# Training Notes

## Practical Electrical Training

DUKE

RC

KTM

# NOTICE

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# INSIDE THE BOOK

# Specifications

| Item | Standard |
|---|---|
| **Battery** | |
|     Type | Sealed Battery  Valve Regulated Lead Acid Battery (VRLA) |
|     Capacity | 12V 8 Ah. |
| **Charging System** | |
|     Type | Three-phase AC |
|     Alternator Output Voltage | 40V or more at 4 000 r/min (rpm) |
|     Stator Coil Resistance | $\leq 1 \ \Omega$ at $20^0$C |
|     Charging Voltage | 14.0~14.6 V |
|     (Regulator/Rectifier Output Voltage) | |
| **Ignition System** | |
|     Crankshaft Sensor (Pick-up coil) Resistance | $365 \pm 20 \ \Omega$ |
|     Ignition coil (H.T coil) | |
|     Primary Winding Resistance | $0.8 \sim 1.2 \ \Omega$ |
|     Secondary Winding Resistance | $4.2 \sim 6.5$ K $\Omega$ |
| **Spark Plug:** | |
|     Gap | 0.7~0.8 mm  (Till MY 14),  1mm (MY 15) |
| **Electric Starter System** | |
|     Current Drawn | Less then 65Amps (KTM 200),  Less then 35Amps (KTM 390/250) |
| **Switches and Fuel level sensors** | |
|     Rear brake light switch timing | ON after about 10 mm of pedal travel |
|     Engine oil pressure switch connections | When engine is stopped continuity : ON |
| | When engine is running continuity : OFF |
|     Fuel level sensor resistance : | 10 ($\pm$2) $\Omega$ |
|         Full position | 110 ($\pm$3) $\Omega$ |
|         Empty position | |
| **Starter relay** | |
|     Starter relay resistance | $3.9 \pm 0.4 \ \Omega$ |
| **Relay** | |
|     Relay resistance | 90~110 $\Omega$ |
| **Horn** | |
|     Current drawn | $3.0 \pm 0.3$ amp. |
| **Radiator Fan** | |
|     Current drawn | 3.0 amp. max |
| **Side stand switch** | |
|     Output voltage | Stand down condition : 3.7 V (D&F tool) |
| | Stand up condition    : 1.7 V (D&F tool) |
| **Water temperature sensor** | |
|     Check Resistance | (x 1 K $\Omega$ ) at $25^0$C  ( P/L- Y/W) : 1.88 ~ 2.12 K $\Omega$ |

# Basic Concept of Electricity

### Electrical Charge

Electricity is the movement of electrons. Electrons create charge, which we can harness to do work. Your lightbulb, your stereo, your phone, etc., are all harnessing the movement of the electrons in order to do work. They all operate using the same basic power source: the movement of electrons.

The three basic principles for this tutorial can be explained using electrons, or more specifically, the charge they create:

- **Current** is the rate at which charge is flowing.
- **Resistance** is a material's tendency to resist the flow of charge (current). More resistance less the current flow.
- **Voltage** is the difference in charge between two points.

Hot the temp., low is resistance.
Cold the temp., High is resistance.

- **Pressure** = Voltage (measured in Volts).
- **Flow** = Current (measured in Amperes, or "Amps" for short).
- **Hose Width** = Resistance (measured in Ohm).

**Thicker the wire – less is resistance, more is current flow.**
**Thine the wire – More is resistance, less is current flow.**

**Resistors :** Components used to resist or restrict flow of current

| | | |
|---|---|---|
| Resistor | - | Fixed Value |
| Resistor network | - | Array of resistors in one package. |
| Potentiometer or Rheostat | - | Variable Resistor. |
| Heater | - | Heating Element. |
| Resistance wire | - | Wire of high resistance material, similar to heating element. |
| Thermistor | - | Temperature – varied resistor. |
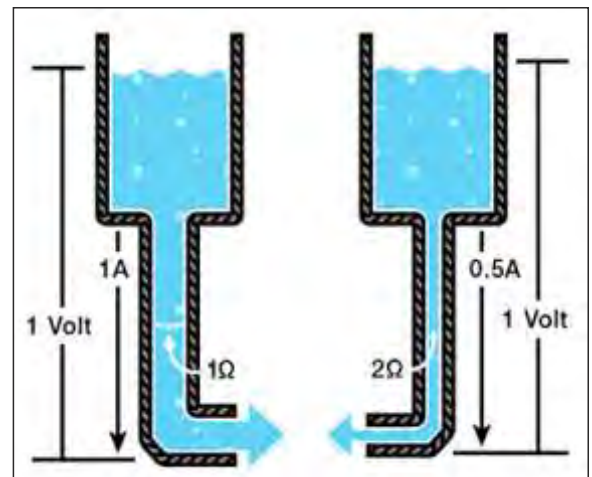
### Understanding & Usage of Multi meter

- Red meter lead Is connected to Voltage/Resistance or amperage port Is considered the positive connection.
- Probes Are the handles used to hold tip on the tested connection.
- Tips Are at the end of the probe and provides a connection point.
- Black meter lead Is always connected to the common port Is considered the negative connection.

### Multi meter symbols

| | | | |
|---|---|---|---|
| − | AC Voltage | ⏚ | Ground |
| = | DC Voltage | ⊣⊢ | Capacitor |
| Hz | Hertz | µF | MicroFarad |
| + | Positive | µ | Micro |
| − | Negative | m | Milli |
| Ω | Ohms | M | Mega |
| ⧻ | Diode | K | Kilo |
| •))) | Audible Continuity | OL | Overload |

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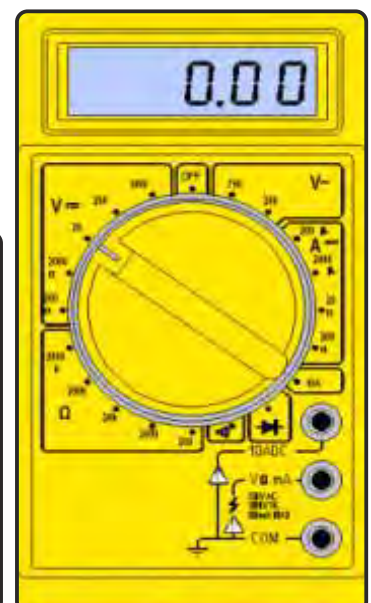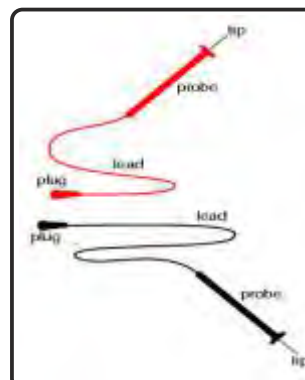
# Basic Concept of Electricity

**Charging Current Inspection**



25.18

9 volts

circuit current now has to go through the meter

**Black wire**

**Red wire**
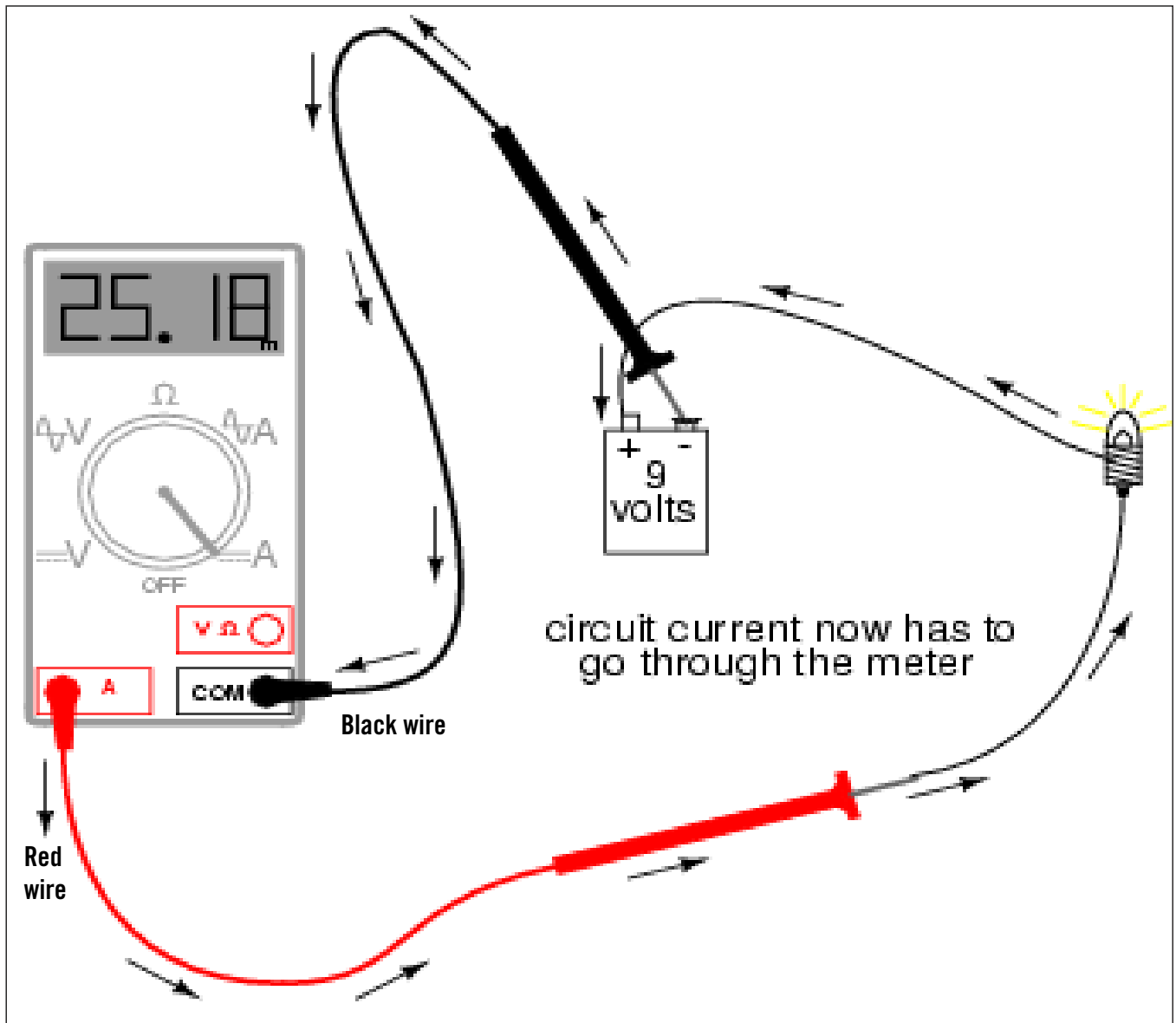
# Basic Concept of Electricity

## Wires Colour Code Identify

| Colour Code | |
|---|---|
| R | Red |
| W | White |
| B | Black |
| O | Orange |
| L | Blue |
| G | Green |
| Gr | Gray |
| Br | Brown |
| Pi | Pink |
| Y | Yellow |
| V | Violet |
| Lg | Light Green |
| R/W | Red/White |

Exercise : wire Identify :

Colour code
Br/L :
Gr/G:
Br/R :
B/Y :
R/W :
Br/W:
L/G :
O/W :
W/B :
Gr/L :
Y/R :
W/G :
V/B :
Pi/L :
W/Y :

R/W wire: 80% red colour & 20% white colour in wire (approx.)

**R/W wire** : 80% red colour and 20% white colour in wire (Approx.)

## Significance of Wire Colour Codes

| Wire colour | Standard | Condition | Tool to be used |
|---|---|---|---|
| Black wire | Used for frame earthing | | |
| Yellow black | Used for FI components earthing | | |
| Black yellow | Used for DC components earthing | | |
| Red wire | 12 V carry from battery to main fuse, ABS fuse and starter relay. | Without ignition switch ON | Multi-meter |
| White–black wire | 12 V carry from fuse box 1 | Without ignition switch ON | Multi-meter |
| White wire | 12 V carry from fuse box 2 | Without ignition switch ON | Multi-meter |
| Brown–blue wire | 12 V carry from ignition switch | After ignition switch ON | Multi-meter |
| Brown wire | 12 V carry from fuse 6 to DC components | After ignition switch ON | Multi-meter |
| Gray and green wires | 12 V carry from LH control switch to front and rear indicator | After ignition switch ON | Multi-meter |
| Gray –red wire | 12 V carry from Kill switch | After kill switch ON | Multi-meter |
| Pink–Blue | FI Earthing | After kill switch ON | Multi-meter |

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# Fuse Box Explanation & Electrical Circuits

| Electrical system MY17 250 Duke : Fuse Box | | |
|---|---|---|
| **INPUT** | **FUSE BOX** | **OUTPUT** |
| 12V (Battery voltage)<br>Battery Voltage Input- "R" wire -when battery connected | **Fuse 1**<br>**30 Amp Main fuse** | "W/B" wire to Ignition switch, Termination unit,<br>Fuse box-2, Fuse box-3, Fuse box -5, Fuse box-9 and 2 "W/B" wire to<br>Regulator Assly 12V - As soon as battery is connected. |
| 12V (Battery voltage)<br>Output of Main Fuse "W/B"-As soon as battery is connected | **Fuse 2**<br>**10 Amp Speedometer** | "W" to Speedometer(pin 1),1 wire to  Immobilizer(Alarm)pin 8 12V<br>without ignition switch ON |
| 12V (Battery voltage)<br>Output of Main Fuse "W/B"-As soon as battery is connected | **Fuse 3**<br>**10 Amp Main relay** | "R/W" 2 wires to Main 12V Withoutignition switch ON. |
| 12V (Battery voltage)<br>**"Br/L" Output of Ignition Switch post switch is made ON** | **Fuse 4**<br>**15 Amp HT coil,** | "O/W" wire to Ignition Coil(HT coil), **Horn, Fuel pump relay , Intermediate _ Starter relay** 12V post ignition switch ON |
| 12V (Battery voltage)<br>Output of Main Fuse "W/B"-As soon as battery is connected | **Fuse 5**<br>**10 Amp Radiator fan** | "O"- wire to Radiator Fan Relay 12V<br>without ignition switch ON |
| 12V (Battery voltage)<br>**"Br/L" Output of Ignition Switch post switch is made ON** | **Fuse 6**<br>**15 Amp All lighting loads** | "Br" wire to LH control switch, Front Brake Switch, Vehicle **Speed sensor**,<br>Rear Brake Switch,  Flasher, Tail Lamp,Number plate lamp, Pilot lamp, 2<br>wire Hi/Low beam relay 12V when ignition switch ON |
| 12V (Battery voltage)<br>**"Br/L" Output of Ignition Switch post switch is made ON** | **Fuse 7**<br>**10Amp**<br>**ABS ECU** | **"Gr/Pi" signal to Speedometer pin 11**, Immobilizerpin 14, Can Interface<br>12V when IGN switch ON |
| 12V (Battery voltage)<br>**"Br/L" Output of Ignition Switch post switch is made ON** | **Fuse 8**<br>**10 Amp.**<br>**Kill switch** | "Gr/L" signal to  Immobilizerpin12 through (Br/L-Gr/R) pin 19  to Kill<br>Switch 12V when IGN switch ON . |
| 12 V (Battery voltage)<br>Output of Main Fuse "W/B"-As soon as battery is connected | **Fuse 9**<br>**10 Amp  Accessories 1** | "Y/Gr"  signal to Accessories 1, 12V -As soon as battery is connected. |
| 12 V (Battery voltage)<br>"Br/L" output of ignition switch post switch is made ON | **Fuse 10**<br>**10 Amp  Accessories 2** | 2 wire "Y/R"  signal to Accessories 2, 12V when IGN switch ON |

# Fuse Box Explanation & Electrical Circuits

| | Electrical system MY17 390 Duke : Fuse Box | |
|---|---|---|
| **INPUT** | **FUSE BOX** | **OUTPUT** |
| 12V (Battery voltage)<br>Battery Voltage Input- "R" wire -when battery connected | **Fuse 1**<br>**30 Amp Main fuse** | "W/B" wire to Ignition switch, Termination unit,<br>**Head lamp** , Fuse box-2,Fuse box-3 ,Fuse box-5, Fuse box-9 and 2<br>"W/B" wire to Regulator Assly 12V-As soon as battery is connected. |
| 12V (Battery voltage)<br>Output of Main Fuse "W/B"-As soon as battery is connected | **Fuse 2**<br>**10 Amp Speedometer** | **2 "W" to Speedometer(pin 24& 25),**1 wire to  Security system(Alarm) pin<br>8 12V without ignition switch ON |
| 12V (Battery voltage)<br>Output of Main Fuse "W/B"-As soon as battery is connected | **Fuse 3**<br>**10 Amp Main relay** | "R/W" 2 wires to Main 12V Withoutignition switch ON. |
| 12V (Battery voltage)<br>**"Br/L" Output of Ignition Switch post switch is made ON** | **Fuse 4**<br>**15 Amp HT coil,** | "O/W" wire to Ignition Coil(HT coil)**Horn, Fuel pump relay , Intermediate**<br>**_ Starter relay** 12V post ignition switch ON |
| 12V (Battery voltage)<br>Output of Main Fuse "W/B"-As soon as battery is connected | **Fuse 5**<br>**10 Amp Radiator fan** | "O"- wire to Radiator Fan Relay 12V<br>without ignition switch ON |
| 12V (Battery voltage)<br>**"Br/L" Output of Ignition Switch post switch is made ON** | **Fuse 6**<br>**15 Amp All lighting loads** | "Br" wire to LH control switch, Front Brake Switch, Head light, Rear Brake<br>Switch,  Flasher, Tail Lamp, Number plate lamp 12V when ignition switch<br>ON |
| 12V (Battery voltage)<br>**"Br/L" Output of Ignition Switch post switch is made ON** | **Fuse 7**<br>**10Amp**<br>**ABS ECU** | "Gr/Pi" signal to Speedometer pin 34,Security system(Alarm) pin14, ABS<br>ECU Pin 4, Can Interface 12V when IGN switch ON |
| 12V (Battery voltage)<br>**"Br/L" Output of Ignition Switch post switch is made ON** | **Fuse 8**<br>**10 Amp.**<br>**Kill switch** | "Gr/L" signal to  Security system(Alarm) pin12 through (Br/L-Gr/R) to Kill<br>Switch 12V when IGN switch ON . |
| 12 V (Battery voltage)<br>Output of Main Fuse "W/B"-As soon as battery is connected | **Fuse 9**<br>**10 Amp  Accessories 1** | "Y/Gr"  signal to Accessories 1, 12V -As soon as battery is connected. |
| 12 V (Battery voltage)<br>"Br/L" output of ignition switch post switch is made ON | **Fuse 10**<br>**10 Amp  Accessories 2** | 2 wire "Y/R"  signal to Accessories 2, 12V when IGN switch ON |

# Fuse Box Explanation & Electrical Circuits

| Electrical system MY16 390-Duke : Fuse Box | | |
|---|---|---|
| **INPUT** | **FUSE BOX** | **OUTPUT** |
| 12V (Battery voltage) Battery Voltage Input- "R" wire -when battery connected | Fuse 1 30 Amp Main fuse | "W/B" wire to Ignition switch, Termination unit, Fuse box-2, Fuse box-3 and Fuse box -5 and 2 "W/B" wire to Regulator Assly 12V -As soon as battery is connected. |
| 12V (Battery voltage) Output of Main Fuse "W/B"-As soon as battery is connected | Fuse 2 15 Amp Immobilizer, speedometer | "W"-Speedometor, Immobilizer 12V without IGN switch ON |
| 12V (Battery voltage) Output of Main Fuse "W/B"-As soon as battery is connected | Fuse 3 15Amp Main relay, Fuel pump relay | "R/W" 2 wires to Main Relay, 1 wire to Fuel Pump Relay 12V Without IGN switch ON |
| 12V (Battery voltage) Input of RH control switch (Kill Switch) "Gr/L" from IGN switch through Immobilizer (Br/L-Gr/L), post IGN switch ON | Fuse 4, 15 Amp HT coil, Security alarm, Starter switch | "O/W" Immobilizer 14, Ignition Coil, 12V post IGN switch ON |
| 12V (Battery voltage) Output of Main Fuse "W/B"-As soon as battery is connected | Fuse 5 15 Amp Radiator fan | "O"- wire to Radiator Fan Relay 12V without IGN switch ON |
| 12V (Battery voltage) "Br/L" Output of Ignition Switch post switch is made ON | Fuse 6 15 Amp All lighting loads, horn, CAN interface | "Br"- Can_ Interface, Horn, Front Brake Switch, 2 wires to Head light control unit, Rear Brake Switch, Flasher, Pass Switch 12V when IGN switch ON |
| 12V (Battery voltage) "Br/L" Output of Ignition Switch post switch is made ON | Fuse 7 10Amp ABS ECU | "Gr/G" signal to ABS ECU pin 4 12V when IGN switch ON |
| 12V (Battery voltage) "Gr/R" output from kill switch-when kill switch is made ON | Fuse 8, 10 Amp EMS ECU, Speedometer, Auxiliary relays, fuel pump relay. | "Gr/Pi" signal to Main ECU pin 9,Fuel pump relay, Aux_starter relay 1, 2 wire to Aux_starter relay 2 and signal to Meter via pin 11 12V when Kill Switch is made ON |
| 12 V (Battery voltage) "Br/L" output of ignition switch post switch is made ON | Fuse 9 10 Amp Acc 2 | "Y/R" signal to Accessories 2 When kill switch is made ON |

| Electrical system MY16 200-Duke : Fuse Box | | |
|---|---|---|
| **INPUT** | **FUSE BOX** | **OUTPUT** |
| 12V (Battery voltage) Battery Voltage Input- "R" wire -when battery connected | Fuse 1 30 Amp Main fuse | "W/B" wire to Ignition switch, Termination unit, Fuse box-2, Fuse box-3 and Fuse box -5 and 2 "W/B" wire to Regulator Assly 12V -As soon as battery is connected. |
| 12V (Battery voltage) Output of Main Fuse "W/B"-As soon as battery is connected | Fuse 2 15 Amp Immobilizer, speedometer | "W"-Speedometor, Immobilizer 12V without IGN switch ON |
| 12V (Battery voltage) Output of Main Fuse "W/B"-As soon as battery is connected | Fuse 3 15Amp Main relay, Fuel pump relay | "R/W" 2 wires to Main Relay, 1 wire to Fuel Pump Relay 12V Without IGN switch ON |
| 12V (Battery voltage) Input of RH control switch (Kill Switch) "Gr/L" from IGN switch through Immobilizer (Br/L-Gr/L), post IGN switch ON | Fuse 4, 15 Amp HT coil, Security alarm, Starter switch | "O/W" Immobilizer 14, Ignition Coil, 12V post IGN switch ON |
| 12V (Battery voltage) Output of Main Fuse "W/B"-As soon as battery is connected | Fuse 5 15 Amp Radiator fan | "O"- wire to Radiator Fan Relay 12V without IGN switch ON |
| 12V (Battery voltage) "Br/L" Output of Ignition Switch post switch is made ON | Fuse 6 15 Amp All lighting loads, horn, CAN interface | "Br"- Can_ Interface, Horn, Front Brake Switch, 2 wires to Head light control unit, Rear Brake Switch, Flasher, Pass Switch 12V when IGN switch ON |
| | Fuse 7 10Amp | |
| 12V (Battery voltage) "Gr/R" output from kill switch-when kill switch is made ON | Fuse 8, 10 Amp EMS ECU, Speedometer, Auxiliary relays, fuel pump relay. | "Gr/Pi" signal to Main ECU pin 9,Fuel pump relay, Aux_starter relay 1, 2 wire to Aux_starter relay 2 and signal to Meter via pin 11 12V when Kill Switch is made ON |
| 12 V (Battery voltage) "Br/L" output of ignition switch post switch is made ON | Fuse 9 10 Amp Acc 2 | "Y/R" signal to Accessories 2 When kill switch is made ON |

# Fuse Box Explanation & Electrical Circuits

| Electrical system MY15 390-Duke : Fuse Box | | |
|---|---|---|
| **INPUT** | **FUSE BOX** | **OUTPUT** |
| 12V (Battery voltage)<br>Battery Voltage Input- "R" wire -when battery connected | Fuse 1<br>30 Amp Main fuse | "W/B" wire to Ignition switch, Termination unit, Fuse box-2, Fuse box-3 and Fuse box -5 and 2 "W/B"<br>wire to Regulator Assly 12V -As soon as battery is connected. |
| 12V (Battery voltage)<br>Output of Main Fuse "W/B"-As soon as battery is connected | Fuse 2<br>15 Amp Immobilizer, speedometer | "W"-Speedometor, Immobilizer 12V without IGN switch ON |
| 12V (Battery voltage)<br>Output of Main Fuse "W/B"-As soon as battery is connected | Fuse 3<br>15Amp Main relay, Fuel pump relay | "R/W" 2 wires to Main Relay, 1 wire to<br>Fuel Pump Relay 12V Without IGN switch ON |
| 12V (Battery voltage)<br>"Gr/L" from IGN switch through Immobilizer<br>(Br/L-Gr/L) post IGN switch ON | Fuse 4<br>15 Amp HT coil, Security alarm, Starter switch | "O/W"- RH control switch (Kill Switch),<br>Immobilizer 14, Ignition Coil, 12V post IGN switch ON |
| 12V (Battery voltage)<br>Output of Main Fuse "W/B"-As soon as battery is connected | Fuse 5<br>15 Amp Radiator fan | "O"- wire to Radiator Fan Relay 12V<br>without IGN switch ON |
| 12V (Battery voltage)<br>"Br/L" Output of Ignition Switch post switch is made ON | Fuse 6<br>15 Amp All lighting loads, horn, CAN interface | "Br"- Can_ Interface, Horn, Front Brake Switch,<br>2 wires to Head light control unit, Rear Brake Switch,<br>Flasher, Pass Switch 12V when IGN switch ON |
| 12V (Battery voltage)<br>"Br/L" Output of Ignition Switch post switch is made ON | Fuse 7<br>10Amp ABS ECU | "Gr/G" signal to ABS ECU pin 4 12V when IGN switch ON |
| 12V (Battery voltage)<br>"Gr/R" output from kill switch-when kill switch is made ON | Fuse 8, 10 Amp EMS ECU, Speedometer, Auxiliary relays, fuel pump relay. | "Gr/Pi" signal to Main ECU pin 9,Fuel pump relay, Aux_starter relay 1, 2 wire to Aux_starter relay 2 and signal to Meter via pin 11 12V when Kill Switch is made ON |
|  | Fuse 9<br>10 Amp  Acc 2 |  |

| Electrical system MY15 200-Duke : Fuse Box | | |
|---|---|---|
| **INPUT** | **FUSE BOX** | **OUTPUT** |
| 12V (Battery voltage)<br>Battery Voltage Input- "R" wire -when battery connected | Fuse 1<br>30 Amp Main fuse | "W/B" wire to Ignition switch, Termination unit, Fuse box-2, Fuse box-3 and Fuse box -5 and 2 "W/B"<br>wire to Regulator Assly 12V -As soon as battery is connected. |
| 12V (Battery voltage)<br>Output of Main Fuse "W/B"-As soon as battery is connected | Fuse 2<br>15 Amp Immobilizer, speedometer | "W"-Speedometor, Immobilizer 12V without IGN switch ON |
| 12V (Battery voltage)<br>Output of Main Fuse "W/B"-As soon as battery is connected | Fuse 3<br>15Amp Main relay, Fuel pump relay | "R/W" 2 wires to Main Relay, 1 wire to<br>Fuel Pump Relay 12V Without IGN switch ON |
| 12V (Battery voltage)<br>"Gr/L" from IGN switch through Immobilizer<br>(Br/L-Gr/L) post IGN switch ON | Fuse 4<br>15 Amp HT coil, Security alarm, Starter switch | "O/W"- RH control switch (Kill Switch),<br>Immobilizer 14, Ignition Coil, 12V post IGN switch ON |
| 12V (Battery voltage)<br>Output of Main Fuse "W/B"-As soon as battery is connected | Fuse 5<br>15 Amp Radiator fan | "O"- wire to Radiator Fan Relay 12V<br>without IGN switch ON |
| 12V (Battery voltage)<br>"Br/L" Output of Ignition Switch post switch is made ON | Fuse 6<br>15 Amp All lighting loads, horn, CAN interface | "Br"- Can_ Interface, Horn, Front Brake Switch,<br>2 wires to Head light control unit, Rear Brake Switch,<br>Flasher, Pass Switch 12V when IGN switch ON |
|  | Fuse 7<br>10Amp |  |
| 12V (Battery voltage)<br>"Gr/R" output from kill switch-when kill switch is made ON | Fuse 8, 10 Amp EMS ECU, Speedometer, Auxiliary relays, fuel pump relay. | "Gr/Pi" signal to Main ECU pin 9,Fuel pump relay, Aux_starter relay 1, 2 wire to Aux_starter relay 2 and signal to Meter via pin 11 12V when Kill Switch is made ON |
|  | Fuse 9<br>10 Amp  Acc 2 |  |

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# Fuse Box Explanation & Electrical Circuits

| Electrical system MY14 Duke 390 : Fuse Box | | |
|---|---|---|
| **INPUT** | **FUSE BOX** | **OUTPUT** |
| Battery Voltage Input- "R" wire | Fuse 1<br>30 Amp<br>Main fuse | "W/B" wire to Ignition switch, Termination unit.<br>Fuse box-2, Fuse box 3 and Fuse box 5. |
| Output of Main Fuse "W/B" | Fuse 2<br>15 Amp Immobilizer,<br>Seat Switch | "W"- Hi-Beam Relay, Meter, Immobilizer, and<br>Can (D&F tool coupler).<br>12V without IGN switch ON |
| Output of Main Fuse "W/B" | Fuse 3<br>15Amp<br>Main relay ECU | "R/W" 2 wires to Power Relay, 1-Pump Relay.<br>12 V without IGN switch ON |
| "Gr/L" from IGN switch through Immobilizer (Br/L-Gr/L) | Fuse 4<br>15 Amp<br>HT coil | "O/W"- Kill Switch, Immobilizer 14, Ignition Coil,<br>1 wire Aux Relay 1, 2 Inputs Aux Relay 2.<br>12 V post IGN switch ON |
| Output of Main Fuse "W/B" | Fuse 5<br>15 Amp Radiator fan | "O"- wire to Fan Relay.<br>12V without IGN switch ON |
| "Br/L" Output of Ignition Switch post switch is made ON | Fuse 6<br>15 Amp Head light control<br>unit + Other loads | "Br"- 2 wires to Head light control unit, Front Brake Switch,<br>Rear Brake Switch, Horn, Flasher, Pass Switch.<br>12 V when IGN switch ON |
| "Gr/R" Output from Kill Switch - when Kill Switch<br>is made ON | FUSE 7<br>10 Amp<br>Main ECU +<br>Electrical Cluster | "Gr/Pi" signal to Main ECU pin 9 and signal to<br>Meter via pin 11.<br>12 V when Kill switch ON |
| "Gr/R" Output from Kill Switch - when Kill Switch<br>is made ON | FUSE 8<br>5 Amp<br>ABS ECU | "Gr/G" signal to ABS ECU pin 4.<br>12 V when Kill switch ON |

| Electrical system MY14 Duke 200 : Fuse Box | | |
|---|---|---|
| **INPUT** | **FUSE BOX** | **OUTPUT** |
| Battery Voltage Input- "R" wire | Fuse 1<br>30 Amp<br>Main fuse | "W/B" wire to Ignition switch, Termination unit.<br>Fuse box-2, Fuse box 3 and Fuse box 5. |
| Output of Main Fuse "W/B" | Fuse 2<br>15 Amp Immobilizer,<br>Seat Switch | "W"- Hi-Beam Relay, Meter, Immobilizer, and<br>Can (D&F tool coupler).<br>12V without IGN switch ON |
| Output of Main Fuse "W/B" | Fuse 3<br>15Amp<br>Main relay ECU | "R/W" 2 wires to Power Relay, 1-Pump Relay.<br>12 V without IGN switch ON |
| "Gr/L" from IGN switch through Immobilizer (Br/L-Gr/L) | Fuse 4<br>15 Amp<br>HT coil | "O/W"- Kill Switch, Immobilizer 14, Ignition Coil,<br>1 wire Aux Relay 1, 2 Inputs Aux Relay 2.<br>12 V post IGN switch ON |
| Output of Main Fuse "W/B" | Fuse 5<br>15 Amp Radiator fan | "O"- wire to Fan Relay.<br>12V without IGN switch ON |
| "Br/L" Output of Ignition Switch post switch is made ON | Fuse 6<br>15 Amp Head light control<br>unit + Other loads | "Br"- 2 wires to Head light control unit, Front Brake Switch,<br>Rear Brake Switch, Horn, Flasher, Pass Switch.<br>12 V when IGN switch ON |
| "Gr/R" Output from Kill Switch - when Kill Switch<br>is made ON | FUSE 7<br>10 Amp<br>Main ECU +<br>Electrical Cluster | "Gr/Pi" signal to Main ECU pin 9 and signal to<br>Meter via pin 11.<br>12 V when Kill switch ON |
| | FUSE 8<br>5 Amp<br>ABS ECU | |

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# Fuse Box Explanation & Electrical Circuits

| Electrical system MY17 RC 390 : Fuse Box | | |
|---|---|---|
| **INPUT** | | **OUTPUT** |
| 12V (Battery voltage)<br>Battery Voltage Input- "R" wire -when battery connected Battery Voltage Input- "R" wire | Fuse 1<br>30 Amp<br>MAIN FUSE | "W/B" wire to Ignition switch, Termination unit. Fuse box 2, Fuse box 3, Fuse box 5 and Fuse box 9, 2 wire Regulator unit.<br>12V - As soon as battery is connected. |
| 12V (Battery voltage)<br>Output of Main Fuse "W/B"-As soon as battery is connected | Fuse 2<br>10 Amp | "W"- Security system pin 8 (Alarm), Speedometer pin 1- 12V without ignition switch ON |
| 12V (Battery voltage)<br>Output of Main Fuse "W/B"-As soon as battery is connected | FUSE 3<br>10 Amp<br>MAIN RELAY | "R/W" 2 wires to Power(Main) Relay- 12 V without ignition switch ON |
| 12V (Battery voltage)<br>**"Br/L" Output of Ignition Switch post switch is made ON** | FUSE 4<br>15 Amp<br>HT COIL | **"O/W" wire to Ignition Coil(HT coil),Horn, Fuelpump relay , Intermediate _ Starter relay 12V post ignition switch ON** |
| 12V (Battery voltage)<br>Output of Main Fuse "W/B"-As soon as battery is connected | FUSE 5<br>10 Amp<br>RADIATOR FAN | "O"- wire to Radiator Fan Relay- 12V without ignition switch ON |
| 12V (Battery voltage)<br>"Br/L" Output of Ignition Switch post switch is made ON | FUSE 6<br>15 Amp | "Br"- 2 wires to LH control switch, Front Brake Switch, Rear Brake Switch, Horn, Flasher, Speedometer pin 15, Tail stop lamp, Rear number plate lamp -12 V when ignition switch ON |
| 12V (Battery voltage)<br>**"Br/L" Output of Ignition Switch post switch is made ON** | FUSE 7<br>10 Amp | "Gr/Pi" signal to Speedometer pin 11, Security system (Alarm) pin 14, ABS ECU Pin 4, Can Interface -12V when IGN switch ON**.** |
| 12V (Battery voltage)<br>**"Br/L" Output of Ignition Switch post switch is made ON** | FUSE 8<br>10 Amp | **"Gr/L" signal to Security system (Alarm) pin 12 through (Br/L-Gr/R) to Kill Switch - 12V when IGN switch ON.** |
| 12 V (Battery voltage)<br>Output of Main Fuse "W/B"-As soon as battery is connected | Fuse 9<br>10 Amp Accessories 1 | "Y/R" signal to Accessories 1<br>12V without ignition switch ON |
| 12 V (Battery voltage)<br>"Br/L" output of ignition switch post switch is made ON | Fuse 10<br>10 Amp Accessories 2 | "L/R" signal to Accessories 2<br>12 V post ignition switch ON |

# Fuse Box Explanation & Electrical Circuits

| Electrical system MY 16 RC 390 : Fuse Box | | |
|---|---|---|
| **INPUT** | **FUSE BOX** | **OUTPUT** |
| 12V (Battery voltage)<br>Battery Voltage Input- "R" wire -when battery connected<br>Battery Voltage Input- "R" wire | Fuse 1, 30 Amp<br>MAIN FUSE | "W/B" wire to Ignition switch, Termination unit.<br>Fuse box-2, Fuse box 3 and Fuse box 5.<br>12V -As soon as battery is connected. |
| 12V (Battery voltage)<br>Output of Main Fuse "W/B"-As soon as battery is connected | Fuse 2, 15 Amp<br>Immobilizer, Seat Switch | "W"- Hi-Beam Relay, Meter, Immobilizer, and Can<br>(D&F tool coupler). 12V without IGN switch ON |
| 12V (Battery voltage)<br>Output of Main Fuse "W/B"-As soon as battery is connected | Fuse 3, 15Amp<br>Main relay ECU | "R/W" 2 wires to Power Relay, 1-Pump Relay.<br>12 V without IGN switch ON |
| 12V (Battery voltage)<br>"Gr/L" from IGN switch through Immobilizer<br>(Br/L-Gr/L) post IGN switch ON | Fuse 4,<br>15 Amp<br>HT COIL | "O/W"- Kill Switch, Immobilizer 14, Ignition Coil,<br>1 wire Aux Relay 1, 2 Inputs Aux Relay 2.<br>12 V post IGN switch ON |
| 12V (Battery voltage)<br>Output of Main Fuse "W/B"-As soon as battery is connected | Fuse 5<br>15 Amp Radiator fan | "O"- wire to Radiator Fan Relay 12V<br>without IGN switch ON |
| 12V (Battery voltage)<br>"Br/L" Output of Ignition Switch post switch is made ON | Fuse 6, 15 Amp<br>Head Light Control Unit +<br>Other Loads | "Br"- 2 wires to Head light control unit,<br>Front Brake Switch, Rear Brake Switch, Horn, Flasher,<br>Pass Switch. 12 V when IGN switch ON |
| 12V (Battery voltage)<br>"Gr/R" output from kill switch-when kill switch is made ON | Fuse 7, 10 Amp, Main<br>ECU+Electrical Cluster | "Gr/Pi" signal to Main ECU pin 9 & signal to Meter via pin 11<br>12 V when Kill switch ON |
| 12V (Battery voltage)<br>"Gr/R" output from kill switch-when kill switch is made ON | Fuse 8, 5 Amp<br>ABS ECU | "Gr/G" signal to ABS ECU pin 4.<br>12 V when Kill switch ON |
| 12 V (Battery voltage)<br>Output of Main Fuse "W/B"-As soon as battery is connected | Fuse 9<br>10 Amp  Accessories 1 | "Y/R"  signal to Accessories 1<br>12V without ignition switch ON |
| 12 V (Battery voltage)<br>"Br/L" output of ignition switch post switch is made ON | Fuse 10<br>10 Amp  Accessories 2 | "L/R" signal to Accessories 2<br>When kill switch is made ON |

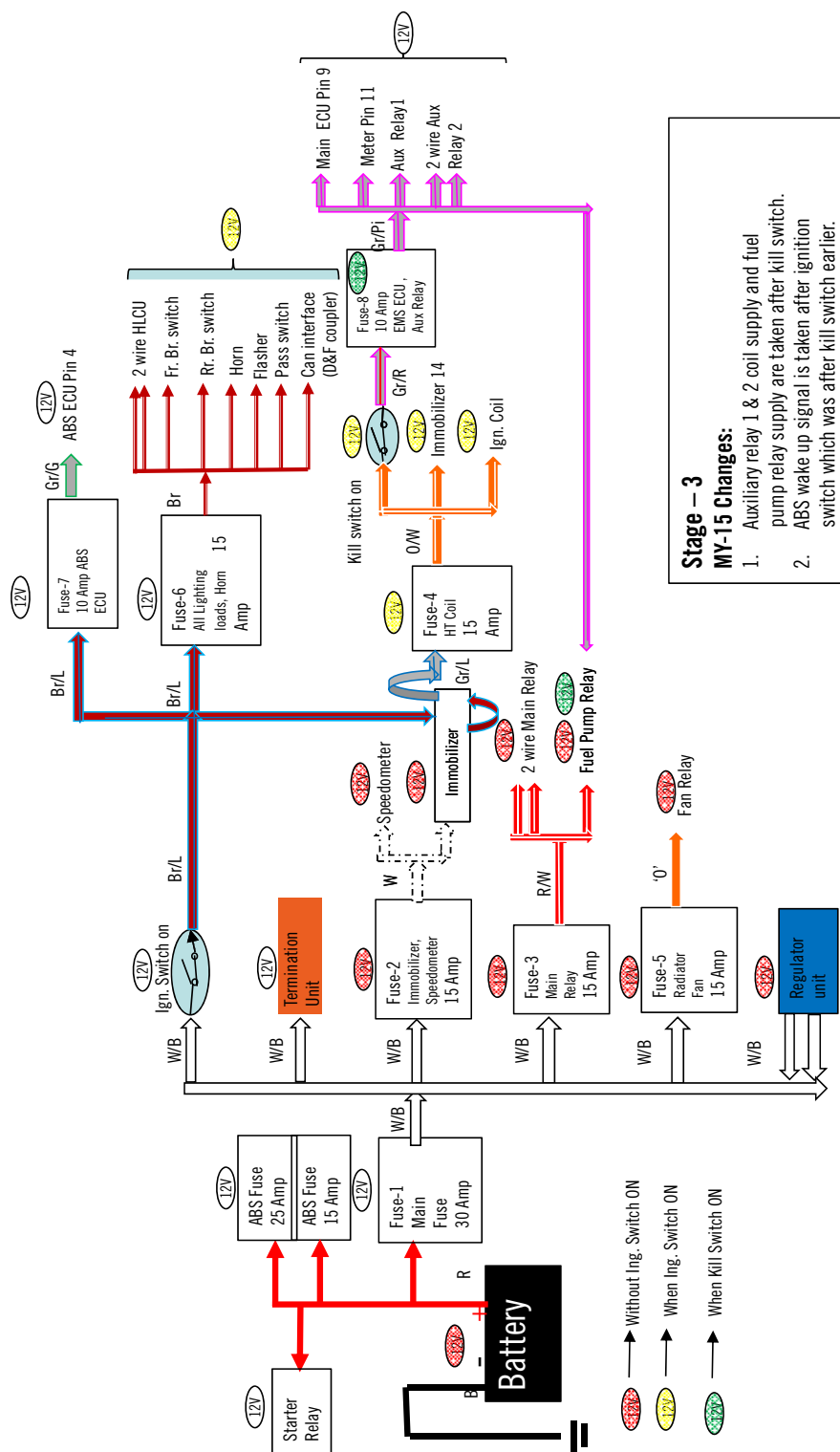| Electrical system MY 16 RC 200 : Fuse Box | | |
|---|---|---|
| **INPUT** | **FUSE BOX** | **OUTPUT** |
| 12V (Battery voltage)<br>Battery Voltage Input- "R" wire -when battery connected<br>Battery Voltage Input- "R" wire | Fuse 1, 30 Amp<br>MAIN FUSE | "W/B" wire to Ignition switch, Termination unit.<br>Fuse box-2, Fuse box 3 and Fuse box 5.<br>12V -As soon as battery is connected. |
| 12V (Battery voltage)<br>Output of Main Fuse "W/B"-As soon as battery is connected | Fuse 2, 15 Amp<br>Immobilizer, Seat Switch | "W"- Hi-Beam Relay, Meter, Immobilizer, and Can<br>(D&F tool coupler). 12V without IGN switch ON |
| 12V (Battery voltage)<br>Output of Main Fuse "W/B"-As soon as battery is connected | Fuse 3, 15Amp<br>Main relay ECU | "R/W" 2 wires to Power Relay, 1-Pump Relay.<br>12 V without IGN switch ON |
| 12V (Battery voltage)<br>"Gr/L" from IGN switch through Immobilizer<br>(Br/L-Gr/L) post IGN switch ON | Fuse 4,<br>15 Amp<br>HT COIL | "O/W"- Kill Switch, Immobilizer 14, Ignition Coil,<br>1 wire Aux Relay 1, 2 Inputs Aux Relay 2.<br>12 V post IGN switch ON |
| 12V (Battery voltage)<br>Output of Main Fuse "W/B"-As soon as battery is connected | Fuse 5<br>15 Amp Radiator fan | "O"- wire to Radiator Fan Relay 12V<br>without IGN switch ON |
| 12V (Battery voltage)<br>"Br/L" Output of Ignition Switch post switch is made ON | Fuse 6, 15 Amp<br>Head Light Control Unit +<br>Other Loads | "Br"- 2 wires to Head light control unit,<br>Front Brake Switch, Rear Brake Switch, Horn, Flasher,<br>Pass Switch. 12 V when IGN switch ON |
| 12V (Battery voltage)<br>"Gr/R" output from kill switch-when kill switch is made ON | Fuse 7, 10 Amp, Main<br>ECU+Electrical Cluster | "Gr/Pi" signal to Main ECU pin 9 & signal to Meter via pin 11<br>12 V when Kill switch ON |
|  | Fuse 8,<br>5 Amp |  |
| 12 V (Battery voltage)<br>Output of Main Fuse "W/B"-As soon as battery is connected | Fuse 9<br>10 Amp  Accessories 1 | "Y/R"  signal to Accessories 1<br>12V without ignition switch ON |
| 12 V (Battery voltage)<br>"Br/L" output of ignition switch post switch is made ON | Fuse 10<br>10 Amp  Accessories 2 | "L/R" signal to Accessories 2<br>When kill switch is made ON |

# Fuse Box Explanation & Electrical Circuits

| Electrical system MY 15 RC 390 : Fuse Box | | |
|---|---|---|
| **INPUT** | **FUSE BOX** | **OUTPUT** |
| Battery Voltage Input- "R" wire | Fuse 1 30 Amp MAIN FUSE | "W/B" wire to Ignition switch, Termination unit. Fuse box-2,Fuse box 3 and Fuse box 5. |
| Output of Main Fuse "W/B" | Fuse 2, 15 Amp IMMOBILIZER, SEAT SWITCH | "W"- Hi-Beam Relay, Meter, Immobilizer, and Can (D&F tool coupler). 12V without IGN switch ON |
| Output of Main Fuse "W/B" | FUSE 3, 15Amp MAIN RELAY ECU | "R/W" 2 wires to Power Relay, 1-Pump Relay. 12 V without IGN switch ON |
| "Gr/L" from IGN switch through Immobilizer (Br/L-Gr/L) | Fuse 4, 15 Amp HT COIL | "O/W"- Kill Switch, Immobilizer 14, Ignition Coil, 1 wire Aux Relay 1, 2 Inputs Aux Relay 2. 12 V post IGN switch ON |
| Output of Main Fuse "W/B" | Fuse 5 15 Amp Radiator fan | "O"- wire to Radiator Fan Relay 12V without IGN switch ON |
| "Br/L" Output of Ignition Switch post switch is made ON | Fuse 6, 15 Amp Head Light Control Unit + Other Loads | "Br"- 2 wires to Head light control unit, Front Brake Switch, Rear Brake Switch, Horn, Flasher, Pass Switch. 12 V when IGN switch ON |
| "Gr/R" output from kill switch-when kill switch is made ON | Fuse 7, 10 Amp, Main ECU+Electrical Cluster | "Gr/Pi" signal to Main ECU pin 9 & signal to Meter via pin 11 12 V when Kill switch ON |
| "Gr/R" output from kill switch-when kill switch is made ON | Fuse 8, 5 Amp ABS ECU | "Gr/G" signal to ABS ECU pin 4. 12 V when Kill switch ON |

| Electrical system MY 15 RC 200 : Fuse Box | | |
|---|---|---|
| **INPUT** | **FUSE BOX** | **OUTPUT** |
| Battery Voltage Input- "R" wire | Fuse 1 30 Amp MAIN FUSE | "W/B" wire to Ignition switch, Termination unit. Fuse box-2,Fuse box 3 and Fuse box 5. |
| Output of Main Fuse "W/B" | Fuse 2, 15 Amp IMMOBILIZER, SEAT SWITCH | "W"- Hi-Beam Relay, Meter, Immobilizer, and Can (D&F tool coupler). 12V without IGN switch ON |
| Output of Main Fuse "W/B" | FUSE 3, 15Amp MAIN RELAY ECU | "R/W" 2 wires to Power Relay, 1-Pump Relay. 12 V without IGN switch ON |
| "Gr/L" from IGN switch through Immobilizer (Br/L-Gr/L) | Fuse 4, 15 Amp HT COIL | "O/W"- Kill Switch, Immobilizer 14, Ignition Coil, 1 wire Aux Relay 1, 2 Inputs Aux Relay 2. 12 V post IGN switch ON |
| Output of Main Fuse "W/B" | Fuse 5 15 Amp Radiator fan | "O"- wire to Radiator Fan Relay 12V without IGN switch ON |
| "Br/L" Output of Ignition Switch post switch is made ON | Fuse 6, 15 Amp Head Light Control Unit + Other Loads | "Br"- 2 wires to Head light control unit, Front Brake Switch, Rear Brake Switch, Horn, Flasher, Pass Switch. 12 V when IGN switch ON |
| "Gr/R" output from kill switch-when kill switch is made ON | Fuse 7, 10 Amp, Main ECU+Electrical Cluster | "Gr/Pi" signal to Main ECU pin 9 & signal to Meter via pin 11 12 V when Kill switch ON |
| | Fuse 8, 5 Amp ABS ECU | |

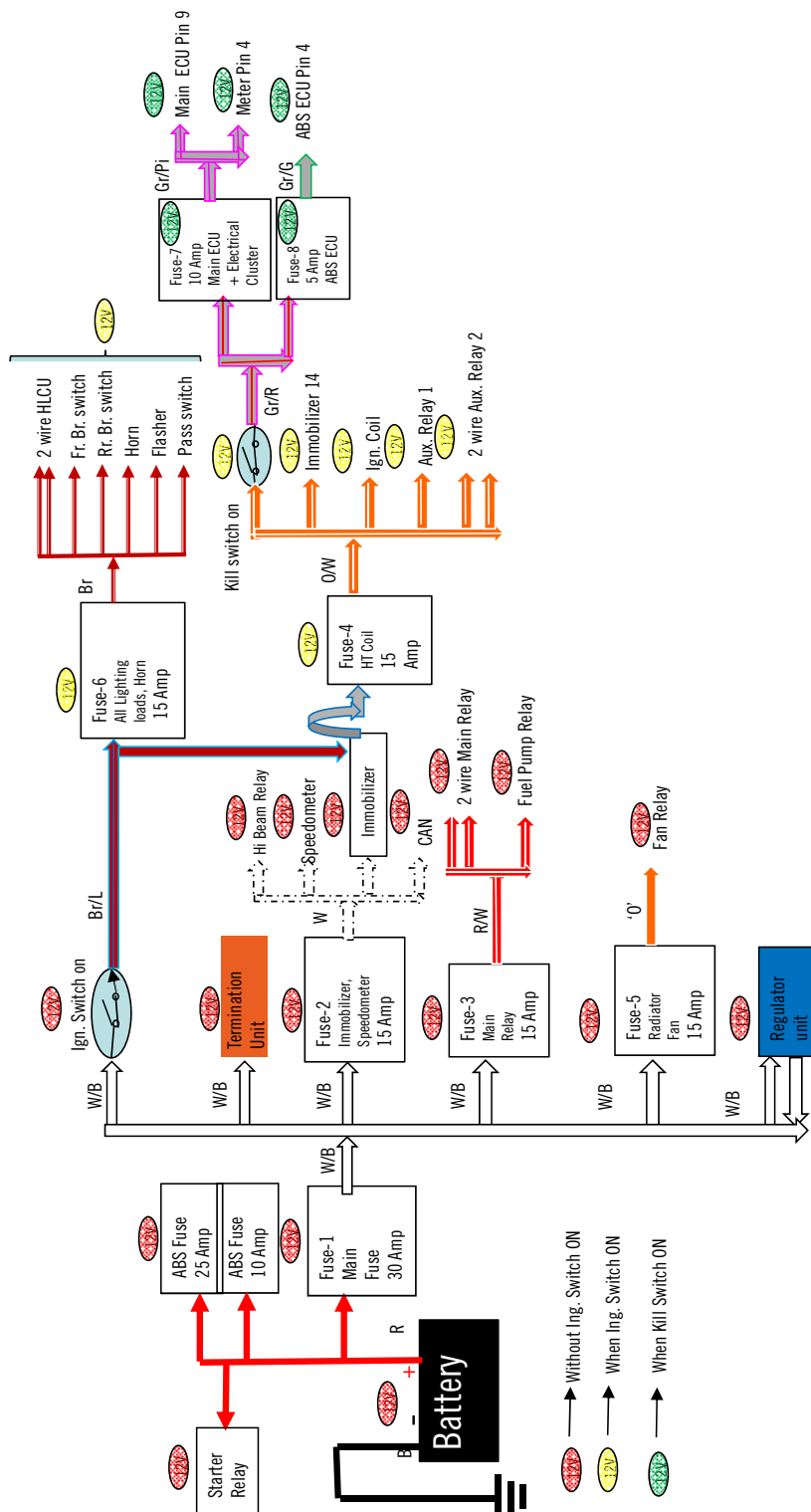# Fuse Box Explanation & Electrical Circuits

MY15 390 Duke condition based voltage flow.

Electrical System 390-Duke MY-15 : Current Flow; Stage 3 : Kill Switch ON.



**Stage – 3**
**MY-15 Changes:**
1. Auxiliary relay 1 & 2 coil supply and fuel pump relay supply are taken after kill switch.
2. ABS wake up signal is taken after ignition switch which was after kill switch earlier.

Main ECU Pin 9
Meter Pin 11
Aux Relay1
2 wire Aux Relay 2

ABS ECU Pin 4

2 wire HLCU
Fr. Br. switch
Rr. Br. switch
Horn
Flasher
Pass switch
Can interface (D&F coupler)

Gr/Pi

Fuse-8 10 Amp EMS ECU, Aux Relay

Gr/R
Immobilizer 14
Ign. Coil

Kill switch on

O/W

Gr/G

Fuse-7 10 Amp ABS ECU

Br

Fuse-6 All Lighting loads, Horn Amp 15

Fuse-4 HT Coil 15 Amp

Br/L

Br/L

Gr/L

Speedometer

Immobilizer

2 wire Main Relay

Fuel Pump Relay

Fan Relay

Br/L

Ign. Switch on

W

R/W

'O'

Termination Unit

Fuse-2 Immobilizer, Speedometer 15 Amp

Fuse-3 Main Relay 15 Amp

Fuse-5 Radiator Fan 15 Amp

Regulator unit

W/B
W/B
W/B
W/B
W/B
W/B

ABS Fuse 25 Amp
ABS Fuse 15 Amp

Fuse-1 Main Fuse 30 Amp

W/B

R

Battery

Starter Relay

B

Without Ing. Switch ON
When Ing. Switch ON
When Kill Switch ON

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# Fuse Box Explanation & Electrical Circuits

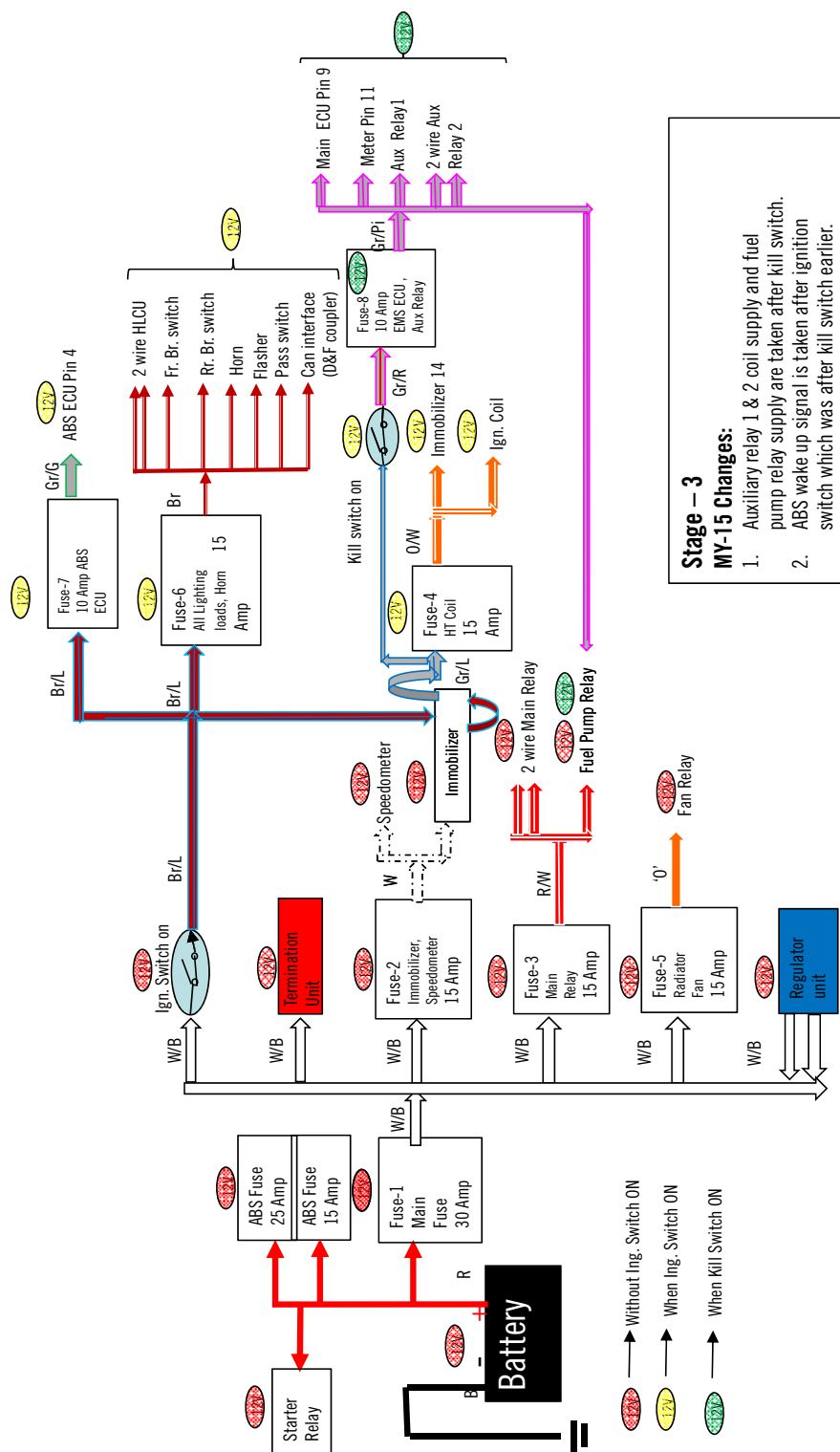MY15 RC-390 condition based voltage flow. / MY 14 Duke 390



Electrical System RC-390 MY-15 : Current Flow ; Stage 3 : Kill Switch ON

# Fuse Box Explanation & Electrical Circuits

MY16 390 Duke condition based voltage flow

Electrical System 390-Duke MY-16 : Current Flow ; Stage 3 : Kill Switch ON.



**Stage – 3**
**MY-15 Changes:**
1. Auxiliary relay 1 & 2 coil supply and fuel pump relay supply are taken after kill switch.
2. ABS wake up signal is taken after ignition switch which was after kill switch earlier.

Main ECU Pin 9
Meter Pin 11
Aux Relay1
2 wire Aux Relay 2

Gr/Pi

Fuse-8
10 Amp
EMS ECU,
Aux Relay

Gr/R
Immobilizer 14
Ign. Coil

2 wire HLCU
Fr. Br. switch
Rr. Br. switch
Horn
Flasher
Pass switch
Can interface (D&F coupler)

ABS ECU Pin 4
Gr/G

Kill switch on

O/W

Fuse-7
10 Amp ABS ECU

Fuse-6
All Lighting loads, Horn 15 Amp

Fuse-4
HT Coil 15 Amp

Br/L
Br/L
Gr/L

Immobilizer
2 wire Main Relay
Fuel Pump Relay

Speedometer

W
R/W
'O'
Fan Relay

Br/L

Ign. Switch on

Termination Unit

Fuse-2
Immobilizer, Speedometer 15 Amp

Fuse-3
Main Relay 15 Amp

Fuse-5
Radiator Fan 15 Amp

Regulator unit

W/B    W/B    W/B    W/B    W/B    W/B

W/B

ABS Fuse 25 Amp
ABS Fuse 15 Amp

Fuse-1
Main Fuse 30 Amp

R

Battery

Starter Relay

Without Ing. Switch ON
When Ing. Switch ON
When Kill Switch ON
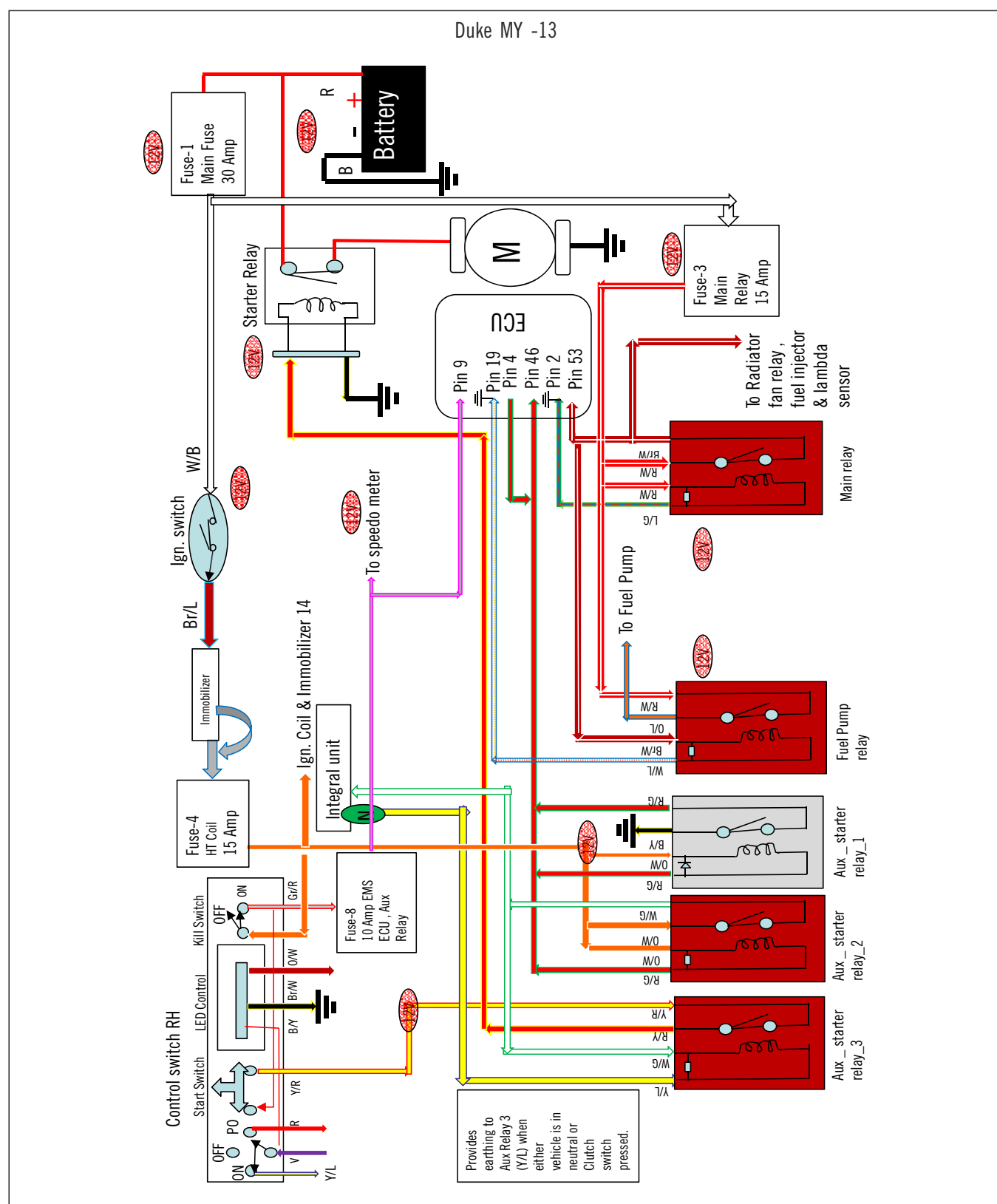
# Fuse Box Explanation & Electrical Circuits

MY16 RC-390 condition based voltage flow.



Electrical System RC-390 MY-16 : Current Flow ; Stage 3 : Kill Switch ON.
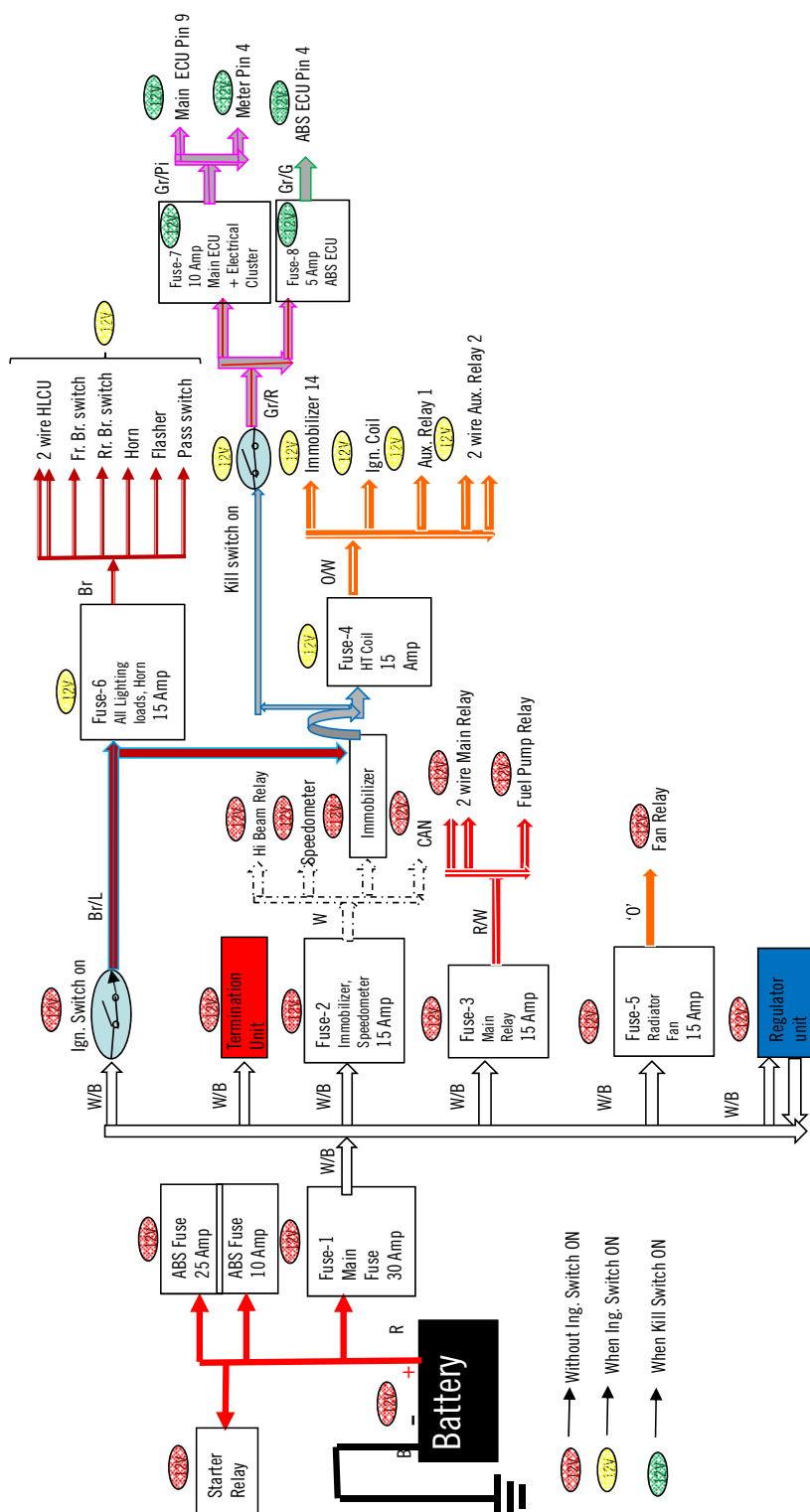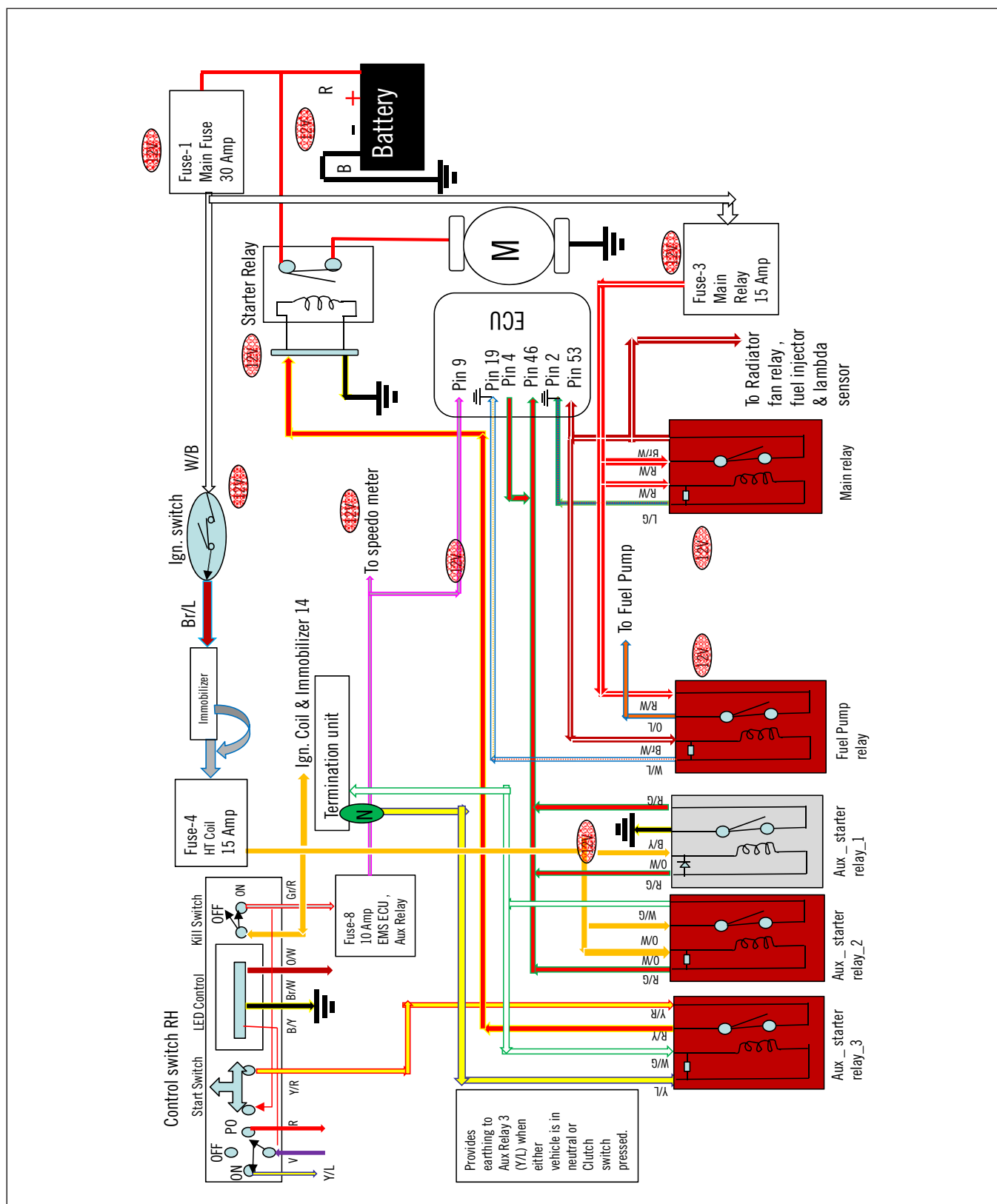
# Fuse Box Explanation & Electrical Circuits
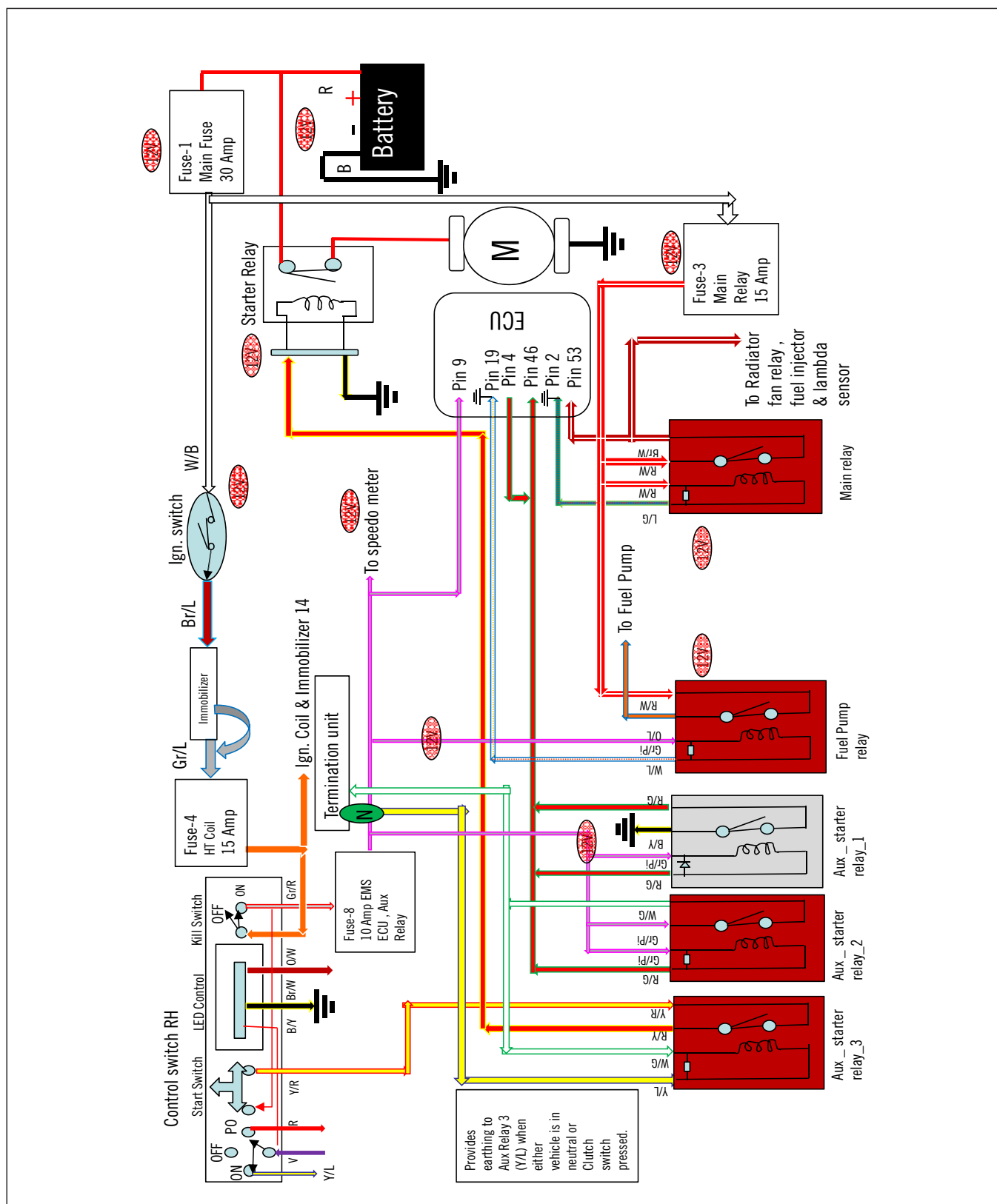
390-Duke : MY-13 ; Cranking (Start) system.



Duke MY -13

# Fuse Box Explanation & Electrical Circuits

390-Duke : MY-14 ; Cranking (Start) system.
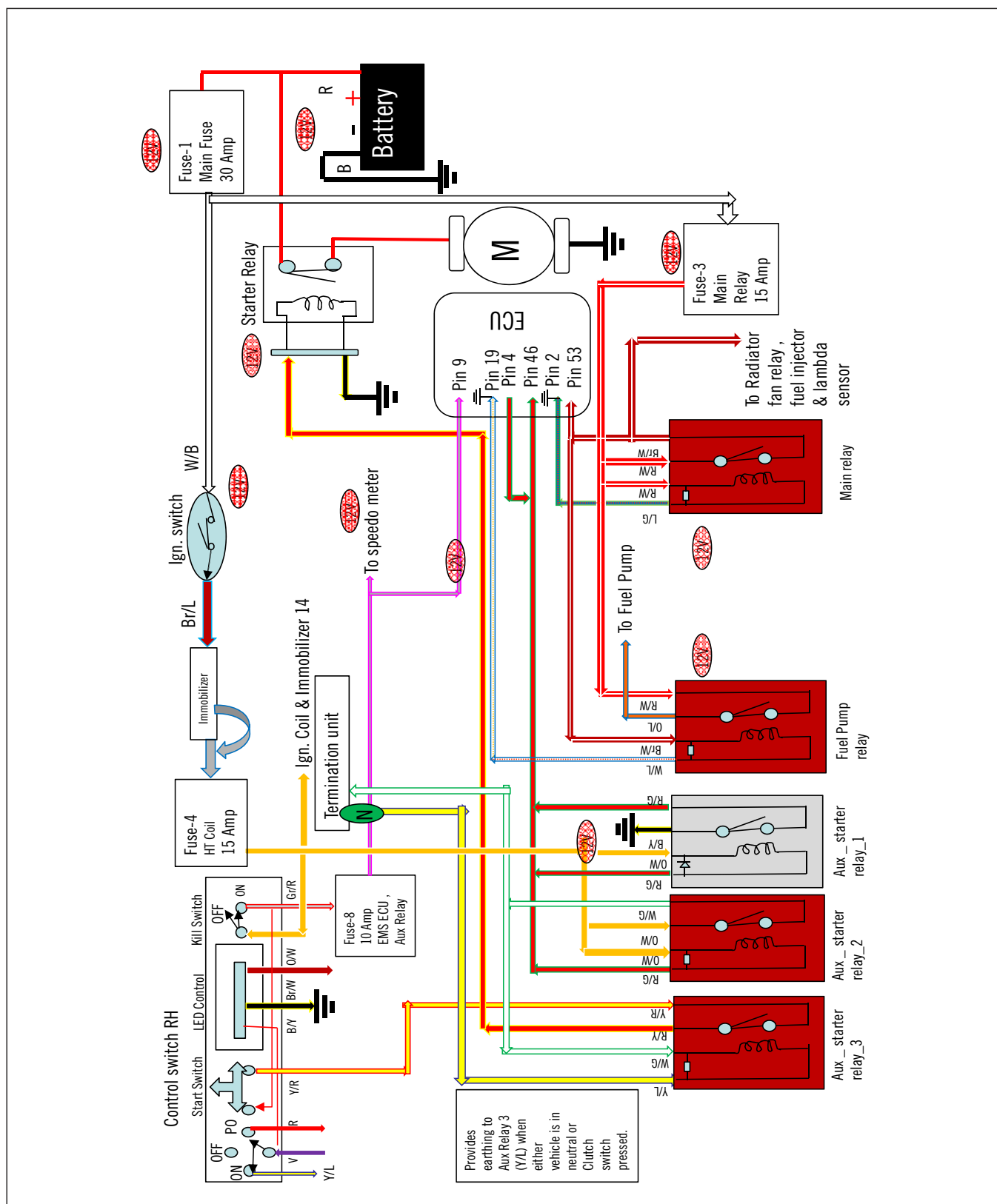
# Fuse Box Explanation & Electrical Circuits
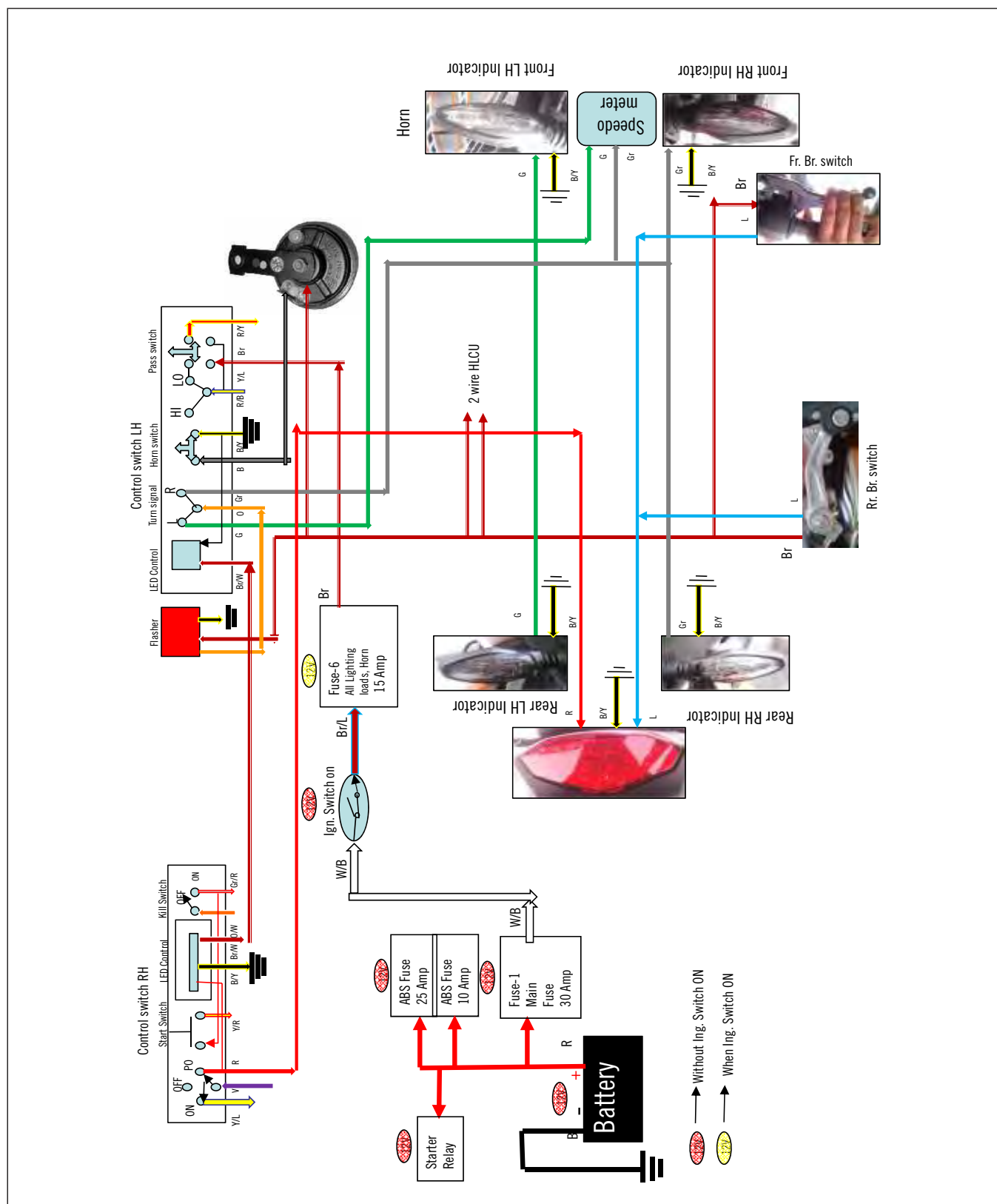
390-Duke : MY-15 and MY16 ; Cranking (Start) system.

# Fuse Box Explanation & Electrical Circuits

RC -390: MY-15 and MY16 ; Cranking (Start) system).
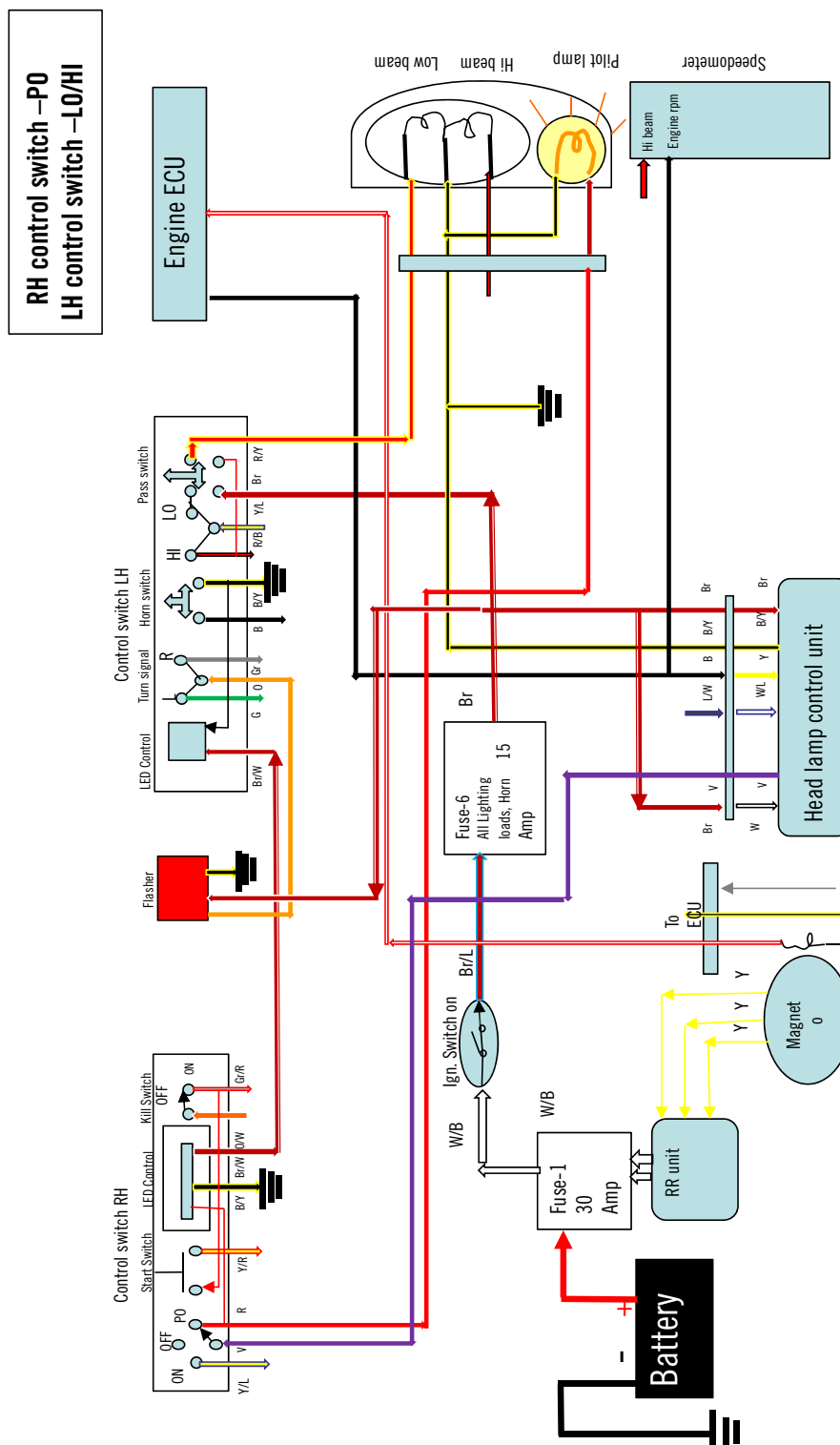
# Fuse Box Explanation & Electrical Circuits

390-Duke MY-15 : Current Flow ; DC circuit.

Front LH Indicator

Front RH Indicator

Horn

Speedo meter

Fr. Br. switch

Pass switch

2 wire HLCU

Control switch LH

Horn switch

HI
LO

Turn signal

Rr. Br. switch

LED Control

Flasher

Fuse-6
All Lighting
loads, Horn
15 Amp

Rear LH Indicator

Rear RH Indicator

Br

Ign. Switch on

Br/L

W/B

Kill Switch
ON
OFF

Control switch RH

Start Switch    LED Control

ABS Fuse
25 Amp

ABS Fuse
10 Amp

W/B

Fuse-1
Main
Fuse
30 Amp

Battery

OFF    P0
ON

Starter
Relay

Without Ing. Switch ON

When Ing. Switch ON

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# Fuse Box Explanation & Electrical Circuits

390-Duke MY-15 : Head light circuit.

Electrical System 390 Duke MY-15 : Head light circuit ; Stage 1 : Engine on and vehicle not moving.

# Fuse Box Explanation & Electrical Circuits

390-Duke MY-15 : Head light circuit.
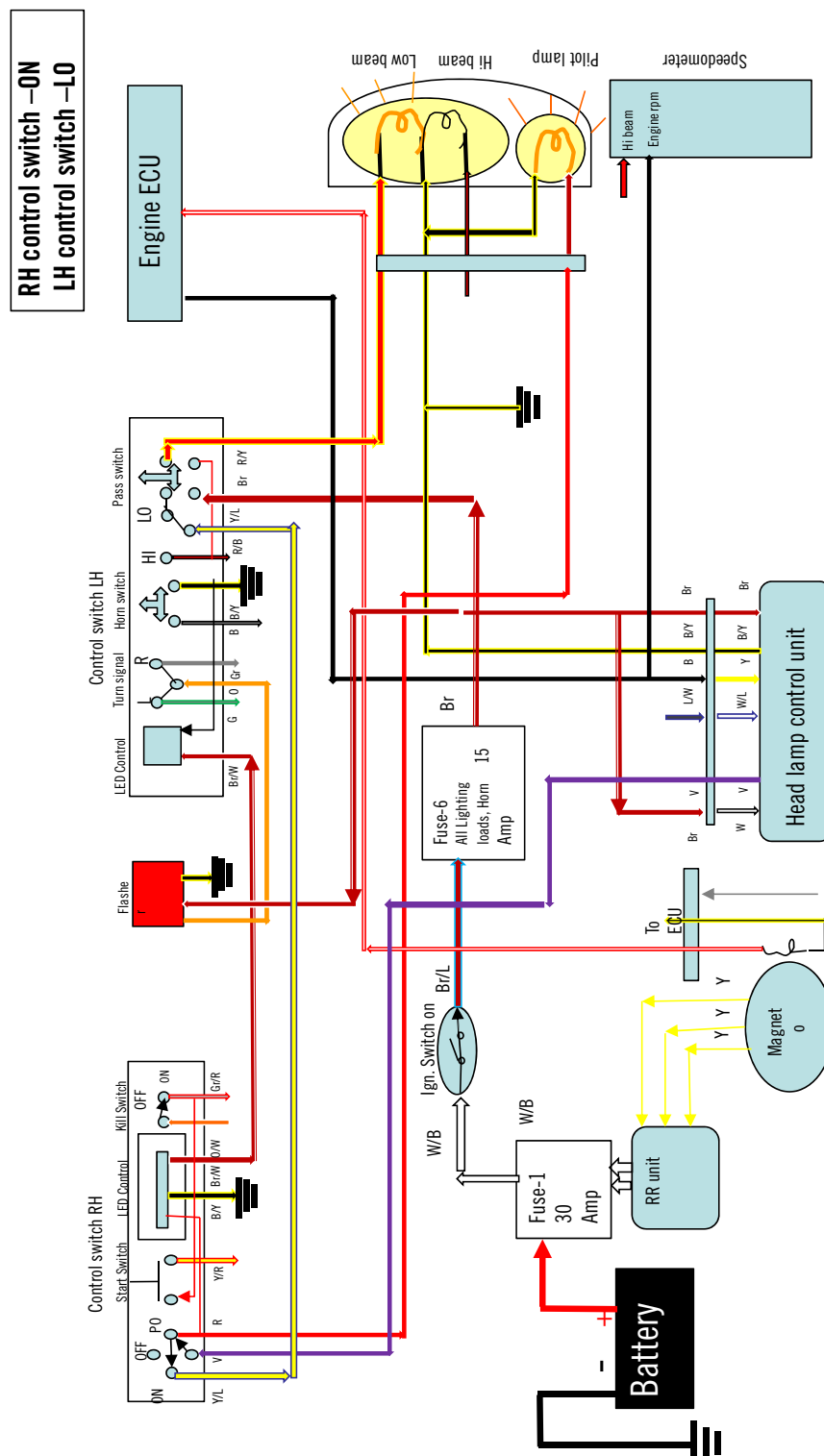
Electrical System 390-Duke MY-15 : Head light circuit ; Stage 2 : Engine on and vehicle not moving.

# Fuse Box Explanation & Electrical Circuits

390-Duke MY-15 : Head light circuit.

Electrical System 390-Duke MY-15 : Head light circuit ; Stage 3 : Engine off and vehicle moving.
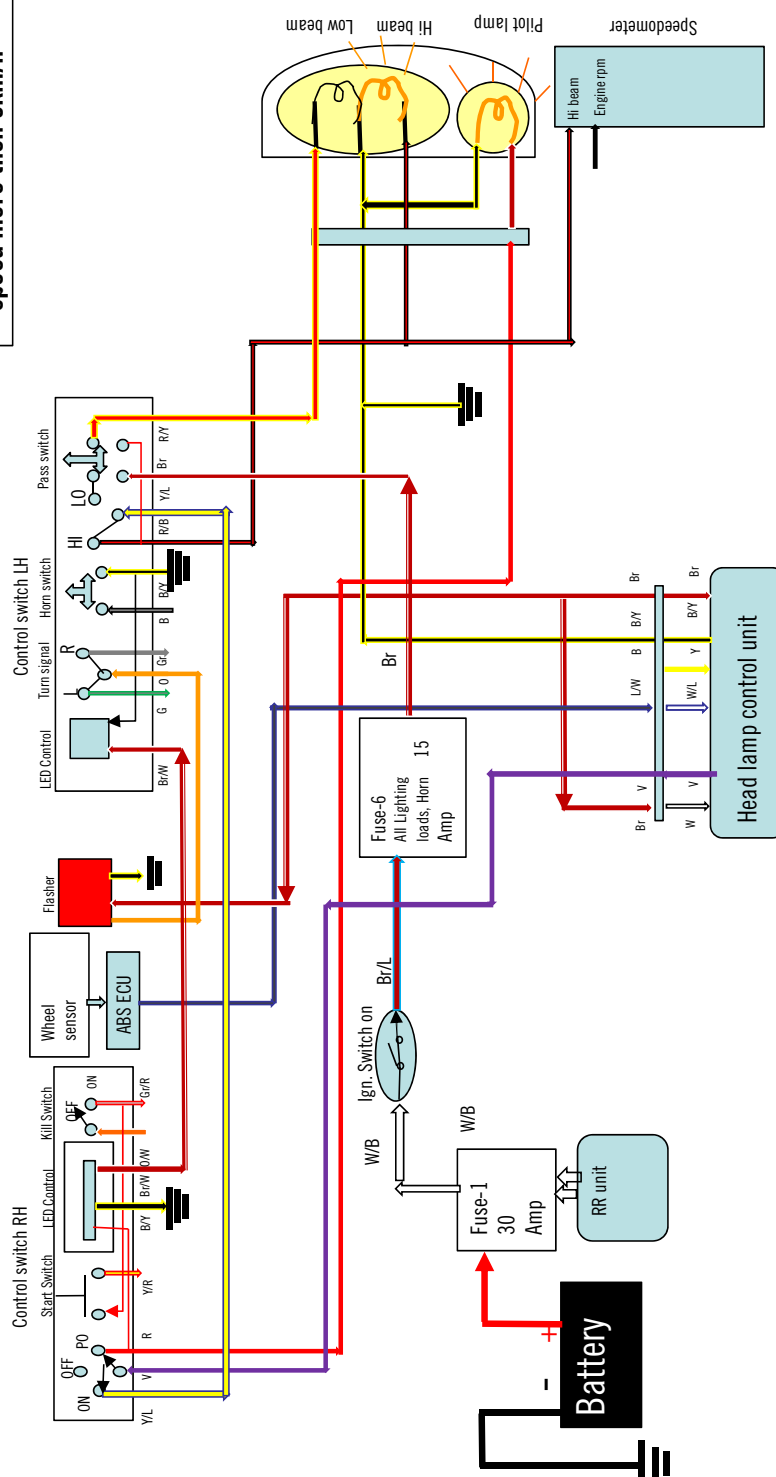
# Fuse Box Explanation & Electrical Circuits

390-Duke MY-15 : Head light circuit.



Electrical System 390 -Duke MY-15 : Head light circuit ; Stage 4 : Engine on.

# Fuse Box Explanation & Electrical Circuits

390-Duke MY-15 : Head light circuit.

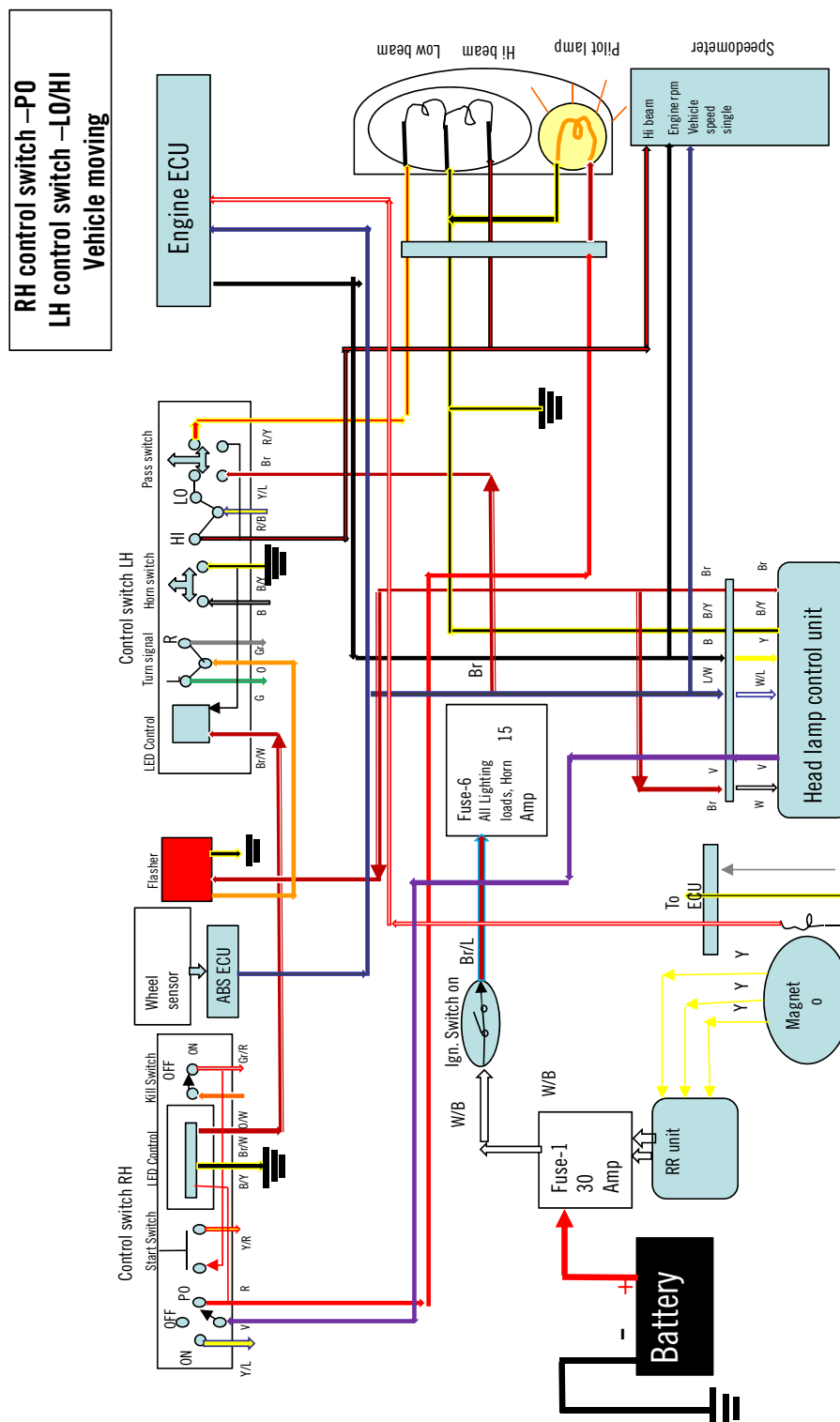Electrical System Duke MY-15 : Head light circuit ; Stage 5 : Engine on and vehicle moving
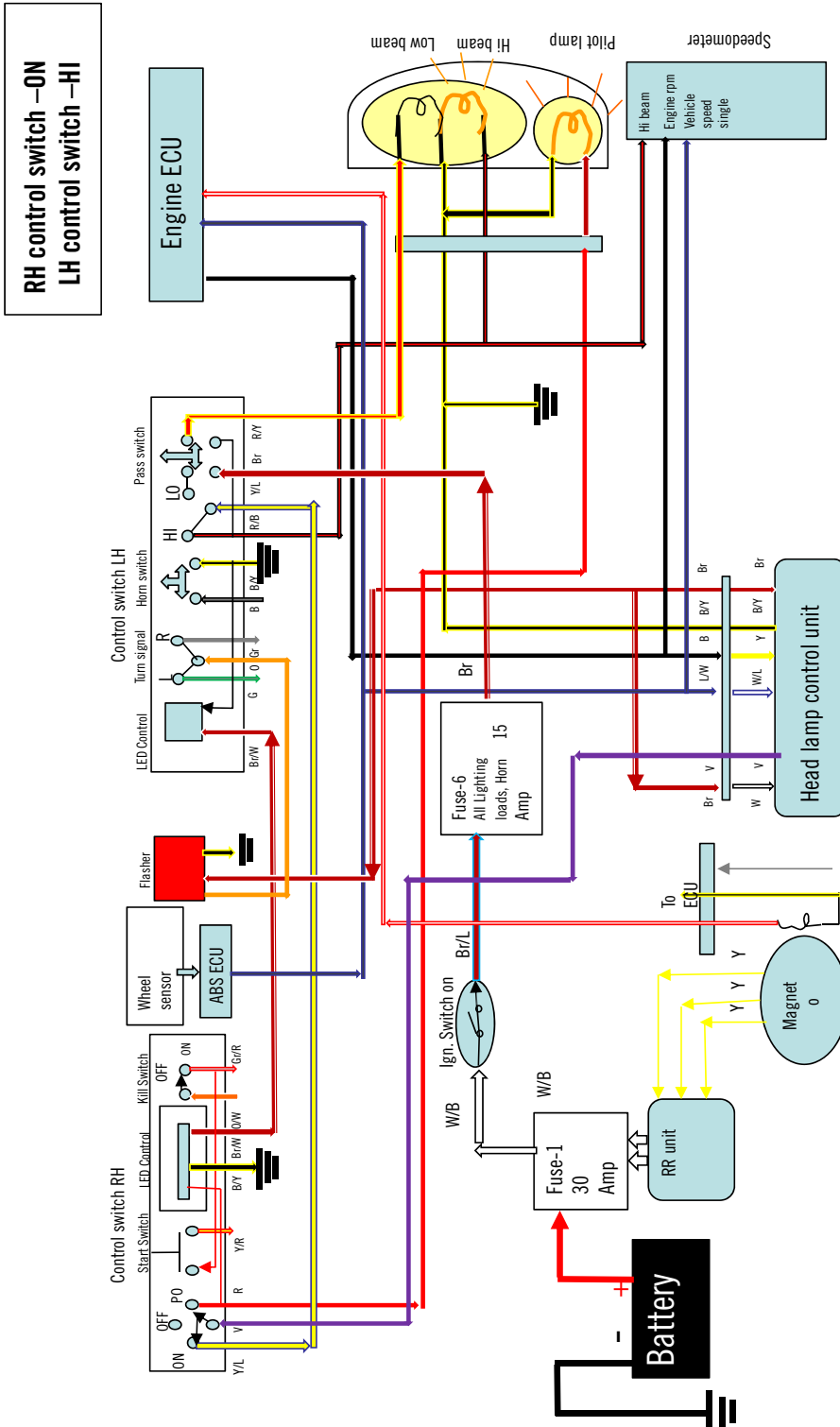
# Fuse Box Explanation & Electrical Circuits

390-Duke MY-16 : Head light circuit.

# Fuse Box Explanation & Electrical Circuits

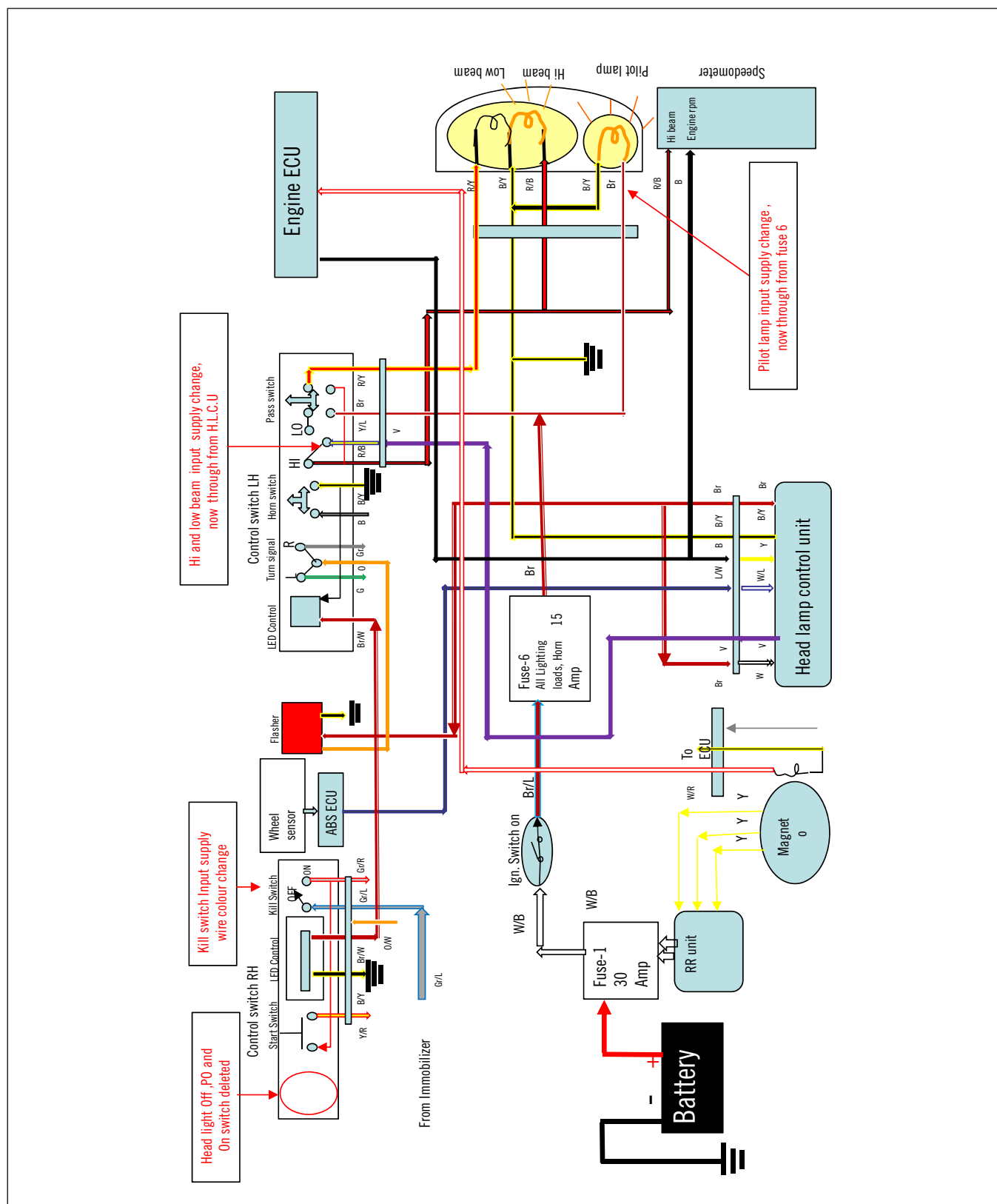RC 390 MY-15 : Head light circuit.
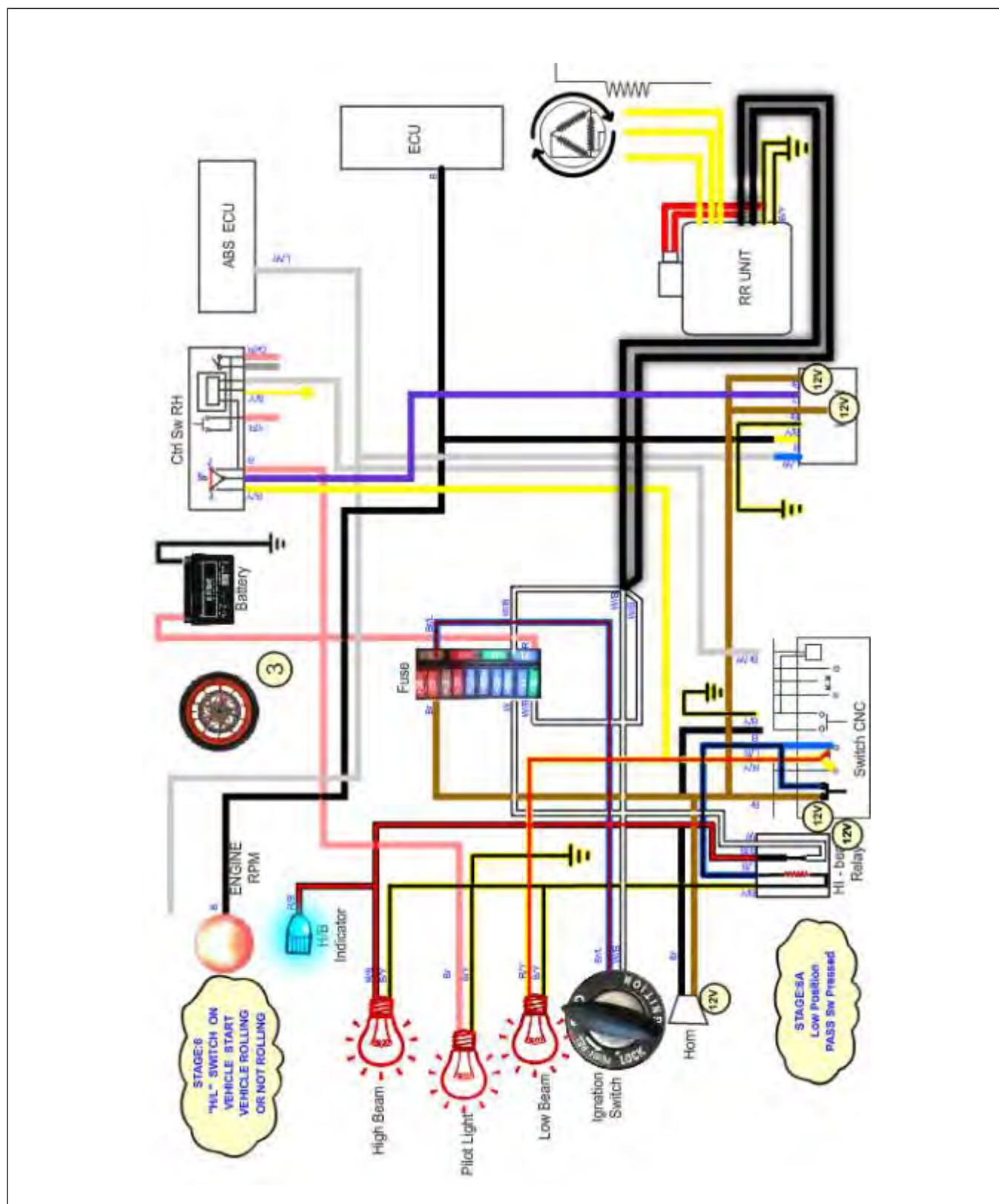
# Fuse Box Explanation & Electrical Circuits

RC 390 MY-16 : Head light circuit.
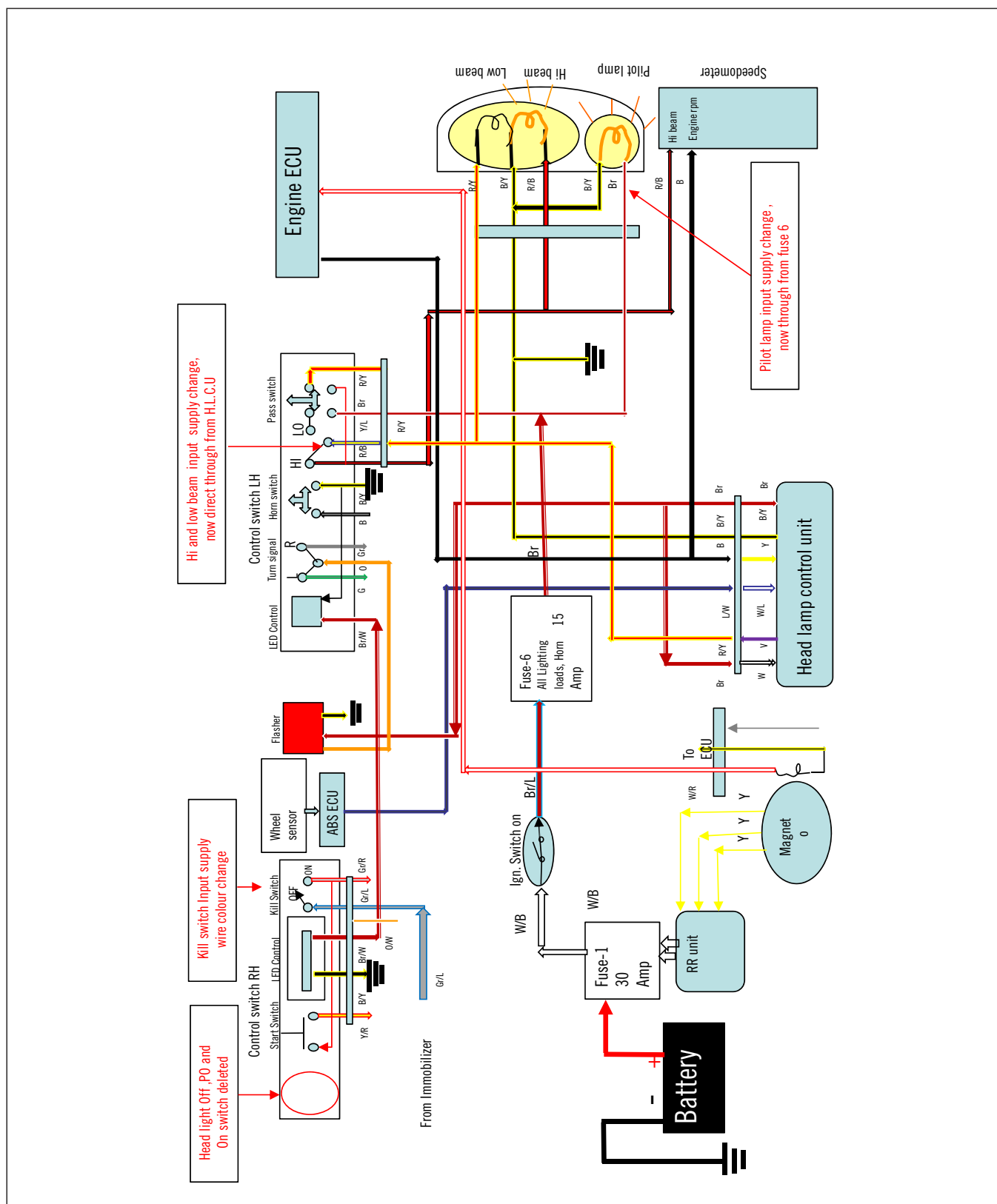
# Fuse Box Explanation & Electrical Circuits

Electrical System 390-Duke MY-17: Current Flow; Stage 2: Ignition Switch ON and Kill switch ON.
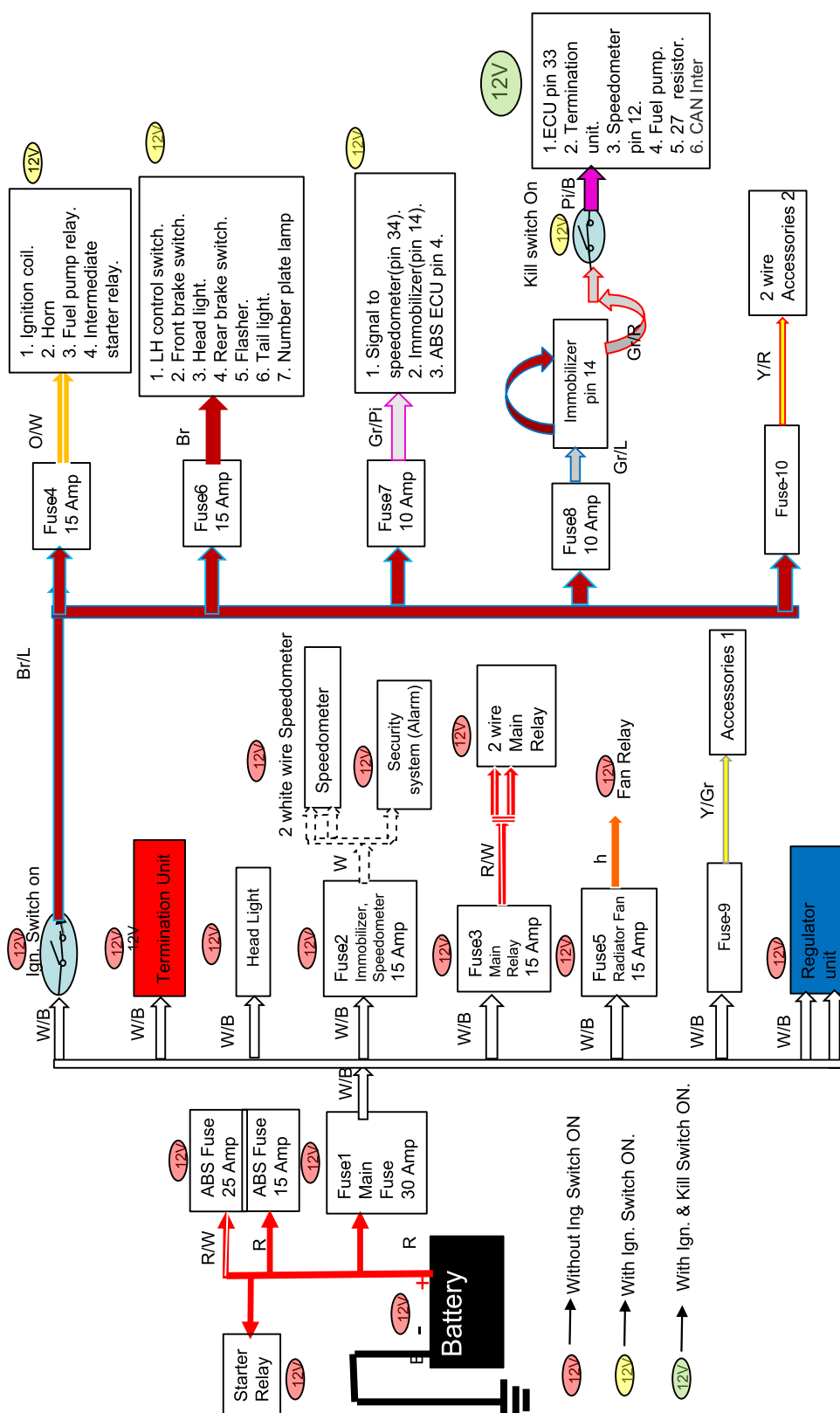
# Fuse Box Explanation & Electrical Circuits

Electrical System 250-Duke MY-17: Current Flow; Stage 2: Ignition Switch ON and Kill switch ON.
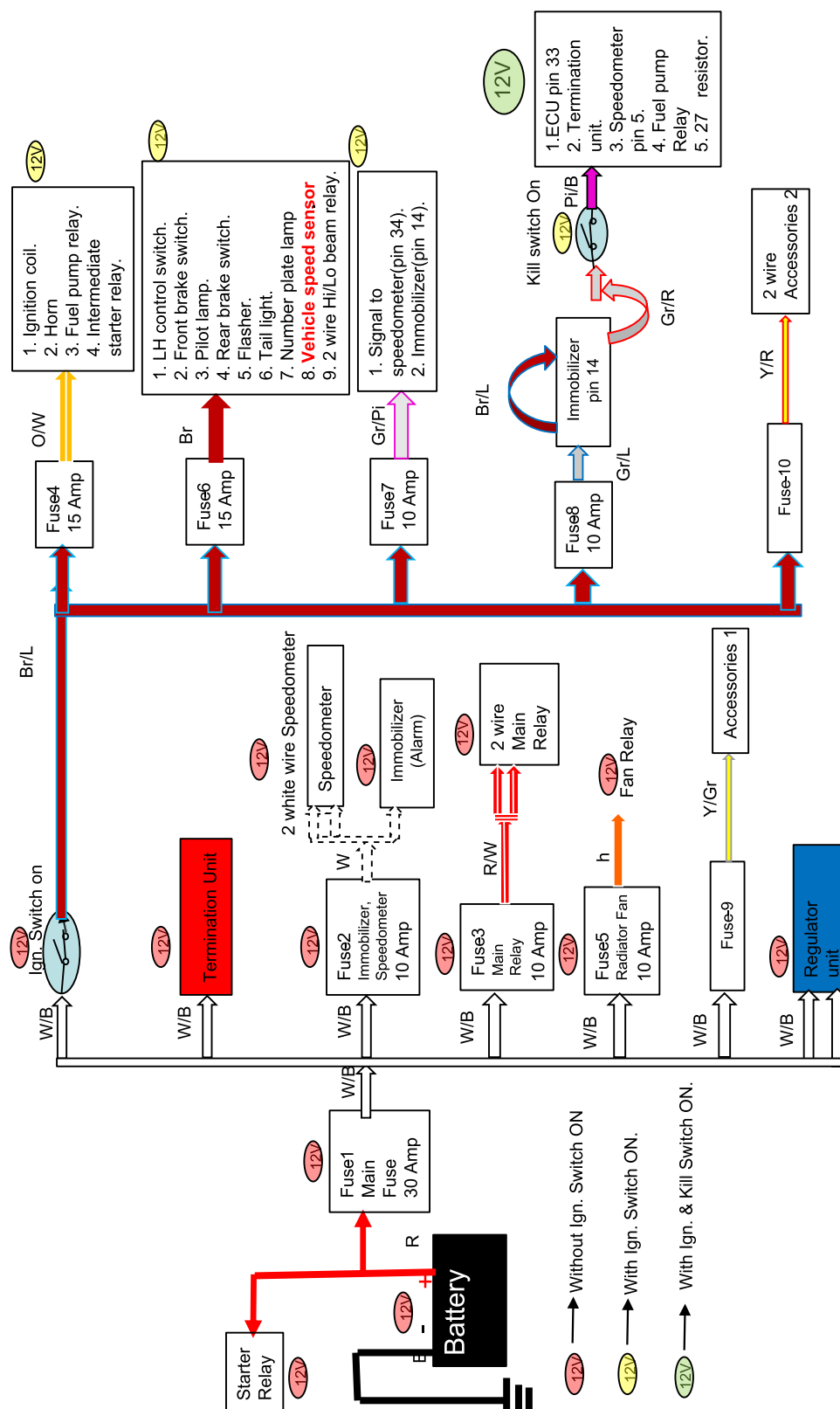
# Fuse Box Explanation & Electrical Circuits

390 / 250 Duke : MY-17 ; Cranking (Start) system.        Stage 4: Press start switch.
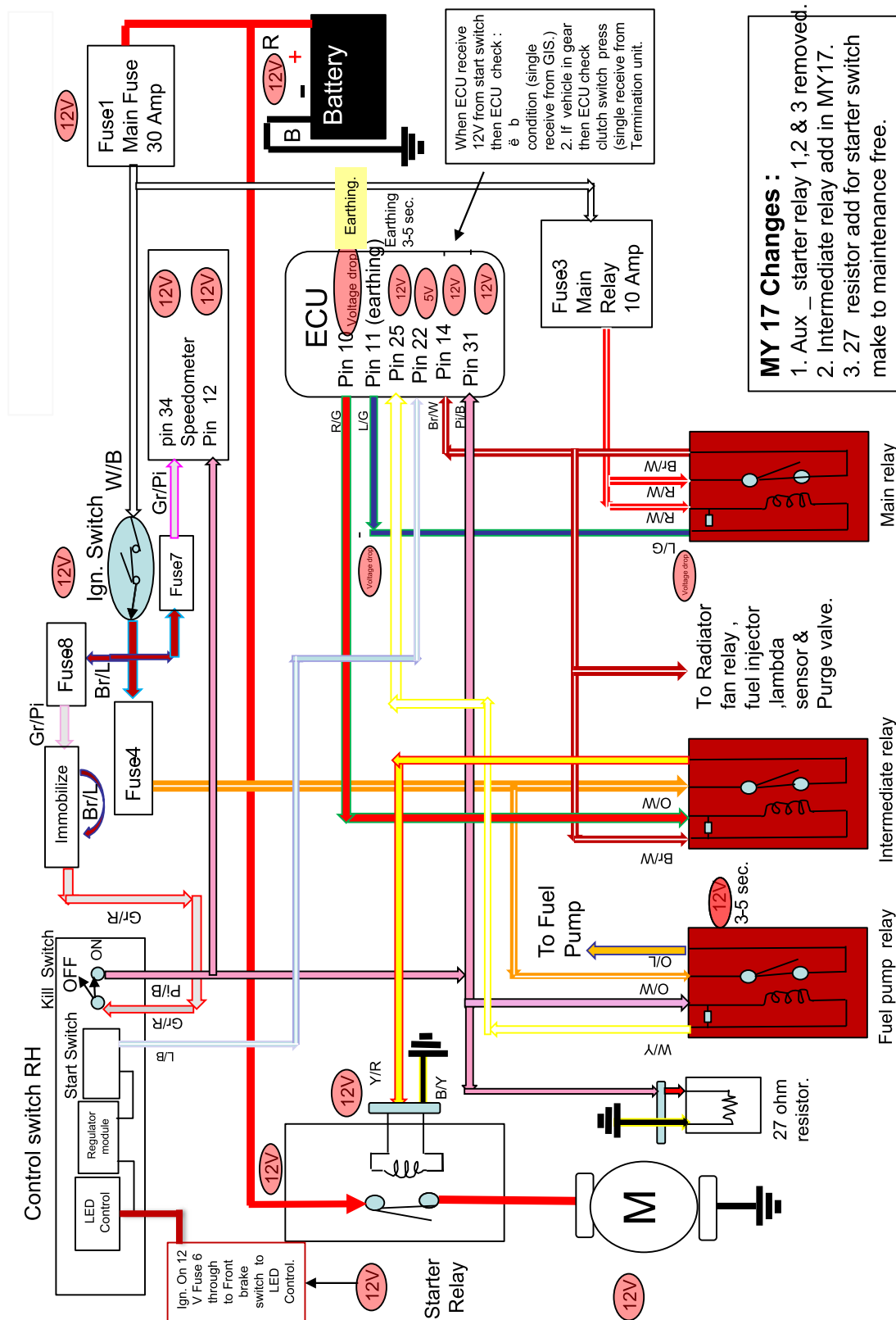


**MY 17 Changes :**
1. Aux _ starter relay 1,2 & 3 removed.
2. Intermediate relay add in MY17.
3. 27 resistor add for starter switch make to maintenance free.

When ECU receive 12V from start switch then ECU check :
ē b condition (single receive from GIS.)
2. If vehicle in gear then ECU check clutch switch press (single receive from Termination unit.

# Fuse Box Explanation & Electrical Circuits

390 Duke MY-17 : Head light circuit. Stage 2: Ign. ON and Kill switch off. LH control switch : HI beam.



**Head Lamp.**

V Battery.
Can Low.
After Ign.
High beam/ Pass
Can High.
Ground.

W/B
Y/L
Br
R/B
G/L
B/Y

From ECU pin 36
From ECU pin 37

**Control switch LH**

Pass switch
Horn switch
Turn signal
LED Control

LO
HI
R

Pass switch
Y
R/B
B/Y
B
G/L
G
O
Br
Br/W

Flasher

Fuse6
All Lighting
loads,
10 Amp

Br

Ign. Switch on
Br/L

W/B
W/B

**Control switch RH**

Start Switch
LED Control

ON
OFF
Pi/B
Gr/R

Br/W

Br

Fuse-
1
30
Amp

Br wire.

Fuse 6
through
to Front
brake
switch to
LED
Control.

**Battery**
+
−

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# Fuse Box Explanation & Electrical Circuits

390 Duke MY-17 : Head light circuit. Stage 1: Ign. ON and Kill switch off.  LH control switch : LO beam.



**Head Lamp.**

V Battery.
Can Low.
After Ign.
High beam/ Pass
Can High.
Ground.

W/B
Y/L
Br
R/B
G/L
B/Y

From ECU pin 36

From ECU pin 37

**Control switch LH**

Pass switch

LO
HI
R

LED Control  Turn signal  Horn switch

G  O  G/
B
Br/W
R/B  Y
B/Y
Br

Flasher

**Control switch RH**

OFF
ON

LED Control Start Switch

Gr/R
Pi/B

Br/W

Br wire.

Fuse 6
through
to Front
brake
switch to
LED
Control.

Br

Fuse6
All Lighting
loads,
10 Amp

Ign. Switch on
Br/L

W/B
W/B

Fuse-
1
30
Amp

**Battery**
+

# Fuse Box Explanation & Electrical Circuits

250-Duke MY-17 : Head light circuit.

Ign. ON LH control switch –HI/Lo.

Engine running / Vehicle speed more than 3Km/hr.
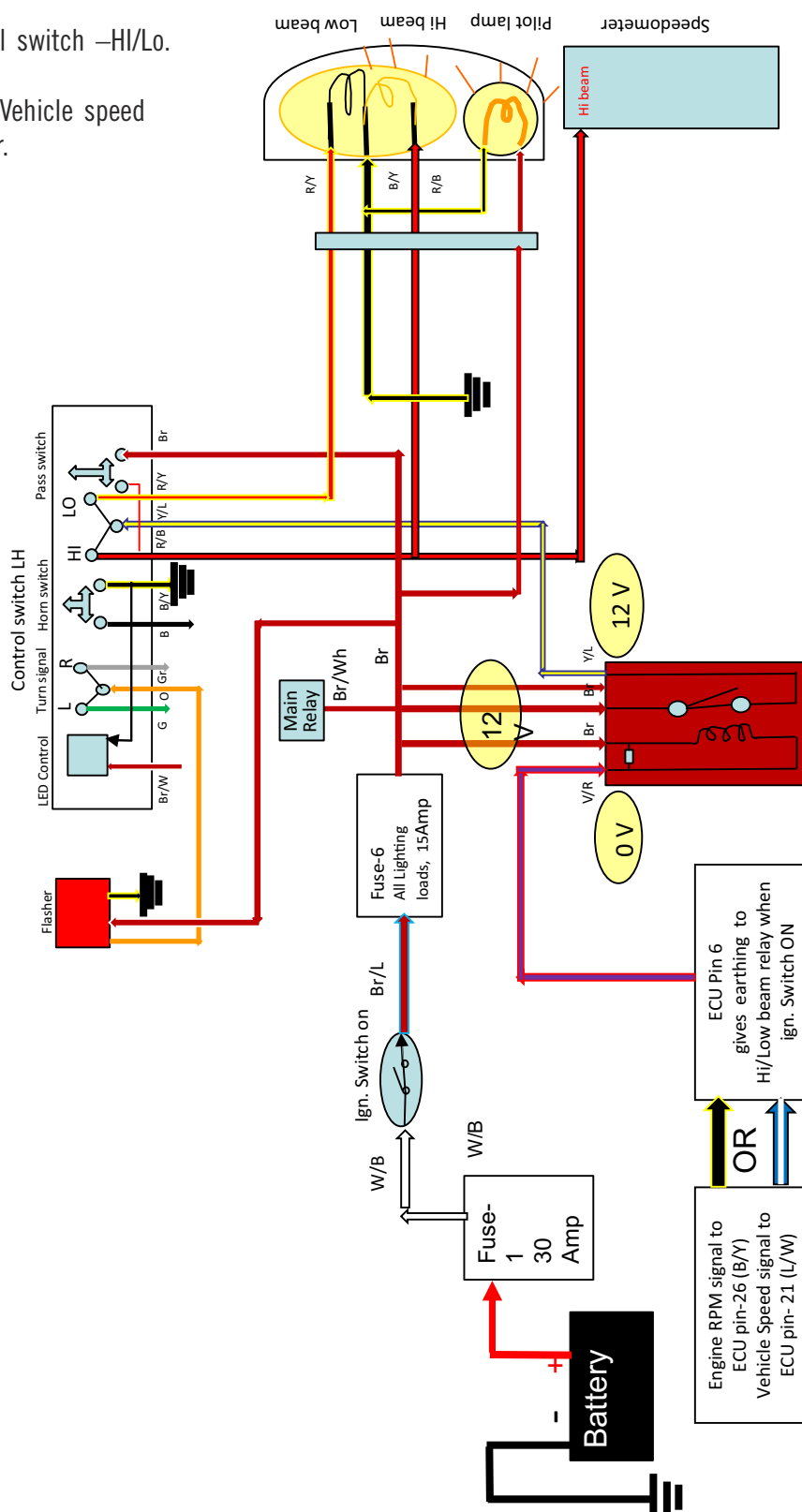
# Fuse Box Explanation & Electrical Circuits

Key Changes :RC 390  MY-17 : Head light circuit.
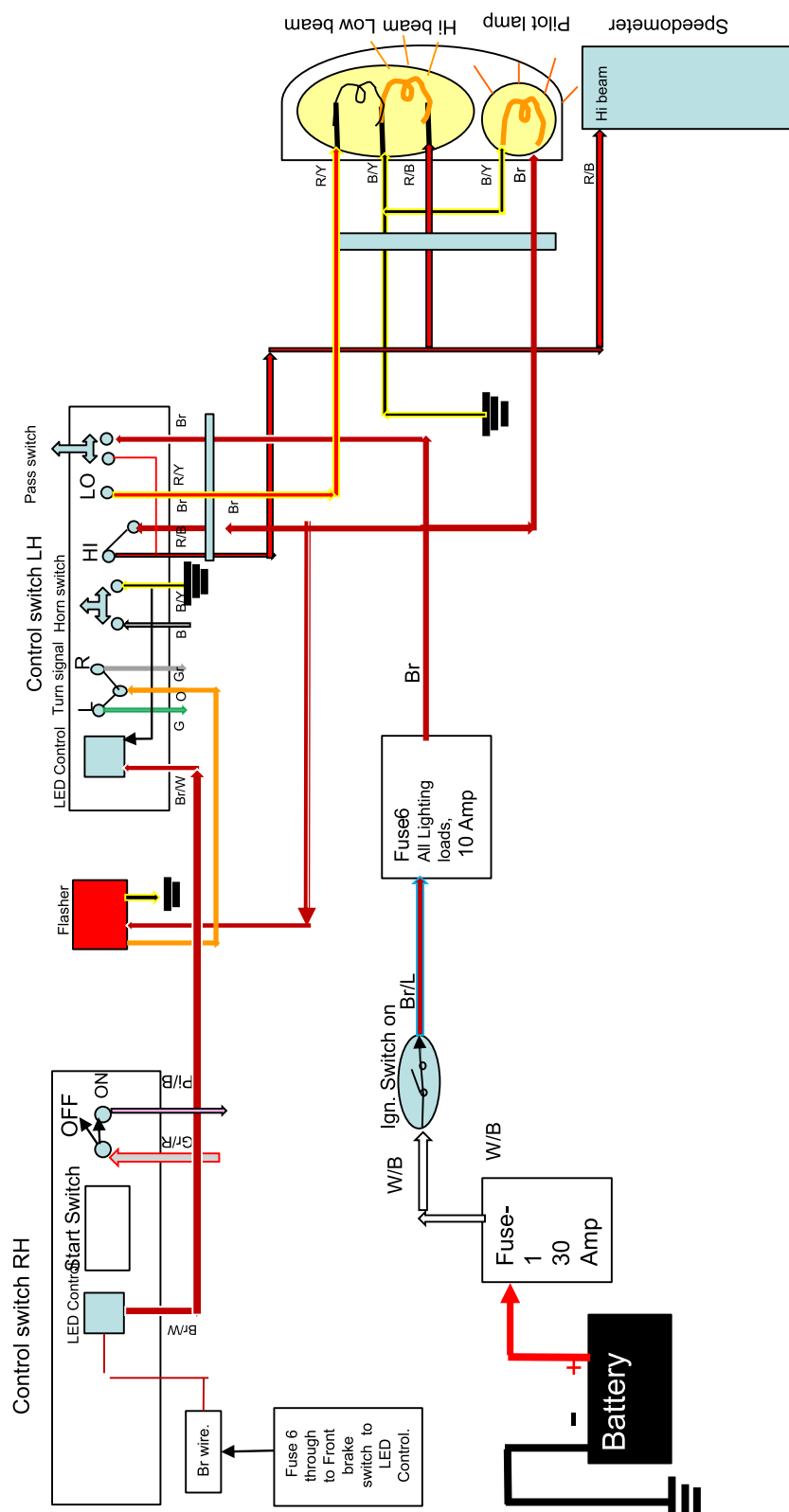
**MY 17 Changes :**
1.  Hi beam relay removed.
2.  Hi beam and low beam glows independent.
3.  HLCU removed.

Speedometer

Pilot lamp

Hi beam Low beam

Hi beam

R/Y  B/Y  R/B  B/Y  Br  R/B

Control switch LH

Pass switch

LO  HI  R

Br  R/Y  Br  Br

R/B  B/Y  B  G/O/Gt

LED Control  Turn signal  Horn switch

G

Br/W

Flasher

Fuse6
All Lighting
loads,
10 Amp

Br

Ign. Switch on
Br/L

W/B  W/B

Fuse-
1
30
Amp

Control switch RH

Start Switch

OFF  ON

Pi/B

Gr/R

LED Control

Br/W

Br wire.

Fuse 6
through
to Front
brake
switch  to
LED
Control.

Battery
+

# Electrical System : Working of Components

**Battery:**

- Battery is as part of a circuit that provides the electricity. Battery can be said as the source to provide electricity to the circuit. So its main function is to supply electric power in order for electric items to work.

**Fuse:**

- A fuse is a type of low resistance to provide over current protection, of either the load or source circuit.

**Wires:**

- Wires are used to join parts of a circuit. Electricity flows through wires. Its main function is to provide electrical items the power they need to work, provided by battery.

**Switch :**

- Switch is something that can make a gap in a circuit, to turn things on or off. Basically it is the main component of electricity that controls the electricity that flows through light items by turning it on or off.

**Relay :**

- A relay is an electromagnetic switch. In other words it is activated when a current is applied to it. Normally a relay is used in a circuit as a type of switch. There are different types of relays and they operate at different voltages. When you build your circuit you need to consider the voltage that will trigger it.

**Light Bulb :**

- A light bulb is that component of circuit that lights up when electricity flows through it and vice versa.
- Its main function is to tell whether electricity is being supplied or not. Its function is also to light up dark places.

**Head Lamp Control Unit:**

- To activate Hi beam when vehicle is rolling above 3kmph. To Disallow power supply to Switch RH when Engine not running. To supply power to Switch RH Post engine running.

# Electrical System : Working of Component

**Termination Unit :**
- To Monitor Working of neutral light/switch.
- Monitor Engagement/disengagement of Clutch Switch. To Operate Auxiliary Relay 3 during Cranking.



**Capacitor with RR Unit :**
- This is provided to store extra power which should assist the battery during cranking.



**Electronic Control Unit :**
- One type of electronic control unit that manages an engine's operation.



**Alternator :**
- The alternator, is the main source of power while engine is running. It converts the mechanical energy in to electrical energy. It also recharges the battery while engine is running.
  Main parts :
  1. Magneto,
  2. Starter coil
  3. Pick-up coil





**Clutch Switch :**
- In gear condition, clutch switch is operated there by connecting 'Close' & 'normally open' terminals. The clutch switch has 3 wires. In neutral conditions, clutch switch is in non-operated condition closing 'Close' and 'normally close' terminals.



**Resister :**
- In MY17 KTM 390 and 250 models, resister is added for kill switch maintenance.
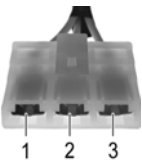
# Electrical System : Parts Inspection Parameter

**Charging Voltage Inspection**

| Checking parameter | Standard | Condition | Tool to be used | Action |
|---|---|---|---|---|
| Battery Charging voltage | 14.5 ± 0.5V (at Battery terminal) | Start condition @ 4000RPM | Load tester / Multi-meter | If charging voltage is not in range then check charging circuit - RR unit & its coupler, Stator plate. Diagnose & Replace defective part & Re check. |
| Battery Charging voltage on Head light on condition  | 14.5 ± 0.5V (at Battery terminal) | | | If voltage drop is there then check Bulb & Bulb holder. Replace & again recheck. |

| Tester range | Connections | | Reading |
|---|---|---|---|
| | Tester (+) to | Tester (-) to | |
| 20 V DC | Battery (+) | Battery (-) | 14.5 ± 0.5V |

**Alternator - checking the stator winding**

| Checking parameter | Standard | Condition | Tool to be used | Action |
|---|---|---|---|---|
| Stator winding  | $\leq 1\Omega$ at $20^{0}$C) | Connector pin 1 to 3 1 to 2 | Multi-meter | Diagnose & Replace defective part & Re check. |
| | $\infty$ | Connector pin 1 to ground | | |

**Alternator output voltage at 4000 rpm**
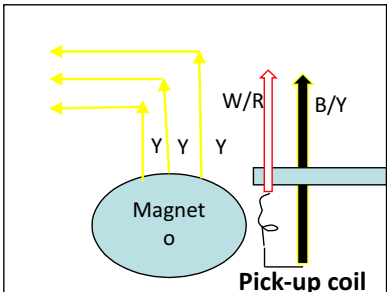
| Tester range | Connections | | Reading |
|---|---|---|---|
| | Tester (+) to | Tester (-) to | |
| 250 V AC | 1st yellow wire (+) | Another yellow wire | 40 V more at 4000 rpm |
| | 2nd yellow wire (+) | Another yellow wire | 40 V more at 4000 rpm |
| | 3rd yellow wire (+) | Another yellow wire | 40 V more at 4000 rpm |

**RR unit output voltage at 4000 rpm**
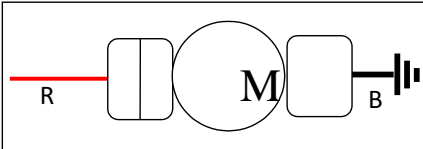
| Tester range | Connections | | Reading |
|---|---|---|---|
| | Tester (+) to | Tester (-) to | |
| 20 V DC | 1st Red wire (+) | Another Black-yellow (Earthing) wire | 14.0 ~ 15.6 V |
| | 2nd Red wire (+) | Another Black-yellow (Earthing) wire | 14.0 ~ 15.6 V |

# Electrical System : Parts Inspection Parameter

**Crankshaft (pick-up coil) sensor resistance Unit :**

| Checking parameter | Standard | Condition | Tool to be used | Action |
|---|---|---|---|---|
| Pick-up coil<br>W/R  B/Y<br>Y Y Y<br>Magneto<br>**Pick-up coil** | Multi-meter in the resistance check mode<br>Resistance :<br>W/R-B/Y-<br>365 ± 20 Ω | Check resistance between W/R and B/Y wires | Multi-meter | Diagnose & Replace defective part & Re check.<br>Check gap between pick-up coil and rotor : 0.7±0.2 mm |

**Starter motor Inspection**

| Checking parameter | Standard | Condition | Tool to be used | Action |
|---|---|---|---|---|
| Check current drawn by Starter motor<br>R   M   B<br>**Starter motor** | Should be less then 35Amps (Duke/Rc-200) and Should be less then 65Amps (Duke/RC-390) | By Cranking the engine thru starter button. (Don't consider initial current drawn) | Clamp meter. | Current drawn is more then check starter motor for Jam. Replace & recheck current drawn. |

**Oil pressure switch Inspection**

| Checking parameter | Standard | Condition | Tool to be used | Action |
|---|---|---|---|---|
| Oil pressure switch | Multi-meter in the continuity check mode<br>1. Speciation with engine switch off<br>- Multi-meter * 1 ohms = continuity<br>2. Speciation with engine running at 3000 rpm<br>-Multi-meter* 1 ohms = open circuit | ON vehicle:<br>Check continuity wire terminal of oil pressure switch and nut of oil pressure switch ( earth) | Multi-meter | Diagnose & Replace defective part & Re check. |

**Horn Inspection**

| Checking parameter | Standard | Condition | Tool to be used | Action |
|---|---|---|---|---|
| Horn | current value : 3.0 ± 0.3 Amp | 1) Encircle clamp meter jaws around brown wire of horn.<br>2) Press horn switch and check instantaneous current drawn by horn. | DC Clamp meter/ Multi-meter | Diagnose & Replace defective part & Re check. |

# Electrical System : Parts Inspection Parameter

**Front brake light switch  Inspection**

| Checking parameter | Standard | Condition | Tool to be used | Action |
|---|---|---|---|---|
| Front brake light  switch | Multi-meter in the continuity check mode<br>1.Lever pressed : Continuity is shown<br>2. Lever released : No continuity | Turn on ignition switch<br>:<br>Check continuity both<br>terminal of front brake<br>light  switch | Multi-meter | Diagnose & Replace defective part<br>& Re check. |

**Rear brake light switch Inspection**

| Checking parameter | Standard | Condition | Tool to be used | Action |
|---|---|---|---|---|
| Rear brake light switch | Multi-meter in the continuity check mode<br>1. Brake pedal pressed : Continuity is shown<br>2. Brake pedal  released : No  continuity. | Turn on ignition switch:<br>Check continuity<br>both terminal of rear<br>brake pedal brake light<br>switch | Multi-meter | Diagnose &<br>Replace defective<br>part<br>& Re check. |

**Clutch switch  Inspection**
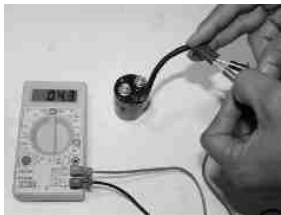
| Checking parameter | Standard | Condition | Tool to be used | Action |
|---|---|---|---|---|
| Clutch switch | Multi-meter in the continuity check mode<br>1. Clutch lever not pressed :No Continuity<br>2. Clutch lever pressed : Continuity<br>   is shown | Check continuity | Multi-meter | Diagnose & Replace defective part<br>& Re check. |

**Ignition switch  Inspection**

| Checking parameter | Standard | Condition | Tool to be used | Action |
|---|---|---|---|---|
| Ignition switch | Multi-meter in the continuity check mode<br>(white – brown wires)<br>1. Ignition switch 'ON' : Continuity is shown.<br>2. Ignition switch 'OFF' : No  continuity. | Check continuity | Multi-meter | Diagnose &<br>Replace defective<br>part<br>& Re check. |

# Electrical System : Parts Inspection Parameter
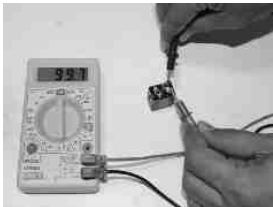
**Starter relay  Inspection**

| Checking parameter | | Standard | Condition | Tool to be used | Action |
|---|---|---|---|---|---|
| Starter relay  | | Multi-meter in the resistance check mode Resistance : (R/Y-B wires) 3.9  ± 0.4 Ω | Check resistance between R/Y and B wires (multi-meter range - 200Ω) | Multi-meter | Diagnose & Replace defective part & Re check. |
|  | | Multi-meter in the continuity check mode. | Connect multi-meter at the relay contact terminals. | Multi-meter | Diagnose & Replace defective part & Re check. |

**Relay   Inspection**
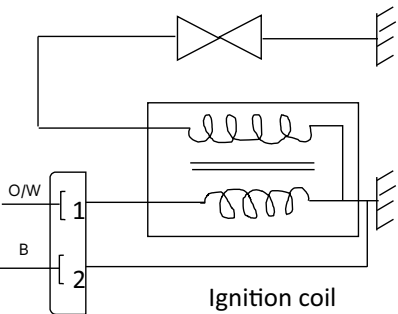
**SOP :**

- Connect external 12V DC supply to relay coil terminals.
- "TUK' sound will be heard.
- Set multi-meter on continuity mode.
- Connect multi-meter at to relay contact terminals.
- Continuity (beep sound) indicates relay is OK.

| Checking parameter | Standard | Condition | Tool to be used | Action |
|---|---|---|---|---|
| Relay  | Multi-meter in the resistance check mode : Relay coil terminal 1 and relay coil terminal 2 : 90~110  Ω | Check resistance | Multi-meter | Diagnose & Replace defective part & Re check. |

# Electrical System : Parts Inspection Parameter

**Ignition coil  (H.T coil ) inspection :**

| Checking parameter | Standard | Condition | Tool to be used | Action |
|---|---|---|---|---|
| Ignition coil | Multi-meter in the resistance check mode Resistance : Primary windings (Meter range : 200    ): Multi-meter : Pin 1 & 2 (O/W-B)  : 0.8 ~ 1.2 Secondary windings (Meter range : 20 КΩ) : Multi-meter : (output wire and Black wire ) 4.2 ~ 6.5 КΩ | Check resistance between (O/W-B and output wire and  Black wire wires | Multi-meter | Diagnose & Replace defective part & Re check. |

**Fuel level sensor inspection :**

- Remove :  fuel pump.
- Check that the float moves up and down smoothly without bending. It should go down under its own weight. If the float does not move smoothly, replace the fuel pump.
- Using the multi-meter, measure the resistance between the  Y/B and G/R lead terminals. If the multi-meter readings do not change smoothly according as the float moves up and down, replace the fuel pump.

B/Y
O/L
Y/B
G/R

Fuel level sensor
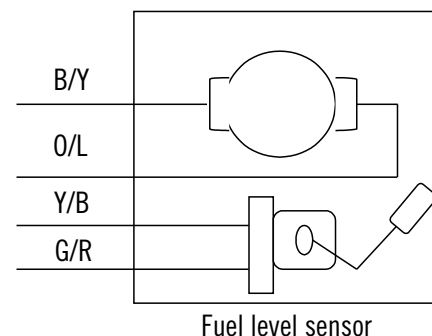
| Minimum Fuel Volume (lit.) +0.2 lit. | RC 390/200 Resistance(O) | Bars Displayed | Minimum Fuel Volume (lit.) | Duke 390/200 Resistance(O) | Bars Displayed |
|---|---|---|---|---|---|
| 0 | 110 (+3) | 0 | 0 | 107 | 0 |
| 2.5 | 80 (+2) | 2 | 2.5 | 83 | 2 |
| 4 | 60 (+2) | 4 | 4 | 63 | 4 |
| 5.5 | 40 (+2) | 6 | 6 | 40 | 6 |
| 7 | 20 (+2) | 8 | 7 | 33 | 7 |
| 8.1 | 15 (+2) | 8 | 8 | 23 | 8 |
| 8.5 | 10 (+2) | 9 | 9 | 16 | 9 |

Fuel level sensor mounting screw

| Sr.No. | Fuel pump pressure | Fuel delivery  in 10 sec. |
|---|---|---|
| Duke/RC 200 | 2.7kg/cm2 | Min.180 ml |
| Duke/RC 390 | 3.5kg/cm2 | |

❖ **Using the multi-meter, do not show continuity between G/R wire and Fuel level sensor mounting screw in RC.**

# Electrical System : Speedometer Connection

**Speed Meter Connection**

| Mt pin | Harness | Meter | What and When to Check |
|--------|---------|-------|------------------------|
| 1 | W | W | Receives 12V battery Post Ign switch is ON |
| 2 | W/Br | W/Br | ABS diactivation switch. Voltage when switch is ON and drops current when switch pressed |
| 4 | G/R | B | Fuel level indicator from Fuel gauge Output |
| 5 | R/B | R/B | Hi beam input From switch LHS in hi beam/pass - 12V |
| 6 | V/B | V/B | Milleage indicator Input from ECU Pin 20 |
| 7 | G. | G. | Left turn indicator Input from G wire of Indicator Relay |
| 8 | | | Internal input to set button |
| 9 | | | internal input to mode button |
| 10 | Gr | Gr | Right turn indicator Input from Gr wire of Indicator Relay |
| 11 | B | B | rpm( tachometer) sensor from ECU Pin 21 |
| 12 | B/Y | B/Y | Meter Groung cable near RR unit. |
| 13 | B/W | B/W | ABS light activation wire from ABS Pin 17 |
| 14 | | | |
| 15 | W/Y | W/Y | Fuel level Rest Tank Input from ECU Pin 8 |
| 15 | Gr/Pi | Br | Input from Kill switch . Gets signal post Kill switch ON- ECU Pin 9 |
| 16 | Y/W | Y/W | WTS Input. Also connects to ECU Pin 44 |
| 17 | L/W | L/W | Receives sensor Input thru ABS ECU Pin 8 |
| 18 | | V. | Programe Output |
| 19 | | W/B | Programe. |
| 20 | | Br/W | Programe |
| 21 | | Pi/L | Homologation |
| 22 | L/W | L/W | Gear 1 earthing in gear Indicator switch ( Gear 1) |
| 23 | R | R | Gear 2 earthing in gear Indicator switch ( Gear 2) |
| 24 | Y. | Y. | Gear 3 earthing in gear Indicator switch( Gear 3) |
| 25 | G. | G. | Gear 4 earthing in gear Indicator switch ( Gear 4) |
| 26 | W. | W. | Gear 5 earthing in gear Indicator switch (Gear5) |
| 27 | B | B | Gear 6 earthing in gear Indicator switch ( Gear6) |
| 28 | Lg | Lg | Neutral position earthing in gear indicator switch( Neutral) |
| 29 | Gr/W | Gr/W | Immobolizer Input from Immobolizer Pin 11 |
| 30 | O/L | O/L | Input from side stand. 4.5V when down & 2-2.2 when Up |
| 31 | Br/R | Br/R | Input to MIL when FI has a issue from ECU Pin 3 |
| 32 | Br/Pi | Br/Pi | Input voltage from oil pressure switch. Voltage low with rise temp |

# Working of Relays

**Component : Aux _ starter relay_1**
**Working :** To operate the Cranking (starter) relay post kill switch on provide earthing.

| AUXILLARY 1(GREY) | | | IGN.SWI | KILL SWI | IGN.SWI | KILL SWI | IGN.SWI/KILL SWI |
|---|---|---|---|---|---|---|---|
| **COLOUR CODE** | **CONNECTION FROM** | | **OFF** | **OFF** | **ON** | **OFF** | **ON** |
| | **MY 13/14** | **MY 15** | | | | | |
| B/Y | Ground-frame | | 0V | | 0V | | FLOW |
| O/W (MY 13/14) \| Gr/Pi (MY 15) | Input To Kill Switch (Via Fuse before kill switch) | Input From Fuse Box - 8 (After kill switch) | 0V | | 12V | | 12V |
| R/G | Input From ECU | | 0V | | 12V | | 12v Momentarily |
| R/G | Output To Aux 2 Relay | | 0V | | 0V | | 12v Momentarily |
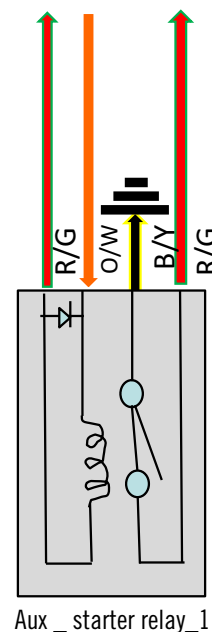


Aux _ starter relay_1

**Component : Aux _ starter relay_2**
**Working :** To operate the Cranking (starter) relay post kill switch on provide power to Aux _starter relay _3 and Termination unit.

| AUXILLARY 1(GREY) | | | IGN.SWI | KILL SWI | IGN.SWI | KILL SWI | IGN.SWI/KILL SWI |
|---|---|---|---|---|---|---|---|
| **COLOUR CODE** | **CONNECTION FROM** | | **OFF** | **OFF** | **ON** | **OFF** | **ON** |
| | **MY 13/14** | **MY 15** | | | | | |
| O/W (MY 13/14) \| Gr/Pi (MY 15) | Input To Kill Switch (Via Fuse) | Input From Fuse Box -8 | 0V | | 12V | | 12V |
| W/G | O/P To Aux.3 Relay | | 0V | | 0V | | 12V |
| R/G | To ECU Ground | | 0V | | 12V | | 0V |
| O/W | Input To Kill Switch (Via Fuse) | | 0V | | 0V | | 12V |

# Working of Relays

### Component : Aux _ starter relay_3
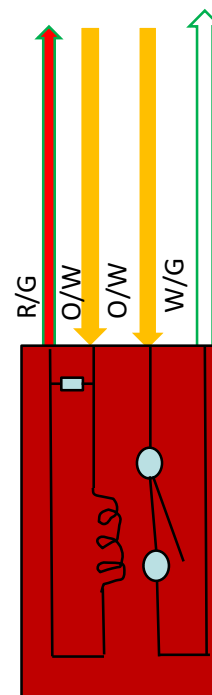**Working :** To operate the Cranking (starter) relay post kill switch on provide power to starter relay.

| AUXILLARY 3 | NEUTRAL | IGN.SWI | KILL SWI | IGN.SWI | KILL SWI | IGN.SWI/KILL SWI NEUTRAL |
|---|---|---|---|---|---|---|
| COLOUR CODE | CONNECTION FROM | OFF | OFF | ON | OFF | ON |
| R/Y | O/P To Starter Relay | 0V | | 0V | | 12V |
| Y/R | O/P From Starter Switch | 0V | | 0V | | 12v When Str Switch Pressed |
| Y/L | GROUND- Termination Unit | 0V | | 0V | | 0v In Neutral (Volt. Drop) |
| W/G | I/P From Aux. Relay 2 | 0V | | 0V | | 12V |

| AUXILLARY 3 | IGN.SWI/KILL SWI ( IN GEAR ) |
|---|---|
| COLOUR CODE | ON |
| R/Y | 12v |
| Y/R | O V When Str Switch Pressed |
| Y/L | 12 V In Gear(clutch Switch Not Pressed) |
| W/G | 12v |

| AUXILLARY 3 | IGN.SWI/KILL SWI(IN GEAR CL.SWI. PRESS) |
|---|---|
| COLOUR CODE | ON |
| R/Y | 12v |
| Y/R | 12v When Str Switch Pressed |
| Y/L | Vol .Drop -Gear ,(Clu. Switch Pressed) |
| W/G | 12v |
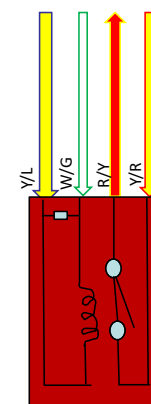


Aux _ starter relay_3

### Component : Power (Main) relay
**Working :** To operate the FI system post kill switch on (provide power).

| BATTERY CONNECTED WITH VOLTAGE-13V | | | IGN.SWI | KILL SWI | IGN.SWI | KILL SWI | IGN.SWI/ KILL SWI |
|---|---|---|---|---|---|---|---|
| POWER  RELAY | | | OFF | OFF | ON | OFF | ON |
| COLOUR CODE | CONNECTION FROM | | | | | | |
| | MY-13/14 | MY-15 | 12V | | 12V | | 12V |
| R/W | FUSE BOX - 15A Main Relay ECU | | | | | | |
| R/W | FUSE BOX - 15A Main Relay ECU | | 12V | | 12V | | 12V |
| L/G | ECU Ground Pin 2 | | 12V | | 12V | | DROP ~3.3V |
| Br/W | O/P- Pump Relay, Injector, Radiator Fan Relay , Fuel Injector & Lambda | O/P- Injector, Radiator Fan Relay, Fuel Injector & Lambda | 0V | | 0V | | 12V |
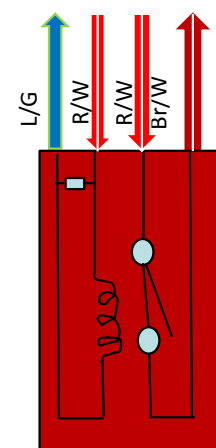


Main relay

### Component : Fan relay
**Working :** To provide power to fan when received earthing from ECU.

| FAN RELAY | | IGN.SWI | KILL SWI | IGN.SWI | KILL SWI | IGN.SWI/KILL SWI |
|---|---|---|---|---|---|---|
| COLOUR CODE | CONNECTION FROM | OFF | OFF | ON | OFF | ON |
| O | FUSE BOX  - 15A | 12V | | 12V | | 12V |
| Br/W | Input From -Main Relay O/P | 0V | | 0V | | 12 V |
| G/PI | Input From –ECU pin 49 When engine temp. is 96$^0$C and above | 0V | | 0V | | 12 V drop when  Engine temp. is 96$^0$C and above |
| Gr/Y | O/P to radiator fan | 0V | | 0V | | 12 V Flow When Engine temp. is 96$^0$C and above |
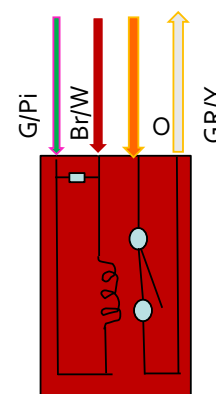


Fan relay

# Working of Relays

**Component : Fuel pump relay**
**Working :** To provide power to fuel pump when received earthing from ECU.

| FUEL PUMP RELAY | | | IGN.SWI | KILL SWI | IGN.SWI | KILL SWI | IGN.SWI/KILL SWI |
|---|---|---|---|---|---|---|---|
| **COLOUR CODE** | **CONNECTION FROM** | | OFF | OFF | ON | OFF | ON |
| | MY-13/14 | MY-15 | | | | | |
| R/W | FUSE BOX - 15A Main Relay ECU | | 12V | | 12V | | 12V |
| O/L | Input To Fuel Pump | | 0V | | 0V | | 12v For Priming Then 0v, 12v In Engine Running Condition |
| Br/W (MY 13/14) | Gr/Pi (MY 15) | Input From -Main Relay O/P | Input From—Fuse Box 8 | 0V | | 0V | | 12v |
| W/L | ECU Pin 19 Ground | | 0V | | 0V | | Flow For Priming Then 12v Flow When Engine Running |
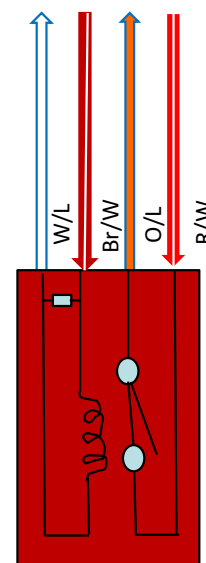
Fuel Pump relay

## Working of Termination Unit

| Termination unit | | IGN.SWI/KILL SWI | IGN.SWI | KILL SWI | IGN.SWI/KILL SWI | IGN.SWI/KILL SWI | IGN.SWI/KILL SWI |
|---|---|---|---|---|---|---|---|
| Colour code | Connection From | OFF | ON | OFF | ON and vehicle in neutral | ON vehicle in gear | ON vehicle in gear and clutch switch pressed |
| B/Y | Chassis earth. | 0 V | 0 V | 0 V | 0 V | 0 V | 0 V |
| W/B | Input from fuse box 1 (30 amp) | 12 V | 12 V | 12 V | 12 V | 12 V | 12 V |
| Y/L | Output (earthing) to Aux relay 3. | 0 V | 0 V | 0 V | Less then 3V | 12 V | Less then 3V |
| W/G | Input from Aux relay 2. | 0 V | 0 V | 0 V | 12 V | 12 V | 12 V |
| Y/G | Output (earthing) from clutch switch. | 0 V | 0 V | 0 V | 12 V | 12 V | Less then 3V |
| Lg | Output (earthing) from neutral switch. | 0 V | 0 V | 0 V | Less then 3 V | 12 V | 12 V |

# Working of Gear Indicator Switch

| Gear indicator switch | | | | | | | |
|---|---|---|---|---|---|---|---|
| Ign. On and kill switch on | | | | | | | |
| | Lg - wire | L/W- wire | R - wire | Y- wire | G - wire | W- wire | B - wire |
| Natural condition | Less Then 3V | 12V | 12V | 12V | 12V | 12V | 12V |
| 1st gear | 12V | Less Then 3V | 12V | 12V | 12V | 12V | 12V |
| 2nd Gear | 12V | 12V | Less Then 3V | 12V | 12V | 12V | 12V |
| 3rd Gear | 12V | 12V | 12V | Less Then 3V | 12V | 12V | 12V |
| 4th Gear | 12V | 12V | 12V | 12V | Less Then 3V | 12V | 12V |
| 5th Gear | 12V | 12V | 12V | 12V | 12V | Less Then 3V | 12V |
| 6th Gear | 12V | 12V | 12V | 12V | 12V | 12V | Less Then 3V |

To ECU pin 28

Termination unit

Speedometer

Lg

Gr

**To Speedometer**

W  B  G  Y  L/W  R

5  4  3  2
6  N  1

Gear Indicator switch
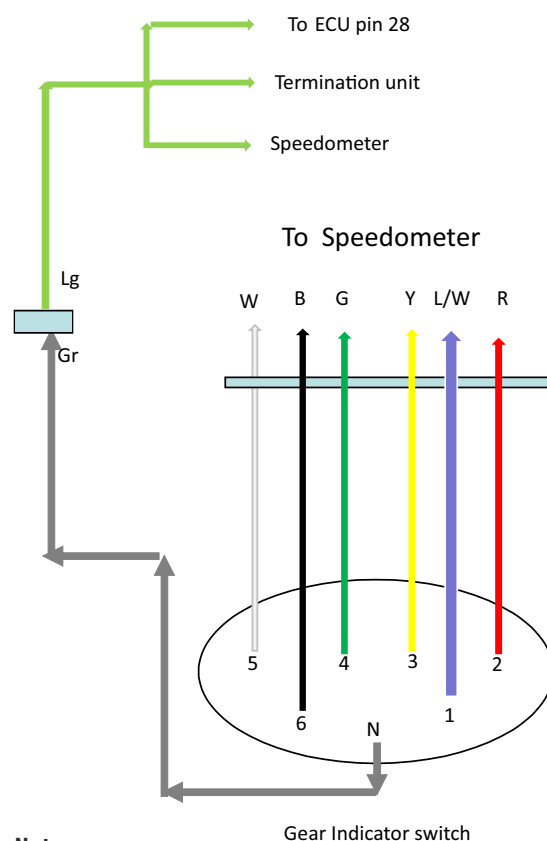
**Note :**

- If 12V not available : Check meter and meter to gear wire continuity .
- If 12V available but no voltage drop : Check gear indicator switch & drum pin for earthing.

# Speedometer Wire Connection

**Operating terminals (Inputs) of Dashboard : MY17 Duke 390).**

<table>
<tr><td colspan="6" align="center"><strong>390 Duke  Speedometer connection.</strong></td></tr>
<tr><th>Wire</th><th>Coupler pin</th><th>Meter Location</th><th>Meter wire</th><th>Meter pin</th><th>Meter Location</th></tr>
<tr><td>Gr/W</td><td>1</td><td>Security Alarm</td><td>21</td><td>Gr/Pi</td><td>Handle Bar Exit</td></tr>
<tr><td></td><td>2</td><td>Brake Light_2</td><td>22</td><td>O/Gr</td><td>Handle bar Down</td></tr>
<tr><td></td><td>3</td><td>Brake Light</td><td>23</td><td>G/W</td><td>Ground</td></tr>
<tr><td>G/R</td><td>4</td><td>Fuel Level Sensor</td><td>24</td><td>W</td><td>Battery Voltage (+12V)</td></tr>
<tr><td></td><td>5</td><td>USB Master Supply</td><td>25</td><td>W</td><td>Battery Voltage (+12V)</td></tr>
<tr><td>G</td><td>6</td><td>Left Turn Indicator</td><td>26</td><td></td><td>INT Programmer</td></tr>
<tr><td>Gr</td><td>7</td><td>Right Turn Indicator</td><td>27</td><td>G</td><td>USB Data(+)</td></tr>
<tr><td></td><td>8</td><td>MIL</td><td>28</td><td>W</td><td>USB Data(-)</td></tr>
<tr><td>O/Gr</td><td>9</td><td>Oil Pressure Switch</td><td>29</td><td>R</td><td>USB Supply</td></tr>
<tr><td></td><td>10</td><td>INT Programmer</td><td>30</td><td>G/L</td><td>CAN Hi</td></tr>
<tr><td></td><td>11</td><td>INT Programmer</td><td>31</td><td>Y/L</td><td>CAN Low</td></tr>
<tr><td>Pi/B</td><td>12</td><td>Kill Switch</td><td>32</td><td>B</td><td>USB Ground</td></tr>
<tr><td></td><td>13</td><td>Set Button</td><td>33</td><td>B/G</td><td>Power Ground</td></tr>
<tr><td></td><td>14</td><td>Air Temp. sensor</td><td>34</td><td>Gr/Pi</td><td>Ign.  ON.</td></tr>
<tr><td></td><td>15</td><td>Cruise Control Button</td><td></td><td></td><td></td></tr>
<tr><td></td><td>16</td><td>Resume Button</td><td></td><td></td><td></td></tr>
<tr><td>Gr/G</td><td>17</td><td>Handle Bar UP</td><td></td><td></td><td></td></tr>
<tr><td></td><td>18</td><td>INT Programmer</td><td></td><td></td><td></td></tr>
<tr><td></td><td>19</td><td>INT Programmer</td><td></td><td></td><td></td></tr>
<tr><td>Y/Gr</td><td>20</td><td>Handle Bar Set</td><td></td><td></td><td></td></tr>
</table>

## Speedometer Wire Connection

**Speed meter Connection : MY17 RC 390 (JY402404).**

| RC Speedometer connection | | | | |
|---|---|---|---|---|
| **Harness wire** | **Harness & meter coupler pin** | **Meter wire** | **Meter pin** | **Meter Location** |
| W | 1 | W | 1 | Input Battery (+12V) |
| Gr/Pi | 11 | Gr/Pi | 2 | Ignition Switch (+12V) |
| Pi/R | 3 | Pi/R | 3 | Ground |
| | 4 | B/Y | 4 | Ground |
| Pi/B | 5 | Pi/B | 5 | Kill Switch Input |
| G/R | 6 | G/R | 6 | Fuel Level Sensor Input |
| Br/Pi | 7 | Br/Pi | 7 | Oil Pressure Input |
| G/L | 8 | NC | 8 | NC |
| Y/L | 9 | Y/L | 9 | CAN Low |
| B/Y | 10 | G/L | 10 | CAN Hi |
| G | 2 | G | 11 | Left Turn Indicator Input |
| Gr | 12 | Gr | 12 | Right Turn Indicator Input |
| Gr/W | 13 | 13 | Gr/W | Immobilizer Input |
| | 14 | 14 | R/B | High Beam Input |
| Br | 15 | 15 | NC | |
| | 16 | 16 | Br/W | Programming : TEST-C |
| | 17 | 17 | Pi | Programming : UIN- C |
| | 18 | 18 | W/B | Programming : UOUT-C |
| | 19 | 19 | V | Programming : RESET-C |
| | 20 | 20 | O/L | Programming : DEBUG-C |

# Speedometer Wire Connection

**Indicators on Meter**

| S. No. | Indicator | Colour | Description | Symbol | Changes : MY17 |
|---|---|---|---|---|---|
| 1 | Set | Black | Set button. | | Same |
| 2 | Mode | Black | Mode button. | | Same |
| 3 | Turn indicator | Green | ON when turn signal LH/RH ON. | | Same |
| 4 | MIL | Yellow | Malfunction indicator from EFI system. | | MY12 to MY 16 : FI issue : MIL starts blinking. MY 17 : FI issue : MI light stay ON. |
| 5 | Shift Light (Engine rpm driven | Red | Blinking : Shift rpm 1 < Eng. RPM < Shift RPM2. Continuously ON : Shift RPM 1 < Shift RPM 2 < Eng. RPM. | | Same |
| 6 | Neutral Indicator | Green | ON when engine in neutral position. | | Same |
| 7 | High beam indicator | Blue | ON when high beam is ON. | | Same |
| 8 | ABS indication | Yellow | To inform the rider about the status of ABS system (active or deactivate. | | MY13 to MY 16 : ABS issue : ABS light stay ON. MY 17 : ABS issue : ABS will stay ON & failure message displayed in meter. |
| 9 | Immobilizer | Red | To inform the rider about the status from the optional alarm system. | | Same |
| 10 | Alarm, Generic | Yellow | No of alarm messages =1 LED will glow continuously. No of alarm messages > 1 LED blinks at 1 Hz. No of alarm messages =0 LED turns off. | | Same |



CAN Speedometer.

# Speedometer Wire Connection

## Meter Working Power ON Cycle

Ignition ON and Kill switch off (Applicable only for RC 390 MY17).

| Before. | After. |
|---|---|
|  |  |
| 1. (Till MY -16 ): Ign 'ON' , Kill switch OFF, Meter will not display. <br><br> 2. Ign 'ON' , Kill switch 'ON', "READY TO RACE" message will display on Dot Matrix | 1. MY -17 : Ign 'ON' , Kill switch 'OFF', Meter display will glow and 'Kill Switch' message will be displayed as above. <br><br> 2. Ign 'ON' , Kill switch 'ON', "READY TO RACE" message will display on Dot Matrix |

## Dot Matrix Alarm Message Display Features

| S.No. | Message Text (Till MY 16). | Message Text – MY17 |
|---|---|---|
| 1 | Side Stand Down | CAN Failure |
| 2 | Low Oil Pressure | CAN ABS Failure |
| 3 | High Coolant Temperature | CAN EMS Failure |
| 4 | Low Fuel Level | Transport Lock |
| 5 | Low Battery | Side Stand Down |
| 6 | | Kill Switch Off |
| 7 | | ABS Failure |
| 8 | | Low Oil Pressure |
| 9 | | Coolant Sensor Failure |
| 10 | | High Coolant  Temperature |
| 11 | | Fuel Level Sensor Failure |
| 12 | | Low Fuel Level |
| 13 | | Low Battery. |



| S.No. | Message Text (Till MY 17) |
|---|---|
| 1 | ODOROLL OVER =1, for 10 sec. at Ignition ON Depending on km/h or mph mode, if ODO has crossed 99999 twice then message will be ODO ROLL OVER =2 for 10 sec and so on. |
| 2 | SERVICE RESET for 10 sec. at Ignition ON. |



**DOT Matrix Working:**

In case of more than alarm message the message would scroll after every 5 sec. in the order of 1-13.

1. If Kill switch is Off then "CAN" messages would be detected and display on the dot matrix display. However ABS failure would be displayed with kill switch OFF.

2. In case any new message gets input during scrolling then scrolling will restart including the new message and in priority of 1-13.

3. Error message will be displayed at Odo in case of any of 13 errors

KTM_SERVICE

# Speedometer Wire Connection

**ABS Activation Mode on Meter**

ABS Self-diagnosis function :
ABS ECU has a self-diagnosis function that determines if the ABS system is operating normally. If failure is detected from sensor inputs or at any electronic circuits, it is indicated over the meter. ABS MIL to go off and remain off after 6 kmph if  no failure in ABS system.

| Before. | After. |
|---|---|
| **MY -16 and Rc 200 MY17** :  | **MY -17  RC 390** :  |
| **ABS failure :**  ABS warning lamp will stay ON after 6 kmph to inform the rider of the ABS  failure<br><br>**ABS Deactivated**  ABS warning lamp will Blink if ABS is deactivated by rider. | "ABS failure" message displayed in odometer to  inform the rider of the ABS failure along with glowing of ABS light.<br><br>ABS warning lamp with glow if ABS is deactivated by rider but ABS failure will not be displayed. Do not press ABS deactivate button more than 6 sec. |

**Operating terminals of Meter : MY17 RC 390 (JY402404)**

| RC  MY 17 CAN Speedometer connection | | | | |
|---|---|---|---|---|
| Harness wire | Harness & meter coupler pin | Meter wire | Meter pin | Meter Location |
| W | 1 | W | 1 | Input  Battery (+12V) |
| Gr/Pi | 11 | Gr/Pi | 2 | Ignition Switch (+12V) |
| Pi/R | 3 | Pi/R | 3 | Ground |
|  | 4 | B/Y | 4 | Ground |
| Pi/B | 5 | Pi/B | 5 | Kill Switch Input |
| G/R | 6 | G/R | 6 | Fuel Level Sensor Input |
| Br/Pi | 7 | Br/Pi | 7 | Oil Pressure Input |
| G/L | 8 | NC | 8 | NC |
| Y/L | 9 | Y/L | 9 | CAN Low |
| B/Y | 10 | G/L | 10 | CAN Hi |
| G | 2 | G | 11 | Left Turn Indicator Input |
| Gr | 12 | Gr | 12 | Right Turn Indicator Input |
| Gr/W | 13 | 13 | Gr/W | Immobilizer Input |
|  | 14 | 14 | R/B | High Beam Input |
| Br | 15 | 15 | NC |  |
|  | 16 | 16 | Br/W | Programming : TEST-C |
|  | 17 | 17 | Pi | Programming : UIN- C |
|  | 18 | 18 | W/B | Programming : UOUT-C |
|  | 19 | 19 | V | Programming : RESET-C |
|  | 20 | 20 | O/L | Programming : DEBUG-C |

◆ White wire operates the meter ( current supplied directly through battery)
◆ Gr/Pi wire from ignition switch helps illuminate the meter display.
◆ Pi/B wire from kill switch brings the ECU on meter through CAN .
◆ Program pins (16-20) are to set a program on meter. Currently not used by us. We will start using them shortly.
◆ Y/L and G/L wires in 9 and 10 are CAN wires connecting meter to other CAN bus systems.

## Speedometer Wire Connection

**Operating terminals of Meter : MY17 RC 390 (JY402404) Fuel Level indicator**

Calibration : Fuel level is Displayed on meter as per the table shown below.

| Fuel in Tank | Resistance by fuel gauge (Ω) | Indication on LCD (Bar Displayed) | Approx. Fuel Volume (Lit.) |
|---|---|---|---|
| Empty | 110 ± 2 | 0 | 0 |
|  | 100 ± 2 | 1 | 2 |
|  | 90 ± 2 | 2 | 2.3 |
| Reserve | 80 ± 2 | 2 | 2.3 |
|  | 70 ± 2 | 3 | 3 |
|  | 60 ± 2 | 4 | 4 |
|  | 50 ± 2 | 5 | 5 |
| Half | 40 ± 2 | 6 | 5.5 |
|  | 30 ± 2 | 7 | 6.5 |
|  | 20 ± 2 | 8 | 7.5 |
|  | 15 ± 2 | 8 | 8 |
| Full | 10 ± 2 | 9 | 8.5 |

**Operating terminals of Meter : MY17 RC 390 (JY402404) Water temperature**

| Indication on LCD | | Temp (degree Celsius) ± 2 °C by WTS | Alarms |
|---|---|---|---|
| Zone 1 | 1 Bar | 40 | None |
|  | 2 Bar | 45 |  |
|  | 3 Bar | 50 |  |
|  | 4 Bar | 55 |  |
|  | 5 Bar | 60 |  |
|  | 6 Bar | 65 |  |
|  | 7 Bar | 70 |  |
|  | 8 Bar | 80 |  |
|  | 9 Bar | 90 |  |
|  | 10 Bar | 95 |  |
| Zone 2 | 11 Bar | 110 | High Coolant Temperature Message. |
|  | 12 Bar | 115 |  |
|  | 13 bar | 120 |  |

**KTM_SERVICE**

# Push Button Management Table - 390 Duke MY17

MENU
KTM MY RIDE
INFO
MOTORCYCLE
SETTINGS
PREFERENCES

Up | Back | Set | Down

**Battery voltage : More then 12.5 V.**

| Menu | Speed | RPM | Function | Button | Time (Secs) | Activity | Remark |
|---|---|---|---|---|---|---|---|
| KTM MY RIDE | 0 | 0 | Bluetooth Pairing. | Set | <1 Sec | To enter KTM my ride and select pairing and Scan mobile devices available for Bluetooth pairing or pair them. Check status of the paired device. | For Phone pairing : bluetooth should be On condition. |
| | | | Incoming call. | | | To receive call-in infrromation from the smartphone into the dashboard on the paired device. | |
| | | | | Set | <1 Sec | To accept phone calls on the paired device. | |
| | | | | Back | <1 Sec | To reject phone calls on the paired device. | |
| | | | Playlist. | Set | <1 Sec | To enter KTM my ride and select audio a Music change ( Press up/down button), vol. up (long press up/down button - according to require vol. | |
| | | | | Set | <1 Sec | Music play/pause | |
| | | | | Up & Down | <1 Sec | Music change. | Listen/Shuffle through audio tracks of paired device.adjust its volume. |
| | | | | Up & Down | >5 sec | volume increases up button press & volume decrease down button press. | |
| INFO | 0 | 0 | General Info | Set | <1 Sec | Check battery voltage. | |
| | | | Trip 1 reset | Set | <1 Sec | To enter Info mode and select Trip 1. | |
| | | | | Set | >5 sec | Trip 1 reset. | |
| | | | Trip 2 reset | Set | <1 Sec | To enter Info mode and select Trip 2. | |
| | | | | Set | >5 sec | Trip 2 reset. | |
| | | | Warning | Set | <1 Sec | To enter warning mode and check massage list. | |
| MOTORCYCLE | 0 | 0 | ABS deactivation | Set | <1 Sec | To enter motorcycle and select ABS off | ABS deactivation is not legal. |
| | | | | Set | >5 sec | Press Butten and release according to dashboard. | |
| | 6 Km/h | | ABS activation | Ignition signal | one time Ignition switch off and ON. | ABS activate (In road mode.)To activate ABS system Switch OFF and Switch ON the Ignition. | Road mode : Both channel are working. |
| | 0 | 0 | ABS rear channel deactivation | Set | >5 sec | Press Butten(Select Sup Mot) and release according to dashboard. For SUP MOT to Road Mode : Press Butten (Select Road) and release according to dashboard. | SUP MOT mode : You can deactivate ABS rear channel. |
| SETTINGS | 0 | 0 | Favorites list on dashboard. | Set | <1 Sec | To enter favorites mode and select max 8 as do you want. For select priority on display from Quick selector 1 and 2 on dashboard. | Max. select will be 8 and min 2 on dashboard. |
| PREFERENCES | 0 | 0 | Bluetooth On/Off | Set | <1 Sec | To enter Bluetooth Mode and Select On/Off. | For Phone bluetooth pairing : It should be On condition. |
| | | | Shift Light | Set | <1 Sec | To enter RPM1 and RMP2 mode and Set RPM. | Shift RPM light menu is not available below 1000 kms. |
| | | | On entering Clock/Date set Mode | Set | <1 Sec | To enter Clock/ Date Mode. | |
| | | | | Set | <1 Sec | Select Clock and press Up/Down buttons to change the time, press set button to saving the data. | |
| | | | | Down | <1 Sec | To enter Date Mode. | |
| | | | | Set | <1 Sec | Select Date and press Up/Down buttons to change the date, press set button to saving the data. | |
| | | | DRL On/Off | Set | <1 Sec | To enter DRL Mode and Select On/Off. | |
| | | | Select Units : 1.Km/h to mph, 2.Temp. (Celsius to Fahrenheit) 3.Fuel Cons. (liter/ 100 kms, Kms/liter...) | Set | <1 Sec | To enter Units Mode. | |
| | | | | Set | <1 Sec | To enter distance Mode and select Kilometres to Miles & vice versa. | Km/h unit for India. |
| | | | | Set | <1 Sec | To enter temp. Mode and select Celsius to Fahrenheit & vice versa. | Celsius unit for India. |
| | | | | Set | <1 Sec | To enter Fuel cons. Mode and select unit according to country. | Km/l unit for India. |
| | | | Select Country wise language. | Set | <1 Sec | Select Language : Country wise language. | EN UK language for India. |
| | | | Service reset | Up & Down together | >5 sec | Press Up & Down Button press together in Preferences Mode. | |
| | | | | Set | <1 Sec | Select Next service, On pressing the set to change Kms. | 0.1 sec per 500 kms |
| | | | | Set | >5 sec | On pressing the set buttons to save kms. | |
| | | | TFT dashboard program version | Set | <1 Sec | To enter service and check program version in odometer. | |
| | | | Next service | Set | <1 Sec | To enter service and check next service. | |
| | | | Extra Functions | Set | <1 Sec | To enter extra functions and check status. | |

# Speedometer Wire Connection

**Probable faults in meter : MY17 RC 390 (JY402404)**

```
                    1. Meter display glows w/o Ignition ON
                                    |
                              Remove Coupler
                                    |
                       Check Voltage in meter
                       socket of Gr/Pi wire
                                    |
                  ┌─────────────────┴──────────────────┐
                 0 V                                1 – 12 V
                  |                                     |
            Clean and Dry                    Check Gr/Pi Ignition
                  |                              Switch Output
          ┌───────┴───────┐                  ┌───────┴────────┐
   Meter stops      Meter still            0 V            1 – 12 V
    glowing           glows                 |                 |
        |               |            Replace Wiring      Ignition Switch
       OK         Replace Meter         Harness             Replace
```

```
        2. Meter Display does not glow with Ignition switch  "ON"
                                  |
                   Check voltage in White wire from battery & Gr/Pi wire
                                from Ign. Switch.
                                  |
        ┌─────────────┬────────────────┬────────────────┐
  If 12V not      If 12V found       If 12V found in       IF12V found White
  found in white  in 12V but not     white and Gr/Pi       and Gr/Pi wire and
  wire.           found in Gr/PI     wires then check      earthing wire found
                  wire.              B/Y wire continuity   ok then replaced meter.
        |              |             between meter to
  Check fuse 2    Check ign. Switch  earthing ground.
  :12V (Battery   output voltage.    Check coupler pin
  connected.)         |              for bend or backing
        |         If found then
  If 12V found    check wire
  then check      continuity.
  white wire
  continuity
```

# Process Failure Report (PFR)

| REPAIR ERROR | Time Issue –Delay in setting of shift rpm |
| --- | --- |

| WHY WHY ANALYSIS | |
| --- | --- |
| **Customer Voice** | Delay in changing shift rpm. ( when possible after initial 1000 kmslock ) |
| **Reason for Complaint** | Service center not able to reset the Shift RPM 1 on RC 390 MY17 |
| **Why 1** | Shiftrpm1couldnotgetreset. |
| **Why 2** | ChangedmethodofshiftrpmresetinRC390MY17,notknowntotechnician. |
| **Root Cause** | Not explained during initial training. |
| **Action** | For speedometers communicating on CANBUS the shift rpm 1 & 2 would happen at Trip 1 & Trip 2 mode respectively. |

### Before

Up to 1000 kms. –Shift RPM reset would not be allowed, its locked for ensuring running in.
Shift RPM 1 & 2 can be reset in Trip 2 in MY 16 RC 390

### After



Shift RPM 1 can only be reset on Trip 1 & Shift RPM 2 can only be reset on Trip 2 in MY 17 Meter communicating with CANBUS.

# Process Failure Report (PFR)

| REPAIR ERROR | Deactivation of ABS not happening in RC 390 MY17 |
| --- | --- |

| WHY WHY ANALYSIS | |
| --- | --- |
| Customer Voice | ABS is not getting deactivated in RC390 MY17. |
| Reason for Complaint | Once deactivated, ABS not remaining deactivated , after achieving speed of 7 km/hr. |
| Why 1 | Wrong method of ABS deactivation. |
| Why 2 | Correct method of ABS deactivation with can bus not followed. |
| Root Cause | Was not explained during initial training. |
| Action | Ignition ON and engine running condition is must for an effective deactivation. |

**Before**
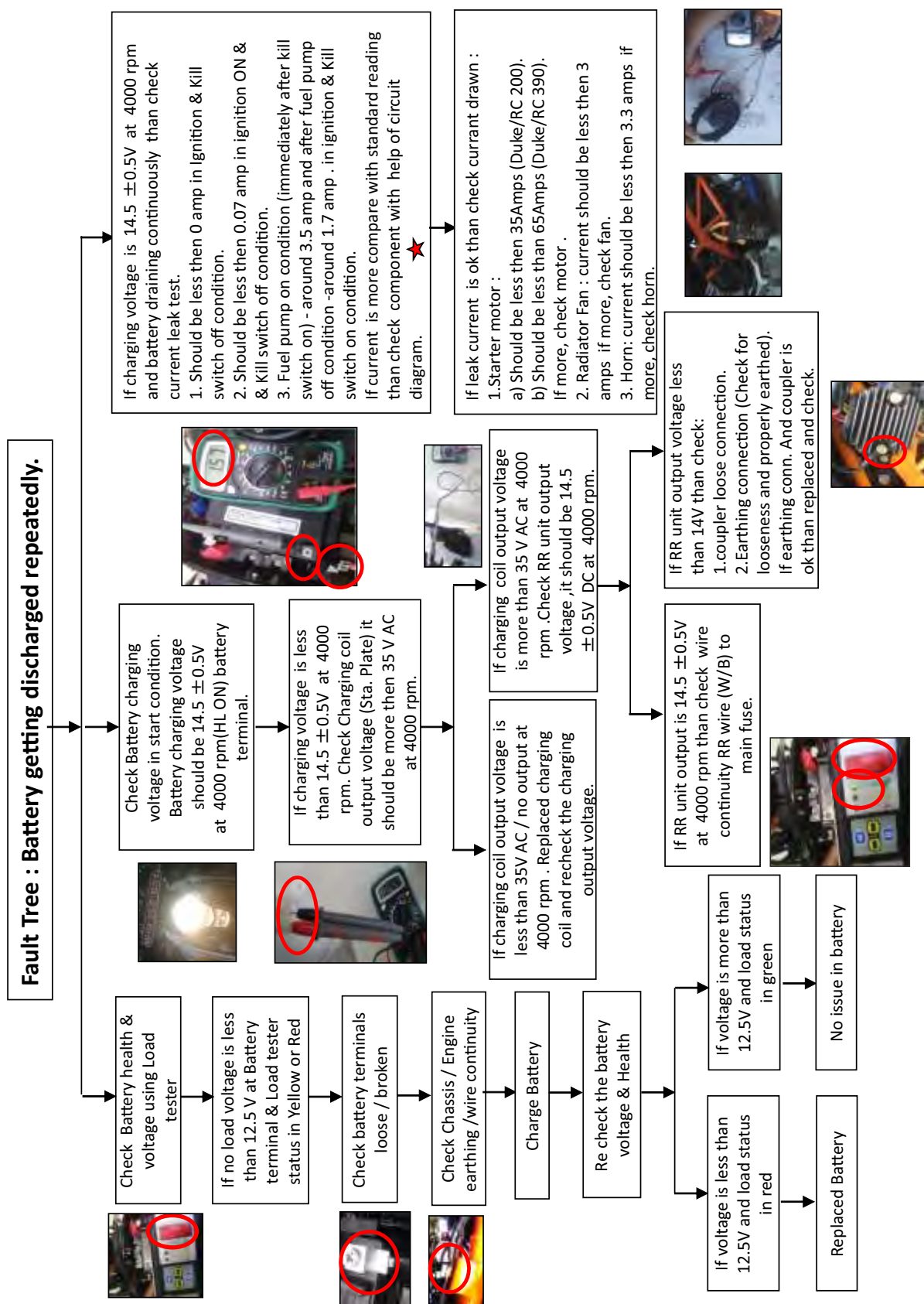
ABS would get deactivated with Ignition "ON" :
by pressing deactivation button for some time.
Deactivated ABS could be confirmed by the blinking of
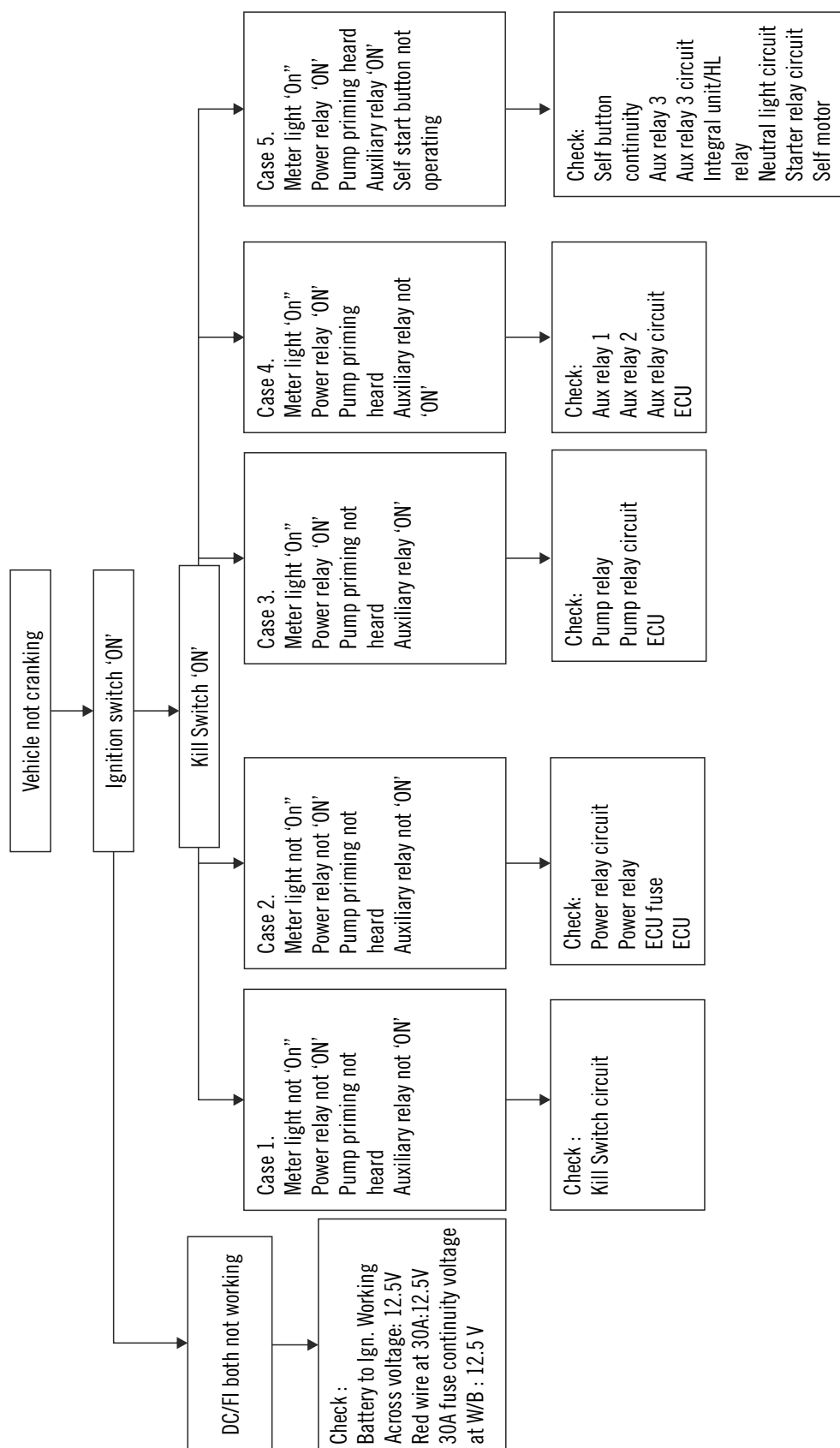ABS indicator.

**After**



In CAN BUS system ABS will get deactivated with Ignition "ON"
and engine in running condition by pressing deactivation
button for some time. Deactivated ABS could be confirmed
by "Not legal" message display on meter

# Fault Tree

## Fault Tree : Battery getting discharged repeatedly.

If charging voltage is 14.5 ±0.5V at 4000 rpm and battery draining continuously than check current leak test.
1. Should be less then 0 amp in Ignition & Kill switch off condition.
2. Should be less then 0.07 amp in ignition ON & & Kill switch off condition.
3. Fuel pump on condition (immediately after kill switch on) - around 3.5 amp and after fuel pump off condition -around 1.7 amp . in ignition & Kill switch on condition.
If current is more compare with standard reading than check component with help of circuit diagram.

If leak current is ok than check currant drawn :
1.Starter motor :
a) Should be less then 35Amps (Duke/RC 200).
b) Should be less than 65Amps (Duke/RC 390).
If more, check motor .
2. Radiator Fan : current should be less then 3 amps if more, check fan.
3. Horn: current should be less then 3.3 amps if more, check horn.

If RR unit output voltage less than 14V than check:
1.coupler loose connection.
2.Earthing connection (Check for looseness and properly earthed). If earthing conn. And coupler is ok than replaced and check.

Check Battery charging voltage in start condition. Battery charging voltage should be 14.5 ±0.5V at 4000 rpm(HL ON) battery terminal.

If charging voltage is less than 14.5 ±0.5V at 4000 rpm. Check Charging coil output voltage (Sta. Plate) it should be more then 35 V AC at 4000 rpm.

If charging coil output voltage is more than 35 V AC at 4000 rpm .Check RR unit output voltage ,it should be 14.5 ±0.5V DC at 4000 rpm.

If RR unit output is 14.5 ±0.5V at 4000 rpm than check wire continuity RR wire (W/B) to main fuse.

If charging coil output voltage is less than 35V AC / no output at 4000 rpm . Replaced charging coil and recheck the charging output voltage.

Check Battery health & voltage using Load tester

If no load voltage is less than 12.5 V at Battery terminal & Load tester status in Yellow or Red

Check battery terminals loose / broken

Check Chassis / Engine earthing /wire continuity

Charge Battery

Re check the battery voltage & Health

If voltage is more than 12.5V and load status in green

If voltage is less than 12.5V and load status in red

No issue in battery

Replaced Battery

## Fault Tree

Vehicle not cranking

Ignition switch 'ON'

Kill Switch 'ON'

DC/FI both not working

Check :
Battery to Ign. Working
Across voltage: 12.5V
Red wire at 30A:12.5V
30A fuse continuity voltage
at W/B : 12.5 V

Case 1.
Meter light not 'On''
Power relay not 'ON'
Pump priming not
heard
Auxiliary relay not 'ON'

Check :
Kill Switch circuit

Case 2.
Meter light not 'On''
Power relay not 'ON'
Pump priming not
heard
Auxiliary relay not 'ON'

Check:
Power relay circuit
Power relay
ECU fuse
ECU

Case 3.
Meter light 'On''
Power relay 'ON'
Pump priming not
heard
Auxiliary relay 'ON'

Check:
Pump relay
Pump relay circuit
ECU

Case 4.
Meter light 'On''
Power relay 'ON'
Pump priming
heard
Auxiliary relay not
'ON'

Check:
Aux relay 1
Aux relay 2
Aux relay circuit
ECU

Case 5.
Meter light 'On''
Power relay 'ON'
Pump priming heard
Auxiliary relay 'ON'
Self start button not
operating

Check:
Self button
continuity
Aux relay 3
Aux relay 3 circuit
Integral unit/HL
relay
Neutral light circuit
Starter relay circuit
Self motor

# Process Failure Report (PFR)

| REPAIR ERROR | SPEEDOMETER TURNING TO ZERO ABRUPTLY" ON RUN EVEN THOUGH THE SPEED IS MORE THAN 50 KMPH. |
|---|---|

### WHY WHY ANALYSIS

| | |
|---|---|
| Customer Voice | Speedometer turning to Zero abruptly sometimes while vehicle is still driven -390.Duke. |
| Reason for Complaint | Even after replacement with new speedometer assembly issue was unresolved. |
| Why 1 | Speedometer display communication logic was an issue |
| Why 2 | Software at the speedometer creating the changes |
| Root Cause | Modified software speedometer information not known to the service staff. |
| Action | 1. Ensure fitment of modified software version speedometers only while replacements.<br>2. Fit JY_1.3.2 software version speedometers only and not with JY_1.3.1.<br>3. Modified speedometer fitment cut Off is from VIN Number-VBKJYJ4FXEC204536. Need to take care of vehicles prior to it. |

**Befor**
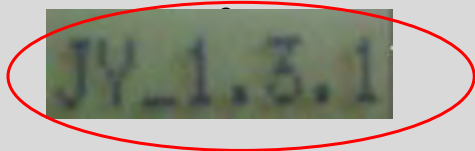


Display of version on speedometer screen-JY_1.3.1.

Old logic speedometer fitted creating repeated speedo reading "zero" issue.

**After**
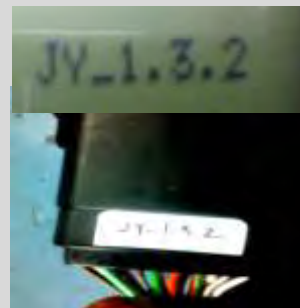


**Use of modified logic speedometers only with version displayed as seen.**

**Sticker pasted in initially modified vehicles on speedometer 20 pin coupler displaying JY_1.3.2**

# Process Failure Report (PFR)

**REPAIR ERROR**

| WHY WHY ANALYSIS | |
|---|---|
| **Customer Voice** | PDT not adhered as delay due to excess time taken to diagnose an electrical issue. |
| **Reason for Complaint** | Time consumed to confirm exact point of short circuit in DC system Is excessive. |
| **Why 1** | Diagnosis of short circuit point in system is done by trial and error method. (Many fuse get blown off) |
| **Why 2** | Logical method of checking short circuit point with circuit tester in series not explained. |
| **Root Cause** | Systematic approach and Circuit tester non availability. |
| **Action** | 1. Detach all DC instruments in the circuit for which culprit fuse is assigned to.<br>2. Use Circuit tester, adaptor of which can be inserted as like fuse at fuse box.<br>3. Determine whether no drain /normal drain or excess drain (short circuit) is seen.<br>4. Catch the culprit part this way – quickly. |

**Before**



Thicker wire inserted till the time the culprit point of short circuit is found out.( Danger of wiring harness burning)
Or many number of fuses installed till the time the culprit short component is found out.
Thus consuming a lot of time.

**After**

Use of circuit tester with bulb instead of wire or additional fuse.
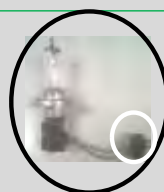


Attach adaptor in place of fuse.

**1**

Bulb not lighting – no supply to horn. Horn not blowing. OK condition.



**2**

Bulb glowing dim - normal drain when supply is going through horn. Horn blowing. OK condition.
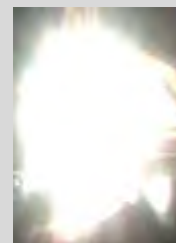


**3**

Bulb glowing with lot of flash – short circuit : Heavy current flowing through horn : Not OK.

# Process Failure Report (PFR)

| REPAIR ERROR | INSPECTION OF CAPACITOR FOR FREQUENT LOW BATTERY INDICATIONS ON SPEEDOMETER. |
|---|---|

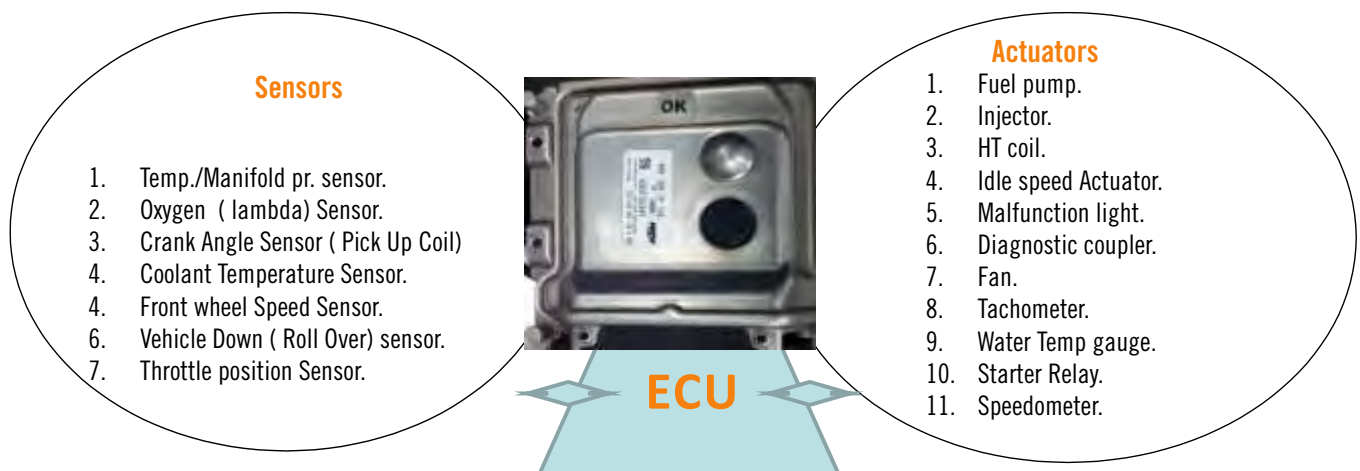| WHY WHY ANALYSIS | |
|---|---|
| Customer Voice | Frequent low battery indication on speedometer. |
| Reason for Complaint | Low battery issue not diagnosed properly during last visit. |
| Why 1 | All parameters were checked other than capacitor charge holding capacity. |
| Why 2 | Proper procedure of checking capacitor not known. |
| Root Cause | Checking of defective capacitor with poor charge holding capacity not known. |
| Action | • Check for voltage readings at red wire of capacitor.<br>• Voltage readings dropping to <1 volt with ignition if switched off indicates defective capacitor.<br>• Ok capacitor will give battery voltage, with very slow rate of drop in voltages at red wire. |

**Not Ok**



Readings dropping to<1 volt at red wire of defective capacitor.

**Ok**



Ok capacitor with almost battery voltage at red wire of capacitor.

# Engine Management System - FI

## Working Principle of FI - MY 17

### Sensors
1. **Manifold Air pressure Sensor**
2. **Ambient Temperature Sensor**
3. Crank Angle Sensor (Pick Up Coil)
4. Coolant Temperature Sensor.
4. Front wheel Speed Sensor.
6. Vehicle Down (Roll Over) sensor.
7. **Electronic Throttle Sensor.**
8. **Accelerator position sensor.**
9. **Side stand switch.**
10. **Gear position Indication sensor.**

**New**

EPM 44 for MY17-390.

**ECU**

### Actuators
1. Fuel pump.
2. Injector.
3. HT coil.
4. Malfunction light.
5. Diagnostic coupler.
6. Fan.
7. Tachometer.
8. Water Temp gauge
9. **Purge valve.**
10. Speedometer.

## Working Principle of FI - upto MY16

### Sensors
1. Temp./Manifold pr. sensor.
2. Oxygen  ( lambda) Sensor.
3. Crank Angle Sensor ( Pick Up Coil)
4. Coolant Temperature Sensor.
4. Front wheel Speed Sensor.
6. Vehicle Down ( Roll Over) sensor.
7. Throttle position Sensor.

**ECU**

### Actuators
1. Fuel pump.
2. Injector.
3. HT coil.
4. Idle speed Actuator.
5. Malfunction light.
6. Diagnostic coupler.
7. Fan.
8. Tachometer.
9. Water Temp gauge.
10. Starter Relay.
11. Speedometer.

### Construction & Basic Function:
- Fuel requirements can be accurately controlled catering for variations in altitude, temperature and other environmental & engine conditions.
- Bosch EMS operates an indirect injection and Electronic timing Control.

### Advantages of Fuel Injection:
- Better Performance & torque curve at less fuel consumption.
- Decrease in emission values.
- More comfort for the owner for different altitudes, automatic cold start function etc.
- Easy adaptation of Power output & torque curves ( ECU Flashing).
- User friendly :- self diagnosis system.

# Engine Management System - FI

## Specifications

| Item | Standard |
|---|---|
| **Switches and sensors** | |
| Rear brake light switch timing | ON after about 10 mm of pedal travel |
| Engine oil pressure switch connections | When engine is stopped continuity : ON |
| | When engine is running continuity: OFF |
| Fuel level sensor resistance : | |
| Full position | 10 ($\pm$2) |
| Empty position | 110 ($\pm$3) |
| **Starter relay**   Starter relay resistance | 3.9 $\pm$ 0.4 |
| **Relay**   Relay resistance | 90 ~ 110 |
| **Horn**   Current drawn | 3.0 $\pm$ 0.3  amp. |
| **Radiator Fan**   Current drawn | 3.0 amp. max |
| **Side stand switch**   Output voltage | Stand down condition : 4.0 ~ 4.5 V |
| | Stand up condition :  2 ~ 2.2 V |
| **Water temperature sensor** | |
| Check Resistance | (x 1 K    ) at $25^0$C  ( P/L-Y/W): 1.88 ~ 2.12 K |
| **TMAP sensor**   Resistance (pin 1 and pin 2) | 2 $\pm$ 0.5K    @ $25^0$C |
| Input voltage | 5 V DC |
| Output voltage | 3.8 $\pm$ 0.65  V DC |
| **TPS sensor**   Input voltage | 5 V DC |
| Idle throttle | 0.35 ~ 0.65 V DC |
| Wide open throttle | 4.35 ~ 4.65 V DC |
| **Stepper motor**   Resistance | |
| Pin 1 – Pin 4 | 46    ~ 56 |
| Pin 2 – Pin 3 | 46    ~ 56 |
| **Injector**   Resistance | |
| Pin 1 – Pin 2 | 12 - 0.6    @ $25^0$C |
| **Roll over sensor** | |
| Output voltage (Normal vehicle mounted condition) | 4.8 ~ 4.9 V DC |
| Output voltage (Tilted more than $60^0$) | 2.0 ~ 2.2 V DC |
| **Oxygen (Lambda) sensor**   Resistance | |
| Pin 1 – Pin 2 | 9.5 $\pm$ 0.5    @ $25^0$C |
| Pin 3 – Pin 4 | Open @ $25^0$C |
| **Purge valve**   Resistance (pin 1 and pin 2) | 17 ohms ($\Omega$) |
| **TPS sensor 1**   Input voltage | 5 V DC |
| Idle throttle | 0.35 ~ 0.65 V DC |
| Wide open throttle | 4.35 ~ 4.65 V DC |
| **TPS sensor 2**   Input voltage | 5 V DC |
| Idle throttle | 4.35 ~ 4.65 V DC |
| Wide open throttle | 0.35 ~ 0.65 V DC |
| **APS** | Check the voltages of APS 1 and APS 2 in D&F in 2: 1 ratio |
| **GPI Sensor** | Check the indication of Gear position on D&F tool |

# Engine Management System - FI

## Functions of Key Components

### Controller Area Network (CAN BUS) :

The CAN data bus is a kind of data transfer between different components and keeps them connected with a complete control system.

CAN = Controller Area Network.

### Data Principal :

- The data transfer in the CAN –Bus is similar to a conference call on telephone.

- One component (ECU) "speaks" in its data into the Network , while the other components of this data "listen" to this data.

- Some components may use this data for their working while some others may ignore.

The advantages of the CAN BUS:

- Less chances of errors due to constant checking's.
- Fast transfer of data between each components and main controller.
- Less wires in the cable harness (weight reduction/ better overview).
- In case any component needs any upgrade the same can be done with software upgradation easily.
- The CAN bus is the word standard. Therefore, it can also control the exchange of data from different manufactures.

### ECU (EPM 44) :

The electronic control unit (ECU) collects all necessary information for the engine, for sensor signals, prioritizes them, and accordingly operates the actuators to run an engine smoothly.

### EPM 44 benefits :

- Vibration resistance.
- Low weight and small size.
- Fast and easy calibration.
- Easy to maintain.
- Good thermal conductivity and temperature stability.
- Can assist OBD rules
- It can also enable customer experience with a blue tooth connectivity.

### Accelerator position sensor ( APS) :

The position of the accelerator is measured with acceleration position sensor which is connected to the ECU. The APS is equipped with two potentiometers to increase reliability. Each potentiometer has a separate power supply and grounding from ECU,
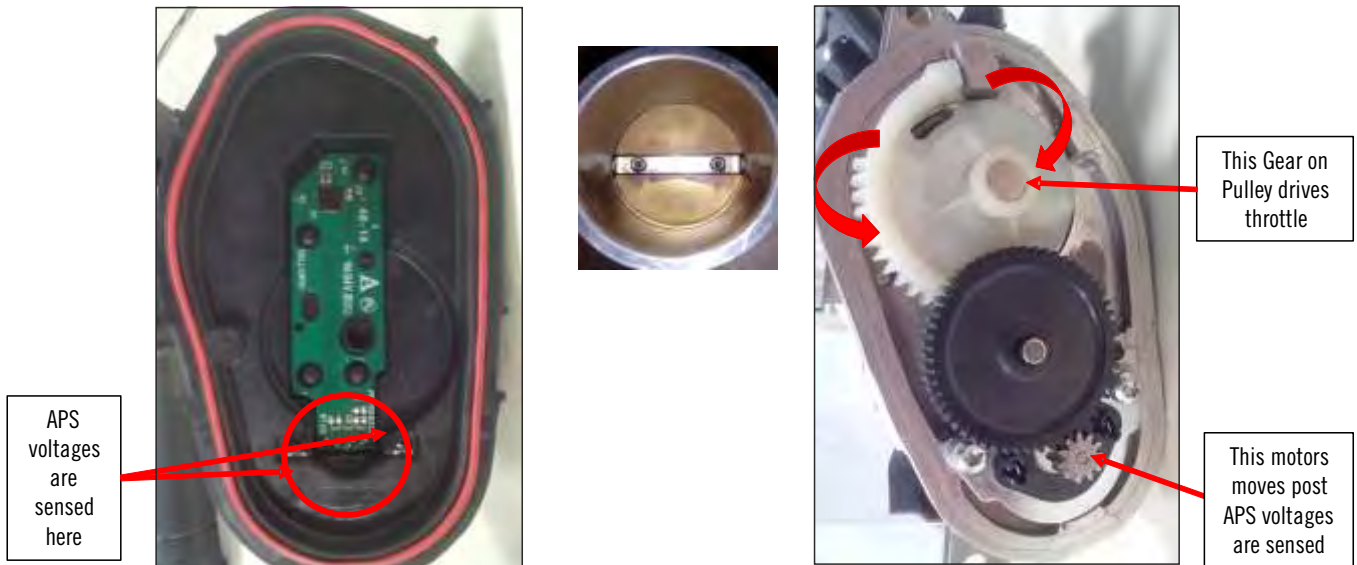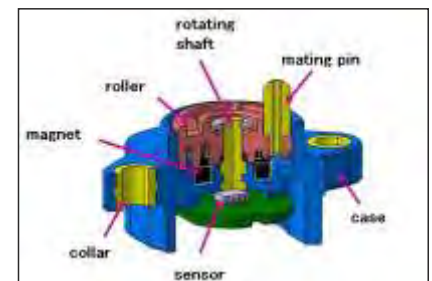
# Engine Management System - FI

**Electronic throttle body( ETB) :**

The electronic throttle body comprises an electrically driven throttle body and a non-contact angular-position sensor for position feedback. The electronic engine Management system triggers the throttle body electrically. Input variables are from accelerator grip position and the requirements of systems that can influence engine torque, or active safety systems.



APS voltages are sensed here

This Gear on Pulley drives throttle

This motors moves post APS voltages are sensed

**Gear Position Indication Sensor (GPI) :**

- Non-Contact Rotary Position Indication Sensor converts rotary motion into an electrical signal to provide gear position information to the ECU and meter display via CAN bus..

- The Non-Contact Rotary Position Sensor's linear output voltage is directly proportional to the sensor's angle of rotation.

- The three-wire sensor is fully electro-magnetic capability (EMC) compliant and is fully isolated from external disturbances.



**Benefits :**

- Flexible design is adaptable to a wide range of applications.
- Non-contact technology eliminates signal loss on high dither applications.
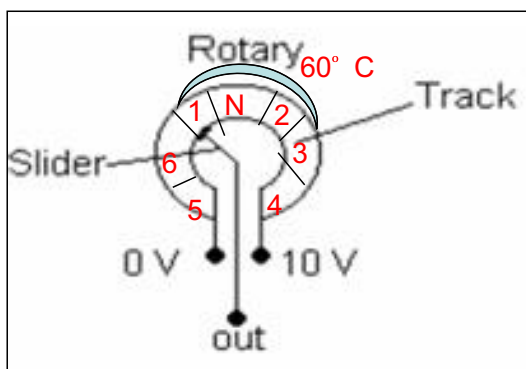
# Engine Management System - FI

**ECU :**

- One type of electronic control unit that manages an engine's operation.
- ECU works as brain of the system and receives signals from various sensors.
- ECU processes these signals and controls various components.

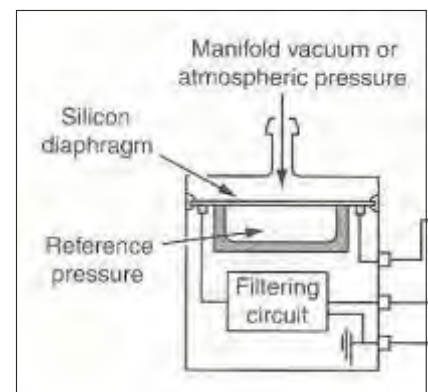**SENSORS**

**Temp / Manifold Absolute Pressure Sensor :**

- MAP (Manifold Absolute Pressure) sensor is used to find out the amount of air flow into the engine. It helps ECU to determine fuel quantity to be injected.
- IAT (Intake air Temperature) sensor is positioned in the air intake passage to read the temperature of air entering the engine. This helps ECU determine the air density and quantity of fuel needed.

**Manifold Pressure Sensor:**

Working :

- Supplies the load information of Engine to ECU. Has a diaphragm and electronic analyzing element. The diaphragm changes its form with change in pressure which changes the resistance.
- The electronic analyzing element prepares a voltage and supplies to ECU.
- With closed throttle( low vacuum/air pressure) the voltage output is low. With increase in throttle the pressure increases and hence voltage. It is supplied 5V input& Earthing by ECU.

**Intake Air Temperature Sensor( IAT):**

Working :

- It is a NTC thermistor which changes its electrical resistance depending on the temperature. With increase in temp. the resistance of sensor decreases and vice versa.
- It is supplied with 5V by ECU. It measures the temperature of air coming inside. Since it is located near intake manifold the temperature increases with increase in engine temperature.
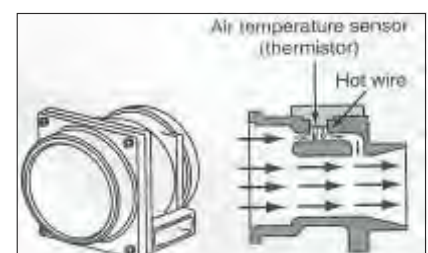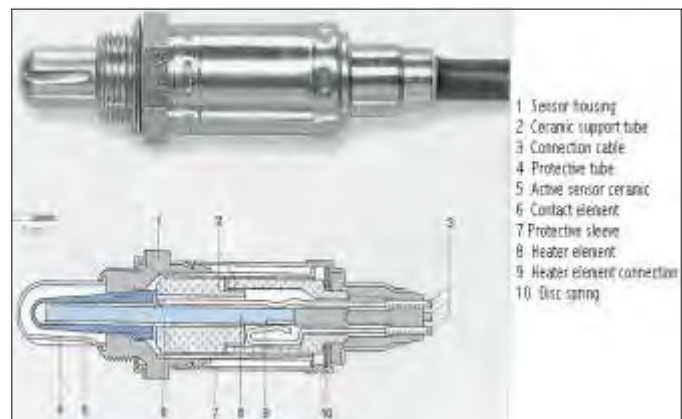
# Engine Management System - FI

**Oxygen (lambda) Sensor :**

- The Oxygen sensor measure the density of Oxygen in exhaust gases and gives this information to ECU. This helps ECU to maintain Stoichiometric ratio of air-fuel mixture.
- The atmosphere contains 21% oxygen.
- The O2 sensor generates voltage signal by comparing the atmosphere oxygen and oxygen content in exhaust.

Working :

- Consists of ceramic hollow body covered by a thin platinum/zoradium layer (Heater). Outer layer is in contact with hot exhaust gases while inner layer with environmental air. At a temp. of @ 350$^o$ C ceramic body becomes conductive. When O2 contain of exhaust gas and environmental air differs an electrical voltage is created.
- Bigger the difference- higher the voltage. if O2 is less in exhaust gas voltage is high( Rich mix) if O2 increases the voltage is low (Lean mix).
- The ECU accordingly adjusts the A/F ratio.

1  Sensor housing
2  Ceramic support tube
3  Connection cable
4  Protective tube
5  Active sensor ceramic
6  Contact element
7  Protective sleeve
8  Heater element
9  Heater element connection
10 Disc spring

**Side Stand Switch :**

- It is a hall effect sensor. It prevents the motorcycle from driving off with the side stand open. It is responsible for informing ECU of stand position. With Stand fully up it delivers 2-2.2 V which indicates ECU to keep the vehicle started.

**Crank Angle Sensor (Pick Up Coil) :**

- It helps ECU to determine the position of crank.
- Crank angle sensor signal is given as sine wave with a missing tooth which indicates the position of crank.
- It signals ECU when cylinder comes at TDC (Top Dead Center) at the end of compression.

Working :

- It consists of a permanent magnet & an inductor coil with soft iron core. Its pulse is generated by the 22 teeth on rotor. The magnetic flow inside coil depends upon whether sensor is close to a gap or tooth. Tooth concentrates the magnetic leak flux while gap weakens it. This change of magnetic field induces voltage inside coil. ECU calculates Engine speed according to rate of impulses received by pick up coil. Each tooth induces a signal. The large gap makes ECU recognize the actual crank position.

Magnet
Core
Coil
Toothed
Wheel
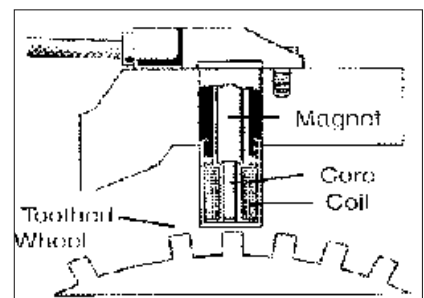
# Engine Management System - FI

**Gear Position switch:**

- It recognizes neutral and gear positions. Neutral gear indication is important for starting safety and for MIL. MIL blinks only when in neutral.

**Coolant Temperature Sensor :**

- EUC monitors coolant temperature and increases the fuel quantity in cold condition start up.
- With increase in temperature the resistance of sensor decreases and vice versa. It is supplied with 5V by ECU. It measures the Engine temperature via coolant temperature.

Working :

- It is a NTC thermistor which changes its electrical resistance depending on the temperature. With increase in temp. the resistance of sensor decreases and vice versa. It is supplied with 5V by ECU. It measures the Engine temperature via coolant temperature.



1 Electrical connection
2 Housing
3 Gasket
4 Thread
5 Measuring resistor
6 Coolant
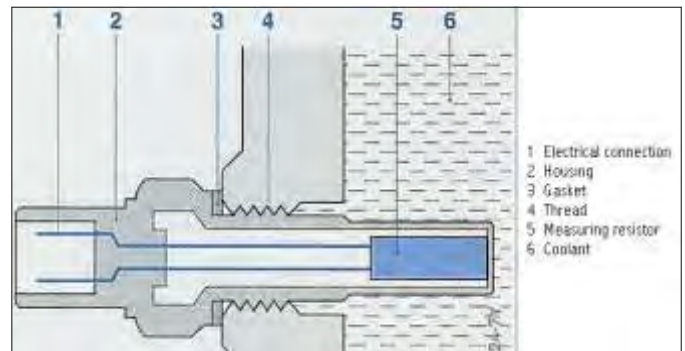
**Throttle Position sensor (TPS) :**

- The throttle position sensor is a variable resistance(potentiometer) mounted on the throttle body. When the throttle is closed it gives a low voltage signal(0.5 V) and when throttle is wide open, it gives high voltage signal (4.65 V).

Working :

- It is a variable resister. The contact arm of potentiometer is directly connected to the butterfly valve. Depending on the position of the flap the voltage changes as the resistance of potentiometer changes with change in position of its arm. It is supplied 5V by ECU and earthing. With increase in throttle voltage increases.
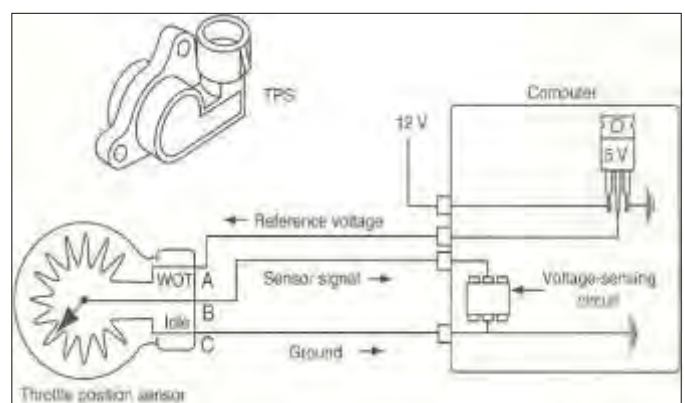


**Rollover Sensor (ROS) :**

- Inside a ROS is a pendulum & a magnet. The Pendulum is guided over a hall element. When vehicle tilts the pendulum moves and the voltage changes. Post tilt of around 75$^o$ the voltage output triggers ECU to shut off the Fuel supply.

# Engine Management System - FI

## ACTUATORS

### Injector:

- The fuel injector is given a continuous supply of pressurized fuel with the help of fuel pump. The ECU controls the amount of fuel by varying the opening(ON) time of injector. This time depends on various conditions such as throttle angle, engine temperature, MAP sensor signal, O2 sensor signal etc.



Working :

- It is build up of a magnetic coil, a spring loaded Plunger, a needle valve and filter.
- When supplied current a magnetic field is created in the magnetic coil which lifts the plunger piston against the spring & therefore opens the needle valve. The fuel flows at 3kgcm2 through 8 holes . When current is disconnected the magnetic field breaks down & the springs closes the needle valve. Filter Prevents bores from contamination.
- Injector receives 12V from battery. ECU calculates required injection amount(time) & Puts the earthing connection to injector thereby Creating magnetic field. The longer the injector valve is connected to ground, the higher the volume of injected fuel.
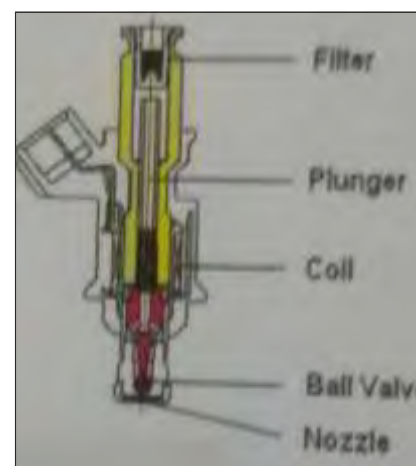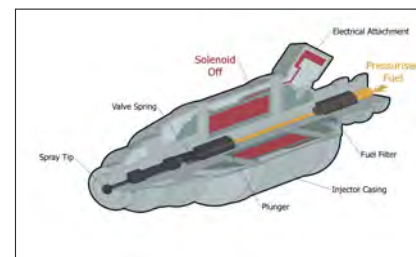


### Fuel Pump :

- Pump has a pressure valve which adjusts injection pressure at 3 kg/cm2 & guides excess fuel back to tank. ECU uses the fuel pump relay to switch the fuel pump 'ON' and 'OFF'. The fuel pump relay switches the fuel pump ON as soon as the ignition and kill switch are turned ON. The fuel pump remains ON as long as the engine in running or is being cranked.

  **Pump Pressure - BOSCH Pump : 3.5kg/cm$^2$, Pricol Pump : 3.1 kg/cm$^2$ for 390 and for Duke 200 :  2.8 kg/cm$^2$**



### Stepper Motor :

- It controls the Air flow which bypass the main venture of throttle body



### HT Coil (Ignition coil) :

- Main Components are Primary windings, secondary windings, electric connections & soft iron core. Iron core is made of several layers of thin iron plates that intensify the magnetic field. The Primary circuit is connected to ground. Secondary circuit to Input from ECU. HT Output is connected to Spark plug and ground through Spark Plug gap. HT coil gets it input from Battery 12V. Ignition angle and closure angle are calculated  by a CDI which is inside ECU.
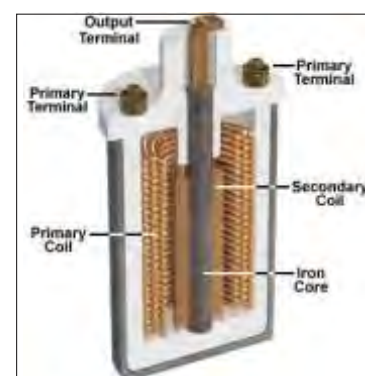
# Engine Management System - FI

**CAN Interface :**

- Located at rear end. Has 4 cables blue and yellow are inputs from ECU (Can high and Can low). White (till MY 14) / Brown (MY-15) Cable takes 12V from Fuse box 2 (till MY-14) / Fuse box 6 (MY-15). One cable is ground (B/Y).
- D&F tool is connected here to read ECU.

**Canister purge valve :**

The canister purge valve is a solenoid in a plastic housing and is controlled by the engine control unit. It is one way valve operated by ECU from and till the engine is running. It carry's over vapor's from canister and supply's it inside ETB just ahead of Injector opening.

**Understand from Customer : Logical Steps**

Understand from Customer
a. What is the trouble ?
b. In which condition is it happening ?

| Logical Events that should happen. | Fault can be |
|---|---|
| 1. Ignition switch on – DC ON | No DC |
| 2. Neutral and malfunction light should come on. | MUL light not glowing. |
| 3. Kill switch ON - Pump noise to be noticed. | Pump not getting ON. |
| 4 . Button pressing and engine starts. | No start |
| 5. Malfunction light goes off. | Stays On after starting |
| 6. Engine sustains idling. | Idling not sustained |
| 7. Engine can be accelerated up to 30 KMPH. | Jerking/misfiring |
| 8. Engine can be accelerated at higher speeds. | Jerking/misfiring |

- Check which of the logical event is not happening out of above. (Refer table above)
- Refer diagnostic chart for troubleshooting.
  (Fi system related / electrical system / eng mechanical trouble)
- Use logic – do not doubt Fi system only. Check other parameters too.
- For Fi related troubles – When MUL malfunction indication is seen
  - Attach Diagnostic tool to find out DTC code in Active/Occurred/History mode.
  - Use Defect code table for understanding where the issue is present.
  - Check individual component (sensor/Actuator). (Multi meter with syringe pins)
  - Check wiring harness continuity - from that component up to ECU.
  - Check ECU earthing &power to ECU via auxiliary relay.
  - Clear all DTC codes once the trouble shooting is over.

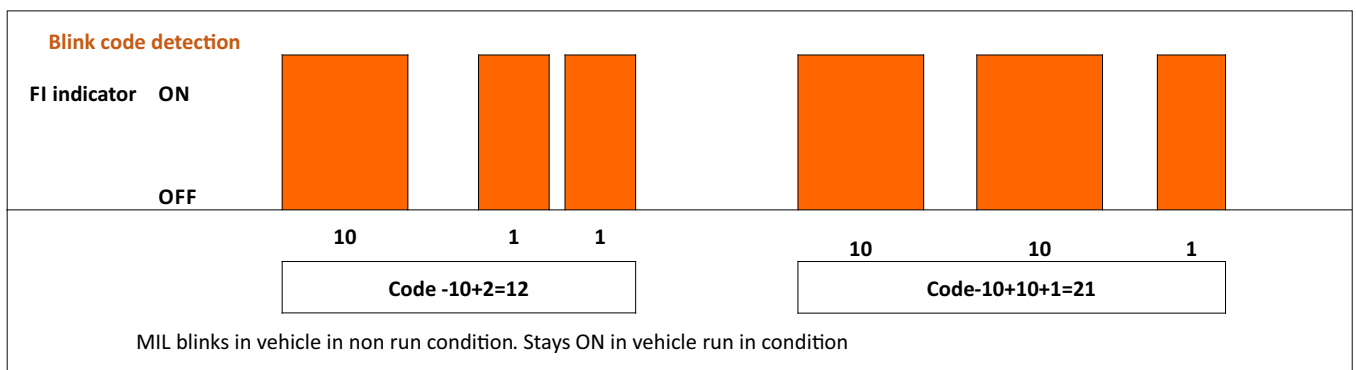# Engine Management System - FI

**MIL (Malfunction indication light) :**

• Malfunction indication light is located on meter. It consists of a LED

Working :

• Should Glow when Ignition switch & kill switch made ON before cranking.
• Show switch OFF when engine starts running.
• Should glow when vehicle is running with a FI problem
• Should Blink when vehicle is in idling condition with a FI problem.

Blink Patterns :

• Long blink is for a multiple of Ten followed by small blink of digit.
• In case of multiple defects – smallest code would appear first and then in increasing pattern.
• Once all defects are displayed the blinks start again from smallest code.

| **Blink code detection** | | | | | | |
|---|---|---|---|---|---|---|
| **FI indicator   ON** | | | | | | |
| **OFF** | | | | | | |
| 10 | 1 | 1 | | 10 | 10 | 1 |
| Code -10+2=12 | | | | Code-10+10+1=21 | | |

MIL blinks in vehicle in non run condition. Stays ON in vehicle run in condition

**MIL (Malfunction indication light) MY17 :**

Malfunction indication light is located on meter. It consists of a LED

**Working :**

• Should Glow when Ignition switch & kill switch made ON before cranking.
• Show switch OFF when engine starts running.
• Should glow when vehicle is running with a FI problem.

# Engine Management System - FI

**SOP - D & F Tool**

|  1  |  2  |  3  |  4  |  5  |
|-----|-----|-----|-----|-----|
|  |  |  |  |  |
| 1. Connect : D& F tool<br>2. Do not press ENTER key | Ign. and kill switch ON | Press Enter | Select Vehicle Diagnostics | Select Vehicle Manufacture year. |

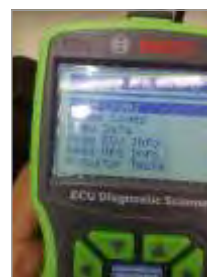|  6  |  7  |  8  |  9  |  10  |  11  |
|-----|-----|-----|-----|------|------|
|  |  |  |  |  |  |
| Select Brand | Select Model | Select EMS | Press Enter | Select Read code & enter | |

1. Checking of various engine parameters in  View data.
2. Actuator tests.
3. ECU + Chassis number identification.

# Engine Management System - FI

## SOP for unlocking the "Transport Lock" (For 250 Duke, 390 Duke, RC 390 only)

**SOP**



| 1. Message displayed in meter. | 2. Connect :D&F tool. & Do not press ENTER key. | 3. Ignition and kill switch ON. | 4. Select Vehicle Diagnostics. | 5. Select Vehicle Manufacture year. | 6. Select Brand |

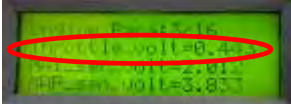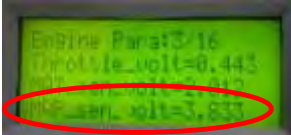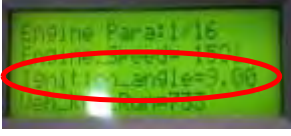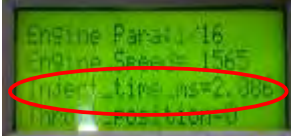| 7. Select Model | 8. Select EMS EPM 44. | 9.Press Enter | 10. Select write data. | 11. Select Permanent Transport Bit. | 12. Permanent Transport Bit. | 13. Write success. |

*Note: The vehicle will run for 3 hours of Engine run time if 'Transport Lock' is not unlocked in PDI. Post 3 hrs. vehicle will shut off. (For 250 Duke, 390 Duke, RC 390 only)*
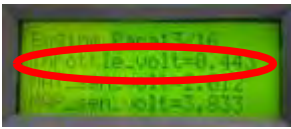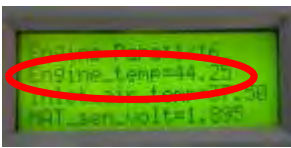
# Engine Management System - FI

## MIL Codes

| DTC meaning | Dia Tool | Meaning | Engine symptoms | Probable cause of Trouble | What to check. | Range |
|---|---|---|---|---|---|---|
| 6 | P0123 | Throttle/Pedal Position Sensor Circuit High | ▶ Idling instable, Drivability not smooth, <br> ▶ Engine raves above cut off rpm. <br> ▶ Load is calculated based on MAP Sensor. | Short Circuit to battery, Short to sensor Supply (5V) | Sensor Output voltage at Idle throttle : 0.35~0.65V WOT : 4.35~ 4.65 V On Diagnostic tool | Input: R/B cable from ECU R/B- B/G : More than 4.88V for 2 sec If Short check : R/B cable continuity from ECU Pin 6 to TPS |
| 6 | P0122 | Throttle/Pedal Position Sensor Circuit Low | | Short Circuit to Ground, Open Circuit |  | Less than 0.17 V for 2 sec Output- G/Y- R/G . Check R/G(Earthing)- continuity to Pin 31 ECU G/Y- Continuity to Pin 10 ECU |
| 11 | P0507 | Idle Air Control System RPM Higher | Engine speed is limited | Leakage through intake manifold | Idling rpm | higher than 1200rpm post 5 sec |
| 11 | P0506 | Idle Air Control System RPM Lower | | Torque loss of engine is too high | Idling rpm | deviation greater than 300 post 15s |
| | P0107 | | | | | |
| 9 | P0108 | Manifold Absolute Pressure/Barometric Pressure Circuit High | ▶ Starting trouble in Cold condition, <br> ▶ Stabilisation post cold start is effected. <br> ▶ Engine does not adapt to change of altitude. <br> ▶ Drivability not smooth. | Short Circuit to Battery Short circuit to sensor supply. Open circuit. | Sensor Ouput voltage ( D&F tool) <br>  | Sensor Output signal W/O- Y/B > 4.87 V with Eng rpm >600- <br><br> Check Continuity of W/O- Pin 22 ECU. Check Continuity of Y/B- Pin 42 ECU (Roll over, Fuel sensor, SS switch, TMAP- Common Ground by ECU) |
| 9 | P0109 | Manifold Absolute Pressure/Barometric Pressure Circuit Low | | Short Circuit to Ground. | | Sensor signal <0.2V with Eng rpm >600 |
| 41 | P0629 | Fuel Pump "A" Control Circuit High | High Speed driving affected | Short Circuit to Battery. | Pump Voltage | Bat Voltage not higher than 16V ( W/L wire) from Pump Relay -Pin 19 ECU |
| 41 | P0628 | Fuel Pump "A" Control Circuit Low | | Short Circuit to ground | Pump Voltage | Bat Voltage not Lower than 9V- (W/L wire) from Pump Relay -Pin 19 ECU |
| 41 | P0627 | Fuel Pump "A" Control Circuit/open | | Open circuit | Open circuit | W/L- Continuity From Pump Relay coil 2 - Pin 19 ECU |
| 2 | P0336 | Crankshaft Position Sensor "A" Circuit Range / Performance | ▶ Engine may not start/stops. <br> ▶ Irratic running of Engine. | loose connection, electrical disturbance (resistance), defective tooth wheel on rotor. |  | Crank Angle sensor ( pickup coil ) Resistance W/R-B/Y - 365 Ω_ -20 **Input- W/R- to Pin 39 ECU Continuity- W/R- Pin 39 ECU B/Y- Pin 27 ECU** |
| 33 | P0262 | Cylinder 1 Injector Circuit High | | Short Circuit to Battery. | Multimeter check Br/W - 12V Continuity from Main Relay output | |
| 33 | P0261 | Cyl 1 injector Circuit Low | ▶ Engine may not start/stops. <br> ▶ Intermittent & irregular running of Engine. | Short Circuit to ground |  | Br/W- Voltage to be 12V when Pump Relay On. Check wire resistance. |
| 33 | P0201 | Injector circuit Open- Cyl 1 | | Open circuit | | B/W- No continuity. Check B/W- Pin 5 ECU. Drop /Rise voltage in Br/W |
| 14 | P1611 | Fuel Consumption signal Output short to battery | No specific symptoms. | Short Circuit to Battery. | Short Circuit to Battery. | V/B- Pin 20 ECU - Pin 26 Meter - 12V if short circuit with any battery wire |
| 14 | P1610 | Fuel Consumption signal Output short to ground. | | Short Circuit to ground | Short Circuit to ground | V/B- Pin 20 ECU - Pin 26 Meter - Low voltage if short circuit with any ground connection. |

# Engine Management System - FI

| DTC meaning | Dia Tool | Meaning | Engine symptoms | Probable cause of Trouble | What to check. | Range |
|---|---|---|---|---|---|---|
| 14 | P1609 | Fuel Consumption signal Output open. | | Open circuit | Open circuit | No continuity between V/B at ECU and Meter |
| 45 | P0032 | HO2S Heater Control Circuit High Bank1 Sensor 1 | Lambda control activation is delayed. ▶ Lambda sensor signal diagnosis is switched off. ▶ Drivability may get affected. ▶ Exhaust emissions are affected. | Short Circuit to Battery. | X 1 - Pin 1(Br/W)- Pin 2(L/R) = 9+- 1 Ω (at 25 deg) X1 - Pin 3(B/G)- Pin 4(L/Y) = OPEN (at 25 deg) | L/R or Br/W - Voltage High (Battery voltage) |
| 45 | P0031 | HO2S Heater Control Circuit Low Bank1 Sensor 1 | | Short Circuit to ground | | L/R- Voltage drop ( earthing) Check resistance |
| 45 | P0030 | HO2S Heater Control Circuit Bank1 Sensor 1 | | Open circuit | | L/R- Wire cut- Check continuity - Pin 2 of sensor Pin 14 ECU |
| 16 | P0692 | Radiator Fan control circuit High | Fan is not running. Engine will heat up & seize ▶ and may cause damage to components. | Short Circuit to Battery. | Engine running, vehicle running. temperature above 97° C | G/Pi- Voltage high from Br/W or touching live wire. |
| 16 | P0691 | Radiator Fan control circuit Low | | Short Circuit to ground | | G/Pi- Voltage drop even before ECU decides. Check wire for short with ground or Relay for direct |
| 16 | P0480 | Radiator Fan Relay control circuit faulty. | | Open circuit | | G/Pi- No voltage- wire cut/relay short. Check continuity G/Pi with Pin 49ECU & Fan Relay itself |
| 17 | P0132 | O2 sensor circuit high Bank 1 Sensor 1 | Lambda control is deactivated. ▶ Drivability could be affected. ▶ Exhaust emissions are affected. | Short Circuit to Battery. | | O2 sensor inactive (Vehicle in cold condition - Volt 0.45 V |
| 17 | P0131 | O2 sensor circuit Low Bank 1 Sensor 1 | | Short Circuit to ground | | Range : Operating range 0.02 V~0.8V if remains continuously at low range then mixture is lean & if at high range then mixture is rich. |
| 17 | P0130 | O2 sensor circuit Bank 1 Sensor 1 | | Heater encoupling to sensor signal. | | |
| 17 | P0134 | O2 sensor circuit no activity detected Bank 1 Sensor 1 | | Open circuit signal or open circuit ground | | L/Y from Lambda Pin 4 to Pin 43 ECU |
| 18 | P1605 | MIL control circuit high | MIL function is not guaranteed | Short Circuit to Battery. | Short Circuit to Battery. | Br/R- Voltage high- |
| 18 | P1604 | MIL control circuit Low | | Short Circuit to ground | Short Circuit to ground | Br/R- Cut and touching chassis |
| 18 | P0650 | MIL control circuit. | | Open circuit | Open circuit | Br/R disconnected- continuity from Meter Pin 18 to Pin 3 ECU. |
| 15 | P1504 | Rollover Sensor circuit short to battery | No safety fuel pump shut-off, ignition cut-off or injection cut-off can happen in case of vehicle tilted/fall down. | Short Circuit to Battery. | R/L- Y/B : 4.9 ~ 5.05 V ( Input) Br/G- Y/B : Normal 4.8 ~ 4.93 V Tilted 2 ~ 2.2 V ( 60 egrees) | R/L- Y/B : 4.9 ~ 5.05 V ( Input) Br/G-Y/B : Normal 4.8 ~ 4.93 V :Tilted 2 ~ 2.2 V ( 75degrees) |
| 15 | P1503 | Rollover Sensor circuit short to ground | | Short Circuit to ground | | |
| 15 | P1501 | Rollover Sensor circuit signal not plausible. | | No valid sensor signal | | |
| 15 | P1502 | Rollover Sensor circuit Open | | Open circuit | | Br/G continuity- Pin 23 ECU |
| 19 | P1603 | Rest Tank Fuel Indicator Circuit High | No specific symptoms. | Short Circuit to Battery. | Short Circuit to Battery. | Multimeter Test |
| 19 | P1602 | Rest Tank Fuel Indicator Circuit Low | | Short Circuit to ground | Short Circuit to ground | Multimeter Test |
| 19 | P1601 | Rest Tank Fuel Indicator Circuit Open | | Open circuit | Open circuit | Multimeter Test |

# Engine Management System - FI

| DTC meaning | Dia Tool | Meaning | Engine symptoms | Probable cause of Trouble | What to check. | Range |
|---|---|---|---|---|---|---|
| 25 | P1508 | Side Stand switch short circuit to battery | Safety fuel cut-off is active when vehicle is not in neutral gear | Short Circuit to Battery. | R/L- Y/B : 4.95 ~ 5.05 V - OK ( Input) PI- Y/B : SS Up(2 ~2.2 V) SS Down( 4.8~4.93V) R/L continuity to Pin 7 ECU ( TMAO/ ROS) Pi- Continuity to Pin 32 ECU | |
| 25 | P1507 | Side Stand switch short circuit to ground. | | Short Circuit to ground | | |
| 25 | P1506 | Side Stand switch circuit signal not plausible. | | No valid sensor signal | | |
| 25 | P1505 | Side Stand switch circuit Open. | | Open circuit | | |
| 49 | P0509 | Idle Air Control System Circuit High | ► Engine Start is affected. ► Idle is not stable. ► Vehicle crawling is affected. | Short Circuit to Battery. | Multimeter Test ( Resistance) X 1 : Pin 1(G/Y) ~ Pin 4(L/B) = 51Ω **(at 25 deg)** X1 : Pin 2(G/R) ~ Pin 3(Gr/W) = 51Ω **(at 25 deg)** | L/B continuity- Pin 25 ECU Gr/W continuity - Pin 26 ECU G/Y continuity - Pin 37 ECU G/R continuity - Pin 38 ECU |
| 49 | P0508 | Idle Air Control System Circuit Low | | Short Circuit to ground | | |
| 49 | P0511 | Idle Air Control Circuit | | Open Circuit | | |
| 21 | P0689 | ECM/PCM Power relay sense circuit Low | Vehicle working affected- ECU may get damaged. | Main Relay is sticky & does not open properly | Output of L/G wire from main relay | 12V- 13V |
| 13 | P0112 | Intake Air temperature Sensor 1 Circuit Low | intake air temperature tans is switched to a fixed value (TADE=20 deg C) ► Engine start and hot start is affected. ► Drivability is affected. | Short Circuit to ground |  | Standard value- 2.250 V at ambient temperature of engine . As engine temperature increases this voltage should reduce. Input R/L 5V - Pin 7 ECU Output G - Pin 24 ECU |
| 13 | P0113 | Intake Air temperature Sensor 1 Circuit High | | Short Circuit to Battery. | | |
| 12 | P0117 | Engine Coolant temp sensor 1 Circuit Low | coolant temperature tmot is switched to a modeled value (tmrw) ► Engine Starts affected depending upon surrounding temperature. ► Radiator Fan runs continuously. ► Fuel consumption may get affected. | Short Circuit to ground |  | Input- Pi/L - 5V input from Pin 30 ECU Output- Y/W- Pin 44 ECU and Pin 16 Meter |
| 12 | P0118 | Engine Coolant temp sensor 1 Circuit High | | Short Circuit to Battery. | | Multimeter test Resistance at various degree of Temp |
| 22 | P1608 | Engine Speed Signal Circuit High | No out put for engine speed in dash board | Short Circuit to Battery. | Short Circuit to Battery. | |
| 22 | P1607 | Engine Speed Signal Circuit Low | | Short Circuit to ground | Short Circuit to ground | |
| 22 | P1606 | Engine Speed Signal Circuit Open | | Open Circuit | Open Circuit | |
| 24 | P0563 | System Voltage High | ► No effect on drivability. ► May affect Idle as stepper is closed. ► May damage ECU & other component if voltage is too high & Voltage remaining high for longer time. | Short Circuit to Battery. | Short Circuit to Battery. | Br/W - voltage at 4000 rpm |
| 24 | P0562 | System Voltage Low | ► No effect on drivability but engine may hunt/stop if battery is fully discharged as ECU will stop functioning. | Short Circuit to ground | Short Circuit to ground | Br/W - voltage at 4000 rpm |
| 24 | P1510 | System voltage sensing failure in ECU | Battery voltage ub is switched to fix value UBDE; ubsq is switched to UBDE * SY_UBSQ_W | Battery voltage mesaured in correctly | Battery voltage mesaured in correctly | ECU |

# Engine Management System - FI

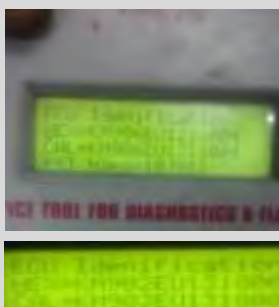| DTC meaning | Dia Tool | Meaning | Engine symptoms | Probable cause of Trouble | What to check. | Range |
|---|---|---|---|---|---|---|
| 23 | P0501 | Veh speed sensor "A" Range/Performance | Vehicle speed limitation is done by limiting engine speed. ▶ Gear detection is not possible | Sensor voltage high/low or short | Position of Wheel ( Input) Any: +ve R/W - ve B/Y = 11~13 volts. One full slow rotation: (Output) +ve (B/W)~ - ve (B/Y) = Change from 0 v to 4.5+- 0.5 or from 4.5+-0.5 to 0 for 6 times. | |
| 26 | P0643 | Sensor Reference Voltage "A" circuit High | Idle control is affected. ▶ No overrun fuel cut-off happens. ▶ Drivability is affected. ▶ Load on engine is calculated based only on MAP sensor. | Short Circuit to Battery | Short Circuit to Battery | |
| 26 | P0642 | Sensor Reference Voltage "A" circuit Low | | Short circuit to ground | Short circuit to ground | |
| 27 | P0653 | Sensor Reference Voltage "B" circuit High | ▶ Injection and Ignition cut-off is active when vehicle is put in gear ▶ Engine start and after start is affected. ▶ Altitude adaptation doesn't happen. ▶ Only TPS is used for sensing load. | Short Circuit to Battery | Short Circuit to Battery | |
| 27 | P0652 | Sensor Reference Voltage "B" circuit Low | | Short circuit to ground | Short circuit to ground | |

# Process Failure Report (PFR)

## REPAIR ERROR — Repeat job due to wrong identification of ECU.

| WHY WHY ANALYSIS | |
|---|---|
| Customer Voice | My 390 Duke does not accelerate as good as my friends bike |
| Reason for Complaint | Engine rpm & vehicle speed not matching in given gear on MY 17 vehicle. |
| Why 1 | Workshop staff not able to measure ECU parameters on MY 17 model. |
| Root Cause | Latest Identification of ECU Hex files not updated perpetually. |
| Action | 1. Apart from part number ECU for given product/model year will have different program. 2. The specific program for given product & model year combination can be identified by Hex file . 3. Pick up hex file number with diagnosis tool and confirm that it matches with specifications. 4. Do not interchange ECU with different models to avoid complaints as above. |

**Before**

Specifications of Hex File not Known to Technicians

**After**

| SN | Product | Model Year | HEX File No |
|---|---|---|---|
| 1 | 200 Duke | MY 12/MY13 | KM906EU1211004 |
| 2 | 200 Duke | MY 14 | KM906IN1418006 |
| 3 | 200 Duke | MY 15/MY16 | KM906IN1518007 |
| 4 | 200 Duke | MY17 | KM906CN1519003 |
| 5 | 250 Duke | MY17 | KM902EU1715101 |
| 6 | 390 Duke | MY 13 | KM902EU1318002 |
| 7 | 390 Duke | MY 14 | KM902EU1419004 |
| 8 | 390 Duke | MY 15/MY16 | KM902EU1519005 |
| 9 | 390 Duke | MY17 | KM933IN1710501 |
| 10 | RC 200 | MY 15/MY16 | KM906IN1538007 |
| 11 | RC 200 | MY17 | KM906CN1519003 |
| 12 | RC 390 | MY 15/MY16 | KM902EU1519005 |
| 13 | RC 390 | MY17 | KM933IN1710501 |

Product /Model year wise Hex Files For reference

# Engine Management System - FI

**Terminal No. of ECU Connector**
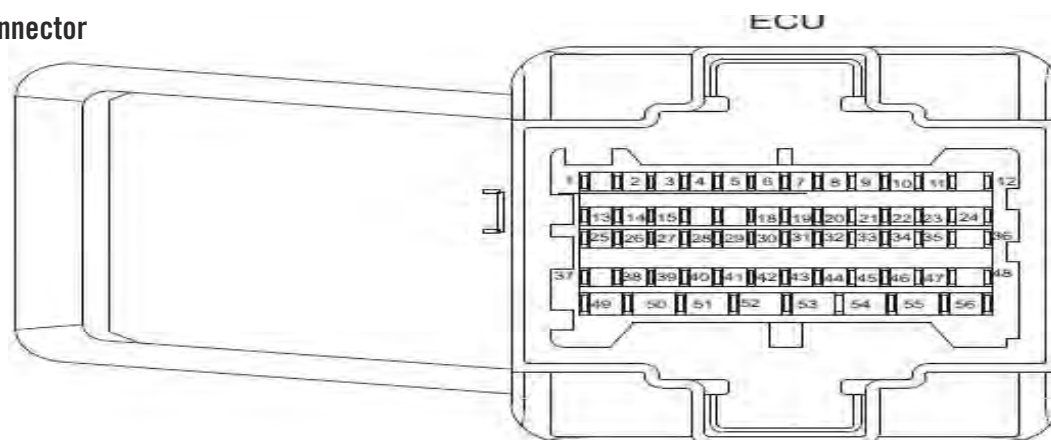


| Pin | Wire | Connection | Pin | Wire | Connection |
|-----|------|------------|-----|------|------------|
| 1 | O/L | Side Stand Indicator | 29 | | |
| 2 | L/G | Main Relay coil 2 | 30 | PI/L | I/P to Water temperature Sensor ( Pin 1) |
| 3 | Br/R | MIL Indicator | 31 | B/G | Lambda Sensor & TPS Negative ( Pin 3) |
| 4 | R/G | Auxillary Starter Relay 1 coil | 32 | PI | Input from Side Stand Switch |
| 5 | B/W | Earthing to Injector - injector timing(m/s) | 33 | | Dummy Plug |
| 6 | R/B | TPS 3.3 V Supply ( Input to TPS) | 34 | | Dummy Plug |
| 7 | R/L | TMAP/ROS/SSS ( 5V Input) | 35 | Y/L | Diagnostic Connector CANL-2 |
| 8 | W/Y | Fuel Tank Indicator | 36 | L. | Diagnostic CAN interface |
| 9 | Gr/R | Kill switch Trigger supply (Duke/RC 200) | 37 | G/Y | Stepper Motor Coup- Pin A |
| | Gr/Pi | Kill switch Trigger supply (Duke/RC 390) | | | |
| 10 | G/Y | TPS Sensor Signal ( Output from TPS) | 38 | G/R | Stepper Motor Coup- Pin B |
| 11 | G/R | Fuel Level Guage | 39 | W/R | Crank Angel sensor + ve |
| 12 | | | 40 | Y/G | Clutch Switch |
| 13 | | Dummy Plug | 41 | | Dummy Plug |
| 14 | L/R | Lambda Heater - Pin 2 | 42 | Y/B | TMAP sensor / ROS/Fuel Gauge/SSS ground/ ECU ground |
| 15 | G/Pi | Purge valve | 43 | L/Y | Output From Lambda Sensor. |
| 16 | | | 44 | Y/W | I/P from Water temp. Sensor ( Pin 2) |
| 17 | | | 45 | G/W | Veh Speed Sensor -Intergral Unit |
| 18 | | Dummy Plug | 46 | R/G | Connecting Aux Relay to ECU |
| 19 | W/L | Fuel Pump Relay Coil 2 | 47 | G/L | Diagnostic Connector CANH-2 |
| 20 | V/B | Fuel Consumption Indicator | 48 | Y. | Diagnostic CAN interface |
| 21 | B | Output to Tachometer. | 49 | G/PI | Fan Relay coil 2 |
| 22 | W/O | TMAP Sensor Pressure | 50 | B/Y | Veh Speed Sensor -Intergral Unit |
| 23 | Br/G | Rollover sensor Output | 51 | B/Y | Chassis Ground |
| 24 | G | TMAP Sensor Temperature | 52 | B/Y | Chassis Ground |
| 25 | L/B | Stepper Motor Coupler Pin D | 53 | Br/W | Batt. Supply.-Main relay Protected link ( O/P of Main relay) |
| 26 | Gr/W | Stepper Motor Coupler Pin C | 54 | | Dummy Plug |
| 27 | B/Y | Crank Angel sensor - ve | 55 | B. | Earthing Signal to Ignition Coil Input for firing |
| 28 | Lg | Input to Neutral Switch. | 56 | | Dummy Plug |

# Engine Management System - FI

**Key Changes :Terminal no. of ECU Connector : RC 390 ECUMY-17 with EPM 44**

| Pin | Wire | Connection | Pin | Wire | Connection |
|-----|------|------------|-----|------|------------|
| 1 | B/Y | Power Ground 1 | 23 | B/Y | Power Ground 2 |
| 2 | | Dummy Plug | 24 | B | Earthing signal to Ignition coil  (H.T coil) input for firing. |
| 3 | O/Br | +ve supply to TMAP, Side stand, Gear position sensor, APS – RH control switch). | 25 | Br/W | Power Supply After Main Relay (Input from main relay). |
| 4 | W/R | Crankshaft Input 1 | 26 | B/Y | Crankshaft Input(-) |
| 5 | B/W | Earthing to Injector- injector timing (m/s) | 27 | R/L | Sensor Supply 2 (Roll over sensor, TPS sensor, APS (RH control switch). |
| 6 | | Dummy Plug | 28 | L/W | Lambda Upstream Sensor |
| 7 | O/Gr | ETC (-ve) | 29 | G/B | Sensor 1 (APS)- RH control switch |
| 8 | W/G | ETC (+ve) | 30 | V/R | Sensor 1 (APS)- RH control switch |
| 9 | B/G | Lambda Sensor Pin 3 | 31 | Pi/R | Input supply to  Throttle Position Sensor 2 |
| 10 | R/G | Intermediate Starter Relay | 32 | G/Br | Earthing signal to Radiator Fan Relay at 96 C |
| 11 | L/G | Main Relay coil 2 | 33 | Pi/B | Input supply  from Kill switch |
| 12 | G/W | Intake Air Temp. (I/P). | 34 | G/Pi | Earthing signal to  Canister Purge Valve |
| 13 | | Dummy Plug | 35 | | Dummy Plug |
| 14 | W/Y | Fuel Pump Relay coil 2 | 36 | Y/L | CAN Low |
| 15 | L/Y | Lambda Sensor Pin 2 | 37 | G/L | CAN High |
| 16 | | Dummy Plug | 38 | | Dummy Plug |
| 17 | | Dummy Plug | 39 | Br/G | Roll Over Sensor |
| 18 | G/Y | Throttle Position Sensor | 40 | Pi | Side Stand Switch |
| 19 | Y/W | Engine Temp.  Sensor | 41 | W/O | Manifold Air Pressure Sensor |
| 20 | Y | Signal from Gear Position Sensor | 42 | Y/G | Signal from Clutch Switch |
| 21 | | Dummy Plug | 43 | Y/B | Sensor Ground 2 |
| 22 | L/B | Starter Switch I/P | 44 | Pi/L | Sensor Ground 1 (Input supply to TMAP, Side stand, Gear position sensor, APS – RH control switch). |

# Engine Management System - FI

**Key Changes : Terminal no. of ECU Connector :  390 ECUMY-17 with EPM 44**

| Pin | Wire | Connection | Pin | Wire | Connection |
|---|---|---|---|---|---|
| 1 | B/Y | Power Ground 1 | 23 | B/Y | Power Ground 2 |
| 2 | | Dummy Plug | 24 | B | Earthing signal to Ignition coil  (H.T coil) input for firing. |
| 3 | O/Br | +ve supply to TMAP, Side stand, Gear position sensor, APS – RH control switch). | 25 | Br/W | Power Supply After Main Relay (Input from main relay). |
| 4 | W/R | Crankshaft Input 1 | 26 | B/Y | Crankshaft Input(-) |
| 5 | B/W | Earthing to Injector- injector timing (m/s) | 27 | R/L | Sensor Supply 2 (Roll over sensor, TPS sensor, APS (RH control switch). |
| 6 | | Dummy Plug | 28 | L/W | Lambda Upstream Sensor |
| 7 | O/Gr | ETC (-ve) | 29 | G/B | Sensor 1 (APS)- RH control switch |
| 8 | W/G | ETC (+ve) | 30 | V/R | Sensor 1 (APS)- RH control switch |
| 9 | B/G | Lambda Sensor Pin 3 | 31 | Pi/R | Input supply to  Throttle Position Sensor 2 |
| 10 | R/G | Intermediate Starter Relay | 32 | G/Br | Earthing signal to Radiator Fan Relay at 96 C |
| 11 | L/G | Main Relay coil 2 | 33 | Pi/B | Input supply  from Kill switch |
| 12 | G/W | Intake Air Temp. (I/P). | 34 | G/Pi | Earthing signal to  Canister Purge Valve |
| 13 | | Dummy Plug | 35 | | Dummy Plug |
| 14 | W/Y | Fuel Pump Relay coil 2 | 36 | Y/L | CAN Low |
| 15 | L/Y | Lambda Sensor Pin 2 | 37 | G/L | CAN High |
| 16 | | Dummy Plug | 38 | | Dummy Plug |
| 17 | | Dummy Plug | 39 | Br/G | Roll Over Sensor |
| 18 | G/Y | Throttle Position Sensor | 40 | Pi | Side Stand Switch |
| 19 | Y/W | Engine Temp.  Sensor | 41 | W/O | Manifold Air Pressure Sensor |
| 20 | Y | Signal from Gear Position Sensor | 42 | Y/G | Signal from Clutch Switch |
| 21 | | Dummy Plug | 43 | Y/B | Sensor Ground 2 |
| 22 | L/B | Starter Switch I/P | 44 | Pi/L | Sensor Ground 1 (Input supply to TMAP, Side stand, Gear position sensor, APS – RH control switch). |

# Engine Management System - FI

**Terminal no. of ECU Connector : 250 Duke ECU MY-17 with EPM 44 .**

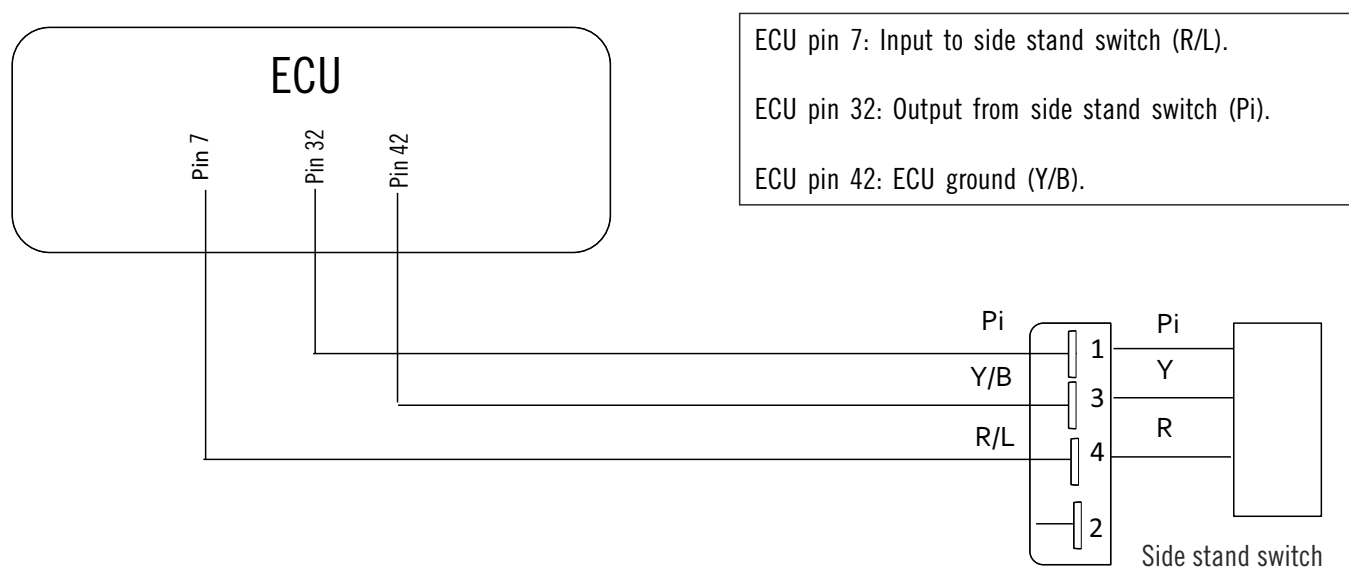| Pin | Wire | Connection | Pin | Wire | Connection |
|-----|------|------------|-----|------|------------|
| 1 | B/Y | Power Ground 1 | 23 | B/Y | Power Ground 2 |
| 2 | | Dummy Plug | 24 | B | Earthing signal to Ignition coil  (H.T coil) input for firing. |
| 3 | O/Br | +ve supply to TMAP, Side stand, Gear position sensor, APS – RH control switch). | 25 | Br/W | Power Supply After Main Relay (Input from main relay). |
| 4 | W/R | Crankshaft Input 1 | 26 | B/Y | Crankshaft Input(-) |
| 5 | B/W | Earthing to Injector- injector timing (m/s) | 27 | R/L | Sensor Supply 2 (Roll over sensor, TPS sensor, APS (RH control switch). |
| 6 | V/R | High/Low Beam relay coil | 28 | L/W | Lambda Upstream Sensor |
| 7 | | | 29 | G/Y | Steeper Driver |
| 8 | | | 30 | G/R | Steeper Driver B |
| 9 | B/G | Lambda Sensor Pin 3 | 31 | | Steeper Driver |
| 10 | R/G | Intermediate Starter Relay | 32 | G/Br | Earthing signal to Radiator Fan Relay at 96 C |
| 11 | L/G | Main Relay coil 2 | 33 | Pi/B | Input supply  from Kill switch |
| 12 | G/W | Intake Air Temp. (I/P). | 34 | G/Pi | Earthing signal to  Canister Purge Valve |
| 13 | B/Y | Poka-Yoke I/P | 35 | | Dummy Plug |
| 14 | W/Y | Fuel Pump Relay coil 2 | 36 | Y/L | CAN Low |
| 15 | L/Y | Lambda Sensor Pin 2 | 37 | G/L | CAN High |
| 16 | | Dummy Plug | 38 | Y/B | Sensor Ground 2 |
| 17 | | Dummy Plug | 39 | Br/G | Roll Over Sensor |
| 18 | G/Y | Throttle Position Sensor | 40 | Pi | Side Stand Switch |
| 19 | Y/W | Engine Temp.  Sensor | 41 | W/O | Manifold Air Pressure Sensor |
| 20 | Y | Signal from Gear Position Sensor | 42 | Y/G | Signal from Clutch Switch |
| 21 | L/W | Vehicle speed I/P | 43 | L/B | Steeper Driver D |
| 22 | L/B | Starter Switch I/P | 44 | Pi/L | Sensor Ground 1 (Input supply to TMAP, Side stand, Gear position sensor, APS – RH control switch). |

# Engine Management System - Parts Inspection Parameter

**Side stand inspection :**

Working :

It is a hall effect sensor. It prevents the motorcycle from driving off with the side stand open. It is responsible for informing ECU of stand position. With Stand fully up it delivers 2-2.2 V which indicates ECU to keep the vehicle started.



ECU pin 7: Input to side stand switch (R/L).

ECU pin 32: Output from side stand switch (Pi).

ECU pin 42: ECU ground (Y/B).

**Check with multi-meter :**

Input voltage : 4.75 ~ 5 V  (from ECU terminal 7)

+ ve terminal : R/L  and   - ve terminal  : Y/B

Output voltage to terminal 32 of ECU

 + ve terminal : Pi   and  - ve terminal  : Y/B
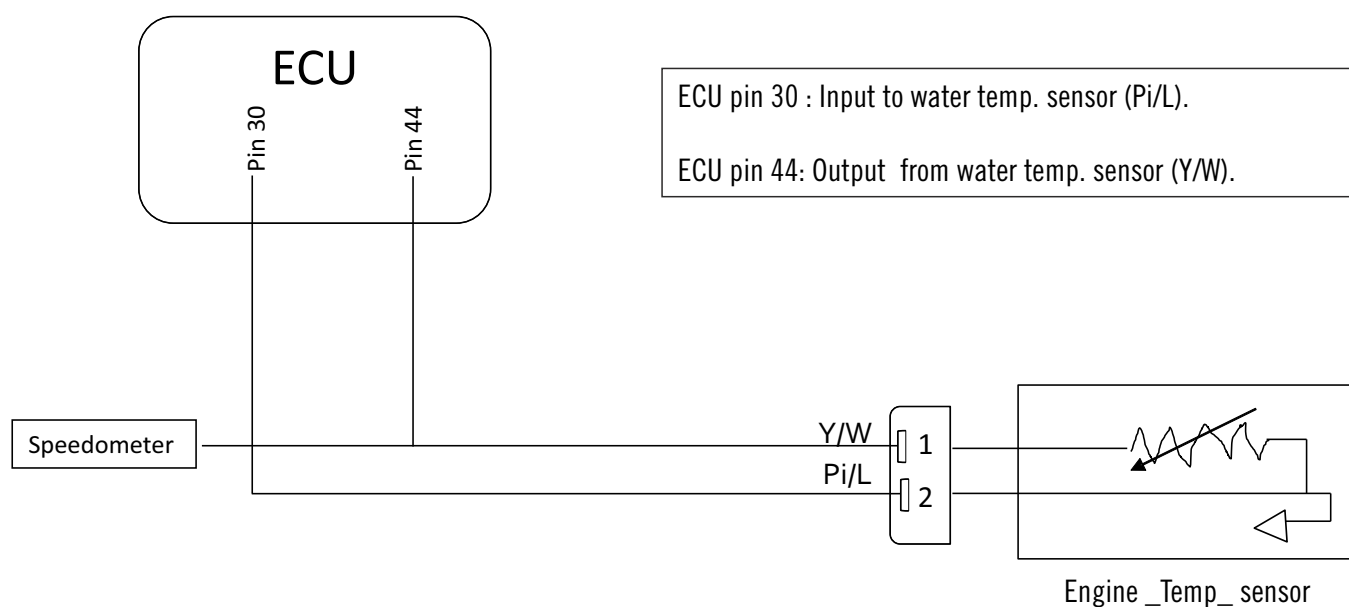
Stand down condition : 4.75 V

Stand up condition :  2 ~ 2.2 V

# Engine Management System - Parts Inspection Parameter

**Water temperature sensor inspection :**

Working :

EUC monitors coolant temperature and increases the fuel quantity in cold condition start up. With increase in temperature the resistance of sensor decreases and vice versa. It is supplied with 5V by ECU. It measures the Engine temperature via coolant temperature.

ECU

Pin 30

Pin 44

ECU pin 30 : Input to water temp. sensor (Pi/L).

ECU pin 44: Output from water temp. sensor (Y/W).

Speedometer

Y/W  1
Pi/L  2

Engine _Temp_ sensor

**Check with multi-meter :**

Check with multi-meter :

Check Resistance : (x 1 K $\Omega$ ) at 25 °C  (P/L- Y/W)

$\qquad$ 1.88 ~ 2.12 K $\Omega$

Input voltage : 4.75 ~ 5 V Pi/L from ECU terminal 30
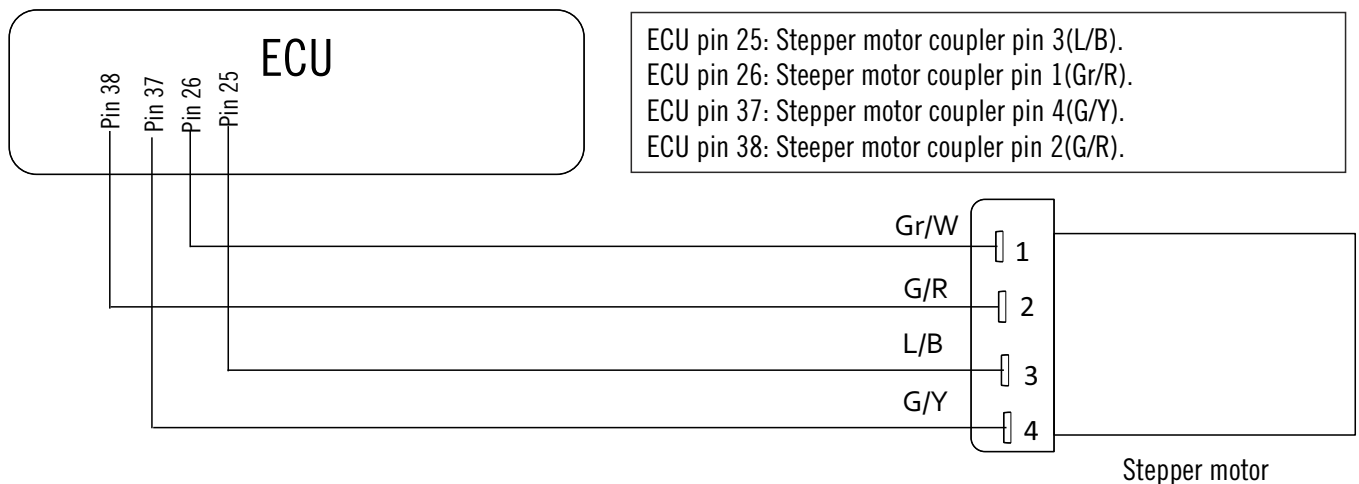
Output voltage Y/W to terminal 44 of ECU

Change in Resistance value and voltage (Hotter the coolant-lesser the resistance value).

# Engine Management System - Parts Inspection Parameter

**Stepper motor inspection :**

Working :

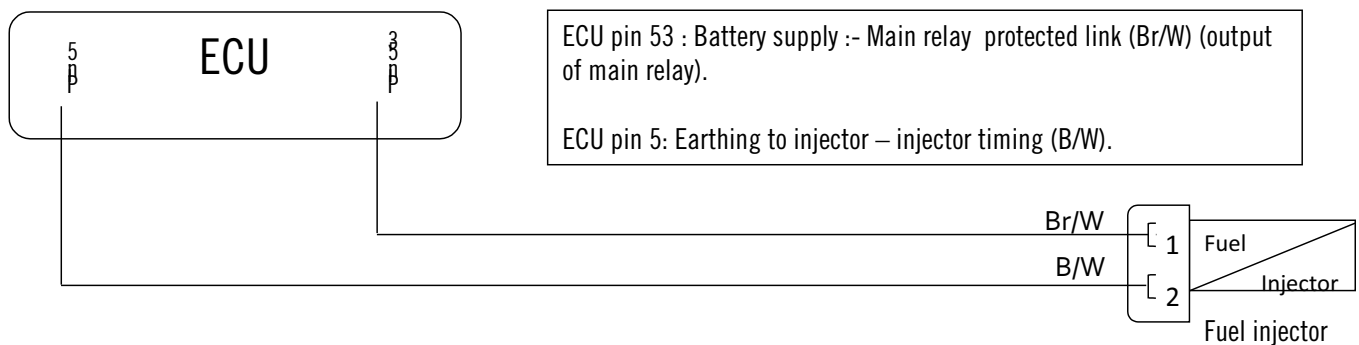It controls the Air flow which bypass the main venture of throttle body.

```
ECU
Pin 38   Pin 37   Pin 26   Pin 25
```

ECU pin 25: Stepper motor coupler pin 3(L/B).
ECU pin 26: Steeper motor coupler pin 1(Gr/R).
ECU pin 37: Stepper motor coupler pin 4(G/Y).
ECU pin 38: Steeper motor coupler pin 2(G/R).

```
Gr/W    [ 1
G/R     [ 2
L/B     [ 3
G/Y     [ 4
```

Stepper motor

**Check with multi-meter :**

Resistance

Pin 1 – Pin 4   : 46 Ω ~ 56 Ω
Pin 2 – Pin 3   : 46 Ω ~ 56 Ω

**Injector inspection :**

Working :

The fuel injector is given a continuous supply of pressurized fuel with the help of fuel pump. The ECU controls the amount of fuel by varying the opening (ON) time of injector.

```
ECU
Pin 5          Pin 53
```

ECU pin 53 : Battery supply :- Main relay  protected link (Br/W) (output of main relay).

ECU pin 5: Earthing to injector – injector timing (B/W).

```
Br/W    [ 1   Fuel
B/W     [ 2   Injector
```

Fuel injector

**Check with multi-meter :**

Resistance

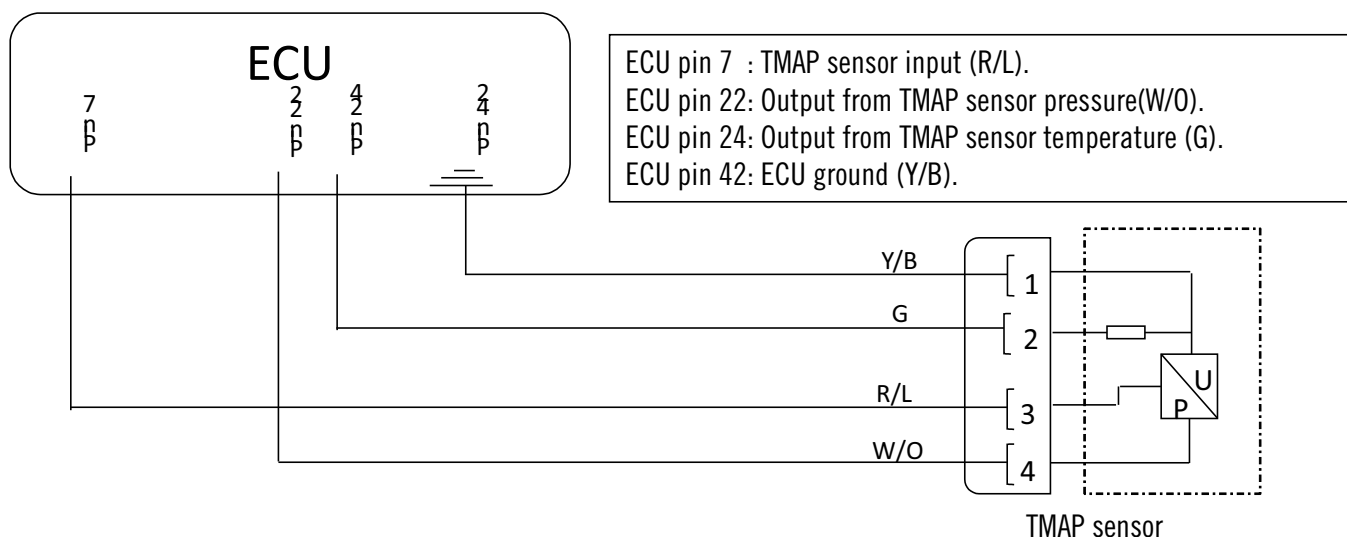Pin 1 – Pin 2   : 12 ± 0.6 Ω @ 25   C

# Engine Management System - Parts Inspection Parameter

**TMAP (Temp./Manifold Absolute Pressure sensor) inspection :**

Working :

Monitors temperature and pressure of air entering manifold and gives signal to ECU.

ECU pin 7 : TMAP sensor input (R/L).
ECU pin 22: Output from TMAP sensor pressure(W/O).
ECU pin 24: Output from TMAP sensor temperature (G).
ECU pin 42: ECU ground (Y/B).

TMAP sensor

**Check with multi-meter :**

- Input voltage : 4.75~ 5 V

    + ve terminal : R/L (from ECU terminal 7)

    - ve terminal : Y/B (Earthing & terminal 42 of ECU)

- Output voltage to terminal 22 of ECU

    (for TMAP sensor pressure)

    + ve terminal : W/O

    - ve terminal  : Y/B

    3.8 ± 0.65 V at atmospheric pressure.

Temperature sensor to terminal 24 of ECU:
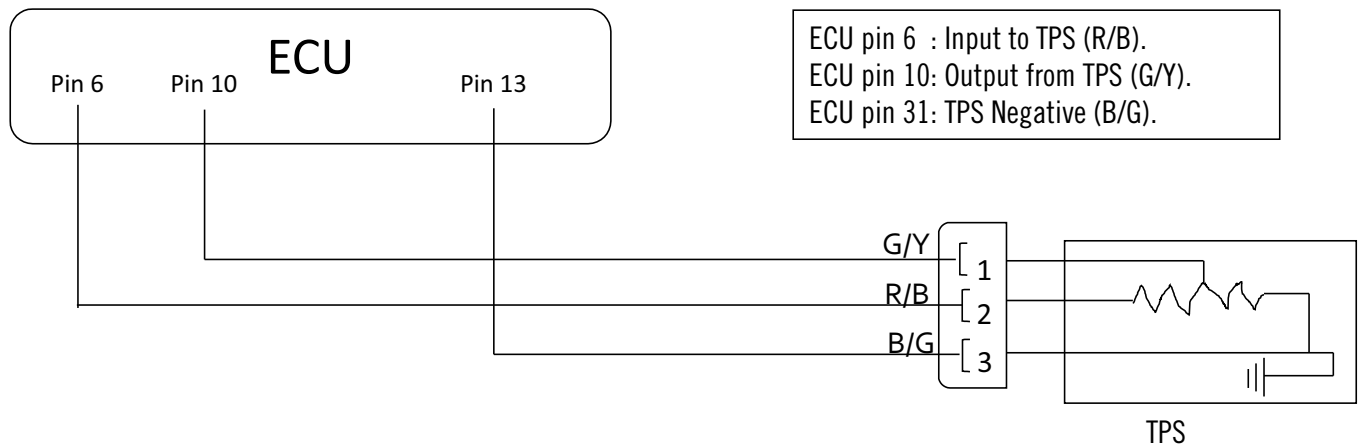
Resistance between pin 1 and pin 2  : 2 ± 0.5K Ω @ 25  C

# Engine Management System - Parts Inspection Parameter

**TPS (Throttle Position sensor) inspection :**

Working :

Monitors position of throttle  and gives signal to ECU.



ECU pin 6  : Input to TPS (R/B).
ECU pin 10: Output from TPS (G/Y).
ECU pin 31: TPS Negative (B/G).

TPS

**Check with multi-meter :**

• Input voltage : 4.75 ~ 5 V  (from ECU terminal 6)

    + ve terminal : R/B

    - ve terminal  : B/G


Output voltage to terminal 10 of ECU

    + ve terminal : G/Y

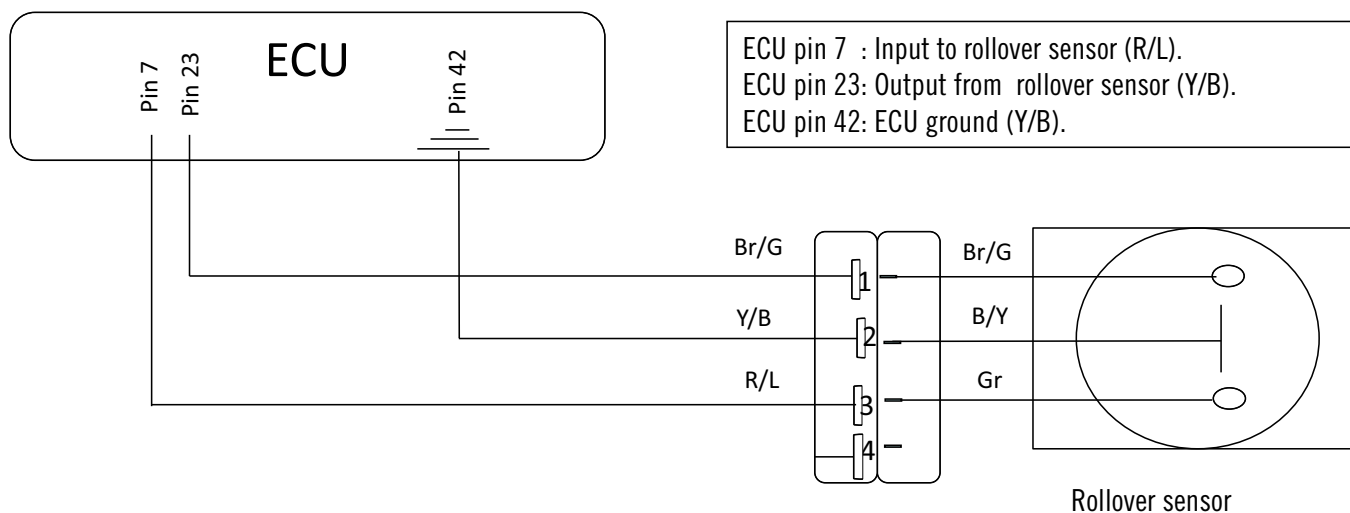    - ve terminal  : B/G

    Idle throttle          : 0.35 ~ 0.65 V

    Wide open throttle : 4.35 ~ 4.65 V

# Engine Management System - Parts Inspection Parameter

**Roll over sensor inspection :**

Working :

Inside a ROS is a pendulum & a magnet. The Pendulum is guided over a hall element. When vehicle tilts the pendulum moves and the voltage changes. Post tilt of around 75$^o$ the voltage output triggers ECU to shut off the Fuel supply.

ECU pin 7  : Input to rollover sensor (R/L).
ECU pin 23: Output from  rollover sensor (Y/B).
ECU pin 42: ECU ground (Y/B).

ECU

Pin 7
Pin 23
Pin 42

Br/G    1    Br/G
Y/B     2    B/Y
R/L     3    Gr
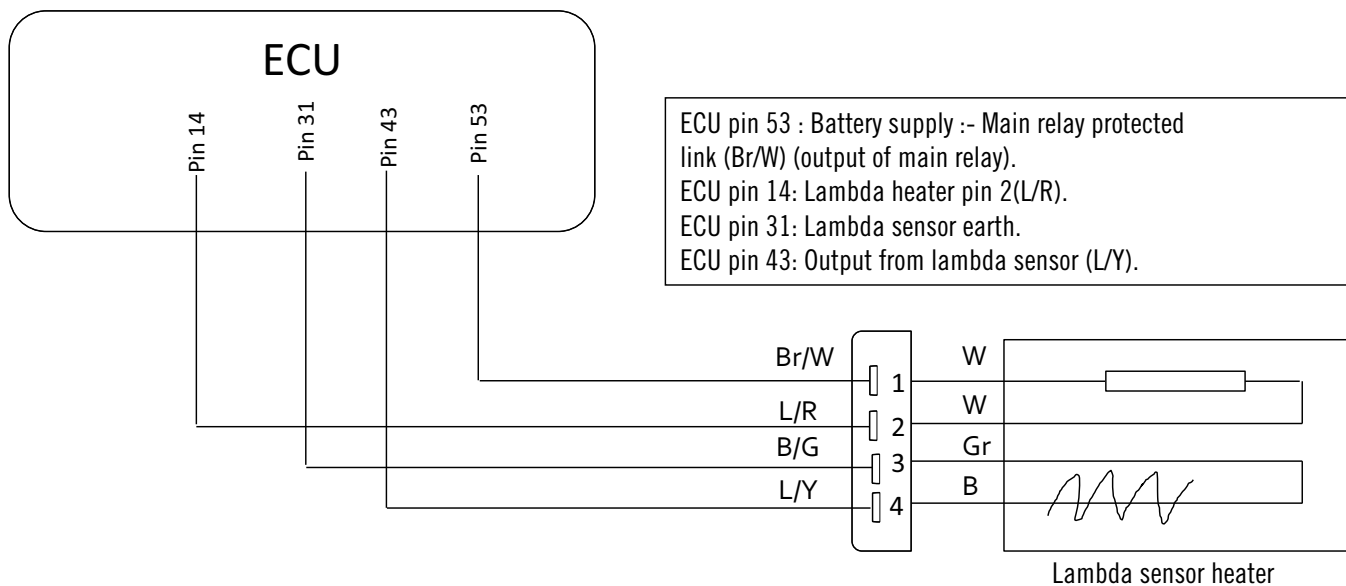        4

Rollover sensor

**Check with multi-meter :**

• Input voltage : 4.75 ~ 5 V  (from ECU terminal 7)

+ ve terminal : R/L

- ve terminal  : Y/B


• Output voltage to terminal 23 of ECU

+ ve terminal : Br/G

- ve terminal  : Y/B

Normal position of ROS : 4.8 ~ 4.9 V

Tiled position of ROS    : 2.0 ~ 2.2 V

KTM_SERVICE

# Engine Management System - Parts Inspection Parameter

**Oxygen (Lambda) sensor inspection :**

Working :

The Oxygen sensor measure the density of Oxygen in exhaust gases and gives this information to ECU. This helps ECU to maintain Stoichiometric ratio of air-fuel mixture.

ECU pin 53 : Battery supply :- Main relay protected link (Br/W) (output of main relay).
ECU pin 14: Lambda heater pin 2(L/R).
ECU pin 31: Lambda sensor earth.
ECU pin 43: Output from lambda sensor (L/Y).

**ECU**

Pin 14    Pin 31    Pin 43    Pin 53

| | |
|---|---|
| Br/W | W |
| L/R | W |
| B/G | Gr |
| L/Y | B |

1
2
3
4

Lambda sensor heater

**Check with multi-meter :**

- Resistance

  Multi-meter : Ohm ( X 1)
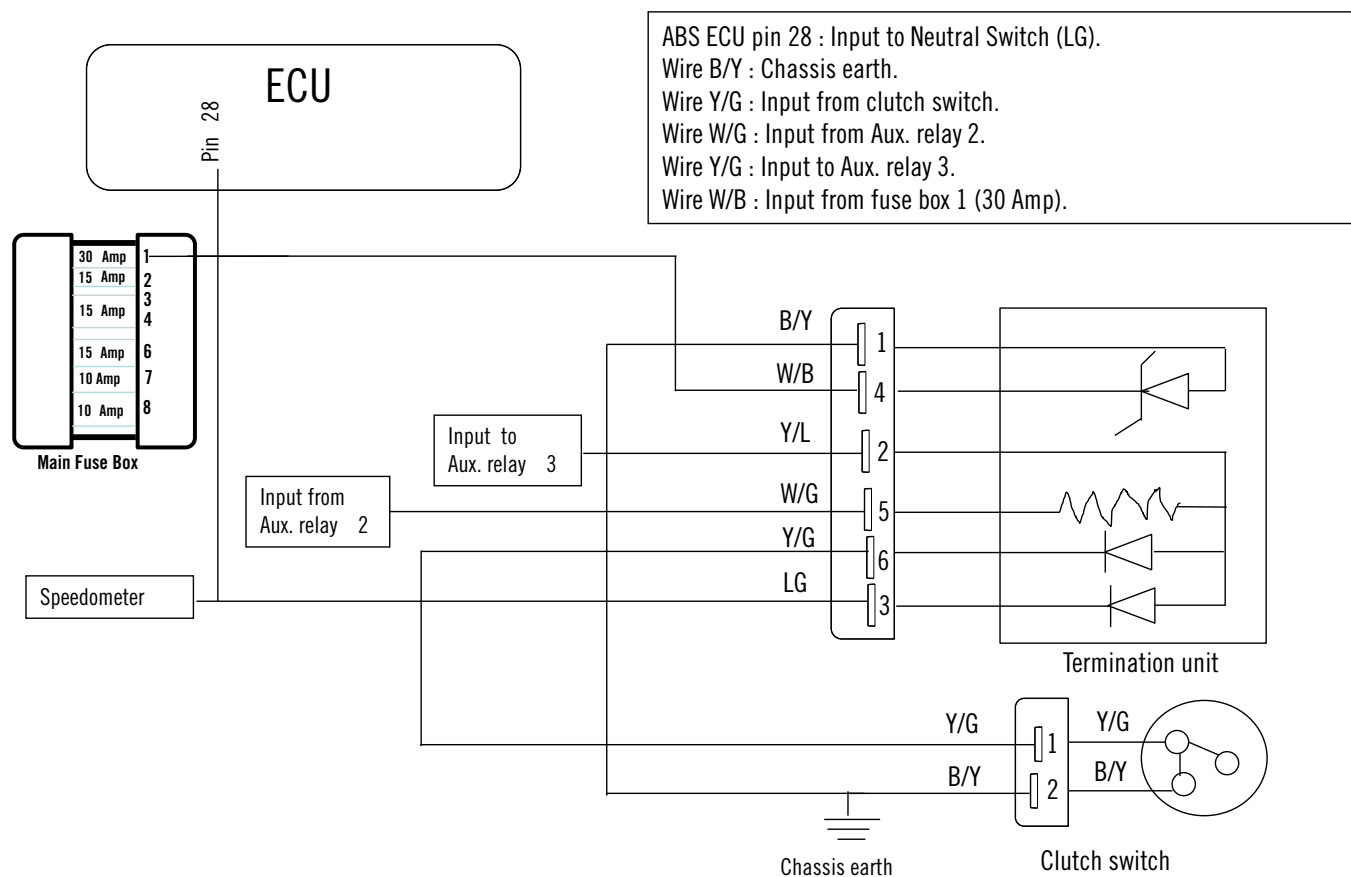
  Heater resistance (at 25  temp)

  Pin 1 & 2 (Br/W- L/R) : 9 Ω ± 1 Ω

- Pin 3(B/G)- Pin 4(L/Y)= OPEN (at 25 deg)

# Engine Management System - Parts Inspection Parameter
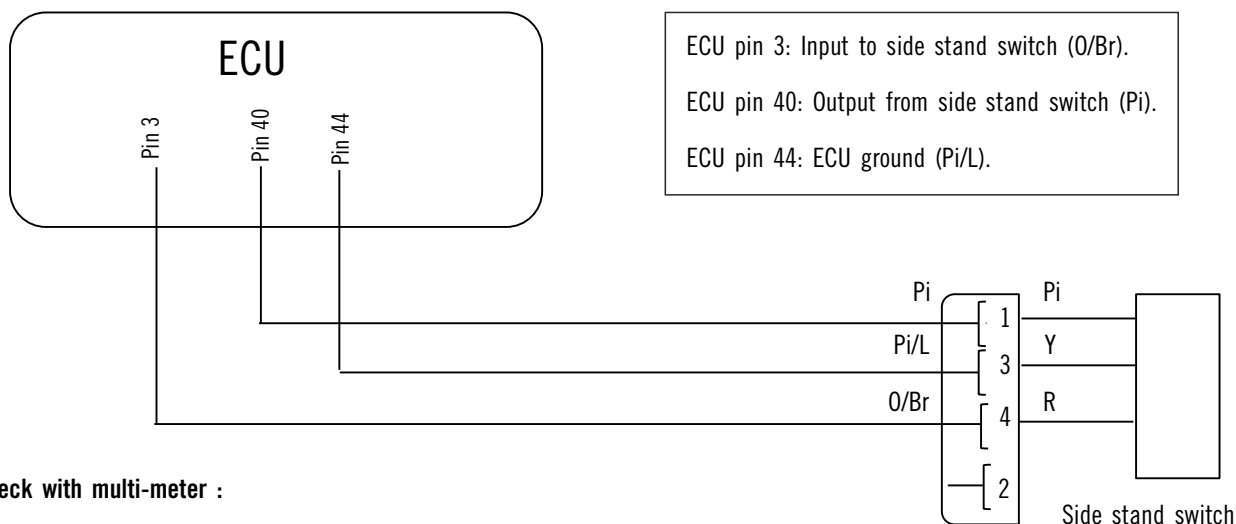
**Termination unit circuit :**

ECU

Pin 28

ABS ECU pin 28 : Input to Neutral Switch (LG).
Wire B/Y : Chassis earth.
Wire Y/G : Input from clutch switch.
Wire W/G : Input from Aux. relay 2.
Wire Y/G : Input to Aux. relay 3.
Wire W/B : Input from fuse box 1 (30 Amp).

30 Amp   1
15 Amp   2
  3
15 Amp   4
15 Amp   6
10 Amp   7
10 Amp   8

**Main Fuse Box**

Input to
Aux. relay   3

Input from
Aux. relay   2

Speedometer

B/Y   1
W/B   4
Y/L   2
W/G   5
Y/G   6
LG   3

Termination unit

Y/G   1   Y/G
B/Y   2   B/Y

Chassis earth

Clutch switch

# Engine Management System - Parts Inspection Parameter

## FI Circuits - Understanding All Stages : MY 17
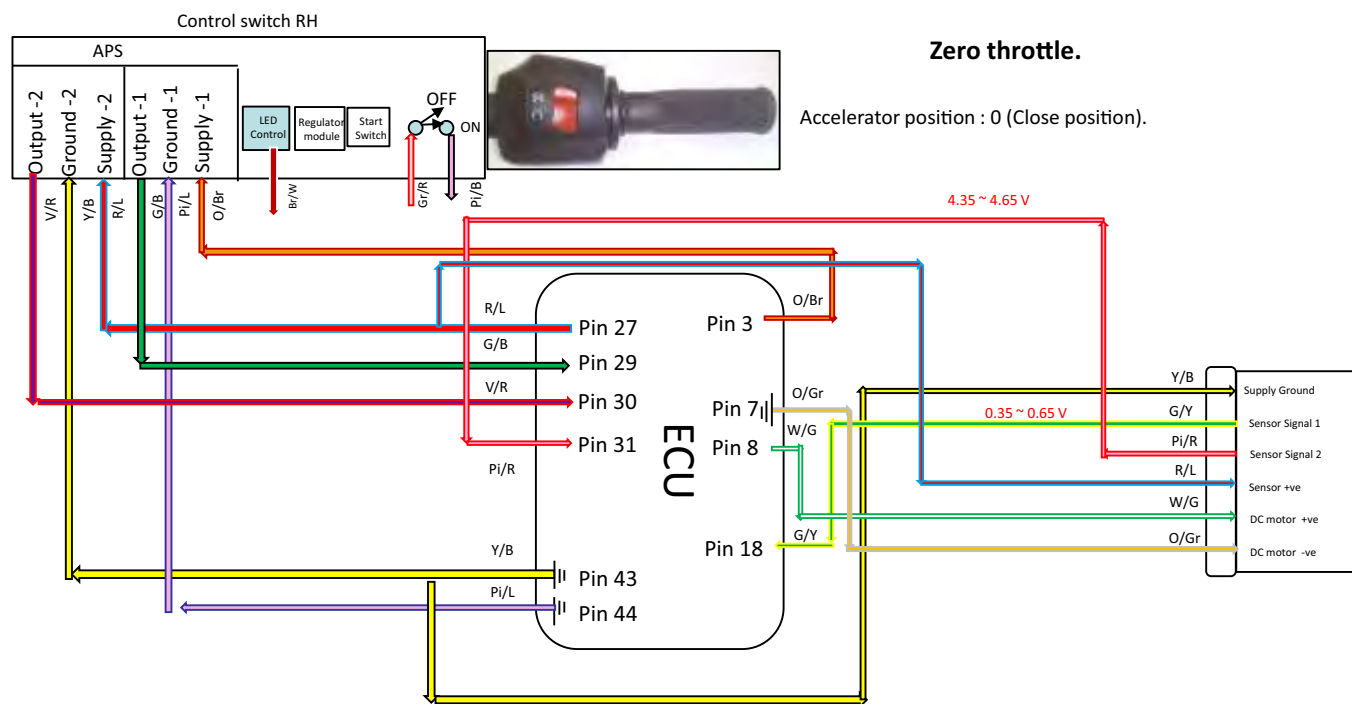


**Zero throttle.**

Accelerator position : 0 (Close position).

## Side Stand Inspection :

Working : It is a hall effect sensor. It prevents the motorcycle from driving off with the side stand open. It is responsible for informing ECU of stand position. With stand fully up it delivers 2-2.2 V which indicates ECU to keep the vehicle started.



ECU pin 3: Input to side stand switch (O/Br).

ECU pin 40: Output from side stand switch (Pi).

ECU pin 44: ECU ground (Pi/L).

**Check with multi-meter :**

Input voltage : 4.75 ~ 5V (from ECU terminal 3)

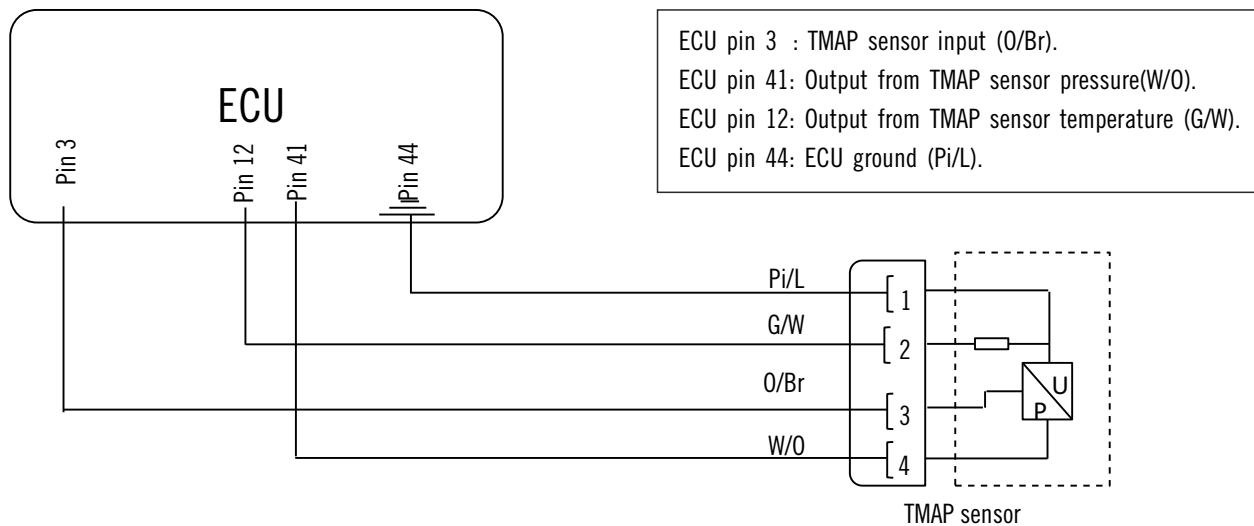+ ve terminal: O/Br (Orange/Brown), and - ve terminal: Pi/L (Pink/Blue)

Output voltage to terminal 40 of ECU

+ve terminal: Pi (Pink) and - ve terminal: Pi/L (Pink/Blue), Stand down - 3.9, Stand Up - 1.6- 1.7 V

# Engine Management System - Parts Inspection Parameter

## TMAP (Temp. / Manifold Absolute Pressure Sensor) Inspection :

Working : Monitors temperature and pressure of air entering manifold and gives signal to ECU.



ECU pin 3 : TMAP sensor input (O/Br).
ECU pin 41: Output from TMAP sensor pressure(W/O).
ECU pin 12: Output from TMAP sensor temperature (G/W).
ECU pin 44: ECU ground (Pi/L).

TMAP sensor

### Check with multi-meter :

• Input voltage : 4.75~ 5 V

+ ve terminal : O/Br (from ECU terminal 3)

- ve terminal : Pi/L (Earthing & terminal 44 of ECU)


• Output voltage to terminal 41` of ECU

(for TMAP sensor pressure)

+ ve terminal : W/O

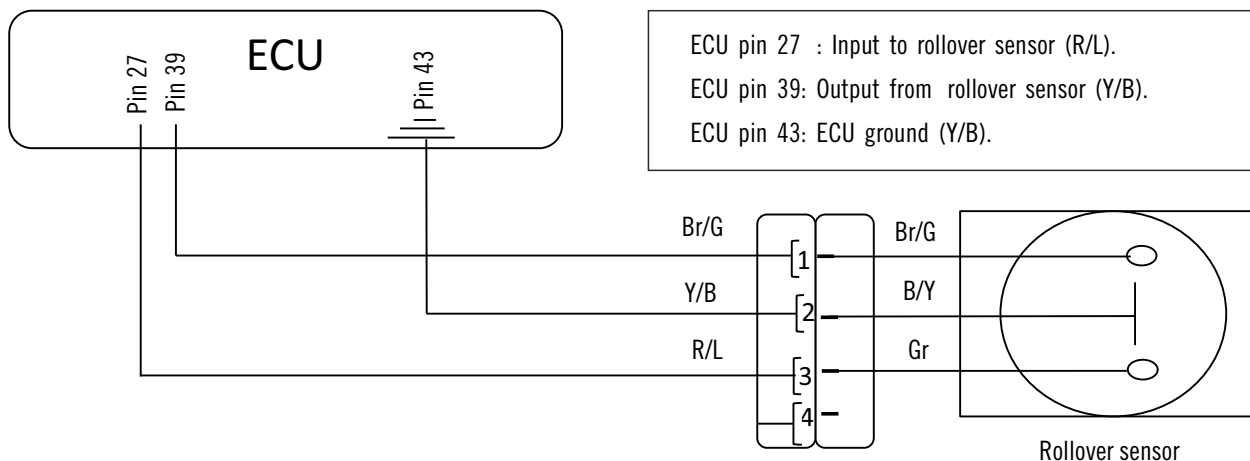- ve terminal : Pi/L

3.8 ± 0.65 V at atmospheric pressure.


**Temperature sensor to terminal 12 of ECU:**

**Resistance between pin 1 and pin 2 : 2 ± 0.5K Ω @ 25$^0$C**

# Engine Management System - Parts Inspection Parameter

## Roll Over Sensor Inspection :

Working : Inside a ROS is a pendulum & a magnet. The Pendulum is guided over a hall element. When vehicle tilts the pendulum moves and the voltage changes. Post tilt of around 75$^o$ the voltage output triggers ECU to shut off the Fuel supply.

**ECU**

Pin 27  Pin 39  Pin 43

ECU pin 27 : Input to rollover sensor (R/L).
ECU pin 39: Output from rollover sensor (Y/B).
ECU pin 43: ECU ground (Y/B).

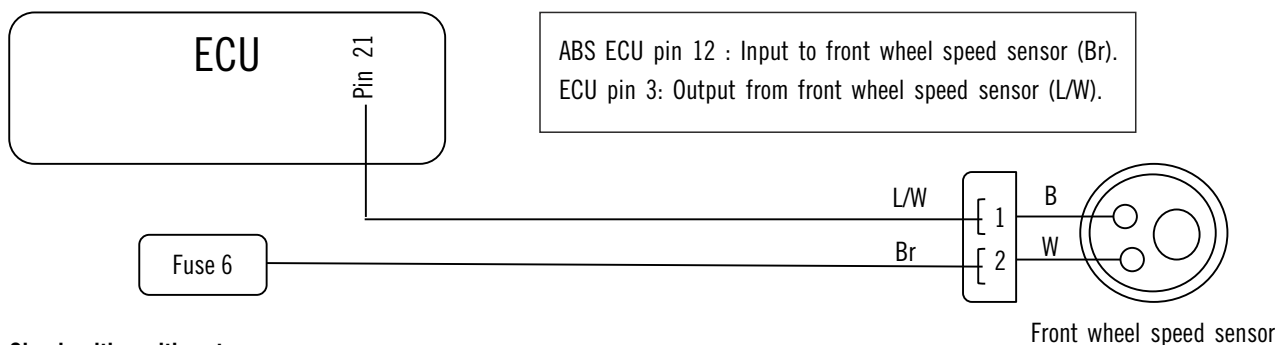| | | |
|---|---|---|
| Br/G | 1 | Br/G |
| Y/B | 2 | B/Y |
| R/L | 3 | Gr |
| | 4 | |

Rollover sensor

### Check with multi-meter :
- Input voltage : 4.75 ~ 5 V  (from ECU terminal 27)
     + ve terminal : R/L
     - ve terminal  : Y/B

- Output voltage to terminal 39 of ECU
     + ve terminal : Br/G
     - ve terminal  : Y/B
     Normal position of ROS : 4.8 ~ 4.9 V
     Tiled position of ROS    : 2.0 ~ 2.2 V

## Front Wheel Speed Sensor Inspection (Duke 250 MY17) :

Working : Wheel speed sensor, sense the pulses from the pulsar rings mounted on the wheels and convey it to ABS ECU.

### Front Wheel Speed Sensor Circuit :

**ECU**

Pin 21

ABS ECU pin 12 : Input to front wheel speed sensor (Br).
ECU pin 3: Output from front wheel speed sensor (L/W).

Fuse 6

| | | |
|---|---|---|
| L/W | 1 | B |
| Br | 2 | W |

Front wheel speed sensor

### Check with multi-meter :
- Input voltage : 12 V
- Output voltage: 4.5 – 5.0 V

**KTM_SERVICE**

# Engine Management System - Parts Inspection Parameter

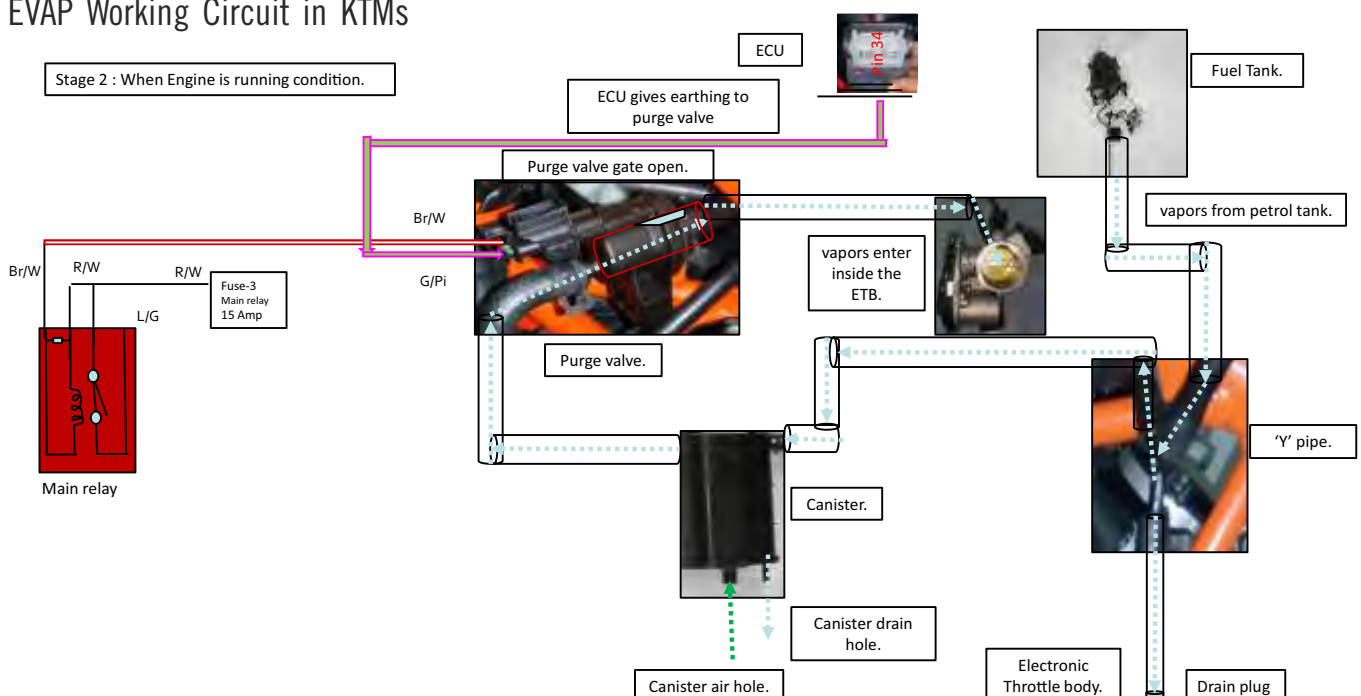## Working Principle of Evaporative Emission Control System (EVAP)

The Evaporative Emission Control System is used to prevent gasoline vapors from escaping into the atmosphere from the fuel tank and fuel system.



Petrol Tank

Hose

Electronic Throttle body

Purge valve

Canister

'Y' pipe

ECU

**Why EVAP System?**

- Fuel vapors contain a variety of hydrocarbons (HC). These substances react with air & sunlight (called a photochemical reaction) to form smog. Uncontrolled evaporative emissions like this can account for as much as 20 percent of the pollution produced by a motor vehicle.

- The EVAP system eliminates fuel vapors polluting the air by sealing off the fuel system from the atmosphere. Vent lines from the fuel tank route vapors to the EVAP storage canister, where they are trapped and stored until the engine is started. When the engine is running the ECU opens the purge valve allowing the vapors to be siphoned from the storage canister into the intake manifold. The fuel vapors are then burnt by the engine.

## EVAP Working Circuit in KTMs



Stage 2 : When Engine is running condition.

ECU

ECU gives earthing to purge valve

Fuel Tank.

Purge valve gate open.

Br/W

vapors enter inside the ETB.

vapors from petrol tank.

Br/W    R/W    R/W

L/G

Fuse-3
Main relay
15 Amp

G/Pi

Purge valve.

'Y' pipe.

Main relay

Canister.

Electronic Throttle body.

Drain plug

Canister air hole.

Canister drain hole.

# Engine Management System - FI

**Description of Fuel Injector**

| Sr. No. | Category | Vehicle | Injector BAL part no. | Injector no. on part |
|---------|----------|---------|----------------------|---------------------|
| 1 | Ø 46 Th. Body | DUKE 390 | JY611000 | 280158325 |
| 2 | Ø 38 Th. Body | DUKE 200 | JG611007 | 280158312 |
| 3 | Ø 33 Th. Body | Duke 125 | JG611004 | 280158281 |

**Ø 46 Th. Body ( DC 5)**
**JY611202**

Golden Colour Indicates That Injector With T. Body Ø 46
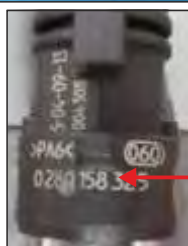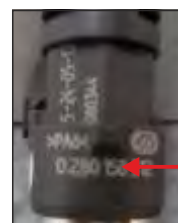
Injector Code For Ø 46 T. Body

Yellow Colour Indicates That Injector With T. Body Ø 46

**Ø 38 Th. Body ( DC 2)**
**JU581404**
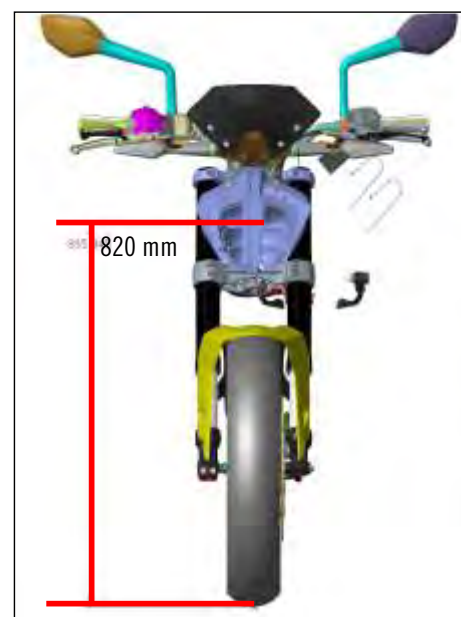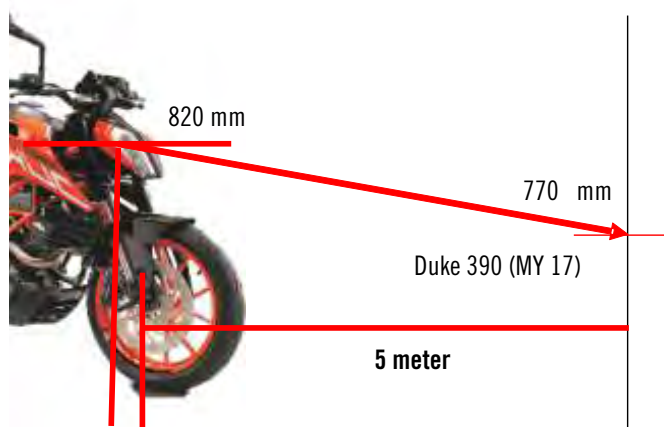
White Colour Indicates That Injector With T. Body Ø 38

Injector Code For Ø 38 T. Body

White Colour Indicates That Injector With T. Body Ø 38
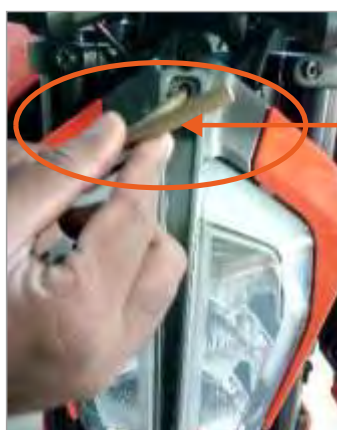
# Engine Management System - FI

**Head Light Focus Adjustment - Duke 250 MY 17**
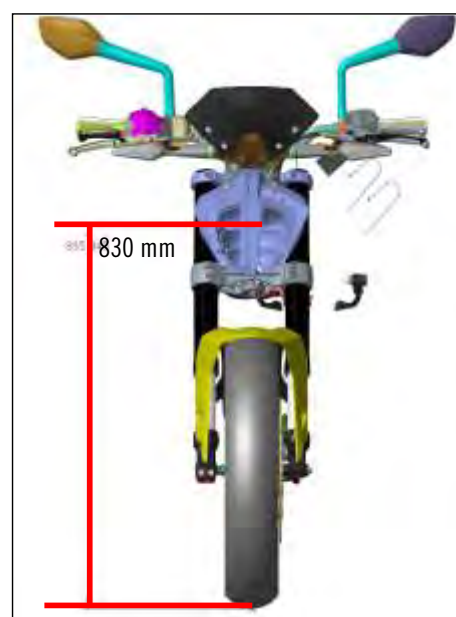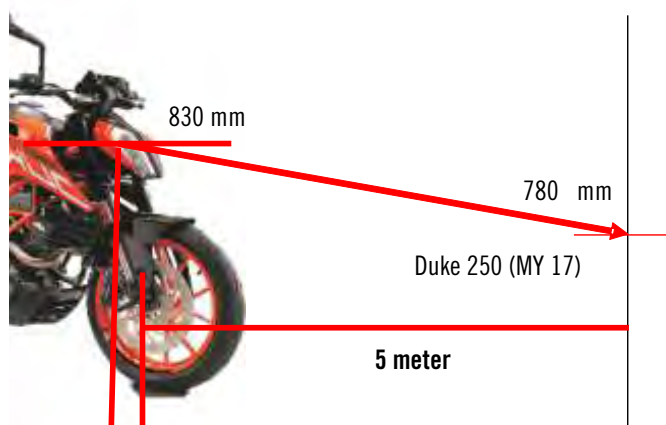
820 mm

770 mm

Duke 390 (MY 17)

**5 meter**

820 mm

**Head Light Focus Adjustment - Duke 390 MY 17**

Focus
Adjustment
Screw

Head light focus
adjustment Tool

830 mm

780 mm

Duke 250 (MY 17)

**5 meter**

830 mm

# Fault Tree

## Idling Instable

Idling Instable

Check the Variation in idling rpm with help of D&F tool (1450 for 200 and 1800 for 390)

**FI Blink**

**No FI Blink**

**D&F tool DTC**

**D&F tool (Engine parameter)**

### Sensors
4. TPS circuit
11. Idle Air control
9. MAP circuit
3. Crank Angle circuit
33. Injector circuit
45. Lambda heater circuit
49. Idle Air control circuit
13. IAT sensor circuit
17. Lambda sensor circuit

### Lean Mixture

**Fuel supply**

Fuel used
Fuel quantity
Fuel Quality

Fuel Supply
Delivery of fuel pump
Clogging of fuel filter
Pinching of fuel pipes

Fuel spray
Clogging of injector
Spray of injector

**Air Supply**

Air supply excess
Throttle holder clamp
Holder rubber
Intake manifold

Throttle body
TMAP loose
Steeper loose
Injector 'o' ring
Injector loose

### Rich Mixture

**Mechanical**

Compression pressure
Valve timing
Cam sprocket lugs
Cam lobes profile
Decomp lever (Ex valve)
Rocker movement

Valves
Leakage from
intake/exhaust valves
Valve seats wear
Head seat wear/sunk
inside
Head gasket

Cylinder piston
Cylinder piston wear Piston
rings wear/broken
Blow hole on piston Crown
Block facing

**Electrical Supply**

Spark plug
Cap loose
End gap
Current spark plug tip
Electrode loose
Ceramic cracked

H.T. coil
Current output
Coil cracked
Coil resistance
Input voltage

Generators
Battery voltage
Charging current
Charging coil
Pickup coil resistance
Ignition timing
Rotor gap
Rotor run out

Choke
ETS improper working

**Air Supply**

Flow
Air Filter clogged
Intake pipe pinched
Cloth blocking air
Filter box crack

Throttle body
TMAP loose
Steeper loose
Injector 'o' ring
Injector loose

# Process Failure Report (PFR)

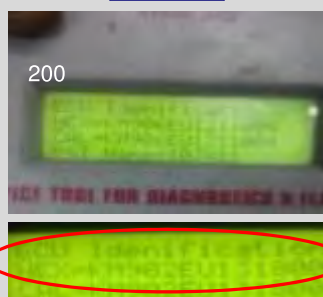| REPAIR ERROR | **Repeat job due to wrong identification of ECU.** |
|---|---|

<table>
<tr><td colspan="2" align="center">WHY WHY ANALYSIS</td></tr>
<tr><td>**Customer Voice**</td><td>My 390 Duke does not accelerate as good as my friends bike</td></tr>
<tr><td>**Reason for Complaint**</td><td>Engine rpm & vehicle speed not matching in given gear on MY 17 vehicle.</td></tr>
<tr><td>**Why 1**</td><td>Workshop staff not able to measure ECU parameters on MY 17model.</td></tr>
<tr><td>**Root Cause**</td><td>Latest Identification of ECU Hex files not updated perpetually.</td></tr>
<tr><td>**Action**</td><td>1. Apart from part number ECU for given product/model year will have differentprogram.<br>2. The specific program for given product & model year combination can be identified by Hex file .<br>3. Pick up hex file number with diagnosis tool and confirm that it matches with specifications.<br>4. Do not interchange ECU with different models to avoid complaints as above.</td></tr>
</table>

**Before**

200

Specifications of Hex File not Known to Technicians

**After**

| SN | Product | Model Year | HEX File No |
|---|---|---|---|
| 1 | 200 Duke | MY 12/MY13 | KM906EU1711004 |
| 2 | 200 Duke | MY 14 | KM906IN1418006 |
| 3 | 200 Duke | MY 15/MY16 | KM906IN1518007 |
| 4 | 200 Duke | MY17 | KM906CN1519005 |
| 5 | 250 Duke | MY17 | KM9U2EU1715101 |
| 6 | 390 Duke | MY 13 | KM902EU1318002 |
| 7 | 390 Duke | MY 14 | KM902EU1419004 |
| 8 | 390 Duke | MY 15/MY16 | KM902EU1519005 |
| 9 | 390 Duke | MY17 | KM903IN1710901 |
| 10 | RC 200 | MY 15/MY16 | KM906IN1518007 |
| 11 | RC 200 | MY17 | KM906CN1519005 |
| 12 | RC 390 | MY 15/MY16 | KM902EU1519005 |
| 13 | RC 390 | MY17 | KM903IN1710901 |

Product /Model year wise Hex Files For reference.

# Process Failure Report (PFR)

**REPAIR ERROR**  **REPLACEMENT OF OK PART UNDER WARRANTY**

| WHY WHY ANALYSIS | |
|---|---|
| **Customer Voice** | Idling instability & vehicle misfiring at times. |
| **Reason for Complaint** | Doubt on O2 sensor as voltage output not fluctuating as specified. |
| **Why 1** | No voltage output fluctuation seen as O2 sensor tip was clogged with carbon. |
| **Why 2** | Technician did not check resistance too before replacing it under warranty. |
| **Action** | SOP : O2 sensor tip to be cleaned for carbon deposits removal. Compressed dry air to be used to clean O2 sensor at periodic service. Sensor should not be replaced only on voltage output reading alone. |

**BEFORE**

- O2 sensor output voltage checked with D&F tool. O2 sensor reading in D&F @ 96degrees: should fluctuate between **0.02 to 0.9V**
- In case of no reading or slow changes Sensor getting replaced.

**AFTER**

- O2 sensor tip to be checked for blockage due to carbon deposition.
- Clean O2 sensor with compressed air, refit & recheck readings.
- Check O2 sensor resistance before replacement.
  PIN 1 – PIN 2:  9.5 — 0.5 Ω@ 25° C
  PIN 3 – PIN 4:  OPEN @ 25

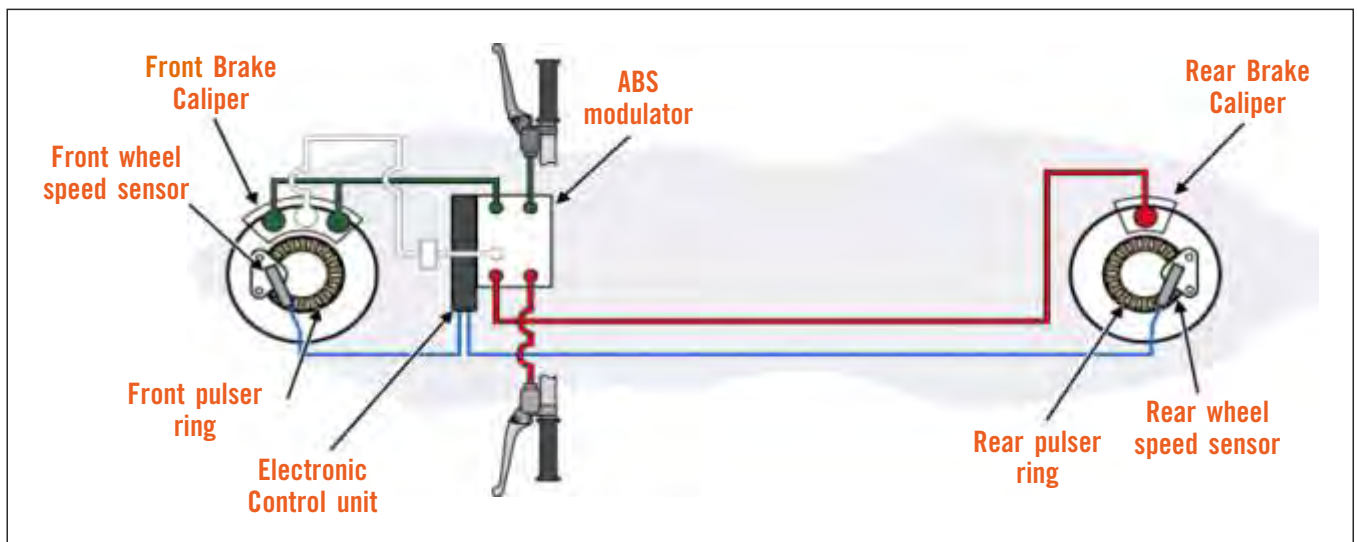Clogged sensor        Cleaning sensor tip        Clean sensor

# Anti Lock Braking System

## Working Principle

### ABS : Function

Wheel lock can occur while driving especially on slippery roads and harsh braking, thus braking has to be controlled carefully. With the ABS function, the rider can easily apply stable braking. The control unit detects the tendency of wheel lock by input from the sensors at both wheels. When the wheels are about to lock, the control unit sends signals to the modulator, according to the preset control map. Then, the modulator controls the Brake caliper fluid pressure (braking force), thus preventing wheel lock.

ABS ECU has a self-diagnosis function that determines if the entire system is operating normally. If failure is detected from sensor inputs or at any electronic circuits, ABS indicator lamp illuminates to inform the rider of the failure.
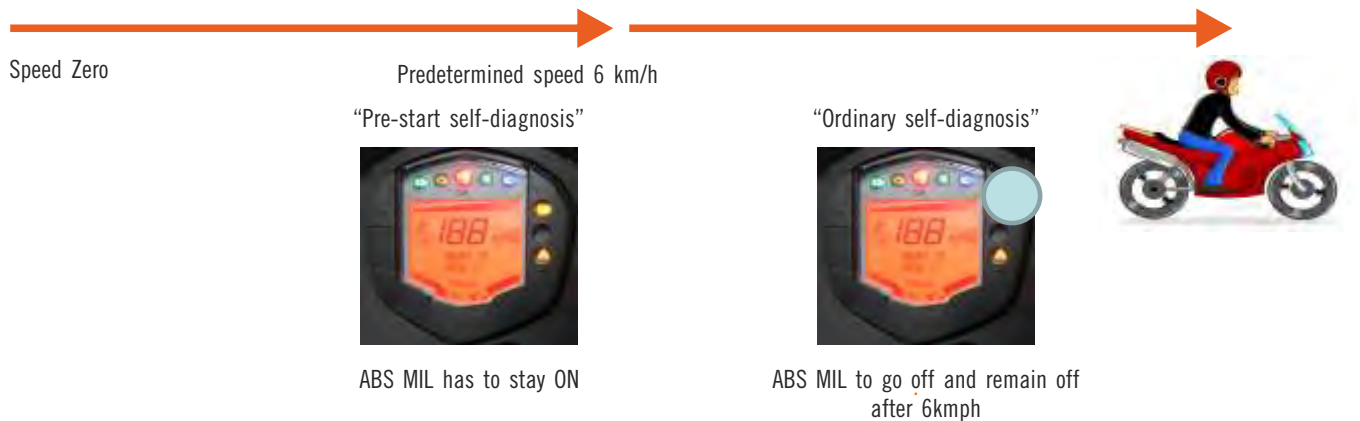
# Anti Lock Braking System

**Location of Parts**



Data Link Coupler

ABS fuse box

Fr. Brake lever

ABS MIL

ABS deactivation button

ABS Modulator and ECU

Rear Brake lever

Rr.Wheel Speed Sensor

Rr.Pulsar Ring

Fr. Wheel Speed Sensor

Fr.Pulsar Ring



Fr. Brake lever

Data Link Coupler

ABS fuse box

ABS Modulator and ECU

Rear Brake lever

Rr.Wheel Speed Sensor

Rr.Pulsar Ring

Fr. Wheel Speed Sensor

Fr.Pulsar Ring

# Anti Lock Braking System

## ABS - Self Diagnosis Function

ABS ECU has a self-diagnosis function that determines if the entire system is operating normally. If failure is detected from sensor inputs or at any electronic circuits, ABS indicator lamp illuminates or blinks to inform the rider of the failure.

Speed Zero

Predetermined speed 6 km/h

"Pre-start self-diagnosis"

"Ordinary self-diagnosis"



ABS MIL has to stay ON

ABS MIL to go off and remain off after 6kmph

## ABS Deactivation

- ABS always remains ON by default whenever Ignition switch is ON.
- ABS can be deactivated by following steps
    1. Turn Ignition switch ON
    2. ABS MIL remains ON
    3. Press the button below the SET button and hold it for more than 5 seconds.
    4. ABS MIL starts blinking
    5. Now the ABS is deactivated.



- **To again activate ABS, switch OFF & switch ON ignition switch.**
- When ABS is malfunctioning /not working ,there is no effect on the normal braking. They absolutely work fine.
- When the ABS operates, the ABS makes noise and the rider feels the reaction force on the brake lever and brake pedal. This is a normal condition. It informs the rider that the ABS is operating normally.
- Use of non-recommended tires may cause malfunctioning of ABS and can lead to extended braking distance resulting in an accident. Always use recommended standard tires for this motorcycle.

# Anti Lock Braking System

## Function of Parts

### ABS ECU (1):
- The ABS ECU will receive pulse signal from wheel speed sensor & actuates motor and pump to make – Brake pad contacts at disc at high frequency.

### ABS Modulator (2) :
- ABS modulator is located between the master cylinder and the caliper. The signal from the ECU opens or closes the solenoid valve inside modulator, switching the Brake fluid passage and controlling the fluid pressure to the caliper.

### Solenoid Valve (Inlet) :
- Solenoid valve(inlet) is normally open type by letting the Brake fluid flow to Brake caliper by spring force. However, if there is an electric current from ABS ECU, there will be induction, which cause the valve to close.

### Solenoid Valve (Outlet) :
- Solenoid valve (outlet) is normally closed type by blocking the Brake fluid from Brake fluid reservoir to Brake caliper by spring force. However, if there is an electric current from ABS ECU, there will be induction, which cause the valve to open.

### Brake Fluid Reservoir :
- Brake fluid will be forced to the Brake fluid back reservoir to reduce pressure in Brake system.

### ABS Warning (MIL) Lamp (1):
- Ignition switch is turned ON, warning lamp will stay on, until vehicle speed is more that 6 km/h, thereafter it goes off. If there is any problem in system, ABS warning lamp will stay ON during run)

### ABS Deactivation Button (2) :
- Pressing it for more than 3 seconds deactivates ABS system and ABS warning indicator lamp starts blink.

### Wheel Speed Sensors :
- These are HALL effect type speed sensors .Both are identical to each other. They sense the pulses from the pulsar rings mounted on the wheels and convey it to ECU.
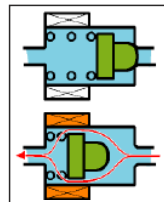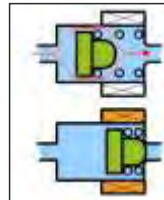
# Anti Lock Braking System

## Service Precautions

Precautions while diagnosis of ABS malfunction :

• Ensure the battery voltage in standard  limit (  >=12.6 Volts).

• Never jump start the vehicle with high capacity  battery. (> 8Ah)

• Always check connection/ connectors for  dust accumulation and loose  connection.

• Always use multimeter & circuit diagram  to inspect particular circuit.

• Never apply excessive force on connector at the time of removal/installation especially at the ABS ECU wiring harness coupler or it may damage it.

• **ABS ECU coupler removal and assembly care.**

Press Lock  Inside – Before Removing Coupler          Pull Lock Backwards to Disconnect

## SOP - D&F (BOSCH) Tool

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|

1. Connect : D& F tool
2. Do not press ENTER key

Ign. and kill switch ON

Press Enter

Select Vehicle Diagnostics

Select Vehicle Manufacture year.

| 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|

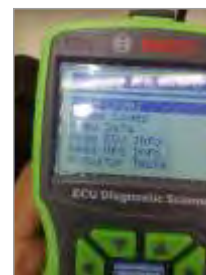Select Brand          Select Model          Select ABS          Press Enter          Select Read code & enter

1. Erase codes use for History clear.

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# Anti Lock Braking System

**DTC Table**

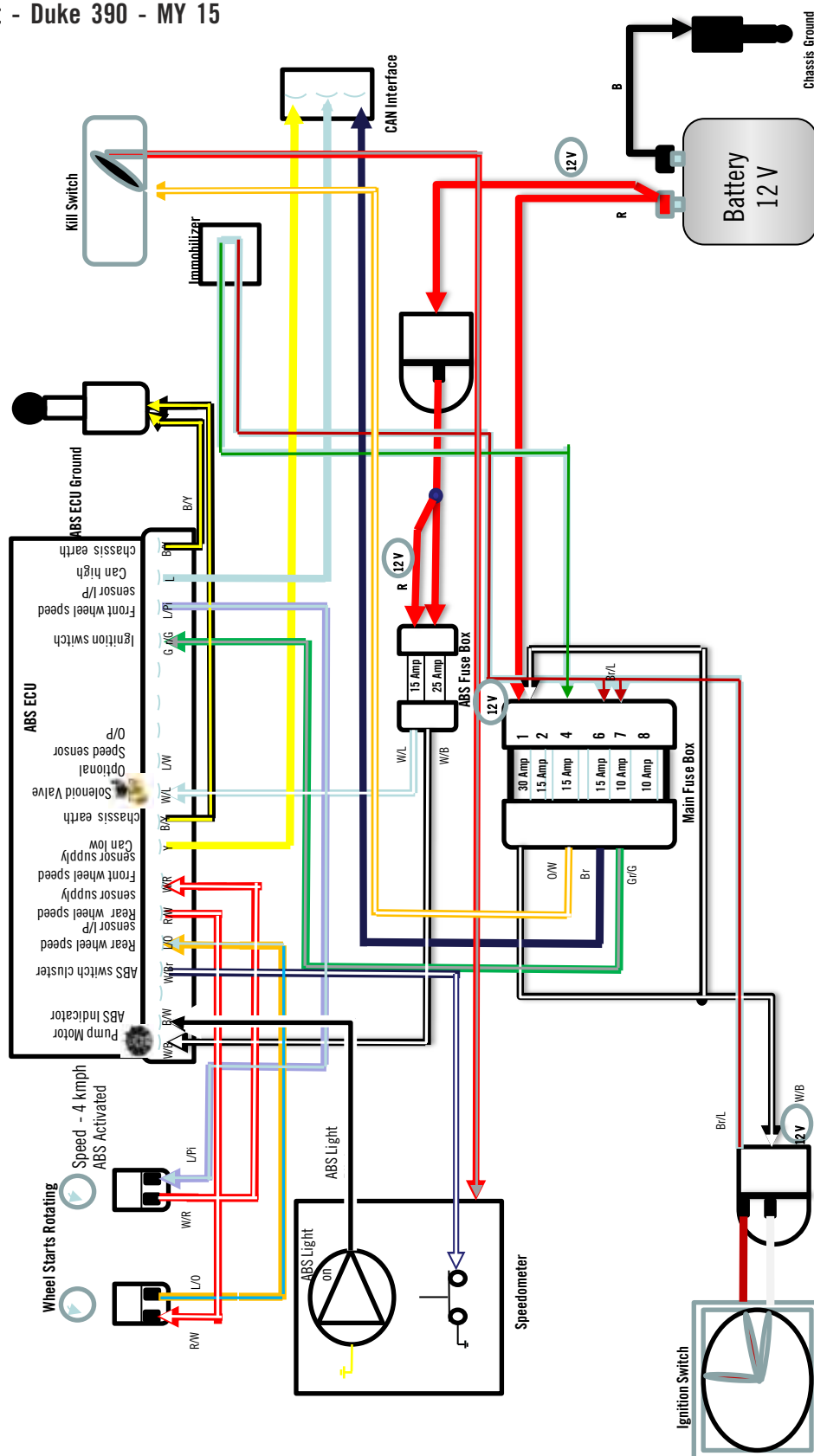| DTC (Hex) | Fault path |
|-----------|------------|
| - | Normal (No fault memory) |
| 5033 H | Front wheel speed sensor Disconnection/gnd Short |
| 5034 H | Front wheel speed sensor malfunction – Plausibility |
| 5031 H | Rear wheel speed sensor Disconnection/gnd Short |
| 5032 H | Rear wheel speed sensor malfunction – Plausibility |
| 5024 H | Deviation between Wheel speeds (WSS_GENERIC) |
| 5054 H | Front Inlet Valve malfunction (EV) |
| 5049 H | Front Outlet Valve malfunction (AV) |
| 5052 H | Rear Inlet Valve malfunction (EV) |
| 5048 H | Rear Outlet Valve malfunction (AV) |
| 5015 H | Pump Motor Malfunction |
| 5014 H | Valve Relay malfunction (Failsafe relay) |
| 5021 H | ECU malfunction |
| 5331 H | Front Wheel Pressure Sensor HW Failure* |
| 5332 H | Front Wheel Pressure Sensor Offset Failure* |
| 5333 H | External Power Supply for Pressure Sensor Failure* |
| 5058 H | Power Supply Malfunction (Low Voltage) |
| 5059 H | Power Supply Malfunction (High Voltage) |
| E921 H | CAN Generic |
| E922 H | CAN Bus OFF |
| E923 H | ABS MTC Control Info ( ID 125 ) Timeout / Data Corrupt |

# Anti Lock Braking System - Fault Tree

**Fault tree for ABS not working**

↓

Collect information from rider

↓

Check
1. Brake fluid level in reservoir
2. Fluid leakage
3. Brake lever/pedal working
4. Brake disc/pulse ring
5. Wheels rotation
6. Check for kick back effect
7. Tyre Size changed

↓

Check for ABS working

ABS MIL glows after Ign. switch ON

ABS MIL does not glows after Ign. switch ON

**ABS MIL glows after Ign. switch ON branch:**

↓

Test drive above 10 km/hr

↓

IF MIL stay on          IF MIL goes off

↓                        ↓

Check DTC in D& F tool   ABS is normal

↓

Rectify if any

↓

Test drive and reconfirm → Delete history in D&F tool

**ABS MIL does not glows after Ign. switch ON branch:**

↓

Check the power source wiring and meter unit)

↓

Rectify if any

↓

Test drive and reconfirm

# Anti Lock Braking System - Electrical Circuits

**Electrical Circuit - Duke 390 - MY 15**

# Anti Lock Braking System

**Electrical Circuit - Duke 390 - MY 14**
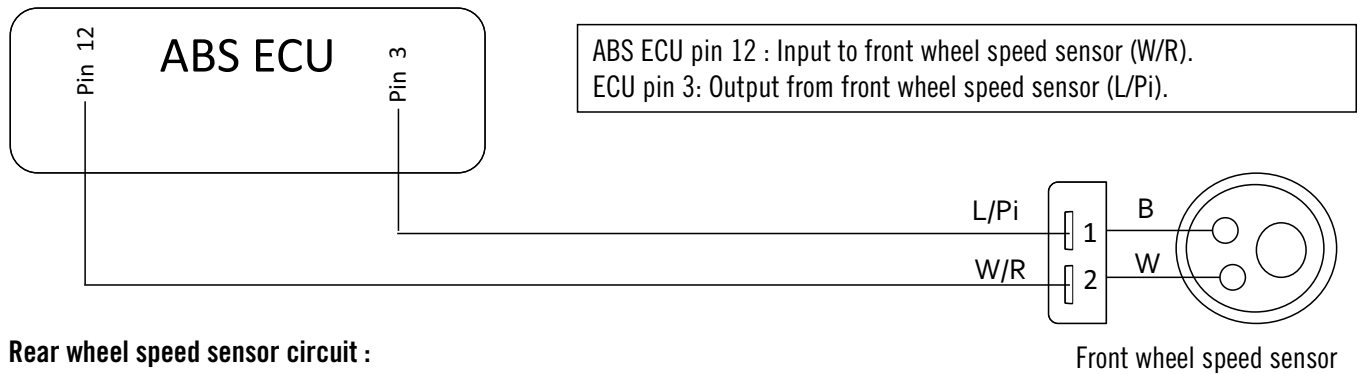


ABS WIRING DIAGRAM KTM 390 DUKE
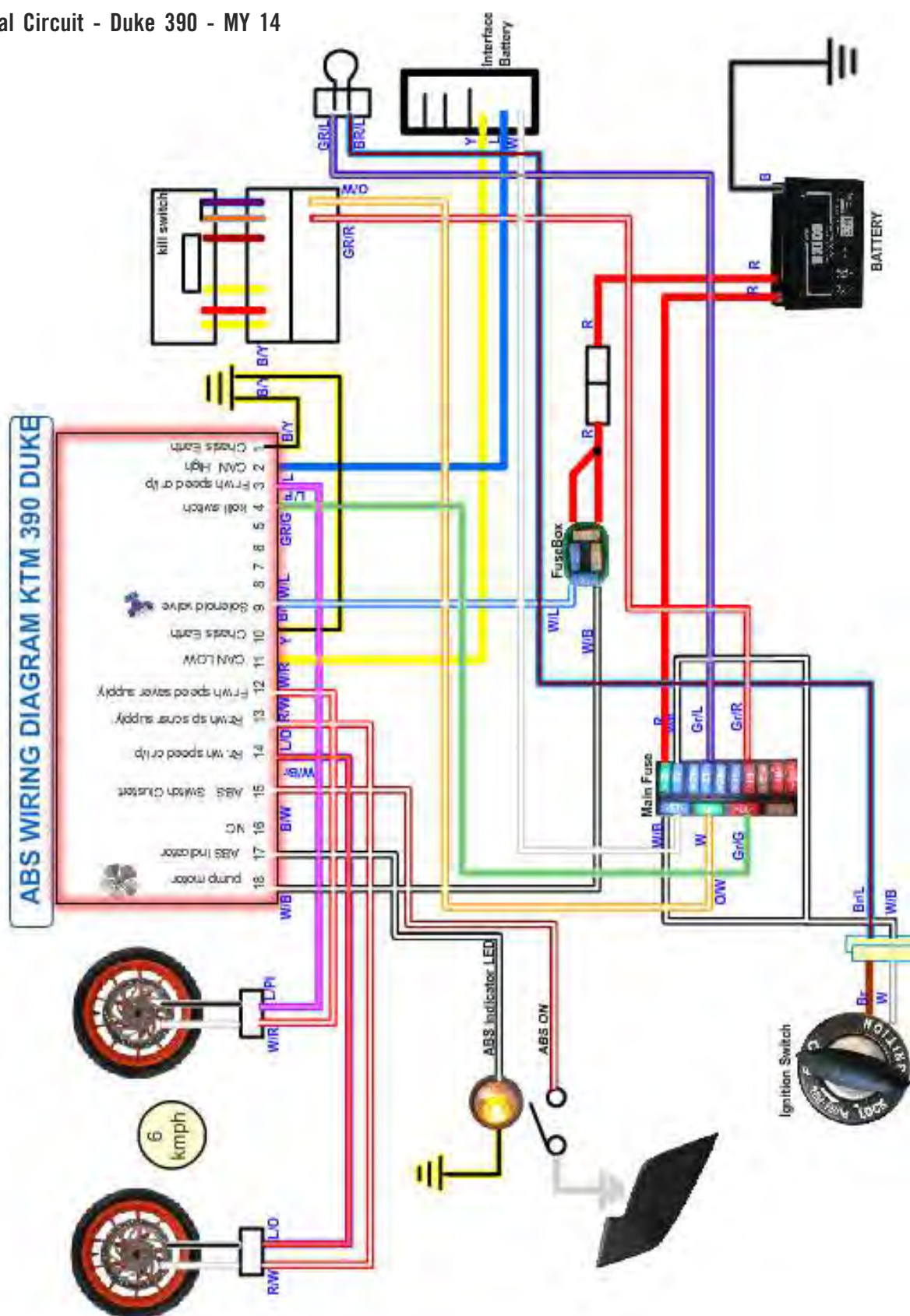
# Anti Lock Braking System - Part Inspection Parameter
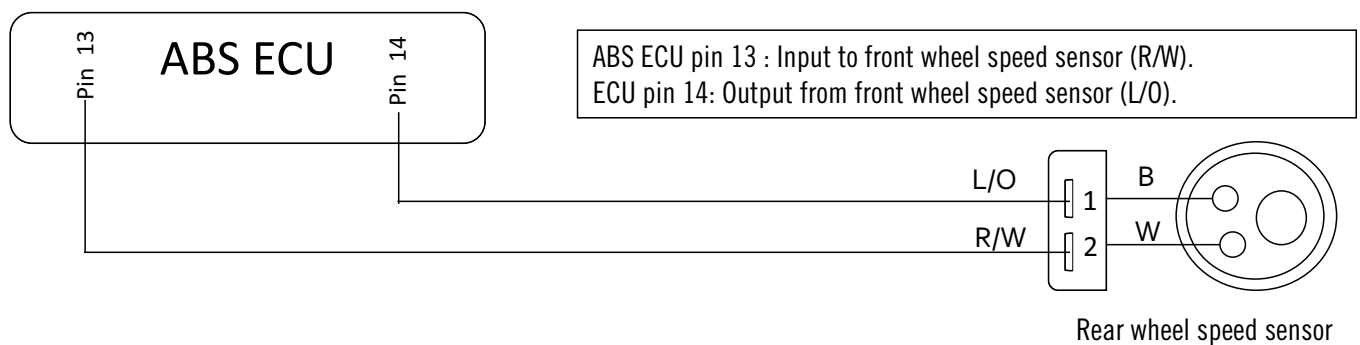
**Front and rear wheel speed sensor inspection :**

Working :

Wheel speed sensor, sense the pulses from the pulsar rings mounted on the wheels and convey it to ABS ECU.
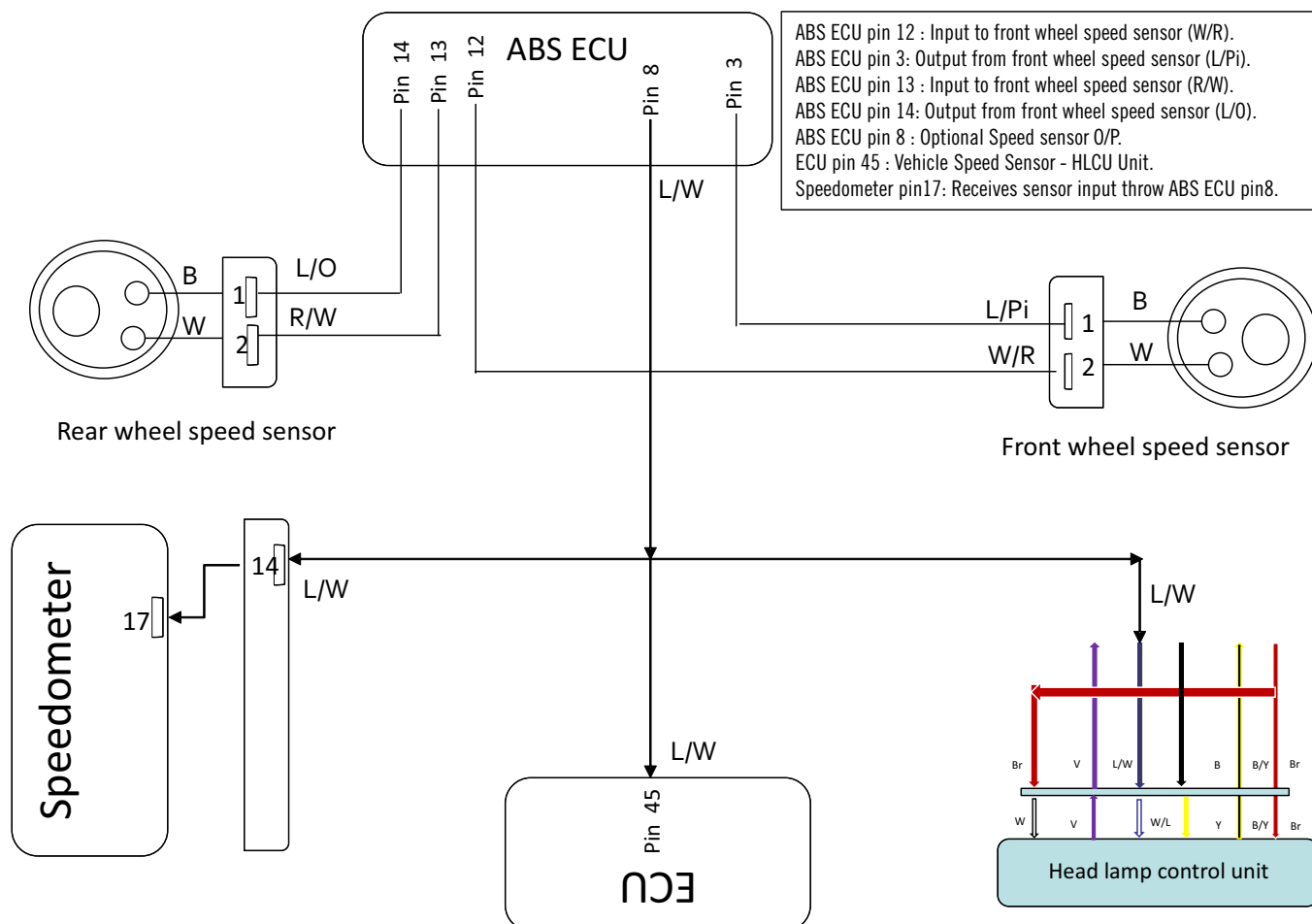
**Front wheel speed sensor circuit :**

ABS ECU

Pin 12

Pin 3

ABS ECU pin 12 : Input to front wheel speed sensor (W/R).
ECU pin 3: Output from front wheel speed sensor (L/Pi).

L/Pi

W/R

1

2

B

W

Front wheel speed sensor

**Rear wheel speed sensor circuit :**

ABS ECU

Pin 13

Pin 14

ABS ECU pin 13 : Input to front wheel speed sensor (R/W).
ECU pin 14: Output from front wheel speed sensor (L/O).

L/O

R/W

1

2

B

W

Rear wheel speed sensor

**Check with multi-meter :**

- Input voltage : 10 V ~ 12 V
- Output voltage

# Anti Lock Braking System - Part Inspection Parameter

**Parts Inspection Parameter**

ABS ECU pin 12 : Input to front wheel speed sensor (W/R).
ABS ECU pin 3: Output from front wheel speed sensor (L/Pi).
ABS ECU pin 13 : Input to front wheel speed sensor (R/W).
ABS ECU pin 14: Output from front wheel speed sensor (L/O).
ABS ECU pin 8 : Optional Speed sensor O/P.
ECU pin 45 : Vehicle Speed Sensor - HLCU Unit.
Speedometer pin17: Receives sensor input throw ABS ECU pin8.

ABS ECU

Pin 14  Pin 13  Pin 12  Pin 8  Pin 3

L/W

Rear wheel speed sensor

B  1  L/O
W  2  R/W

Front wheel speed sensor

L/Pi  1  B
W/R  2  W

Speedometer

14  L/W
17

L/W

ECU

Pin 45

L/W

L/W

Head lamp control unit

Br  V  L/W  B  B/Y  Br
W  V  W/L  Y  B/Y  Br

# Anti Lock Braking System - Part Inspection Parameter

| Part name | Function | Inspection-values | Method | Special tool |
|---|---|---|---|---|
| **MILlight**<br> | Indicate to<br>ABS system is working | When ignition switch is turned ON,<br>the ABS warning lamp will stay on,<br>until front and rear wheel speed<br>is more that 6 km/h, thereafter<br>it goes off. | :<br>Check<br>1. ABS ECU pin 17<br>(B/W wire) : 12V<br>when ign. and<br>kill switch ON. | Multi-meter |
| **Wheel speed sensor**<br> | Wheel speed sensor, sense<br>the pulses from the<br>pulsar rings mounted on the<br>wheels and convey it to ECU. | 1. Physical damages.<br>2. Wiring cut.<br>3. Gap between sensor and<br>pulsar ring. | Check 48 Pulses in<br>sensor checking tool. |  |
| **ABS ECU**<br> | Receives pulse signal from<br>wheel speed sensors &<br>actuates motor and pump<br>to make – Brake pad contacts<br>at disc at high frequency | 1. Coupler pin damage/bend.<br>2. Wiring cut. | Check DTC in<br>D&F tool | D&F tool |
| Pulsar rings<br> | Activation of<br>wheel speed sensor<br>as per wheel rotation. | 1. Physical damage (bend/crack) | Visual inspection :<br>Physical damage<br>and run out. | |
| ABS Warning (MIL)<br>Lamp(1)<br>& ABS deactivation<br>button (2)<br>1<br>2 | Mal function indicator lamp<br>to display ABS-mal function,<br>activation & deactivation. | 1. Coupler pin damage/bend.<br>2. Wiring cut.<br>3. Speedometer faulty | 1. Check DTC in<br>D&F tool and<br>check voltage<br>speedometer. | D&F tool and<br>multi-meter |
| | Deactivation of ABS system | 1. Physical working of deactivation<br>button (should blink after<br>deactivation button pressed<br>for 3 sec.<br>2. After Ign. Switch on MIL on. | 1. Check by pressing<br>button for blinking. | D&F tool |

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