80-6

# 1980 Cadillac

CADILLAC CERTIFIED SERVICE

# 1981 POWER TRAINS

ROUNDTABLE SUMMARY BOOK

CADILLAC SERVICE



CADILLAC MOTOR CAR DIVISION

GENERAL MOTORS CORPORATION

# 1981
# POWER TRAINS

This Service Roundtable covers some of the highlights of the new options and combinations in power trains for Cadillac for 1981.

## 1981 CADILLAC POWER TRAINS

| VEHICLE | ENGINE | TRANSMISSION |
|---|---|---|
| "C" DE VILLE BROUGHAM | 6.0 L. V-8 BASE<br>4.1 L. V-6 OPT.<br>5.7 L. DIESEL OPT. | THM 400<br>THM 200-4R<br>THM 200C |
| "E" ELDORADO | 6.0 L. V-8 BASE<br>4.1 L. V-6 OPT.<br>5.7 L. DIESEL OPT. | THM 325<br>THM 325<br>THM 325 |
| "K" SEVILLE | 5.7 L. DIESEL BASE<br>6.0 L. V-8 OPT.<br>4.1 L. V-6 OPT. | THM 325<br>THM 325<br>THM 325 |
| "D" & "Z" LIMOUSINE AND COMMERCIAL | 6.0 L. V-8 | THM 400 |

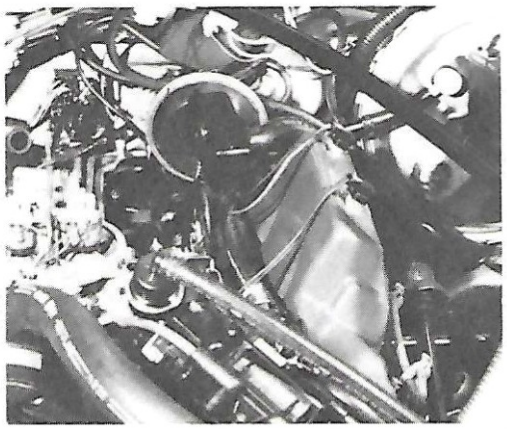
This chart shows the engine and transmission combinations that are available. There are three engines, the 6 liter V-8, 4.1 liter V-6 and the 5.7 liter diesel; and three carryover transmissions, the THM 325 front wheel drive for the Eldorado and Seville, the THM 400 for the V-8 on C-cars, and the THM 200C for diesel powered C-cars. New for 1981 is the Turbo Hydra-Matic 200-4R, overdrive transmission. This transmission is used on V-6 powered C-cars.

The most immediately noticeable change for 1981 is the modulated displacement operation of the 6 liter V-8. Modulated displacement is the operation of the engine on 8, 6 or 4 cylinders, depending on power demand and driving conditions.

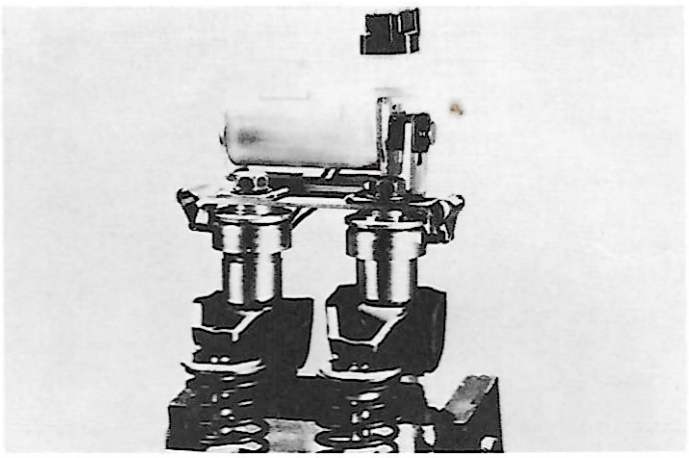
## V-8 MD ENGINE

| | |
|---|---|
| 8 CYLINDERS | START UP AND HIGH DEMAND |
| 6 CYLINDERS | INTERMEDIATE DEMAND AND SMOOTH TRANSITION |
| 4 CYLINDERS | CRUISING AND LOW DEMAND |

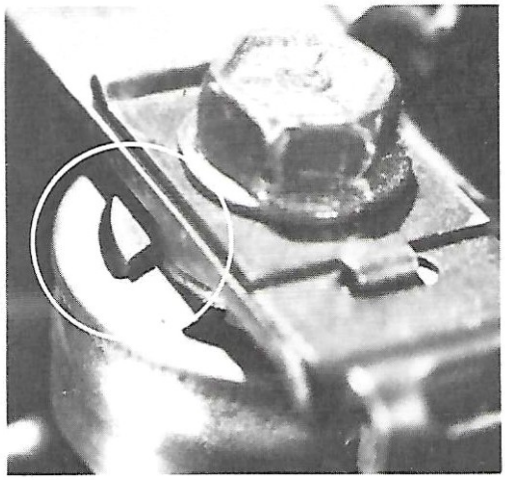
The modulated displacement, or MD engine, operates on 8 cylinders when starting up or in periods of high power demand; on 6 cylinders during brief periods of intermediate demand, and to effect a smooth transition between 8 cylinder and 4 cylinder operation; and on 4 cylinders when cruising and during periods of low demand.



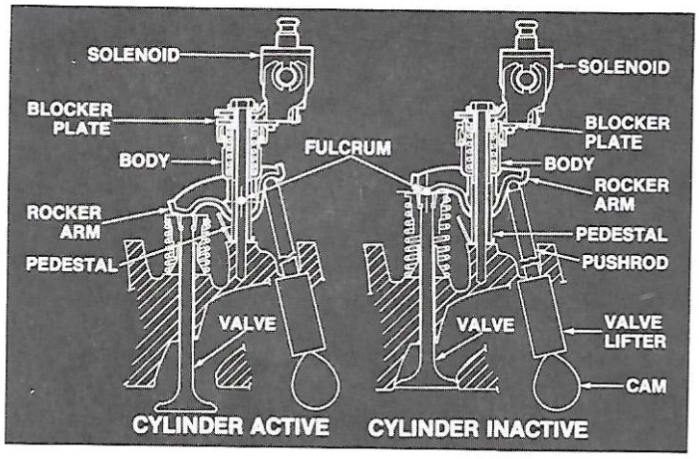
The cylinder operation selector units are mounted on top of the engine, under the rocker arm covers, giving a distinctively different look to the engine.



The unit itself consists of a solenoid operated slide and blocking ring, mounted above the rocker arms and connected to them. This unit is an electromechanical device that can simultaneously deactivate both valves of a cylinder on a command from the electronic control module.

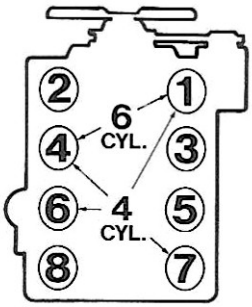


When the command is received to deactivate a cylinder, the solenoid energizes, moving the slide and causing the ring to rotate so that the slide fingers in the body of the unit are lined up with the slots in the ring.

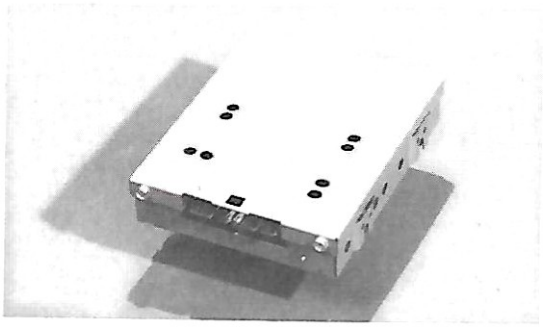



This allows the body, to which the rocker arm is attached, to rise with the pushrod when it comes up. This shifts the fulcrum of the rocker arm from the unit body, where it is in normal operation, to the top of the valve stem. As a result, when the push rod comes up, the valve does not open, there is no intake of fuel and the cylinder is deactivated.

## MODULATED DISPLACEMENT

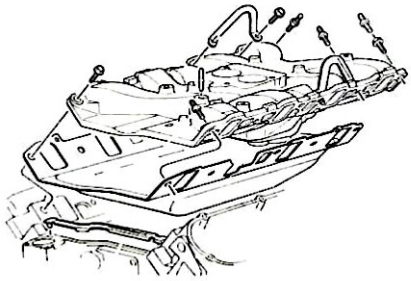



Valve selection units are located on cylinders 1, 4, 6 and 7. For 6 cylinder operation, cylinders 1 and 4 are deactivated, and in 4 cylinder operation, cylinders 1, 4, 6 and 7 are deactivated. To accommodate modulated displacement operation, some changes and additions have been made to the 6 liter engine.

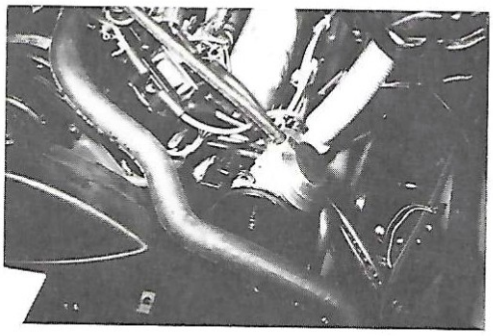


Because the output signal from the ECM is very small, a modulated displacement driver assembly, or MDDA, has been added behind the instrument panel. This assembly boosts the strength of the electrical signal to the solenoids so they will operate.

SINGLE PLANE INTAKE MANIFOLD



A single plane manifold is used on the MD engine, to assure even fuel distribution to the operating cylinders during operational changes.



And a vacuum pump has been added to the engine to provide added vacuum during 4 cylinder operation.

The modulated displacement engine, by operating on only 4 or 6 cylinders when engine demand is low, provides additional fuel economy for 1981; particularly in highway cruising.

# DFI FOR 1981

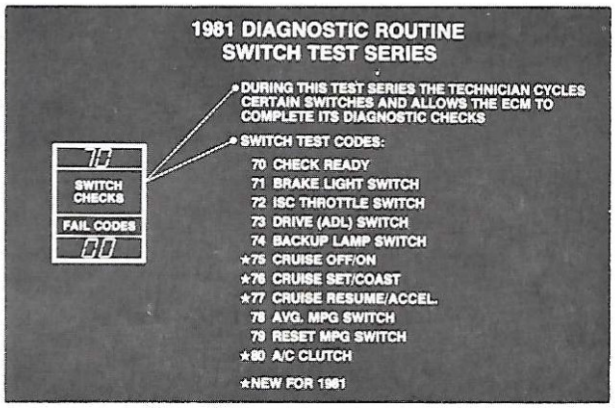
In addition to modulated displacement operation, several new features have been added to DFI for 1981. The diagnostics have been expanded, with the addition of new codes and new series.

### 1981 ENGINE TROUBLE CODES

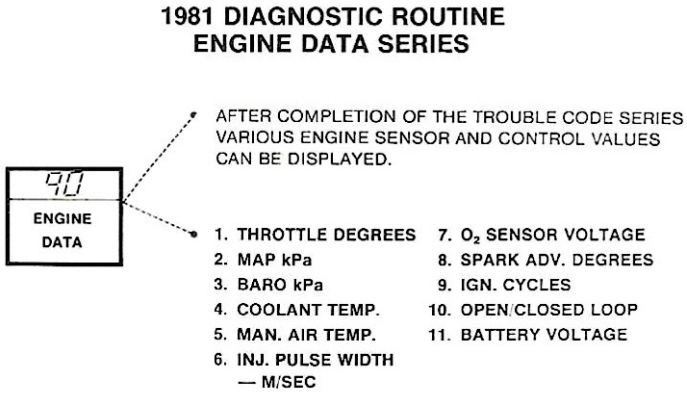
| | | | |
|---|---|---|---|
| 12 | No tack signal | 32 | Open MAP sensor circuit |
| *13 | $O_2$ sensor not ready | 33 | MAP/BARO sensor correlation |
| 14 | Shorted coolant sensor | 34 | MAP hose |
| 15 | Open coolant sensor circuit | 35 | Shorted BARO sensor circuit |
| *16 | Generator voltage out of range | 36 | Open BARO sensor circuit |
| *17 | Crank signal circuit high | 37 | Shorted MAT sensor circuit |
| *18 | Open crank signal circuit | 38 | Open MAT sensor circuit |
| *19 | Fuel pump circuit high | *44 | $O_2$ sensor lean |
| *20 | Open fuel pump circuit | *45 | $O_2$ sensor rich |
| 21 | Shorted throttle position sensor circuit | 51 | PROM insertion faulty |
| 22 | Open throttle position sensor circuit | *60 | Drive (ADL) switch circuit |
| *23 | EST/Bypass circuit shorted or open | *61 | Set and resume switch circuit |
| *24 | Speed sensor failure | *62 | Car speed exceeds max limit |
| *25 | Modulated displacement failure | *63 | Car and set speed tolerance exceeded |
| *26 | Shorted throttle switch circuit | *64 | Car acceleration exceeds maximum limit |
| *27 | Open throttle switch circuit | *65 | Coolant temperature exceeds maximum limit |
| 30 | Idle speed control circuit | *66 | Engine RPM exceeds maximum limit |
| 31 | Shorted MAP sensor circuit | *68 | Set and resume switch circuit |

*NEW FOR 1981

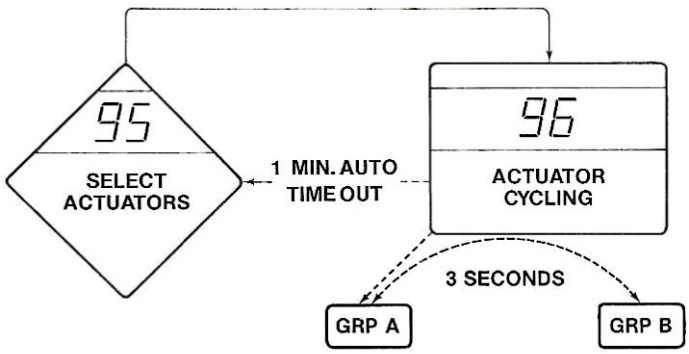
The engine trouble code series has been expanded from 15 in 1980 to 35 in 1981. The codes that have been added are indicated on the chart by an asterisk. Note that cruise control codes are included in the additions. This became possible with the elimination of the separate controller for cruise control the the incorporation of its function into the ECM. The cruise control has also been improved to provide more precise control, particularly on hills.



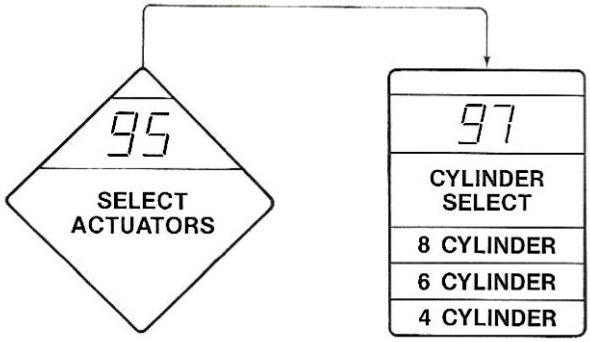

The 70 Series checks, in which you interact with the computer on a series of switch tests, has also been expanded.




A completely new 90 Series of checks has been added for 1981, which can be selected at the option of the technician. Using the 90 Series, various engine sensor and control values can be displayed, as shown here.

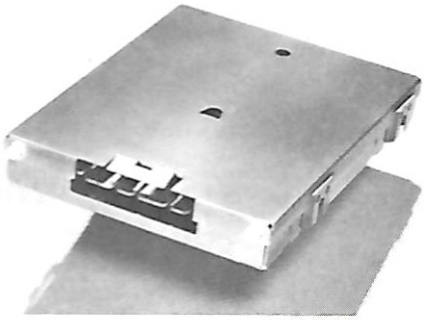



In addition, there is another new test called the 95 Series, Select Actuators, that can be selected at the option of the technician. This series has two parts. The first is the 96 Series, called "actuator cycling," which checks various engine actuators and solenoids in two groups; such as cruise control power and vacuum valves, EGR and canister purge solenoids, and air management valves. These items are separated into groups "A" and "B." Each actuator in Group A is cycled for 3 seconds. Then, those in Group B are cycled for 3 seconds. This process continues for one minute, and then the action stops to wait for further instructions. This allows the technician to feel the solenoid valves actuate, or to check them with a test light.

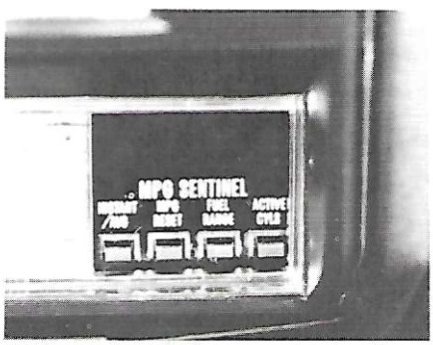



The second part is the 97 Series, which allows manual selection of operation of the engine in either 8, 6 or 4 cylinder mode for road testing.


Another change for 1981 is the addition of two buttons to the MPG Sentinel, for a total of four, on DFI modulated displacement engine cars. The two new buttons, on the right, are the "Fuel Range" and "Active Cylinders." The Fuel Range button displays the driving range remaining with the fuel in the tank at the time.

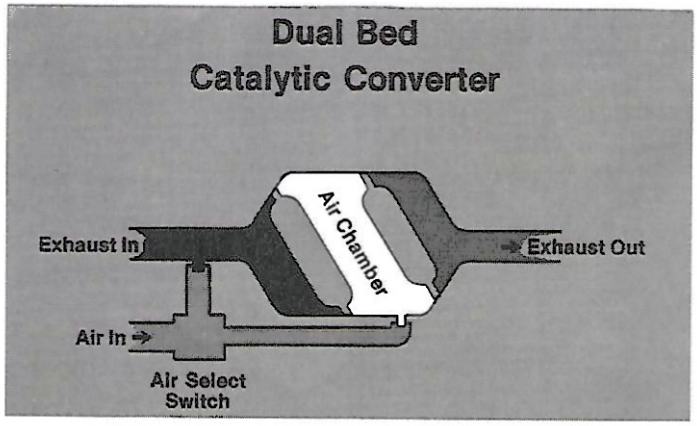


A small, new microcomputer range module has been added behind the instrument panel to perform this function. The range module receives inputs from the ECM on the average miles per gallon, and from the fuel sending unit on the fuel remaining, and makes this calculation.

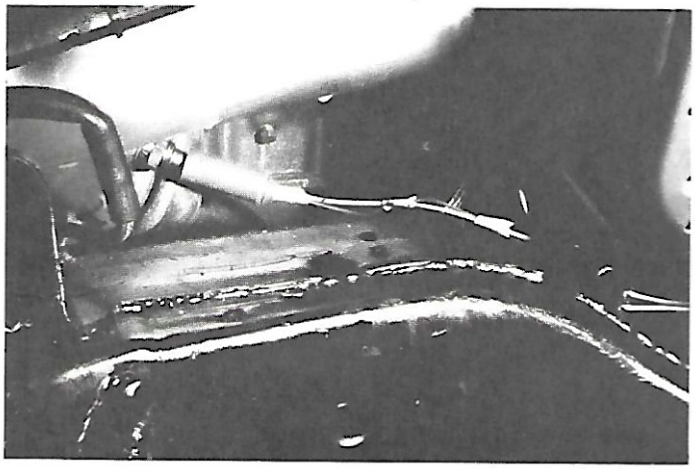



The Active Cylinders button initiates a continuous display of the number of cylinders in use until another button is pushed.

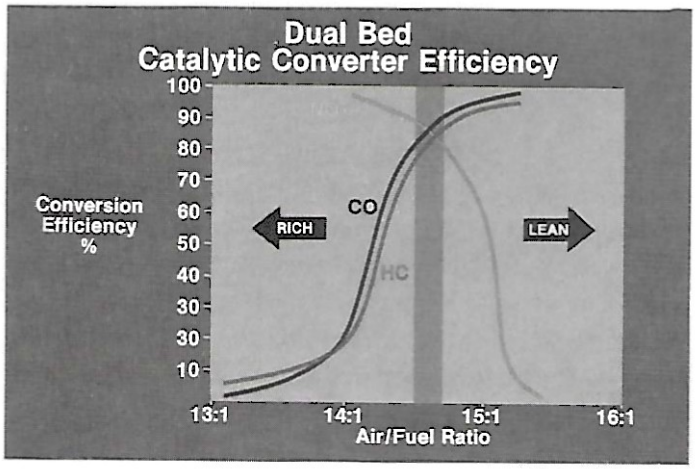
Another new feature of the 6 liter V-8-6-4 engine for 1981 is the change from an open loop to a closed loop emission control system.




This system makes use of the dual bed catalytic converter introduced on some 1980 models;



and requires an oxygen sensor to determine the amount of free oxygen in the exhaust.



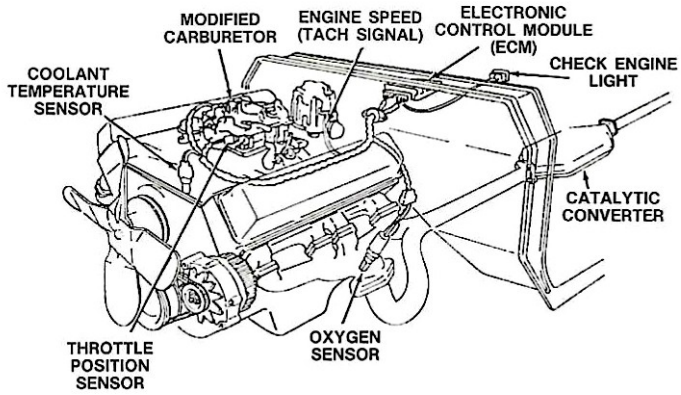

The objective of the closed loop system is to maintain an air-fuel ratio as close as possible to the 14.7 to 1 balance point for maximum emission control.

The new features of modulated displacement operation, DFI expanded diagnostics and other changes, and closed loop emission control systems, will be covered in depth in the General Motors Product Service Training courses on these subjects. Every effort should be made to attend these schools to fully understand these new developments.

# COMPUTER COMMAND CONTROL SYSTEM

The Computer Command Control emissions control system for 1981, used only on the 4.1 liter, V-6 engine, is a closed-loop system that was formerly referred to as the Computer Controlled Catalytic Converter, or C-4 system, which is used on California 6.0 liter engines.

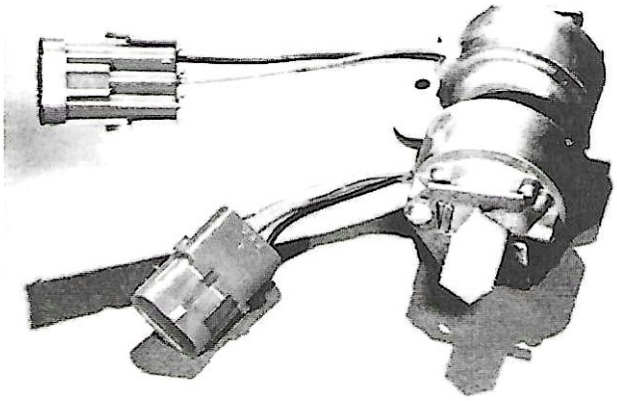
TYPICAL 1980 C-4 SYSTEM




This diagram shows the elements of the 1980 system, indicating the coolant temperature sensor; electro-mechanical carburetor with a mixture control solenoid and throttle position sensor; engine speed, or tachometer signal; electronic control module, which provides the system diagnostics function, using an instrument panel check engine light; 3-way catalytic converter; oxygen sensor; and air management coolant temperature.

The operation of the 1980 system, and a description of its components, is discussed in detail in the July, 1979 Service Roundtable film "1980 Systems Preview." This release should be reviewed by anyone not familiar with the system's operation before proceeding with the Computer Command Control section of this book. All features of the 1980 C-4 system have been incorporated into the 1981 system. This book will discuss only those features that are new to the system for 1981.

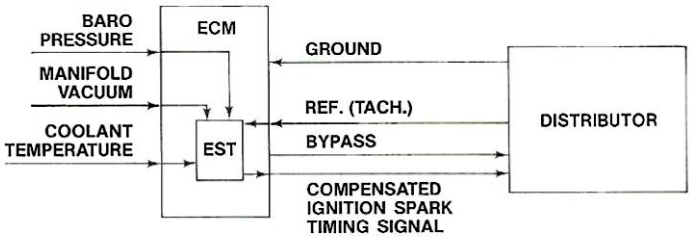
Use of the V-6 engine has been expanded in 1981 to include the Eldorado and Seville, as well as C-body cars. Several of the new features on the engine for 1981 are used on all models, while several others are specific to "C" cars only. First we will review those features used on all V-6 engines.



Two new input sensors have been added, a manifold absolute pressure, or MAP sensor, and a barometric pressure, or BARO sensor. The MAP sensor is used to monitor changes in intake manifold pressure that result from engine load and speed changes. The BARO sensor measures changes in barometric pressure. The information supplied by these two sensors supplements that provided by the other carryover sensors from 1980 to calculate the appropriate air-fuel ratio.

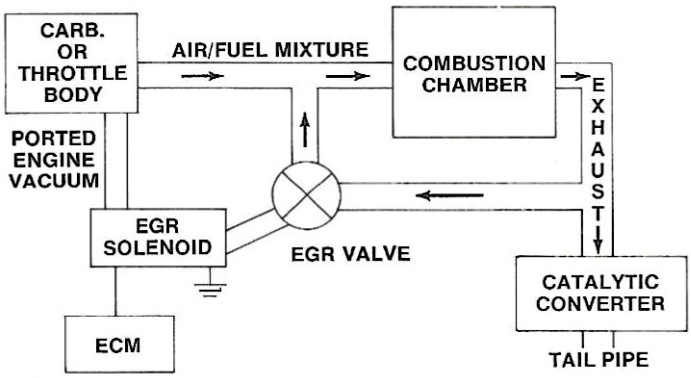
The processing capabilities of the electronic control module have been expanded for 1981 to include three new output controls for improved emission control.

ELECTRONIC SPARK TIMING (EST)



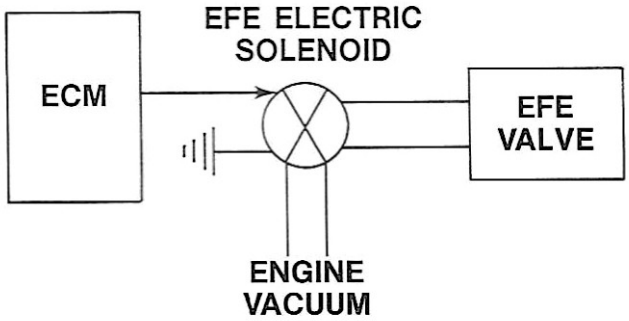

The first is electronic spark timing, which is similar to the electronic spark selection system used on previous model Cadillacs, but with the logic portion of the system now incorporated into the electronic control module. Using various inputs of the computer command control system, a signal is sent from the electronic control module to the HEI distributor to achieve the optimum spark timing, based on the current needs of the engine.

EXHAUST GAS RECIRCULATION (EGR)




The second is the control of the exhaust gas recirculation system. In-line with the vacuum line to the EGR valve is an electronic control module controlled solenoid which is used to shut off exhaust gas recirculation under specific operating conditions.

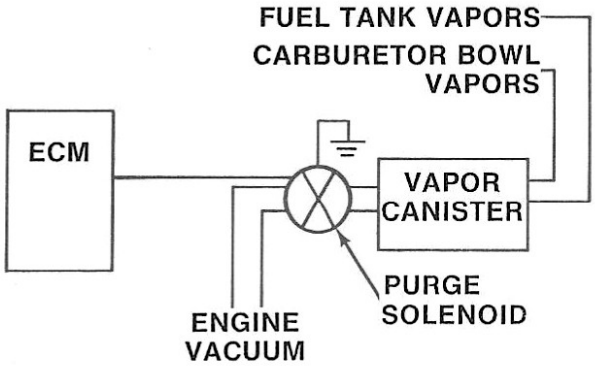
## EARLY FUEL EVAPORATION (EFE) CONTROL SYSTEM




The third new control is for the early fuel evaporation, or EFE system. An electronic control module operated solenoid is used to control the vacuum supplied to the early fuel evaporation valve, opening and closing the valve in response to programmed engine conditions, in the same way that exhaust gas recirculation is controlled.

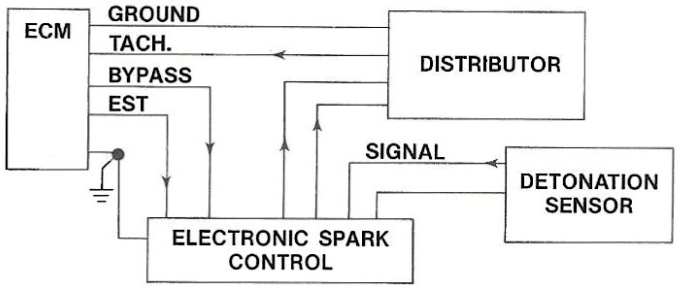
This covers the features that will be used on all V-6 applications in 1981. The following features are used specifically on C-cars only.

## CANISTER PURGE




The first of these is the electronic control module control of the evaporative emission canister purge, which is accomplished by placing a solenoid in-line with the purge line from the canister. This control, along with those on the exhaust gas recirculation and early fuel evaporation systems, allows the electronic control module to control total emissions more closely in response to engine operating conditions.

## ANTI-KNOCK SYSTEM ON V-6 (C-CAR ONLY)



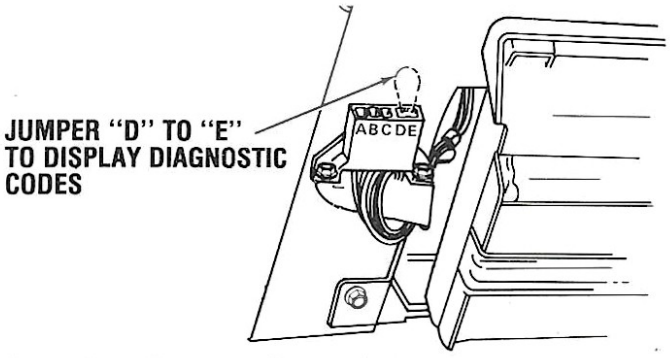

The next feature exclusive to the C-Car is an anti-knock, or anti-detonation system. This system, called Electronic Spark Control, consists of two main components, an engine mounted detonation sensor, and an electronic spark control, or ESC module. The ESC module is placed in line with the output signal from the electronic control module to the distributor. When detonation occurs, the detonation sensor, calibrated to detect this specific sound frequency, sends a signal to the electronic spark control module, which then modifies the EST distributor signal, retarding the timing 4 degrees each second until the detonation ceases. At that time, the electronic spark control module returns spark timing control to the electronic control module, and is nonfunctional until detonation is sensed again.

The 1981 C-Cars will also feature electronic control of the torque converter clutch. The electronic control module uses all the system inputs previously described, plus inputs on vehicle speed, brake pedal position, shift quadrant position, and transmission gear position, to determine clutch application. The system is operational only in third and fourth gear at speeds above 35 miles per hour, as in the 1980 diesel C-Cars. Using the ECM to control torque converter clutch operation provides a smooth apply and release of the converter clutch.

# DIAGNOSTICS

The Computer Command Control system provides all of the diagnostic aids that were included in the 1980 C-4 system, plus additional diagnostic codes for the new features.

## ALCL CONNECTOR

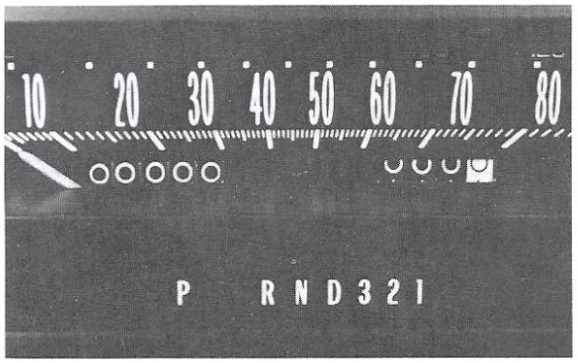



There is a change in the method of accessing the diagnostics for 1981. The green jumper lead under the right side of the instrument panel, used to activate the diagnostic sequence, is no longer there. In 1981, the diagnostics are activated by jumpering pins "D" and "E" of the new assembly line computer link, or ALCL connector. This five pin connector is located under the instrument panel between the ash tray bracket and the glove compartment and should be visible once the close out panel is removed.

The Computer Command Control system, incorporating all the new features, will provide improved fuel economy and emissions control for the 4.1 liter V-6 engine. To understand this new system completely, the two day GMPST training course should be attended at your local training center.

# TURBO HYDRA-MATIC 200-4R TRANSMISSION

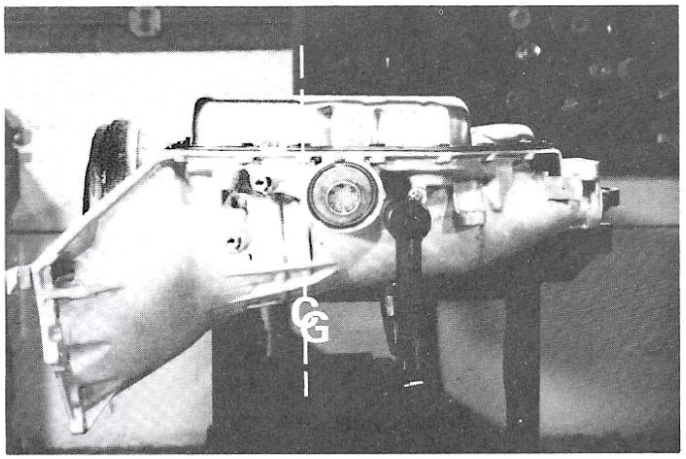
The third subject in this Service Roundtable film is the all new for 1981 Turbo Hydra-Matic 200-4R transmission.



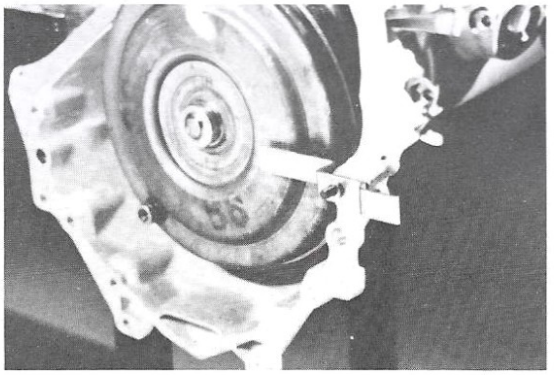

The first thing the driver will notice when operating a vehicle equipped with this transmission will be the new shift indications. Gone is the sometimes confusing "drive left," "drive right," and "low" callouts. It has a "P" for Park, "R" for reverse, "N" for neutral and "D" for drive; in which all forward speeds are available, including overdrive. Manual thrid gear is indicated by a "3", which provides direct drive high gear, but no overdrive. Manual second gear is in the "2" position, and first gear, or low, in the "1" position.

The Turbo Hydra-Matic 200-4R transmission is fully automatic, consisting of a three element hydraulic torque converter with a clutch mechanism, three planetary gear sets and an overdrive unit.

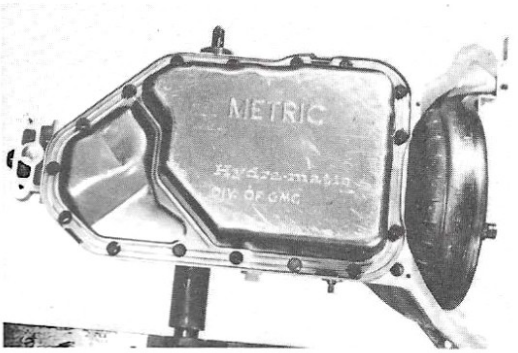
Five multiple-disc clutches, two roller clutches, and a band provide the friction elements required to achieve the desired functions of the transmission.



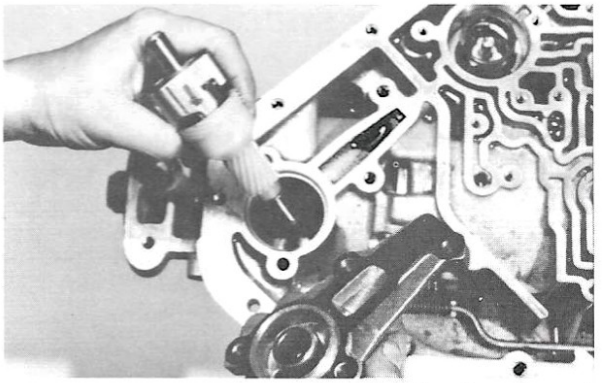

The center of gravity of the THM 200-4R transmission is approximately 4 1/2 inches forward of the holding point of the transmission bench holding tool. Because of this, care should be taken when mounting the transmission or it can tip forward, allowing the torque converter to drop out.



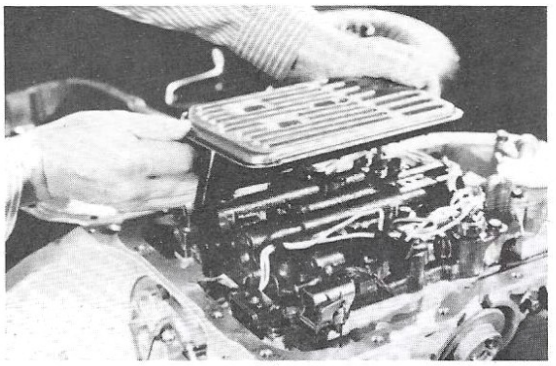
To prevent this from happening, torque converter holding tool J-21366 must be used as a safety precaution.



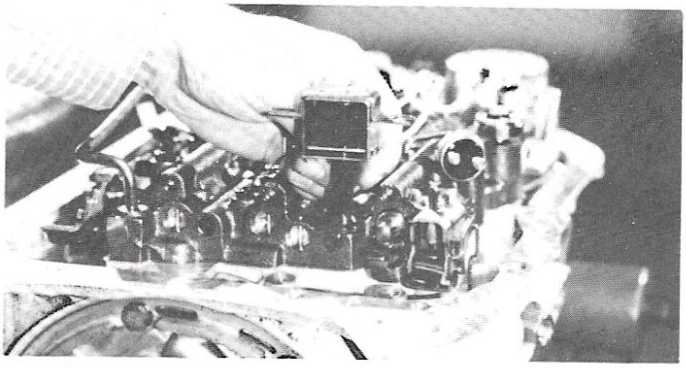

The oil pan on this transmission is one piece, covering the entire bottom, and all fasteners used in the transmission are metric.



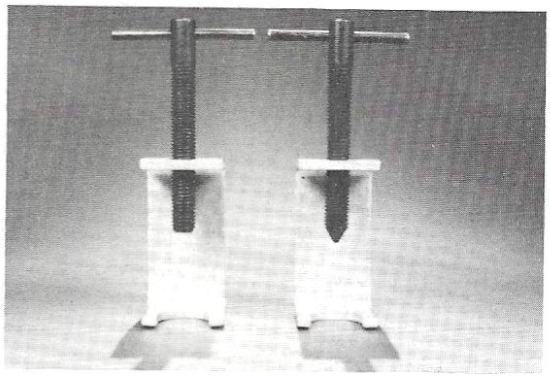
The governor in the THM 200-4R is under the oil pan, held in place by the governor cover. This is an all new governor assembly that incorporates the speedometer drive gear on top, and the governor driven gear on the bottom, as seen here.



Before removing the front pump assembly, the oil filter, which is all new in this transmission;

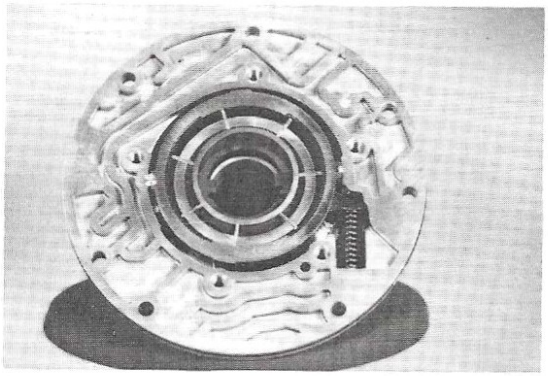


and the new torque converter clutch solenoid, must be removed first. They each have a plastic neck which extends through the case and into the pump, which would be broken off if the pump were removed first.



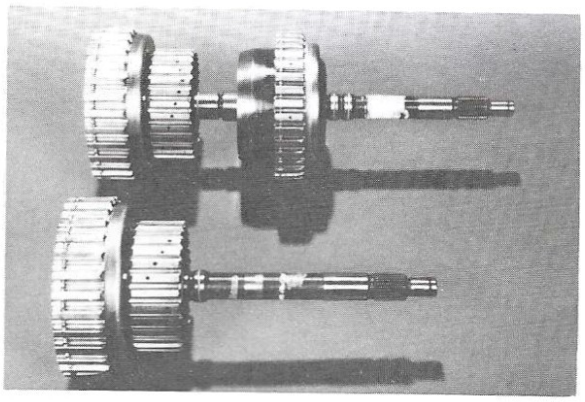
Before using the pump removing tool, J-24773-1, for the THM 200C or the THM 200-4R transmissions, the tool must be altered by grinding approximately 3/16ths of an inch off the pointed tip of the bolt. Just enough champher should be left to act as a guide.

This is necessary to prevent breaking the seal of the turbine shaft end plug during pump removal. The altered tool can still be used on other THM 200 transmissions.



Both the housing and the cover of the all new pump assembly are aluminum. The stator shaft is steel and is serviced separately.

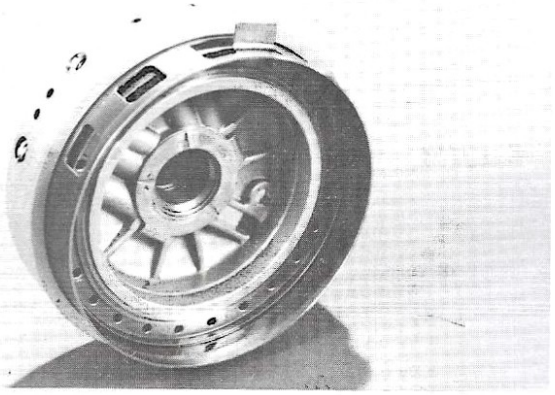
The pump is a self-regulating, variable displacement vane type, instead of a geared pump. Regulation is accomplished by the pressure regulator valve and spring assembly, seen here at the 4 o'clock position. This acts on a boss on the cam ring to move it against its fulcrum point, at the 9 o'clock position. This changes the displacement, regulating the pressure within the pump. The pump mechanism is serviced separately from the cover.



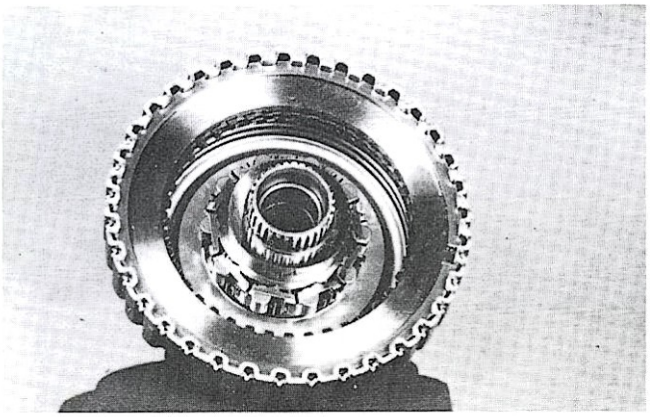
The overdrive assembly in the THM 200-4R transmission is located ahead of the forward clutch and is driven by the turbine shaft. It is shown here, on the top, compared with the turbine shaft, forward and direct clutch from the THM 200C transmission on the bottom.

This picture shows the overdrive assembly disassembled with the turbine shaft on the bottom. The overdrive carrier assembly is on the left, which contains the overrun clutch pack and the overdrive roller clutch inside of it. In the center of the picture is the planetary gear set for the overdrive unit, which consists of the sun gear, the planet pinion carrier, and the internal gear. The planet carrier also contains the outer race for the overdrive roller clutch.

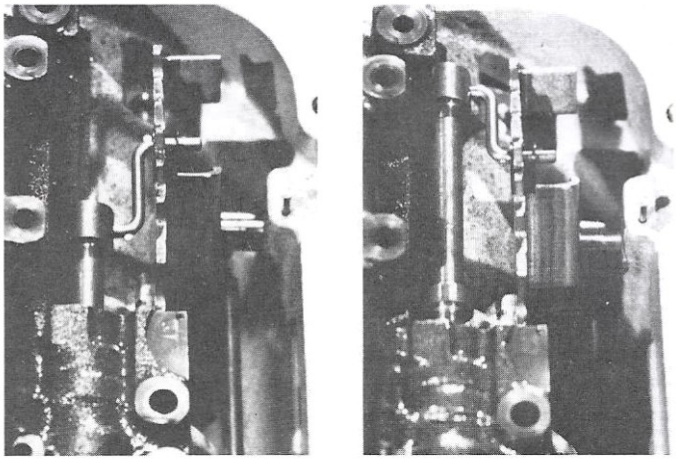
The THM 200-4R also has an all new case center support, aluminum in construction.



This support incorporates the apply piston for the 4th, or overdrive clutch. The piston is the stamped steel ring around the outer circumference of the case center support. The piston and the support are serviced separately.

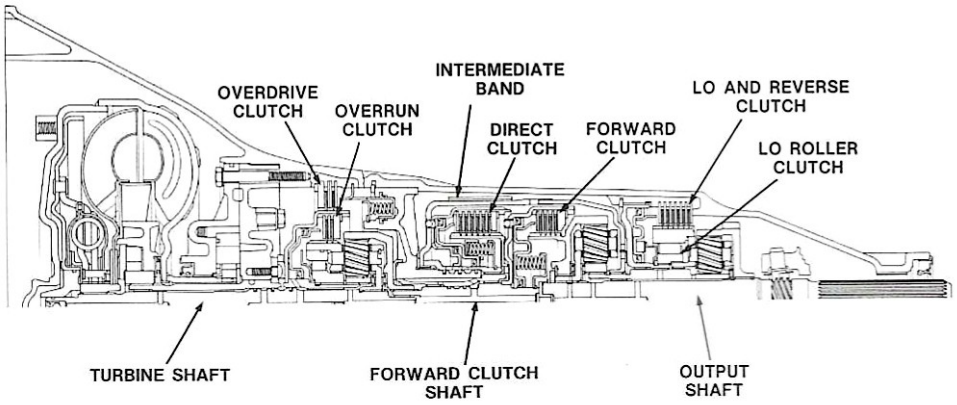


The overdrive roller clutch is mounted in the center of the overdrive carrier assembly. The inner race of the roller clutch is splined to the overdrive sun gear.



When servicing the THM 200-4R transmission, if it is necessary to remove the valve body, note carefully the position of the "S" link that connects the manual valve to the detent lever. The correct position is shown here on the left, with the link pointing toward the back of the transmission as it enters the manual valve. It can be assembled incorrectly, as shown on the right.

This drawing shows the locations and the identification of all 5 of the friction clutches, the band, and the two roller clutches used in the THM 200-4R transmission.




**THM 200-4R TRANSMISSION FRICTION CLUTCH, BAND AND ROLLER CLUTCH APPLICATION CHART**

| GEAR | FORWARD CLUTCH | INTERMEDIATE BAND | DIRECT CLUTCH | OVERDRIVE CLUTCH | OVERRUN CLUTCH | OVERDRIVE ROLLER CLUTCH | LO AND REVERSE CLUTCH | LO ROLLER CLUTCH |
|---|---|---|---|---|---|---|---|---|
| PARK AND NEUTRAL | RELEASED | RELEASED | RELEASED | RELEASED | RELEASED | HOLDING | RELEASED | NOT HOLDING |
| DRIVE RANGE FIRST GEAR | APPLIED | " | " | " | " | " | " | HOLDING |
| DRIVE RANGE SECOND GEAR | " | APPLIED | " | " | " | " | " | NOT HOLDING |
| DRIVE RANGE THIRD GEAR | " | RELEASED | APPLIED | " | " | " | " | " |
| DRIVE RANGE OVERDRIVE | " | " | " | APPLIED | " | " | " | " |
| REVERSE | RELEASED | " | " | RELEASED | " | " | APPLIED | " |
| MANUAL THIRD GEAR | APPLIED | " | " | " | APPLIED | NOT HOLDING | " | |
| MANUAL SECOND GEAR | " | APPLIED | RELEASED | " | " | " | " | " |
| MANUAL FIRST GEAR | " | RELEASED | " | " | " | " | APPLIED | HOLDING |

This has been only a brief introduction to the new modulated displacement operation of the 6.0 liter, V-8-6-4 engine, Computer Command Control fuel delivery system for 1981, and the new Turbo Hydra-Matic 200-4R transmission. For a complete understanding of these subjects, it is essential to attend the two day courses on each subject that will be available at the General Motors Training Centers in the fall of 1980.

All information in this book is based on data available at the time of production and is subject to change.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