs/en_20030307_TPC8003_datasheet.pdf)

Q3, Q5 and Q9 FMY5 transistor arrays:

<http://www.rohm.com/products/databook/tr/pdf/fmy5.pdf>

Q6 – BC847B:

<http://www.rohm.com/products/databook/tr/pdf/bc847b.pdf>