

SECTION 5 MECHATRONICS SYSTEM

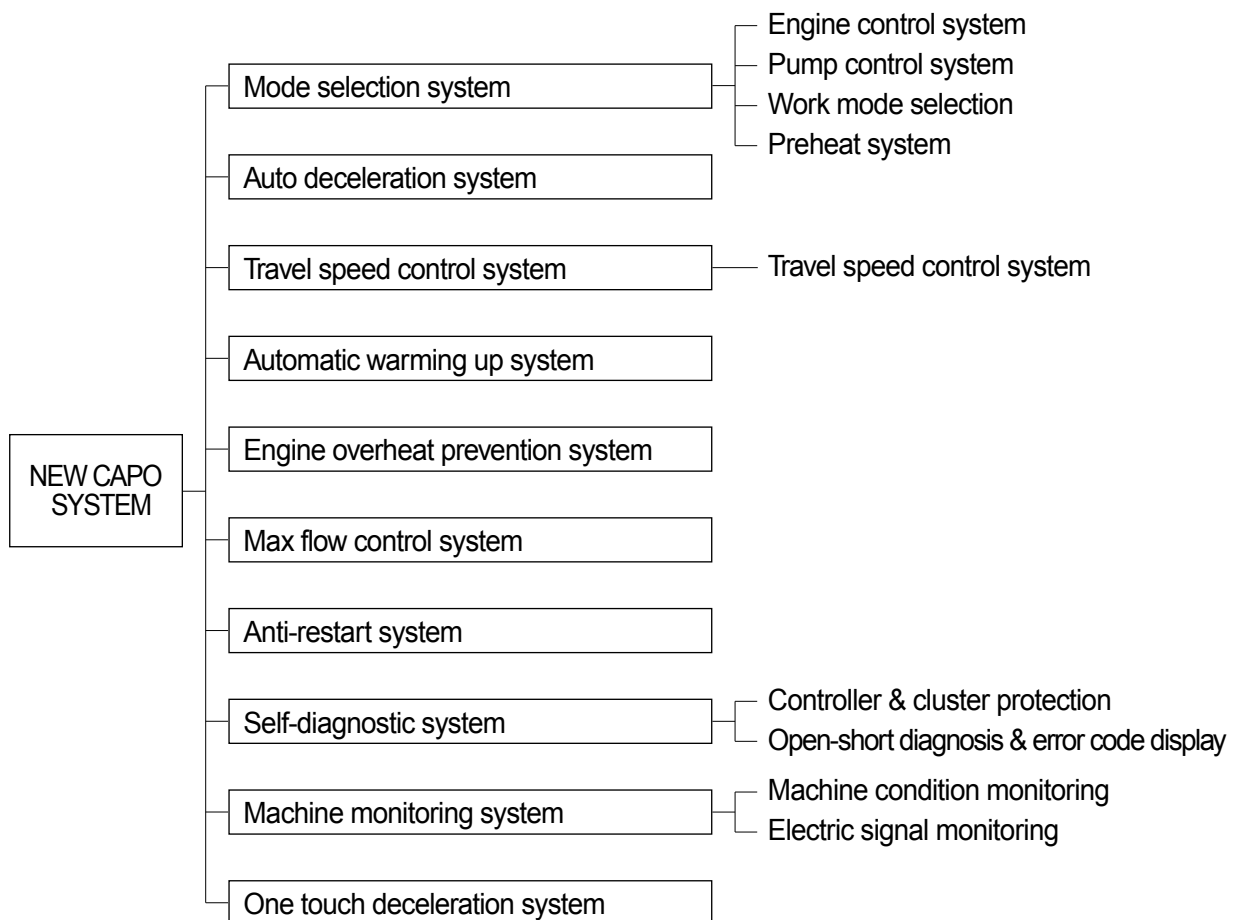
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SECTION 5 MECHATRONICS SYSTEM

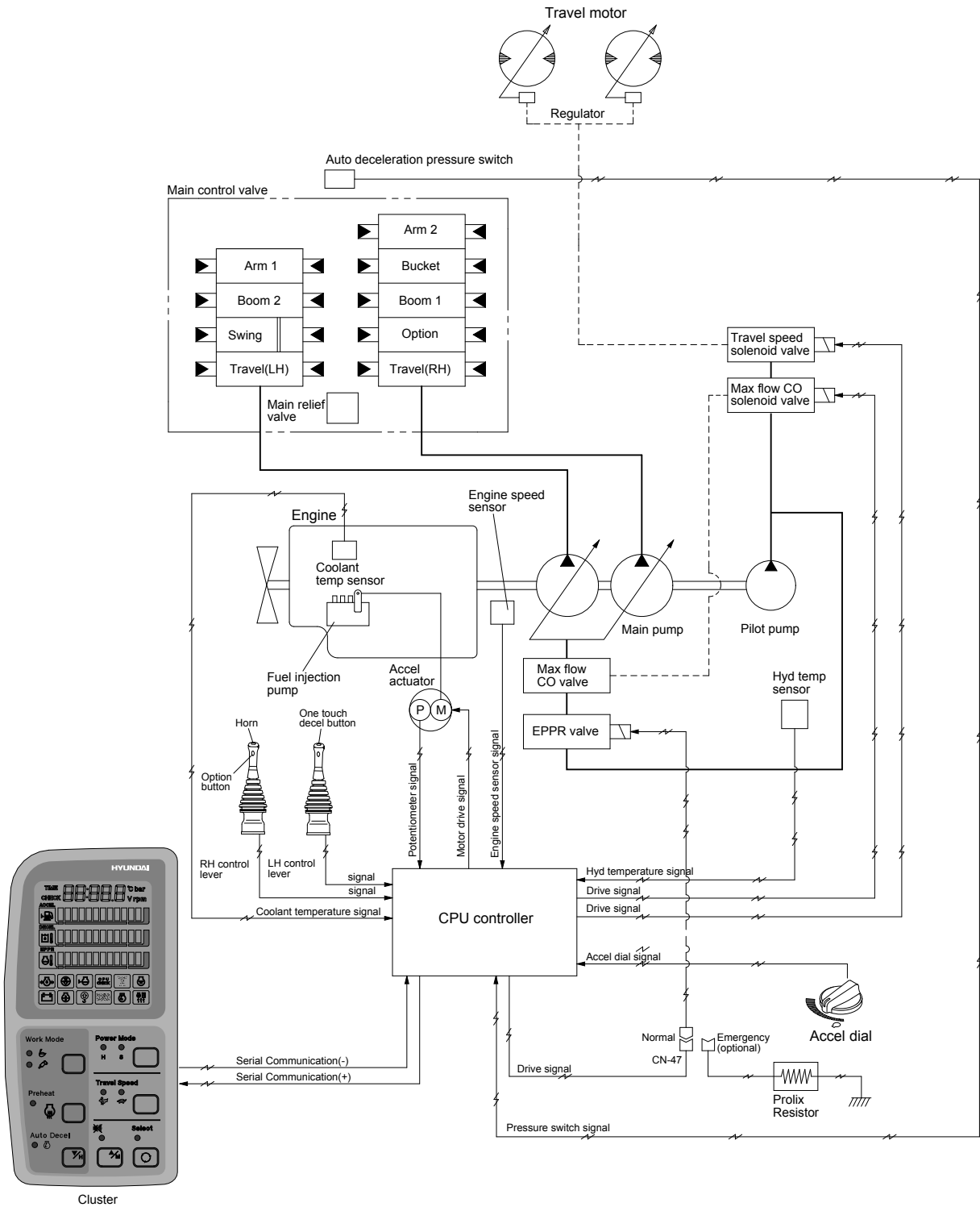
GROUP 1 OUTLINE

The NEW CAPO(Computer Aided Power Optimization) system controls engine and pump mutual power at an optimum and less fuel consuming state for the selected work by mode selection, auto-deceleration, power boost function, etc. It monitors machine conditions, for instance, engine speed, coolant temperature, hydraulic oil temperature, and hydraulic oil pressure, etc.

It consists for a CPU controller, a cluster, an accel actuator, an EPPR valve, and other components. The CPU controller and the cluster protect themselves from over-current and high voltage input, and diagnose malfunctions caused by short or open circuit in electric system, and display error codes on the cluster.



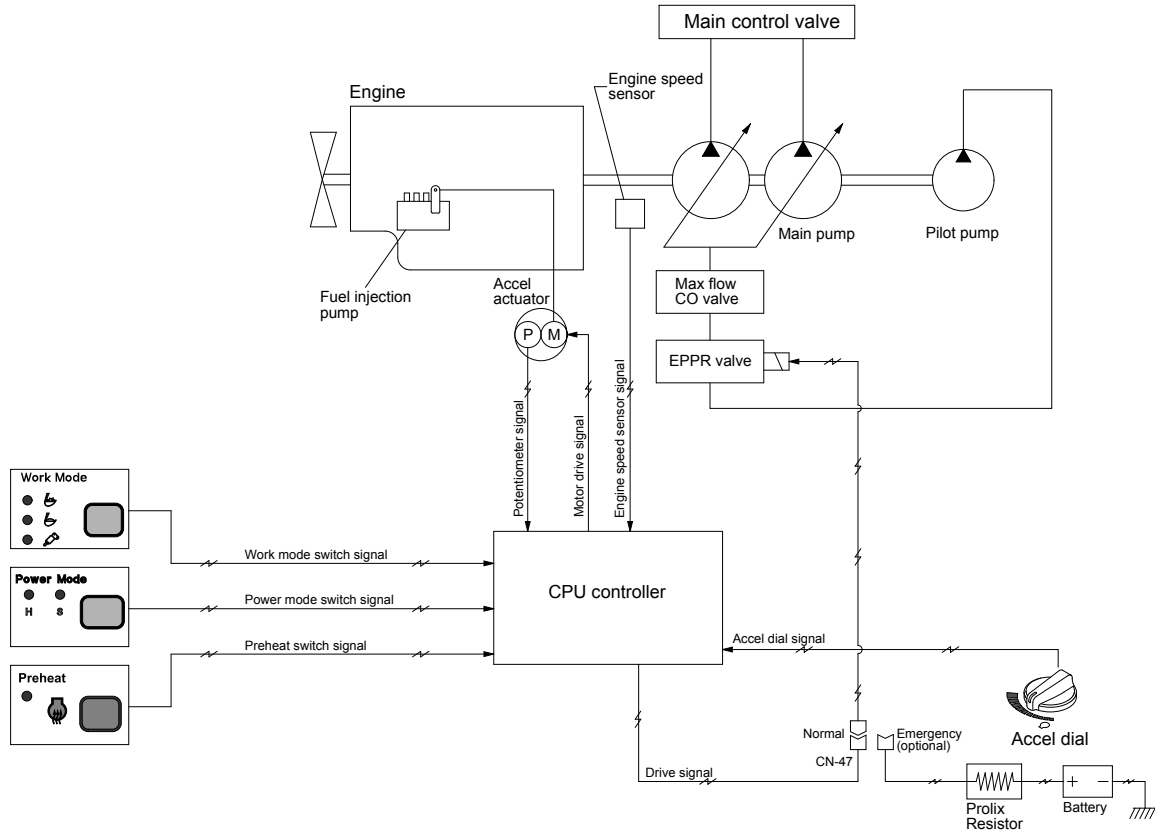
SYSTEM DIAGRAM



RD21075MS01A

GROUP 2 MODE SELECTION SYSTEM

1. POWER MODE SELECTION SYSTEM



RD21075MS02A

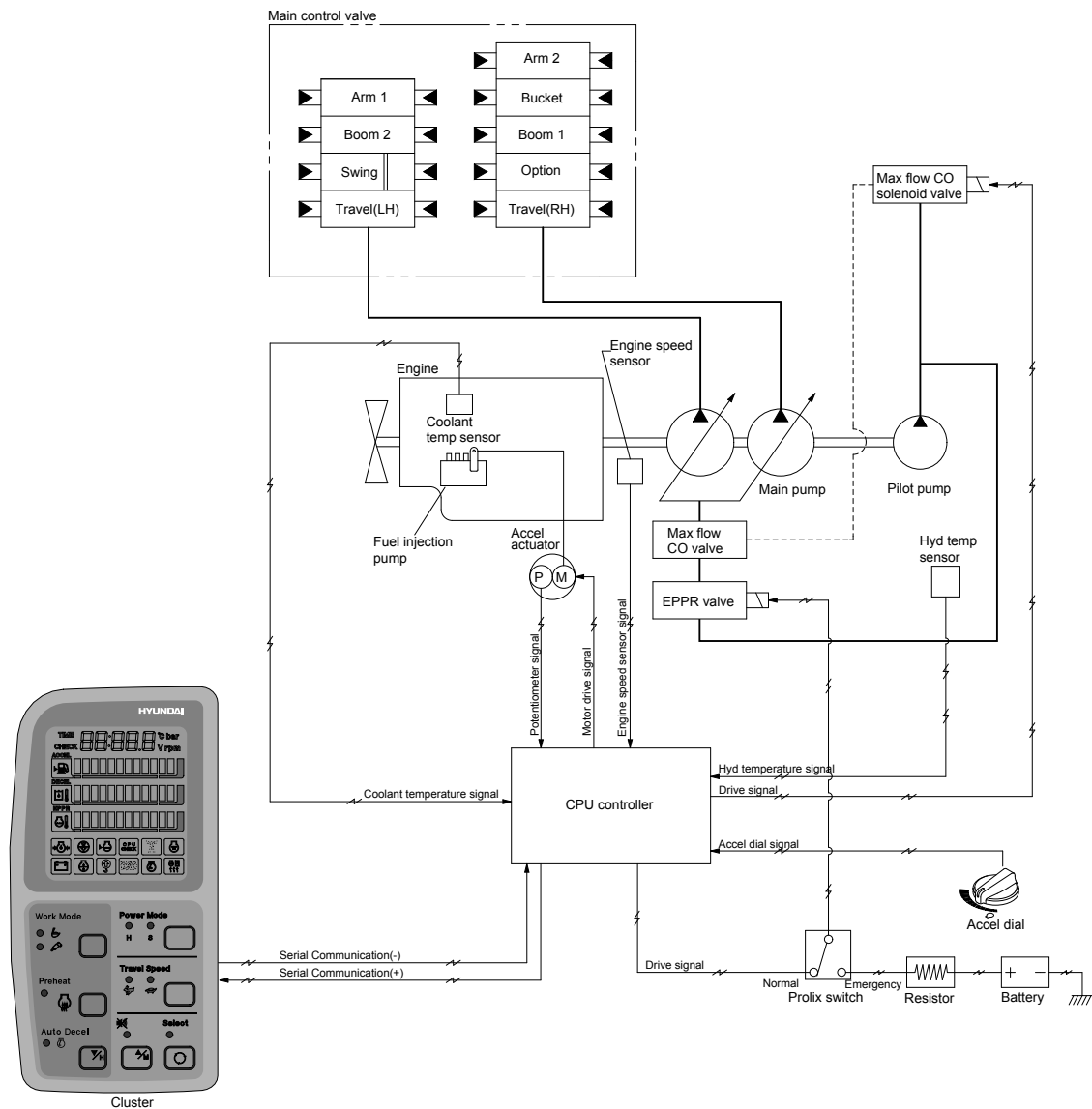
Mode selection system(Micro computer based electro-hydraulic pump and engine mutual control system) optimizes the engine and pump performance.

The combination of 2 power modes(H, S) and accel dial position(10 set) makes it possible to use the engine and pump power more effectively corresponding to the work conditions from a heavy and great power requesting work to a light and precise work.

| Mode | Application | Power set (%) | Engine rpm | | Power shift by EPPR valve | | | |
|-----------------|---------------------------|---------------|------------|------|---------------------------|---------------------------------|--------------|---------------------------------|
| | | | Unload | Load | Default | | Other case | |
| | | | | | Current (mA) | Pressure (kgf/cm ²) | Current (mA) | Pressure (kgf/cm ²) |
| H | High power | 100 | 2050 ± 50 | - | 250 ± 30 | 5 | 190 | 2.5 |
| S | Standard power | 85 | 1750 ± 50 | - | 330 ± 30 | 10 | 300 | 8 |
| AUTO DECEL | Engine deceleration | - | 1200 ± 100 | - | 670 ± 30 | 31 | 670 ± 30 | 31 |
| One touch decel | Engine quick deceleration | - | 1000 ± 100 | - | 700 ± 30 | 35 | 700 ± 30 | 35 |
| KEY START | Key switch start position | - | 1000 ± 100 | - | 700 ± 30 | 35 | 700 ± 30 | 35 |

2. WORK MODE SELECTION SYSTEM

2 work modes can be selected for the optional work speed of the machine operation.



RD21075MS03

1) GENERAL WORK MODE

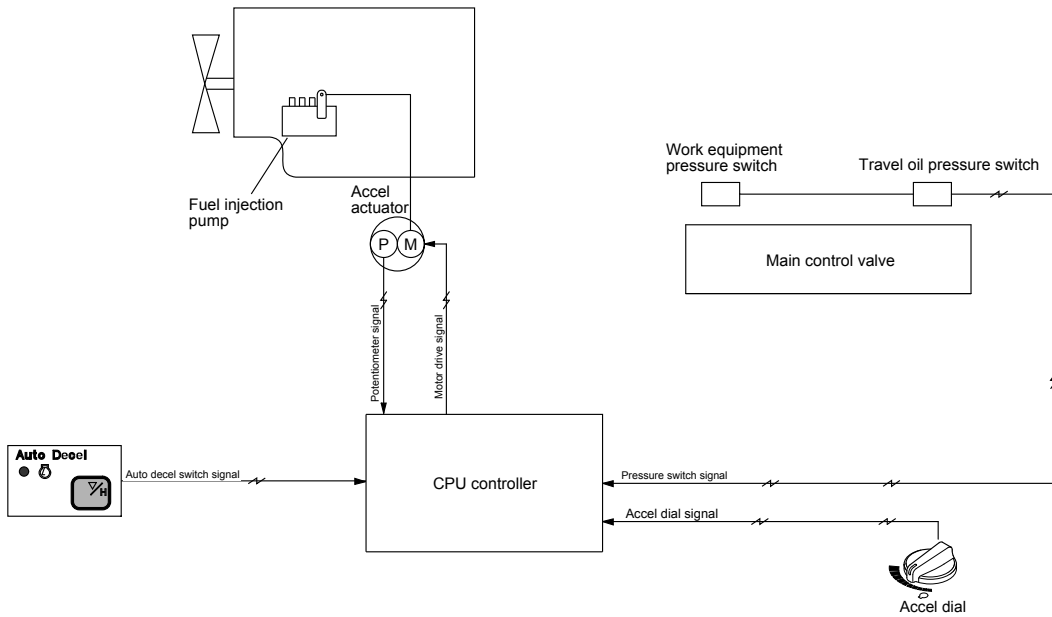
When key switch is turned ON, this mode is selected and swing operation speed is faster than heavy duty work mode.

2) BREAKER OPERATION MODE

It sets the pump flow to the optimal operation of breaker by activating the max flow cut-off solenoid.

| Work mode | Max flow cut-off solenoid |
|-----------|---------------------------|
| General | OFF |
| Breaker | ON |

GROUP 3 AUTOMATIC DECELERATION SYSTEM

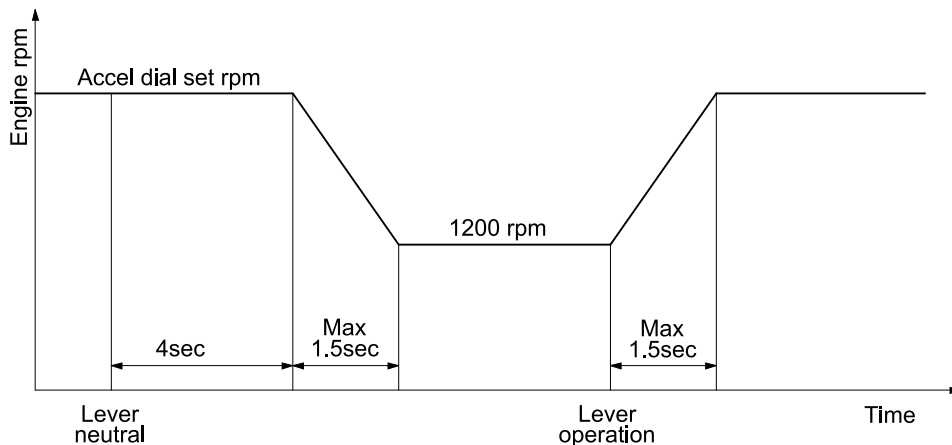


21075MS04

1. WHEN AUTO DECEL LAMP ON

If all the work equipment control levers including swing and travel levers are at neutral for at least 4 seconds, CPU controller drives the governor motor to reduce the engine speed to 1200rpm. As the result of reducing the engine speed, fuel consumption and noise are effectively cut down during non-operation of the control levers.

When the Auto decel lamp is turned off by pressing the switch or any control lever is operated, the reduced engine speed rises up to the speed set before deceleration in a second.



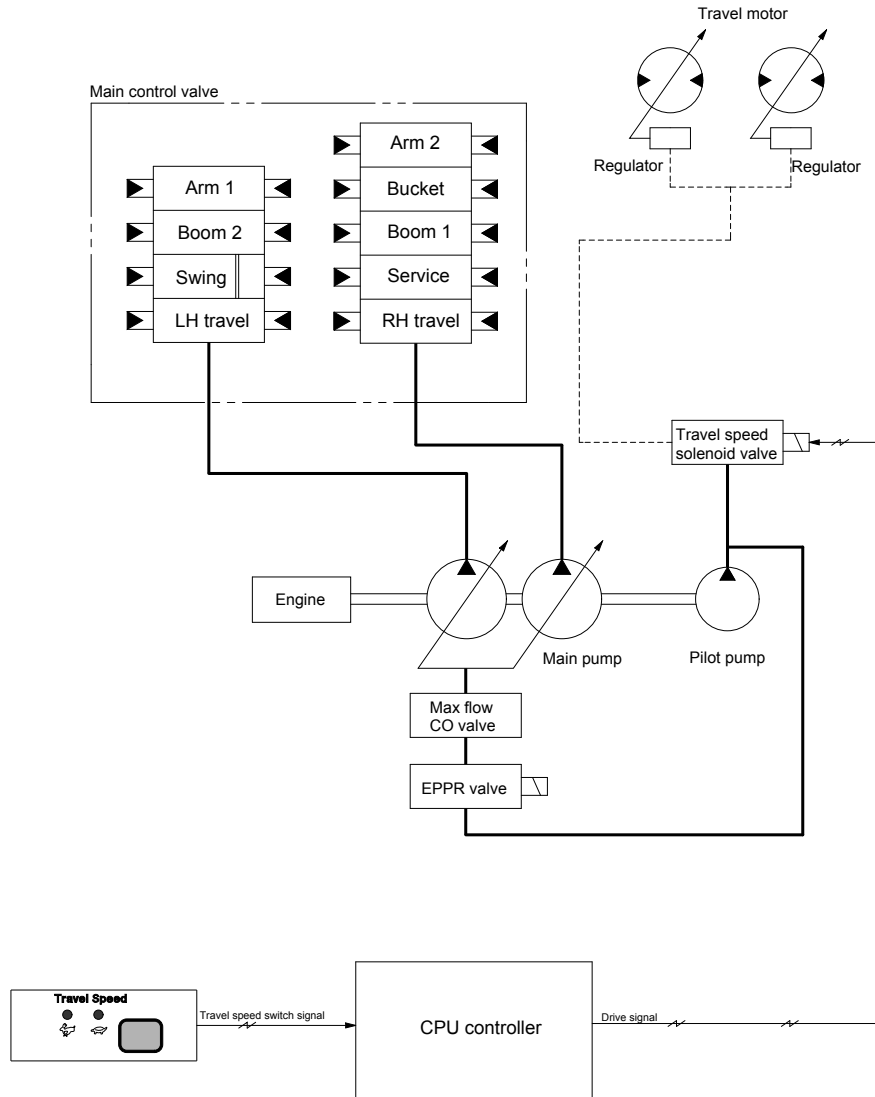
21075MS05

2. WHEN AUTO DECEL LAMP OFF

The engine speed can be set as desired using the engine speed switch, and even if the control levers are neutral, the engine speed is not reduced.

Note : Auto decel function can be activated when accel dial position is over 4.

GROUP 4 TRAVEL SPEED CONTROL SYSTEM



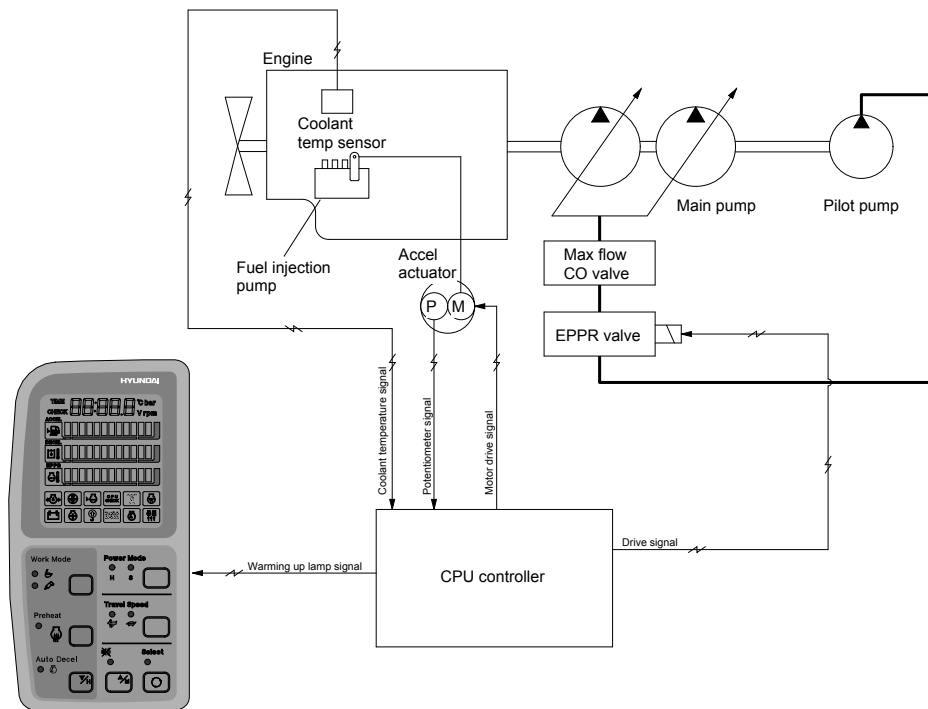
RD21075MS07

Travel speed can be switched manually by pressing the travel speed switch on the cluster.

| Speed | Travel speed solenoid valve | Lamp on cluster | Operation |
|-------|-----------------------------|-----------------|--|
| Lo | OFF | Turtle | Low speed, high driving torque in the travel motor |
| Hi | ON | Rabbit | High speed, low driving torque in the travel motor |

※ Default : Turtle(Lo)

GROUP 5 AUTOMATIC WARMING UP FUNCTION



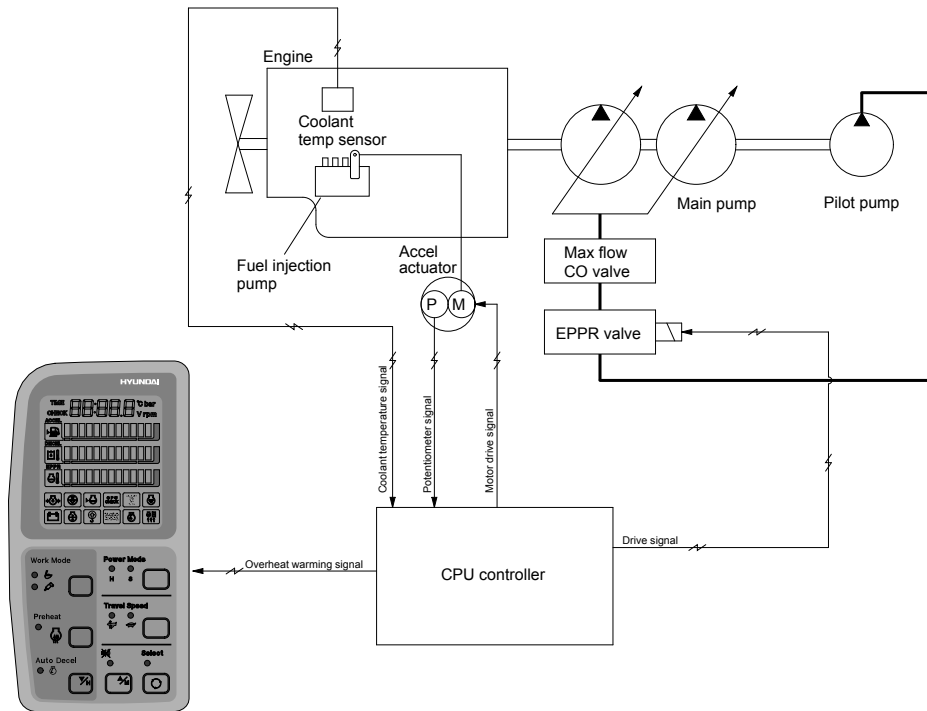
RD21075MS08

1. CPU controller reads engine coolant temperature through the temperature sensor, and if the coolant temperature is less than 30°C, it increases the engine speed from key start rpm to 1200rpm. At this time the mode does not change.
2. In case of the coolant temperature increases up to 30°C, the engine speed is decreased to key start speed. And if an operator changes mode set during the warming up function, the CPU controller cancels the automatic warming up function.

3. LOGIC TABLE

| Description | Condition | Function |
|-----------------|---|---|
| Actuated | - Coolant temperature : Less than 30°C(After engine run) - Accel dial position is under 3 | - Mode : Default(S mode) - Warming up time : 10 minutes(Max) - Warming up lamp : ON |
| Canceled | - Coolant temperature : Above 30°C - Warming up time : Above 10 minutes - Changed mode set by operator - Increase engine speed by rotating accel dial clockwise ※ If any of the above conditions is applicable, the automatic warming up function is canceled | - Default mode - Default mode - Changed mode |
| Warming up lamp | - Coolant temperature : Above 30°C | - Warming up lamp : OFF |

GROUP 6 ENGINE OVERHEAT PREVENTION FUNCTION



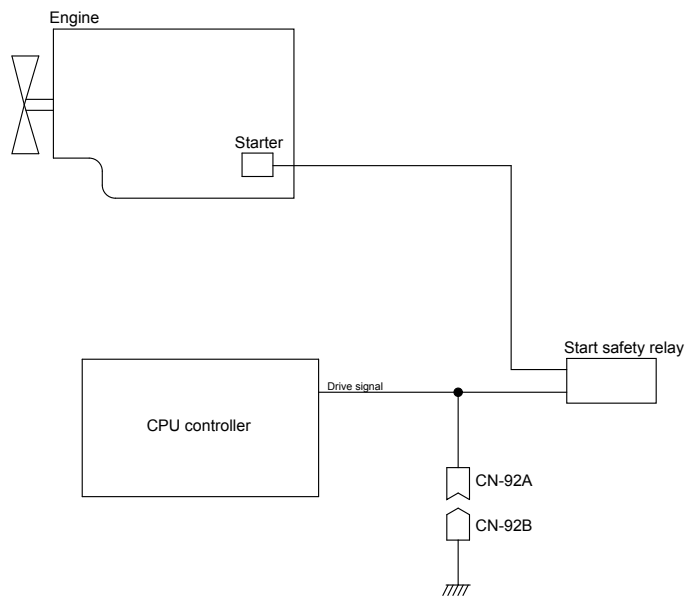
RD21075MS09

1. CPU controller reads engine coolant temperature through the temperature sensor and when the engine coolant boils up to 110°C, it sends overheat warning signal to the cluster and decrease the engine speed same as accel dial 7 position.
2. If the coolant temperature drops less than 100°C, the CPU controller returns the mode to the mode set before. And if mode set is changed during the function, the CPU controller cancels the function. Even if the overheat prevention function is canceled by mode change, the overheat warning lamp turns OFF only when the coolant temperature is less than 100°C.

3. LOGIC TABLE

| Description | Condition | Function |
|-----------------------|--|---|
| Actuated | - Coolant temperature : Above 110°C - Accel dial set : Above 8 | - Engine rpm drop to accel dial 7 position - Overheat warning lamp & buzzer : ON |
| Canceled | - Coolant temperature : Less than 100°C - Changed mode set by operator ※ If any of the above conditions is applicable, engine overheat prevention function is canceled | - Return to the mode and accel dial set before - Hold on the changed set |
| Overheat warning lamp | - Coolant temperature : Less than 100°C | - Overheat warning lamp : OFF |

GROUP 7 ANTI-RESTART SYSTEM



21075MS10

1. ANTI-RESTART FUNCTION

After 10 seconds from the engine starts to run, CPU controller turns off the start safety relay to protect the starter from inadvertent restarting.

2. When a replacement or taking-off of the CPU controller is needed, connect CN-92a and CN-92b to ensure the engine start without the CPU controller.

GROUP 8 SELF-DIAGNOSTIC SYSTEM

1. OUTLINE

When any abnormality occurs in the NEW CAPO system caused by electric parts malfunction and by open or short circuit, the CPU controller diagnoses the problem and sends the error codes to the cluster and also stores them in the memory.

The current or recorded error codes are displayed at the error display mode selected by touching **SELECT** switch 2 times while pressing **BUZZER STOP** switch.

2. CURRENT ERROR DISPLAY

Cluster displays **Co : Er** and makes buzzer sound itself to warn the communication error when communication problem caused by wire-cut or malfunction of the CPU controller occurs.

Cluster displays real time error codes received from CPU controller through communication. In case of no problem it displays **CHECK Er : 00**.

If there are more than 2 error codes, each one can be displayed by pressing **▲** and **▼** switch respectively.

Examples :

1) Communication Error

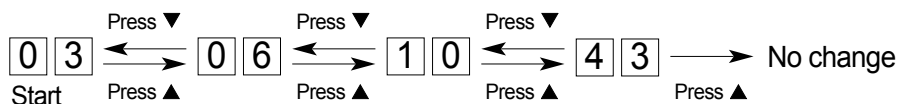
Co : Er & Buzzer sound

2) No problem

CHECK Er : 00

3) 4 Error codes(03, 06, 10, 43) display

CHECK Er : 03

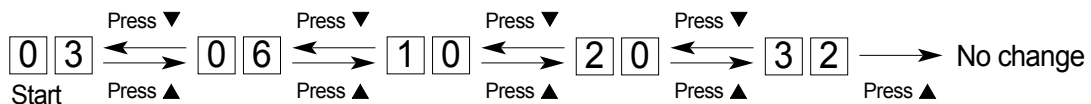


3. RECORDED ERROR DISPLAY



The recorded error can be displayed only when the key switch is at ON position.

Examples : 5 Recorded error codes(03, 06, 10, 20, 32) display

TIME Er : 03



4. DELETE ALL RECORDED ERROR CODES

Select recorded error(**TIME Er**) display and press engine  and select switch  at the same time for 2 seconds or more. Cluster display changes to **TIME Er : 00**, which shows that CPU controller deleted all the recorded error codes in the memory.

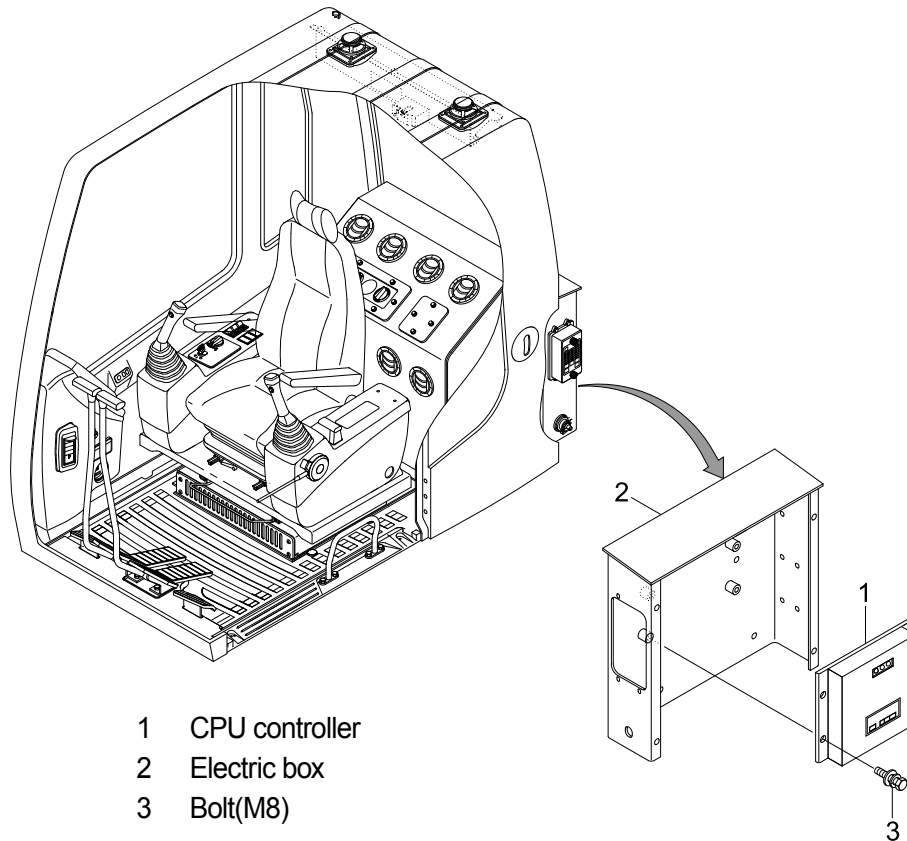
5. ERROR CODES TABLE

| Fault code No. | Description |
|----------------|--|
| 1 | Short circuit in governor motor system |
| 2 | Potentiometer circuit is shorted to Vcc(5V) or battery + |
| 3 | Short circuit in pump EPPR valve system |
| 4 | Short circuit in boom down EPPR valve system |
| 5 | Short circuit in travel speed solenoid system |
| 7 | Short circuit in max flow solenoid system |
| 10 | Short circuit in hour-meter system |
| 11 | Accel dial circuit is shorted to Vcc(5V) or battery + |
| 12 | P1 pressure sensor circuit is shorted to power supply(24V) line |
| 13 | P2 pressure sensor circuit is shorted to power supply(24V) line |
| 14 | P3 pressure sensor circuit is shorted to power supply(24) line |
| 15 | Boom down pressure circuit is shorted to power supply(24V) line |
| 16 | Governor motor circuit is open or shorted to ground |
| 17 | Potentiometer circuit is open or shorted to ground |
| 18 | Pump EPPR valve circuit is open or shorted to ground |
| 19 | Boom down EPPR valve circuit is open or shorted to ground |
| 20 | Travel speed solenoid circuit is open or shorted to ground |
| 22 | Max flow solenoid circuit is open or shorted to ground |
| 25 | Hour-meter circuit is open or shorted to ground |
| 26 | Accel dial circuit is open or shorted to ground |
| 27 | P1 pressure sensor circuit is open or shorted to ground |
| 28 | P2 pressure sensor circuit is open or shorted to ground |
| 29 | P3 pressure sensor circuit is open or shorted to ground |
| 30 | Boom down pressure sensor circuit is open or shorted to ground |
| 31 | Engine preheater circuit is open or shorted to ground |
| 33 | Alternator circuit is open or shorted to ground |
| 34 | Controller input voltage is below 18V |
| 35 | Controller input voltage is over 38V |
| 36 | Communication error with cluster |
| 37 | Engine speed sensor circuit is open or shorted to ground |
| 38 | Anti-restart relay circuit is open or shorted to ground |
| 39 | Accel actuator does not stop at a target position |
| 40 | There is more than 500rpm difference between target speed and actual speed |
| 41 | Hydraulic oil temperature sensor circuit is shorted to ground |
| 42 | Fuel level sensor circuit is shorted to ground |
| 43 | Coolant temperature sensor circuit is shorted to ground |

| Fault code No. | Description |
|----------------|--|
| 44 | Boom up pressure sensor circuit is shorted to power supply(24V) line |
| 45 | Hydraulic oil temperature sensor circuit is open or shorted to battery + |
| 46 | Fuel level sensor circuit is open or shorted to battery + |
| 47 | Coolant temperature sensor circuit is open or shorted to battery + |
| 48 | Boom up pressure sensor circuit is open or shorted to ground |
| 49 | Engine preheater circuit is shorted to battery + |

GROUP 9 ENGINE CONTROL SYSTEM

1. CPU CONTROLLER MOUNTING



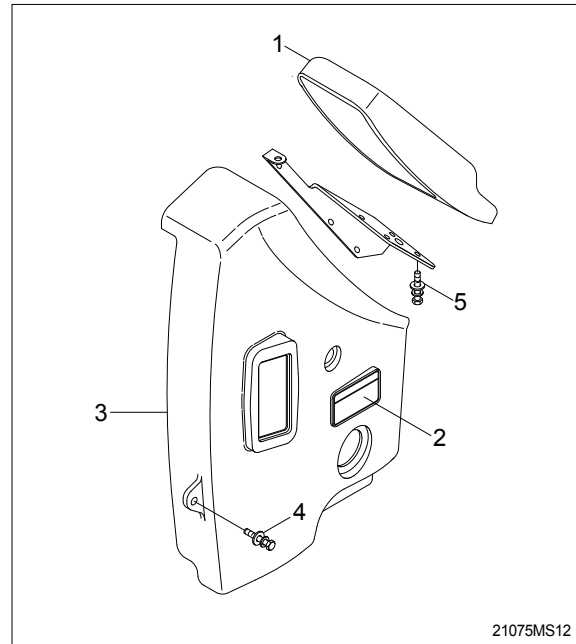
RD21075MS11A

2. CPU CONTROLLER ASSEMBLY

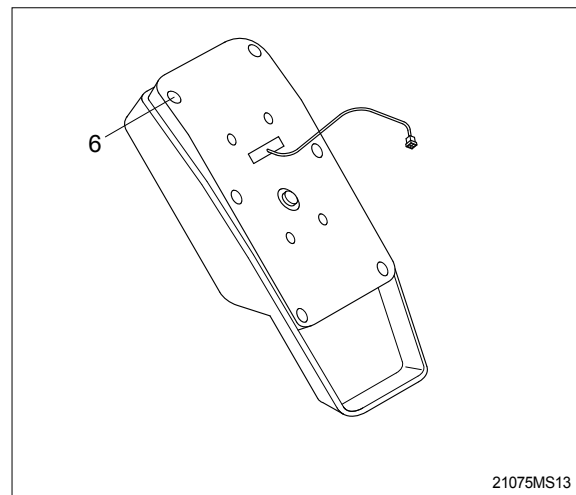
- 1) Remove four pieces of bolt(3) of electric box(2).
- 2) Disconnect 2 connectors from CPU controller.
- 3) Remove 6 pieces of screw and open the cover of CPU controller.
- 4) Inspection : Check PCB(Printed Circuit Board)
 - (1) If any damage is found, replace CPU controller assembly.
 - (2) If not, but CAPO system does not work please report it to HHI dealer or A/S department.

3. EXCHANGE METHOD OF THE ROM

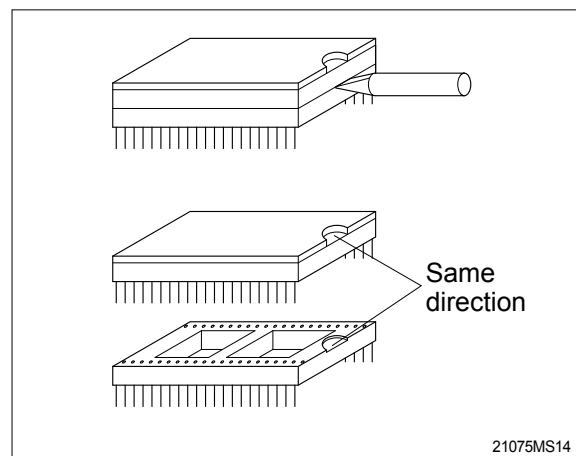
- 1) Disassemble the ash tray(2).
- 2) Disassemble the wiper motor cover(3).
- 3) Disassemble the cluster(1).



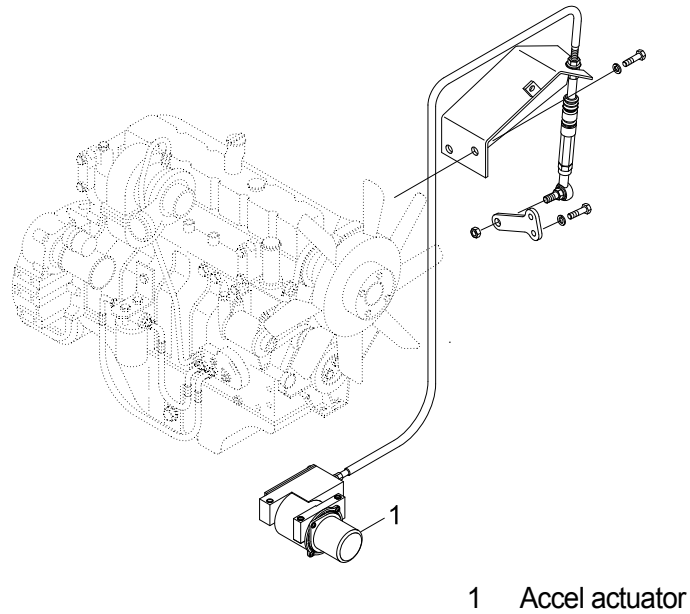
- 4) Loosen the screws(6EA) located back of the cluster.
- 5) Then you can open the upper case of the cluster easily.



- 6) Install the new ROM.(Be careful of direction and assemble the cluster in the reverse order to removal).

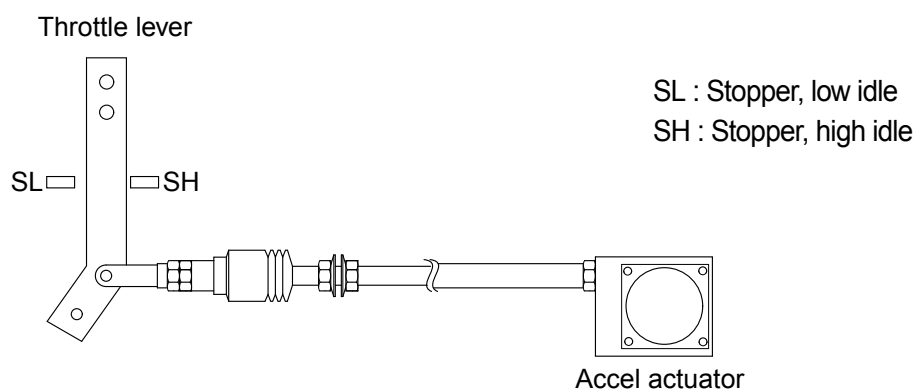


4. ENGINE ACCEL ACTUATOR



RD21075MS60

1) ENGINE THROTTLE LEVER

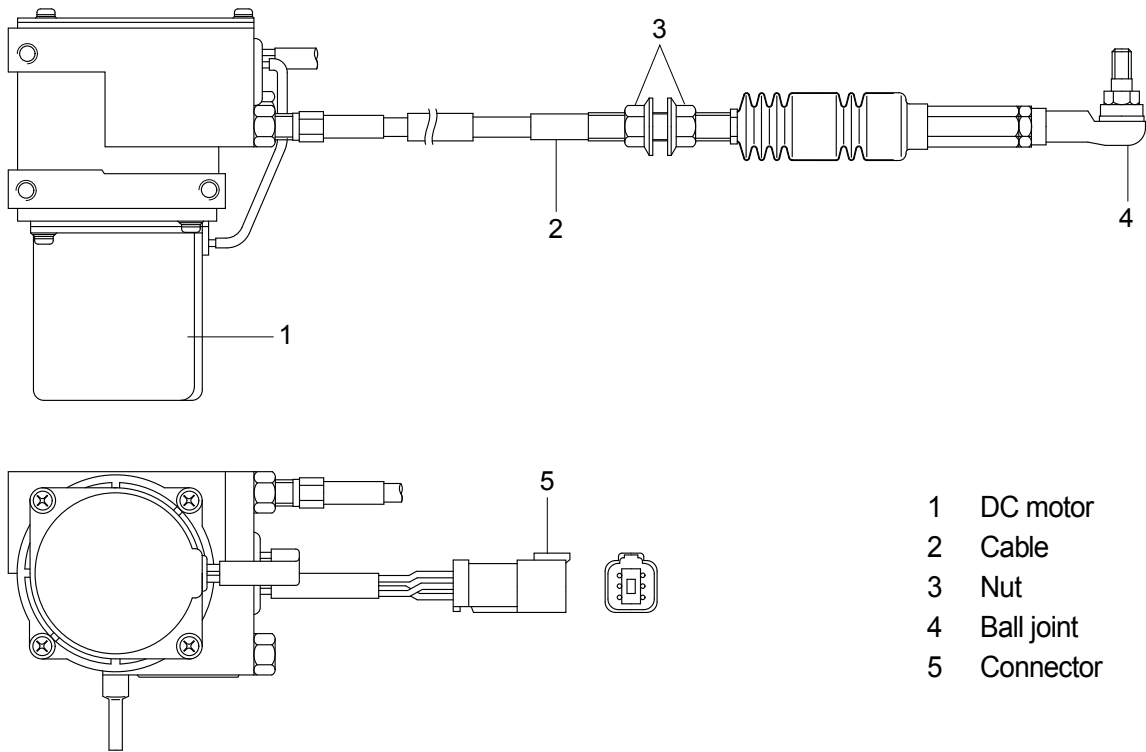


(210-7) 5-18(2)

2) EMERGENCY CABLE (Push-pull cable)

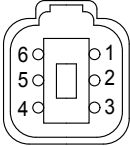
It controls engine speed by connecting onto the lever of the injection pump when the malfunction of the CPU controller or the accel actuator happen.

3) ACCEL ACTUATOR



- 1 DC motor
- 2 Cable
- 3 Nut
- 4 Ball joint
- 5 Connector

(210-7) 5-19(1)

| | | |
|--------------------------|---|---|
| Connector | |  |
| Type | 6P, female | |
| Line color & description | 1 | White(Potentiometer 5V) |
| | 2 | Blue(Potentiometer SIG) |
| | 3 | Black(Potentiometer GND) |
| | 4 | - |
| | 5 | Green(Motor+) |
| | 6 | Yellow(Motor -) |
| Inspection | Check resistance Spec : 1~2 Ω (Between No.5-6) 0.8~1.2kΩ (Between No.1-3) | |

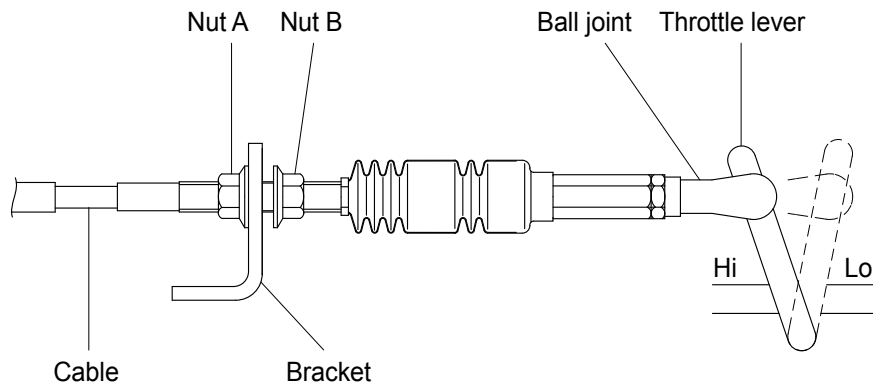
4) ACCEL ACTUATOR CABLE SETTING PROCEDURE

(1) Key OFF

- ① Connect the ball joint of cable to engine throttle lever.
- ② Pull the cable to high stopper and put nut **A** edge to yoke of the bracket.
※ Make throttle lever not contact to the edge of high stopper.
- ③ Turn nut **A** to clockwise until touching to the edge of high stopper.
- ④ Make 1 turn more to clockwise in condition of the nut **A** contact to the edge of high stopper.

(2) Key START

- ⑤ Confirm if the engine speed on cluster is same as each mode specification.
- ⑥ If the engine speed displayed on cluster is higher than each mode specification, then turn the nut **A** to counter clockwise and make the engine speed same to each mode specification.
- ⑦ If the engine speed displayed on cluster is lower than each mode specification, then turn the nut **A** to clockwise and make the engine speed same to each mode specification.
- ⑧ Turn nut **B** to clockwise and fix the cable to bracket.

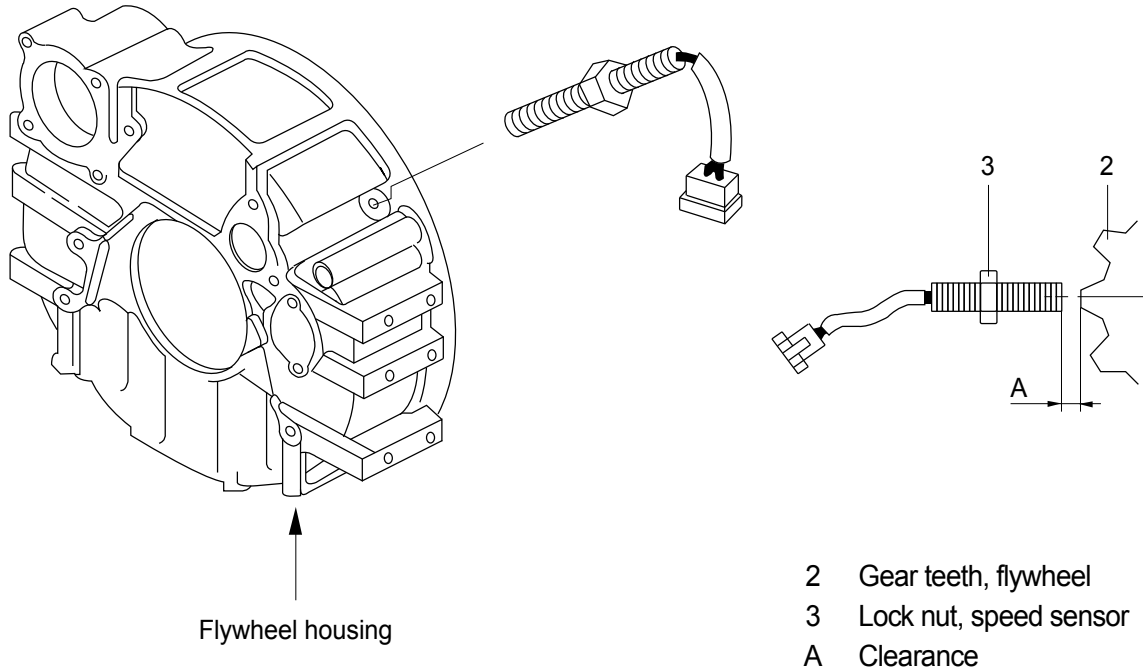


130W5MS05

| Mode | RPM |
|------------|------------|
| H | 2050 ± 50 |
| S | 1750 ± 50 |
| Auto decel | 1200 ± 100 |
| Key start | 1000 ± 100 |

5. ENGINE SPEED SENSOR

1) DETECT ACTUAL ENGINE RPM AND SEND SIGNAL TO TACHOMETER



5-20 (210-7)

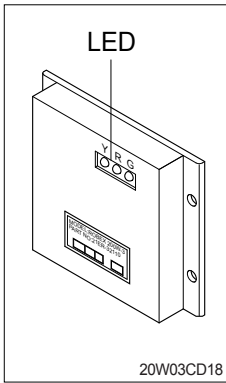
2) INSTALLATION

- (1) Clean contacting point of sensor.
- (2) Loosen lock nut.
- (3) Screw speed sensor into flywheel housing.
- (4) Turn it back 135° when it contacts with gear teeth.
- (5) Tight lock nut and connect wiring.

3) INSPECTION

- (1) Check resistance
 - SPEC : $300 \pm 30K\Omega$
- (2) Check voltage while engine run.
 - SPEC : 2~28Vac, dependent on the engine speed(rpm)

6. CPU CONTROLLER



(1) To match the engine torque with the pump absorption torque, CPU controller varies EPPR valve output pressure, which control pump discharge amount whenever feedbacked engine speed drops under the reference rpm of each mode set.

(2) Three LED lamps on the CPU controller display as below.

| LED lamp | Trouble | Service |
|--------------------------|--------------------------------------|--|
| G is turned ON | Normal | - |
| G and R are turned ON | Trouble on CPU or ROM | <ul style="list-style-type: none"> Change the controller |
| G and Y are turned ON | Trouble on serial communication line | <ul style="list-style-type: none"> Check if serial communication lines between controller and cluster are disconnected |
| Three LED are turned OFF | Trouble on CPU controller power | <ul style="list-style-type: none"> Check if the input power wire (24V, GND) of controller is disconnected Check the fuse |

G : green, R : red, Y : yellow

GROUP 10 EPPR VALVE

1. COMPOSITION OF EPPR VALVE

EPPR(Electro Proportional Pressure Reducing) valve consists of electro magnet and spool valve installed at main hydraulic pump.

1) ELECTRO MAGNET VALVE

Receive electric current from CPU controller and move the spool proportionally according to the specific amount of electric current value.

2) SPOOL VALVE

Is the two way direction control valve for pilot pressure to reduce hydraulic pump flow.

When the electro magnet valve is activated, pilot pressure enters into flow regulator of hydraulic pump. So, pump flow decreases to prevent engine stall.

3) PRESSURE AND ELECTRIC CURRENT VALUE FOR EACH MODE



| Mode | | Pressure | | Electric current (mA) | Engine rpm (At accel dial 10) |
|-------------------------|---|---------------------|----------|--------------------------|----------------------------------|
| | | kgf/cm ² | psi | | |
| Standard (Ver : 1.x) | H | 5 ± 3 | 71 ± 40 | 250 ± 30 | 2050 ± 50 |
| | S | 10 ± 3 | 142 ± 40 | 330 ± 30 | 1750 ± 50 |
| Option (Ver : 2.x) | H | 3 ± 3 | 40 ± 40 | 190 ± 30 | 2150 ± 50 |
| | S | 8 ± 3 | 114 ± 40 | 300 ± 30 | 1950 ± 50 |

2. HOW TO SWITCH THE VERSION(1.x ↔ 2.x) ON THE CLUSTER

You can switch the EPPR valve pressure set by selecting the version(1.x ↔ 2.x).

Step 1. Turn the key switch **ON**.

Step 2. Press the **SELECT** switch 3 times.

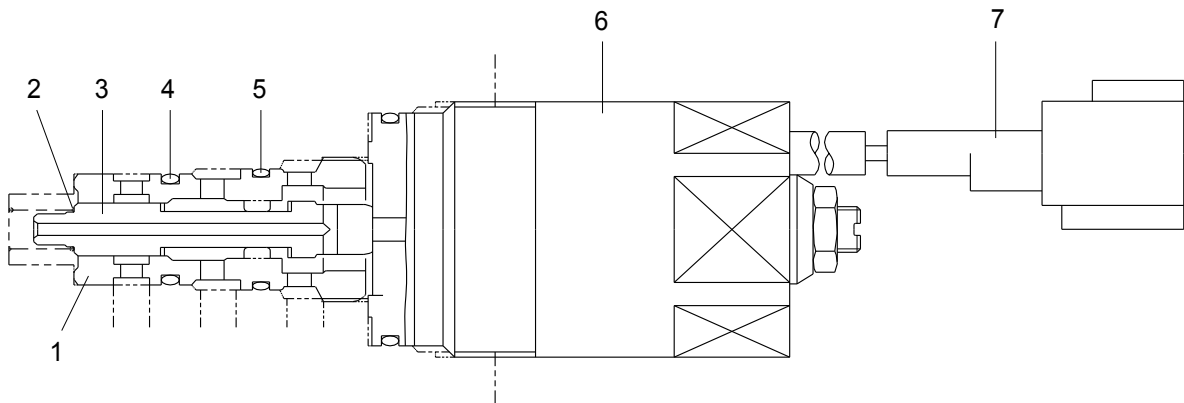
Step 3. While 7 segment on the cluster shows the version of the CPU controller program, for example **21C1.4** press the buzzer stop switch() + travel speed control switch() at the same time for 2 seconds.

The display changes to **21C2.4**, and it indicates that version 2.4(Option) is selected.

※ If you want to get back to ver:1.x, go to step 1~3.

2. OPERATING PRINCIPLE

1) STRUCTURE

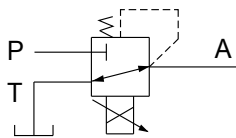


5-22(1) (290-7)

- 1 Sleeve
- 2 Spring
- 3 Spool

- 4 O-ring
- 5 O-ring

- 6 Solenoid valve
- 7 Connector



5-22A (290-7)

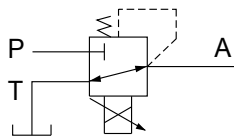
P Pilot oil supply line(Pilot pressure)

T Return to tank

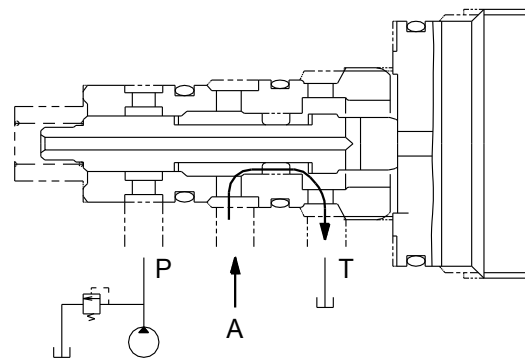
A Secondary pressure to flow regulator at hydraulic pump

2) AT H MODE

Pressure line is blocked and A oil returns to tank.

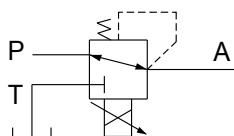


5-22B (290-7)

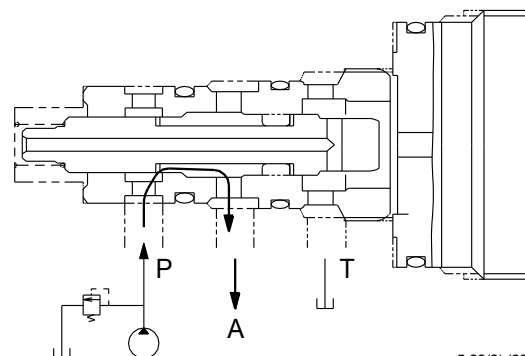


3) AT S MODE

Secondary pressure enters into A.



5-22C (290-7)

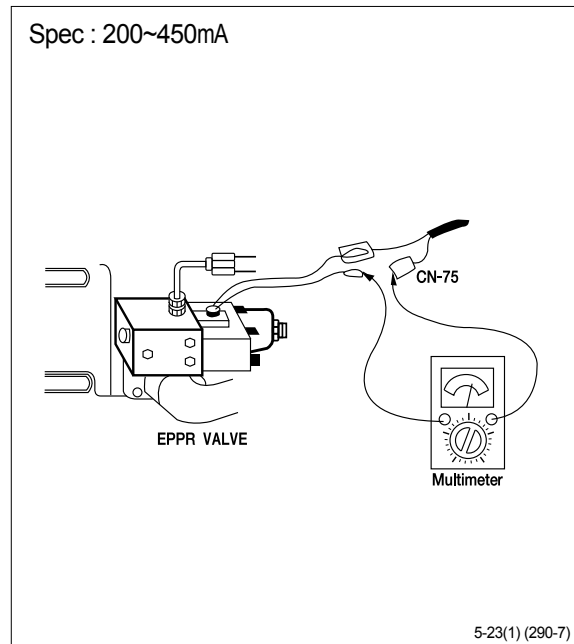


5-22(2) (290-7)

3. EPPR VALVE CHECK PROCEDURE

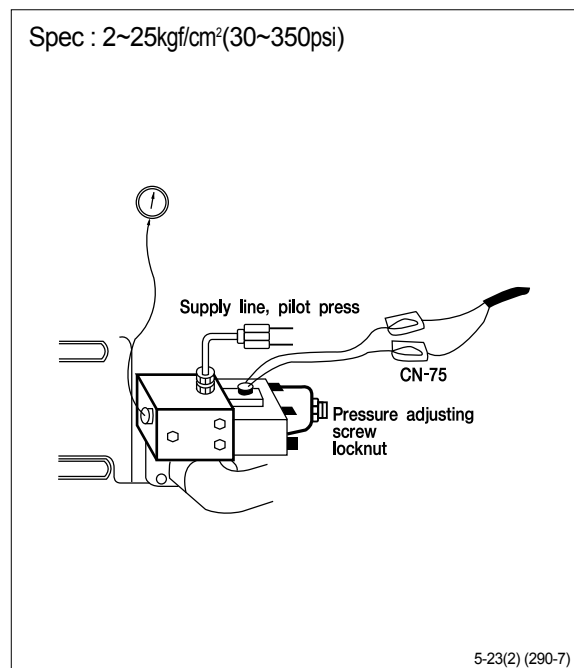
1) CHECK ELECTRIC VALUE AT EPPR VALVE

- (1) Start engine.
- (2) Set S-mode and cancel auto decel mode.
- (3) Position the accel dial at 10.
- (4) If tachometer show approx 1750 ± 50 rpm, disconnect one wire harness from EPPR valve.
- (5) Install multimeter as figure.
- (6) Check electric current at bucket circuit relief position.



2) CHECK PRESSURE AT EPPR VALVE

- (1) Remove plug and connect pressure gauge as figure.
 - Gauge capacity : 0 to 40-50kgf/cm²
(0 to 580-725psi)
- (2) Start engine.
- (3) Set S-mode and cancel auto decel mode.
- (4) Position the accel dial at 10.
- (5) If tachometer show approx 1750 ± 50 rpm, check pressure at relief position of bucket circuit by operating bucket control lever.
- (6) If pressure is not correct, adjust it.
- (7) After adjust, test the machine.



GROUP 11 MONITORING SYSTEM

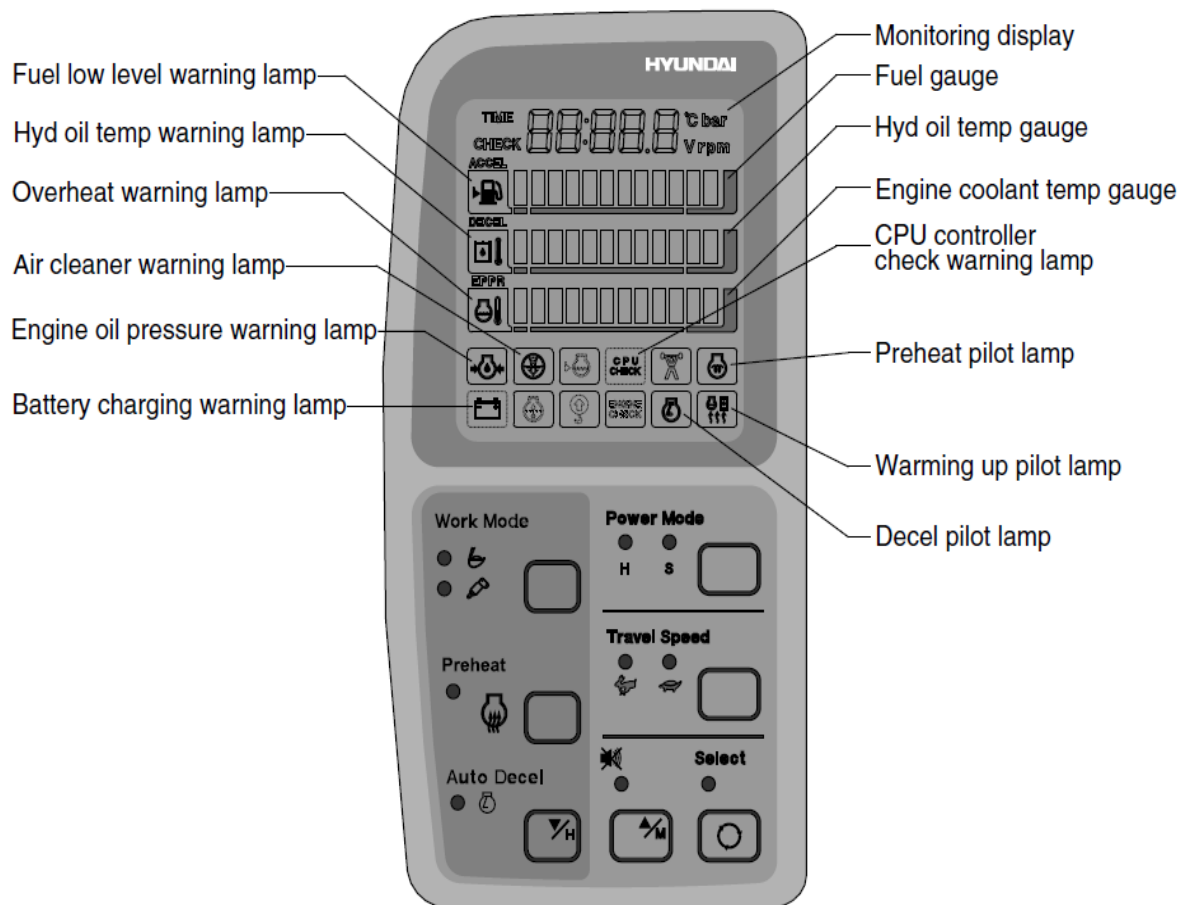
1) MONITOR PANEL

The monitor panel consists of gauges and lamps as shown below, to warn the operator in case of abnormal machine operation or conditions for the appropriate operation and inspection.

- Gauges : Indicate operating status of the machine.
- Warning lamp : Indicate abnormality of the machine(Red).
- Pilot lamp : Indicate operating status of the machine(Amber).

※ **The monitor installed on this machine does not entirely guarantee the condition of the machine. Daily inspection should be performed according to chapter 6, Maintenance.**

※ **When the monitor provides a warning immediately check the problem, and perform the required action.**



RD21073CD02

※ **The warning lamp lights ON and the buzzer sounds when the machine has a problem. In this case, press the buzzer stop switch and buzzer stop, but the warning lamp lights until the problem is cleared.**

2) CLUSTER CHECK PROCEDURE

(1) Start key : ON

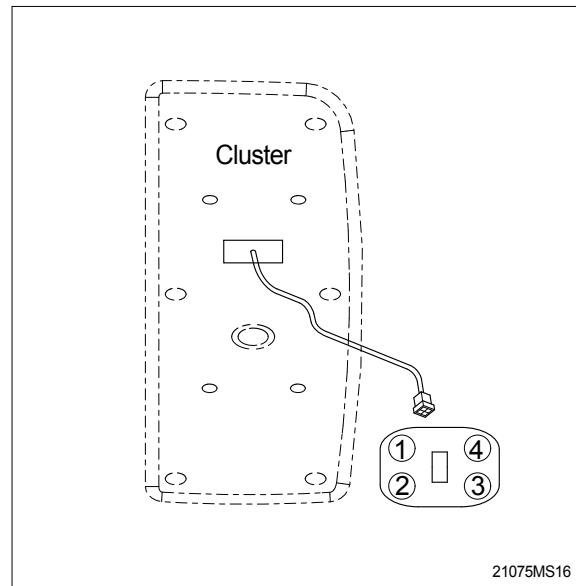
- ① Check monitor initial 5 seconds
 - a. All lamps light up.
 - b. Buzzer sound.
- ② Check monitor after 2 seconds : Indicate cluster version and machine condition
 - a. Cluster program version : CL : 2.0 ← Indicates program version 2.0 for 2 seconds.
 - b. Tachometer : 0rpm
 - c. Fuel gauge : All light up below appropriate level
 - d. Hydraulic temperature : All light up below appropriate level
 - e. Engine coolant temperature gauge : All light up below appropriate level
 - f. 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°C, the warming up lamp lights up.
- ③ Indicating lamp state
 - a. Work mode selection : General work
 - b. Power mode selection : S mode
 - c. User mode selection : No LED ON
 - d. Auto decel LED : ON
 - e. Travel speed pilot lamp : Low(Turtle)

(2) Start of engine

- ① Check machine condition
 - a. Tachometer indicates at present rpm
 - b. Gauge and warning lamp : Indicate at present condition.
 - ※ When normal condition : All warning lamp OFF
 - c. Work mode selection : General work
 - d. Power mode selection : S mode
 - e. User mode selection : No LED ON
 - f. Auto decel LED : ON
 - g. Travel speed pilot lamp : Low(Turtle)
- ② When warming up operation
 - a. Warming up lamp : ON
 - b. 10 seconds after engine started, engine speed increases to 1200rpm(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.

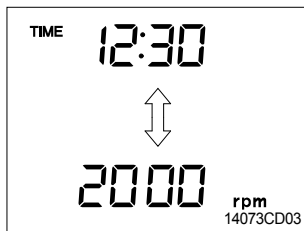
3. CLUSTER CONNECTOR

| 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) |



4. CLUSTER FUNCTION

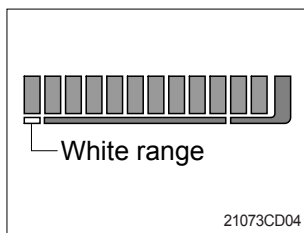
1) MONITORING DISPLAY



- (1) This displays the current time and machine information such as engine rpm, coolant/hydraulic oil temperature, hydraulic oil pressure and also error codes.


※ Refer to the page 5-34 for details.

2) FUEL GAUGE

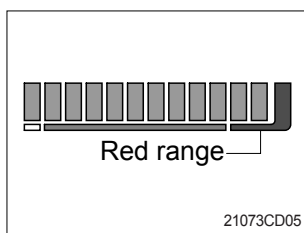


- (1) This gauge indicates the amount of fuel in the fuel tank.

- (2) Fill the fuel when the white range or warning lamp  blinks.

※ If the gauge illuminates the white range or warning lamp  blinks even though the machine is on the normal condition, check the electric device as that can be caused by the poor connection of electricity or sensor.

3) HYDRAULIC OIL TEMPERATURE GAUGE



- (1) This indicates the temperature of coolant.

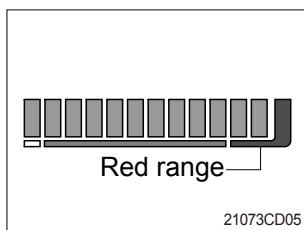
- White range : Below 30°C(86°F)
- Green range : 30-105 °C(86-221°F)
- Red range : Above 105°C(221°F)

- (2) The green range illuminates when operating.

- (3) Keep idling engine at low speed until the green range illuminates before operation of machine.

- (4) When the red range illuminates, reduce the load on the system. If the gauge stays in the red range, stop the machine and check the cause of the problem.

4) ENGINE COOLANT TEMPERATURE GAUGE



- (1) This indicates the temperature of coolant.

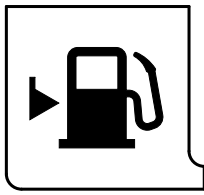
- White range : Below 30°C(86°F)
- Green range : 30-105 °C(86-221°F)
- Red range : Above 105°C(221°F)

- (2) The green range illuminates when operating.

- (3) Keep idling engine at low speed until the green range illuminates before operation of machine.

- (4) When the red range illuminates, turn OFF the engine, check the radiator and engine.

5) FUEL LOW LEVEL WARNING LAMP

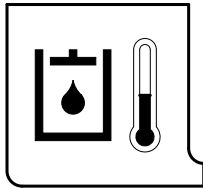


21073CD04A

(1) This lamp blinks and the buzzer sounds when the level of fuel is below 31 l (8.2U.S. gal).

(2) Fill the fuel immediately when the lamp blinks.

6) HYDRAULIC OIL TEMPERATURE WARNING LAMP



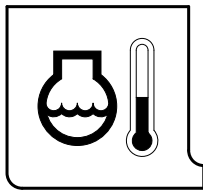
21073CD05A

(1) This warning lamp operates and the buzzer sounds when the temperature of hydraulic oil is over 105°C (221°F).

(2) Check the hydraulic oil level when the lamp blinks.

(3) Check for debris between oil cooler and radiator.

7) OVERHEAT WARNING LAMP

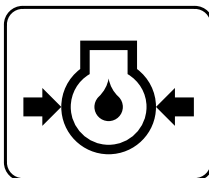


21073CD06A

(1) This lamp blinks and the buzzer sounds when the temperature of coolant is over the normal temperature 110°C (230°F).

(2) Check the cooling system when the lamp blinks.

8) ENGINE OIL PRESSURE WARNING LAMP

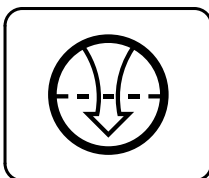


21073CD07

(1) This lamp blinks and the buzzer sounds after starting the engine because of pressure.

(2) If the lamp blinks during engine operation, shut OFF engine immediately. Check oil level.

9) AIR CLEANER WARNING LAMP

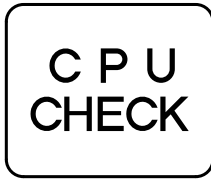


21073CD08

(1) This lamp is operated by the vacuum caused inside when the filter of air cleaner is clogged which supply air to the engine.

(2) Check the filter and clean or replace it when the lamp blinks.

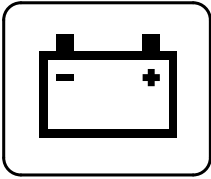
10) CPU CONTROLLER CHECK WARMING LAMP



21073CD10

- (1) Communication problem with CPU controller makes the lamp blinks and the buzzer sounds.
- (2) Check if any fuse for CPU burnt off.
- (3) If not check the communication line between them.

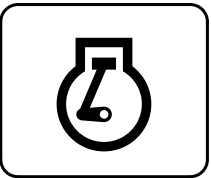
11) BATTERY CHARGING WARNING LAMP



21073CD13

- (1) This lamp blinks and the buzzer sounds when the starting switch is ON, it is turned OFF after starting the engine.
- (2) Check the battery charging circuit when this lamp blinks during engine operation.

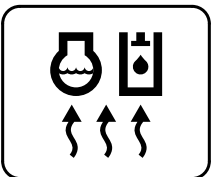
12) DECEL PILOT LAMP



21073CD17

- (1) Operating auto decel or one touch decel makes the lamp ON.
- (2) The lamp will be ON when pushing one touch decel switch on the LH RCV lever.

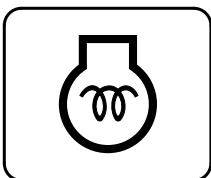
13) WARMING UP PILOT LAMP



21073CD18

- (1) This lamp is turned ON when the coolant temperature is below 30°C (86 °F).
- (2) The automatic warming up is cancelled when the engine coolant temperature is above 30 °C, or when 10 minutes have passed since starting.

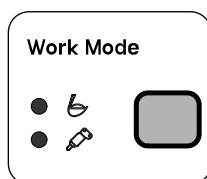
14) PREHEAT PILOT LAMP



21073CD12



- (1) Turning the start key switch ON position starts preheating in cold weather.
- (2) Start the engine as this lamp is OFF.

15) WORK MODE SWITCH



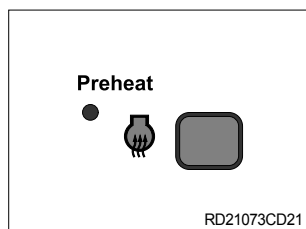
RD21073CD20

(1) This switch is to select the machine operation mode, which shifts from general operation mode to heavy operation mode and breaker mode in a row by pressing the switch.

-  : General work mode
-  : Breaker operation mode

※ Refer to the page 5-4 for details.

16) PREHEAT SWITCH



RD21073CD21

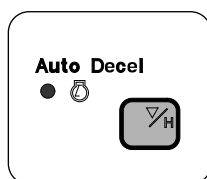
(1) This switch is used for starting the engine in cold weather.

If pressed, grid heater is activated to get easier engine starting.

※ **Never hold the push button switch in for more than 30 seconds, as this can damage the grid heater.**

(2) The indicator lamp is turned ON when operating this switch.

17) AUTO DECELERATION SWITCH



21073CD22

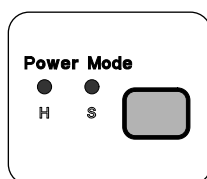
(1) This switch is used to actuate or cancel the auto deceleration function.

When the switch actuated and all control levers and pedals are at neutral position. Engine speed will be lowered automatically to save fuel consumption.


- Light ON : Auto deceleration function is selected.
- Light OFF : Auto deceleration function is cancelled so that the engine speed increased to previous setting value.

(2) Operating the auto deceleration function makes the decel indicating lamp on the LCD panel ON.

18) POWER MODE SWITCH

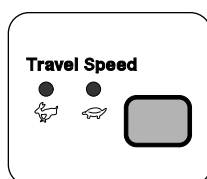


21073CD23

(1) The lamp of selected mode is turned ON by pressing the switch().

- H : High power work.
- S : Standard power work.

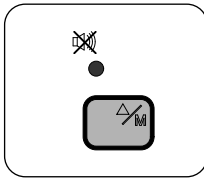
19) TRAVEL SPEED CONTROL SWITCH



21073CD24

(1) This switch is to control the travel speed which is changed to high speed(Rabbit mark) by pressing the switch and low speed(Turtle mark) by pressing it again.

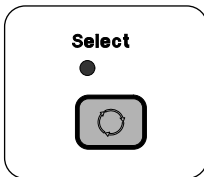
20)BUZZER STOP SWITCH





21073CD25

- (1) When the starting switch is turned ON first, normally the alarm buzzer sounds for 2 seconds during lamp check operation.
- (2) The red lamp lights ON and the buzzer sounds when the machine has a problem.
In this case, press this switch and buzzer stops, but the red lamp lights until the problem is cleared.

21)SELECT SWITCH



21073CD25A

- (1) This switch is used to select the monitor display function.
※ **Refer to the page 5-31 for details.**
- (2) If the switch is pressed for 3 seconds in time display mode, it is selected time adjusting function, as below.
 - Hour by auto decel()switch
 - Minute by buzzer stop() switch.
- (3) After time set, the switch is pressed, it returns to clock display.

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 | 1000 rpm |
| | | Touch SELECT 1 time | Time | TIME 12:30 |
| | | Touch SELECT 2 times | Power shift pressure (EPPR valve) | EP: 10 bar |
| | | Touch SELECT 3 times | CPU model & version | 21C5.1 |
| 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) | b:24.8 _v |
| | | Touch SELECT 1 time | Potentiometer voltage(V) | Pa: 2.5 _v |
| | | Touch SELECT 2 times | Accel dial voltage(V) | dL: 3.8 _v |
| | | Touch SELECT 3 times | Hydraulic oil temperature(°C) | Hd: 50 ^{°C} |
| | | Touch SELECT 4 times | Coolant temperature(°C) | Ct: 85 ^{°C} |
| Group 2 (Error code) | Touch SELECT switch twice while pressing BUZZER STOP . In this group BUZZER STOP LED blinks | Default | Current error | CHECK Er: 03 |
| | | Touch SELECT 1 time | Recorded error (Only key switch ON) | TIME Er: 03 |
| | | Press down(▼) & SELECT at the same time | Recorded error deletion (Only key switch ON) | TIME Er: 00 |
| Group 3 (Switch input) | Touch SELECT switch 3 times while pressing BUZZER STOP . In this group SELECT LED blinks at 0.5sec interval | Default | Auto decel pressure switch | dP:on or oFF |
| | | Touch SELECT 1 times | Travel oil pressure switch | oP:on or oFF |
| | | Touch SELECT 2 times | One touch decel switch | od:on or oFF |
| | | Touch SELECT 3 times | Preheat switch | PH:on or oFF |
| Group 4 (Output) | Touch SELECT switch 4 times while pressing BUZZER STOP . In this group SELECT LED blinks at 1sec interval | Default | Hourmeter | Ho:on or oFF |
| | | Touch SELECT 1 time | Neutral relay (Anti-restart relay) | nr:on or oFF |
| | | Touch SELECT 2 times | Travel speed solenoid | tS:on or oFF |
| | | Touch SELECT 3 times | Max flow cut off solenoid | FS:on or oFF |
| | | Touch SELECT 4 times | Preheat relay | PR: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 | 1000 rpm | Engine speed | It displays current engine speed detected by engine speed sensor from 500 to 3000rpm. Range : 500~3000rpm by 10rpm |
| | TIME 12 : 30 | Time | It displays current time(12 is hour and 30 is minute) Range : Hour(1~12), minute(00~59) |
| | EP : 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. Range : 00~50bar by 1bar |
| | 21 : C1.4 | Model and CPU program version | It shows that machine model(R210) and the program version of the CPU controller is 1.4. Version display range : 0.0~9.9 by 0.1 |
| Group 1 | b : 24.8V | Battery voltage | It shows that battery power of 24.8V is supplied into CPU controller. Range : 00.0~48.0V by 0.1V |
| | Po : 2.5V | Potentiometer voltage | It shows that potentiometer signal voltage is 2.5V. Range : 0.0~5.0V by 0.1V |
| | dL : 3.8V | Accel dial voltage | It shows that accel dial signal voltage is 3.8V. Range : 0.0~5.0V by 0.1V |
| | Hd : 50°C | Hydraulic oil temperature | It shows that hydraulic oil temperature detected by temperature sensor is 50°C. Range : 0~150°C by 1°C |
| | Ct : 85°C | Coolant temperature | It shows that coolant oil temperature detected by temperature sensor is 50°C. Range : 0~150°C by 1°C |
| Group 2 | CHECK Er : 03 | Current error | It shows that current error of 03(Short circuit in pump EPPR valve system) is diagnosed by self diagnosis system in the CPU controller. If more than 2 errors, when pressing ▼ or ▲ switch, other error codes show. Range : 00~58 |
| | TIME Er : 03 | Recorded error | It shows recorded error code of 03 which is diagnosed before. If more than 2 error codes, when pressing ▼ or ▲ switch, other error codes show. Range : 00~58 |
| | TIME Er : 00 | Recorded error deletion | It shows all recorded error codes are removed in the CPU controller memory. |

| Group | Display | Name | Description |
|---------|----------------|------------------------------------|--|
| Group 3 | dP : on or oFF | Auto decel pressure switch | dP : on Shows that auto decel pressure switch is pressed on (No operation of control lever). dP : oFF Shows that auto decel pressure switch is released off (Operation of control lever). |
| | oP : on or oFF | Travel oil pressure switch | oP : on Shows that travel oil pressure switch is pressed on (No operation of travel control lever). oP : oFF Shows that travel oil pressure switch is released off (Operation of travel control lever). |
| | od : on or oFF | One touch decel switch | od : on Shows that one touch decel switch is pressed. od : oFF Shows that one touch decel switch is released. |
| | PH : on or oFF | Preheat switch | PH : on Shows that preheat switch is pressed. PH : oFF Shows that preheat switch is released. |
| Group 4 | Ho : on or oFF | Hourmeter | Ho : on Shows that hourmeter is activated by CPU controller. 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). nr : oFF Shows that neutral relay is turned off to disable the engine restart. |
| | ts : on or oFF | Travel speed solenoid | ts : on Shows that travel speed solenoid is activated (High speed). ts : oFF Shows that travel speed solenoid is released (Low speed). |