

# 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 SYSTEM  
THE OXYGEN DENSITY IN THE EXHAUST GASES IS DETECTED AND INPUT AS A CONTROL SIGNAL INTO **TERMINALS OXL1, OXR1 AND OXS** 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 (**HTL, HTR AND HTS**).
- ( 4) RPM SIGNAL SYSTEM  
CAMSHAFT POSITION AND CRANKSHAFT POSITION ARE DETECTED BY THE CAMSHAFT POSITION SENSOR AND CRANKSHAFT POSITION SENSOR. THE CAMSHAFT POSITION IS INPUT AS A CONTROL SIGNAL TO **TERMINAL G22+** 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 SYSTEM  
THE VEHICLE SPEED SENSOR, INSTALLED INSIDE THE TRANSMISSION, DETECTS THE VEHICLE SPEED AND INPUTS A CONTROL SIGNAL INTO **TERMINAL SPD** OF THE ENGINE CONTROL MODULE.
- ( 7) PARK/NEUTRAL POSITION SW SIGNAL SYSTEM  
THE PARK/NEUTRAL POSITION SW DETECTS WHETHER THE SHIFT POSITION IS IN NEUTRAL, PARKING OR NOT, AND INPUTS A CONTROL SIGNAL INTO **TERMINAL STA** OF THE ENGINE CONTROL MODULE
- ( 8) A/C SW SIGNAL SYSTEM  
THE A/C CONTROL ASSEMBLY INPUTS THE A/C OPERATIONS INTO **TERMINAL A/C** OF THE ENGINE CONTROL MODULE AS A CONTROL SIGNAL.
- ( 9) BATTERY SIGNAL CIRCUIT  
VOLTAGE IS CONSTANTLY APPLIED TO **TERMINAL BATT** OF THE ENGINE CONTROL MODULE. WHEN THE IGNITION SW IS TURNED ON, VOLTAGE FOR THE ENGINE CONTROL MODULE OPERATION IS APPLIED TO **TERMINAL +B** OF THE ENGINE CONTROL MODULE VIA 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) NSW 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 NSW** OF THE ENGINE CONTROL MODULE AS A CONTROL SIGNAL.
- (12) ENGINE KNOCK SIGNAL CIRCUIT  
ENGINE KNOCKING IS DETECTED BY THE KNOCK SENSOR 1 AND 2, THEN THE SIGNALS ARE INPUT INTO **TERMINALS KNKR AND KNKL** OF THE ENGINE CONTROL MODULE AS A CONTROL SIGNAL.

## 2. CONTROL SYSTEM

- SFI (SEQUENTIAL MULTIPOINT FUEL INJECTION) SYSTEM  
THE SFI SYSTEM MONITORS THE ENGINE CONDITION THROUGH THE SIGNALS, WHICH ARE INPUT FROM EACH SENSOR (INPUT SIGNALS (1) TO (12)). 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 (ELECTRONIC SPARK ADVANCE) SYSTEM  
THE ESA SYSTEM MONITORS THE ENGINE CONDITION THROUGH THE SIGNALS, WHICH ARE INPUT TO THE ENGINE CONTROL MODULE FROM EACH SENSOR (INPUT SIGNALS FROM 1, 3, 4, 12). 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 AND IGT3**. 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 (INPUT SIGNALS FROM 1, 4, 9, 10), CURRENT IS OUTPUT TO **TERMINALS HTL, HTR AND HTS**, CONTROLLING THE HEATER.
- IDLE AIR CONTROL SYSTEM  
THE IDLE AIR CONTROL SYSTEM (ROTARY SOLENOID TYPE) INCREASES THE RPM AND PROVIDES IDLE STABILITY FOR FAST IDLE-UP WHEN THE ENGINE IS COLD, AND WHEN THE IDLE SPEED HAS DROPPED DUE TO ELECTRICAL LOAD AND SO ON, THE ENGINE CONTROL MODULE EVALUATES THE SIGNALS FROM EACH SENSOR (INPUT SIGNALS FROM 1, 4, 5, 8, 9), CURRENT IS OUTPUT TO **TERMINALS RSO AND RSC** TO CONTROL IDLE AIR CONTROL VALVE.
- EGR CONTROL SYSTEM  
THE EGR CONTROL SYSTEM DETECTS THE SIGNAL FROM EACH SENSOR (INPUT SIGNALS FROM 1, 4, 9, 10), AND OUTPUTS CURRENT TO **TERMINAL EGR** TO CONTROL THE VSV (EGR).  
THE EGR VALVE POSITION SENSOR IS MOUNTED ON THE EGR VALVE. THIS SENSOR CONVERTS THE EGR VALVE OPENING HEIGHT INTO A VOLTAGE AND SENDS IT TO THE ENGINE CONTROL MODULE AS THE EGR VALVE POSITION SIGNAL.
- ACIS (ACOUSTIC CONTROL INDUCTION SYSTEM)  
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 ((4), (5)) FROM EACH SENSOR AND OUTPUTS SIGNALS TO THE **TERMINAL ACIS** TO CONTROL THE VSV (INTAKE AIR CONTROL).

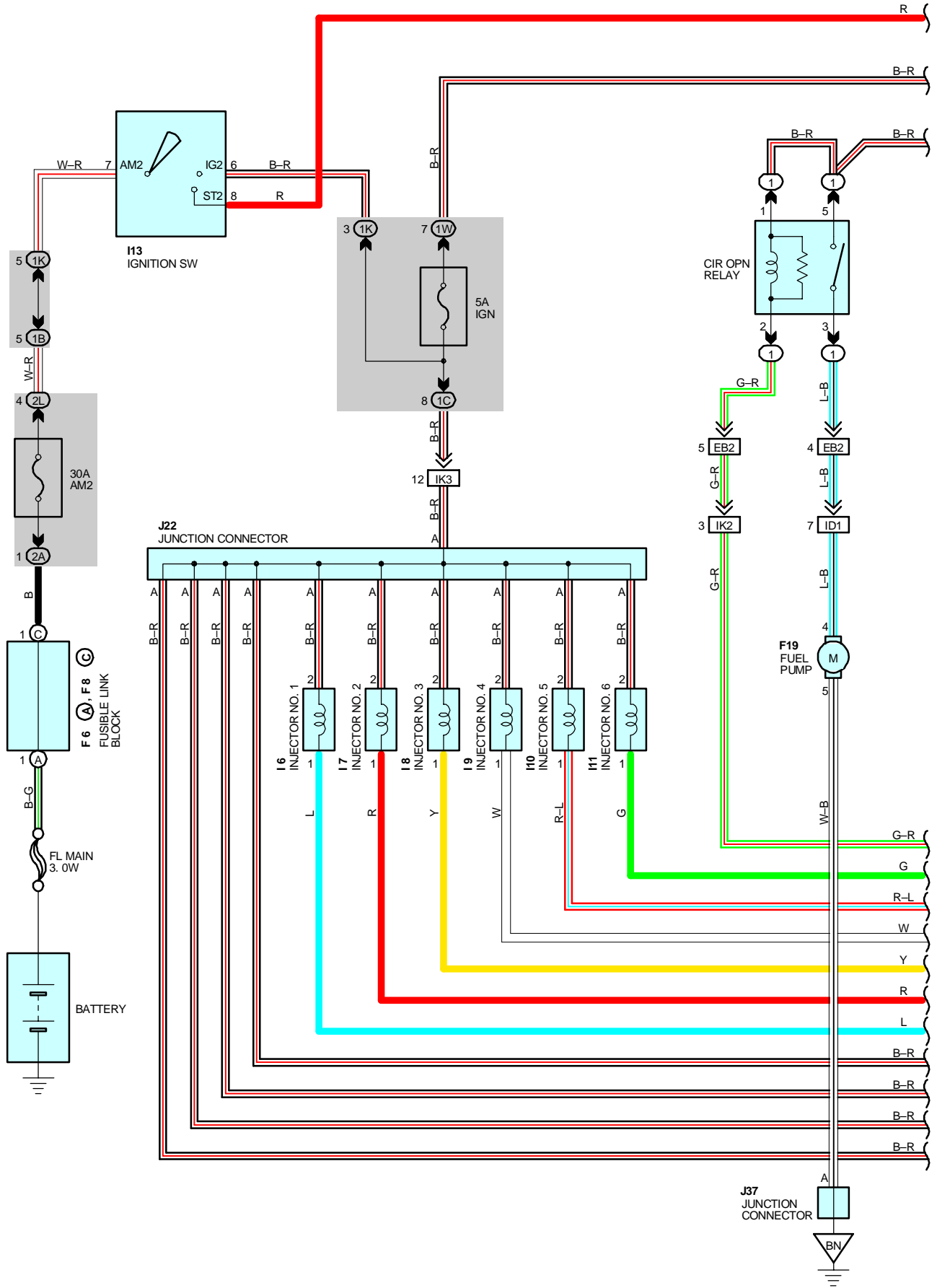
## 3. DIAGNOSIS SYSTEM

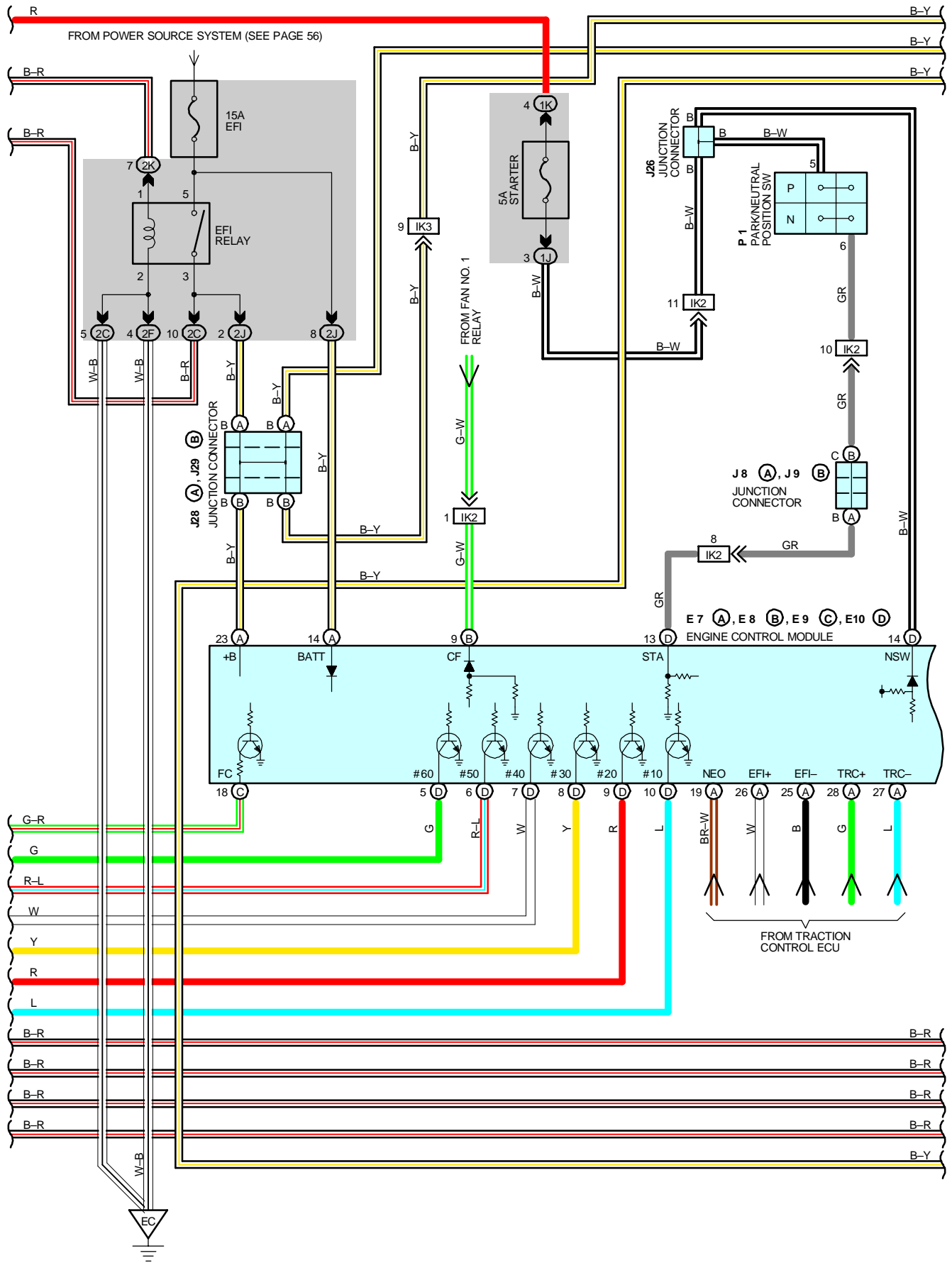
WITH THE DIAGNOSIS SYSTEM, WHEN THERE IS A MALFUNCTION IN THE ENGINE CONTROL MODULE SIGNAL SYSTEM, THE MALFUNCTIONING SYSTEM IS RECORDED IN THE MEMORY.

## 4. FAIL-SAFE SYSTEM

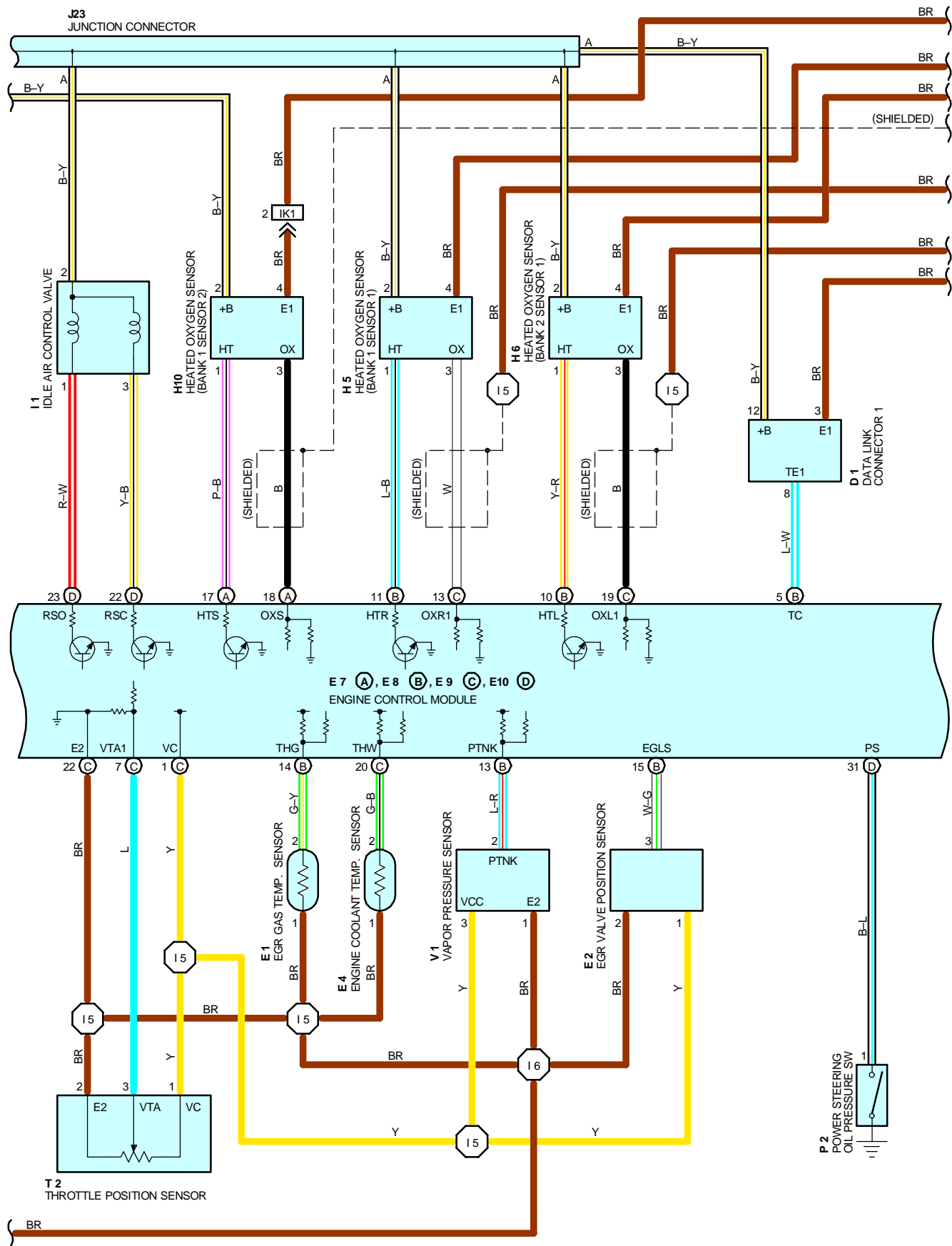
WHEN A MALFUNCTION OCCURS IN ANY SYSTEMS, IF THERE IS A POSSIBILITY OF ENGINE TROUBLE BEING CAUSED BY CONTINUED CONTROL BASED ON THE SIGNALS FROM THAT SYSTEM, THE FAIL-SAFE SYSTEM EITHER CONTROLS THE SYSTEM BY USING DATA (STANDARD VALUES) RECORDED IN THE ENGINE CONTROL MODULE MEMORY OR ELSE STOPS THE ENGINE.

# ENGINE CONTROL

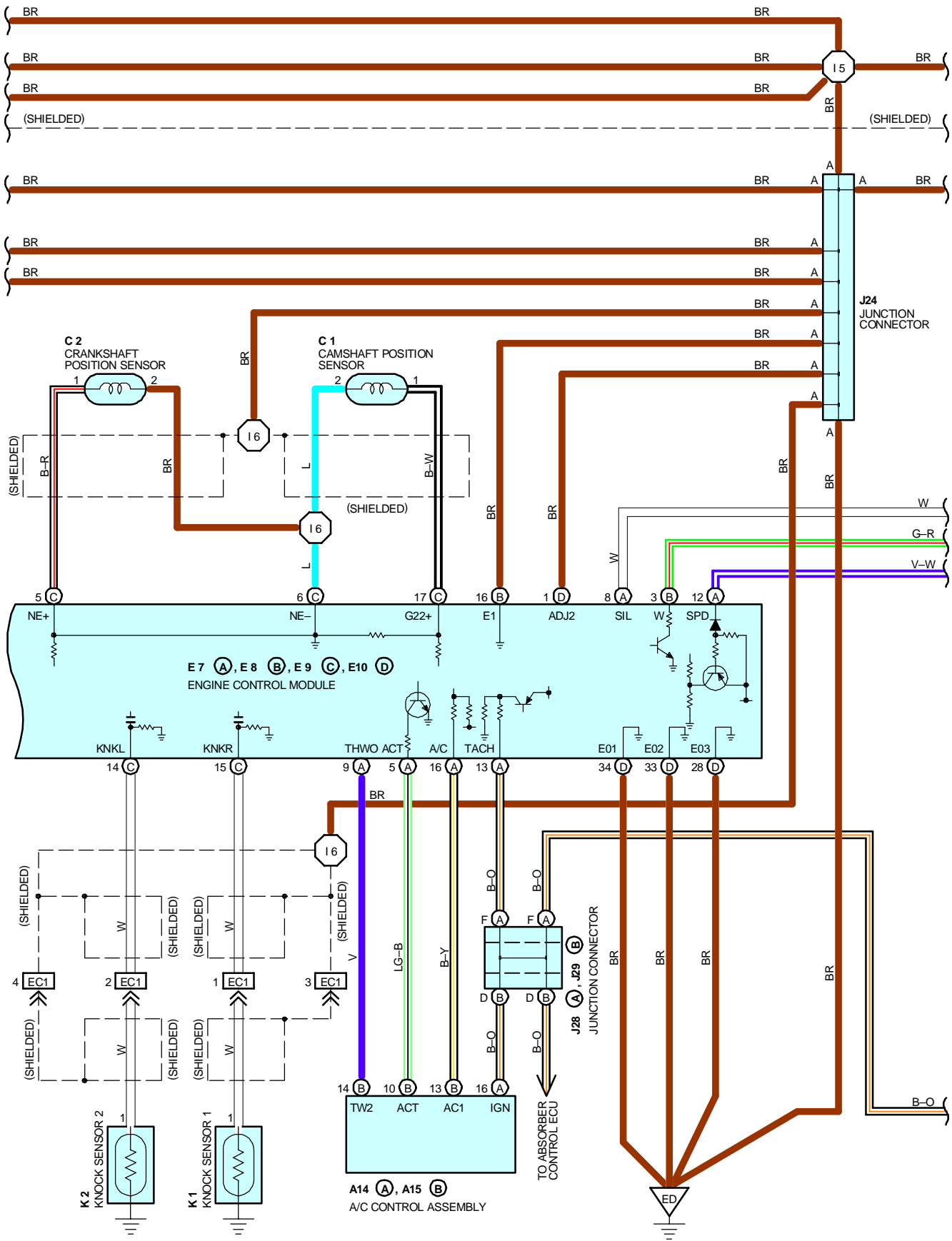


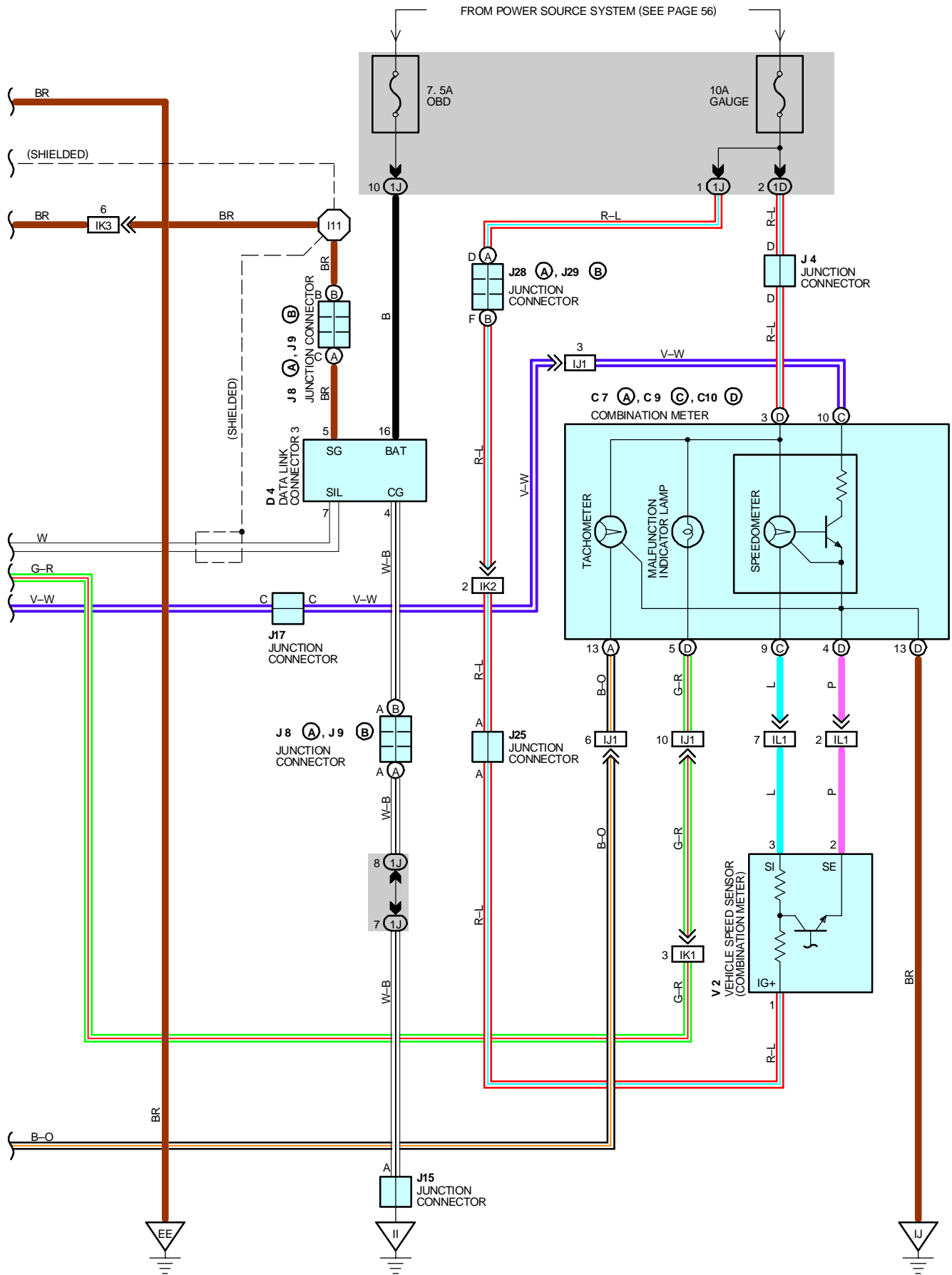






# ENGINE CONTROL





# ENGINE CONTROL

## SERVICE HINTS

### CIR OPN RELAY

①5 - ①3 : CLOSED WITH THE STARTER RUNNING

### EFI RELAY

5-3 : CLOSED WITH THE IGNITION SW AT **ON** OR **ST** POSITION

### E 4 ENGINE COOLANT TEMP. SENSOR

1-2 : 10.0 -20.0 K $\Omega$  (-20°C, -4°F)  
4.0 - 7.0 K $\Omega$  ( 0°C, 32°F)  
2.0 - 3.0 K $\Omega$  ( 20°C, 68°F)  
0.9 - 1.3 K $\Omega$  ( 40°C, 104°F)  
0.4 - 0.7 K $\Omega$  ( 60°C, 140°F)  
0.2 - 0.4 K $\Omega$  ( 80°C, 176°F)

### E7Ⓐ, E8Ⓑ, E9Ⓒ, E10Ⓓ 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 TO **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)

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 COOLANT TEMP. 80°C, 176°F)

IGF-E1 : 4.5-5.5 VOLTS (IGNITION SW AT **ON** POSITION)

PULSE GENERATION (ENGINE IDLING)

G22+-NE : PULSE GENERATION (ENGINE IDLING)

NE+-NE : PULSE GENERATION (ENGINE IDLING)

SIL-E1 : PULSE GENERATION (DURING TRANSMISSION)

TACH-E1 : PULSE GENERATION (ENGINE IDLING)

STA-E1 : 6.0 VOLTS OR MORE (ENGINE CRANKING)

THG-E2 : 4.5-5.5 VOLTS (IGNITION SW AT **ON** POSITION)

EGR-E01 : 9.0-14.0 VOLTS (IGNITION SW AT **ON** POSITION)

FC-E1 : 9.0-14.0 VOLTS (IGNITION SW AT **ON** POSITION)

0-3.0 VOLTS (ENGINE IDLING)

SPD-E1 : PULSE GENERATION (IGNITION SW ON AND ROTATE DRIVING WHEEL SLOWLY)

W-E1 : BELOW 3.0 VOLTS (IGNITION SW AT **ON** POSITION)

A/C-E1 : BELOW 2.0 VOLTS (ENGINE IDLING AND A/C SW ON)

9.0-14.0 VOLTS (A/C SW OFF)

ACT-E1 : 9.0-14.0 VOLTS (ENGINE IDLING AND A/C SW ON)

BELOW 2.0 VOLTS (A/C SW OFF)

ACIS-E01 : 9.0-14.0 VOLTS (IGNITION SW AT **ON** POSITION)

NSW-E1 : 9.0-14.0 VOLTS (IGNITION SW ON AND OTHER SHIFT POSITION IN **P** OR **N** POSITION)

0-3.0 VOLTS (IGNITION SW ON AND SHIFT POSITION IN **P** OR **N** POSITION)

EVP-E01 : 9.0-14.0 VOLTS (IGNITION SW AT **ON** POSITION)

TC-E1 : 9.0-14.0 VOLTS (IGNITION SW AT **ON** POSITION)

STP-E1 : 7.5-14.0 VOLTS (IGNITION SW ON AND BRAKE PEDAL DEPRESSED)

0-1.5 VOLTS (IGNITION SW ON AND BRAKE PEDAL DEPRESSED)

CF-E1 : 9.0-14.0 VOLTS (COOLING FAN IS OPERATING ON HIGH SPEED)

: 0-2.0 VOLTS (COOLING FAN IS OPERATING ON LOW SPEED OR OFF)

TPC-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)

RSC,RSO-E1 : 9.0-14.0 VOLTS (IGNITION SW AT **ON** POSITION)

KNKL,KNKR-E1 : PULSE GENERATION (ENGINE IDLING)

HTS, HTL, HTR-E03 : 9.0-14.0 VOLTS (IGNITION SW AT **ON** POSITION)

0-3.0 VOLTS (ENGINE IDLING)

OXS, OXL1, OXR1-E1 : PULSE GENERATION (MAINTAIN ENGINE SPEED AT 2500 RPM FOR TWO MINUTES AFTER WARMING UP)

IGT1, IGT2, IGT3-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)

### I 6, I 7, I 8, I 9, I 10, I 11 INJECTOR

2-1 : APPROX. 13.8  $\Omega$

### T 2 THROTTLE POSITION SENSOR

2-1 : 3.75 K $\Omega$

**○ : PARTS LOCATION**

| CODE |   | SEE PAGE | CODE |    | SEE PAGE | CODE |    | SEE PAGE |
|------|---|----------|------|----|----------|------|----|----------|
| A14  | A | 28       | H10  | 28 | J23      | 29   |    |          |
| A15  | B | 28       | I 1  | 27 | J24      | 29   |    |          |
| C 1  |   | 26       | I 2  | 27 | J25      | 29   |    |          |
| C 2  |   | 26       | I 3  | 27 | J26      | 29   |    |          |
| C 7  | A | 28       | I 4  | 27 | J27      | 29   |    |          |
| C 9  | C | 28       | I 5  | 27 | J28      | A    | 29 |          |
| C10  | D | 28       | I 6  | 27 | J29      | B    | 29 |          |
| D 1  |   | 26       | I 7  | 27 | J37      | 30   |    |          |
| D 4  |   | 28       | I 8  | 27 | K 1      | 27   |    |          |
| E 1  |   | 26       | I 9  | 27 | K 2      | 27   |    |          |
| E 2  |   | 26       | I10  | 27 | M 1      | 27   |    |          |
| E 4  |   | 26       | I11  | 27 | P 1      | 27   |    |          |
| E 7  | A | 28       | I13  | 28 | P 2      | 27   |    |          |
| E 8  | B | 28       | J 4  | 29 | S10      | 29   |    |          |
| E 9  | C | 28       | J 8  | A  | T 2      | 27   |    |          |
| E10  | D | 28       | J 9  | B  | V 1      | 27   |    |          |
| F 6  | A | 26       | J15  | 29 | V 2      | 27   |    |          |
| F 8  | C | 26       | J17  | 29 | V 4      | 27   |    |          |
| F19  |   | 30       | J18  | A  | V 5      | 27   |    |          |
| H 5  |   | 26       | J19  | B  | V 6      | 27   |    |          |
| H 6  |   | 26       | J22  | 29 | V 7      | 27   |    |          |

**○ : RELAY BLOCKS**

| CODE | SEE PAGE | RELAY BLOCKS (RELAY BLOCK LOCATION)       |
|------|----------|---|
| 1    | 22       | ENGINE ROOM R/B (ENGINE COMPARTMENT LEFT) |

**○ : JUNCTION BLOCK AND WIRE HARNESS CONNECTOR**

| CODE | SEE PAGE | JUNCTION BLOCK AND WIRE HARNESS (CONNECTOR LOCATION)                |
|------|----------|---|
| 1B   | 24       | COWL WIRE AND INSTRUMENT PANEL J/B (LOWER FINISH PANEL)             |
| 1C   |          |   |
| 1D   | 24       | INSTRUMENT PANEL WIRE AND INSTRUMENT PANEL J/B (LOWER FINISH PANEL) |
| 1J   | 24       | COWL WIRE AND INSTRUMENT PANEL J/B (LOWER FINISH PANEL)             |
| 1K   |          |   |
| 1R   |          |   |
| 1W   |          |   |
| 2A   | 20       | ENGINE ROOM MAIN WIRE AND ENGINE ROOM J/B (ENGINE COMPARTMENT LEFT) |
| 2C   |          |   |
| 2F   |          |   |
| 2J   | 20       | COWL WIRE AND ENGINE ROOM J/B (ENGINE COMPARTMENT LEFT)             |
| 2K   |          |   |
| 2L   |          |   |

**□ : CONNECTOR JOINING WIRE HARNESS AND WIRE HARNESS**

| CODE | SEE PAGE | JOINING WIRE HARNESS AND WIRE HARNESS (CONNECTOR LOCATION)      |
|------|----------|---|
| EB2  | 34       | COWL WIRE AND ENGINE ROOM MAIN WIRE (UNDER THE ENGINE ROOM J/B) |
| EC1  | 34       | ENGINE WIRE AND SENSOR WIRE (LEFT BANK OF THE CYLINDER HEAD)    |

**☐ : CONNECTOR JOINING WIRE HARNESS AND WIRE HARNESS**

| CODE | SEE PAGE | JOINING WIRE HARNESS AND WIRE HARNESS (CONNECTOR LOCATION)  |
|------|----------|---|
| ID1  | 36       | FLOOR WIRE AND COWL WIRE (LEFT KICK PANEL)                  |
| IJ1  | 38       | INSTRUMENT PANEL WIRE AND COWL WIRE (UNDER THE GLOVE BOX)   |
| IK1  | 38       | ENGINE WIRE AND COWL WIRE (UNDER THE GLOVE BOX)             |
| IK2  |          |   |
| IK3  |          |   |
| IL1  | 38       | ENGINE WIRE AND INSTRUMENT PANEL WIRE (UNDER THE GLOVE BOX) |

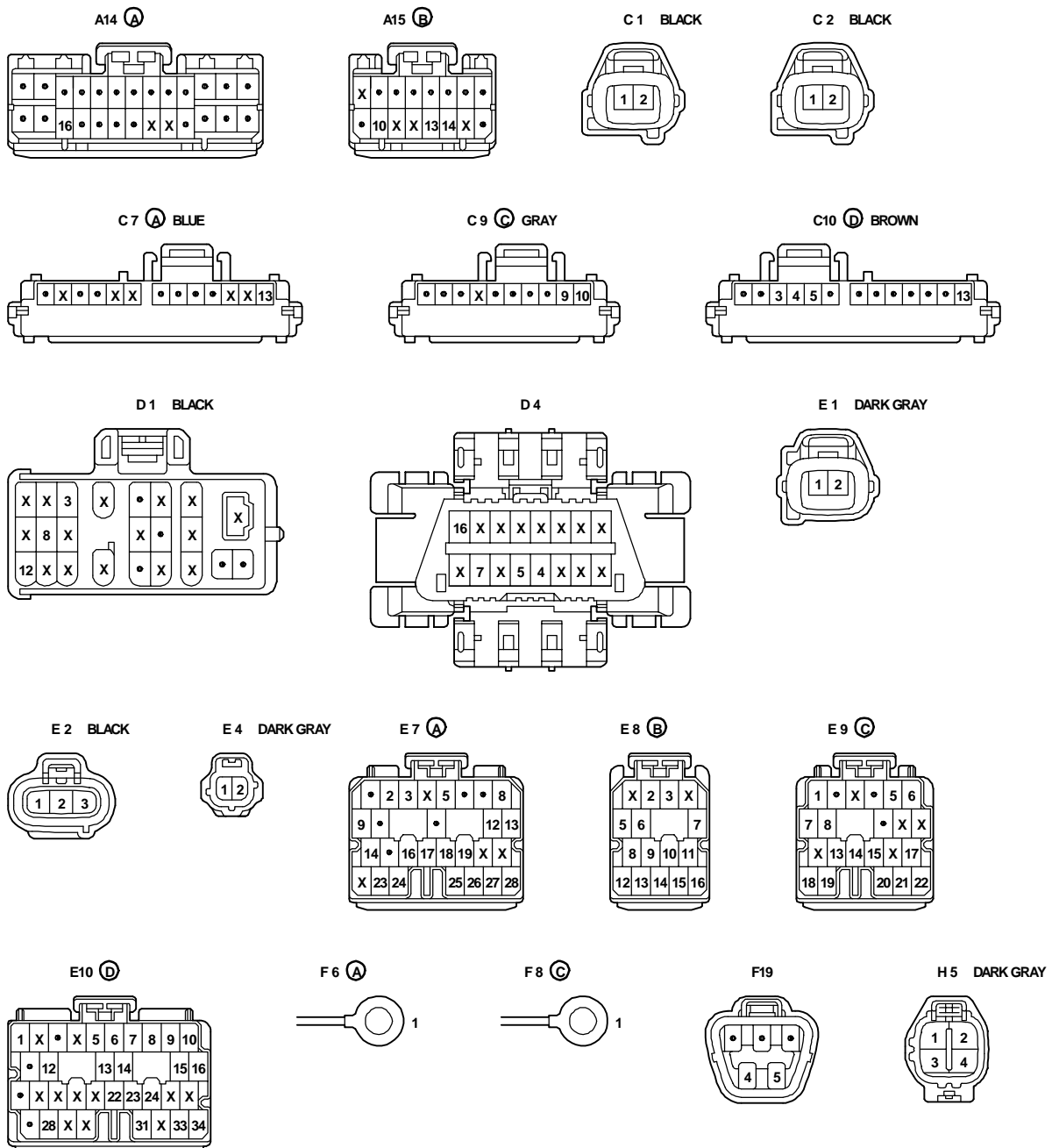
# ENGINE CONTROL

## ▽ : GROUND POINTS

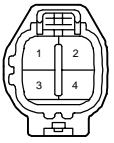
| CODE | SEE PAGE | GROUND POINTS LOCATION       |
|------|----------|------------------------------|
| EC   | 34       | LEFT RADIATOR SIDE SUPPORT   |
| ED   | 34       | SURGE TANK RH                |
| EE   | 34       | REAR SIDE OF SURGE TANK      |
| II   | 36       | INSTRUMENT PANEL BRACE LH    |
| IJ   | 36       | INSTRUMENT PANEL BRACE RH    |
| BN   | 40       | UNDER THE LEFT CENTER PILLAR |

## ○ : SPLICE POINTS

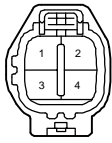
| CODE | SEE PAGE | WIRE HARNESS WITH SPLICE POINTS | CODE | SEE PAGE | WIRE HARNESS WITH SPLICE POINTS |
|------|----------|---------------------------------|------|----------|---------------------------------|
| I 5  | 38       | ENGINE WIRE                     | I 11 | 38       | INSTRUMENT PANEL WIRE           |
| I 6  |          |                                 |      |          |                                 |



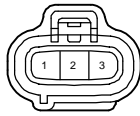
H 6 DARK GRAY



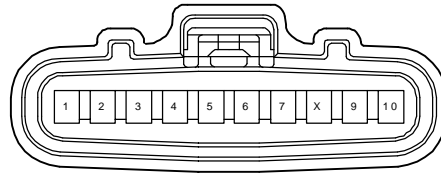
H10 DARK GRAY



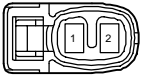
I 1 GRAY



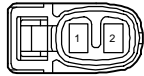
I 2 BLACK



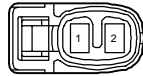
I 3 BLACK



I 4 BLACK



I 5 BLACK



I 6 GRAY



I 7 GRAY



I 8 GRAY



I 9 GRAY



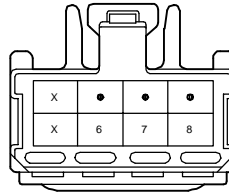
I10 GRAY



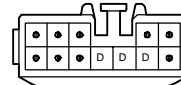
I11 GRAY



I13

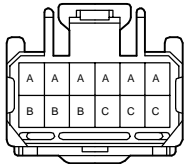


J 4 BLACK



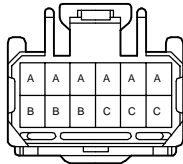
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J 8 (A) GRAY



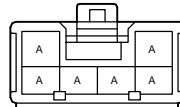
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J 9 (B) GRAY



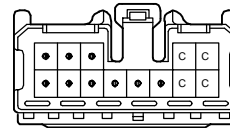
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J15



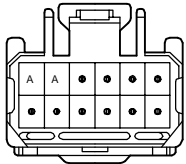
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J17 BLUE



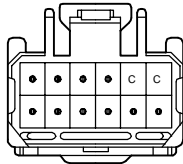
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J18 (A) BLACK



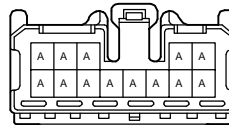
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J19 (B) BLACK



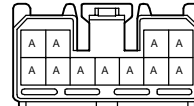
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J22 ORANGE



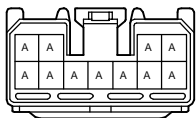
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J23



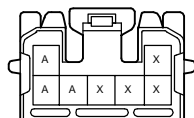
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J24



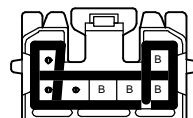
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J25



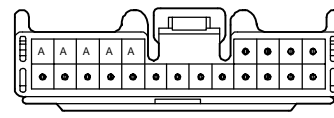
(HINT : SEE PAGE 7)

J26



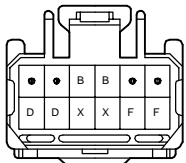
(HINT : SEE PAGE 7)

J27



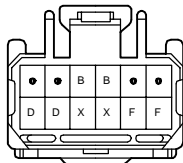
(HINT : SEE PAGE 7)

J28 (A)

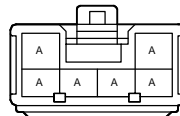


(HINT : SEE PAGE 7)

J29 (B)



J37



K 1 DARK GRAY



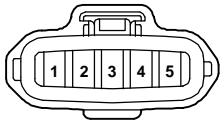
K 2 DARK GRAY



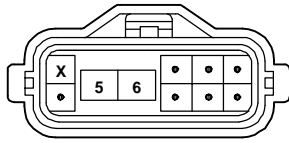
# ENGINE CONTROL

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M 1 BLACK



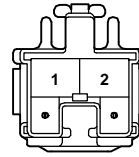
P 1 GRAY



P 2 BLACK



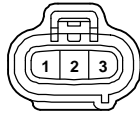
S10 BLUE



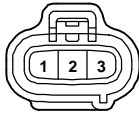
T 2 BLACK



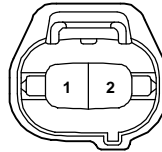
V 1 GRAY



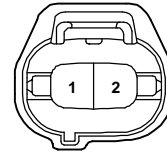
V 2 BLACK



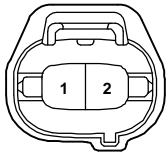
V 4 BROWN



V 5 BLUE



V 6 BROWN



V 7 BLUE

