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Magnum, 300C

Cobalt and HHR

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Corvette C4

Corvette C5, Z06

Corvette C6, Z06

Corvette C7

Countryman/Paceman
by MINI

Crown Vic- Panther

Dart

Eclipse 1G

Eclipse 2G

F150 (2010+)

Fiesta

Focus 00-'07

Focus 2012+

Ford Ranger

Fusion '13+

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Impala/Caprice '71-'76

Jeep Cherokee

Juke

Lancia Scorpion

Lightning, Harley
F150 99-04

Marauder

Dual Master Cylinder Bias and Torque Calculator

This new calculator will produce torque results based upon projected maximum deceleration demands and allow users to build a dual master cylinder brake system with a wide variety of variables used in its design criteria. Additionally, the calculator can be used to fine tune desired brake bias based upon altering the pivot point of the balance bar in the pedal assembly thus giving an accurate picture of what true 'adjustable bias' can produce via the cockpit cable adjuster. ***To use the dual MC calculator as a single bore design- set both MCs in the table to the same spec, then set the "pivot offset" value to zero. This will give the same line pressure to both axles and not favor one or the other.**

The calculators requires a fair amount of data to get the desired results. In the brake bias calculator you will need the dimensions of many of the components of your current or desired brake system. This includes things such as the pedal dimensions, piston sizes, rotor diameter and brake pad coefficient of friction. The Torque table will require you to know the estimated weight of your vehicle per axle as well as an estimated 'center of gravity' as well as the desired g-force or "g" you feel your vehicle can achieve. When fully populated the tables work in tandem with one another allowing you to tune the bias calculator to achieve the goals set in and by the torque calculator.

A few opening thoughts:

1. The calculator has a default built into it to serve as a sample. In the sample vehicle we have designed a fairly reasonable 14"/13", 6/4 piston front and rear brake system with a modest .45 pad Cf and a common pedal ratio design. Note how the 68/32 brake bias is produced by fine tuning of the balance bar (+.150") so that the "required" torque per axle matches that of the "torque from left" cells. The total torque should also match relative to the leg input pressure for 100% value.

2. Use reasonable data. Don't make unreasonable assumptions that your car cannot achieve. A full 1g deceleration is possible on a vehicle with very high grip tires and optimum conditions. Most street tires will work best at perhaps a .6g target. If you can achieve more at some point it will only be relative to the amount of rotor torque and thus a bump in pedal effort to get to .8g may be minimal. Watch you "leg effort" number; the default 93lbs is huge. A more realistic value is in the 50-60lb range. Test this with a bathroom scale propped up against a wall and find your comfort level.

3. Surface conditions. The calculator does not take into account surface conditions. We are assuming simple Mu of 1 or a clean, dry surface. Obviously you cannot achieve 1.2g deceleration on a gravel surface regardless of the tires or brakes. Again, be realistic in your input.

Differences in this calculator vs the Bias Calculator; Here the calculator will require you input much of the same data as the other, however there are some changes also. The pedal ratio will need to be calculated by supplying the measurements of the short and long portions of the brake pedal. You will need to populate the diameter of all pistons in the calipers to represent the total pressure- as opposed to 1/2 of the caliper when comparing only bias and an oe sliding/floating caliper. While bias will not change one way or the other we now want to calculate the total force produced by clamping. *If using a single or dual piston sliding/floating caliper populate the "Outboard" piston data to match that of the "Inboard" to compensate for the slide force factor.

Brake Bias Calculator

Weight Transfer Values

Leg force effort (lbs.)	<input type="text" value="100"/>	Front axle wt.	<input type="text" value="1000"/>	<input type="text" value="40.00%"/>
Distance: pedal pad center to pushrod center	<input type="text" value="10.000"/>	Rear axle wt. lbs.	<input type="text" value="1500"/>	<input type="text" value="60.00%"/>
Distance: pushrod center to mount pivot center	<input type="text" value="1.500"/>	Total Weight lbs.	<input type="text" value="2500.000"/>	<input type="text" value="100%"/>
		Center of pushrod to center of pedal mount pivot.		
Pedal ratio	<input type="text" value="6.667"/>	CG Ht. inches	<input type="text" value="12.0"/>	
Force applied	<input type="text" value="666.700"/>	Wheelbase; inches	<input type="text" value="102.0"/>	
Distance: ctr. to ctr. of pushrods.	<input type="text" value="2.500"/>	Deceleration; 'g'	<input type="text" value="1"/>	
Pivot offset (+ Front or - Rear)	<input type="text" value="0.0"/>	Total Transfer	<input type="text" value="294.118"/>	
% Front offset	<input type="text" value="0.500"/>	Net Dynamic Front wt.	<input type="text" value="1294.118"/>	<input type="text" value="51.76%"/>
FRONT Master Cylinder bore	<input type="text" value="0.75"/>	Net Dynamic Rear wt.	<input type="text" value="1205.882"/>	<input type="text" value="48.24%"/>
Front MC area	<input type="text" value="0.442"/>	Required Brake Torque		
Front line PSI	<input type="text" value="754.186"/>	Desired 'g' from above	<input type="text" value="1"/>	
REAR Master Cylinder bore	<input type="text" value="0.6250"/>	Dynamic front wt. above	<input type="text" value="1294.118"/>	
Rear MC area	<input type="text" value="0.307"/>	Front tire dia. Inches	<input type="text" value="27.0"/>	
Rear line PSI	<input type="text" value="1085.831"/>	Dynamic rear wt above	<input type="text" value="1205.882"/>	

Mazda 3	Front Outer piston 1 dia	<input type="text" value="1.73"/>	Rear tire dia. Inches	<input type="text" value="28.0"/>	
	Front Outer piston 2 dia	<input type="text" value="1.57"/>	Front Torque req.	<input type="text" value="1455.883"/>	<input type="text" value="50.86%"/>
Mazda 6	Front Outer piston 3 dia	<input type="text" value="0"/>	Rear Torque req.	<input type="text" value="1406.862"/>	<input type="text" value="49.14%"/>
Mazda RX8	Front Outer piston 4 dia	<input type="text" value="0.000"/>	Total Torque req.	<input type="text" value="2862.745"/>	<input type="text" value="100%"/>
MINI 01-06	Front Inner piston 1 dia	<input type="text" value="1.73"/>	Front from bias table	<input type="text" value="2970.152"/>	<input type="text" value="62.51%"/>
MINI 07-13	Front Inner piston 2 dia	<input type="text" value="1.57"/>	Rear from bias table	<input type="text" value="1781.492"/>	<input type="text" value="37.49%"/>
MINI 2014+	Front Inner piston 3 dia	<input type="text" value="0"/>	Total from bias table	<input type="text" value="4751.644"/>	<input type="text" value="165.98%"/>
	Front Inner piston 4 dia	<input type="text" value="0.000"/>			
Mustang 05-13					
	Total front area	<input type="text" value="8.573"/>			
Mustang 2015-	Pad coefficient of friction- Cf (Mu)	<input type="text" value="0.450"/>			
Mustang 94-04	Diameter: Outside of rotor	<input type="text" value="14.000"/>			
RSX	<u>Radial height of pad</u>	<input type="text" value="1.750"/>			
SHO '89-95			Swept radius	<input type="text" value="6.125"/>	
SHO, Flex, Explorer, MKS 2010+	Front torque (ft. lbs)		Combined corners	<input type="text" value="2970.152"/>	
Solstice/Sky	Brake bias front %	<input type="text" value="0.625"/>			
SRT-4	<u>Rear Outer piston 1 dia</u>	<input type="text" value="1.10"/>			
	Rear Outer piston 2 dia	<input type="text" value="1.125"/>			
Subaru WRX 08+	Rear Outer piston 3 dia	<input type="text" value="0.000"/>			
Subaru WRX 99-05	Rear Inner piston 1 dia	<input type="text" value="1.10"/>			
Super Duty 1999-2004	Rear Inner piston 2 dia	<input type="text" value="1.125"/>			
Super Duty 2005-2012	Rear Inner piston 3 dia	<input type="text" value="0.000"/>			
Super Duty 2013+			Total rear area	<input type="text" value="3.889"/>	
Tiburon	Pad coefficient of friction- Cf (Mu)	<input type="text" value="0.450"/>			
Titan-Armada	Diameter: Outside of rotor	<input type="text" value="13.000"/>			
XXX Customs	<u>Radial height of pad</u>	<input type="text" value="1.750"/>			
			Swept radius	<input type="text" value="5.625"/>	
	Rear torque (ft. lbs)		Combined corners	<input type="text" value="1781.492"/>	
	Brake bias rear %	<input type="text" value="0.375"/>			

After thoughts: in the example above we have a relatively high "leg" or input level. This is fine to show the relationship of these designs but the value should be closer to 60-70lbs total. To achieve that low a value and retain the total necessary rotor torque what would you do?? You'd use less leg input and either decrease the mc bores or more likely; increase the total piston area of both calipers. Give it a try and see. Or you can also put huge rotors on the car or even change the pedal ratio- all the while these changes will require you match the values in the right hand tables.

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