

## Introduction

This report describes the details of fitting the Porsche 993 RS KW Clubsport kit and prototype KW top mounts to a 993 C2 conducted in October 2009. The client had requested monoball top mounts as an upgrade to the OEM.

Mr Bump of KW provided prototype top mounts for the project hence this detailed feedback report.

## Background

The original KW CS kit was originally fitted to a Porsche 993 RS which was subsequently reverted to OEM prior to sale. The KW CS kit was sold to a Porsche 993 C2 owner. The C2 owner wanted RS ride heights and RS type camber geometry. Installation, ride height and geometry work were conducted by Chris Franklin of center gravity limited. The relative ride heights of RS , C2 and our car are shown in Table 1.

	front		rear	
	camber	ride ht	camber	ride ht
<b>993 C2</b>	-0"20'	144mm	-1"10"	127mm
<b>993 RS</b>	-1"	124mm	-1"20'	107mm
<b>Our car</b>	-1"30'	134mm	-1"20'	117mm

Table 1. \*Our car – results required

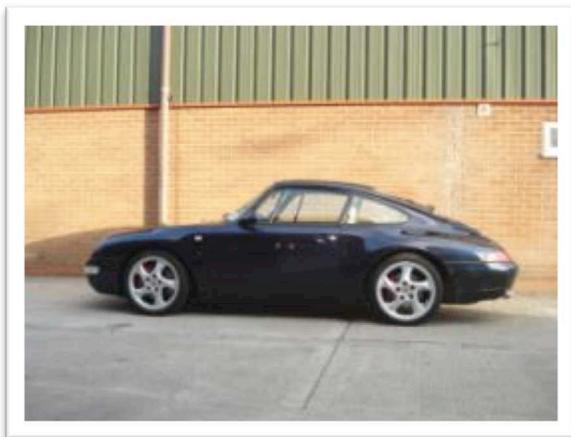


Fig 1. Our Car Completed 993 C2 with KW CS kit

It was recommended by center gravity that RS was too low and target ride heights should be increased by 10mm to reduce bump steer and geometry issues caused by non RS wheel hub carrier and tie rods.

## Assembling modifications and issues

It was acknowledged that the top mounts supplied by Mr Bump were prototypes and feedback from ourselves was required as to their suitability.

It is acknowledged that the KW kit being installed to the 993 C2 was a 993 RS kit and the top mount was for the 993 C2, therefore the modification to the front damper rod was required.

The 993 RS is fitted with a Porsche OEM monoball top mount which require a longer shoulder/damper rod than the stock C2 top mount.

During assembly of the new top mount a 20mm spacer tube was fitted to the 993RS damper rod to place the top mount in the correct position.

Fig 2 shows the assembled top mount without spacer. Fig 3 shows the final assembly with spacer tube fitted.



Fig 2. Shoulder of 993RS damper rod too short for top mount / fitting to 993 C2 prior to spacer being fitted

After fitting the spacer tube the top mount nut correctly fitted and the topmount was correctly positioned, with 3-4mm of rod thread showing.



Fig 3. 20mm spacer tube fitted on 993RS damper rod for correct top mount position for C2

### Top Mount Hex nut issue

The aperture in the top mount plate is the same diameter nearly as the Hex nut. Only with the damper rod perpendicular to the top mount was there clearance. See Fig 4. When installed the rod is inclined to the top mount plate to achieve the KPI formed by the strut.

On first fitting the hex nut conflicted with the top mount circumference for the design ride height (134mm), at Postions #1 and #2 given in Table 2.



Fig 4. Top mount plate aperture and hex nut

### Top mount design and impact on negative camber

After installation of the completed assembly the front and rear ride heights were set as per 'our car' in Fig 1.

The front cambers were then investigated for different permutations of the positions of top mount and eccentric adjuster on the strut.

It was feasible to rotate the top mount through 180° giving inboard or outboard positions for the monoball in relation to the cars top mount turret.

The standard KW eccentric adjuster bolt on the strut/wheel carrier was used in its most and least negative camber positions (in and out). Table 2 below shows the cambers achieved with the unmodified top mount.

position	mount	eccentric	camber
#1	In	In	~-4''30'
#2	In	Out	~-3''00'
#3	Out	In	~-0''15'
#4	Out	Out	+ve camber

Table 2. Top mount permutations for unmodified mount plate

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None of the top mount positions could give the required camber of -1°30'. It is feasible that positions #1 and #2 may be used for race RS but unlikely for road going C2s. Positions #3 and #4 are not suitable for road cars.

### Top mount modification

It was decided to modify the top mount to achieve a range of cambers in the 0 to 2 degree negative range.

This was achieved by moving the mono-ball aperture in the plate to a central position. The original top mount plate was modified by CNC machine, by recreating the fixing point and counter bores in a central position. Fig 5. Shows the modified top mount installed in the car.

Unfortunately one of the 4 bearing fixings could not be refitted.



Fig 5. Modified top mount installed to give 0 to 2degrees negative camber

### Modified top mount cambers

The correct cambers were achieved for the modified top mount seen in Fig5.

Cambers in the range 0 to approximately 2degrees negative could be achieved for the

mid position top mount, using the standard strut eccentric adjuster.

Ride heights of 134mm were achieved for the front axle.

### Final chassis report

A final geometry report is shown in Fig 6. Ride heights were set 10mm higher than 993 RS at 134mm front and 117mm rear .

Measurement printout  
 Car standard measurements  
 993 C2 - 1.1.10 - PORSCHE STANDARD - 1993-1998  
 Date: 02.10.2009 09:20:16

Customer name: 900962 not late  
 Vehicle: 9420136  
 Registration: 77955  
 Comments: 77955

Order Operator: Chris Franklin  
 Order No: 021008 / 001

Vehicle: PORSCHE STANDARD v07 06/2005.00  
 PORSCHE (SA) 993 - Production: 1994 - Chassis: Sport suspension  
 Comment: 1:Rear fuel + 13kg ballast boot + 10kg strut for ride height and geometry adjusters  
 Reason: new low to sub sport coilover 3160 / new powerflex front axle bushes fitted

Rear Axle		Initial Measurement	Target Data	Final Measurement
Camber	left	-1.72°	-0°15' (-1°10') +0°15'	-1.52°
	right	-1.88°	-0°15' (-1°10') +0°15'	-1.68°
Cross Camber		0.18°	0°30'	-0.02°
Individual Toe	left	+1.0 mm	-0.7 mm [+1.3 mm] -0.7 mm	+1.3 mm
	right	+0.8 mm	-0.7 mm [+1.3 mm] -0.7 mm	+1.3 mm
Cross Toe		-0.2 mm	0.5 mm	-0.1 mm
Total Toe		+1.8 mm	-1.3 mm [+0.7 mm] +1.3 mm	+0.7 mm
Setback		+1.5 mm		+1.4 mm
Geometrical driving axis		-0.1°	-0°10' [+0°00'] +0°10'	-0.10°
Front Axle		Initial Measurement	Target Data	Final Measurement
Caster 10°	left	+5.50°	-0°30' [+0°30'] +0°15'	+5.20°
	right	+5.55°	-0°30' [+0°30'] +0°15'	+5.25°
K.P. 1. 10°	left	+25.51°		+25.00°
	right	+25.51°		+25.00°
Camber	left	-1.02°	-0°10' [-0°30'] +0°10'	-1.30°
	right	-0.70°	-0°10' [-0°30'] +0°10'	-1.30°
Cross Camber		0.32°	0°10'	-0.20°
Individual Toe	left	+1.7 mm	-0.7 mm [+0.7 mm] -0.7 mm	+0.7 mm
	right	+0.8 mm	-0.7 mm [+0.7 mm] -0.7 mm	+0.7 mm
Cross Toe		-0.9 mm	-1.3 mm [+1.3 mm] +1.3 mm	-1.2 mm
Total Toe		+0.8 mm	-1.3 mm [+1.3 mm] +1.3 mm	+0.7 mm
Setback		+0.8 mm		+0.7 mm
Included Angle 10°	left	+13°04'		+13°50'
	right	+13°31'		+13°25'

Figure 6. Final geometry results Porsche 993 C2

### Conclusion

The unmodified top mounts are generally of good design and materials with a feeling of quality.

The mounts fit the car very well with supply of the mounted splined studs.

The top mount rod nut interferes with the top mount plate with the unmodified top mount installed in either inboard or outboard

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positions. The top mount aperture requires a larger radius to allow the nut free movement.

In unmodified form the top mount is useable only for race type cambers of -3" to -4"30' camber at standard ride heights in conjunction with eccentric adjuster.

With modification to the top mount plate cambers in the range of 0 to -2' (2degrees) were achievable.

For production it may be more suitable for road use to modify the top mount plate using a less offset mono-ball bearing.

For our project the bearing was centred, however a good compromise would be to set the new bearing position half-way between the original design and center gravity modification.

Overall the project was a success, giving us the ability to offer a range of cambers. The customer was very happy with the handling of the car!