Subject: 1999 Nissan Maxima “A32, VQ30DE”, USA OBD2 Compliant, Consult Data Registers

This vehicle has a J1962F 16 pin OBD2 connector as well as a 14 pin Consult connector for data communication ports to the ECU. The OBD2 port provides only the basic OBD2 data and is extremely slow. The Consult port provides access to all supported sensors and is very fast.

The available internet information http://www.plmsdevelopments.com/images_ms/Generic_Nissan_ECU_Sensor_or_Data_register_table_Ver_2.pdf on communicating with non-OBD2 European Nissan, ECUs, via the Consult port, is generally applicable to the subject vehicle with some notable differences as described below.

Initialization

The generic ECU ID of ‘EF’ in the initialization command string “FF FF EF” must be replaced with ‘ED’ and the corresponding inverse, which is the ECU’s reply, is 0x12 rather than 0x10. Many of the available Consult interface software programs must be “patched”, to replace “hard coded” generic values with vehicle specific values, before communication with the ECU can be established. The Nissan DataScan program allows the ECU ID to be changed via user input but uses a hard coded value of ‘EF’ in its “Slow ROM Read routine” so this option will not work with the subject vehicle without patching. The program ScanTech also accepts user defined ECU IDs.

ECU Part Number

The ECU part number, obtained with the command string “D0 F0”, is 0x20 (32) bytes long rather than the generic 0x16 (22) bytes. The ASCII characters of interest are the last 5 bytes, an actual example of which is “4L618”. The ECU’s reply to the part number request begins with “FF 20”, which is the header frame byte followed by the data string length in hex. Most of the available Consult interface software programs do not correctly read the part number for the subject vehicle but will usually continue to work in spite of this. An exception is the Nissan DataScan program, which has a “Communications Option” of “96 model z32” that correctly reads the part number.

Data Registers

The CAS REF data is converted to RPM by dividing the number 2.494E6 by the decimal value of registers 0x02 (MSB) and 0x03 (LSB) rather than multiplying it by 8 as is done for the generic conversion. The decimal value of these registers is obtained from the equation MSB*256 + LSB. Therefore:

CAS REF = 2.494E6 / (MSB*256 + LSB) [rpm]

There is no RH MAF sensor and registers 0x06 and 0x07 are not valid (i.e. the ECU responds to the register read command strings "5A 06" and "5A 07" with "A5 FE").

The generic FUEL TEMP SEN register 0x0F is not valid.

The Exhaust Gas Temp sensor register is 0x10 instead of the generic 0x12. Register 0x12 is invalid. The register value represents 'mV' after applying the conversion formula of:

mV = value * 20.

The EGR VCV (Volume Control Valve) step position is available from register 0x78, which appears to have a zero offset of 112 (decimal) with the following conversion formula:

Step = (value – 112) / 2

The AAC Valve (Idle Air Valve %) register 0x17 is invalid.

The vehicle does not have a turbo charger so "Waste Gas Solenoid" and "Turbo Boost Sensor" registers 0x28 and 0x29, although valid registers, probably represent something else.

The Engine Mount On/Off register is 0x27 instead of the generic 0x2A. The generic register is valid, however, and may represent Tank Fuel Temp.

The Position Counter generic register 0x2e is invalid.

The Purg. Vol. Control Valve generic register 0x25 is invalid.

The Tank Fuel Temp generic register 0x26 is invalid. This data may be available from register 0x2A.

The FPCM DR generic register of 0x27 is the Engine Mount ON/OFF register instead.

The Fuel Gauge generic register 0x2F is invalid.

The Ignition Switch generic register 0x32 provides data that appears to follow the Injector Time instead of Ign Sw. It may be associated with B/Fuel Schedule but does not provide a sufficient range of values to be that data.

The CAL/LD register 0x33 is valid and the decimal value represents the % load in increments of 1.

The B/Fuel Schedule generic register 0x34 is valid but represents the fractional load (CAL/LD) after dividing the register value by 255 (decimal). Therefore, CAL/LD is obtained from the formula:

CAL/LD = (0x33)value + (0x34)value / 255 [%]

There does not appear to be any valid register values that correlate to and cover the range of values that would be needed for the B/Fuel Schedule even if combined with other registers. Register 0x32 and 0x48 closely follow Injection Time and provide values that are reasonable for B/Fuel at low loads but the values are much too small at high loads. If added together they produce values that are too high at low loads and still too low at high loads. A dual register MSB/LSB combination similar to Injection Time would be expected but can't be found. It is concluded that B/Fuel is derived from CAL/LD, which would explain why a fractional value for load is provided in register 0x34. The postulated formula is:

$B/Fuel = 9.2764*IAT_{corr}*BARO_{corr}*CAL*VE_{ref}*VE_{corr}*Other_{corr}$ [ms/stroke]

where:

9.2764 = Theoretical B/Fuel [ms/stroke]
for 2988 cc, 6 cylinder engine (VQ30DE), 370 cc/min injectors
and AFR = 14.7, VE = 100%, IAT = 25 ºC, BARO = 29.92 inHg
IAT_{corr} = 298 ºK / (IAT ºC + 273 ºK)
$BARO_{corr}$ = BARO inHg / 29.92 inHg
CAL = (CAL/LD %) / 100
VE_{ref} = 80 % / 100
VE_{corr} = (VE map value %) / 100 at corresponding RPM and CAL/LD
$Other_{corr}$ = Additional corrections for such things as variations in Electrical System Voltage

Injection time values (pulse width) as provided in registers 0x14 (LH_MSB), 0x15 (LH_LSB) and 0x22 (RH_MSB), 0x23 (RH_LSB) after dividing by 100, would then be derived from:

$Inj\ Time = B/Fuel*LTFT*STFT*Other_{corr} + Latency_{corr}$ [ms]

where:

LTFT = Long Term Fuel Trim % / 100
STFT = Short Term Fuel Trim % / 100
$Other_{corr}$ = Additional corrections for such things as WOT, cold engine, etc.
$Latency_{corr}$ = Injector latency [ms]

$Latency_{corr}$ appears to vary approximately between 1 and 2 ms with 1 ms being applied at low loads and 2 ms being applied at high loads and it varies between these values.

The RR O2 Sensor register 0x35 is valid and represents ‘mV’ after multiplying the register value by 10.

There is no RR O2 Sensor and generic register 0x36 is invalid.

The Absolute Throttle Position register 0x37 is valid and is converted to % by dividing the register value by 2.55.

The MAF register 0x38 is valid but the value represents the % rather than gm/s. The ECU derives this value by dividing the VQ table value, at the corresponding MAF voltage, by 65535 and multiplying by 100. The flow in gm/s can be obtained by multiplying % by the reference flow at 100% and dividing by 100. The reference flow is not given but appears to be 272 gm/s at 100%. The reference value is probably stored somewhere in ROM and used by the ECU in calculations for CAL/LD.

The Evap System Pressure generic register 0x39 is valid but may represent something else.

The Absolute Pressure Sensor generic registers are identified as 0x3A and 0x4A both of which are valid. The value in register 0x4A, after multiplying by 20, represents the sensor output in ‘mV’. It is not known what register 0x3A represents, but it does not appear to be related to the APS.

Register 0x48 represents the MAP/BARO solenoid valve that periodically switches the input to the Absolute Pressure Sensor from Intake Manifold to Atmosphere. The ECU uses this to sample the local barometric pressure which is probably used in calculating the CAL/LD.

FPCM F/P generic registers 0x52 and 0x53 are invalid.

Register 0x4B appears to be the ECUs interpreted state for the throttle closed condition during operation because it follows the physical closed state when the engine is running but does not change state with the key on but engine off.

Register 0x56 may represent the Rear O2 sensor heater as it has values similar to those of 0x30 for the Front O2 heater.

Numerous registers from 0x78 on down are valid but it is not known at this time what most of them represent. Many return the value 0 or some other number and don’t appear to change. There are no valid data registers above 0x78.

<u>Active Test Registers</u>

The generic active test register 0x84 for IACV-AAC/V Opening is invalid.

The generic active test register 0x87 for IACV/FICD-Solenoid is invalid.

The generic active test register 0x88 for Power Balance is active and the test is performed as described in the generic literature. The test shuts off the fuel injectors rather than the ignition coils as described in some articles. By shutting off the injectors, unburned fuel will not enter the catalytic converter during testing leading to possible damage to the converter as might occur if the ignition coils were shut off.

The generic active test register 0x8A for P/REG Control-Solenoid is invalid.

The generic active test register 0x8F for Valve Timing Solenoid is invalid (this vehicle does not have Variable Valve Timing).

The generic active test register 0x90 for MAP SW Control-Solenoid is invalid.

The generic active test registers 0x93 and 0x94 for Coolant Fan Low and High Speed Tests are valid but they must be set as a pair for proper operation:

Fans off:
0x93 = 0 (OFF) & 0x94 = 0 (OFF)
Low Speed:
0x93 = 1 (ON) & 0x94 = 0 (OFF)
Hi Speed:
0x93 = 0 (OFF) & 0x94 = 1 (ON)
Simultaneous Low & Hi Speed Windings Energized (not recommended):
0x93 = 1 (ON) & 0x94 = 1 (ON)

Notes:
If 0x94 is set to 1 and 0x93 is not set to 0, the Simultaneous Low & High Speed Windings Energized state results rather than High Speed operation.
If 0x93 is set to 1 and 0x94 is not set to 0 the fans do not run and Low Speed operation is not obtained.

There are several valid test registers above 0x94. Be aware, however, that one of them (it is not known which one except that it is above 0x9F and believed to be 0xB0) initiates re-registering the ignition key with the ECU (NVIS Nissan Vehicle Immobilizer System-NATS Nissan Anti-Theft System) and will result in other keys (besides the one currently in the ignition) no longer working. This was learned through personal experience. Getting those keys re-registered into the ECU costs between $50 and $100 at a locksmith or dealer.

Test register 0x95 is valid and activates ???

Test register 0x97 is valid and activates ???

Test register 0x98 is valid and activates ???

Test register 0x99 is valid and activates ???

Test register 0x9A is valid and activates EVAP SYS Evap Canister Vent Control Valve (located behind LR wheel). This solenoid is also activated by register 0xAB.

Test register 0x9C is valid and activates EVAP SYS Vacuum Cut Bypass Solenoid (located behind LR wheel). This solenoid is also activated by register 0xA7.

Test register 0x9D is valid and activates ???

Test register 0x9E is valid and activates ???

Test register 0xA2 is valid and activates ???

Test register 0xA7 is valid and activates EVAP SYS Vacuum Cut Bypass Solenoid (located behind LR wheel). This solenoid is also activated by register 0x9C.

Test register 0xA9 is valid and activates ???

Test register 0xAA is valid and activates ???

Test register 0xAB is valid and activates EVAP SYS Evap Canister Vent Control Valve (located behind LR wheel). This solenoid is also activated by register 0x9A.

Test register 0xAC is valid and activates ???

Test register 0xB0 is valid and possibly activates NVIS-NATS key re-registration.

There does not appear to be any valid test registers above 0xB0.

ROM Map Data

The locations of ROM maps for this vehicle are totally different than those reported for non-OBD2 vehicles. The maps reside in the low end rather than high end of ROM

The following locations have been identified:

ECU Part Number: 0x11DB (32 bytes)

Normal Fuel Map: 0xH1700 (256 bytes)
Knock Fuel Map: 0xH1800 (256 bytes)
Fuel Load Scale: 0x1900 (16 bytes)
Fuel RPM Scale: 0x1910 (16 bytes)

Normal Timing Map: 0xH1D00 (256 bytes)
Knock Timing Map: 0xH1E00 (256 bytes)

Timing Load Scale:	0x1F10 (16 bytes)
Timing RPM Scale:	0x1F00 (16 bytes)

Vol Eff (VE) Map:	0xH1400 (256 bytes)
VE Load Scale:	0x1500 (16 bytes)
VE RPM Scale:	0x1510 (16 bytes)

VQ Map:	0x1220 (128 bytes)

After Start Enrichment vs Temperature Map:	0x19A0 (16 bytes)
Cold Start Enrichment vs Temperature:	0x19C0 (16 bytes)