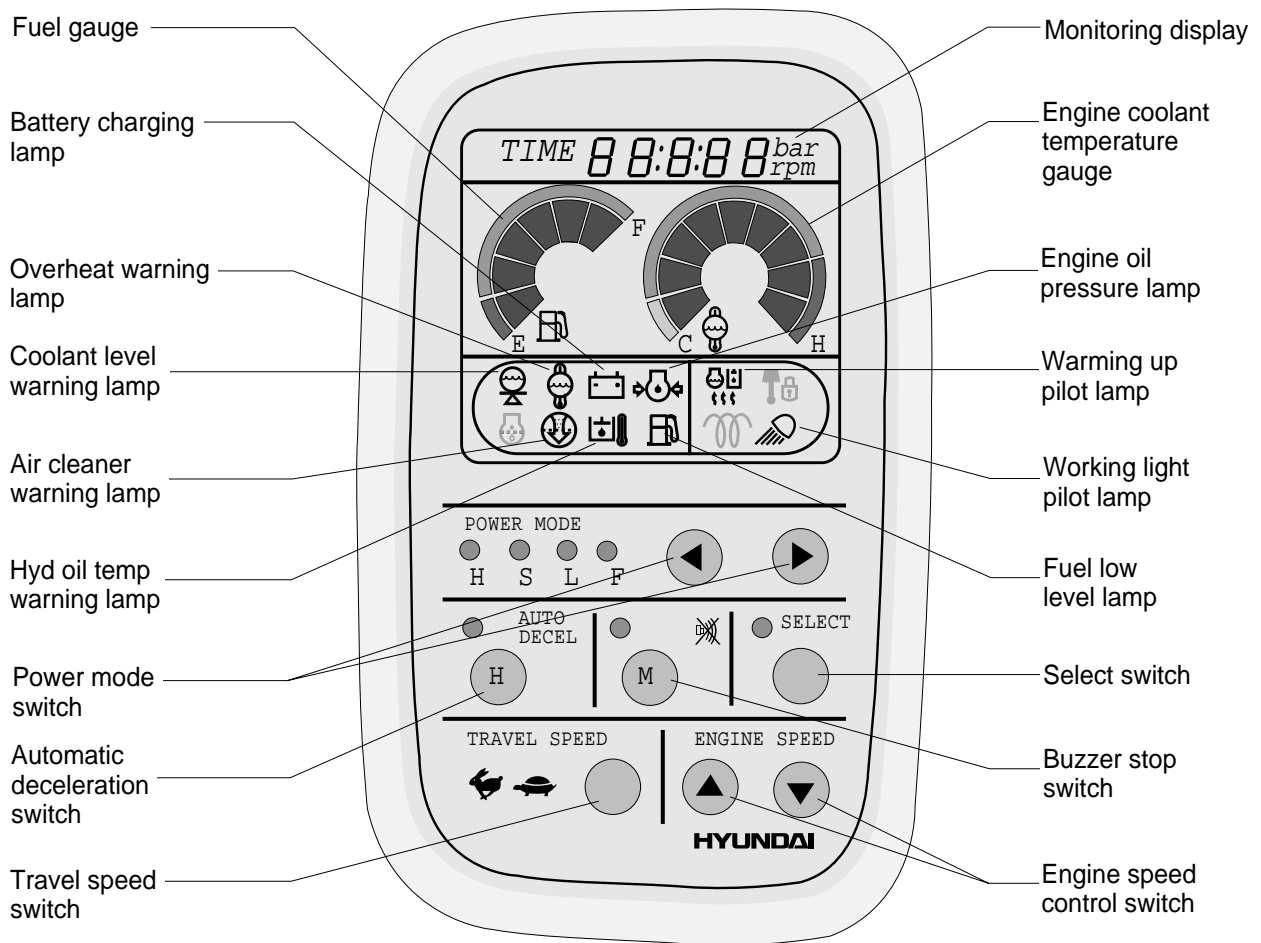## GROUP 14  MONITORING SYSTEM

### 1. OUTLINE

Monitoring system consists of the monitor part and switch part.

The monitor part gives warnings when any abnormality occurs in the machine and informs the condition of the machine.

Various select switches are built into the monitor panel, which act as the control portion of the machine control system.

### 2. CLUSTER

#### 1) MONITOR PANEL

Fuel gauge

Battery charging lamp

Overheat warning lamp

Coolant level warning lamp

Air cleaner warning lamp

Hyd oil temp warning lamp

Power mode switch

Automatic deceleration switch

Travel speed switch

Monitoring display

Engine coolant temperature gauge

Engine oil pressure lamp

Warming up pilot lamp

Working light pilot lamp

Fuel low level lamp

Select switch

Buzzer stop switch

Engine speed control switch

TIME 88:88 bar rpm

POWER MODE
H  S  L  F

AUTO DECEL

SELECT

TRAVEL SPEED     ENGINE SPEED

HYUNDAI

## 2) CLUSTER CHECK PROCEDURE

### (1) Start key : ON

① Check monitor initial 2 seconds

   a. All lamps light up.
   b. Buzzer sound.

② Check monitor after 2 seconds : Indicate cluster version and machine condition

   a. Cluster program version : CLS : 11  ◄— Indicates program version 1.1 for 2 seconds.
   b. Tachometer : 0rpm
   c. Fuel gauge : All light up below appropriate level
   d. Engine coolant temperature gauge : All light up below appropriate level
   e. Warning lamp
   ※ During start key **ON** the engine oil pressure lamp and battery charging lamp go on, but it is not abnormal.
   ※ When engine coolant temperature below 30℃, the warming up lamp lights up.

③ Switch portion

   a. Mode selection : S mode
   b. Auto decel LED : ON
   c. Travel speed switch : Low(Turtle)

### (2) Start of engine

① Check machine condition

   a. Tachometer indicate at present rpm
   b. Gauge and warning lamp : Indicate at present condition.
   ※ When normal condition : All warning lamp OFF
   c. Mode selection : S mode
   d. Auto decel : ON(About 950rpm)
   e. Travel speed : Low(Turtle)

② When warming up operation

   a. Warming up lamp : ON
   b. 10 seconds after engine started, engine speed increases to1200 rpm(Auto decel LED : ON)
      Others same as above ①.

③ When abnormal condition

   a. The lamp lights up and the buzzer sounds.
   b. If **BUZZER STOP** switch is pressed, buzzer sound is canceled but the lamp light up until normal condition.

## 3. CLUSTER CONNECTOR

### 1) CONNECTOR

| No. | Signal | Input / Output |
|-----|--------|----------------|
| 1 | Power IG(24V) | Input(20~32V) |
| 2 | GND | Input(0V) |
| 3 | Serial-(RX) | Input(Vpp=12V) |
| 4 | Serial+(TX) | Output(Vpp=4V) |

Cluster
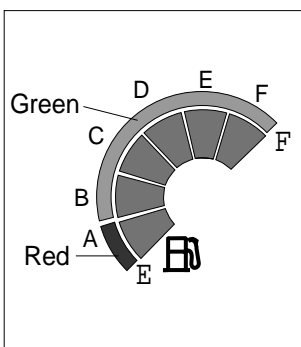
1  4
2  3

CN-56
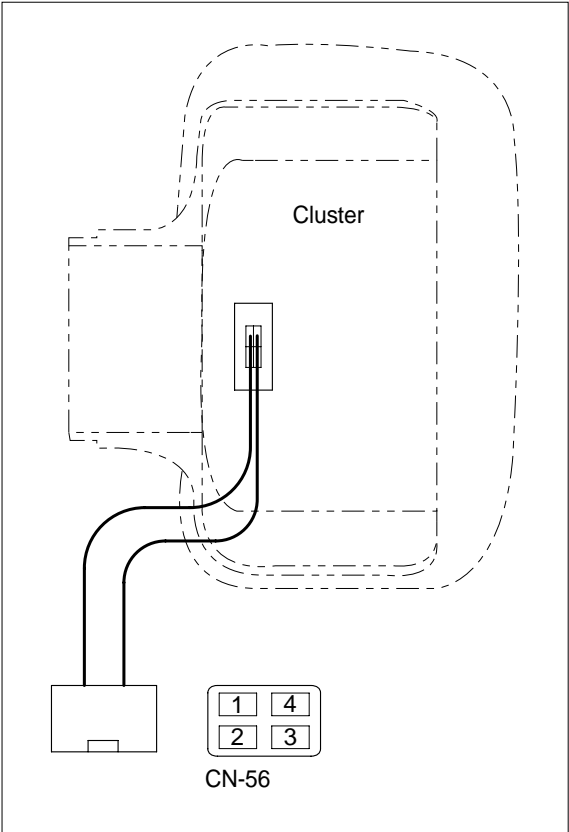
## 4. CLUSTER FUNCTION

### 1) TACHOMETER



① Tachometer displays the number of engine revolutions.
② Refer select switch for the selection and adjustment.

### 2) CLOCK



① Clock displays the current time by electric digital timer.
② Refer select switch for the selection and adjustment.

### 3) FUEL GAUGE



① This gauge indicates the amount of fuel in the fuel tank.
　· Warning lamp display : Approximately 40 $l$
　· Segment A : Approximately　72 $l$
　· Segment B : Approximately 107 $l$
　· Segment C : Approximately 143 $l$
　· Segment D : Approximately 178 $l$
　· Segment E : Approximately 213 $l$
　· Segment F : Approximately 250 $l$
　· Quantity of fuel tank : Approximately 250 $l$

### 4) ENGINE COOLANT TEMPERATURE GAUGE
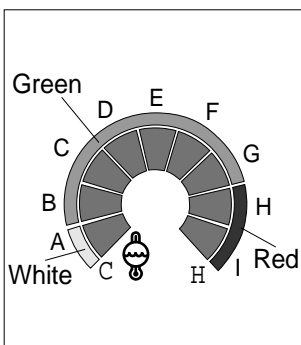


① This gauge indicates the temperature of coolant.
　· Segment A : Approximately　40~60℃(White)
　· Segment B : Approximately　60~70℃(Green)
　· Segment C : Approximately　70~85℃(Green)
　· Segment D : Approximately　85~98℃(Green)
　· Segment E : Approximately　98~101℃(Green)
　· Segment F : Approximately　101~103℃(Green)
　· Segment G : Approximately　103~105℃(Green)
　· Segment H : Approximately　105~110℃(Red)
　· Segment Ⅰ : Approximately　110℃ over(Red)

## 5) COOLANT LEVEL WARNING LAMP
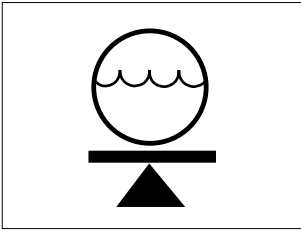
① This lamp is turned ON when the coolant is below LOW in the reservoir tank of radiator.

② Check if the coolant level is between FULL and LOW in the reservoir tank located at the side of radiator after opening the engine cover, and check if there is mixture of oil and coolant.

## 6) BATTERY CHARGING LAMP
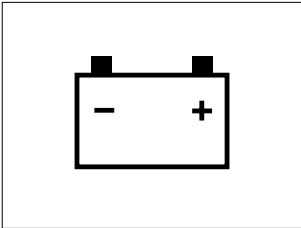
① Check if the charging lamp is OFF during engine operation. If the lamp is turned ON, it is not charged.

② This lamp is ON before starting the engine, but it is turned OFF after starting the engine. Check the battery charging circuit when this lamp comes ON while the engine runs.
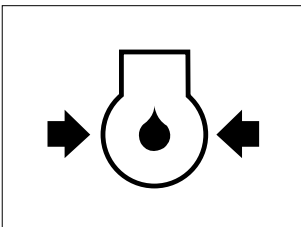
## 7) WORK LAMP INDICATOR LAMP
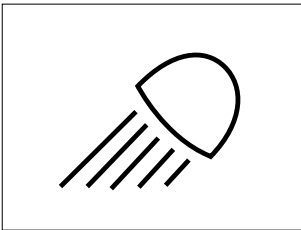
① When the work lamp switch is turned ON, the work lamp mounted on boom and the work lamp indicator lamp light ON.

## 8) HYDRAULIC OIL OVERHEAT WARNING LAMP
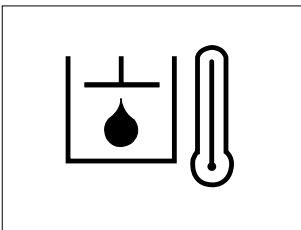
① This warning lamp operates and the buzzer sounds when the temperature of hydraulic oil is over 100℃(216℉).

② Check the coolant when the lamp is turned ON.

## 9) ENGINE OIL PRESSURE WARNING LAMP

① This lamp is turned ON before starting the engine but turned OFF after starting the engine as the pressure caused from the engine oil pump lubricates each part.
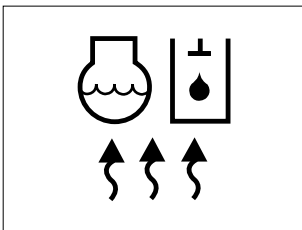
## 10) AIR CLEANER WARNING LAMP
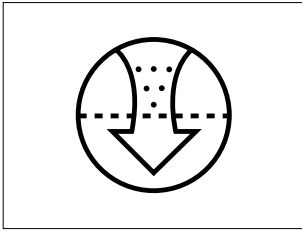
① This lamp is turned on when the filter in the air cleaner is clogged.
② Check the filter and wash or replace it when the lamp is ON.

## 11) OVERHEAT WARNING LAMP
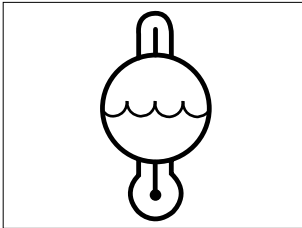
① This lamp is turned ON when the temperature of coolant is over the normal temperature(110℃) and lose the cooling function.
② Check the coolant when the lamp is ON.

## 12) WARMING UP LAMP

① This lamp is turned ON when the coolant temperature is below 30℃.
② The automatic warming up is canceled when the engine coolant temperature is above 30℃, or when 10 minutes have passed since starting.

## 13) MODE SELECTION SWITCH

POWER MODE
H  S  L  F
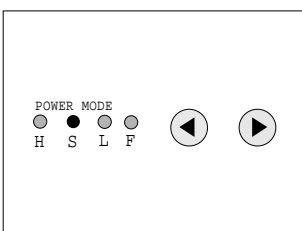
① The lamp of selected mode is turned ON by pressing the right switch( ◀ , ▶ ), when selecting the mode to use.
  · H : This is used for heavy-duty work.
  · S : This is used for ordinary work.
  · L : This is used for light-duty work.
  · F : This is used for light-duty work, especially for finishing work.
② At each pressing of the switch, a short term beep sounds.

## 14) AUTO DECELERATION SWITCH

AUTO
DECEL

H
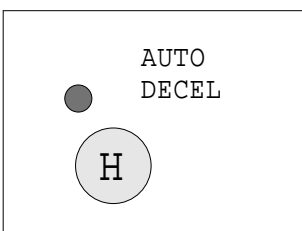
① This switch is used to select the auto-deceleration function.
② If the auto deceleration function is activated the engine speed is lowered when temporary stop or stand-by for dump is required.
③ At each pressing of the switch, a short term beep sounds.

## 15) ENGINE SPEED CONTROL SWITCH
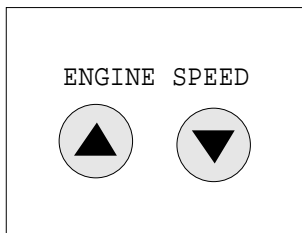
ENGINE SPEED

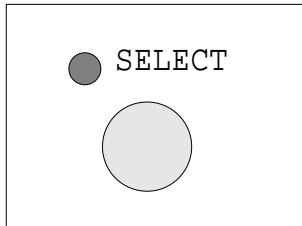① This switch is to control the engine speed, which is increased by pressing ▲ switch and decreased by pressing ▼ switch.

② At each pressing of the switches, a short term beep sounds.

## 16) SELECTION SWITCH(Tachometer and clock)

● SELECT

① This switch is used to select the tachometer or clock.

② The switch is pressed, each function is selected by turns.

③ The switch is pressed over 3 seconds, it is selected time adjusting function.

   ・Hour   : Auto decel switch

   ・Minute : Buzzer stop switch

④ After time set, if the switch is pressed, it is returned to clock.

⑤ If any pump pressure sensor is installed pump pressure display (P1, P2, P3) is also selected by this switch.

⑥ At each pressing of the switch, a short term beep sounds.

## 17) BUZZER STOP SWITCH

M
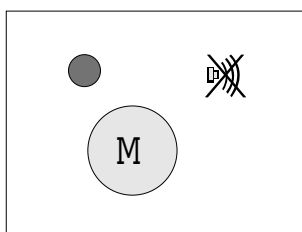
① The buzzer sounds is stopped by touching this buzzer stop switch.

② Buzzer sound comes out when cluster lights up a warning indicator lamp.

③ At each pressing of the switch, a short term beep sounds.

## 18) FUEL LOW LEVEL LAMP
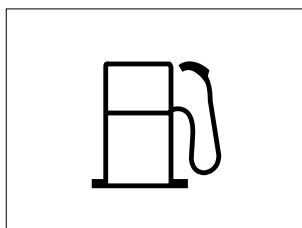
① This lamp lights on when fuel level is below 40 $l$ .
In that case, fill up fuel again.

## 19) TRAVEL SPEED SWITCH
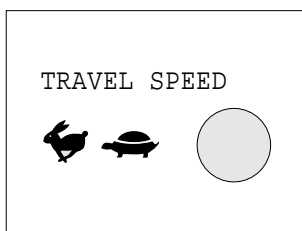
TRAVEL SPEED

① This switch controls the travel speed.

② When you press the switch once, travel speed is change over high speed( ), and press once more, travel speed is changed over low speed( ).

③ At each pressing of the switch, a short term beep sounds.

## 5.MONITORING DISPLAY

### 1) OUTLINE

Information of machine performance as monitored by the CPU controller can be displayed on the cluster when the operator selects a display mode by touching **SELECT** switch alone or with **BUZZER STOP** switch on the cluster as below.

| Display group | How to select display mode | | Name | Display on the cluster |
|---|---|---|---|---|
| | Group selection | Display mode selection | | |
| **Group 0** (Default) | Way 1 Key switch **ON** or **START** Way 2 Touch **AUTO DECEL** switch while pressing **BUZZER STOP** at group 1~4. | Initial | Engine rpm | $950_{rpm}$ |
| | | Touch **SELECT** 1 time | Time | TIME 12:30 |
| | | Touch **SELECT** 2 times | Option (Only when a pressure sensor is installed) | Front pump pressure | $P1:100^{bar}$ |
| | | Touch **SELECT** 3 times | | Rear pump pressure | $P2:200^{bar}$ |
| | | Touch **SELECT** 4 times | | Pilot pressure | $P3:30^{bar}$ |
| **Group 1** (Volt, temp, EPPR press, version) | Touch **SELECT** switch **once** while pressing BUZZER STOP. In this group **SELECT** LED **ON** | Default | Battery voltage(V) | b24:8 |
| | | Touch **SELECT** 1 time | Potentiometer voltage(V) | Po:2:5 |
| | | Touch **SELECT** 2 times | Hydraulic oil temperature(℃) | Hd:50 |
| | | Touch **SELECT** 3 times | Power shift pressure (EPPR valve) | $EPr:10^{bar}$ |
| | | Touch **SELECT** 4 times | Model & Version | 16C:10 |
| **Group 2** (Error code) | Touch **SELECT** switch **twice** while pressing BUZZER STOP. In this group **BUZZER STOP** LED blinks | Default | Current error | Err:03 |
| | | Touch **SELECT** 1 time | Recorded error (Only key switch ON) | TIME Err:03 |
| | | Press speed up(▲) & speed down(▼) at the same time | Recorded error deletion (Only key switch ON) | TIME Err:00 |
| **Group 3** (Switch input) | Touch **SELECT** switch **3 times** while pressing BUZZER STOP. In this group **SELECT** LED blinks at 0.5sec intervals | Default | Pump prolix switch | PP:on or oFF |
| | | Touch **SELECT** 1 time | Auto decel pressure switch | dP:on or oFF |
| | | Touch **SELECT** 2 times | Power boost switch | Pb:on or oFF |
| | | Touch **SELECT** 3 times | Travel oil pressure switch | oP:on or oFF |
| **Group 4** (Output) | Touch **SELECT** switch **4 times** while pressing BUZZER STOP. In this group **SELECT** LED blinks at 1sec intervals | Default | Hourmeter | Ho:on or oFF |
| | | Touch **SELECT** 1 time | Neutral relay (Anti-restart relay) | nr:on or oFF |
| | | Touch **SELECT** 2 times | Travel solenoid | SS:on or oFF |
| | | Touch **SELECT** 3 times | Power boost solenoid (2-stage relief solenoid) | PS:on or oFF |

※By touching **SELECT** switch once while pressing **BUZZER STOP**, display group shifts.
Example : Group 0 → 1 → 2 → 3 → 4 → 0

## 2) DESCRIPTION OF MONITORING DISPLAY

| Group | Display | Name | Description |
|---|---|---|---|
| **Group 0** | **2450 rpm** | Engine speed | It displays current engine speed detected by engine speed sensor from 500 to 3000rpm.<br>Range : 500~3000rpm by 10rpm |
| | **TIME 12 : 30** | Time | It displays current time(12 is hour and 30 is minute)<br>Range : Hour(1~12), minute(00~59) |
| | **P1 : 100bar**<br>(Option) | Front pump pressure | It displays front pump pressure of 100bar which is detected by pressure sensor.<br>Range : 000~ 500bar by 10bar |
| | **P2 : 200bar**<br>(Option) | Rear pump pressure | It displays rear pump pressure of 200bar which is detected by pressure sensor.<br>Range : 000~ 500bar by 10bar |
| | **P3 : 30bar**<br>(Option) | Pilot pump pressure | It displays pilot pump pressure of 30bar which is detected by pressure sensor.<br>Range : 00~50bar by 1bar |
| **Group 1** | **b24 : 8** | Battery voltage | It shows that battery power of 24.8V is supplied into CPU controller.<br>Range : 00.0~48.0V by 0.1V |
| | **Po : 2 : 5** | Potentiometer voltage | It shows that potentiometer signal voltage is 2.5V.<br>Range : 0.0~5.0V by 0.1V |
| | **Hd : 50** | Hydraulic oil temperature | It shows that hydraulic oil temperature detected by temperature sensor is 50℃.<br>Range : Lo(Below 20℃) ; 30~90℃ by 10℃, Hi(Above 100℃). |
| | **EPr : 10bar** | Power shift pressure of EPPR valve | It shows that pump power shift pressure of EPPR valve being controlled by the CPU controller is 10bar.<br>Range : 00~50bar by 1bar |
| | **16C : 10** | Model and CPU program version | It shows that machine model(R160LC-3) and the program version of the CPU controller is 1.0.<br>Version display range : 0.0~9.9 by 0.1 |
| **Group 2** | **Err : 03** | Current error | It shows that current error of 03(Short circuit in pump EPPR valve 2 lines) is diagnosed by self diagnosis system in the CPU controller.<br>If more than 2 errors, each error code is displayed for 2 seconds and changes to other error codes continuously.<br>Range : 00~47 |
| | **TIME Err : 03** | Recorded error | It shows recorded error code of 03 which is diagnosed before.<br>If more than 2 error codes, each error code is displayed for 2 seconds and changes to other error codes continuously.<br>Range : 00~47 |
| | **TIME Err : 00** | Recorded error deletion | It shows all recorded error codes are removed in the CPU controller memory. |

| Group | Display | Name | Description |
|---|---|---|---|
| **Group 3** | **PP : on** or **oFF** | Pump prolix switch | **PP : on** Shows that pump prolix switch is turned on(At emergency position). <br> **PP : oFF** Shows that pump prolix switch is turned off(At normal position). |
| | **dP : on** or **oFF** | Auto decel pressure switch | **dP : on** Shows that auto decel pressure switch is pressed on (Operation of control lever). <br> **dP : oFF** Shows that auto decel pressure switch is released off (No operation of control lever). |
| | **Pb : on** or **oFF** | Power boost switch | **Pb : on** Shows that power boost switch is pressed on (Activated). <br> **Pb : oFF** Shows that power boost switch is released off (Canceled). |
| | **oP : on** or **oFF** | Travel oil pressure switch | **oP : on** Shows that travel oil pressure switch is pressed on (Operation of travel control lever) <br> **oP : oFF** Shows that travel oil pressure switch is released off (No operation of travel control lever) |
| **Group 4** | **Ho : on** or **oFF** | Hourmeter | **Ho : on** Shows that hourmeter is activated by CPU controller. <br> **Ho : oFF** Shows that hourmeter is turned off. |
| | **nr : on** or **oFF** | Neutral relay (Anti-restart relay) | **nr : on** Shows that neutral relay for anti-restarting function is activated(Engine start is possible). <br> **nr : oFF** Shows that neutral relay is turned off to disable the engine restart. |
| | **SS : on** or **oFF** | Travel speed solenoid | **SS : on** Shows that travel speed solenoid is activated(Hi travel speed). <br> **SS : oFF** Shows that travel speed solenoid is turned off(Lo travel speed). |
| | **PS : on** or **oFF** | Power boost solenoid | **PS : on** Shows that power boost solenoid is activated to maximize the power(Power up). <br> **PS : oFF** Shows that power boost solenoid is turned off(Cancel the power boost function). |