

Toyota E code gearbox

The E-code gearbox is a heavy duty transaxle type gearbox first used in 1988 models. It has been used in various vehicles such as Corolla with 4AGZE, GT4 Celica, MR2 turbo, RAV4, Camry & Caldina, and therefore can be had with a variety of bell-housings to suit different engines, and both 2 & 4 wheel drive format. Wide and narrow versions exist. All applications except the first 4AGZE & RAV4 boxes, share an unusual clutch spline of 29.8mm x 21 teeth. It is the 1st Toyota transaxle to incorporate an internal oil pump to move oil to selected parts of the box and allow for an external cooler. All are 5 speed except the 2006 onwards EB62, 6 speed. As best I can tell, after the 205 GT4, all versions changed to a narrower construction.

The vehicle "build plate" will have unique code stamped in the area marked "trans", such as E50 or E153F5.

- E- Signifying the heavy duty transaxle type transmission
- XX or XXX- signifying the exact model, such as 53,150 etc.
- F- Signifying 4WD version
- 5- Manual selection of centre diff for 4WD.

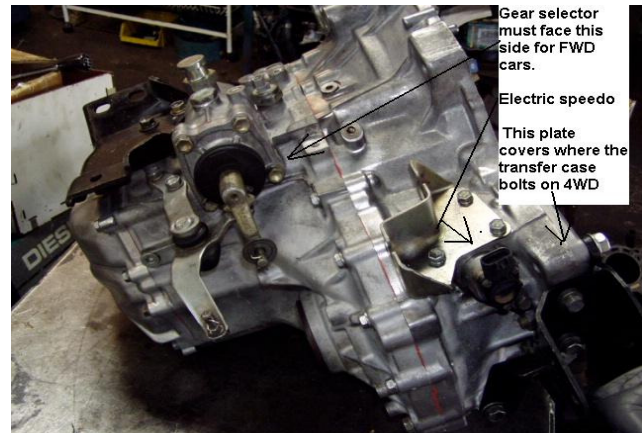
Unfortunately, there is no model info marked on the transaxle case. The manufacturing year however can be determined by the 1st digit of the serial number. The 2nd & 3rd digits refer to the month (01 to 12), whilst the remaining digits are the sequential serial number for the box. This serial number is usually found stamped on the rectangular slot where the clutch lever goes. Eg, 20988888 was made in September 1992 or 2002. Most versions built after mid 1993 have an electronic speedo transmitter, which can be interchanged with the older cable type, provided the gear tooth count is the same.

Both versions of the (wide) MR2 box (different bellhousings for 4AGZE or 3SGTE engines) are unique in that they have the selector shaft pointing towards the front of the car, with the arms for the cables connected to the selector shaft with a cotter pin. To use a MR2 box in a front drive application, the seal for the selector shaft is removed and the hole blanked with a core plug. The complete selector from another "wide" box can then be fitted to the opposite end of the selector housing in the gearbox case. The few that have been used as-is, but with longer/modified cables, are terrible to use.

Conversely, to change the Front drive style case so it works in a MR2, requires complete dismantling and re-machining of the selection housing area, which is a lot of work and hardly worth the effort given the wide availability of these cases. You should not just swap one half of the case for another, as they are machined as a pair.

The 4WD GT4 boxes can be converted back to 2WD and this is a commonly done when a 3SGTE engine package is fitted to a front drive car like Celica or 2WD RAV4. To do this, the entire transfer case, locating studs and internal shafts are removed, and a plate (from a MR2 or Carina) is fitted "over the hole". The diff hemisphere and related axle shafts have to be changed to the 2WD type. New outer axles and a suitable diff ratio, are required to suit the car. As mentioned above, the E code box has an unusual input

spline, so the choice is to swap the clutch and flywheel to a 3SGTE spec, or get a special plate made.

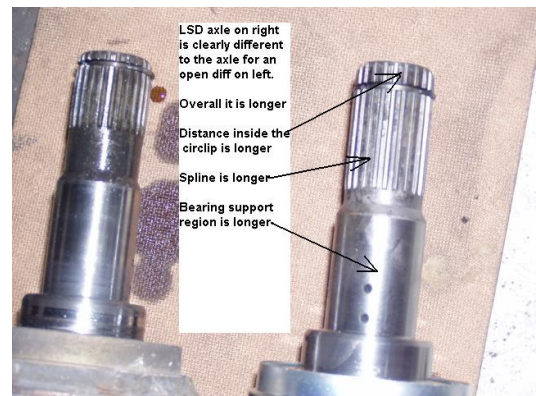


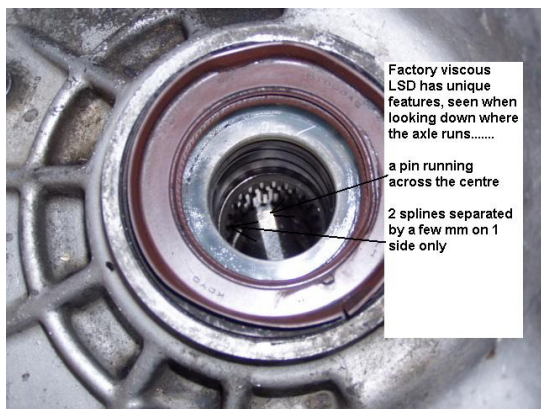
The narrow version of the E code box, can be identified by a pressed steel cover over the 5th & reverse gears. The reason for its use is not clear, but it certainly makes removal easier in some cars. This box is some 20mm narrower in the centre section as the gears/shafts etc are narrower than the "wide" versions found in the MR2 turbo, GT4 and early V6 Camry. As such, it is all-but useless for parts for the wider box. The single piece synchro rings in them are the same as the wider MR2/GT4 box of 1990-91, but not much else is the same. The multi-piece synchros in later versions are different. These are found in RAV4, AE95 and various Camry etc post 2000. Some RAV4 boxes include a vacuum operated lock for the front diff, which is also useless for any other application.

Many 2wd versions could be factory fitted with a viscous limited slip diff centre. If you look down the holes where the axles go, the LSD version can be identified by:

- A pin being seen that travels across the opening (rather than a disc occupying the entire hole). The axles bottom out on this pin.
- 2 separated internal splines on the left -hand (long axle) side

The following pictures show these features

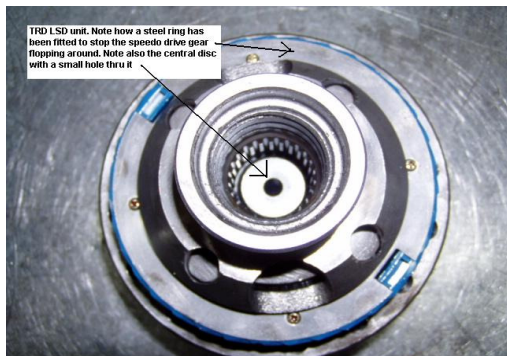




Factory viscous LSD has unique features, seen when looking down where the axle runs.....
 a pin running across the centre
 2 splines separated by a few mm on 1 side only

All factory viscous LSD's require special axles with longer splines and different shaft sizes. The picture above shows the 2 different LH stub axles, with the long splines on the LSD version being quite obvious. Neither side non-LSD axle can be successfully modified to suit a LSD, but some people have re-ground the RH side and claim it works OK. The factory LSD diff centre has a different speedo gear fitted to it and it won't swap with non-LSD speedo gears.

It is possible to fit an aftermarket plate-type LSD that uses standard (non LSD) axles. To complicate matters however, TRD however, offered a plate type LSD kit for open diffs (pic below, note centre button with small hole in it), plus another version for replacing the factory LSD, so you did not have to swap axles. If you happen to get the rare TRD diff designed as a replacement for the factory LSD, then be aware it will



TRD LSD unit. Note how a steel ring has been fitted to stop the speedo drive gear flopping around. Note also the central disc with a small hole thru it

require the long stub axle on one side, otherwise the stub will push in too far and the dust slinger on the stub axle will cut the oil seal. The other problem with some LSD centres, is the fitting of the speedo gear. Some like KAAZ ones require a unique version of the speedo gear to fit their machined casting, while others just don't fit properly and flop about. Even some TRD diffs are terrible in this regard.

The stub axles that push into the diff are different for almost all applications. The E57/58 boxes use smaller seals and the stub axles are different where they run thru the seals. The MR2 turbo & GT4 stub axles are totally different, so basically you have to use the correct axles for the box/car.

The gear ratios changed very little over the years and with various models. The input shaft has the gears ground onto it for 1st, reverse and 2nd, so you can't easily swap these to change the ratios, unless you change the shaft. For race use, these gears can be ground off and new gears of the chosen ratio, welded or splined on. If you do decide to swap shafts, then the input shaft changed when 3-piece syncro

rings were introduced for 2nd and 3rd gears. This change began sometime in late 1992. A really close ratio version was produced for the ST185 "Rallye" model, but most (road use) owners hate it, as there is a large jump from 4th to 5th. For competition use, all of these boxes have a hopelessly low 1st gear, with the best factory box having 3.230, in the E153 used in V6 Camry.

If you dismantle the gearbox, you might note some of the gears have "nicks" around the edges of the teeth. This identifies the use of the shaft/gear, and the ratio. I can only presume this was done to limit confusion at the factory when multiple versions were being built. The gears don't interchange between the narrow and wide versions of the boxes.

There are several diff ratios: 3.935, 4.285, 4.562, 4.933. If you want to change the final drive (diff) ratio you need to swap the following 3 parts, all of which will have the same number of notches ground onto the gears:

- Output shaft which has the pinion gear ground onto it (the lower one in the gearbox)
- Crown wheel (big diff gear)
- Oil pump drive gear

All the different ratio crown wheels will physically bolt to all of the diff hemispheres, but swapping is limited to within wide or narrow boxes. On the GT4, you don't need to change the rear diff as the front diff gear pair controls the ratio, and the rear diff is just the inverse of the transfer case ratio. The shafts don't interchange between wide and narrow boxes.

The only ratio that is easily changed is 5th, but don't get trapped just looking at the ratio. Some unusually tall ratios like 0.75 were only used in the narrow RAV/AE95 4wd type boxes, and these won't fit the wide boxes. Custom 5th gear ratios we fit to the "wide" box are typically 1.00 for the factory Rally (close ratio) box and 0.88 for the "normal" wide box like in the ST185 or 205.

Summary of common ratios

Trans code	First	Second	Third	Fourth	Fifth
E153	3.230	1.913	1.258	0.918	0.732
E150F	3.583	2.045	1.333	0.972	0.732
E350	3.583	2.045	1.333	0.972	0.732
E351	3.583	2.045	1.333	0.972	0.732

(note, some of this data supplied from Toyota USA documents)

The Achilles heel of these boxes is definitely the poor syncro action once they have 100,000km or more on them, and this is especially so with the "wide" version. The gear train is simply too heavy for the syncro rings to slow. Toyota tried to remedy matters with various in-service changes including coating the inner part of the cone with an abrasive, but none of these solved the design fault. A clever 3-piece syncro system was first used on the ST185RC model to help improve the change to 2nd, and was progressively introduced to other models in both wide and narrow box formats.

There are a number of internal changes

- 5th gear has a 3-piece syncro ring assembly. Obvious when you remove the end case and start dismantling it
- 2nd gear has a 3-piece syncro ring assembly. Not obvious until dismantled
- The mainshaft is different at one end (see adjacent picture)



The 3-piece syncros (2nd, 3rd & 5th gears only) are very sensitive to wear. Lightening the gears and lapping the syncros to the gear tapers, both help the syncro action and are routinely done in boxes used mostly in competition. To date, we have had no problems with gear breakage, but we always cryogenically treat lightened gears.

It seems nearly all GT4 boxes have alloy selector forks, whilst the MR2 boxes seem to change to steel forks about mid 1992. The sleeves and widths of the forks differ in width so they can't be swapped randomly. Steel forks have nylon pads riveted to the finger ends to reduce wear on the syncro sleeve. With time, these nylon pads wear away and the fork is quickly destroyed, along with the mating sleeve. The outer part of the hub can be swapped between single and 3-piece syncros, but the inner splined part cannot. Broken alloy selector shafts are becoming common, especially when the syncros wear and the owners "bash" the gear shifter to effect gear changes. The forks don't all directly interchange between wide and narrow boxes, but with a bit of imagination and fettling, many can be swapped around.

The other wear problem with these boxes is the wear on gear ends and syncro hub centres by the bearings and their thrust rings. The wear found in some boxes is so bad, that most of the input shaft gear train is scrapped. In extreme cases, the needle bearing thrust rings shatter and fill the box with very hard pieces, which quickly get caught in moving parts and destroy the entire box.

There is much confusion over the "correct" oil for these boxes. Some documents indicate GL4 rated oil whilst others show GL5 rated oil (GL5 has more anti-friction additive). In most cases the correct oil will be described as "gear oil 75" and is not to be confused with hypoid (or EP) 75, which is "conventional" (rear wheel drive) diff oil. The correct oils are conventional gear oils and do not contain extensive anti-friction agents as the old style bronze syncro cones cannot handle really slippery oils. Gearboxes that have been operated with low friction oil additives, often eventually develop very poor syncro action as the gears become so slippery, the syncros cannot bite and slow down the heavy gears to the correct speed. When dismantled, the syncros are often not worn out, just coated. The extreme result, is the owners keep pulling harder and harder on the gearstick until an alloy selector fork snaps. Some aftermarket LSD

suppliers specify a unique oil however I have found no compelling reason to use this. Most reputable gear oil suppliers offer a suitable oil, however in some cases, a separate anti-chatter additive might be needed if it used in a plate type LSD where the preload is set tight. If you dismantle the LSD plates, they need to be re-assembled with a thin film of moly grease as it takes ages for them to fill with oil.

This article will be progressively up-dated as more information comes to hand. All of this is first-hand experience from repairing these boxes mostly for RAV4, MR2 & GT4 owners.

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DATA WANTED

Anyone reading this who has a gearbox apart, or who has the original E code box in their car, can send in information and I will compile it into a table and eventually publish it here. This is the sort of info I need.....

	1991-93 ST185	Camry V6 1MZFE 1997-99	1992 MR2 SW20 3sgte with LSD	
	E150F	E153		
Diff	60/14=4.285	59/15=3.933		
1	43/12=3.583	3.230	42/13	
2	45/22=2.045	1.913	44/23	
3	40/30=1.333	1.258	39/31	
4	35/36=0.972	0.918	34/37	
5	30/41=0.732	0.731	30/41=0.732	
speedo				
External ID	Triangular plate with 3 holes on transfer case—workshop selection of 2WD for m'tence purposes	Damper on the hydraulic clutch line		
Internal ID			Double syncro on 2 nd , 3 rd & 5 th 3 notches ground onto reverse on input shaft. 1 notch ground onto 3 rd & 4 th on input shaft, 1 st , 2 nd , 3 rd & 4 th on laygear	