

Surreal Development's General Motors Emissions Diagnostic Guide

This document is intended to be supplementary guidance based on Surreal Development's own knowledge of GM diesel engines. This document is made to be a reference in tandem with OEM service manuals and is not made to be a replacement for standard procedures.

Vehicles Which May Follow This Document:

- 2014 to 2015 CRUZE with 2.0L Diesel
- 2011 to 2016 Silverado/Sierra with 6.6L LML
- 2017+ Silverado/Sierra with 6.6L L5P
- 2017+ Chevy Colorado/Canyon with 2.8L LWN
- 2020+ Silverado/Sierra with 3.0L LM2 (except global b variants at this time)
- Other commercial and chassis equivalents.
- Note Global B is not supported by Gretio at this time (2021 LM2). However, the diagnostic procedures are the exact same.

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Required Tools.

Alternative tools may be used however these are made specifically for the DIY and small shop market.

- OBDLINK MX+, LX, or MX.
- Android Tablet or Phone of sufficient quality OR any iOS device
 - a. Good Choices are Samsung Tab A (2016 or 2019), Samsung Galaxy S7 or newer, Google Pixels, and other notable US market phones
 - b. Avoid no name brands and Chinese market brands (Xiaomi).
 - c. Any iOS Device with iOS 14.5 or greater
- Gretio for Android [Gretio - Automotive Scan Tool - Apps on Google Play](#)
OR IOS: [Gretio on the App Store](#)
Currently iOS only supports the OBDLINK MX+
- For help with setup, refer to the video guide.
- [Android] <https://www.youtube.com/watch?v=IVYEOfnNKAA>

- [iOS]

How to use this document

This document is made to be easy to follow. It **focuses on solutions to problems instead of random diagnostics**. With the top solutions always being listed first based on real world data.

All images used in this document will utilize our own diagnostic tool "Gretio" which is a cheap cost effective tool made specifically for GM diesel vehicles (but also supports gas engines). The processes are similar to other professional scan tools so feel free to use what you have available.

To start, simply find your symptom in [Diagnostic by Symptom](#) and start moving down the list of solutions&causes.

You should always [Request DTCs \(Diagnostic Trouble Codes\)](#) as the first step. If a relevant DTC is found you should focus on addressing the DTC first. However many times there is no relevant DTC while diagnosing emission issues. In addition, a DTC will refuse to clear even after replacing the faulty sensor or system. Since DTCs are not reliable, this guide is made to work with no useful active/historical DTCs.

Newer users may benefit from finding their engine in the [Block Diagrams](#). These block diagrams will show the arrangement of emission components which can be useful for interpreting data.

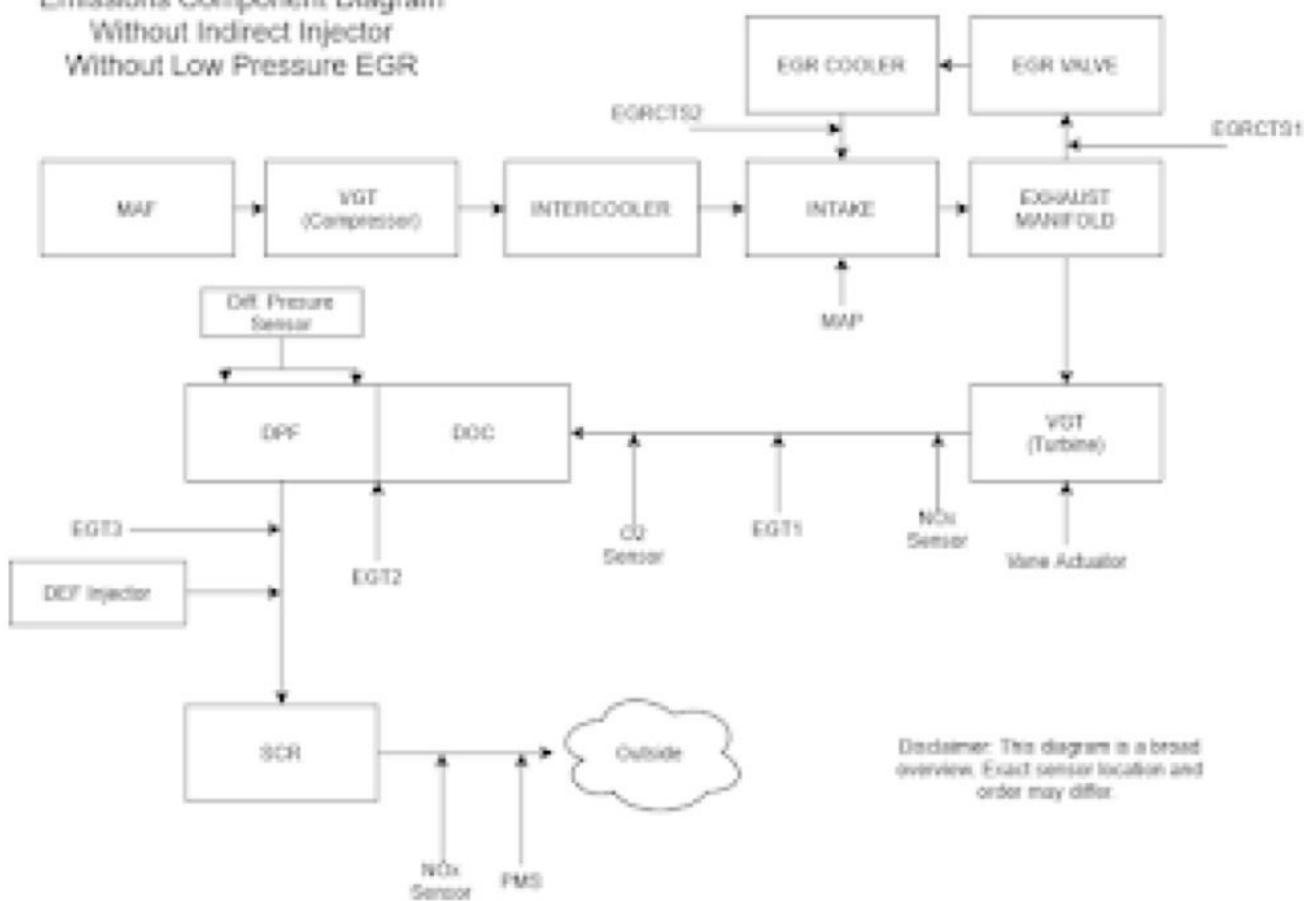
For GM diesel vehicles, there are 3 core tests which this document revolves around. These tests are the only way to clear DIC warnings without driving.

- The Service Regeneration
- The Reductant System Malfunction Warning Service Bay Test
- The Reductant System Tamper Warning Service Bay Test

Block Diagrams

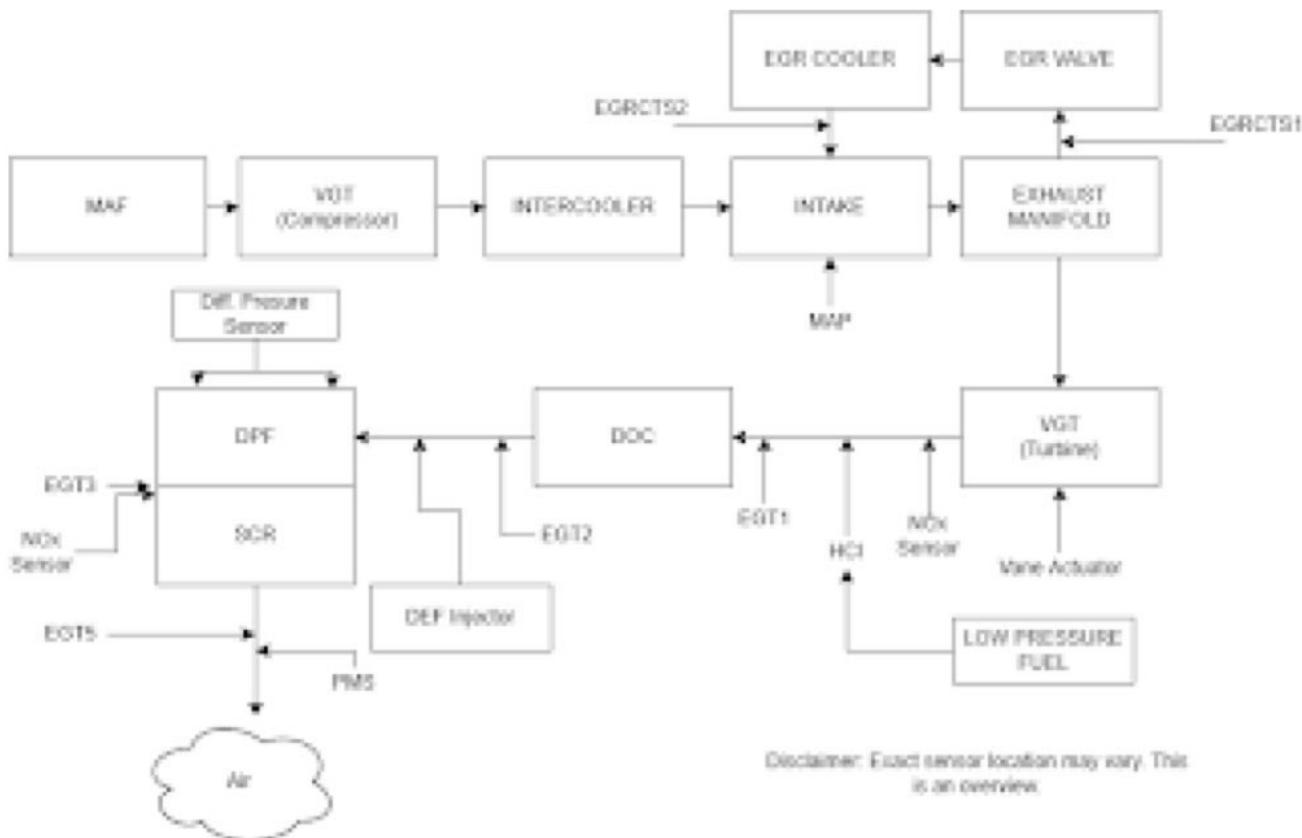
Emissions Component Diagram 2.0L LUZ

Emissions Component Diagram
Without Indirect Injector
Without Low Pressure EGR



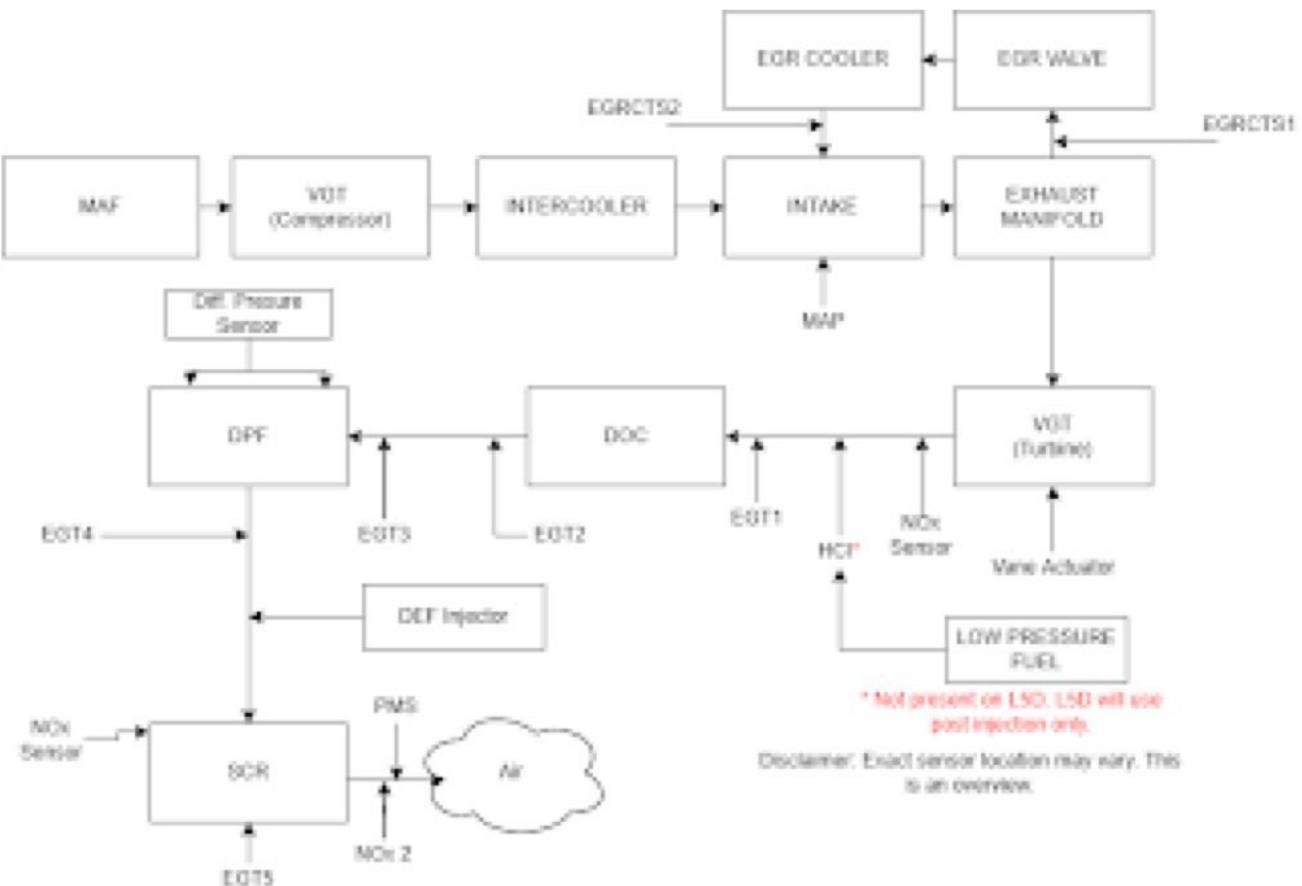
Note: The O2 sensor is not a typo. The 2.0L LUZ utilizes the O2 sensor for various lambda controls like a gasoline engine. Diesels do not normally utilize an O2 sensor.

Emissions Component Diagram 6.6L LML/LGH

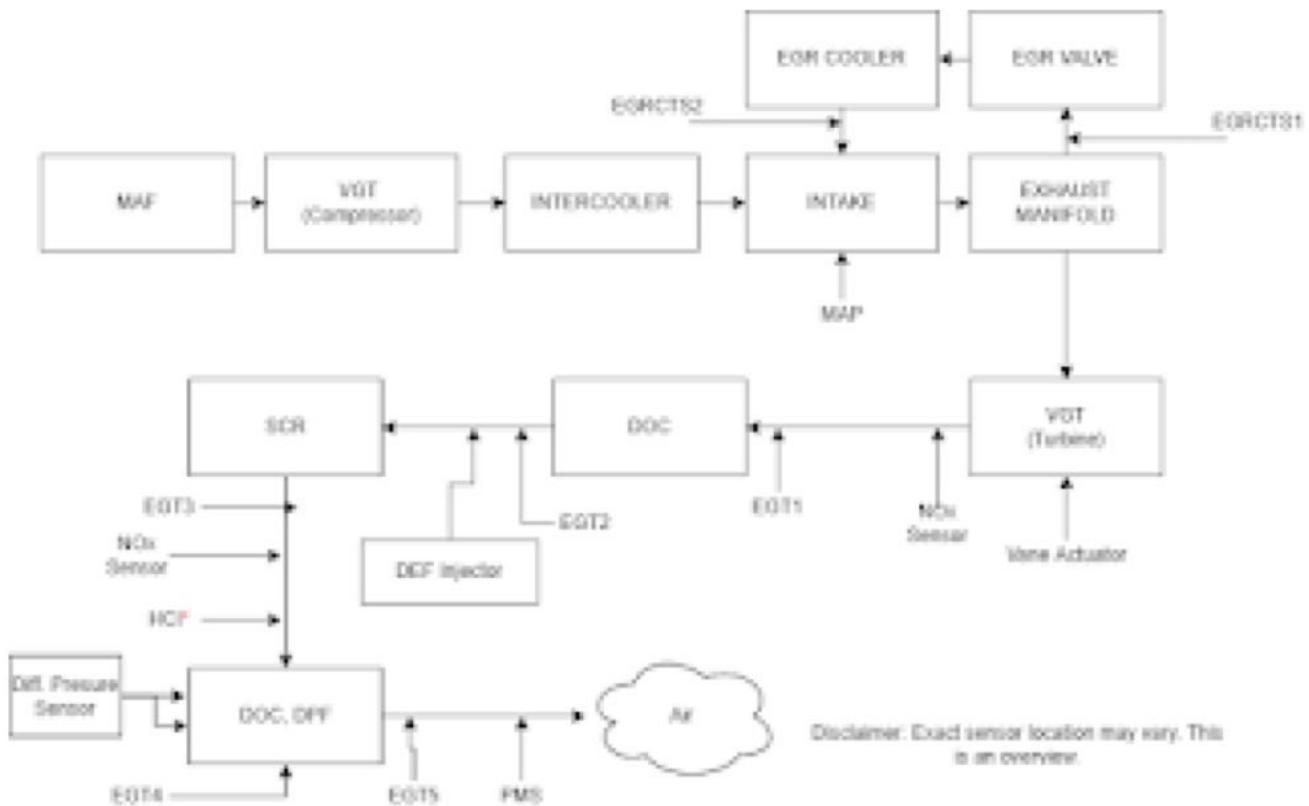


Note: EGT 5 is the sensor PID in Gretio. EGT 5 will be “EGT 4” for DTCs and parts purposes. Other scan tools may correct this and say “EGT 4”. Some other scan tools may show “EGT 4” but the PID will not work. This is because the sensor PID is actually EGT5 not EGT4. This was likely a small mistake by GM.

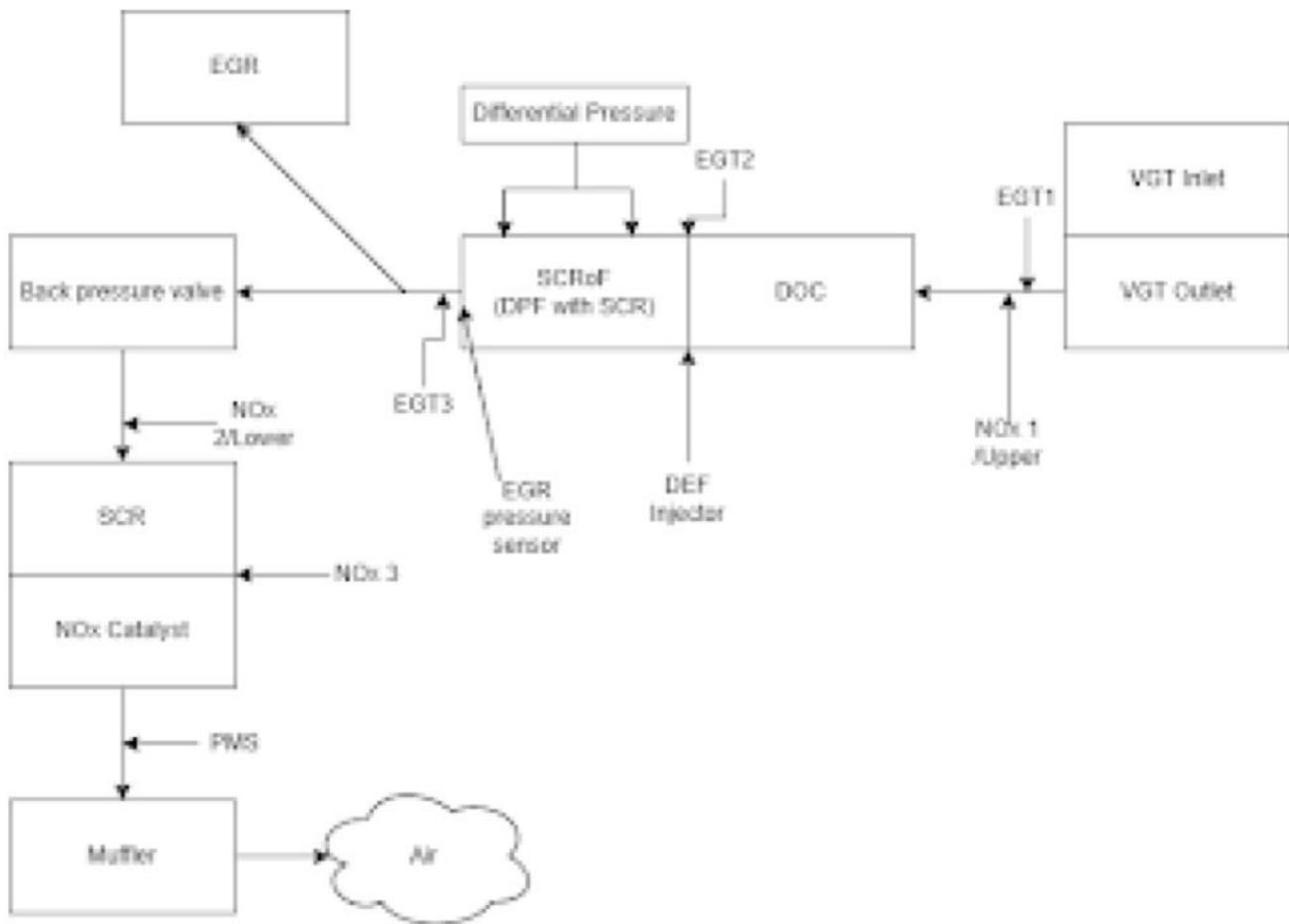
Emissions Component Diagram 6.6L L5D



Emissions Component Diagram 2.8L LWN, 6.6L L5P



Emissions Component Diagram 3.0L LM2



Special Considerations

Deleted Vehicles

A tune may not entirely disable emission functions. It is possible to receive emission DIC warnings (DPF warnings, SCR countdowns, etc....).

These warnings can be temporarily removed in Gretio by exploiting the reset functions (just try various resets until the DIC message disappears). However, Gretio cannot permanently solve the warnings. To get rid of these warnings the vehicle must be returned to stock so that the diagnostic procedures in this document can be performed.

Other Tuned Vehicles

The SCR Service Bay Tests require special conditions to pass their DTCs. Many “emission compliant” tunes modify parameters such as DTC Functions, EGR usage, timing, etc.... These

changes can be incompatible with the tests. The tune will cause the tests to time out without finishing (90 minute).

As such, it is highly recommended you restore your truck to stock before any procedures. You can simply restore the tune after you have cleared the issue.

If returning to stock is not possible you will need to work with your tuner to try and determine what DTC functions could be affected, and they will need to adjust their tune accordingly.

Note to Tuners

Tuners reading this document should make sure their test vehicles can complete a Service Regeneration, SCR Malfunction Warning Service bay Test, and the SCR Tamper Warning Service Bay Test. Extreme care should be taken when modifying DTC functions or disabling DTCs as doing so can cause the tests to hang.

Non Serviceable Parts

Many parts will be a component of another.. For example in 2017+ L5Ps the Def Quality Sensors is a part of the DEF tank. Replacing the quality sensor would require replacing the entire def tank. This can lead to some confusion as the name and descriptions in GM's parts catalog do not represent this.

Diagnostic by Symptom

DIC Messages: “Cleaning Exhaust Filter” -> “Keep Driving Until Message is Cleared” or “Diesel Particulate Filter Full” “Continue Driving”

This error indicates the dpf has exceeded a certain amount of time without doing a successful regen. It could be harmless, but many times is the symptom of a larger issue at play.

Possible Diagnosis and Solutions:

1. Malfunctioning Aftertreatment Injector (P20CC)
 - a. NOT equipped with light vehicles (Cruze, Equinox, etc...). Also not equipped on LGH or L5D. Proceed to cause #2. 
 - b. Otherwise, refer to [Service Aftertreatment Injector](#)
2. Random Chance
 - a. This could happen purely by chance based on driving style. As such simply performing a service regeneration can fix the problem.
 - b. Refer to [Service Regeneration](#)
3. Malfunctioning Differential Pressure Sensor
 - a. [Check for related DTCs](#)
 - b. Manually check “DPF Soot Accumulation” for plausibility (not maxed out to i.e 99)

- grams).
- c. Perform [Service Regeneration](#)
 - d. Verify temperatures during service regeneration. If temperatures are NOT okay see malfunctioning EGT sensor.
 - e. If DPF Soot mass remains unchanged, verify rubber pressure pipes are connected to the pressure sensor.
 - f. Replace DPF Pressure Sensor and perform "DPF Pressure Sensor Reset" service command.
4. Malfunctioning Exhaust Gas Temperature Sensor
- a. [Check for related DTCs](#). If found. -> Replace the faulty EGT.
 - b. Follow the table in [Service Regeneration](#) to diagnose a bad EGT.

DIC Message: “Service Emissions System” or “Exhaust Fluid Low/Empty”

This error indicates a malfunction in the scr system which has triggered this warning.

Possible Diagnosis and Solutions:

1. Verify DEF tank is full, and DEF Level is “OK” and not low.
 - a. If DEF level indicates low, or has a warning level/restriction. Then fill tank and execute command “Reductant Fluid Tank Level Reset”
 - b. Continue to next step 
2. Lookup DTC for more information
 - a. See [Request DTCs](#)
 - b. Many times you or the customer accidentally clears the DTCs. This leads to an awful situation where the system is still in warning mode but we have nothing to go on. In this case, perform a [SCR Warning Service Bay Test](#)
 - i. If DIC warning clears, test passed -> Drive and verify vehicle Operation
 - ii. If 20 minutes pass -> See [Request DTCs](#)
 - iii. If 30 minutes pass-> Test timed out. DTC should be present. If no DTC you may perform a second service bay test.
 - iv. If 2 service bay tests do not clear issue continue to step 3 
3. DTC Present: P20EE or other “Low Efficiency” DTC
 - a. Proceed with [“Exhaust Fluid Quality Poor. See owner’s manual now.”](#)
4. DTC Present: NOx Sensor Performance DTC
 - a. Replace sensor in question
 - b. Perform [DEF Fluid Quality Test](#)
 - i. If quality test passes -> Drive and verify vehicle Operation
 - ii. If the quality test times out -> proceed with [“Exhaust Fluid Quality Poor. See owner’s manual now.”](#)
5. DTC Present: P21DD or other “DEF Heater” DTC
 - a. Replace the DEF Tank Heater or DEF Line Heater(s)
 - i. Depending on the vehicle there may be multiple heaters. Generally there is 1 heater in the tank, and at least 1 heater on the DEF Lines.

- ii. After replacing heaters: If DIC warning is still present perform the [Reductant System Tamper Warning Service Bay Test](#).
 - 1. On LML and LUZ the [Reductant System Malfunction Warning Service Bay Test](#) may be used instead of the tamper test. But Heaters 1 and 2 (if present) should be cycled for 5 minutes prior to performing the test.
 - b. If DIC warning still present: Proceed with "[Exhaust Fluid Quality Poor. See owner's manual now.](#)"
- 6. No DTC
 - a. Proceed with "[Exhaust Fluid Quality Poor. See owner's manual now.](#)"

DIC Message: “Service Exhaust Fluid System”

This is the ‘Tamper’ variant of the SCR warning which focuses on testing ‘Tamper’ DTCs. **Some L5P and LWN trucks may show the wrong warning. This is a known issue and is fixed in newer software calibrations.**

LML, LUZ and other vehicles without a tamper test should follow [DIC Message: “Service Exhaust Fluid System”](#).

Tamper warnings will generally be circuit malfunctions, communication errors, and other issues that could arise from unplugging a sensor or module. Sometimes a tamper test is required after replacing a module or heater. Non tamper warnings are generally long term performance monitoring issues.

Both SCR Malfunction Warnings and SCR Tamper Warnings are caused by DTCs failing. For a Service Bay Test to pass, all DTCs in the failed group must PASS, even if those DTCs never failed (listed as Current in Gretio).

For addressing tamper errors.

1. Lookup DTC for more information
 - a. See [Request DTCs](#) and resolve issues for DTCs first.
 - b. If no DTCs are present, or DTCs are not helpful: Perform a [SCR Tamper Warning Service Bay Test](#)
 - i. If DIC warning clears, test passed -> Drive and verify vehicle Operation
 - ii. If 20 minutes pass -> See [Request DTCs](#)
 - iii. If 30 minutes pass-> Test timed out. DTC should be present. If no DTC you may perform a second service bay test.
 - iv. If 2 service bay tests do not clear issue continue to step 2 
2. Treat as [DIC Message: “Service Emissions System” or “Exhaust Fluid Low/Empty”](#)

General Symptom: Sputtering on start or low speed

There can be a lot that can cause this ranging from faulty injectors to a connecting rod about to break. This document will go over emission related issues that can cause 'sputtering' or other engine performance symptoms.

Possible Diagnosis and Solutions:

1. Throttle Valve is Stuck
 - a. See [Request DTCs](#). Look for throttle valve position errors
 - i. If DTC is present
 1. Remove the intercooler pipe from intake.
 2. Command Throttle Position and verify movement.
 - a. If No movement. Use screwdriver to free throttle valve
 - b. If still no movement. Verify wiring.
 - c. If still no movement. Replace throttle valve
 - ii. If no DTC is present
 1. Proceed to solution #2. 
 - b. If low boost code:
 - i. Inspect intake for leaks, cracks, etc.
 1. If a leak is found , replace the intake pipe in question.
 - ii. Inspect vacuum pump operation and pipes. VGT Control is generally done by vacuum. Inspect proper operation. Replace vacuum pipes and vacuum pump as needed. It is recommended you use a pressure gauge to verify vacuum operation. Vacuum leaks rarely give a DTC, and many leaks do not adversely impact the brake booster, but do impact VGT control.
 - iii. Using Gretio, command turbo VGT position. Verify vanes are moving (either by eye or using scan tool)
 1. If vanes do not move, replace the VGT Actuator.
 - iv. If low boost error is still present replace the Variable Geometry Turbocharger.
 - v. Verify Vehicle Operation
 - c. Other issues:
 - i. Replace Air Filter
 - ii. Replace Mass Air Flow Sensor
 - iii. Verify vehicle operation
 2. Intake leak or unmetered air
 - a. [Request DTCs](#). Look for errors involving low boost.
 - b. If low boost code:
 - i. Inspect intake for leaks, cracks, etc.
 1. If a leak is found , replace the intake pipe in question.
 - ii. Inspect vacuum pump operation and pipes. VGT Control is generally done by vacuum. Inspect proper operation. Replace vacuum pipes and vacuum pump as needed. It is recommended you use a pressure gauge to verify vacuum operation. Vacuum leaks rarely give a DTC, and many leaks do not adversely impact the brake booster, but do impact VGT control.
 - iii. Using Gretio, command turbo VGT position. Verify vanes are moving (either by eye or using scan tool)
 1. If vanes do not move, replace the VGT Actuator.
 - iv. If low boost error is still present replace the Variable Geometry Turbocharger.
 - v. Verify Vehicle Operation
 - c. Other issues:
 - i. Replace Air Filter
 - ii. Replace Mass Air Flow Sensor
 - iii. Verify vehicle operation
 3. Exhaust Gas Recirculation Valve (EGR Valve) is sticking
 - a. Remove intake manifold, and EGR pipe from vehicle.
 - b. If coolant discovered proceed to diagnosis #5 
 - c. Burn excess soot from intake and pipe.
 - d. Reinstall intake components and verify operation.
 - e. If the issue persists, replace EGR Valve.
 - f. Verify vehicle operation
 4. Injector Malfunction
 - a. Command injector shut off (one by one) to see if sputtering improves. While the vehicle will perform poorly one cylinder down a faulty injector will sound different from an injector shutoff.
 - i. Note: Some cylinders throw the engine out of balance more than others.

- This is not a sign of an issue. With a malfunctioning injector, the engine will sound cleaner after you disable the injector even if the engine itself is 'lugging' and 'vibrating'.
- b. Monitor "Balancing Rate" for any abnormalities. Generally, rates higher than 8mm3 at idle are signifying a faulty injector.
 - c. Replace Faulty Injector
 - d. Verify Vehicle Operation
5. EGR Cooler Failure
 - a. Investigate EGR cooler for leaks.
 - b. If a leak is found, many times it is simply the plastic couplings. Replace the couplings (parts vary by vehicle), run the vehicle, and check for leaks again.
 - c. If leaks are still present and/or coolant is finding its way into intake. Replace EGR System (Cooler + Valve). This is very expensive.
 - d. Verify Vehicle Operation
 6. DPF is excessively full
 - a. Verify DPF soot is high (exceeds 80g).
 - b. Verify operation of DPF Differential Pressure Sensor : See "[Cleaning Exhaust Filter](#)" -> "[Keep Driving Until Message is Cleared](#)" or "[Diesel Particulate Filter Full Continue Driving](#)".
 - c. If the pressure sensor is operational, the DPF is destroyed. Do not attempt a service regeneration.
 - d. Replace Diesel Particulate Filter and Diesel Oxidation Catalyst.
 - e. Perform DPF Reset and DPF/Oxidation Catalyst Reset and DPF Pressure Sensor Reset.

Verify vehicle operation

DIC Message: "Exhaust Fluid Quality Poor"

This error indicates the SCR system is not performing as well as it should. In practice, this rarely has anything to do with the DEF Quality. And thus its name is highly misleading.

Note NOx Sensors, like O2 Sensors, require to be warmed up before operation. When a NOx sensor is not warmed up it will read a strange value which does not change such as -100 ppm, -7ppm, or 0ppm. This is generally normal behavior, but NOx sensors should only take a few minutes to reach normal operating conditions under normal conditions (it may take longer if at idle).

Possible Diagnosis and Solutions:

1. Failed DEF Quality Sensor or DEF Additive Contamination
 - a. Only newer trucks (2017+ L5P, 2019+ LWN) use a DEF Quality sensor. Verify Quality sensor is present on vehicle. Older vehicles monitor NOx sensor 1 and NOx sensor 2 for DEF Quality and as such have no physical sensor.
 - i. If no quality sensor is present, proceed to step # 2 
 - ii. If a quality sensor is present, [Request DTCs](#) and resolve the issue (likely by replacing the sensor). No 'Circuit' DTCs should be present before proceeding
 - iii. If a warning message is still present after resolving Quality Sensor DTCs, proceed with the instructions for that warning message.

- b. Usage of DEF additives may interfere with the DEF Quality Sensor found on both the L5P and LWN SCR system. Such additives may come from "Premium" DEF such as BlueDef Peak Platinum.
 - i. In the event a DEF additive was used, the DEF tank must be drained.
 - ii. Once the def has been drained perform a [Reductant System Malfunction Warning Service Bay Test](#).
 - iii. If error persists, replace the DEF quality sensor and perform another [Reductant System Malfunction Warning Service Bay Test](#).

2. Ammonia Slip:

Reference [Ammonia Slip](#) for background information about this issue.

- c. [Perform a service regeneration](#). This will burn off the excess ammonia in the SCR.
- d. Allow the vehicle to rest for 5 minutes **at idle**. Then shut off and turn back on the vehicle.
- e. [Perform a quality test](#) (Service Bay Test for newer GM Diesels).
 - i. If Quality test passes -> Drive and verify vehicle Operation
 - ii. If Quality Test Fails -> Record the failure reason PID and [Request DTCs](#).
 - If no useful DTC is found proceed to step #3 
 - iii. If Quality Test Times Out -> Proceed to step #3 

3. Malfunctioning NOx Sensor

This can occur even if there is no related DTC.

- a. [Perform a quality test](#). Observe the NOx sensor values and note any issues.
 - b. If values out of bounds: Replace the NOx sensor with faulty readings. And go back to solution #1: Ammonia Slip. ↑ *Replacing the NOx Sensor may not fix the issue but it is worth ruling out especially when no other DTCs are present which would indicate a failure.*
 - c. If NOx concentrations look okay, or if you have already replaced the NOx sensors -> Proceed to step #4 
- ## 4. DEF Pump Failure
- a. [Request DTCs](#) for any DEF Pressure malfunctions.
 - b. Inspect pump for signs of leaks
 - i. If leaks-> Replace DEF Pump (or Tank if not serviceable) and Proceed with solution #1.
 - ii. If no leaks-> Continue to step c 
 - c. Command Reductant Pump and verify pressure is being built.
 - i. If no or low pressure -> Replace DEF Pump and Proceed with solution #1
 - ii. If pressure is being built -> Proceed to step #5. 

5. DEF Injector Clogged or Failed

- a. Perform [DEF Quantity Test](#)
- b. During the test the injector should make nice clicky puffs with few to no drops.
 - i. If not clicking or excessive dropping -> Replace DEF injector and proceed with solution #1
 - ii. If functioning okay proceed to step c. 

- c. Relate measured quantity to service manual for your vehicle.
 - i. If too much or too little -> Replace DEF injector and proceed with solution #1
 - ii. If functioning okay proceed to step #6. 
- 6. DEF Lines clogged or def fluid is contaminated
 - a. A refractometer may be used to determine if DEF is contaminated. These can be found inexpensively (such as the OTC 5025). 32.5% Urea in DEF is the standard.
 - i. Refraction test between 31% and 34% -> The tank may or may not be contaminated. You can proceed to flush the tank or proceed to step #6 
 - ii. Refraction test outside range -> Continue to step b 
 - b. Turn off the key of the vehicle and allow 1 minute for the DEF system to purge.
 - c. Remove the DEF Tank and drain its DEF out by rotating the tank upside down onto a secure container.
 - d. Flush DEF lines with distilled water or other highly filtered water
 - e. Flush DEF Tank with distilled water or other highly filtered water
 - f. Reinstall systems and Proceed with solution #2: Ammonia slip. ↑ ↑ ↑ ↑
- 7. SCR Catalyst has failed
 - a. Replace SCR Catalyst
 - b. Perform [Perform a quality test](#)
 - i. if passes -> Drive and verify vehicle operation
 - ii. If fails -> Investigate other causes for excessive NOx.
 - 1. EGR malfunction
 - 2. Excessive Boost
 - 3. Malfunctioning MAF

Other References and TSBs Related to DEF Quality Warning:

[2010 to 2013 LML TSB](#)

[DEF Fluid Contamination, misc vehicles 2010 to 2017 TSB](#)

[DEF Fluid Contamination, misc vehicles, 2017 to 2020.](#)

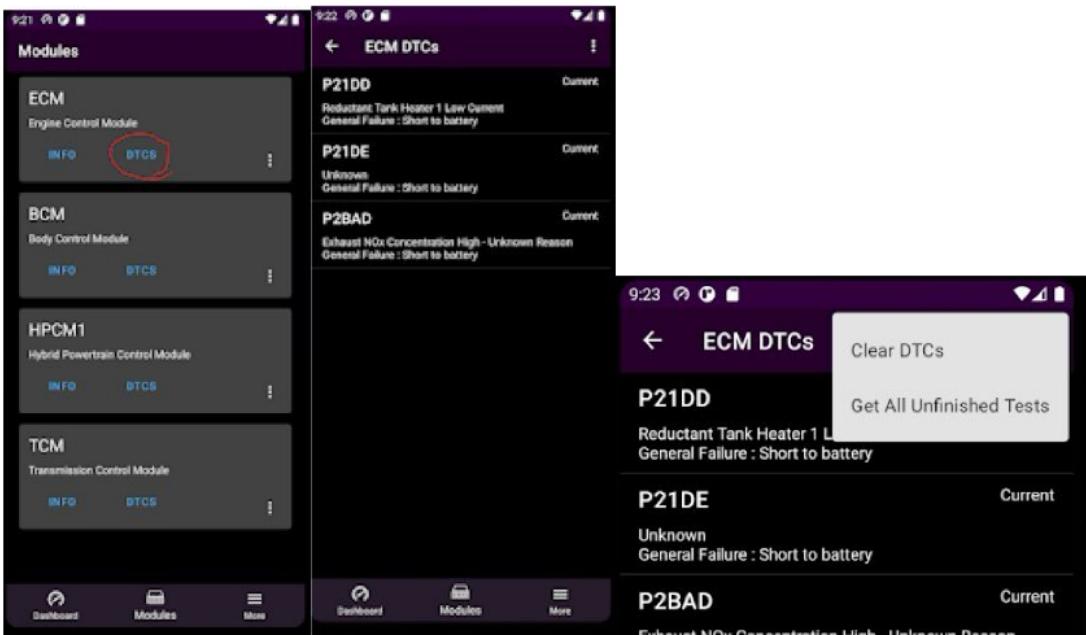
[Exhaust Fluid Low Warnings, LML 2011 to 2014 TSB](#)

[L5P P20EE TSB](#)

Procedures

Request DTCs (Diagnostic Trouble Codes)

1. Connect to the vehicle
2. In the “Modules Menu”
 - On Android: Find the card for the needed module and tap “DTCs”
 - On iOS: Simply tap the module then tap “Current/Historical DTCs”
3. DTCs will be shown (if any)



4. To clear DTCs

Android: tap the 3 button menu and tap “Clear DTCs”.

iOS: Press back (if in the DTC menu) and tap clear dtcs. Then confirm.

- **Clearing DTCs is neither required nor recommended. Do not clear DTCs unless specified to do so.**
- Most vehicles after 2015 will reject clear DTC requests under most circumstances. The error you will receive is undefined but will be one of:
 - “Conditions are not correct to clear DTC. Try again later.”
 - “Service Not Available for this module”
 - “Sub Function not Supported”.
- If clearing DTCs are required and you are still receiving one of the above errors you may try the following steps:
 1. Turn off the ignition. Remove the key. And open and close the driver door. Let the vehicle sit for 5 minutes.
 2. Enter the vehicle and turn the key to RUN. If push start, hold the button without pressing the brake.
 3. Attempt to clear DTCs. If DTCs still fail to clear then the DTC cannot be cleared.

DTC Pinning/Tracking

Gretio currently does not support DTC pinning but it is a planned feature. DTC Pinning allows you to monitor a DTC's status in real time even after it has been cleared. This helps trace erratic behavior.

Service Aftertreatment Injector \ Indirect Injector

This injector will be located upstream of the DOC. If there is more than 1 DOC then it is located before the DOC which is immediately before the dpf. It is very similar to a standard injector and

helps the exhaust reach desired temperatures. When malfunctioning it will cause temperatures to be too low or high.

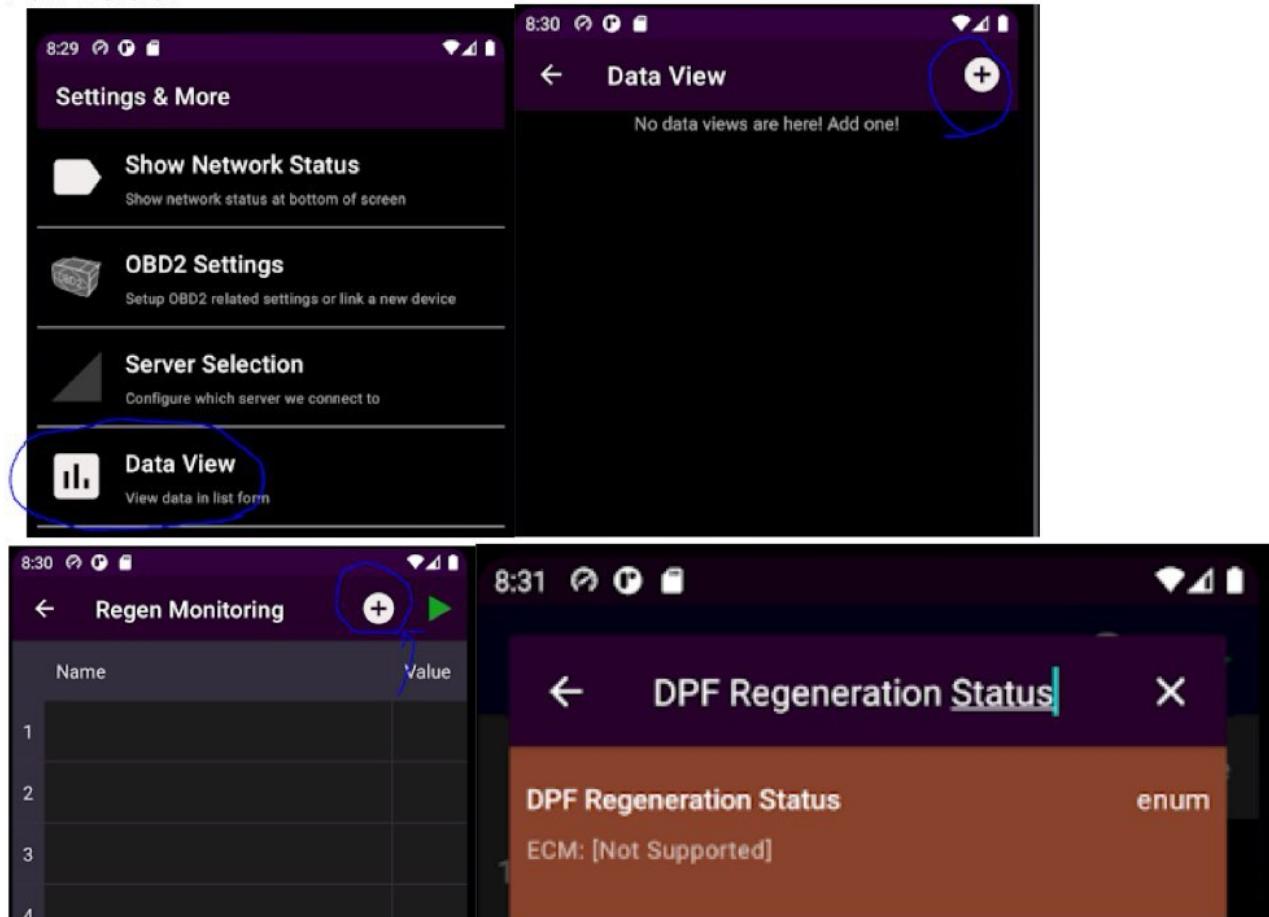
Testing the injector requires special tooling (see service manual). However its diagnosis may be achieved by monitoring temperatures during a [service regeneration](#). Refer to the [Block Diagrams](#) to see which EGTs to monitor.

- A leaking Indirect Injector will cause abnormally high EGTs during normal driving, and excessive EGTs during regens (over 700C).
- A blocked or low performing injector will cause the DPF to not reach temperature (standard regen temperatures are between 500C and 650C).

Monitoring Data

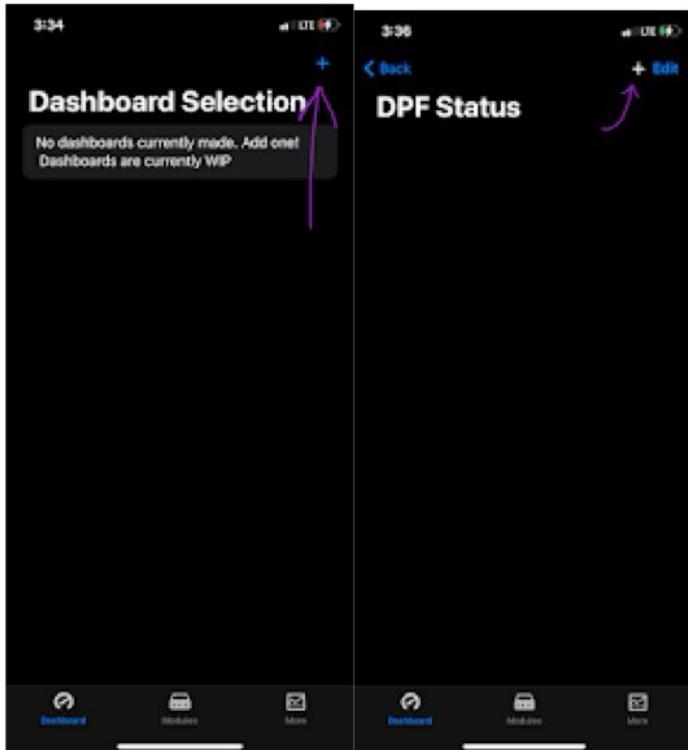
New in Grecio 1.05: Common functions such as service regens will present premade lists of data. So creating your own data lists is no longer required.

For Android:

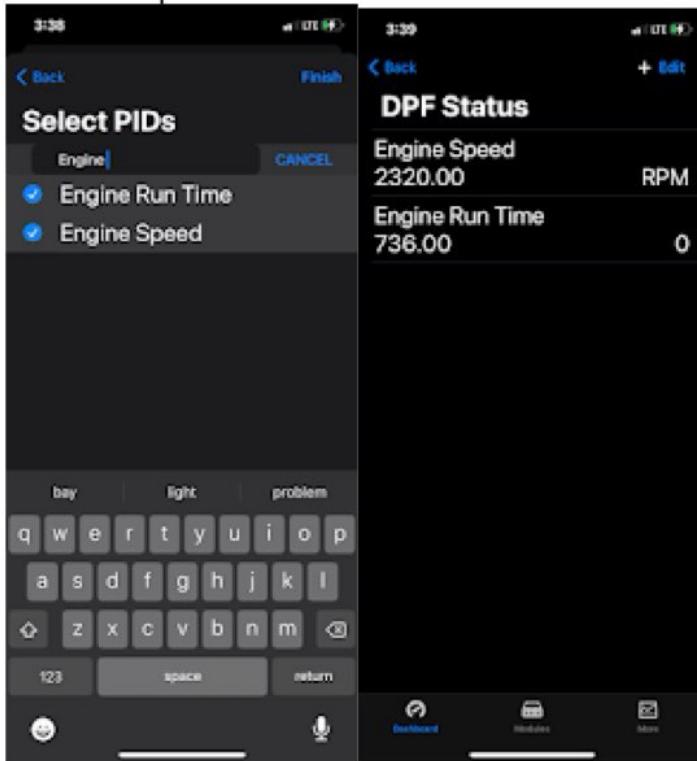


Search for data you would like to monitor and it will be added to the list in a 'spreadsheet' like form.

For iOS:



Tap the plus sign, name your dashboard, and then tap “Add”. Tap your new dashboard to enter it. You will be presented with a blank screen like below.

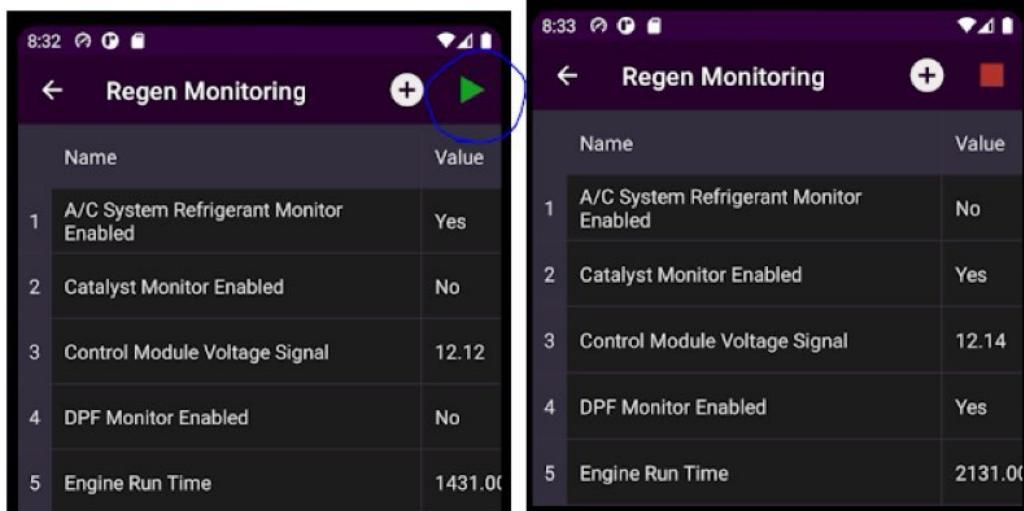


Tap the plus sign next to “edit”. Tap the module you would like to see data for then search for the data. Tap all the data you wish to add then tap “finish”.

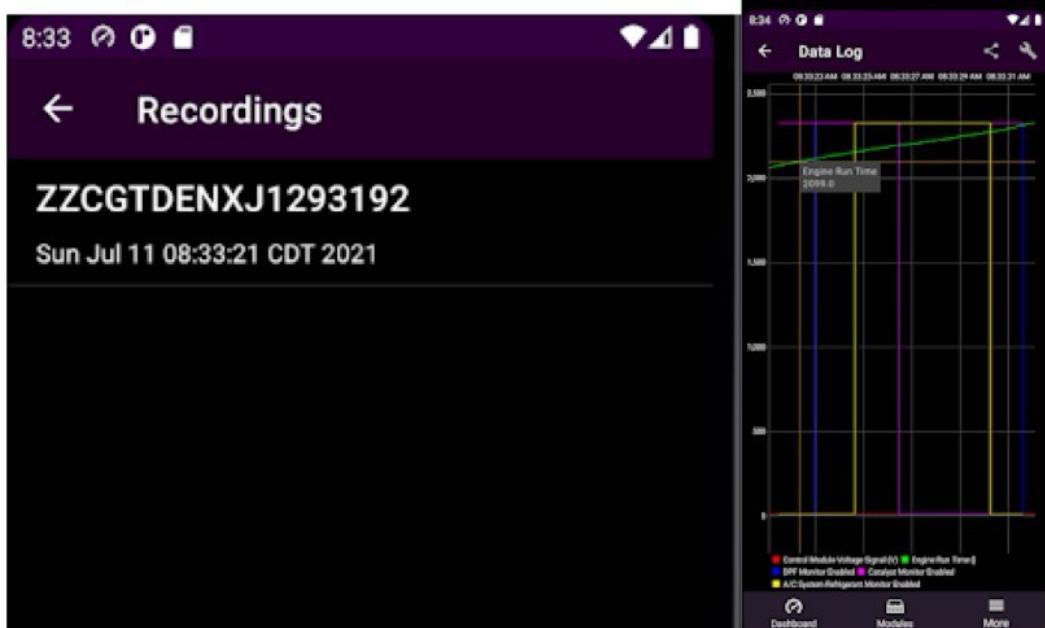
You can search PIDs by their full name or by their label (such as EGT).

Recording Data (Gretio for Android)

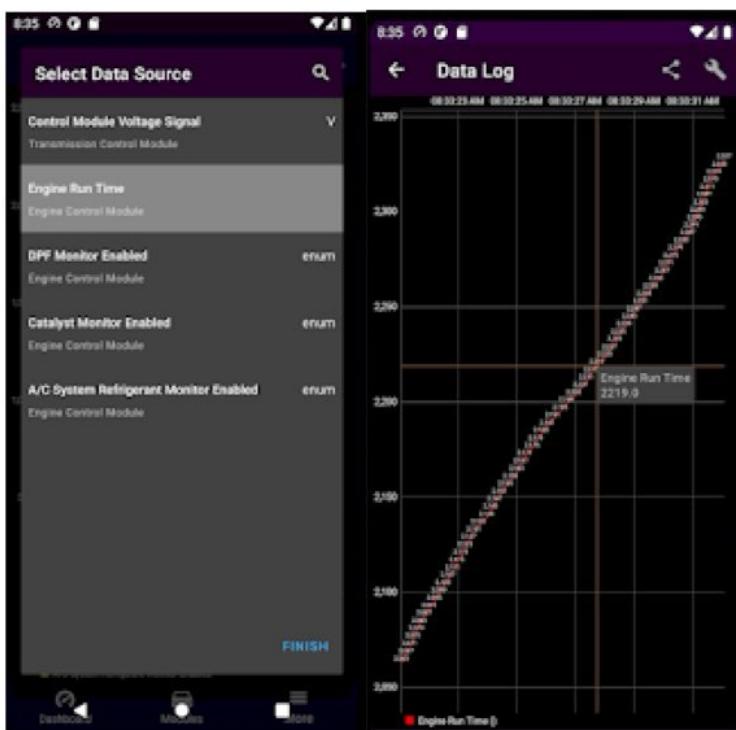
Create a data list (see “Monitoring Data” section) but then simply tap the ‘Play’ Icon. Tap again to stop.



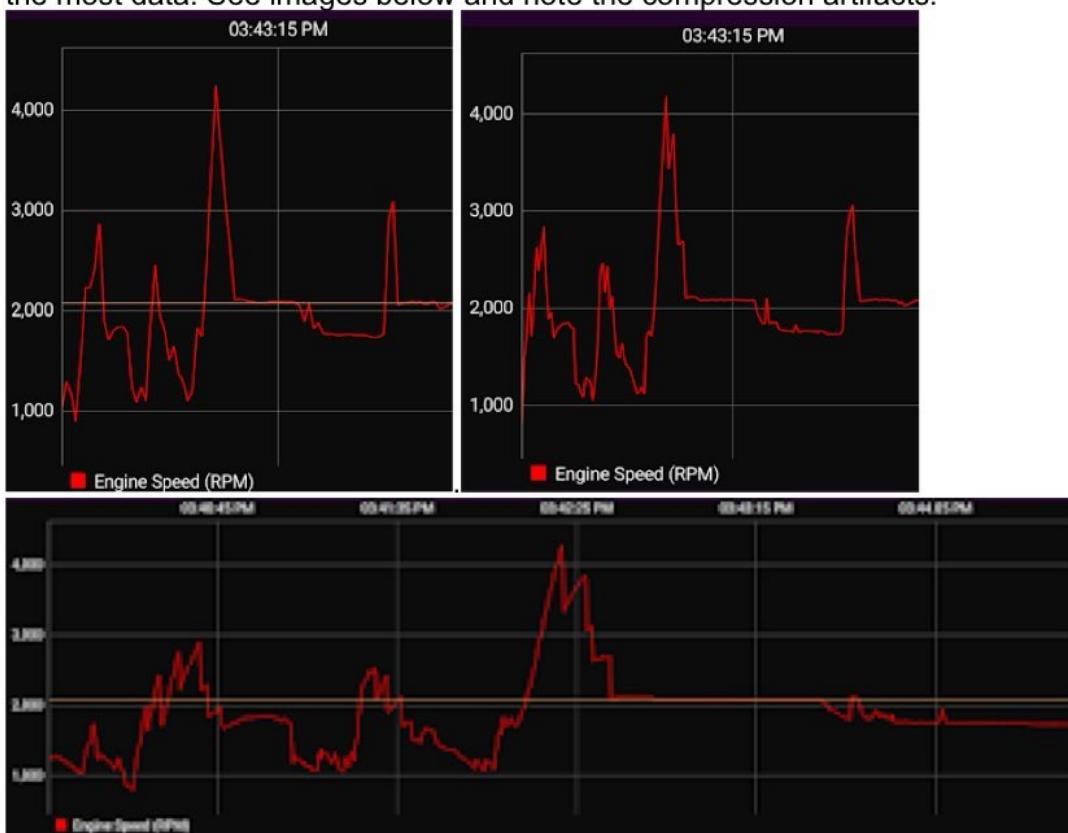
Data is stored in the “Data Records” Menu. Use the touch screen to navigate the data as needed. Recordings must be finished to view.



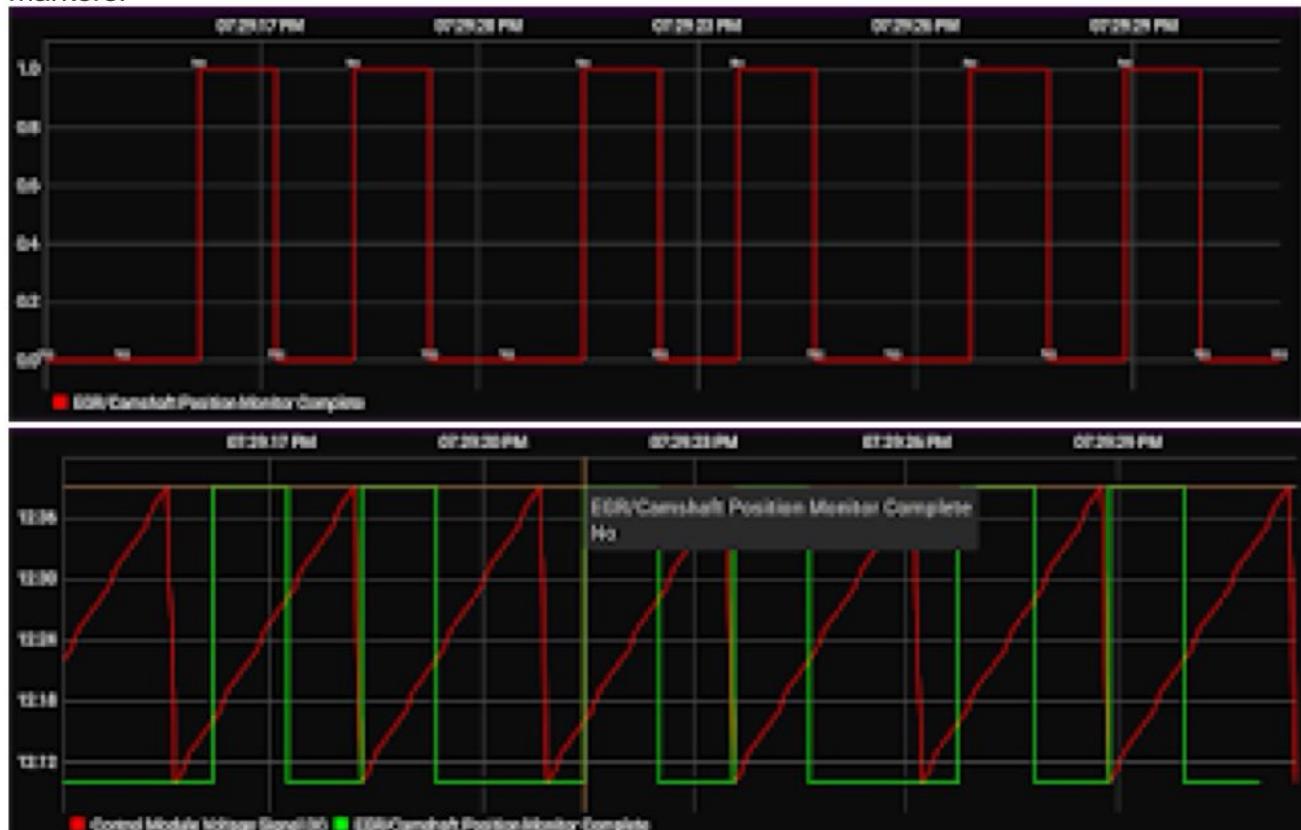
Sometimes there is too much data on the screen. Tap the “Wrench” and then tap the data you would like to see. Then tap “Finish”



Important: Data Graphs are compressed when zoomed out. This will hide detail. Zoom in to see the most data. See images below and note the compression artifacts.



Enumerable PID types are given arbitrary values to display on a graph. This allows you to visually see state change. To see the real value either tap the state or zoom in far enough to see the markers.



Data may be exported as a .zip. It contains 2 files. 1 'meta' and 1 'data' file. The meta file contains PID info (units, name, target module) and other info (VIN, Start Time). The 'data' file contains the PID data using Unix timestamps.

TIME	ID	VALUE
1.581790e+13	412057882	0.00
1.581790e+13	1111433264	20.00
1.581790e+13	1109458762	20.00
1.581790e+13	1109514094	20.00
1.581790e+13	1109515334	20.00
1.581790e+13	1109515770	120.00
1.581790e+13	471144890	0.00
1.581790e+13	1109775134	20.00
1.581790e+13	1109811804	20.00
1.581790e+13	1111433164	20.00
1.581790e+13	1109504562	20.00
1.581790e+13	1109515544	20.00
1.581790e+13	1224438294	20.00
1.581790e+13	1109512494	20.00
1.581790e+13	1109518752	20.00
1.581790e+13	600134767	1.00
1.581790e+13	1111390669	990.00
1.581790e+13	9991095884	0.00
1.581790e+13	502189164	49.50
1.581790e+13	777118914	3.25
1.581790e+13	9280746826	400.00
1.581790e+13	11110618752	20.00
1.581790e+13	1111433264	20.00
1.581790e+13	1109775134	20.00

NAME	VALUE	UNITS	TARGET
STARTTIME	1.581790e+13		
VIN	1G0C7T08R0U293833		
1109515334 Left Front Wheel Speed (km/h)	20.00	km/h	Electronic Brake Control Module
1109515770 Left Rear Wheel Speed (km/h)	20.00	km/h	Electronic Brake Control Module
1109514094 Right Front Wheel Speed (km/h)	20.00	km/h	Electronic Brake Control Module
1109515544 Right Rear Wheel Speed (km/h)	20.00	km/h	Electronic Brake Control Module
1300910094 TCC Dka Demand	20.00	km/h	Transmission Control Module
9000743917 Transmission D8	20.00	km/h	Transmission Control Module
2118790008 Transmission D9	20.00	km/h	Transmission Control Module
121610708 Transmission Range	100.00	km/h	Transmission Control Module
1624991983 Head Dimmer Wheel Speed	20.00	km/h	TransFlex-Easy Control Module
5458931104 Vehicle Speed Sensor	20.00	km/h	Engage Control Module
4073444006 Vehicle Speed Sensor	20.00	km/h	Engage Control Module
5090374606 Driver Requested Axle Torque in	20.00	Nm/m	Transmission Control Module
502110614 Engine Torque	500.00	Nm/m	Transmission Control Module
710117031 On/Off Ratio	1.00		Transmission Control Module

Service Regeneration

Service Regeneration, manual regeneration, or stationary regeneration. This procedure will heat up the exhaust with the intention of burning excess soot.

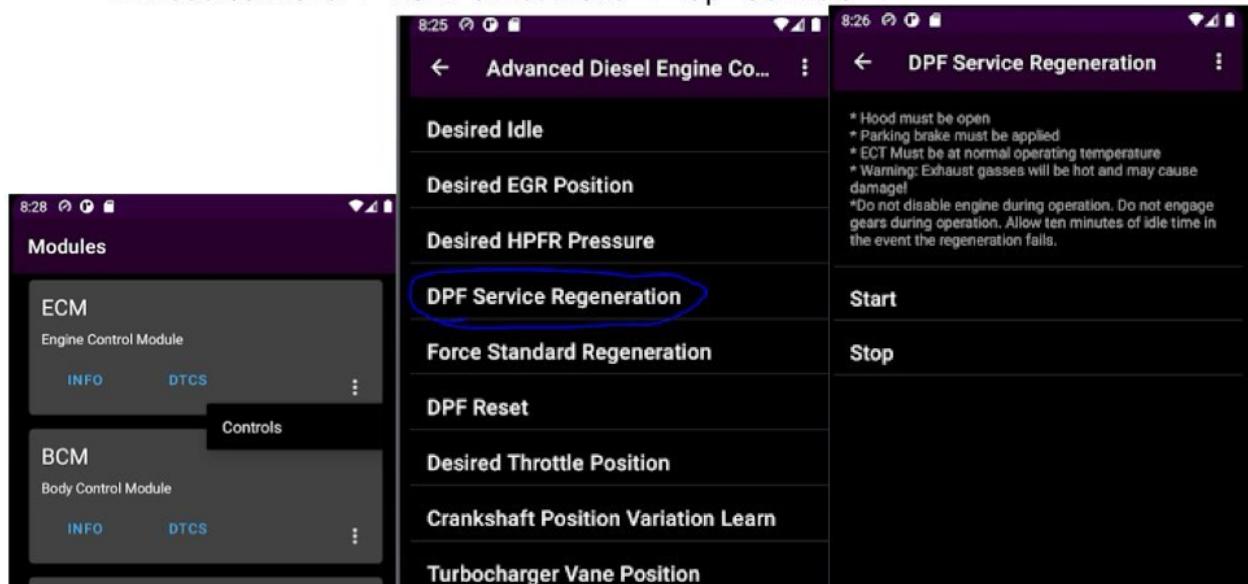
Note some DTCs may block a service regen. In this case address the DTC before continuing.

Prior to procedure

1. Vehicle must be in otherwise reasonable working condition, engine runs, no fuel leaks, etc...
1. Vehicle must be outside away from potential fire dangers. Vehicle should be in park (if automatic) and have a parking brake set.
2. Hood must be open
3. Vehicle must be at operating temperature or Gretio will prompt with an error

Procedure

1. Connect to Vehicle
2. Modules Menu -> ECM 3 Dot Menu -> Tap "Controls" ->



"Advanced Diesel Engine Controls" -> Find Service Regeneration" -> Start -> OK

3. RPMs of vehicles should rise. If not, Follow on screen prompt for error message.
4. Gretio's screen will transfer to a data view screen with relevant PIDs you may wish to monitor. You are free to exit this screen.
5. Service Regen will take on average 30 minutes but can take longer.
6. If needed, diagnose the EGT Temps after about 5 minutes. [See Monitoring Data](#).

Common EGT Readings: DPF must reach over 550C to regenerate effectively. Refer to the [Block Diagrams](#) to see which sensors are located just before or on the dpf. Normal temperatures in a regen will be between 550C and 650C (about 950F to 1150F).

The EGT readings on one vehicle model cannot be applied to another due to layout differences. As such this document will reference EGTs based on their relative location. You must use the [Block Diagrams](#) to determine the EGT numbers found on the scan tool.

Faulty EGT: Generally will read -40C (minimum) or a large number (over 900C) but can also fail in other ways. To diagnose a bad EGT allow the vehicle to sit for 24 hours and then check the temperature of EGTs without starting vehicles. All should be within 10C of one another.

Faulty Indirect Injector: The indirect injector injects a mist of fuel which collects into the DOC (Diesel Oxidation Catalyst) to burn. A leaking injector can cause the EGT after the DOC to spike high, even while normal driving. A plugged or stuck injector will cause the EGT after the DOC to be low with regens that never complete.

Faulty DOC: A faulty DOC will not completely burn the fuel spray from a regen. So the temperature after the DOC will be low while temperatures after the DPF and SCR will be higher.

Runaway / Injector Leak / Turbo Seal: These issues will cause an increase in EGT after the DOC (or first DOC if two).

DEF Fluid Quality Test

The fluid quality test is in many ways similar to the service regen. But temperatures are not nearly as high, and instead its function is to test the reduction of NOx by the SCR system.

Important: Quality Test has been replaced by the Service Bay Test on L5P, LH7, LWN, and LWN. For these vehicles, use the [Reductant System Malfunction Warning Service Bay Test](#) whenever a Quality Test is called for.

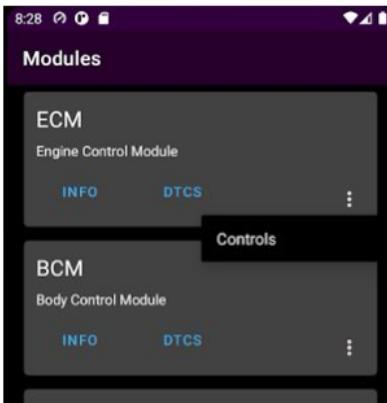
Prior to procedure

1. Vehicle must be in otherwise reasonable working condition, engine runs, no fuel leaks, etc...
2. Vehicle must be outside away from potential fire dangers. Vehicle should be in park (if automatic) and have a parking brake set.
3. Hood must be open
4. Vehicle must be at operating temperature or Gretio will prompt with an error

Steps for procedure

Connect to Vehicle

1. Modules Menu -> ECM 3 Dot Menu -> Tap “Controls” -> “Advanced Diesel Engine Controls” -> Find “DEF Fluid Quality Test” -> Start -> OK



2. RPMs of vehicles should rise. If not, Follow on screen prompt for error message.
3. Service Regen will take on average 30 minutes but can take longer. Up to 90 minutes
4. Search for "Fluid Quality" PIDs to help monitor the results of the test. See [Monitoring Data](#).
5. You may monitor "NOx Concentration (NOx Sensor 1) and NOx Concentration (NOx Sensor 2) during this procedure. The exact values of these sensors do not matter, but NOx Sensor 2 should be about 0.15 times the value of NOx Sensor 1. I.e. if Sensor 1 is 100ppm then sensor 2 should be 15ppm or less.
 - a. If this is not the case you should replace the sensor which looks most out of place.

Reductant System Malfunction Warning Service Bay Test

This test works similar to a fluid quality test. But engine speed will remain near idle or slightly elevated. This test has a very similar name to the "Reductant System Tamper Warning Service Bay Test".

LML/LUZ vehicles should also enable DEF Heaters for this test. Without doing this, the DEF heater tests may not finish. This is crucial if you have recently replaced the DEF heater.

On the LML/LUZ the tests operate in buckets. It is possible to clear one bucket but then another bucket takes its place. This is usually evident by the warning "resetting" by disappearing from the dash and then reappearing several seconds later. If this happens you have most likely cleared the previous malfunction, but now have a new malfunction to address.

Prior to procedure

1. Vehicle must be in otherwise reasonable working condition, engine runs, no fuel leaks, etc...
2. Vehicle must be in a safe environment and away from flammable material..
3. Verify DEF Fluid Temp higher than 19F, and that the vehicle ECT gauge is at normal operating temperature.
4. Hood may remain closed.

Steps for procedure

Connect to Vehicle

1. Modules Menu -> ECM 3 Dot Menu -> Tap "Controls" -> "Advanced Diesel Engine

Controls”

2. [LML/LUZ Only] Find “DEF Heaters for RSMWSBT” and enable this. Wait 30s. Go back to the control list. The heaters time out on their own so there is no need to manually disable them.

- a. If this function fails, then just enable all DEF heaters and wait 30s.
3. Find “Reductant System malfunction Warning Service Bay Test” -> Start -> OK
4. Engine speed will change depending on the vehicle.
5. Test should take on average 20 minutes but no more than 30 minutes.
6. If after 30 minutes DIC warning is still present, [scan for DTCs](#).
7. Test will finish when the DIC warning is cleared.
8. [LML Only] Reset module, Disconnect Gretio.

Reductant System Tamper Warning Service Bay Test

This test works similar to the “Malfunction” test, but tends to test failed circuits and other ‘Tamper’ DTCs. Engine speed will remain near idle.

Note: The LML and LUZ do not have this test. For these vehicles, tamper warnings are addressed using the standard Malfunction Warning Service Bay Test.

Prior to procedure

1. Vehicle must be in otherwise reasonable working condition, engine runs, no fuel leaks, etc...
2. Vehicle must be in a safe environment.
3. Verify DEF Fluid Temp higher than 19F.
4. Hood may remain closed.
5. Vehicle must be at operating temperature or Gretio will prompt with an error.

Steps for procedure

Connect to Vehicle

1. Navigate to Modules Menu -> ECM 3 Dot Menu -> Tap “Controls” -> “Advanced Diesel Engine Controls”
2. Find DEF Heater 1 and 2. Enable both by tapping each -> Start/Enable -> OK. Keep heaters enabled for the test.
 - a. If DEF Heater 2 is not present you can simply stick with Heater #1.
3. Modules Menu -> ECM 3 Dot Menu -> Tap “Controls” -> “Advanced Diesel Engine Controls” -> Find “Reductant System Tamper Warning Service Bay Test” -> Start -> OK
4. Engine will remain at or near idle.
5. Test should take on average 20 minutes but no more than 30 minutes.
6. If after 30 minutes DIC warning is still present, [scan for DTCs](#) for any changes.
7. After the test is complete, shut down the vehicle for 30 seconds before continuing (may require reconnection of Gretio).

Test will finish when the DIC warning is cleared or times out. If after 40 minutes the test has still not cleared you may terminate the test early and try again, or try another diagnostic step.

DEF Quantity Test

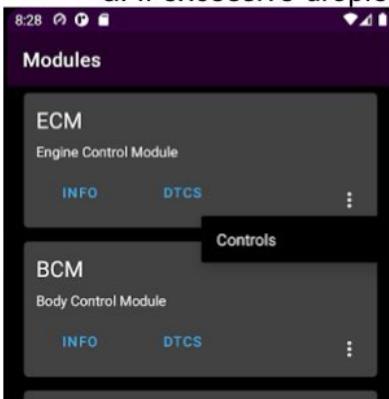
This commandss the injector to cycle for a few minutes. You use this to fill a container and then measure the amount (in milliliters).

Prior to procedure

1. Secure vehicle on jack stands or on lift.
2. Vehicle should be off but in accessory mode
3. **Remove DEF Injector**
4. **Place DEF Injector in a secure inert container such as**
 - a. 1L Glass Beaker or other suitable glassware
 - b. 1L HDPE bottle
 - c. 1L PP (polypropylene) measuring container or beaker (cheapest)
 - d. 1L PVC container

Steps for procedure

1. Connect to Vehicle
2. In Grecio: Modules Menu -> ECM 3 Dot Menu -> Tap “Controls” -> “Advanced Diesel Engine Controls” -> Find “Reductant Injector Quantity Test” -> Start -> OK
3. DEF Injector will begin clicking which each click releasing a fine mist of DEF.
 - a. If excessive droplets -> Injector is faulty



4. Wait for test to finish (injector will stop)
5. Measure the DEF in the container. The quantity will need to be referenced in the service manual but is usually between 30mL (small vehicle) to 50mL (light truck) to 100 mL (HD Truck).

Check for Aftermarket Emissions Tampering \ EPA Testing

‘Delete’ tunes are common on vehicles. Some setups will even look factory but have been heavily modified. These steps will help you verify OEM calibrations are on the vehicle.

Some aftermarket companies have been releasing “compliant” emissions intact tune. These tunes are generally poorly tested and can cause EPA noncompliance or emission malfunctions

To determine compliance, the Factory Calibration will be verified and the exhaust system visually inspected. Readiness monitors and ‘sniff tests’ are ineffective at determining compliance so these

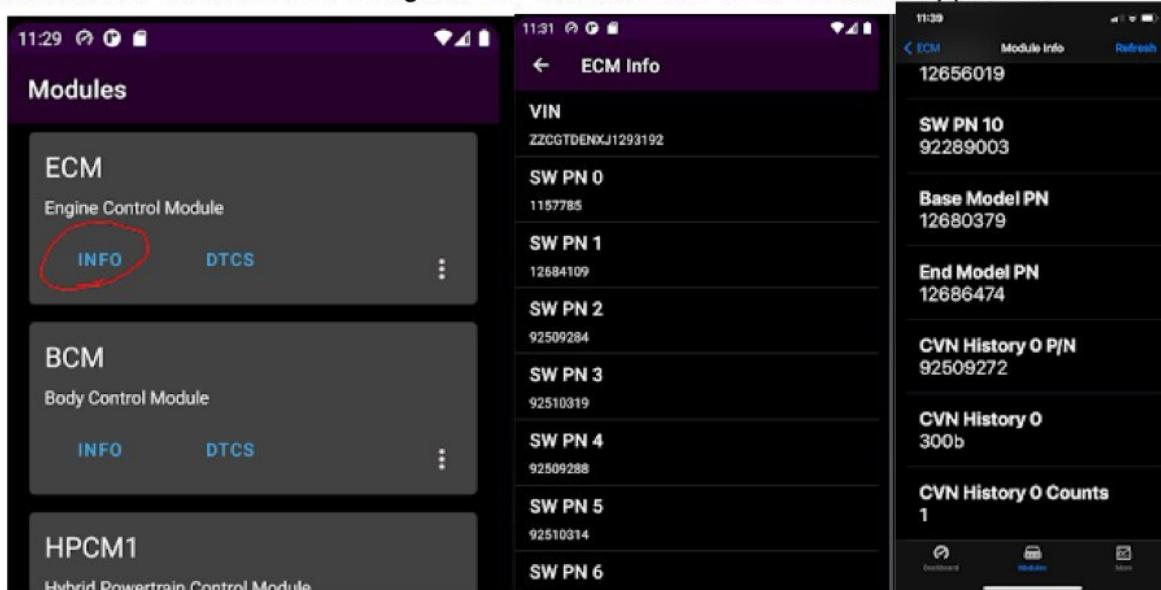
tests may be skipped unless required by jurisdiction. To find readiness monitors simply search for [Diesel] or [Gas] in Gretio data view.

Prior to procedure

1. Secure vehicle on stands or lift.

Steps for procedure

1. Connect to Vehicle
2. In the Gretio app: Go to the modules tab. Find “ECM” and tap “Info”. The SW Partnumbers will be shown alongside the **current CVN** if the module supports it.



3. Enter the SW part number for each of the latest PN in the list.
4. Scroll down and find CVN History
5. CVN History: 0 is the most recent entry. You may tap and hold any entry to copy.
6. Visit [TIS \(gm.com\)](http://TIS.gm.com)

7. Enter the SW part number for each of the latest PN in the list.

Part Number:

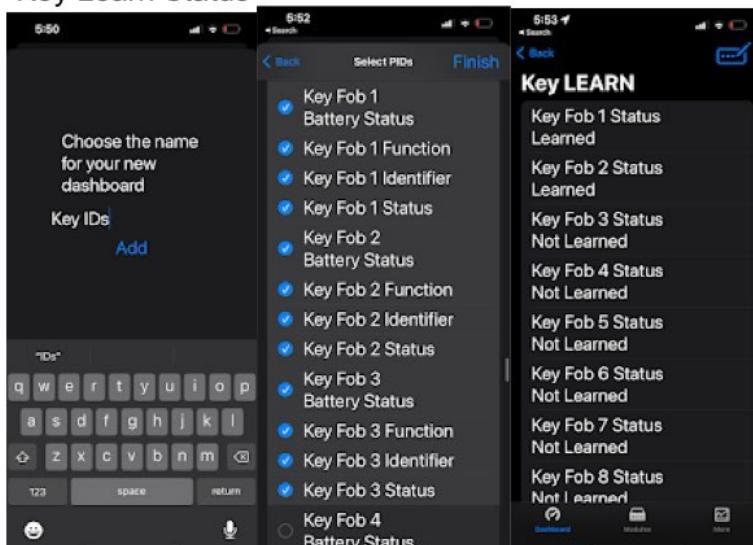
- CVN: 300B
CVN: 0000300B
CVN: 300B
CVN: 0000300B
8. Verify Current CVNs match historical record.
 - a. Any CVN which is not included in the OEM list is considered a FAIL.
 - b. California inspectors may pass vehicles if and only if the owner is able to supply appropriate CARB documentation. This documentation should include the vehicle's VIN and the CVN of the tune. CARB pending documentation is considered a FAIL.
 - c. For non California inspectors, PASS if and only if the owner is able to supply documentation of exemption from municipality, state, or from the EPA. These exemptions are generally reserved for emergency response vehicles.
 - d. All other forms of documentation are not to be considered.
 - e. Vehicles with only 1 historical record generally have never been flashed and thus

- contain their factory calibration. These may be passed.
- f. If a historical PN CVN is not found in GM TIS but has a newer entry with the same PN: The vehicle has been tuned previously but has been reflashed to stock. The customer should be interviewed and their response recorded. You may PASS the vehicle at your discretion.
- i. Satisfactory answers will be “I did not know it was tuned” or “It was tuned, but I returned it stock.”
 - ii. Look at the DPF and SCR systems for scuff marks, clean bolts, etc. Take pictures and attach to inspection notes.
10. Inspect exhaust system for modifications.
- a. Signs of modifications are an immediate FAIL. Even if calibration matches OEM.
11. If no issues have been found by this step, you may PASS the vehicle.

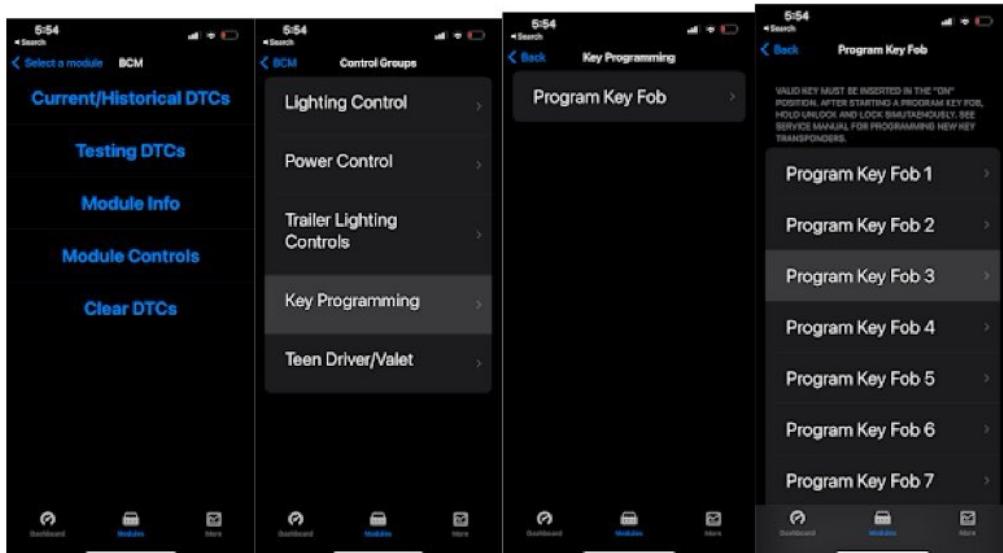
Key FOB Learning (Separate FOB and Key)

The below instructions apply to all ~2012+ GM Vehicles using classic key ignitions with separate FOB.

1. Create new list of pids (Dashboard for iOS or Data View for Android) call it “Key IDs” or “Key Learn Status”

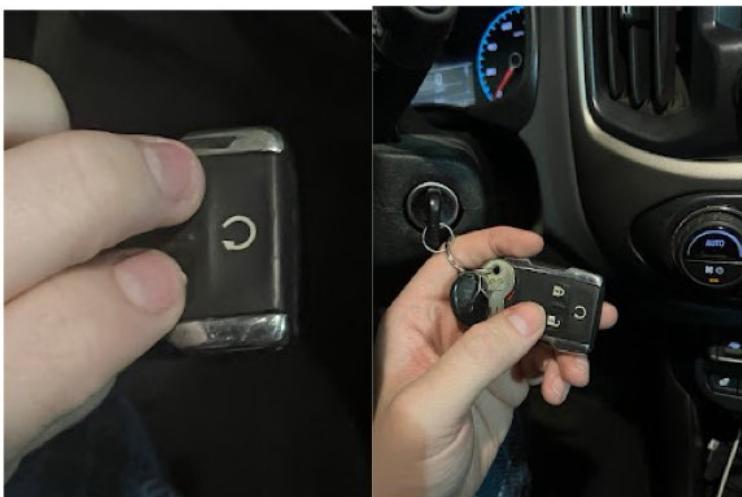


2. Add BCM PIDs “Key Fob # Status”. There should be 8 PIDs. Note first unlearned space.
3. Find BCM Key Programming Control Functions.



4. **Important:** Valid key transponder must be present to learn a new key fob. If the vehicle has no valid key you will need to perform the standardized 90 minute relearn (google for more info). If relearn fails, replace ignition housing.
5. Make sure the ignition is set to ON position.
6. **If a prior key was stolen**, execute control function “Erase All Key Fobs” and start learn procedure from slot #1.
7. Execute “Program Key Fob #” control function for the desired key fob slot.
8. Most vehicles will show a notification in the DIC.
9. Press and hold the LOCK button and UNLOCK button on the key fob for at least 5 seconds. DIC notification should go away. It is possible the doors may or may not lock.
10. Verify function of key fob
11. If another FOB must be relearned return to step 7
12. Disconnect from vehicle.
13. During the relearn it's likely the doors locked. Make sure you do not accidentally lock yourself out.





Key FOB Learning (Switchblade)

This type of key will generally not require a scan tool to learn the FOB. Follow the steps in the owner's manual or service manual to learn a new key. If a scan tool is required, follow the [Key FOB Learning \(Separate FOB and Key\)](#) steps to perform the learn.

In the event the fob functions (lock, unlock, etc) are still not working, replace the battery.

FOB/transmitter Learning (Push to Start)

This type of fob will not require a scan tool to learn. Follow the steps in the owner's manual or service manual to learn a new transmitter.

Other Information

Ammonia Slip

A common situation where the SCR can become oversaturated and allow ammonia to leave the SCR catalyst. The resulting ammonia can cause a high NOx concentration 2 reading (or equivalent downstream SCR Nox Sensors). With excess Ammonia, NOx concentration 2 reading may be even higher than NOx concentration 1.

The ECM will wrongly interpret this as low SCR efficiency. This can create a feedback loop where dosing will increase until it reaches an internal limit. As such it's common to see a code such as P20EE (SCR NOx Catalyst Efficiency low) alongside a injector limit code such as P249D (Closed Loop Reductant Injection Control At Limit). Some emission setups use dedicated NH₃ gas sensors to combat ammonia slip, but such sensors are not used on GM vehicles.

In many cases this issue will also occur with a failing NOx Sensor, or a malfunctioning DEF Injector. It has also occurred alongside DPF Differential Pressure Sensor failures.

DPF service regens, while not made for servicing SCR, are very effective at burning excess ammonia present. This ‘resets’ the SCR Catalyst and will allow a quality test/service bay test to pass.

New GM vehicles may come with a DEF Quality Sensor. The DEF Quality Sensor means the “DEF Quality Poor” warning will generally only be caused by this sensor.