A Look at the New MP Transfer Case

by Steve Garrett
members.atra.com
www.atra.com

If you've had the opportunity to look under a new 4WD truck lately, you've probably noticed something new: The transfer case looks a little different than those you've become used to working with for the last decade or so.

Starting with the 2007 model year, General Motors introduced a series of new transfer case designs to replace the New Venture Gear units they used in the past. Built by Magna Powertrain (MP), the new units are available in three different models:

- Manual Shift (RPO NQG; models 1222/1225/1226)
- Electric Shift (RPO NQF; models 1625/1626)
- Auto (RPO NQH; models 3023/3024)

Several models are available for each application, including the 1222/1225 and 1226 manually shifted units, the 1625/1626 electrically shifted units, and the 3023 and 3024 auto/active transfer case models (figure 1).

All models use DEXRON VI fluid. The models features are shown in the accompanying chart. (Chart 1)

There are several differences between the transfer cases beyond the control system. Some are minor while others will create major parts interchange problems if you try and install the incorrect parts for the unit you're working on.

To identify the transfer case, check the tag or stampings on the case (figure 2). As you can see from the chart, there are nine different transfer cases just for GM applications.

So what's so different about these units? Well, in a nutshell, the construction of the units is similar to the NV design transfer cases you've worked on for years, but the internal operation of the shift mechanism is quite different.

The MP units use a new design shift motor. In addition, this new design shift motor requires a learn process after replacement, for the control module to learn its position properly.

MP T Case Operation

First we'll look at how these units operate:

- (RPO NQF) MP 1625/MP 1626
- (RPO NQH) MP 3023, MP3024

Like other electric shift GM transfer cases, the MP 1625 MP 1626, MP 3023 and MP 3024 use these operational modes:

- 2 High
- 4 High
- Auto (MP 3023, MP 3024)
- 4 Low — 2.68:1
- Neutral

The MP series electronic transfer

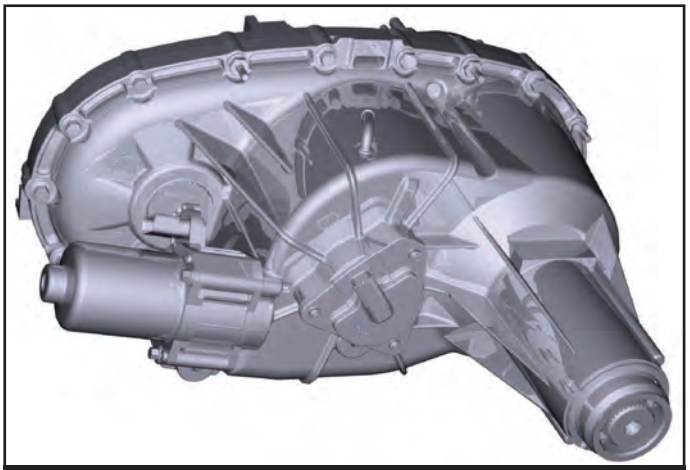

Figure 1

Model	RPO	Trans	Input Shaft Splines	Output Shaft Splines	Chain Size	Planet	App
MP 1222 Light Duty	NQG	4L60E	27T	32T	7/16–1.25	3 Pinion	½ Ton
MP 1222 Light Duty	NQG	6L80	32T	32T	7/16–1.25	3 Pinion	½ Ton
MP 1225 Heavy Duty	NQG	6L90	29T	31T	7/16–1.5	5 Pinion	¾ Ton
MP 1226 Super Duty	NQG	6L90 LCT 1000	29T	31T	7/16–1.5	5 Pinion	¾ Ton 1 Ton
MP 1625 Heavy Duty	NQF	6L90	29T	31T	7/16–1.5	5 Pinion	¾ Ton
MP 1626 Super Duty	NQF	6L90 LCT 1000	29T	31T	7/16–1.5	5 Pinion	¾ Ton 1 Ton
MP 3023 Light Duty	NQH	4L60E	27T	32T	7/16–1.25	3 Pinion	½ Ton
MP 3023 Light Duty	NQH	2ML70	32T	32T	7/16–1.25	3 Pinion	½ Ton
MP 3024 Heavy Duty	NQH	6L90	29T	31T	7/16–1.5	5 Pinion	¾ Ton

CHART 1

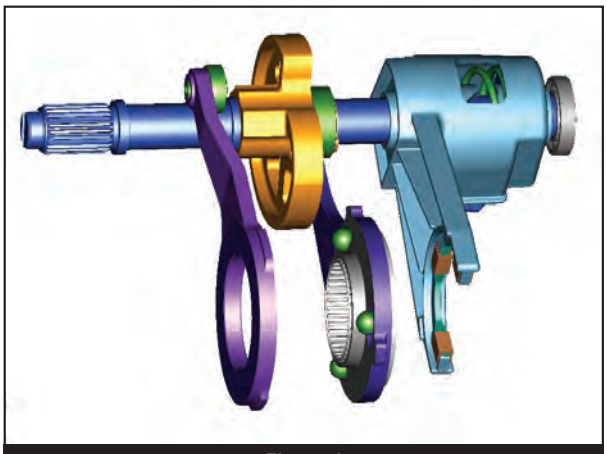

Figure 4

transfer case motor in degrees (0.15º increments) of movement.

The sensor pulls the signal voltage low (0.75 volts), or allows it to go high (4.2 volts) as the motor rotates.

Sensor operation can be confusing, because the transfer case position doesn't necessarily represent a specific voltage value. You can monitor the sensor voltage and degrees of movement with your scan tool. Typical values will be (chart 2):

Command	Incremental Sensor	Incremental Sensor Direction	Incremental Sensor Voltage	Incremental Sensor Impulse**	Incremental Sensor Direction
2WD	37º	0.75V	7.5V	0.75V or 4.2V	CCW
Auto	102º	0.75V	7.5V	0.75V or 4.2V	CW*
4 High	127º	0.75V	7.5V	0.75V or 4.2V	CW*
4 Low	–77º	4.20V	7.5V	0.75 or 4.2V	CW

CHART 2

* The motor direction will register CW while shifting up in range: 2WD to Auto to 4 High to 4 Low. Once the shift is completed, the motor position will read CCW.

** The impulse voltage will vary based on sensor movement. It isn't uncommon to have the voltage read 0.75V, then change to 4.2V; or the opposite may occur, depending on the exact position of the motor. In other words, when shifting the transfer case, you'll see the value change without your input. This is due to the linkage varying just a fraction of a degree or so from the last commanded shift into that range.

Transfer Case Shaft Position Sensor (Rotational Sensor)

The rotational sensor is mounted into the back of the transfer case near the motor assembly (figures 3 & 4). On some applications, the sensor may be described as the *Transfer Case 2/4 Wheel Drive Actuator Position Sensor*. No matter the name, the operation is the same:

The TCCM sends a 5-volt reference signal to the sensor. The TCCM also provides the ground for the sensor. As the shift shaft rotates, the sensor sends a signal voltage to the TCCM which varies with the position of the shaft. This value represents the actual position of the shift shaft. Typical scan voltage values are (chart 3):

Command	Sensor Degrees	Sensor Signal Voltage
2wd	37º	3.0V
Auto	102º	3.6V **
4 High	125º	4.0V
4 Low	-77º	1.8V

CHART 3

** Voltage varies with clutch command.

Transfer Case Motor

The transfer case motor is a permanent magnet, PWM, bidirectional unit, currently manufactured by Bosch (Daewoo on 2011 applications; figure 5). The TCCM controls the drivers for the motor A and motor B circuits. The motor current varies depending on the command, and to meet the clutch slip requirements in Auto Mode:

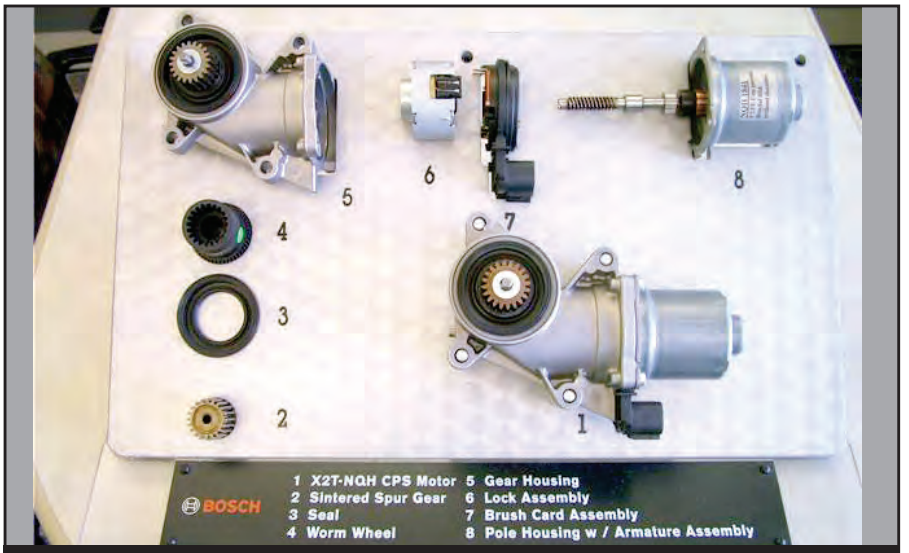

Figure 5

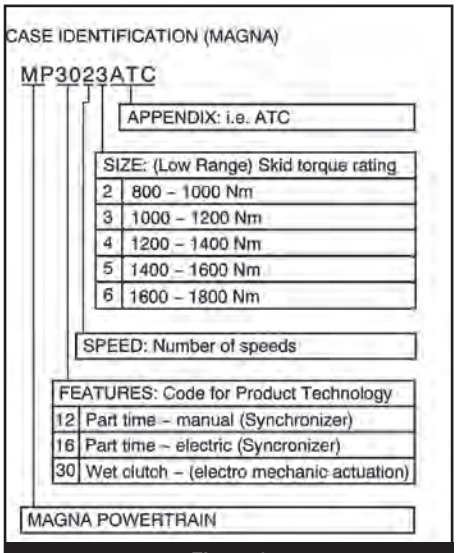

Figure 6

- From 0-15 amps
- Current limited to 30 amps
- Motor resistance 14-20 ohms

Unlike the previous design NVG transfer case motors, the new design actually rotates the shift shaft either clockwise (CW) or counterclockwise (CCW). This moves the actuator cam to apply or release the clutch.

As the actuator cam rotates, the balls located between the levers are forced up the ramps built into the levers. This forces the levers to move apart, applying pressure to the clutch. Increasing the clutch apply pressure reduces clutch slip, which, in turn, increases the torque applied to the front driveshaft (figures 6 and 7).

After replacing the transfer case motor, you must perform a transfer case motor learn process with a scan tool.

Transfer Case Motor Brake

NQH applications use a brake assembly to control the position of the transfer case motor armature. The brake is mounted within the transfer case motor assembly, and is controlled electronically by the TCCM.

The TCCM controls the ground for the brake assembly. The brake is de-energized (motor locked) during 2wd, 4 High and 4 Low ranges. In Auto range, the brake is energized (motor unlocked) if the motor requires movement. Typical scan values will read (chart 4):

** The voltage (current flow) for the brake circuit will vary depending on the commanded position. The 0.5 volts listed in the chart is based on the vehicle being stationary with no wheel slip. As the TCCM changes the clamp load, you may see the voltage change. The brake can cycle in as little as 20ms from fully locked to fully unlocked. This action balances the commanded position for the motor with its actual position, so the motor doesn't need to stay energized all the time in Auto range.

Command	Motor Brake Voltage Feedback
2 WD	7.5 Volts
Auto	0.5 V **
4 High	7.5 V
4 Low	7.5 V

CHART 4

Replacing and Reprogramming the TCCM

Both the NQH and NQF transfer case applications will require programming if the TCCM is replaced or if an updated calibration is released. The process is the same as for other GM modules and carries the same procedures and precautions as you've used in the past with GM modules.

NQH, NQF Transfer Case Clutch Reset Procedure

One additional service area is the need for the TCCM to relearn the transfer case clutch. You can perform this process with a scan tool. If a scan tool isn't available, you can use the vehicle's electronics.

You must perform the clutch relearn process after any of these situations:

- The transfer case was replaced.
- The TCCM was replaced or reprogrammed.
- The transfer case was rebuilt or internal repairs were performed.

Clutch reset *with* a scan tool:

- Key on, engine off.
- Access the Special Functions menu with your scan tool.
- Select Clutch Reset Procedure (Motor Learn Procedure).

When the Clutch Reset Procedure is initiated, you should hear the motor engage, indicating a successful learn procedure.

Clutch reset *without* a scan tool:

- Key set to *accessory*.
- Switch into the 2 High mode.
- Turn the switch clockwise past 4 Low into the neutral request mode and hold it for 30 seconds.

You should hear a noise from the motor, indicating a successful learn procedure.

As you can see, the new MP family of transfer cases isn't something you should be afraid to tackle when one comes your way. Next time we'll look at some of the common problems you may see with these new units.

Until then, remember: *The only limits are, as always, those of vision.*