A 5-Speed transmission for your C1-C2-C3 for under $1500 (Part 1)

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Fig. 1: Camaro T5 transmission installed in a C2 (photo by Tom Austin)

INTRODUCTION

Like many NCRS members, I have a self-imposed rule that I will never make any modification to my vintage Corvette that is not a pure bolt-in change. Any changes must be capable of being easily reversed in the future by either me or by a future owner.

In the years since my C2 achieved a Top Flight award at the 2007 NCRS National, I've made several bolt-in changes to the car to make it more enjoyable to drive. By far, the bolt-in change that I have enjoyed the most was the Tremec TKO 5-speed I installed about twelve years ago. At the time, Keisler was selling a version of the stock Tremec TKO 5-speed that Keisler had modified to relocate the shifter to the C2 position. The conversion kit was advertised (correctly) as a pure bolt-in solution.

Keisler eventually went bankrupt, but most of their assets were acquired by Silver Sport Transmissions, which continued to sell an improved version of the Keisler TKO conversion kit. And, there are now other companies that sell similar conversion kits. A recent development is that Tremec has introduced the new TKX 5-speed, which has some minor improvements over the TKO. All of the major vendors of 5-speed conversion kits for vintage Corvettes are now using the TKX 5-speed in their conversion kits

So, TKX 5-speed conversion kits are now available as bolt-in solutions for a Corvette C1-C2-C3, but at a cost of about $4000. If cost is not a concern, a TKX 5-speed conversion is a very nice bolt-in solution. The TKX is nearly indestructible, with a torque rating of 600 ft-lb.

Over the years that I have had the TKO 5-speed in my C2, many fellow Corvette owners have told me that they would love to have a bolt-in 5-speed in their Corvette, but they are put off by the high cost. The conventional wisdom is that if you want a pure bolt-in solution, the TKX is the only available solution.

To my surprise, I recently learned that some people have managed to install a Tremec T5 5-speed in C2-C3 Corvettes with "almost" no cutting. As I learned more about how they achieved this, I became intrigued with the challenge of making improvements to this method to eliminate the need for any cutting at all. It seemed plausible that a no-cutting solution could be developed for Corvette owners who insist on a pure bolt-in solution.

Used T5 5-speeds are plentiful and comparatively inexpensive. Suitable used T5 transmissions can be purchased from a junkyard for as little as $300 and are easy to rebuild if necessary. There are several additional parts required to put a T5 into a C1-C2-C3, but I set a goal of trying to work out a T5-based, bolt-in solution that costs less than $1500 total.

This series of articles will describe my attempt to develop a bolt-in T5 5-speed option that can be implemented by anyone with ordinary mechanical skills.

OBJECTIVES FOR MY T5 CONVERSION "RESEARCH PROJECT"

Following are the self-imposed objectives I established for my T5 conversion "research project":

- 100% bolt-in solution that is completely reversible to the stock configuration
- Retain the stock C2 bellhousing and stock clutch linkage
- Transmission can be installed without removing the engine
- Mechanical speedometer drive connects to stock C2 speedometer
- Sufficient durability for use behind stock C2 small blocks
- Minimize need for fabrication of complicated components
- Drawings for all fabricated parts to be posted online
- Total parts cost under $1500

ADVANTAGES OF A 5-SPEED

Many people incorrectly assume that the only advantage of a 5-speed is having the additional fifth gear for reducing the engine rpm at cruising speed. However, focusing on just the extra fifth gear overlooks the equally beneficial feature of having a lower first gear. The lower first gear improves acceleration from a standing stop, which makes the car feel more responsive. Most 5-speeds have a much lower first gear ratio than the Muncie.

Back when the C2 was new, the "hot setup" for a Corvette was a Muncie M21 (first gear ratio of 2.20) combined with a 4.11 rear. This provided good standing-start acceleration but high cruising rpm. For highway driving, the preferred rear end was a 3.08. This provided low cruising rpm but poor standing-start acceleration. Many Corvette owners agonized about selecting a compromise rear axle ratio in the range of 3.36 to 3.70 to try to balance these conflicting goals.

A key benefit of using a 5-speed is that this compromise is no longer necessary. To explain why this is, consider that the effective overall ratio for the drivetrain is the transmission ratio multiplied by the rear end ratio. For a typical 5-speed, first gear is somewhat lower than a Muncie, and fifth gear is somewhat higher than a Muncie. So, a single rear end ratio can be used without compromise.

A simple way to visualize this is that with a 3.55 rear end and a 5-speed, first gear will have an overall ratio that accelerates better than a Muncie M21 with a 4.11 rear, and fifth gear will have an overall highway cruising ratio better than a Muncie M20 or M21 with a 3.08 rear. It's the best of both worlds.

A FEW WORDS ABOUT THE TREMEC T5 5-SPEED

The Tremec T5 5-speed is sort of the "Chevy small block" of the transmission world. It has been in continuous production since 1982, and you can still buy a brand new one today from Ford Racing. Millions of T5 transmissions have been manufactured for use in dozens of different cars and trucks, and both new and used T5 parts are widely available.

Like the Chevy small block, the T5 has been improved in various ways over the years, but there is a remarkable amount of parts interchangeability. As with the Chevy small block, builders who know the T5 well can tell you which versions of the T5, and which internal parts, are the best ones to use for a given application. Most experts agree that the strongest production T5s were those that were used in the following applications:

- 1988-1992 Camaro V8
- 1990-1995 Mustang V8
- 1999-2004 Mustang V6

The consensus view is that any of the above transmissions will handle up to 400 HP provided that you don't abuse them. The two key forms of abuse that should be avoided are drag-race style "power shifting," and performing high rpm clutch-dump burnouts.

Power shifting involves keeping the throttle floored while you shift. It is extremely hard on the synchronizers and gear teeth. Full-throttle burnouts are generally okay with the T5, but only if the clutch is fully engaged when you apply full throttle. The type of burnout that should be avoided is to wind the engine up to high rpm with the clutch disengaged, and then dump the clutch. The resulting shock loads are very hard on the transmission.

Aside from the above limitations, any of the above versions of the T5 will hold up fine. Spirited driving with super-fast up-shifts are fine, provided that you lift off the throttle and fully disengage the clutch when you shift (the way that 99.99% of us drive).

In a future article I will go into more detail on the evolution of the strength upgrades in the T5 and reasons why the above-listed T5s are the only ones being considered for this project.

If you have more than 400 HP and you want to drive your car hard, you would probably be better off with a TKX 5-speed that is nearly indestructible. Fortunately, all of the stock C1-C2-C3 Corvette small blocks meet the sub-400 hp criterion for using the T5, so if you are running a stock small block the T5 should hold up fine.

For people running engines with more than 400 hp, G-Force offers an aftermarket gear set for the T5 that they claim will handle 600 hp. However, the incremental cost of this gear set will push the cost of the modified T5 up close to the cost of a TKX.

THE T5 SHIFTER LOCATION IS THE BIGGEST PROBLEM FOR C1-C2-C3 CORVETTES

All modern Tremec 5-speeds (T5, TKO, and TKX) have the shifter centered directly over the main shaft, while the C2 shifter opening is about 2.8 inches off-center toward the driver. The reason for the offset of the C2 shifter opening is that the factory Muncie and T10 shifters were mounted externally on the driver's side of the transmission. If the T5 5-speed shifter was left in its stock, over-the-mainshaft location, it would come up through the ash tray opening in the C2 console.

The shifter relocation problem has been solved by Keisler, Silver Sport and others for the TKO and TKX 5-speeds, but not for the T5 5-speed. For the TKO and TKX 5-speeds, the relocation of the shifter adds cost, but it moves the shifter to the correct C2 position to create a bolt-in solution.

Figures 2 through 5 illustrate the problem. Figure 2 shows a Muncie 4-speed with the shifter mounted on the driver side, offset about 2.8" from the center of the transmission. Figure 3 shows a stock T5 that has the shifter centered over

the main shaft. Figure 4 shows a stock TKO with the shifter centered over the output shaft. Figure 5 shows the modification that needs to be made to the TKO (and the new TKX) to get the shifter to come out in the same place that a Muncie 4-speed shifter comes out in the C2 console.

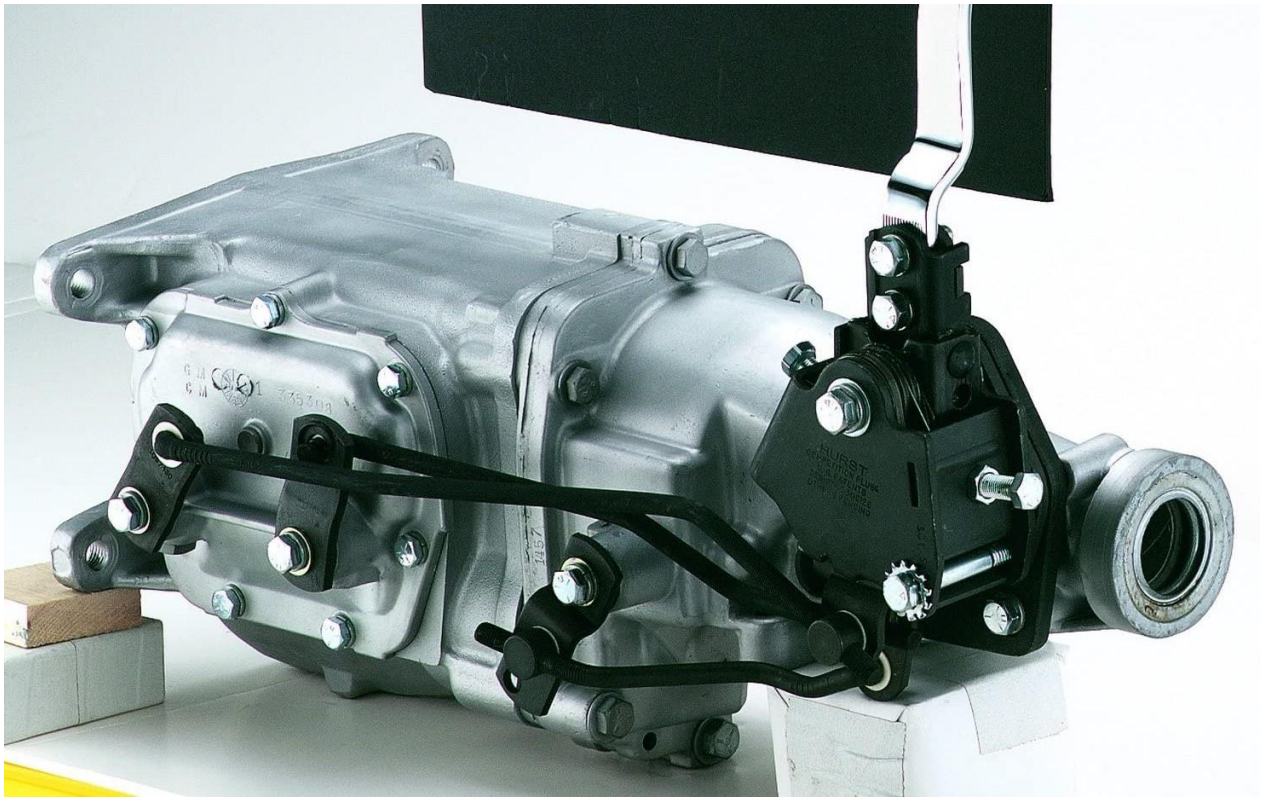

Fig. 2: Muncie 4-speed with stock shifter location on the side of the transmission

Fig.3: Stock T5 5-speed with shifter centered over the output shaft

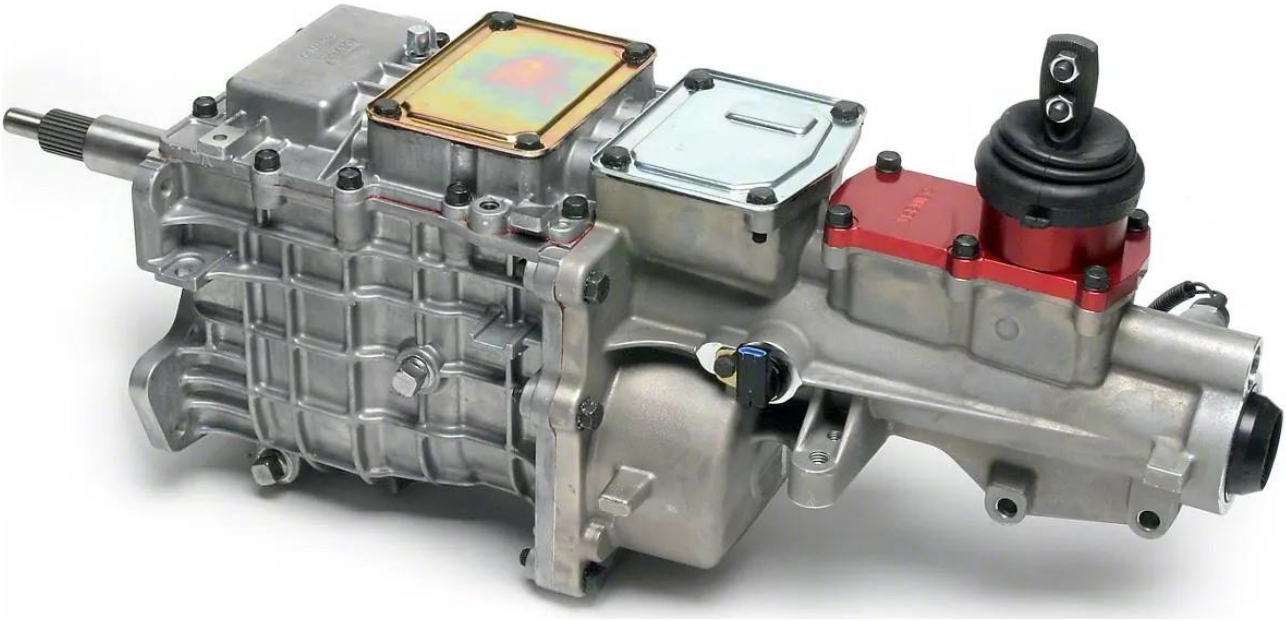

Fig 4: Stock TKO 5-speed with shifter centered over the output shaft

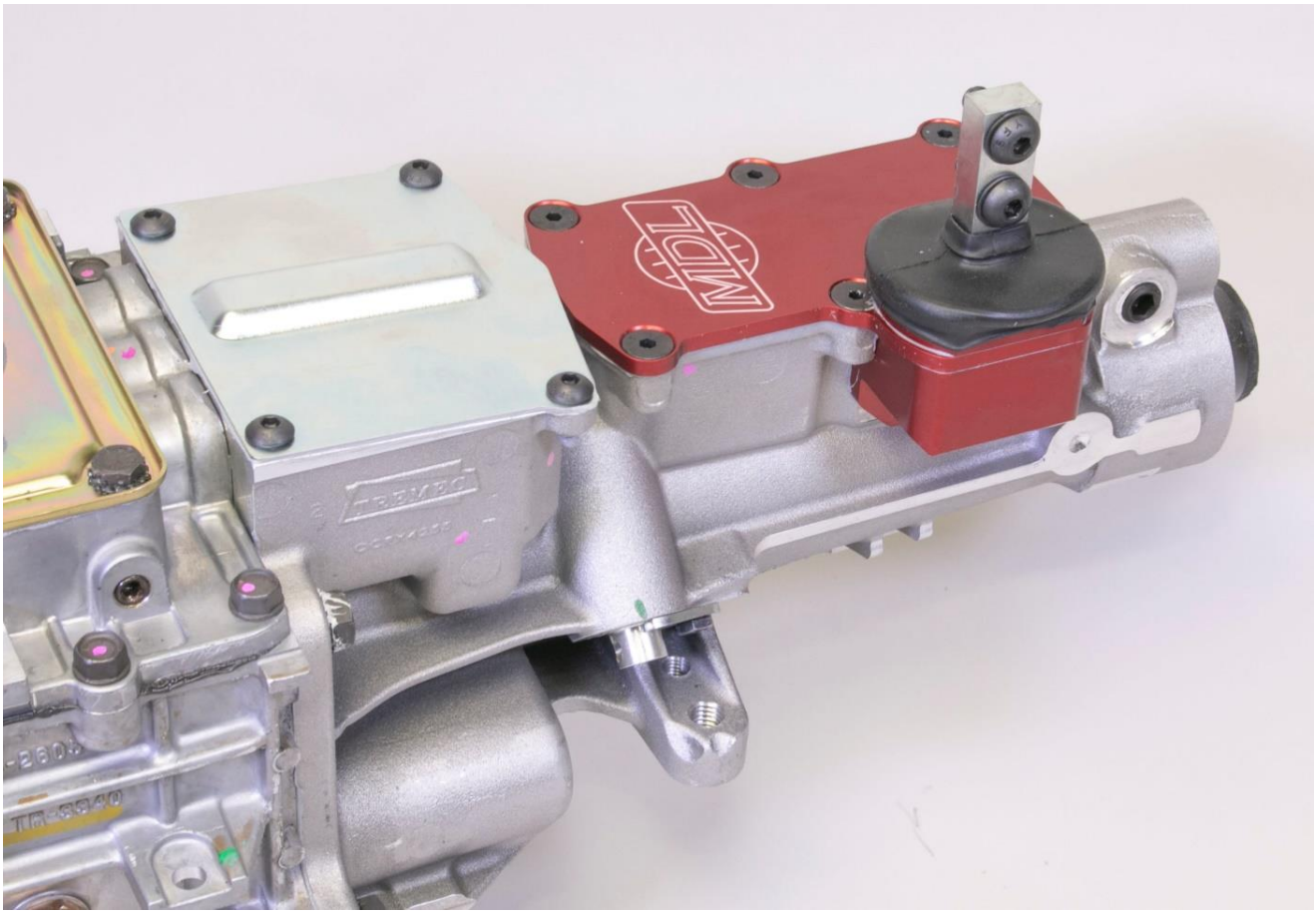

Fig.5: Modified TKO 5-speed with shifter moved toward the driver side

The modification shown in Fig. 5 works very well for the TKO and TKX 5-speeds. Unfortunately, this is an expensive modification to an expensive transmission, resulting in a cost of about $4000 for a kit to install a TKX in a C2.

At present, no one offers a similar shifter relocation for the T5. It turns out that due to some key differences in the T5 shifting mechanism, the basic relocation method used for the TKO and TKX cannot be used for the T5 (unless you are willing to have the shift pattern flipped left-to-right).

THE CAMARO T5

As a result, I was very surprised when Corvette Forum member Tom Austin posted the photo in Fig. 1, shown at the beginning of this article. Tom's photo shows that he had successfully installed a Camaro T5 in his C2. And, he made the shifter come out in the factory location, with the correct shift pattern.

The method that Tom used was not quite a "bolt-in" solution, since Tom had to make some cuts in the transmission tunnel fiberglass that are hidden by the console cover. Fig. 6 shows the cutting that was required:

Fig. 6: What's under the console for the T5 in Fig. 1 (photo by Tom Austin)

I want to emphasize again that this series of articles is focused on a pure bolt-in, "no cutting" T5 installation, so the above solution does not achieve my stated objective. However, the solution shown in Fig. 6 comes much closer to a pure bolt-in solution than I had thought was possible.

In particular, the solution that Tom used moves the T5 shifter toward the driver almost far enough to avoid cutting the divider between the shifter and the ash tray. And, the shifter position is only just a little bit too far back to avoid some cutting at the rear of the shifter opening.

The back story on Tom's T5 shifter relocation actually originates with GM in 1983. In 1983, GM changed the Camaro transmission from a Muncie to a T5. However, the existing shifter opening in the Camaro console was in the Muncie position. So, GM had the same problem with the T5 shifter location that owners of C1-C2-C3 Corvettes have. Manual versions of all three of these generations or Corvettes have consoles with the shifter opening in the Muncie/T10 side-mount location.

To solve this problem for the 1983 Camaro, ***GM simply tilted the entire T5 transmission 19 degrees*** toward the driver. The tilting axis was the transmission main shaft, so the only changes to the T5 were the angle of the rear mount on the tail shaft, the location of the oil fill hole in the passenger side of the main case, and a 19 degree bend in the shifter handle that was hidden under the boot.

The 19 degree tilt was achieved with a special bellhousing where the transmission bolt pattern on the back of the bellhousing had been rotated 19 degrees. Apparently both GM and Tremec felt that the T5 itself would work just fine in this tilted position.

GM used this tilted T5 arrangement in the Camaro from 1983 to 1992, although the bellhousing was converted to a hydraulic clutch in 1984. To retain his C2 mechanical clutch, Tom used the 1983 Camaro bellhousing

CAN THE CAMARO SOLUTION BE FURTHER IMPROVED?

I became intrigued with the challenge of figuring out a way to somehow tweak Tom's Camaro T5 solution so that no cutting would be required.

After exploring about a dozen different options, I settled on an approach that looked promising in terms of simplicity and low cost, and began the process of fabricating the necessary parts to do a test-fit in my C2 (and yes, I temporarily removed my TKO 5-speed to make the T5 test-fitting possible!). Fig. 7 below shows the resulting shifter position.

Fig. 7: Modifications to improve T5 shifter location

The shifter position in Figure 7 requires no cutting of the C2 shifter opening. This was achieved by combining four separate elements:

- An adapter plate to tilt the transmission 19 degrees (same tilt as the Camaro T5 bellhousing)
- A tail housing from a Mustang T5 (brings the shifter forward)
- A catalog T5 shifter from Modern Driveline, modified to lower its height
- An adapter block between the MDL shifter and the shifter handle to correct for the 19 degree tilt

It appears that this arrangement will solve the problem of shifter position, but I still need to finalize the adapter plate, work out a simple rear mount for the transmission, and resolve several small issues.

My goal is to perform a complete installation and actually drive my C2 for a while with the T5 installed, just to make sure everything works as expected. If it does, I plan to document what I did so that others can duplicate the necessary parts.

SUMMARY

At present, the only pure bolt-in option for putting a 5-speed transmission in a C1-C2-C3 Corvette is a specially modified version of the Tremec TKX 5-speed. This is an excellent transmission, but the $4000 cost is a barrier that prevents some C1-C2-C3 owners from enjoying the benefits of a 5-speed transmission.

I think I have worked out a solution for the main problem that needs to be resolved (shifter location) to achieve a bolt-in solution for installing a less expensive T5 5-speed in a C2. The remaining details of the conversion are now being worked out.

While my present test platform is a C2, I think the same basic approach can also be used for the C1 and the C3. My goal is to keep the total parts cost below $1500, and also keep the required skills and tools within the limits of anyone with ordinary mechanical skills.

As time permits, I will be working to refine and finalize all the various details of the conversion. I hope to write a "Part 2" article for an upcoming edition of the Chapter newsletter.

In the meantime, if any chapter members have a C1 or C3 that they would like to convert to a T5 5-speed, I'm interested in finding a local test bed to evaluate what aspects of the C2 solution need to be modified for a C1 or C3.

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