Power Valve modification

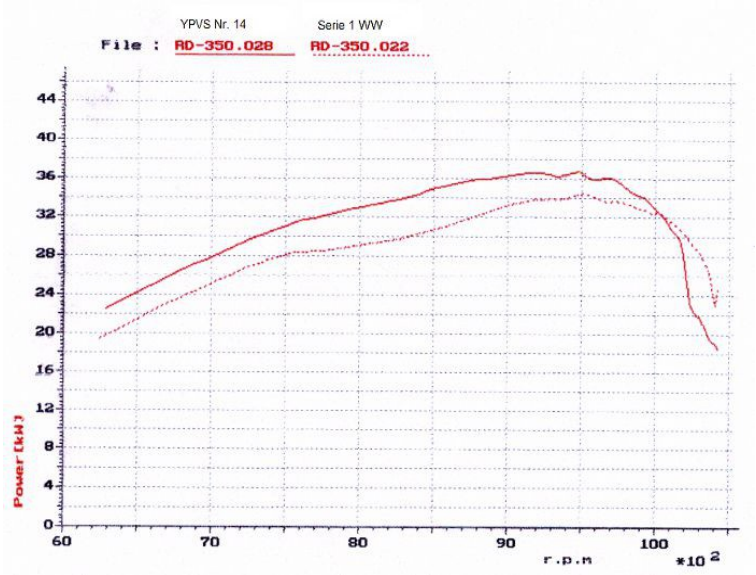
by M. Kieltsch

The PV actuation rpms have huge impact on the engine characteristic and performance.

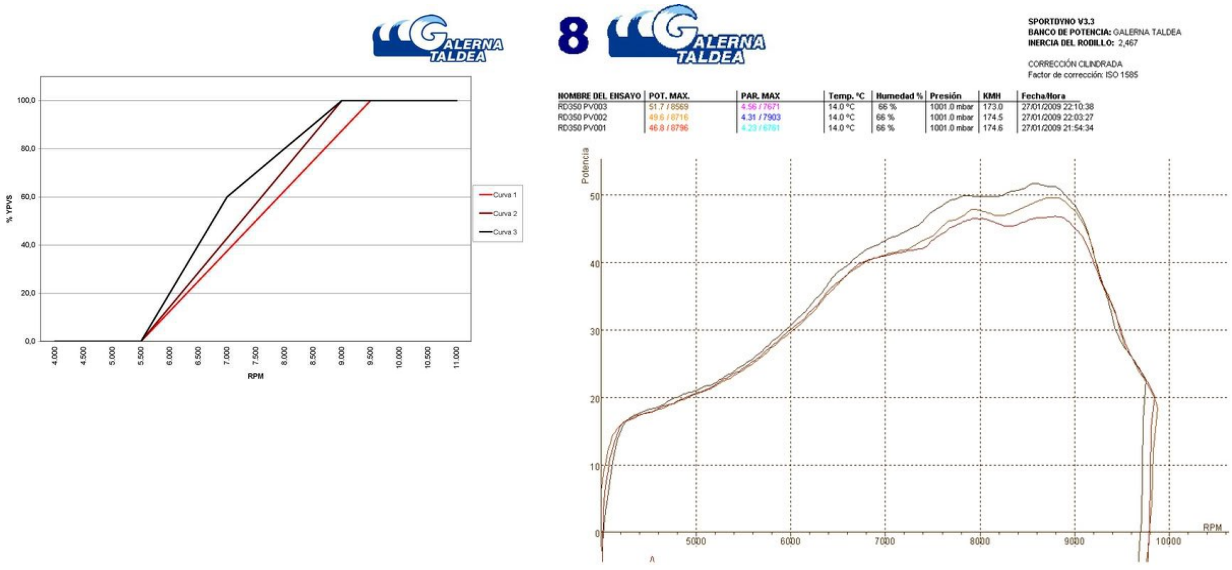
As a rule of thumb for RZ350 engines I found that a fully open valve should occur some few hundred rpm before peak performance rpm.
Depending on your state of tune and combination of stock parts that's often not the case with stock PV control boxes. Worst example is the German 1WW (UK F2 model) box that opens fully at 10.000 combined with a pipe peaking at 8500-9000.

The possible result of modifying the start/end rpm of your control box depends of how good/bad the stock box fits to your engine.

Measured dyno charts before/after on stock RZ engines look like this:



Dyno Marco Böhmer (http://www.sonic-speed.net/), Stock 1WW vs. BDK Curve 14



Dyno Galerna Taldea (http://www.galernataldea.com/) (programmable PV: Zeeltronic PPV)

Suitable PV boxes for mods:
The separate PV control boxes of the years 1983-1989 all have that huge IC that has the rpms & angle coded via bridges on the PCB.
The 31K box from 83/84 is not that comfortable to modify as it has a layer of clear coat on the back of the PCB that is hard to remove. (That's the thick case on the left)
All the later boxes (case on the right) have a 2-3 mm soft transparent coat that is easy to strip off.

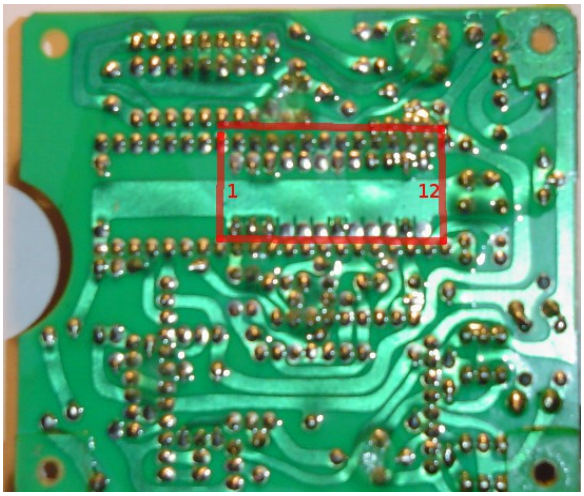
Yamaha PV boxes: left: 31K, right: later RD's, RD500, TZR250

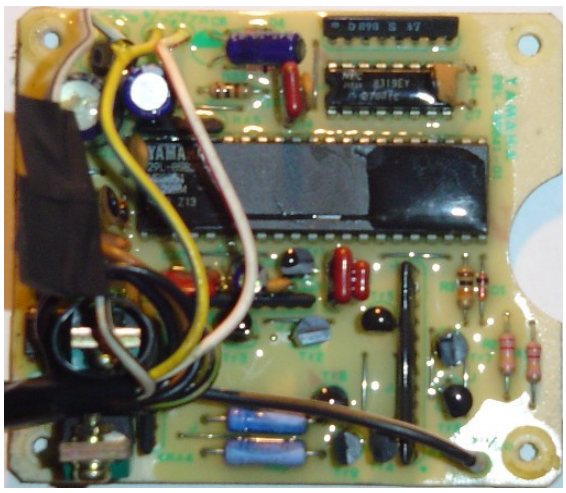
You can do an eBay search for TZR250, RD350YPVS, RD500. They're all electrically compatible but just have different connectors (some have slightly different cable colors).

Conversion:

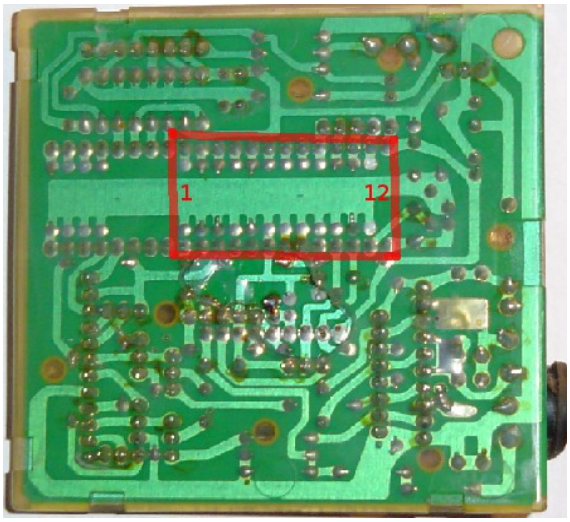
On the back side of the PCB you can see the pins of the main IC.
It has 12 pins that are numbered from left to right.

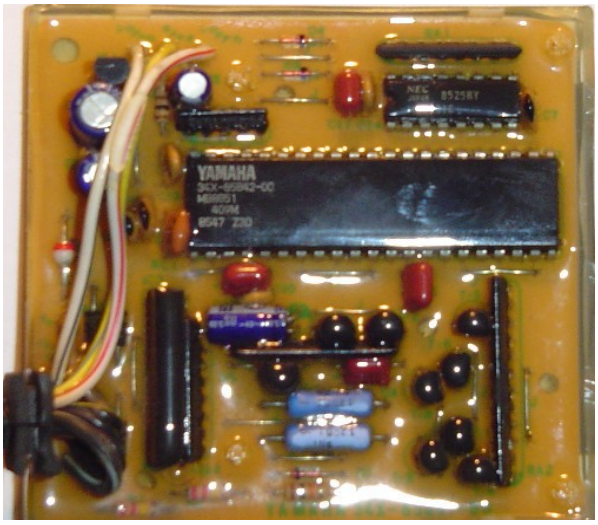
Whether a bridge is active or not can be determined with the protruding wire ends in the 2'nd and 3'rd row (row 1 = top row of pins)
If there is a wire it means “active” (= 1), No wire means “inactive” (= 0)



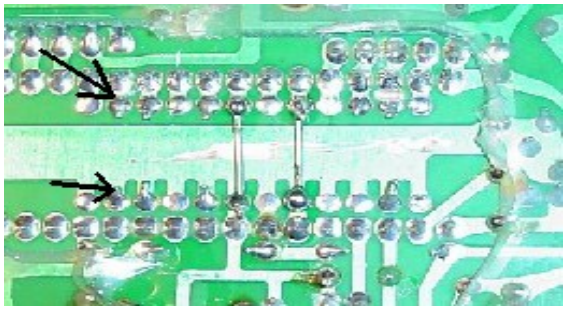


31K: (Bridges at 1,2,3,7 and 11)





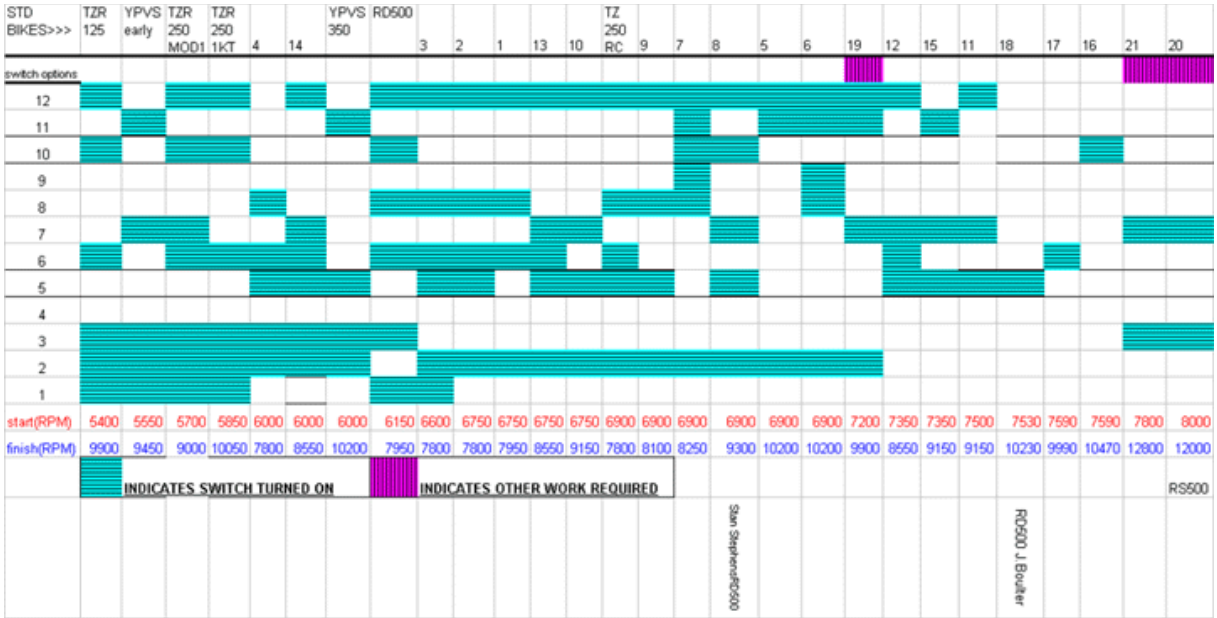
1WW: (Bridges at 2,3,5 and 11)



You can change a 1 into a 0 if you cut the bridges at one of the two indicated locations. Use a Dremel and interrupt the copper path on the PCB.

To turn a 0 into a 1 I solder a piece of wire as shown in the pic. The important detail is that “ground” (the wide path in the middle) is connected to the IC pin in the 1'st row.

The famous BDK PV chart is referring to the pins 1 to 12 on the main IC.
Left column = pin nr.
Green = bridge active
Empty (white) = remove bridge



Source: http://www.bdkraceeng.co.uk/

If you need that a bit more versatile, you can use a measurement from Stefan Rempfer (Germany).

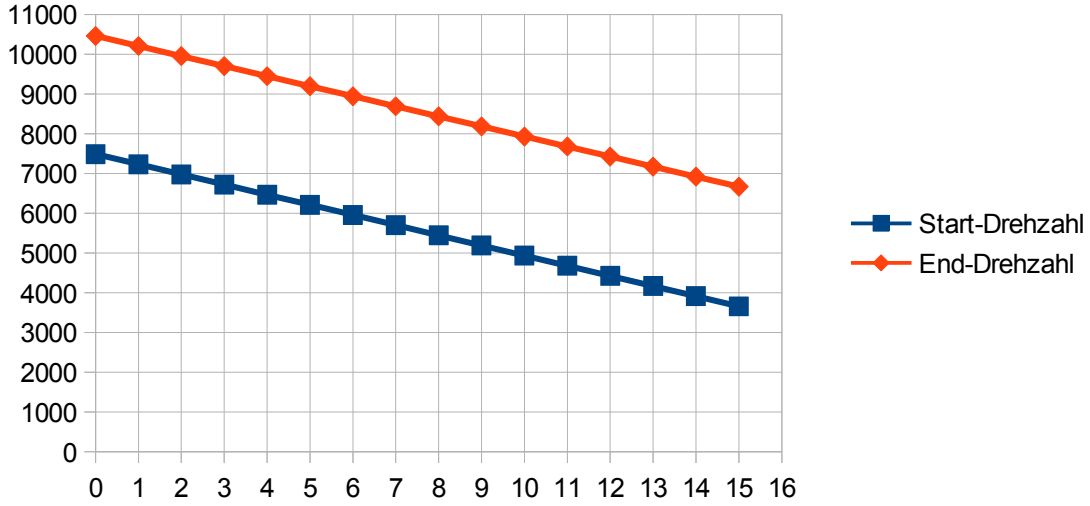
He used a 12 pin DIP switch soldered to the IC pins and measured what the pins actually changed.
At the end he found that it's a binary representation of three 4-bit numbers (i.e. 0-15).
Pin 1-4 controls the start rpm, pin 5-8 the end rpm and pin 9-12 the opening angle of the valve.

PV-Box 1WW converted to DIP-switch.

This was his result for each of the 3 4-pin blocks:

Bridge 1	Bridge 2	Bridge 3	Bridge 4	**Value**	**Start-rpm**	**End-rpm**	**Angle**
0	0	0	0	**0**	**7486**	**10457**	**30,6**
1	0	0	0	**1**	**7230**	**10204**	**31,6**
0	1	0	0	**2**	**6975**	**9951**	**32,7**
1	1	0	0	**3**	**6720**	**9699**	**33,8**
0	0	1	0	**4**	**6465**	**9446**	**34,9**
1	0	1	0	**5**	**6209**	**9193**	**35,9**
0	1	1	0	**6**	**5954**	**8940**	**37,0**
1	1	1	0	**7**	**5699**	**8687**	**38,1**
0	0	0	1	**8**	**5444**	**8435**	**39,2**
1	0	0	1	**9**	**5188**	**8182**	**40,2**
0	1	0	1	**10**	**4933**	**7929**	**41,3**
1	1	0	1	**11**	**4678**	**7676**	**42,4**
0	0	1	1	**12**	**4423**	**7424**	**43,5**
1	0	1	1	**13**	**4167**	**7171**	**44,5**
0	1	1	1	**14**	**3912**	**6918**	**45,6**
1	1	1	1	**15**	**3657**	**6665**	**46,7**

Binary/Decimal conversion table



Graph for start/end rpm

If you cross check that to the BDK table, you get good matches. For example the start rpm (pin 1-4) of the first few columns is a 1-1-1-0 (a 7 in decimal). That gives us a 5700 according to the Rempfer measurement and some 5400-5850 rpm according to BDK.

For the TZR125 and 250 the end-rpm is listed with 0-1-0-0 (a decimal 2). According to Rempfer that's 9951 rpm, according to BDK 9900 or 10050.

As you see this both correlates within some measurement and also individual PV box tolerances and that's the reason why both measurements are not 100% identical.
I have a designated YPVS tester at home and checked the Rempfer table with an own DIP converted box. So I'm able confirm that table with my own measurement.

Practical experiences:

- Solder with caution and let it cool down during your work.
  The IC does not like huge amounts of heat and I already destroyed one in trying a DIP conversion.
- The F2 (German 1WW) pipes have a peak rpm of 8500-9000 rpm (depending on the cylinders used). The most successful end rpms used were in the range of 8200 – 8500.
- The cigar-style 31K pipes have a higher peak. Here we used end rpms of around 8500-9000 rpm.
- The RD500 opens MUCH too early.
  With stock pipes you benefit from a higher end rpm in the 9-10000 rpm range.
  When using for example JL pipes I found that the “RD500 Boulter” setting from BDK was very beneficial to cure the giant midrange dip in the performance curve. That would be a start rpm of 7500 and an end rpm of 10.500.
- On the TZR250 BDK reported a earlier opening to gain performance (9000 instead stock 10000)
- If you use some unknown pipes on RZ based engines, I found that the end rpm should be some few hundred less than the peak performance rpm. For my DIY pipes they peaked at some 9300-9700 and thus I used PV end rpms of some 9000-9300.

- Personally I have not tested much with the opening angle. I have reports that there is a noticeable effect.
  In earlier applications I experimented with a deeper closing of the valve which was beneficial for low end torque. On the other hand it caused undesired effects like partial load bogging at low/mid rpm.

FAQ's:

- Is a fully programmable box worth the extra money ? (Ignitech STPS or Zeeltronic PPV, or even a CDI/PV combo-box)
  In any case yes, because the form of the opening curve can influence the engine characteristic very much. Adding ignition advance will enhance performance even more.
  You just need to be able to read a wiring diagram, solder cables and use a PC software to program the curves.
- If you fix the PV to fully open; is there a difference in peak performance compared to optimized PV start/end rpms ? Theoretically the peak HP should not be affected ?
  Funnily the answer is yes. In several measurements and simulations you can see an increased peak performance with optimized PV actuation rpm's even after the PV is already fully open.
  I cannot explain that effect, but it is existing!