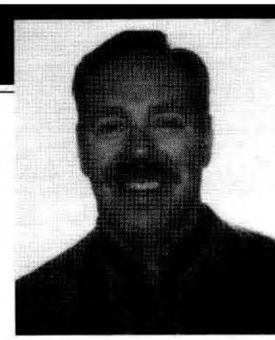
Ratio Roundup



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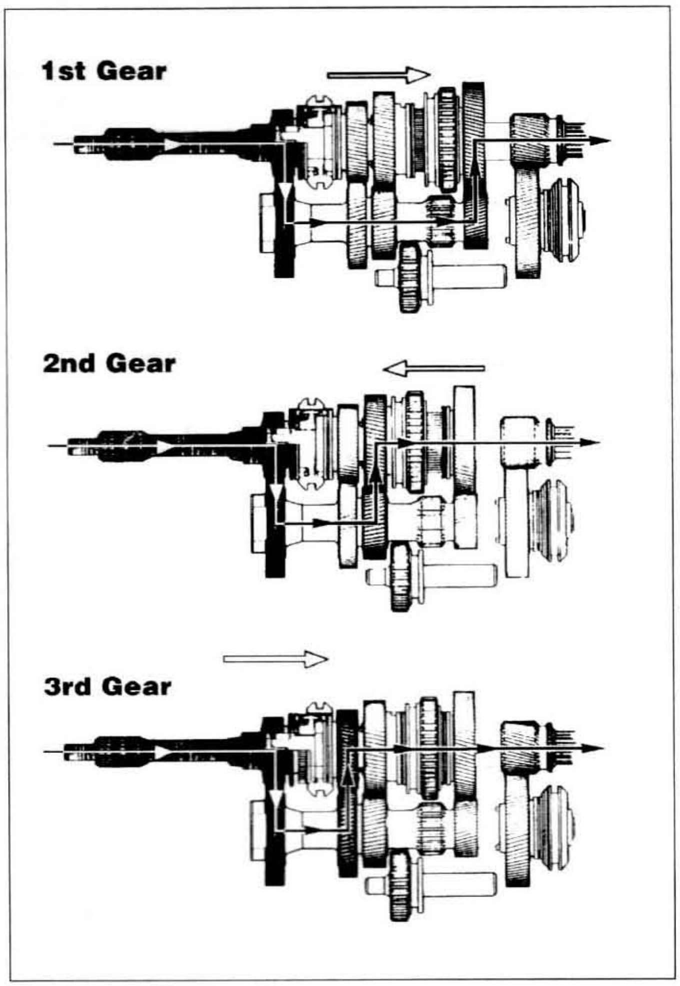
Many calls come in from shops around the country asking how to determine gear ratios. The following information will make it easy to figure ratios for any rear-wheel-drive transmission. We will discuss front wheel drive ratios in another issue.

In order to determine the ratios in a trans, we must know the tooth counts on the gears in the unit, some simple arithmetic and a knowledge of simple powerflow.



Obtaining the tooth counts is simple. I usually mark one tooth with a yellow crayon and make my count. On the cluster gear, stand it up on the big end and count each set of teeth, starting from the largest gear. Once we have written down the tooth counts, we can do the math.

The one rule to remember is that we always divide the DRIVEN gear by the DRIVE GEAR. Example: The input gear (main drive gear) has 24 teeth. The opposing gear on the cluster has 31 teeth (31÷24 = 1.29). We now know that the INPUT RATIO is 1.29. If you are wondering why we did the input first, go to the head of the class. There are three factors we must consider in figuring ratios.

1. The input ratio
2. Ratios of the other speed gears (1,2,3,5)
3. The final drive ratio (rear-end gears)

We need to know the input ratio, because it affects all other gears, and we need to know the rear-end ratio because that tells us the overall vehicle ratio.

Let's do the ratios on a common unit, the world class T5 found in a V8 Chevy Camaro.

We know the cluster gear has a tooth count of 31, 29, 22, 15 (reverse), 14, and removable 5th gear, 55.

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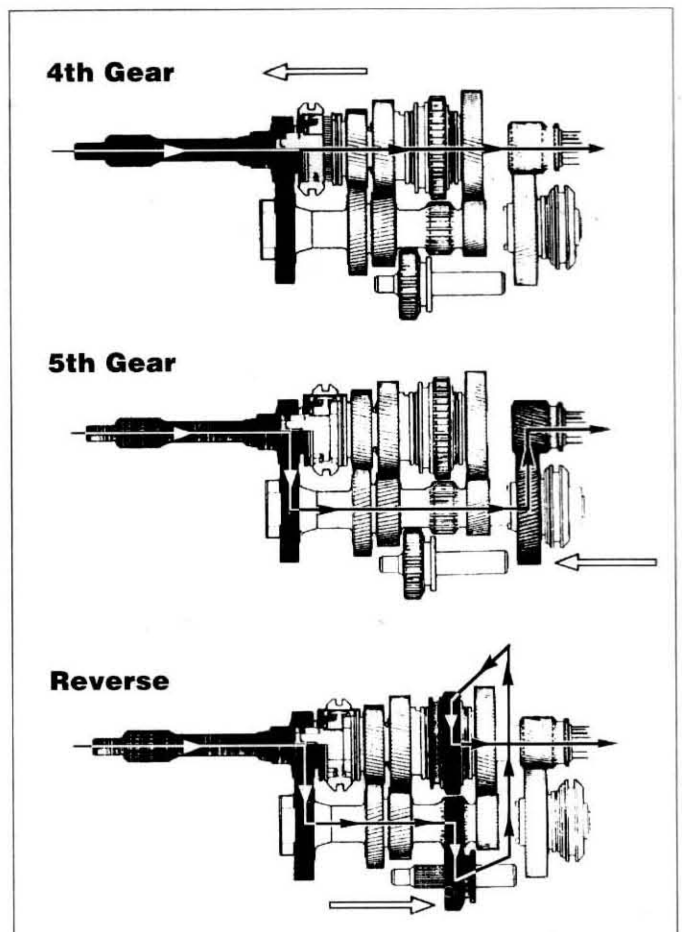

Tooth Counts	The Math	Gear Ratio
Input gear = 24	31÷24 = 1.29	1.29 input ratio
1st gear = 32	32÷14 = 2.28	2.28 1st gear ratio
2nd gear = 33	33÷22 = 1.50	1.50 2nd gear ratio
3rd gear = 30	30÷29 = 1.03	1.03 3rd gear ratio
4th gear = 1 to 1 direct drive (no powerflow through cluster)		
5th gear = 31	31÷55 = 0.56	0.56 5th gear ratio

Now that we have the individual gear ratios, we must multiply them by the input ratio, because all power flows through the input into the cluster, except in 4th which is direct drive.

1st gear ratio = 2.28 X 1.29 input ratio = 2.94 to 1 trans ratio
2nd gear ratio = 1.50 X 1.29 input ratio = 1.94 to 1 trans ratio
3rd gear ratio = 1.03 X 1.29 input ratio = 1.33 to 1 trans ratio
4th gear ratio = 1 to 1 direct drive
5th gear ratio = 0.56 X 1.29 input ratio = 0.72 (overdrive ratio)

Now that we have the transmission ratios for this particular unit, we might want to find out what effect the rear-end gears have on the vehicle overall ratios. To obtain the overall ratio we multiply the trans ratios by the ring-and-pinion ratio.

Let's use a final-drive ratio of 3.08.

1st gear ratio = 2.95 X 3.08 = 9.09 to 1
2nd gear ratio = 1.94 X 3.08 = 5.98 to 1
3rd gear ratio = 1.33 X 3.08 = 4.10 to 1
4th gear ratio = 1.00 X 3.08 = 3.08 to 1
5th gear ratio = 0.72 X 3.08 = 2.22 to 1

By studying the chart we just made, we can see there is a large "step" between 1st and 2nd gears, and that the "steps" between the other gears gradually lessen as we approach overdrive. By comparing ratios, we can see how much mechanical advantage is needed for smooth operation in 1st gear and how much less is needed at cruising speeds. It also becomes obvious that the manufacturer used a lot of care in selecting these ratios for good performance. Remember that performance is not judged by acceleration or top-end alone, but is a balance between driveability, good mileage, emission levels, the power band of the motor and the torque rating of the transmission.

This should prove that making changes in ratios should not be done without a little math and some careful thought. Next time a customer wants you to "throw in" a new superduper ring-and-pinion, you can sit down and figure out the true results of such a change before the fact. It is easy to see that numerically higher rear-end ratios will sacrifice miles-per-gallon and top-end speed. On the other side of the coin, a lower numerical rear ratio will increase mileage at the cost of some acceleration in the lower gears. ■