

Concepts of Double-Clutching and Use of the Clutch-Brake

presented by GearMaster

Introduction

This interactive program is designed to show the basic functions of the drive train. The program focuses on proper procedures for double clutching and using the clutch-brake.

The program may be used in a classroom setting or may be used by individuals.

It is recommended that users print these instructions and review them prior to and during use of the program.

Accessing the Program

The program may be run directly from the web at any time, or you may download it to your computer for off-line use. The website is: www.gearmaster.com/trc. From this title page, you may run the program directly by left-clicking on the program title or you may download it by right-clicking on the title. A CD-ROM containing this program and other items from the Training Resource Center is also available from GearMaster.

If you wish to download this or any other program from the TRC website, right click on the name of the program and then click on the "Save Target As..." option. You will then be asked to identify a location in which to save the program. You may rename it if desired.

To download from the CD Rom, simply copy the "Start GearMaster TRC.htm" file and the "Files" folder to any selected location.

Note: This program requires that you have MacroMedia Flash Player installed on your computer. If you do not have it, it can be downloaded at no charge from www.macromedia.com. Click on Downloads.

Screen Controls

If you are running the program from the internet, the graphics will automatically adjust to the size of your browser screen. The "Full Screen/Restore" button will have no function.

Hint: Whether the programs are run directly from the web, from the CD-ROM or from a stored location in your computer, they are designed to run in a browser such as Internet Explorer. In most cases, you can maximize the amount of screen space available for viewing the program by pressing the F11 key. This will hide all but one of the tool bar lines for best viewing. Pressing F11 again will restore the normal appearance.

The program can be controlled from the keyboard or by using the mouse. An abbreviated guide to the keyboard functions is shown above the engine. You may:

Use the mouse to click the "Hide Controls" box to hide this guide.

Click on "Click to Enlarge" to see a more detailed description of the keyboard controls.

Other screen functions:

You may click on the "Hide GearMaster" box to show or hide the GearMaster display. See "Note to the GearMaster Display" below.

Warning flags will normally appear whenever an improper procedure is attempted or executed. In addition, grinding sounds will be heard when an unsynchronized shift is attempted. You may suppress these warnings by clicking the "Hide Warnings" box.

If you click the "Allow Floating" box, warnings will not appear if you engage/disengage gears without using the clutch. If you attempt an unsynchronized shift, the warning will appear.

Clicking on "Reset" will: 1) stop the engine, 2) put the clutch in the engaged position, 3) put transmission in neutral and, 4) stop the wheels. This makes it easier to start over with any sequence of training.

Running the Program

There are four drive train functions. These can all be controlled by the keyboard or by the mouse. They are:

- Engine speed (or RPM) - For simplicity, the only speeds available are 0 (that is, engine off), 800, 1200, 1600, and 2000 RPM.
- Clutch Position - Engaged, Disengaged, and Clutch Brake
- Gear Selection - Again, for simplicity, the program only provides four gears. In addition to selecting a particular gear, you may also position the drive shaft gear in a neutral position under any of the four gears. To do this with mouse, click on the bar between the "N" and any of the gears.
- Wheel (or vehicle) speed - You may speed up or slow down the wheels to simulate braking or going up or down a hill. If you are in gear and force the engine into an overspeed or underspeed condition, a warning will appear.

A suggested training sequence

Synchronizing Gears in the Transmission - Before teaching the procedures involved in Engine Starting, use of the Clutch Brake, Double Clutching, and possibly Floating, you may wish to have a general discussion on the function of the transmission - what it means to have gears synchronized, the relationships between engine speed, vehicle speed and the various gears, etc. To do this, you can check the "Allow Floating" box so that warning flags do not appear when synchronously engaging or disengaging gears. Each shift, then, is a three step process: 1) go to neutral, 2) synchronize the engine (or the wheels) to the next gear, and 3) engage the next gear.

Engine starting - Normal procedure is to disengage clutch and have transmission in neutral. If you start with clutch engaged OR transmission in a gear, a yellow warning flag will appear. If you start with clutch engaged AND transmission in gear, a red flag will appear - this is a no-no. Try all possibilities and discuss why warnings appear. For instance, starting the engine with the clutch engaged puts much more strain on the starter motor because it must move all the gears in the transmission in addition to turning the engine over. Point out that our simple drawing does not show all the gears in the transmission. You may wish to refer to the "Drive Train and Transmission

Mechanism" section of the Training Resource Center. The last picture in the series shows how many gears and shafts are moving even when no gear is engaged.

Clutch Brake - The clutch brake should never be engaged when the vehicle is moving. The ONLY purpose of the clutch brake is to stop the internal gear wheels in the transmission so that a gear can be engaged when the vehicle is not moving.

If the vehicle is moving and the transmission is in neutral, engaging the clutch brake will stop the internal gear wheels and will make synchronizing impossible.

If the vehicle is moving and the transmission is in any gear (that is, not in neutral), engaging the clutch brake will cause the clutch brake to try and stop the entire vehicle. Of course, it cannot do this and the clutch brake will wear out very rapidly.

Why double clutch?

The normal sequence for shifting gears using a clutch is as follows:

1. disengage the clutch
2. put transmission in neutral
3. reengage the clutch
4. synchronize the engine speed to the new gear
5. disengage the clutch
6. engage the new gear
7. reengage the clutch.

In actual practice, some of these steps take place virtually simultaneously and it does not seem like there are seven separate steps. But in fact, all seven must take place for synchronous shifting to occur. If you try to skip steps 3 and 5 (double clutching), you will see that changing the engine speed has no effect on the speed of the internal gear wheels. There is no way, then, to synchronize those gear wheels to the new gear. To control the speed of the internal gears while in neutral, the clutch MUST be engaged.

Note: Letting the clutch out (engaging it) and immediately pushing it in again (disengaging it) before synchronizing the engine speed defeats the purpose of double clutching. The clutch pedal should be left out (clutch engaged) until the proper engine speed is achieved. Then push in the clutch pedal, engage the gear and let the clutch pedal back out.

Floating

"Floating" refers to the practice of shifting gears without the use of the clutch. While it is possible to float the gears, the potential for damage to the transmission is much greater than when using the clutch. This is especially true if a driver tries to disengage a gear when the engine is developing torque to the transmission - that is when the engine is either pulling or braking the vehicle. For this reason, some fleets do not allow drivers to float and many schools do not teach floating.

If you do wish to teach the concepts of floating, you may check the "Allow Floating" box in the program. In this case, the clutch warning flags will not appear when you synchronously engage or disengage gears.

Note to Gear Colors

The internal gear wheels in the transmission are color coded as follows:

Green - means that the gear is synchronized to the drive shaft/gear at the current engine and vehicle speed. The gear can be smoothly engaged.

Yellow - means that the gear is not currently synchronized to the vehicle speed but it can be synchronized within the operating range of the engine.

Red - means that the gear cannot be synchronized at the current vehicle speed.

Note to the GearMaster Display

It will be seen that the GearMaster display provides a much clearer representation of gear availability and synchronization than is otherwise available. Understanding the GearMaster is very simple:

The horizontal line represents the operating range of the engine from idle (800 RPM) to the maximum governed speed of the engine (2000 RPM). The "tach arrow" scrolls left and right with the speed of the engine. If the engine is operating normally, the arrow will always be under the horizontal line.

The gear numbers scroll left and right in proportion to the speed of the VEHICLE. Any numbers above the line represent gears that are available to the driver at the current vehicle speed. This is the "Gear Availability" feature of the GearMaster.

If the arrow is under a number, then the engine speed and vehicle speed are synchronized for that gear and the shift can be smoothly made. This is the "Gear Synchronization" feature of the GearMaster. (Note: Remember that the clutch must have been engaged so that the gear shaft and the engine are moving at the same speed.)