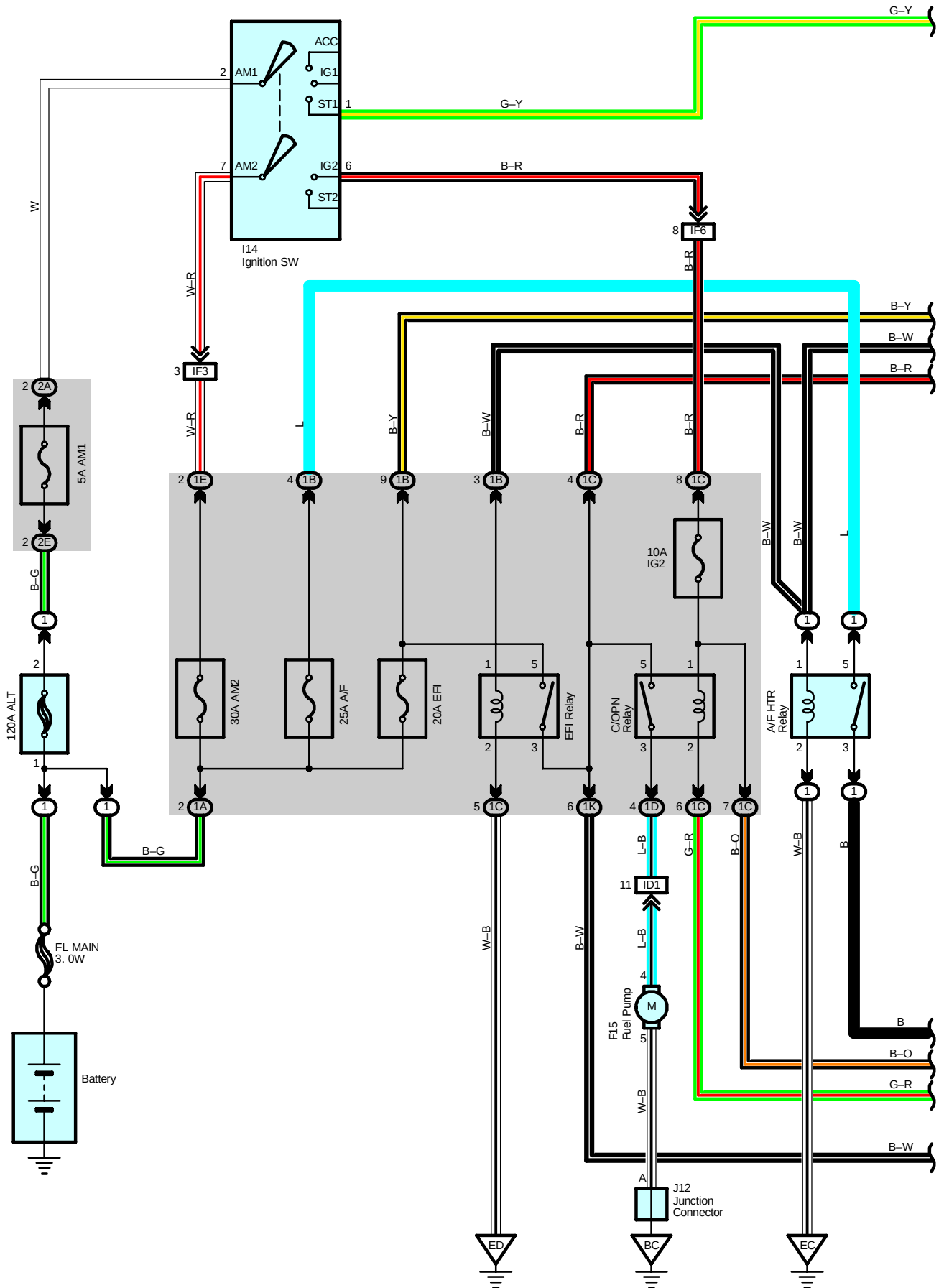
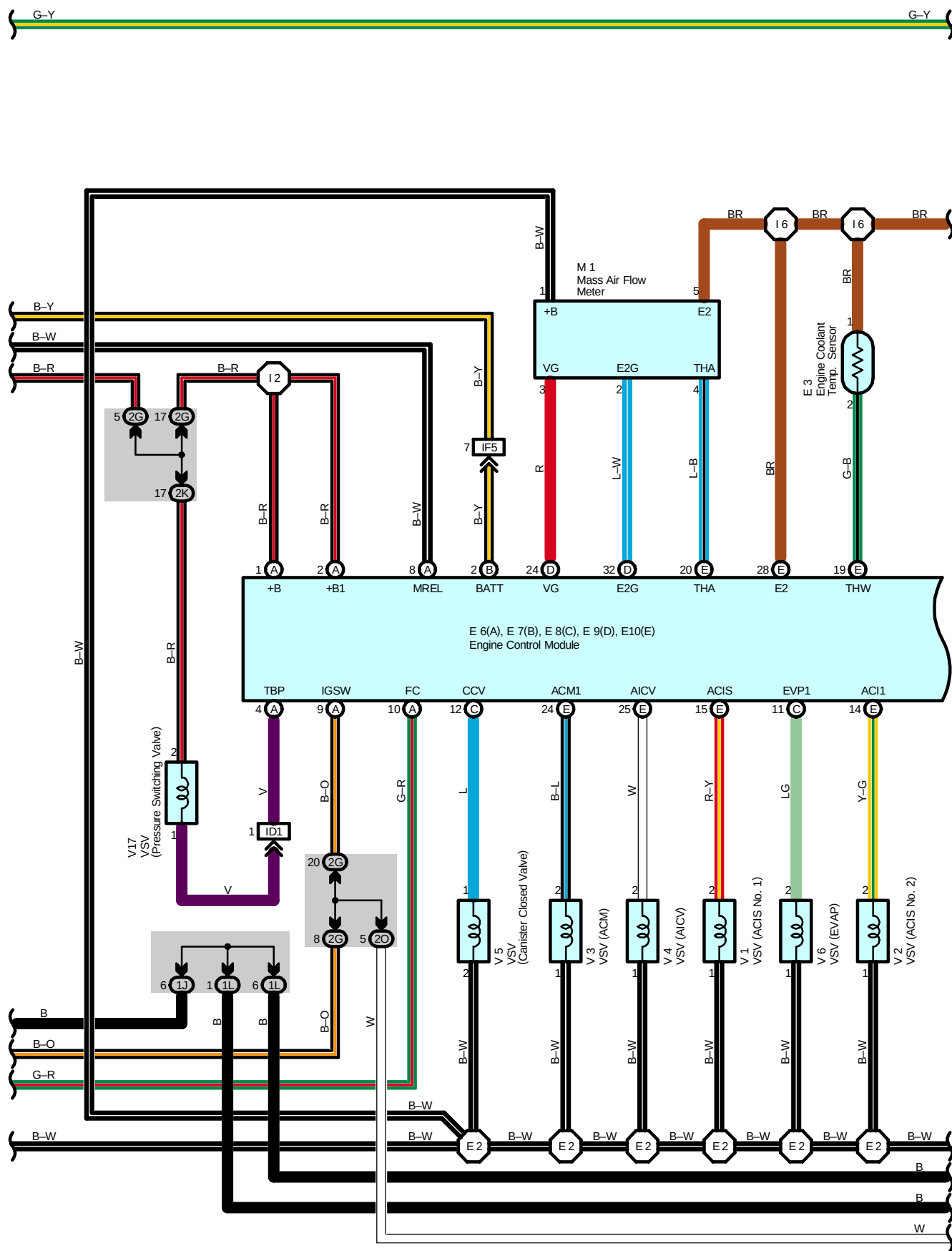
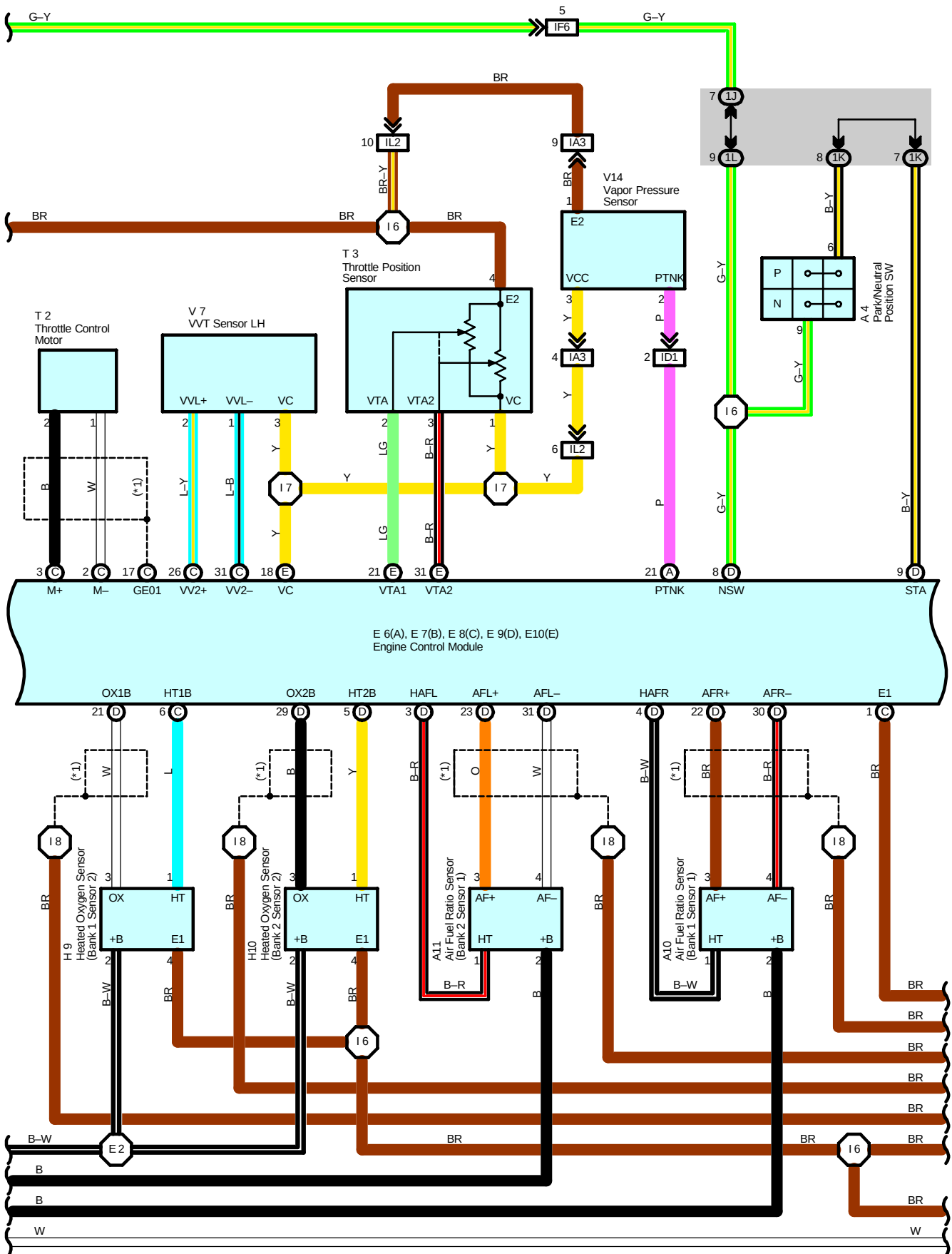






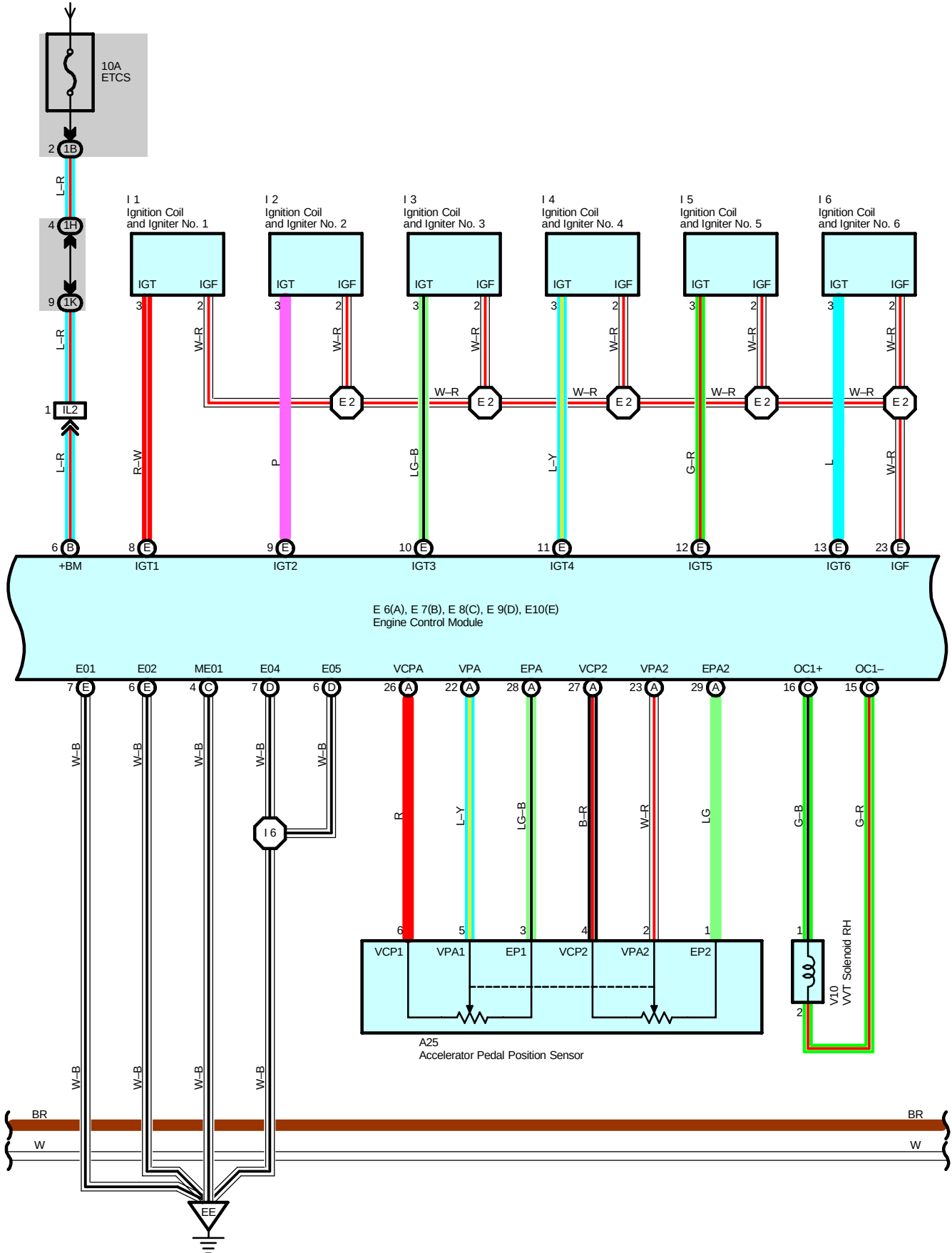
# Engine Control



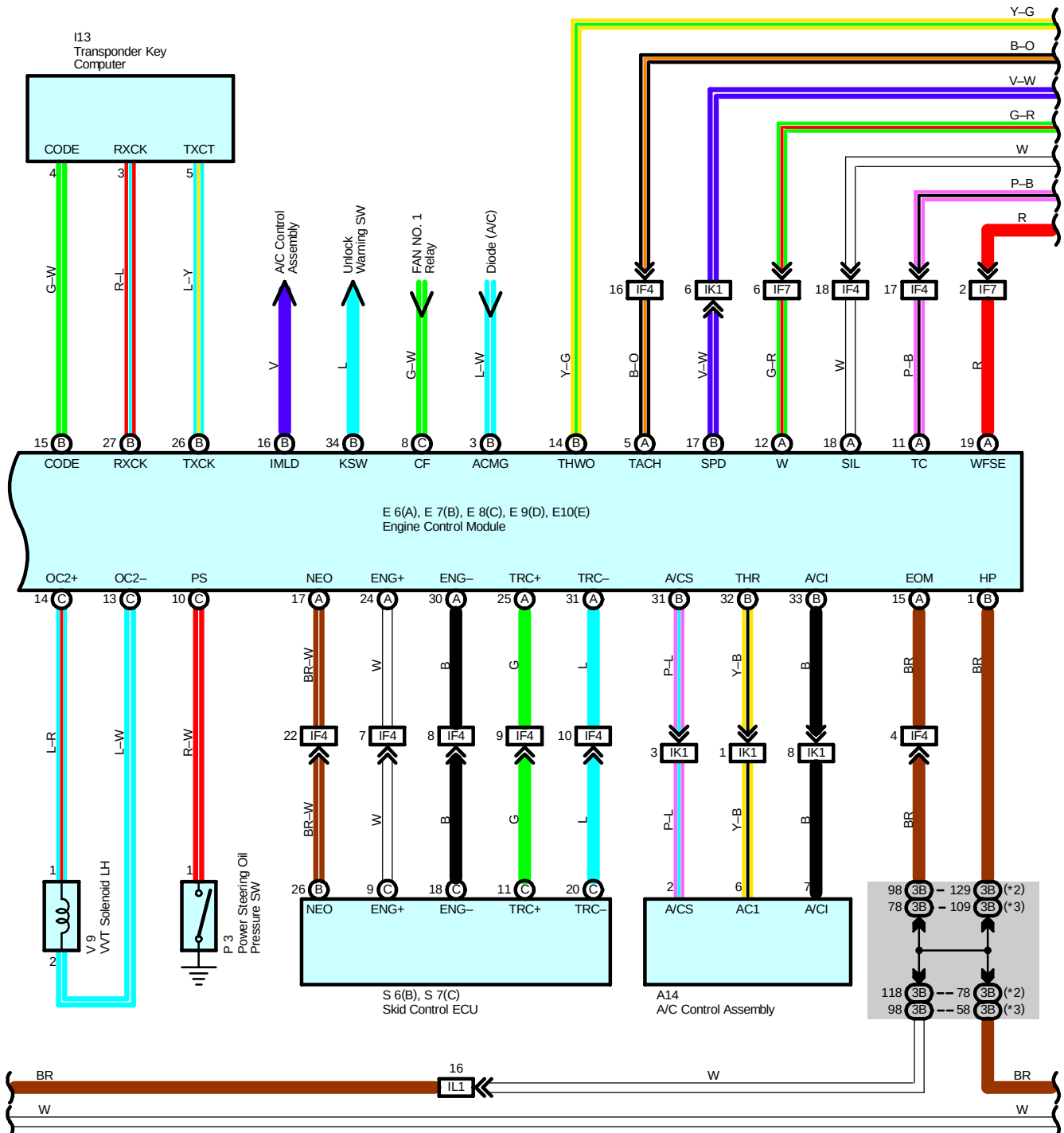


# Engine Control

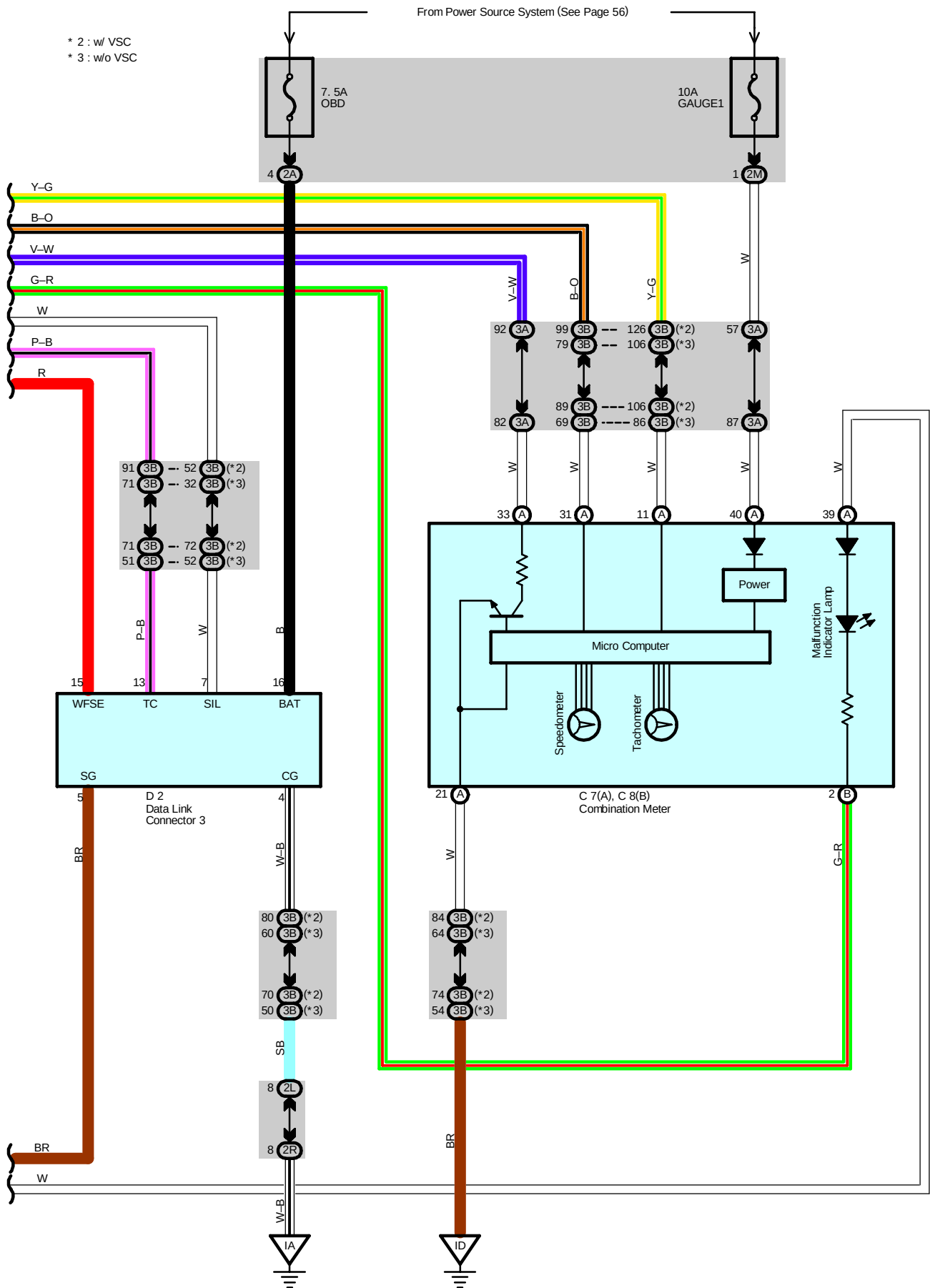
From Power Source System (See Page 56)



\* 2 : w/ VSC  
 \* 3 : w/o VSC



# Engine Control



## System Outline

This system utilizes an engine control module and maintains overall control of the engine, transmission and so on. An outline of the engine control is explained here.

### 1. Input Signals

- (1) Engine coolant temp. signal circuit  
The engine coolant temp. sensor detects the engine coolant temp. and has a built-in thermistor with a resistance which varies according to the water temp. is input into TERMINAL THW of the engine control module as a control signal.
- (2) Intake air temp. signal circuit  
The intake air temp. sensor is installed in the mass air flow meter and detects the intake air temp., which is input as a control signal into TERMINAL THA of the engine control module.
- (3) Oxygen sensor signal circuit  
The oxygen density in the exhaust gases is detected and input as a control signal into TERMINALS OX1B and OX2B of the engine control module. To maintain stable detection performance by the heated oxygen sensor, a heater is used for warming the sensor. The heater is also controlled by the engine control module (HT1B and HT2B).
- (4) RPM signal circuit  
Camshaft position and crankshaft position are detected by the VVT sensor RH and crankshaft position sensor. The camshaft position is input as a control signal to TERMINAL VV1+ of the engine control module, and the engine RPM is input into TERMINAL NE+.
- (5) Throttle signal circuit  
The throttle position sensor detects the throttle valve opening angle as a control signal, which is input into TERMINAL VTA1 of the engine control module.
- (6) Vehicle speed signal circuit  
The vehicle speed sensor, detects the vehicle speed and input to ABS speed sensor of the skid control ECU (w/ VSC) or skid control ECU with actuator (w/o VSC), from skid control ECU to TERMINAL SPD of the engine control module, Via combinatio meter.
- (7) Park/Neutral position SW signal circuit  
The Park/Neutral position SW detects whether the shift position is in neutral, parking or not, and inputs a control signal into TERMINAL NSW of the engine control module.
- (8) A/C SW signal circuit  
The A/C control assembly inputs the A/C operations into TERMINAL A/CS of the engine control module as a control signal.
- (9) Battery signal circuit  
Voltage is always supplies to TERMINAL BATT of the engine control module.  
If you turn on the ignition SW, the current goes from TERMINAL MREL of the engine control module to the EFI relay and put on the relay, and the voltage related to the engine control module operation is supplied to TERMINAL +B of the engine control module through the EFI relay.
- (10) Intake air volume signal circuit  
Intake air volume is detected by the mass air flow meter and a signal is input into TERMINAL VG of the engine control module as a control signal.
- (11) Starter signal circuit  
To confirm whether the engine is cranking, the voltage applied to the starter motor during cranking is detected and the signal is input into TERMINAL STA of the engine control module as a control signal.
- (12) Engine knock signal circuit  
Engine knocking is detected by the knock sensor No.1 and No.2, then the signals are input into TERMINALS KNKR and KNKL of the engine control module as a control signal.
- (13) Air fuel ratio signal circuit  
The air fuel ratio is detected and input as a control signal into TERMINALS AFL+, AFR+ of the engine control module.

## 2. Control System

### \* SFI system

The SFI system monitors the engine condition through the signals, which are input from each sensor to engine control module. The best fuel injection volume is decided based on this data and the program memorized by the engine control module, and the control signal is output to TERMINALS #10, #20, #30, #40, #50 and #60 of the engine control module to operate the injector (Inject the fuel). The SFI system produces control of fuel injection operation by the engine control module in response to the driving conditions.

### \* ESA system

The ESA system monitors the engine condition through the signals, which are input to the engine control module from each sensor. The best ignition timing is decided according to this data and the memorized data in the engine control module, and the control signal is output to TERMINALS IGT1, IGT2, IGT3, IGT4, IGT5 and IGT6. This signal controls the igniter to provide the best ignition timing for the driving conditions.

### \* Heated oxygen sensor heater control system

The heated oxygen sensor heater control system turns the heater on when the intake air volume is low (Temp. of exhaust emissions is low), and warms up the heated oxygen sensor to improve detection performance of the sensor.

The engine control module evaluates the signals from each sensor, current is output to TERMINALS HT1B and HT2B, controlling the heater.

### \* Air fuel ratio sensor heater control system

The air fuel ratio sensor heater control system turns the heater on when the intake air volume is low (Temp. of exhaust emission is low), and warms up the air fuel ratio sensor to improve detection performance of the sensor.

The engine control module evaluates the signals from each sensor, current is output to TERMINALS HAFL and HAFL, controlling the heater.

### \* ACIS

ACIS includes a valve in the bulkhead separating the surge tank into two parts. This valve is opened and closed in accordance with the driving conditions to control the intake manifold length in two stages for increased engine output in all ranges from low to high speeds.

The engine control module judges the engine speed by the signals from each sensor and outputs current to the TERMINAL ACIS to control the VSV (ACIS No.1).

## 3. Diagnosis System

With the diagnosis system, when there is a malfunction in the engine control module signal system, the malfunctioning system is recorded in the memory.

## 4. Fail-Safe System

When a malfunction occurs in any systems, if there is a possibility of engine trouble being caused by continued control based on the signals from that system, the fail-safe system either controls the system by using data (Standard values) recorded in the engine control module memory or else stops the engine.

## Service Hints

### E3 Engine Coolant Temp. Sensor

- 1-2 : Approx. 15.04 k $\Omega$  (-20°C, -4°F)
- Approx. 5.74 k $\Omega$  (0°C, 32°F)
- Approx. 2.45 k $\Omega$  (20°C, 68°F)
- Approx. 1.15 k $\Omega$  (40°C, 104°F)
- Approx. 0.584 k $\Omega$  (60°C, 140°F)
- Approx. 0.318 k $\Omega$  (80°C, 176°F)

### E6 (A), E7 (B), E8 (C), E9 (D), E10 (E) Engine Control Module

Voltage at engine control module wiring connector

- BATT-E1 : Always 9.0-14.0 volts
- +B-E1 : 9.0-14.0 volts (Ignition SW at ON position)
- VC-E2 : Always 4.5-5.5 volts (Ignition SW at ON position)
- VTA1-E2 : 0.3-0.8 volts (Ignition SW on and throttle valve fully closed)
- : 3.2-4.9 volts (Ignition SW on and throttle valve fully open)
- VG-E2G : 1.1-1.5 volts (Engine idling and A/C SW OFF position)
- THA-E2 : 0.5-3.4 volts (Engine idling and intake air temp. 20°C, 68°F)
- THW-E2 : 0.2-1.0 volts (Engine idling and engine coolant temp. 80°C, 176°F)
- IGF-E1 : 4.5-5.5 volts (Ignition SW at ON position)
- Pulse generation (Engine idling)
- VV1+-NE- : Pulse generation (Engine idling)
- NE+-NE- : Pulse generation (Engine idling)
- NSW-E1 : 9.0-14.0 volts (Ignition SW on and other shift position in P or N position)
- Below 3.0 volts (Ignition SW on and shift position in P or N position)
- SPD-E1 : Pulse generation (Ignition SW on and rotate driving wheel slowly)
- W-E1 : Below 3.0 volts
- ACIS-E01 : 9.0-14.0 volts (Ignition SW at ON position)
- STA-E1 : 6.0 volts or more (Engine cranking)
- ELS-E1 : 7.5-14.0 volts (Taillight SW at ON position)
- 0-1.5 volts (Taillight SW at OFF position)
- ELS2-E1 : 7.5-14.0 volts (Defogger SW at ON position)
- 0-1.5 volts (Defogger SW at OFF position)
- FC-E1 : 9.0-14.0 volts (Ignition SW at ON position)
- 0-3.0 volts (Engine idling)
- EVP1-E01 : 9.0-14.0 volts (Ignition SW at ON position)
- CF-E1 : 9.0-14.0 volts (Electric cooling fan is operating on high speed)
- 0-2.0 volts (Electric cooling fan is operating on low speed or off)
- TACH-E1 : Pulse generation (Engine idling)
- TBP-E1 : 9.0-14.0 volts (Ignition SW on and disconnect the vacuum hose from the vapor pressure sensor)
- PTNK-E1 : 3.0-3.6 volts (Ignition SW at ON position)
- 1.3-2.1 volts (Ignition SW on and apply vacuum 2.0 kpa (15.0 mmHg, 0.6 in.Hg))
- STP-E1 : 7.5-14.0 volts (Ignition SW on and brake pedal depressed)
- Below 1.5 volts (Ignition SW on and brake pedal released)
- SIL-E1 : Pulse generation (During transmission)
- KNKL, KNKR-E1 : Pulse generation (Engine idling)
- HT1B, HT2B-E03 : 9.0-14.0 volts (Ignition SW at ON position)
- 0-3.0 volts (Engine idling)
- OX1B, OX2B-E1 : Pulse generation (Maintain engine speed at 2500 rpm for two minutes after warning up)
- IGT1, IGT2, IGT3, IGT4, IGT5, IGT6-E1 : Pulse generation (Engine idling)
- #10, #20, #30, #40, #50, #60-E01 : 9.0-14.0 volts (Ignition SW at ON position)
- Pulse generation (Engine idling)

### I7, I8, I9, I10, I11, I12 Injector

- 2-1 : Approx. 13.8  $\Omega$

### C/OPN Relay

- 3-5 : Closed with starter running

### EFI Relay

- 3-5 : Closed with ignition SW at ON or ST position

# Engine Control

## ○ : Parts Location

| Code | See Page             | Code | See Page           | Code | See Page             |
|------|----------------------|------|--------------------|------|----------------------|
| A4   | <a href="#">36</a>   | I2   | <a href="#">37</a> | S6   | B <a href="#">39</a> |
| A10  | <a href="#">36</a>   | I3   | <a href="#">37</a> | S7   | C <a href="#">39</a> |
| A11  | <a href="#">36</a>   | I4   | <a href="#">37</a> | S13  | <a href="#">39</a>   |
| A14  | <a href="#">38</a>   | I5   | <a href="#">37</a> | T2   | <a href="#">37</a>   |
| A25  | <a href="#">38</a>   | I6   | <a href="#">37</a> | T3   | <a href="#">37</a>   |
| C2   | <a href="#">36</a>   | I7   | <a href="#">37</a> | V1   | <a href="#">37</a>   |
| C7   | A <a href="#">38</a> | I8   | <a href="#">37</a> | V2   | <a href="#">37</a>   |
| C8   | B <a href="#">38</a> | I9   | <a href="#">37</a> | V3   | <a href="#">37</a>   |
| D2   | <a href="#">38</a>   | I10  | <a href="#">37</a> | V4   | <a href="#">37</a>   |
| E3   | <a href="#">36</a>   | I11  | <a href="#">37</a> | V5   | <a href="#">37</a>   |
| E6   | A <a href="#">38</a> | I12  | <a href="#">37</a> | V6   | <a href="#">37</a>   |
| E7   | B <a href="#">38</a> | I13  | <a href="#">39</a> | V7   | <a href="#">37</a>   |
| E8   | C <a href="#">38</a> | I14  | <a href="#">39</a> | V8   | <a href="#">37</a>   |
| E9   | D <a href="#">38</a> | J11  | <a href="#">39</a> | V9   | <a href="#">37</a>   |
| E10  | E <a href="#">38</a> | J12  | <a href="#">40</a> | V10  | <a href="#">37</a>   |
| F15  | <a href="#">40</a>   | K2   | <a href="#">37</a> | V14  | <a href="#">41</a>   |
| H9   | <a href="#">36</a>   | K3   | <a href="#">37</a> | V17  | <a href="#">41</a>   |
| H10  | <a href="#">36</a>   | M1   | <a href="#">37</a> |      |                      |
| I1   | <a href="#">37</a>   | P3   | <a href="#">37</a> |      |                      |

## ○ : Relay Blocks

| Code | See Page           | Relay Blocks (Relay Block Location)       |
|------|--------------------|-------------------------------------------|
| 1    | <a href="#">22</a> | Engine Room R/B (Engine Compartment Left) |

## ○ : Junction Block and Wire Harness Connector

| Code | See Page                                                    | Junction Block and Wire Harness (Connector Location)                     |
|------|-------------------------------------------------------------|--------------------------------------------------------------------------|
| 1A   | <a href="#">25</a>                                          | Engine Room Main Wire and Engine Room J/B (Engine Compartment Left)      |
| 1B   |                                                             |                                                                          |
| 1C   |                                                             |                                                                          |
| 1D   |                                                             |                                                                          |
| 1E   |                                                             |                                                                          |
| 1H   |                                                             |                                                                          |
| 1J   |                                                             |                                                                          |
| 1K   | <a href="#">25</a>                                          | Engine Wire and Engine Room J/B (Engine Compartment Left)                |
| 1L   |                                                             |                                                                          |
| 2A   | <a href="#">28</a>                                          | Instrument Panel Wire and Driver Side J/B (Lower Finish Panel)           |
| 2E   | <a href="#">28</a>                                          | Engine Room Main Wire and Driver Side J/B (Lower Finish Panel)           |
| 2G   |                                                             |                                                                          |
| 2K   | <a href="#">28</a>                                          | Floor No.1 Wire and Driver Side J/B (Lower Finish Panel)                 |
| 2L   | <a href="#">29</a>                                          | Instrument Panel Wire and Driver Side J/B (Lower Finish Panel)           |
| 2M   |                                                             |                                                                          |
| 2O   |                                                             |                                                                          |
| 2R   |                                                             |                                                                          |
| 3A   | <a href="#">34 (w/ VSC)</a><br><a href="#">35 (w/o VSC)</a> | Instrument Panel Wire and Passenger Side J/B (Instrument Panel Brace RH) |
| 3B   | <a href="#">34 (w/ VSC)</a>                                 |                                                                          |
|      | <a href="#">35 (w/o VSC)</a>                                |                                                                          |
|      |                                                             |                                                                          |

 : Connector Joining Wire Harness and Wire Harness

| Code | See Page | Joining Wire Harness and Wire Harness (Connector Location)                           |
|------|----------|--------------------------------------------------------------------------------------|
| EB1  | 44       | Engine Wire and Sensor Wire (Left Bank of the Cylinder Head)                         |
| IA3  | 46       | Instrument Panel Wire and Floor No.1 Wire (Left Kick Panel)                          |
| ID1  | 46       | Engine Room Main Wire and Floor No.1 Wire (Left Side of Driver Side J/B)             |
| IF3  | 46       | Engine Room Main Wire and Instrument Panel Wire (Right Side of Steering Column Tube) |
| IF4  |          |                                                                                      |
| IF5  |          |                                                                                      |
| IF6  |          |                                                                                      |
| IF7  |          |                                                                                      |
| IK1  | 48       | Instrument Panel Wire and Instrument Panel Wire (Instrument Panel Reinforcement RH)  |
| IL1  | 48       | Engine Wire and Instrument Panel Wire (Behind the Glove Box)                         |
| IL2  |          |                                                                                      |

 : Ground Points

| Code | See Page | Ground Points Location                    |
|------|----------|-------------------------------------------|
| EC   | 44       | Left Fender                               |
| ED   |          |                                           |
| EE   | 44       | Left Side of Cylinder Head                |
| EF   | 44       | Intake Side of Cylinder Block             |
| IA   | 46       | Instrument Panel Reinforcement LH         |
| ID   | 46       | Instrument Panel Brace RH                 |
| BC   | 50       | Front Side of Rear Quarter Wheel House LH |

 : Splice Points

| Code | See Page | Wire Harness with Splice Points | Code | See Page | Wire Harness with Splice Points |
|------|----------|---------------------------------|------|----------|---------------------------------|
| E2   | 44       | Engine Wire                     | I6   | 48       | Engine Wire                     |
| E3   |          |                                 | I7   |          |                                 |
| I2   | 48       | Engine Room Main Wire           | I8   |          |                                 |