Before we get started, it’s important to understand that World Diagnostic Systems (WDS) are becoming more and more common as the same units are being sold and used by several different manufacturers. The Nissan RE5F22A is one of these units; the internal components are the same as the AW50-55SN/AF33-5, and now we can put another slash in that list: RE5F22A.

By World Diagnostic Systems, we’re talking about the operating strategies in use. Many manufacturers are opting to incorporate these universal operating systems. Which means that those operational systems are now crossing manufacturer’s lines.

This is great news, because it means that, once you’ve become familiar with the operating system for one manufacturer, you’re already well versed in that system for every manufacturer that uses the same transmission.

But just because the units and operating systems are the same doesn’t mean the diagnostics are. In this edition of Let’s Play Ball, we’re going to cover the Nissan diagnostics and how they apply to the RE5F22A/AW50-55SN/AF33-B.

Let’s get started with the transmission control module (TCM) function, which is to:

- receive input signals sent from various switches and sensors.
- determine required line pressures, shift points, lockup and engine brake operation.
- send required output signals to the individual solenoids.

The transmission control module senses vehicle operating conditions through various sensors or signals. Based on those signals, it provides the optimum shift performance and reduces shift and lockup shock using the CAN network.

This on-vehicle multiplex communication line has high data communication speed and excellent error detection. These vehicles use several electronic control units, and each shares information and links with other control units during operation.

In CAN communication, control units are connected with two communication lines (CAN H line, CAN L line) allowing rapid information transmission with less wiring. Each control unit transmits and receives data, selectively reading only the data it requires. It’s basically able to learn the driver’s habits and control the transmission accordingly.

The TCM provides a signal to pressure control solenoid A, which controls and adjusts line pressure for clutches and brakes to reduce shift shock. Pressure control solenoid A controls the signal pressure to the pressure regulator valve, which adjusts the pressure of the operating oil discharged from the pump. This keeps line pressure appropriate for driving conditions.
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In seminars I call this the child learning curve: Whatever the driver does, the computer behaves like a child, absorbing that behavior and learning what and what not to do. The computer system gathers information from vehicle operation and uses that to develop its own behavior; in this case, to provide a smooth shift and driving conditions.

To obtain the most appropriate line pressure characteristics to meet driving conditions, the TCM controls the current to pressure control solenoid A, which, in turn, controls line pressure.

The clutch pressure control solenoid is controlled based on signals from the switches and sensors. So the clutch pressure is adjusted for engine load and vehicle driving conditions.

This system makes it possible to control the clutch hydraulic pressure with high precision, to attain smoother shifts. Basically the TCM is programmed for economy operation, but it can change to one of several shift schedules automatically, according to the driving conditions. There are several different operating modes built into the TCM, depending on the driver’s needs. These modes include:

**Upslope Mode**

By upslope, we mean climbing a hill. When the TCM determines you’re climbing a hill, based on the increased engine load and decreased acceleration, the TCM alters shift points on the high-speed side to avoid busy shift patterns.

**Downslope Mode**

Downslope is the opposite of upslope: now we’re going downhill. When TCM determines you’re heading downhill, from the increased vehicle speed with accelerator fully closed, it provides moderate engine brake by altering shift points on the high-speed side.

**Hot Mode Control**

This control lowers transmission fluid temperature by changing shift points when the fluid becomes extremely hot.

**Manual Mode**

In manual mode the driver can select his favorite gear and enjoy sports driving similar to a manual transmission. The driver shifts the lever from D position to manual mode, and uses the + (upshift) and – (downshift)

SuperFlow TransDyno SF-66K
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Let’s Play Ball with the Nissan’s RE5F22A…

buttons to shift the transmission manually. Lockup is still controlled automatically. You can restore shift control to automatic operation by shifting from manual gear position to D position.

These control strategies are in effect while the transmission is operated in manual mode:

**Automated Upshift Control**
To avoid overspeeding the engine, the transmission will upshift automatically if engine RPM gets too high.

**Automated Downshift Control**
To avoid stalling the engine, the transmission will downshift automatically if engine RPM drops too low.

**Upshift Permission Control**
To avoid stalling the engine, the transmission won’t upshift unless vehicle speed is high enough.

**Downshift Permission Control**
To avoid overspeeding the engine, the transmission won’t downshift unless the vehicle speed is low enough.

**Up-/Downshift Learning Control**
The TCM learns to identify acceptable pressure levels for each clutch or brake, to reduce shift shock in each shift condition (Up, Down, Manual Downshift, Coastdown).

**N-D Shift Control**
This control improves the N-D shift quality by controlling the line pressure solenoid, based on the forward clutch piston stroke rate. The TCM then applies appropriate hydraulic pressure to the forward clutch when shifting from neutral to drive.

**N-D Shift Learning Control**
The TCM learns what forward clutch hydraulic pressure should be by monitoring forward clutch engagement time and rotation change rate.

**N-R Shift Control**
The TCM improves the N-R shift quality by controlling the shift pressure solenoid, based on the direct clutch piston stroke rate. The TCM then applies appropriate hydraulic pressure to the direct clutch when shifting from neutral to reverse.

**N-R Shift Learning Control**
The TCM learns what direct clutch hydraulic pressure should be by monitoring direct clutch engagement time and rotation change rate.

**Torque Reduction Control**
The TCM improves the shift quality by sending a torque reduction request signal to the ECM, which cuts the engine torque increase at the N-D shift, N-R shift and the shifts between gear ranges 1-2-3-4-5. If you press the accelerator pedal rapidly, this control establishes the upper limit for engine torque, which avoids engine flare at the 2-3, 3-4 and 4-2 shifts.

**Torque Converter and Lockup Control**
The torque converter clutch piston in the torque converter is engaged to eliminate torque converter slip. The TCM controls pressure control solenoid C, which controls the torque converter clutch control valve, which, in turn, engages or releases the torque converter clutch piston.

**Lockup Released**
To release the converter clutch, pressure control solenoid C sets the torque converter clutch control valve to the unlocked position, which allows lockup apply pressure to drain. This prevents the converter clutch from applying.

**Lockup Applied**
To apply the converter clutch, pressure control solenoid C sets the torque converter clutch control valve to the locked position, which generates lockup apply pressure. This applies the torque converter clutch piston, coupling the torque converter housing directly to the input shaft.

**Smooth Lockup Control**
To provide a smooth shift into lockup, the TCM adjusts the current flow to pressure control solenoid C. This enables the converter clutch to apply slowly into a half-clutched state, which reduces apply shock.

**Half-Clutched State**
The TCM varies the current to pressure control solenoid C. This allows lockup apply pressure to rise gradually, putting the converter clutch into the
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half-clutched state. This, in turn, allows the converter clutch to apply smoothly.

**Slip Lockup Control**

The TCM controls the current to pressure control solenoid C to put it into the half-clutched state. This absorbs variations in engine torque, allowing the converter clutch to operate at lower speeds. This raises fuel efficiency for 4th and 5th gears at both low speeds and light throttles.

**Self Diagnostics**

So far we’ve covered the basic operating strategy for the TCM and how it controls shifts. Now we’ll look at how to diagnose the system, starting with a quick introduction of the two self-diagnostic systems.

The first self-diagnostic system is the emission-related, on-board diagnostic system (OBD-II) performed by the TCM in combination with the ECM. System faults are indicated by the MIL (malfunction indicator lamp) on the instrumentation panel. Sensors, switches and solenoids are used as sensing elements. The MIL automatically lights when a diagnostic problem through the MIL is indicated by a diagnostic trouble code (DTC). The ECM stores the fault in its basic self-diagnostic procedures.

**OBD-II Function for the Automatic Trans**

The ECM provides emission-related, on-board diagnostic (OBD-II) functions for the automatic transmission. One function is to receive a signal from the TCM to be used with OBD-II related parts of the automatic transmission control system. The signal is sent to the ECM when a fault occurs in the corresponding OBD-II related part.

The other function is to indicate a diagnostic problem through the MIL (malfunction indicator lamp) on the instrument panel. Sensors, switches and solenoids are used as sensing elements. The MIL automatically lights when a fault related to the transmission occurs over one or two trips or drive cycles.

**One Trip Detection Logic**

If a fault occurs during the first test drive, the ECM will light the MIL and store fault data in memory as a DTC (diagnostic trouble code). The TCM doesn’t have this memory function.

**Two Trip Detection Logic**

When the ECM senses a fault during the first test drive, it stores the fault in memory as a 1st trip DTC or 1st trip freeze frame data. The MIL won’t light yet. But if the same fault occurs during the second test drive, the MIL will light and the ECM will store a code.

The term trip in the One or Two Trip Detection Logic is an OBD-II term that means a driving sequence during which the computer system performs its basic self-diagnostic procedures.

**How to Read DTCs and 1st Trip DTCs**

There are two basic methods for reading DTCs and 1st Trip DTCs:

- with a CONSULT-II factory scan tool, or...
- with a generic scan tool.

Examples: P0705, P0710 etc. These DTCs are prescribed by SAE J2012. In addition to the code, the CONSULT-II also indicates the faulty component or system. The 1st trip DTC is the same as the DTC.

The output of the diagnostic trouble code indicates a fault in the indicated circuit. But neither the Consult-II nor the generic scan tool will indicate whether the fault is still occurring or occurred in the past and has since returned to normal.

**To Erase the DTCs**

You can erase diagnostic trouble codes using the CONSULT-II or generic scan tool, or you can use the ECM Diagnostic Test mode.

To enter Diagnostic Test mode to erase codes is simple; just disconnect the battery cable. The diagnostic trouble code will be lost within 24 hours. While just as effective, it’s easier and quicker to use the CONSULT-II or generic scan tool than switching into Diagnostic Test mode.

The following emission-related diagnostic information is cleared from the ECM memory when erasing DTCs related to the OBD-II system:

- Diagnostic trouble codes (DTC)
- 1st trip diagnostic trouble codes (1st trip DTC)
- Freeze frame data
• Misfire — DTC: P0300 – P0306
• Fuel injection system function — DTC: P0171, P0172, P0174, P0175

To Erase the DTCs with the Consult-II

If a DTC is displayed for both ECM and TCM, you’ll need to erase both of them. Here’s how:
1. Make sure you have the key off for at least 10 seconds.
2. Turn the key on, engine off.
3. Turn CONSULT-II on and touch A/T.
4. Touch SELF-DIAG RESULTS.
5. Touch ERASE (the DTCs in the TCM will be erased).
6. Touch BACK twice.
7. Touch ENGINE.
8. Touch SELF-DIAG RESULTS.
9. Touch ERASE (the DTCs in the ECM will be erased).

To Erase DTCs with a Generic Scan Tool

1. Make sure you have the key off for at least 10 seconds.
2. Turn the key on, engine off.
3. Turn your scan tool on and locate A/T diagnostics.
4. Check the codes SELF-DIAG RESULTS.
5. When asked whether to erase codes, touch yes ERASE (the DTC in the TCM will be erased).
6. Touch ERASE (the DTC in the ECM will be erased).

Diagnosing codes can be difficult; make sure you have the correct information and identification for the codes received.

Line Pressure Test Procedure

Once you’ve checked and cleared any codes, it may be necessary to check the line pressure. Locate the proper pressure taps for the specific clutches you are checking.
1. Check the engine oil and fill if necessary.
2. Drive the car for about 10 minutes to bring the transmission fluid to between 122ºF and 176ºF (50ºC and 80ºC).

NOTE: The automatic fluid temperature will rise to between 122ºF and 176ºF (50ºC and 80ºC) within 10 minutes of driving.
3. Check the transmission fluid level and fill if necessary.
4. Switch the air conditioning off and make sure all accessories are off.
5. Install the pressure gauge in the appropriate tap.

CAUTION: Make sure there are no oil leaks after installing the pressure gauge.
6. Engage the parking brake so that the tires won’t turn.
7. Start the engine.
8. Keep the brake pedal applied fully during the pressure test.
9. Measure the line pressure at both idle and stall speed.
10. After you’re finished, shut the engine off, remove the gauge, install the oil pressure port plug, and tighten it to the specified torque.

As we move into the future, expect to see more and more manufacturers going to the World Diagnostic System. This should make diagnosis much easier for you, provided you take the time to learn the system thoroughly! Until next time, play hard and keep your focus.