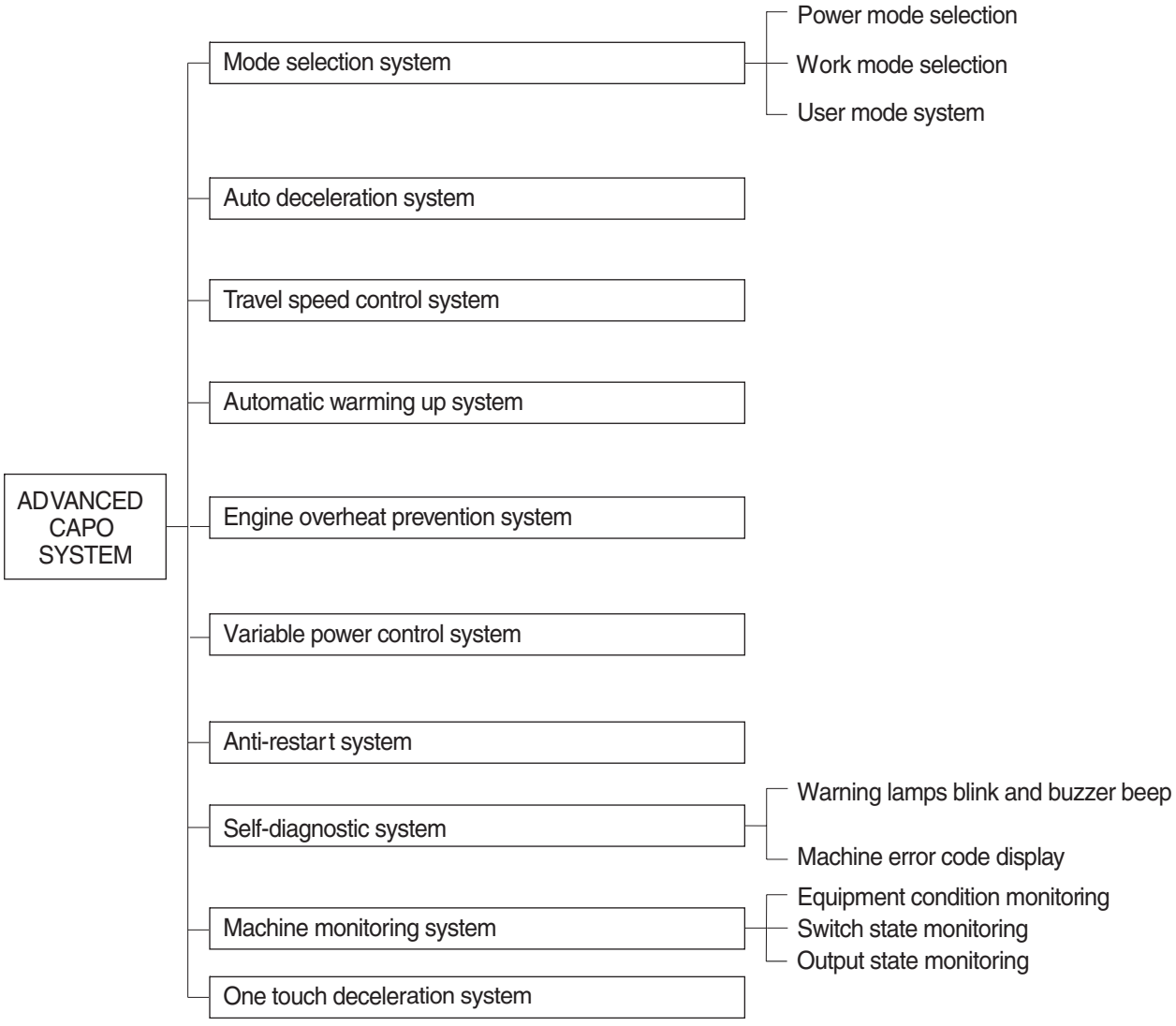
SECTION 5 MECHATRONICS SYSTEM

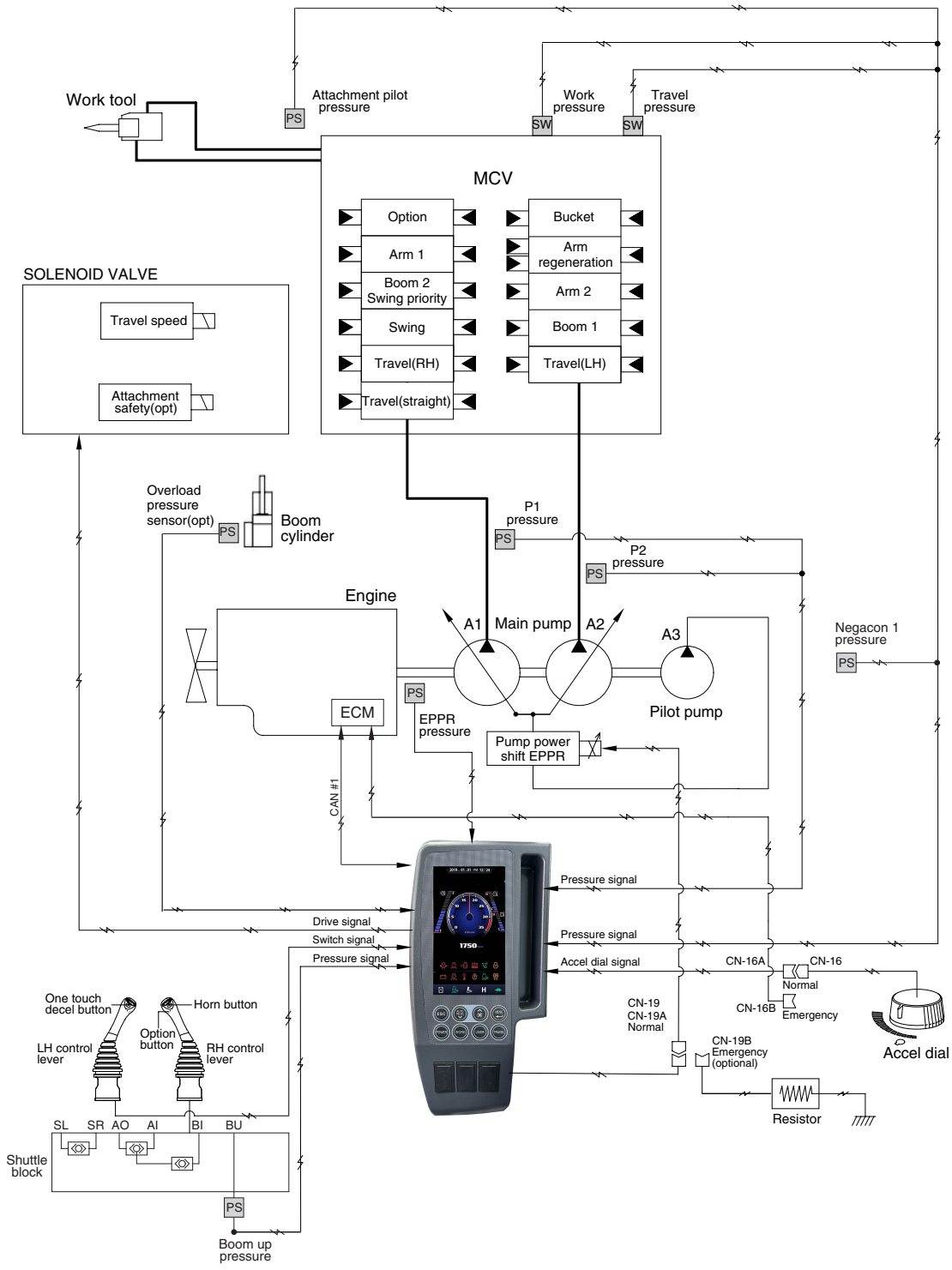
GROUP 1 OUTLINE

■ AD VANCED CAPO (Computer Aided Power Optimization) system

The 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 of a CMCU(cluster& machine control unit integration), an accel actuator, and other components.
The CMCU protect itself 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.

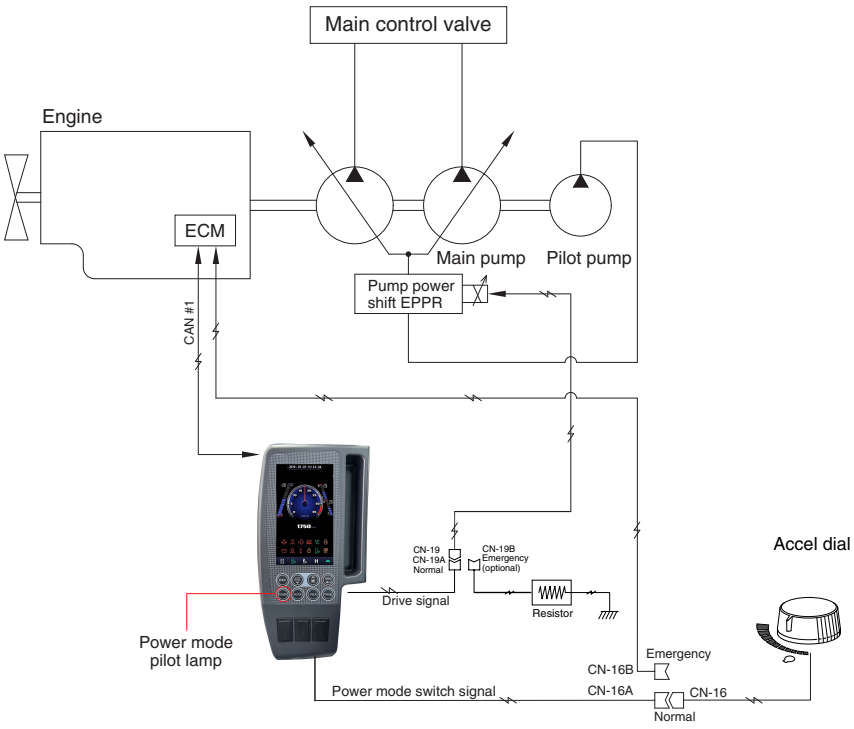


SYSTEM DIAGRAM



GROUP 2 MODE SELECTION SYSTEM

1. POWER MODE SELECTION SYSTEM



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

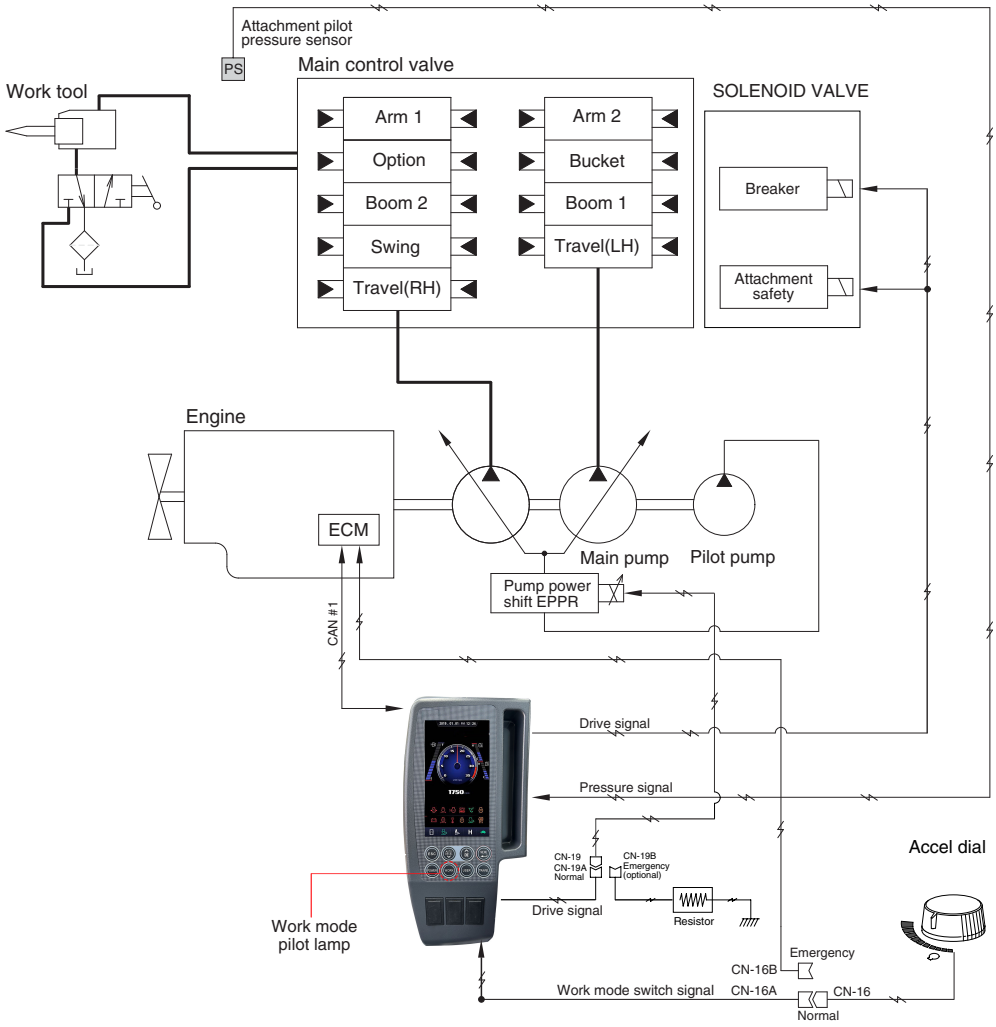
The combination of 3 power modes (M, H, S) and accel dial position (10 set) makes it possible to use the engine and pump power more effectively corresponding to the work conditions from a heavy and great power requesting work to a light and precise work.

Power mode	Application	Engine rpm				Power shift by EPPR valve			
		Standard		Option		Standard		Option	
		Unload	Load	Unload	Load	Current (mA)	Pressure (kgf/cm^2)	Current (mA)	Pressure (kgf/cm^2)
M	Max mode	1900±50	-	1950±50	-	-	10(~3)	-	8 (~3)
H	Heavy duty power	1800±50	-	1850±50	-	-	12(~5)	-	10(~5)
S	Standard power	1700±50	-	1750±50	-	-	15(~8)	-	13(~8)
Auto decel	Engine deceleration	1000±50	-	-	-	-	40±2	-	-
One touch decel	Engine quick deceleration	850±50	-	-	-	-	40±2	-	-
Key start	Key switch start position	850±50	-	-	-	-	40±2	-	-

※ Power shift (Standard/Option) can be changed by "Service menu" in "Management" on the cluster.

2. WORK MODE SELECTION SYSTEM

Work mode consists of the general operation (bucket) and the optional attachment (breaker, crusher).



1) GENERAL WORK MODE (bucket)

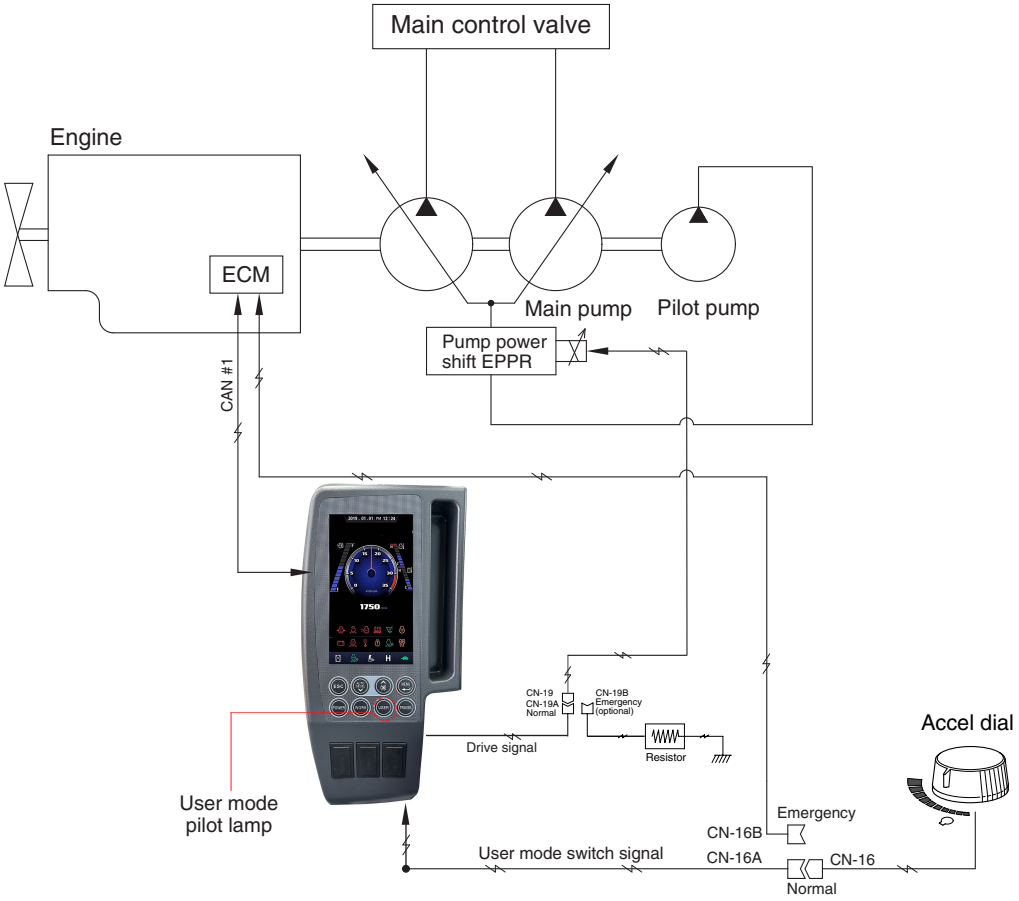
This mode is used to general digging work.

2) ATT WORK MODE (breaker, crusher)

It controls the pump flow and system pressure according to the operation of breaker or crusher.

Description	General mode	Work tool	
	Bucket	Breaker	Crusher
Attachment safety solenoid	OFF	ON	ON

3. USER MODE SELECTION SYSTEM



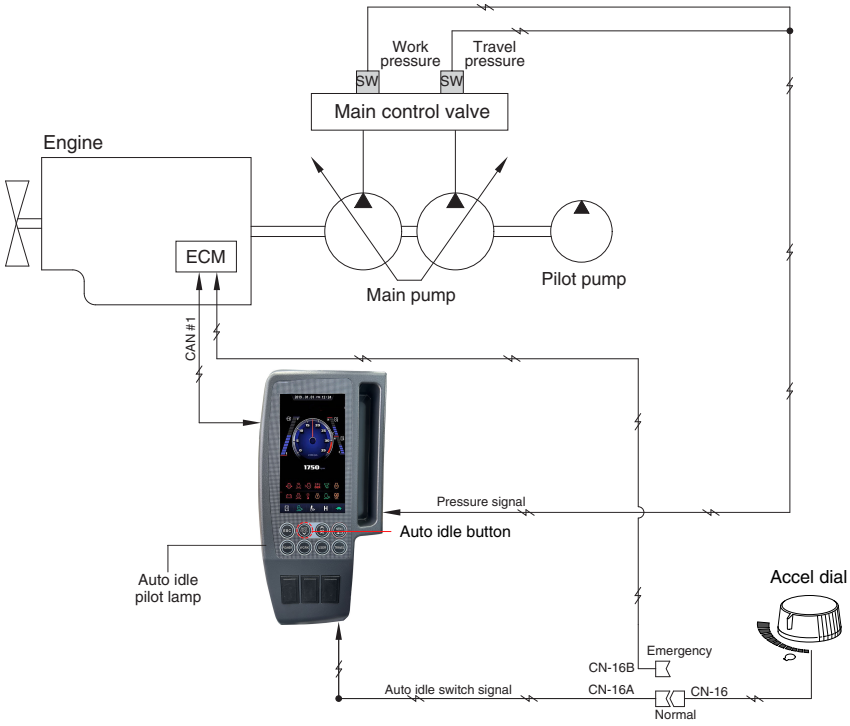
1) High idle rpm, low idle rpm and EPPR pressure can be adjusted and memorized in the U-mode.

2) LCD segment vs parameter setting

Segment (▮)	ACCEL (rpm)	DECEL (rpm)	EPPR (bar)
1	1300	750	38
2	1400	800	32
3	1500	850	26
4	1600	900	20
5	1700	950	16
6	1800	1000	12
7	1850	1050	9
8	1900	1100	6
9	1950	1150	1
10	2000	1200	0

※ **One touch decel:850rpm**

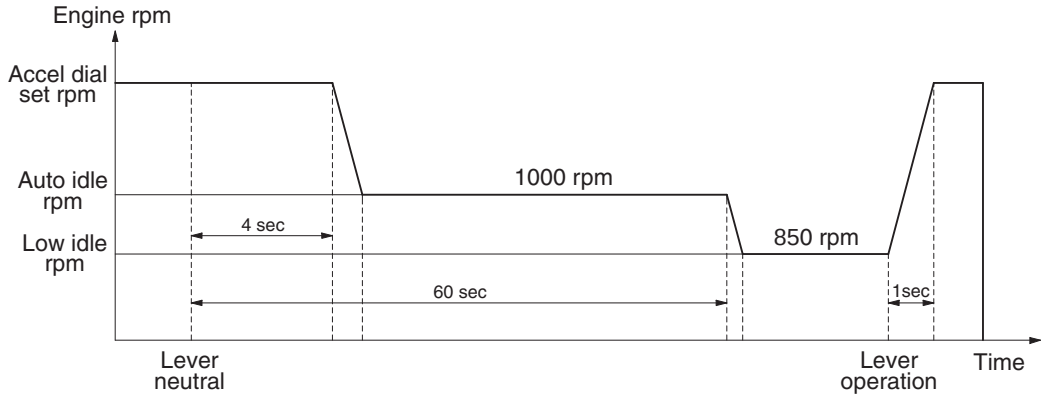
GROUP 3 AUTOMATIC DECELERATION SYSTEM



1. WHEN AUTO IDLE PILOT LAMP ON

When all of the work equipment control levers including swing and travel levers are at neutral for 4 seconds, CMCU drives the accel actuator to reduce the engine speed to 1000 rpm. If the control levers are at neutral for 1 minute, CMCU reduces the engine speed to 850 rpm. 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 idle pilot lamp is turned off by pressing the switch or any control lever is operated, the reduced engine speed rises upto the speed before deceleration in a second.

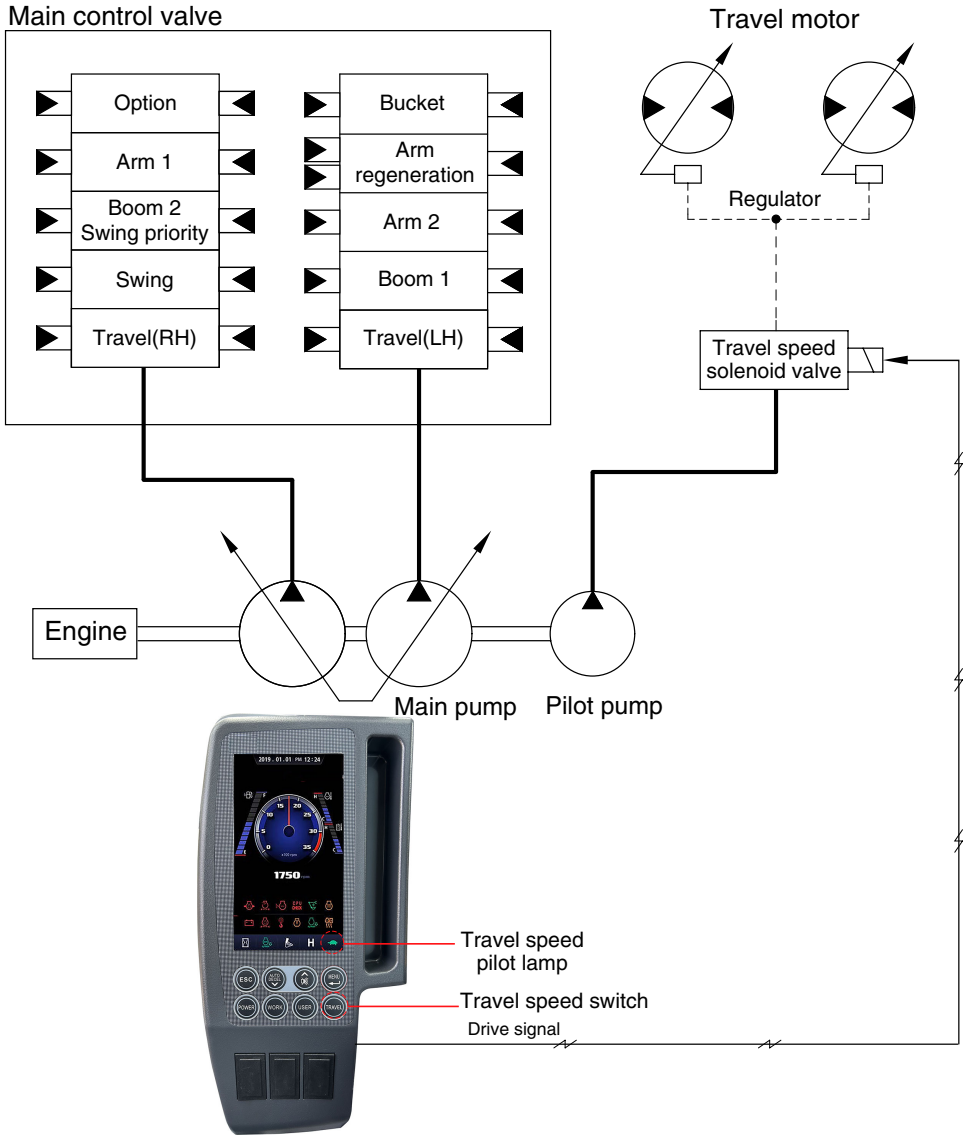


2. WHEN AUTO IDLE PILOT LAMP OFF

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

※ Auto idle function can be activated when accel dial position is over 4.

GROUP 4 TRAVEL SPEED CONTROL SYSTEM

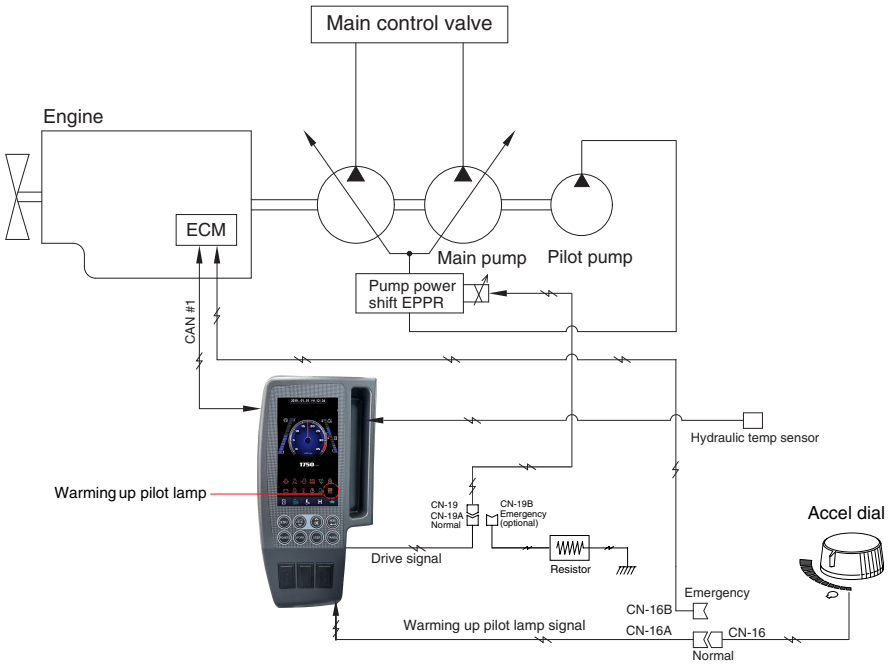


Travel speed can be switched manually by pressing the travel speed switch on the cluster.

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

※ Default : Turtle (low)

GROUP 5 AUTOMATIC WARMING UP SYSTEM



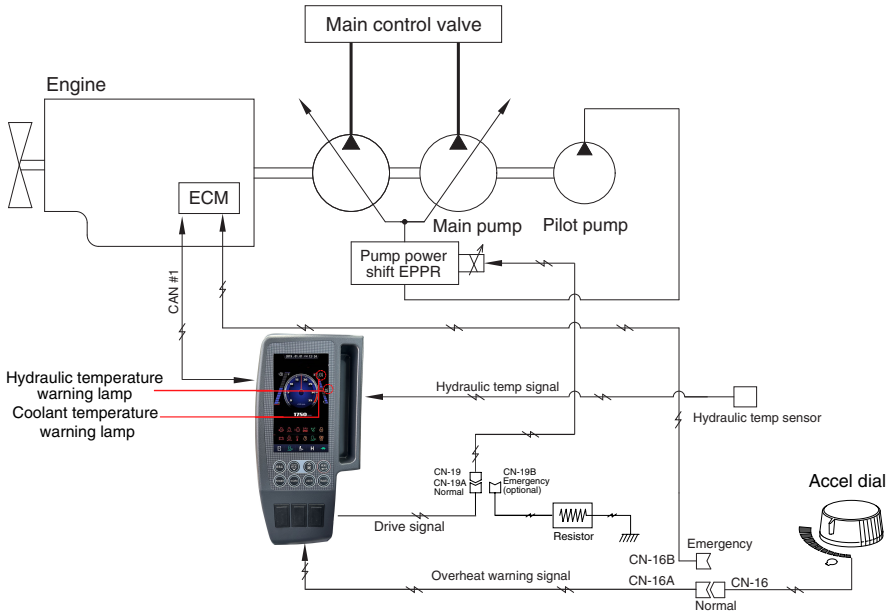
1. The CMCU reads engine coolant temperature through the temperature sensor and if the coolant temperature is below 30˚C, it increases the engine speed from key start rpm to 1000±100rpm. At this time the mode does not change. If the coolant temperature sensor has fault, the hydraulic oil temperature signal is substituted.

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 power mode set during the warming up function, the CMCU cancels the automatic warming up function.

3. LOGIC TABLE

Description	Condition	Function
Actuated	- Coolant temperature : below 30˚C (after engine run)	- Power mode : Default (S mode) - Warming up time : 10 minutes (max) - Warming up pilot lamp : ON
Canceled	- Coolant temperature : Above 30˚C - Warming up time : Above 10 minutes - Changed power mode set by operator - RCV lever or pedal operating - Auto idle cancel ※ If any of the above conditions is applicable, the automatic warming up function is canceled	- Power mode : set mode - Warming up pilot lamp : OFF

GROUP 6 ENGINE OVERHEAT PREVENTION SYSTEM

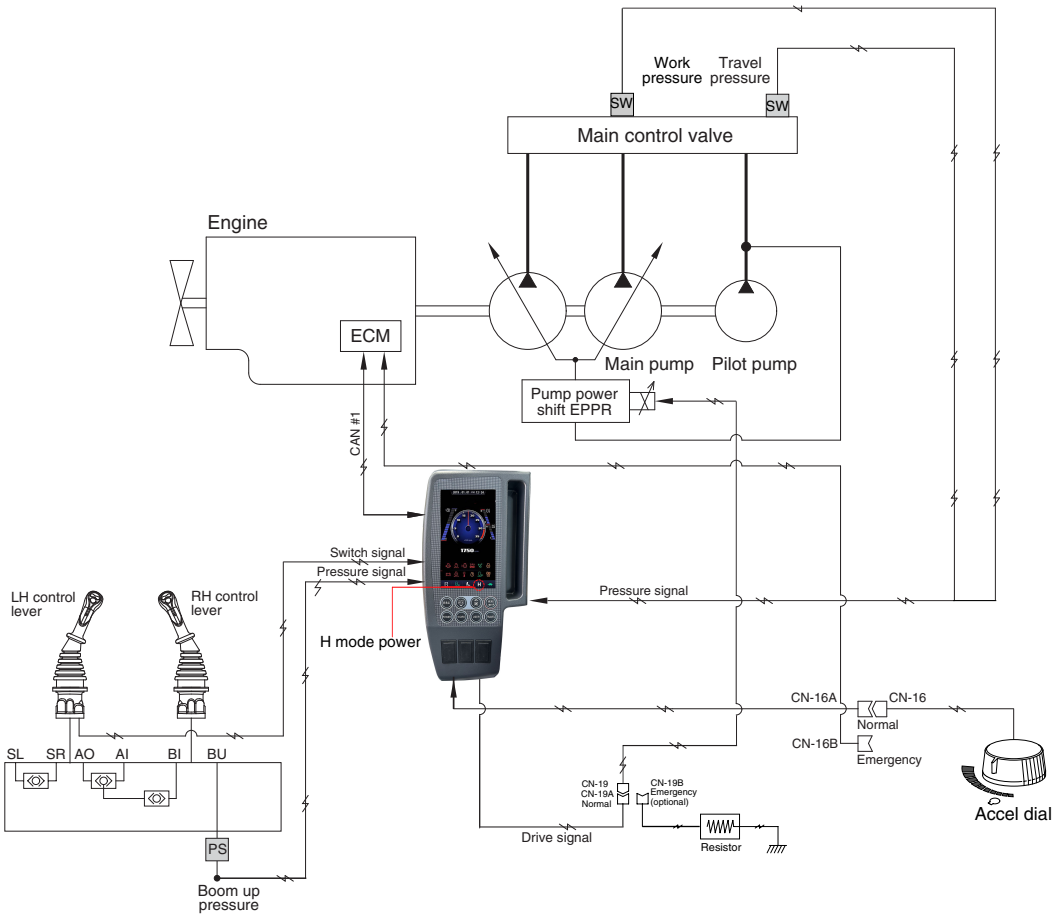


1. If the engine coolant temperature or the hydraulic oil temperature is overheated over 105˚C, the warning lamp is ON and the pump input torque or the engine speed is reduced as below logic table.

2. LOGIC TABLE

Description		Condition	Function
First step warning	Activated	- Coolant or hydraulic oil temperature : Above 100˚C	- Warning lamp buzzer : ON - Pump absorption torque is reduced.
	Canceled	- Coolant or hydraulic oil temperature : Less than 95˚C	- Return to pre-set the pump absorption torque.
Second step warning	Activated	- Coolant or hydraulic oil temperature : Above 105˚C	- Emergency warning lamp pops up on the center of LCD and the buzzer sounds. - Engine speed is reduced after 10 seconds.
	Canceled	- Coolant or hydraulic oil temperature : Less than 101˚C	- Return to pre-set the engine speed. - Hold pump absorption torque on the first step warning.

GROUP 7 VARIABLE POWER CONTROL SYSTEM

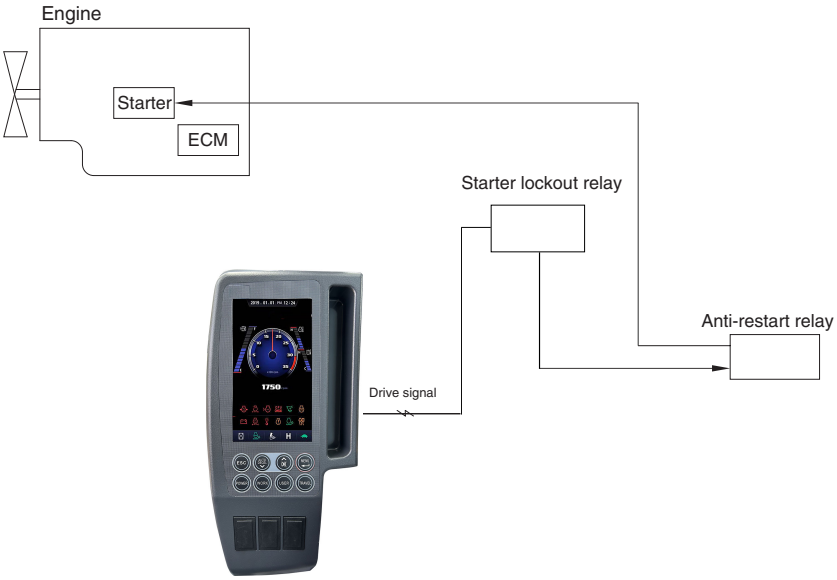


· The variable power control system controls the engine and pump mutual power according to RCV lever stroke and pump load.
It makes fuel saving and smooth control at precise work.

Description	Working condition
Power mode	M , H , S
Work mode	General (bucket)
Pressure sensor	Normal

※ The variable power control function can be activated when the power mode is set to S mode.

GROUP 8 ANTI-RESTART SYSTEM



1. ANTI-RESTART FUNCTION

After a few seconds from the engine starts to run, CMCU turns off the Anti-restart relay to protect the starter from inadvertent restarting.

GROUP 9 SELF-DIAGNOSTIC SYSTEM

1. OUTLINE

When any abnormality occurs in the Advanced CAPO system caused by electric parts malfunction and by open or short circuit, the CMCU diagnoses the problem, make warning lamp blink, the buzzer beep or sends the error codes to the cluster and also stores them in the memory.

2. MONITORING

1) Current Error

· The active faults of the CMCU can be checked by this menu.

2) Recorded Error

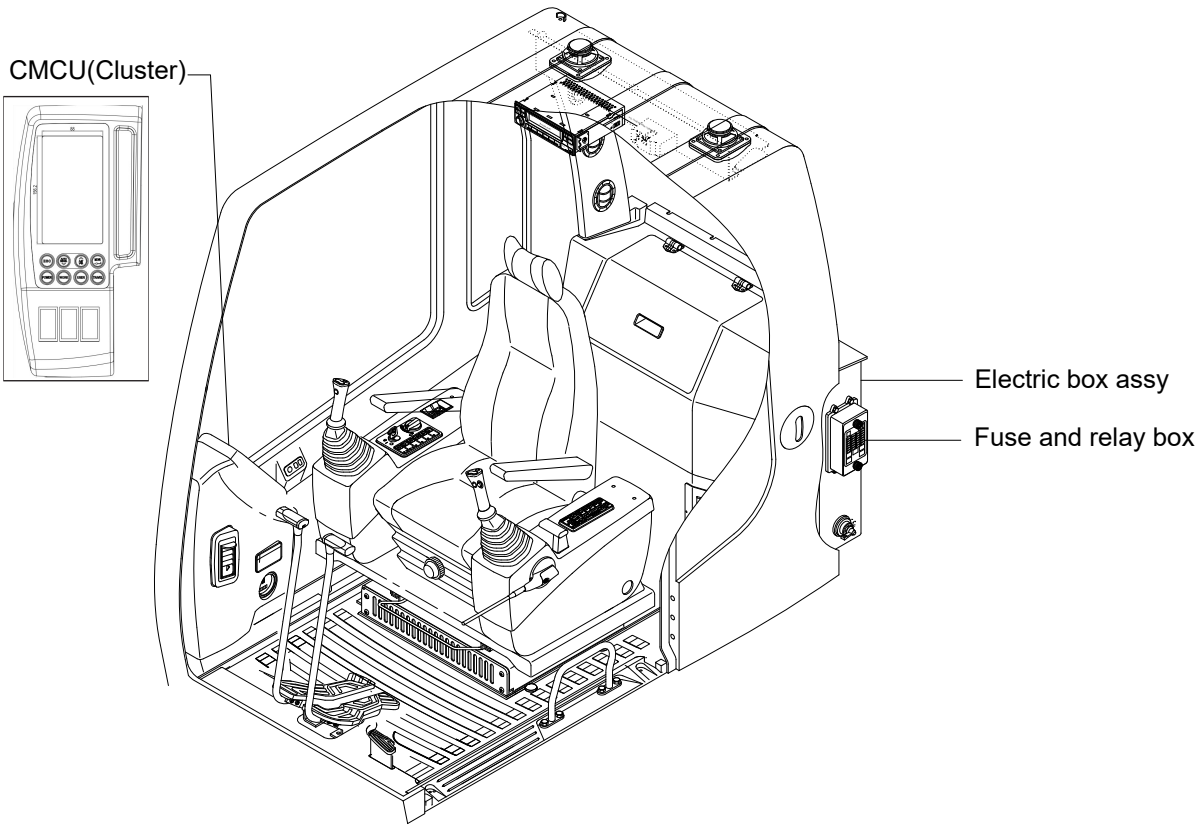
· The recorded error of the CMCU can be checked by this menu.

3. MACHINE ERROR CODES TABLE

FAULT CODE	SPN	FMI	SPN-FMI Description
1	341	6	Motor Driving Status for Engine Governor Actuator - Current Above Normal Or Grounded Circuit
2	340	3	Potentiometer Voltage for Engine Governor Actuator - Voltage Above Normal, Or Shorted To High Source
3	140	6	Main Pump EPPR Valve Current - Current Above Normal Or Grounded Circuit
5	167	6	Travel Speed Solenoid - Voltage Below Normal, Or Shorted To Low Source
10	701	3	Hour-Meter - Voltage Below Normal, Or Shorted To Low Source
11	714	3	Acceleration Dial Voltage - Voltage Above Normal, Or Shorted To High Source
12	120	0	Main Pump 1(P1) Pressure - Data Valid But Above Normal Operational Range
13	121	0	Main Pump 2(P2) Pressure - Data Valid But Above Normal Operational Range
14	200	0	P1_P2_EPPR_VALVE_PRESSURE_MEASUREMENT
16	341	5	Motor Driving Status for Engine Governor Actuator - Current Below Normal Or Open Circuit
18	140	5	Main Pump EPPR Valve Current - Current Below Normal Or Open Circuit
20	167	4	Travel Speed Solenoid - Voltage Below Normal, Or Shorted To Low Source
25	701	4	Hour-Meter - Voltage Below Normal, Or Shorted To Low Source
26	714	4	Acceleration Dial Voltage - Voltage Below Normal, Or Shorted To Low Source
27	120	4	Main Pump 1(P1) Pressure - Voltage Below Normal, Or Shorted To Low Source
28	121	4	Main Pump 2(P2) Pressure - Voltage Below Normal, Or Shorted To Low Source
29	200	4	P1 & P2 EPPR Valve Pressure (Measurement) - Voltage Below Normal, Or Shorted To Low Source
32	722	4	Travel Alarm Buzzer - Voltage Below Normal, Or Shorted To Low Source
33	707	1	Alternator Voltage - Data Valid But Below Normal Operational Range
34	705	1	(MCU Input)Battery Voltage - Data Valid But Below Normal Operational Range
35	705	0	(MCU Input)Battery Voltage - Data Valid But Above Normal Operational Range
36	840	2	Cluster Communication Status - Data Erratic, Intermittent Or Incorrect
38	327	6	Anti-Restart Relay - Current Above Normal Or Grounded Circuit
41	101	4	Hydraulic Oil Temperature - Voltage Below Normal, Or Shorted To Low Source
42	301	4	Fuel Level - Voltage Below Normal, Or Shorted To Low Source
44	127	0	Boom Up Pilot Pressure - Data Valid But Above Normal Operational Range
45	101	3	Hydraulic Oil Temperature - Voltage Above Normal, Or Shorted To High Source
46	301	3	Fuel Level - Voltage Above Normal, Or Shorted To High Source
48	127	4	Boom Up Pilot Pressure - Voltage Below Normal, Or Shorted To Low Sourc
56	722	6	Travel Alarm Buzzer Current Above Normal Or Grounded Circuit
72	841	2	ECM Communication Status - Data Erratic, Intermittent Or Incorrect

Some error codes are not applied to this machine

1.CMCU(cluster&machine control unit integration)



2. CMCU ASSEMBLY

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

GROUP 11 EPPR VALVE

1. PUMP EPPR VALVE

1) COMPOSITION

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

(1) Electro magnet valve

Receive electric current from CMCU 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 main pump flow.
When the electro magnet valve is activated, pilot pressure enters into flow regulator of main pump.

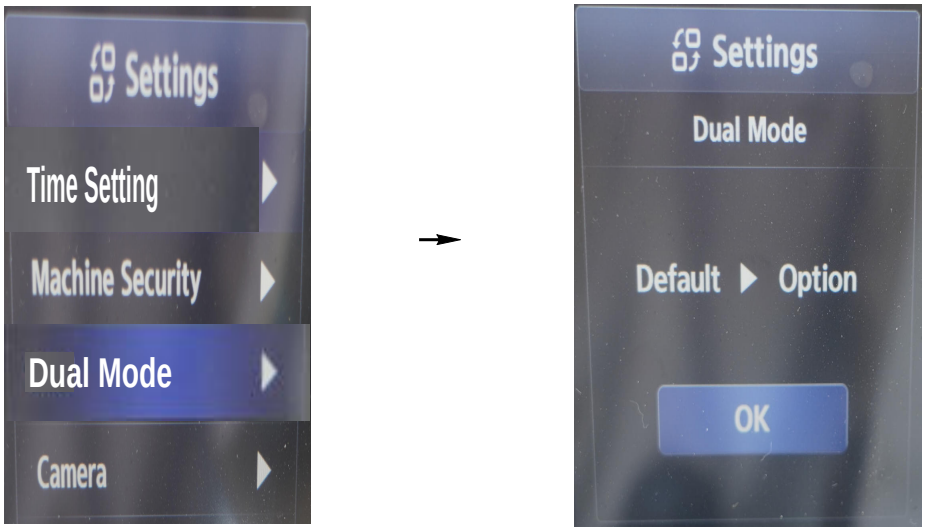
(3) Pressure and electric current value for each mode

Mode		Pressure kgf/cm²	Electric current (mA)	Engine rpm (at accel dial 10)
Standard (Stage : 1.0)	M	10(~3)	—	1900 ± 50
	H	12(~5)	—	1800 ± 50
	S	15(~8)	—	1700 ± 50
Option (Stage : 2.0)	M	8 (~3)	—	1950 ± 50
	H	10(~5)	—	1850 ± 50
	S	13(~8)	—	1750 ± 50

2) HOW TO SWITCH THE STAGE (1.0↔2.0) ON THE CLUSTER

You can switch the EPPR valve pressure set by selecting the stage (1.0↔2.0).

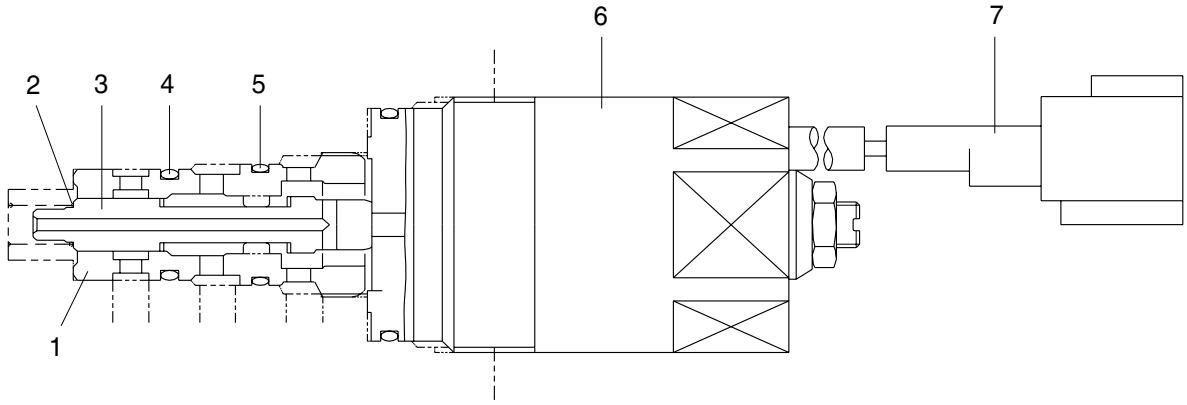
- Settings
  · Dual mode



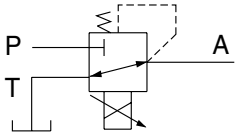
· You can change the mode of the device.

3) OPERATING PRINCIPLE

(1) Structure (pump EPPR valve)



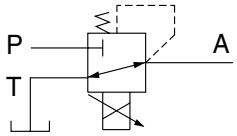
1	Sleeve	4	O-ring	6	Solenoid valve
2	Spring	5	O-ring	7	Connector
3	Spool				

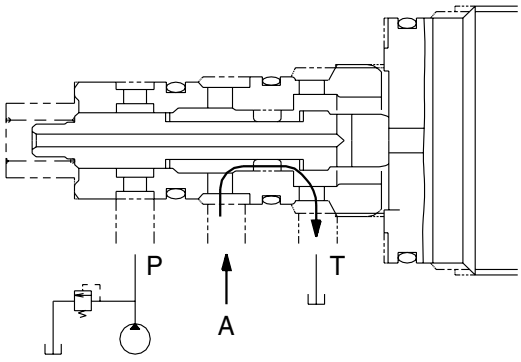


P Pilot oil supply line (pilot pressure)
T Return to tank
A Secondary pressure to flow regulator at main pump

(2) Neutral

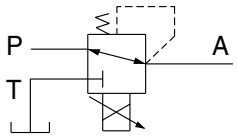
Pressure line is blocked and A oil returns to tank.

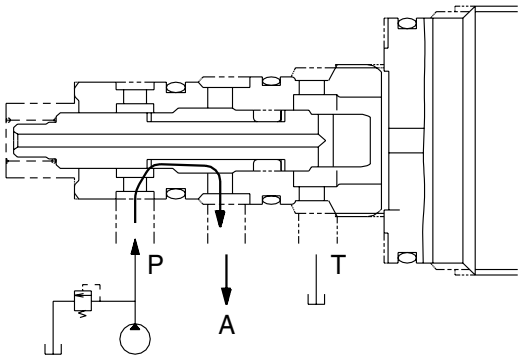




(3) Operating

Secondary pressure enters into A.





4) EPPR VALVE CHECK PROCEDURE

(1) Check electric current value at EPPR valve

① Disconnect connector CN-75 from EPPR valve.

② Insert the adapter to CN-75 and install multimeter as figure.

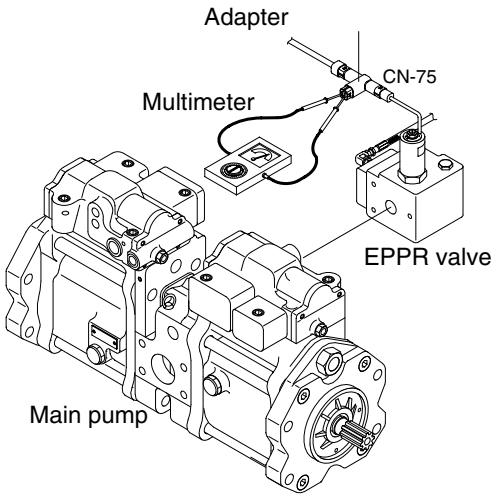
③ Start engine.

④ Set power mode and cancel auto decel mode.
· Choise : H-mode

⑤ Position the accel dial at 10.

⑥ If rpm display show approx 1800±50 rpm check electric current at bucket circuit relief position.

Spec : 100~700 mA



(2) Check pressure at EPPR valve

① Remove plug and connect pressure gauge as figure.
· Gauge capacity : 0 to 50 kgf/cm² (0 to 725 psi)

② Start engine.

③ Set power mode and cancel auto decel mode.
· Choise : H-mode

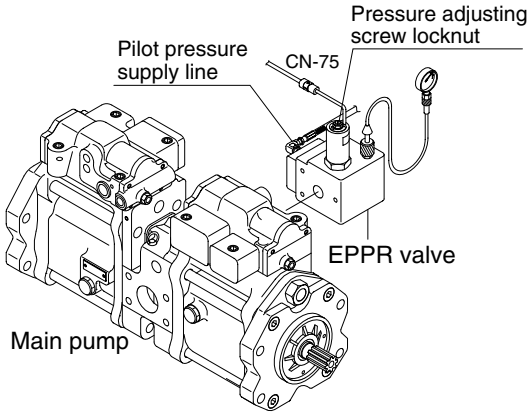
④ Position the accel dial at 10.

⑤ If rpm display approx 1800±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.

Spec : 2~40 kgf/cm² (30~580 psi)



GROUP 12 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(CMCU)

1) MONITOR PANEL

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

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

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 5 seconds : Indicate cluster version and machine condition

a. Cluster program version : 「1.00 」← Indicates program version 「1.00 」for 5 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.

③ Indicating lamp state

a. Work mode selection : General work
b. Power mode selection : H mode
c. User mode selection : No LED ON
d. Auto decel LED : ON
e. Travel speed pilot lamp : Low(Turttle)

(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 : H mode
e. User mode selection : No LED ON
f. Auto decel LED : ON
g. Travel speed pilot lamp : Low(Turttle)

② When warming up operation

a. Warming up lamp : ON
b. 10 seconds after engine started, engine speed increases to1000 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

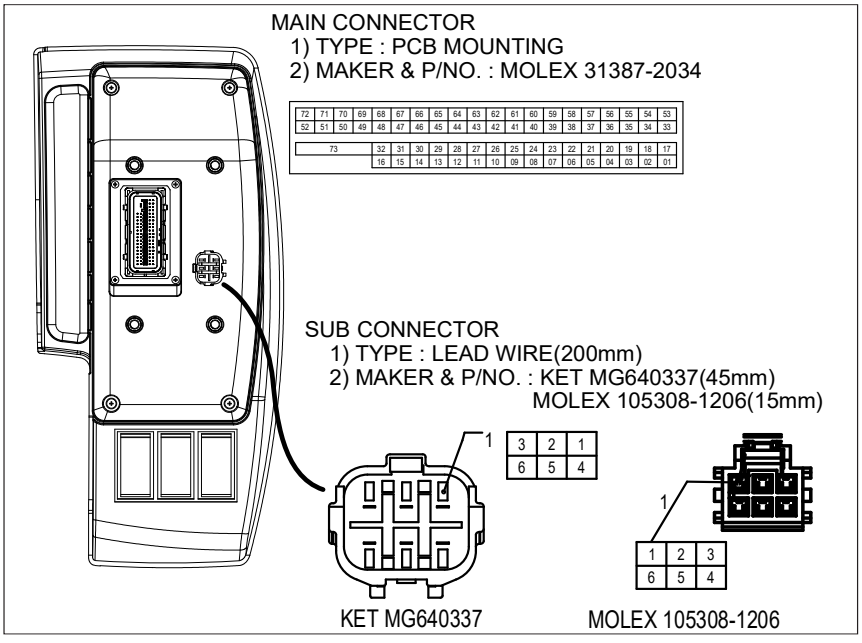
(1) MAIN CONNECTOR

NO	PIN NAME	APPLY	SPEC
1	DOUT_LOW5	X	
2	DOUT_LOW4	OK	Travel Buzzer, ON : 0~2V, OFF : 20~32V
3	GND	OK	MAIN GND
4	HOUR METER	OK	ON : 0V, OFF : 20~32V
5	GND	OK	RS232 GND
6	RS232C_TX1	OK	RS232 TX1(FW Download용)
7	RS232C_RX1	OK	RS232 RX1(FW Download용)
8	GND	OK	MAIN GND
9	NC	X	
10	GND	OK	MIAN GND
11	FW_DUMP	X	FW Download용
12	MOTOR_P	X	Accel Actuator+, 구동 : 20~24V, 정지 : 0V
13	EPPR_N02	X	BOOM DOWN EPPR-, 140~800mA
14	GND	OK	MAIN GND
15	V_EPPR2	X	EPPR POWER 20~32V
16	DOUT_LOW3	OK	Travel Speed SOL, ON : 0~2V, OFF : 20~32V
17	DOUT_LOW2	OK	ANTI Restart Relay, ON : 0~2V, OFF : 20~32V
18	DOUT_LOW1	OK	Fuel Warmer Relay, ON : 0~2V, OFF : 20~32V
19	GND	OK	MAIN GND
20	GND	OK	MAIN GND
21	NC	X	
22	NC	X	
23	GND	OK	CAN GND Shiled
24	CAN1_LOW	OK	CAN1 LOW
25	CAN1_HIGH	OK	CAN1 HIGH
26	GND	OK	Pressure Sensor GND
27	V_PRESS SENSOR	OK	Pressure Sensor Power(24V OUT)
28	MOTOR_N(not use)	X	Accel Actuator-, 구동 : 20~24V, 정지 : 0V
29	EPPR_N01	OK	Pump EPPR-, 140~800mA
30	GND	OK	MAIN GND
31	V_EPPR1	OK	EPPR POWER(Pump EPPR+) 20~32V
32	NC	X	
33	GND	OK	MAIN GND
34	DIN10	X	
35	DIN9	X	
36	DIN8	X	
37	DIN7	OK	Working PS, ON : 0~1V, OFF : 4~5V

NO	PIN NAME	APPLY	SPEC
38	DIN6	OK	Air Clean SW, ON : 0~1V, OFF : 4~5V
39	GND	OK	Digital input GND
40	AIN10	X	
41	AIN9	X	
42	AIN8	X	
43	AIN7	X	
44	AIN6	OK	Boom Up Pilot Press, 1~5V
45	AIN RES TEMP1	X	Cooling Water
46	AIN RES FUEL	OK	Fuel Sensor SIG, 50~700 ohm
47	GND	OK	Sensor GND
48	GND	OK	Alternator GND
49	GND	OK	BAT GND
50	GND	OK	BAT GND
51	GND	OK	BAT GND
52	GND	OK	BAT GND
53	DIN_PULSE(not use)	X	TACHO SIG
54	DIN5	OK	Overload PS SW, ON : 0~1V, OFF : 4~5V
55	DIN4	OK	One Touch Decel SW, ON : 0~1V, OFF : 4~5V
56	DIN3	OK	Travel OIL PS SW, ON : 0~1V, OFF : 4~5V
57	DIN2	OK	Travel alarm SW, ON : 0~1V, OFF : 4~5V
58	DIN1	X	Power MAX SW, ON : 0~1V, OFF : 4~5V
59	GND	OK	Analog input GND
60	AIN5	OK	Negative1 Press, 1~5V
61	AIN4	OK	Accel Dial SIG, 0.5V~4.5V
62	AIN3	OK	P3 Press SIG(Pump EEPR Press), 1~5V
63	AIN2	OK	P2 Press SIG, 1~5V
64	AIN1	OK	P1 Press SIG, 1~5V
65	GND	OK	Sensor Temp GND
66	AIN RES TEMP2	OK	Hydraulic Fluid, 50 ohm~30k ohm
67	AIN_ALT	OK	Alternator SIG(20~32V)
68	GND	OK	Sensor GND
69	5V OUT	OK	5V(POT&DIAL) (4.9~5.1V)
70	10V_OUT(not use)	X	
71	GND	OK	GND
72	IGN	OK	Ignition (ON : 20~32V, OFF : 0~2V)
73	E_VBAT	OK	Battery Power(20~32V)

(2) SUB CONNECTOR

NO	PIN NAME	APPLY	WIRE SPEC		
			COLOR	TYPE	SIZE[mm²]
1	RMCU BATTERY POWER	X	RED	FLRY-B	0.5
2	CAN 2 HIGH	◎	YELLOW / WHITE	FLRY-B	0.5
3	CAN 2 LOW	◎	GREEN / WHITE	FLRY-B	0.5
4	NC	-	-	-	-
5	RMCU IG POWER	X	RED / WHITE	FLRY-B	0.5
6	GROUND	X	BLACK	FLRY-B	0.5

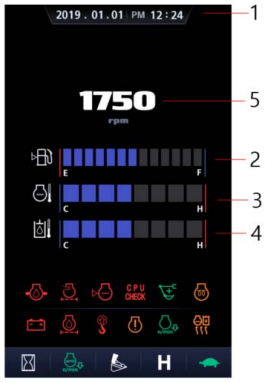


4) GAUGE

(1) Operation screen

Default screen (A Type)

Option screen(B Ttype)



1 Time display

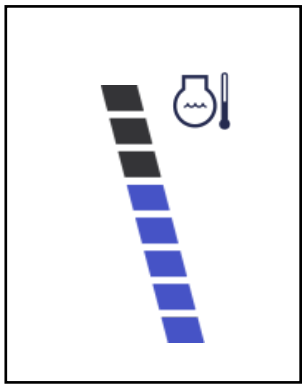
2 Fuel level guage

3 Engine coolant temperature gauge

4 Hydraulic temerature gauge

5 Engine speed(rpm)

(2) Engine coolant temperature gauge



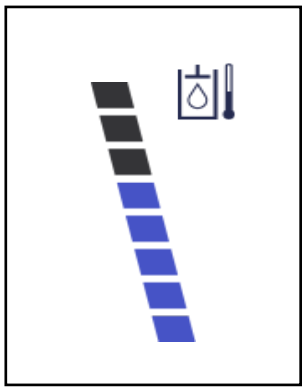
① This gauge indicates the temperature of coolant in 9 step guage

- 0 step: Below 30°C (86°F)
- 1 ~ 7step: 30–104°C (86–219°F)
- 8 step: Above 104°C (219°F)

② When the warning light flashes red, do not immediately extinguish the engine, keep running at intermediate speed,gradually cool and then turn off.

※ If the engine is shut down without sufficient cooling, the temperature of the engine will rise sharply, this can lead to problems with parts inside the engine.

(3) Hydraulic oil temperature gauge



① This gauge indicates the temperature of hydraulic oil in 9 step guage

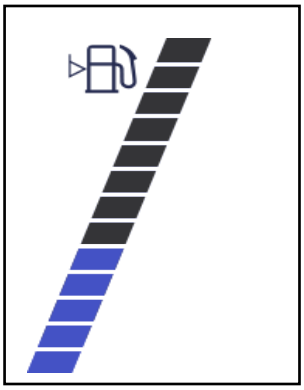
- 0 step: Below 30°C (86°F)
- 1 ~ 7step: 30–104°C (86–219°F)
- 8 step: Above 104°C (219°F)

② The gauge between 1st and 7th steps illuminates when operating.

③ Keep idling engine at low speed until the gauge between 1nd and 7th steps illuminates, before operation of machine.

④ When the gauge of 8th steps illuminates,reduce the load on the system. If the gauge stays in the8 steps, stop the machine and check the cause of the problem.

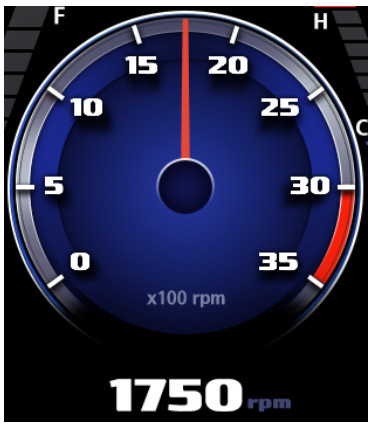
(4) Fuel level gauge



① This gauge indicates the amount of fuel in the fuel tank.

② Fill the fuel when the 1st step or fuel icon blinks in red.

(5) RPM

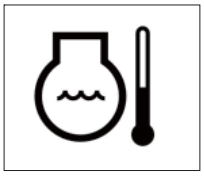


① This displays the round speed of engine

5) WARNING LAMPS

※ The warming 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 warming lamp lights until the problem is cleared.

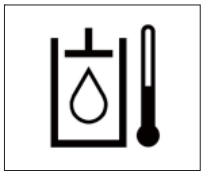
(1) Engine coolant temperature



① The lamp is ON and the buzzer sounds when the cooling water temperature is over the reference temperature (105°C)

② Check the cooling system when the lamp keeps ON.

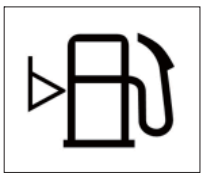
(2) Hydraulic oil temperature



① The lamp is ON and the buzzer sounds when the cooling water temperature is over the reference temperature (105°C)

② Check the cooling water level if this warning lamp is ON.

(3) Fuel level



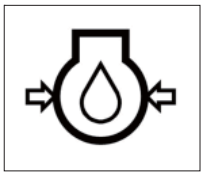
① This warning lamp pops up and the buzzer sounds when the level of fuel is below 31 ℓ (8.2 U.S. gal).

② Fill the fuel immediately when the lamp blinks.

(4) Check engine warning lamp

① This lamp blinks and the buzzer sounds when the communication between CPU controller and ECU on the engine is abnormal, or if any fault code received from ECU.
② Check the communication line between them.
If the communication line is OK, then check the fault code on the cluster

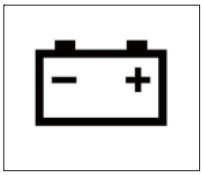
(5) Engine oil pressure warning lamp



① This warning lamp pops up and the buzzer sounds when the engine oil pressure is low.

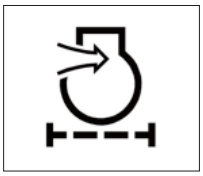
② If the lamp blinks, shut OFF the engine immediately. Check oil level.

(6) Battery charging warning lamp



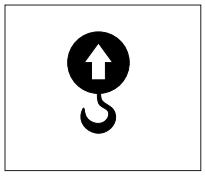
① This lamp blinks when the battery charging voltage is low.
② Check the battery charging circuit when this lamp blinks.

(7) Air cleaner warning lamp



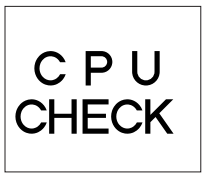
① This warning lamp pops up and the buzzer sounds when the filter of air cleaner is clogged.
② Check the filter and clean or replace it.

(8) Overload warning lamp (opt)



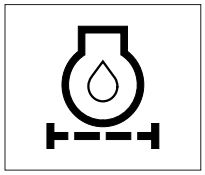
① When the machine is overload, the overload warning lamp blinks during the overload switch is ON. (if equipped)
② Reduce the machine load.

(9) CPU check warning lamp



① If any fault code is received from CPU controller, this lamp blinks and the buzzer sounds.
② Check the communication line between CPU controller and cluster.

(10) Engine oil filter clogged warning lamp



① This warning lamp pops up and the buzzer sounds when the engine oil filter is clogged.
② Check the filter and clean or replace it.

6) PILOT LAMPS

(1) Mode pilot lamps

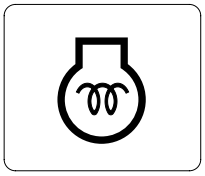
No	Mode	Pilot lamp	Selected mode
1	Power mode	M	Max power mode
		H	High power mode
		S	Standard power mode
2	User mode	U	User preferable power mode
3	Work mode		General operation mode
			Heavy duty work mode
4	Travel mode		Low speed traveling
			High speed traveling
5	Auto idle mode		Auto idle

(2) Power boost pilot lamp

① The lamp will be ON when pushing power max switch on the LH RCV lever.

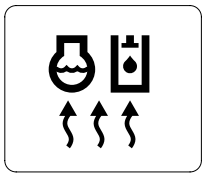
② The power max function operates for a max period of 8 seconds.

(3) Preheat pilot lamp



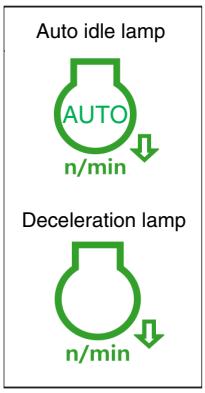
① Turning the start key switch ON position starts preheating in cold weather.
② Start the engine after this lamp is OFF.

(4) Warming up pilot lamp



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 the engine.

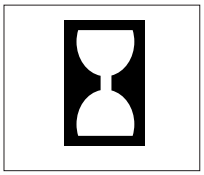
(5) Auto idle status/ Deceleration lamp



① The auto idle mode pilot lamp will light up when the Auto idle function is selected.
② a. Operating one touch decel switch on the RCV lever makes the Deceleration lamp ON.
b. When the Auto idle funciton is selected, and all levers and pedals are in the neutral position, the Auto idle lamp and Deceleration lamp will be ON.
③ One of the lever or pedal is operated, the Deceleration lamp will go OFF and the engine speed returns to the previous conditions.

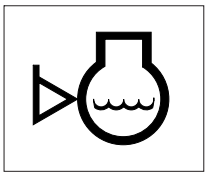
※ **One touch decel is not available when the auto idle pilot lamp is turned ON.**

(6) Engine run status indicated lamp



① This lamp indicated engine status.
When the engine and hour meter is running,this lamp is turn ON.

(7) Coolant level warning lamp

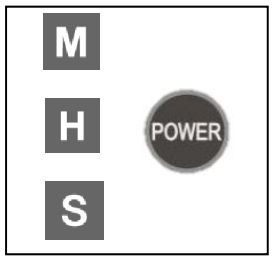


① This warning lamp indicates lack of coolant.
② Check and refill coolant.

7) SWITCHES

※ **When the switches are selected, the pilot lamps are displayed on the LCD.**

(1) Power mode switch



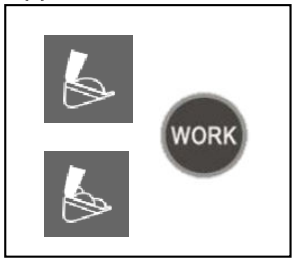
① This switch is to select the machine power mode,and select power mode pilot lamp is display on the position.

· M : Max power mode

· H : High power mode

· S : Standard power mode

(2) Work mode switch



① This switch is to select the machine work mode, which shifts from general operation mode to optional attachment operation mode

: General operation mode

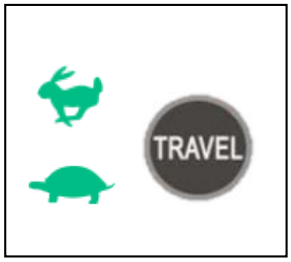
: Heavy duty work mode

(3) User mode switch

① This Switch select User Mode

.

(4) Travel speed control switch



① This switch is used to select the travel speed alternat ively.

· : High speed

· : Low speed

(5) Auto idle switch

① This switch is used to activate or cancel the auto idle function when all levers and pedals are in a nautral position,automatically reduces engine speed and saves fuel .

· Pilot lamp ON : Auto idle function is activated.

· Pilot lamp OFF : Auto idle function is cancelled.

(6) Buzzer stop switch

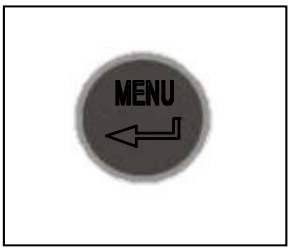
① This switch is used to turn off the buzzer. The buzzer buzzes 2 seconds after the start switch is first turned on,stopping is a normal phenomenon

② When something goes wrong with the equipment, the red light goes on and the buzzer goes off. It can be opened in this case the switch stops the buzze

(7) Escape switch

① This switch is used to return to the previous menu or parent menu.

(8) Menu switch



① This switch used to select the main menu and subordinate menu on the LCD

8) MAIN MENU

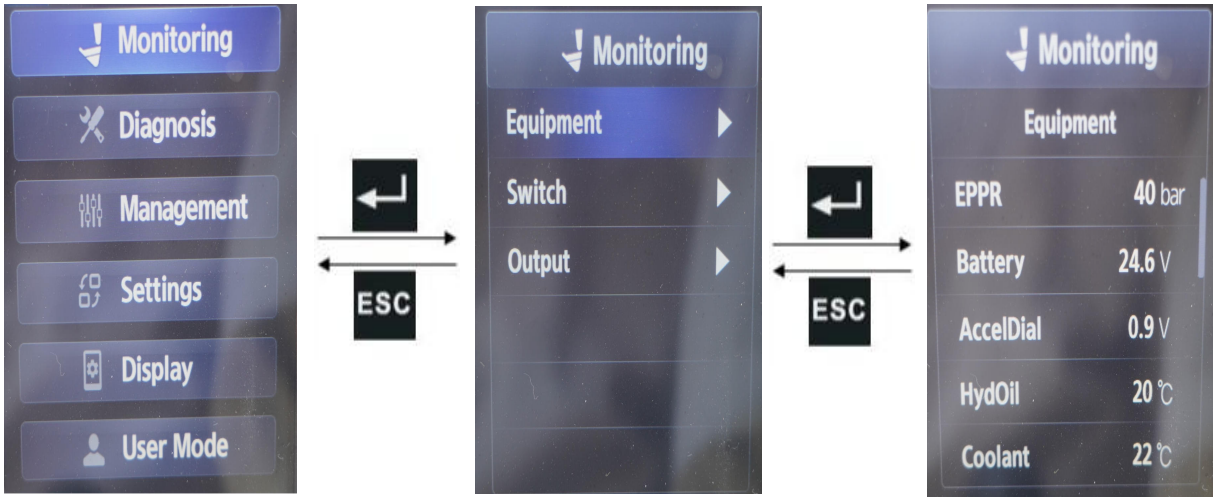
(1) Structure

NO	Main Menu	Sub Menu	Instructions
1	 Monitoring	Equipment Switch Output	Device information and status Switch state output state
2	 Diagnosis	Current Error Recorded Error	CMCU, engine ECM fault record confirmation and delete
3	 Management	Equipment maintenance	Change the exchange cycle of oil and filter element Initialization of service time
4	 Settings	Time Setting Machine Security Dual Mode Camera	Set time Set startup limits and change passwords Mode changes Camera Settings
5	 Display	Operation Skin Brighteness Language	Select boot Mode Set screen brightness Language Settings
6	 User Mode	User Mode Setting	Set engine high speed idling speed automatic decompression speed EPPR valve input current value

(2) Menu description

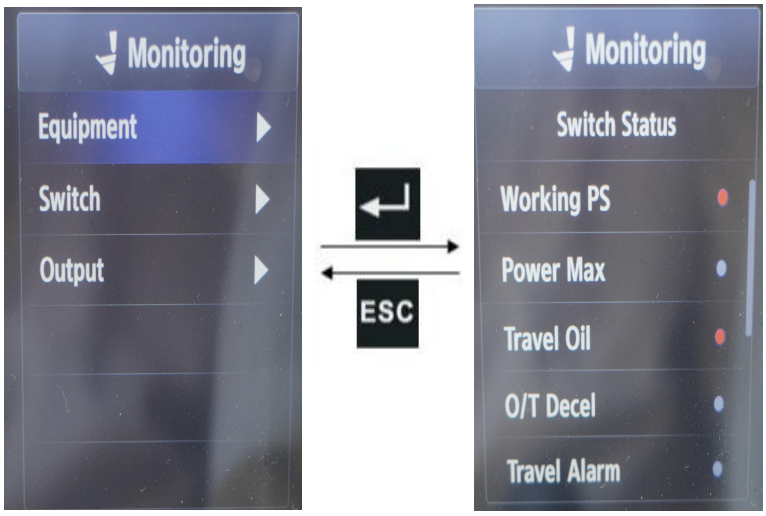
① Monitoring

a. Equipment



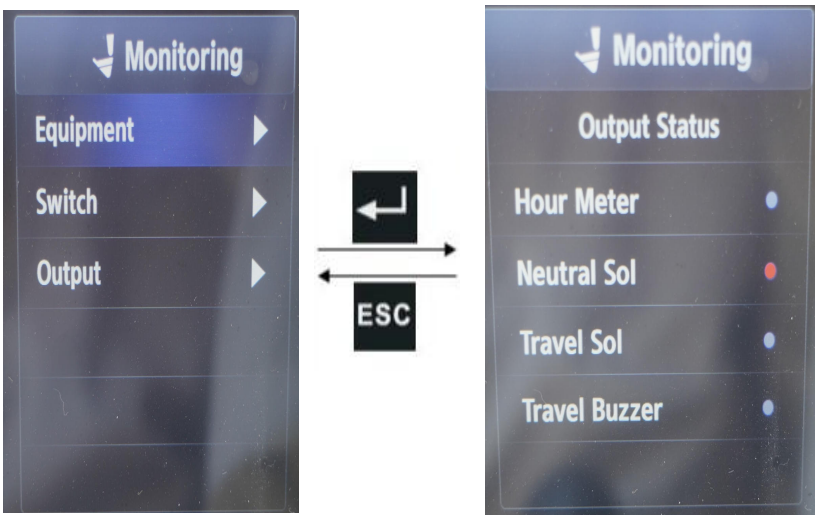
- Equipment status information.

b. Switch



- Switch status information.

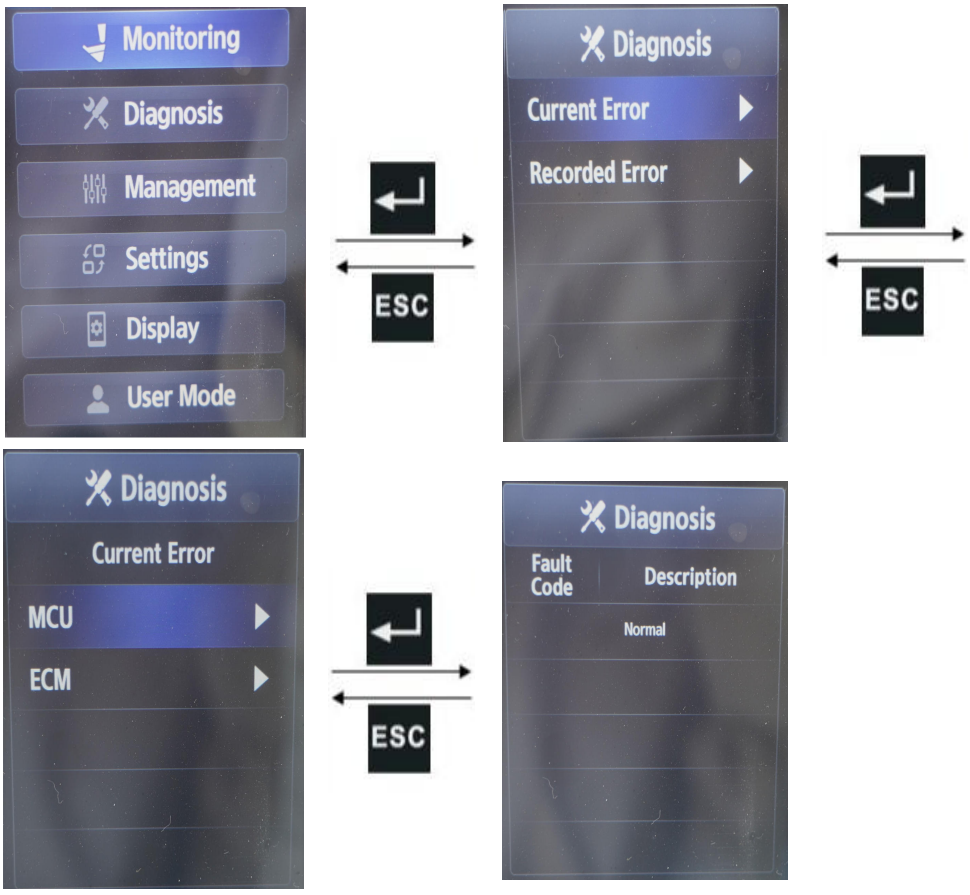
c.Output



- Output status information.

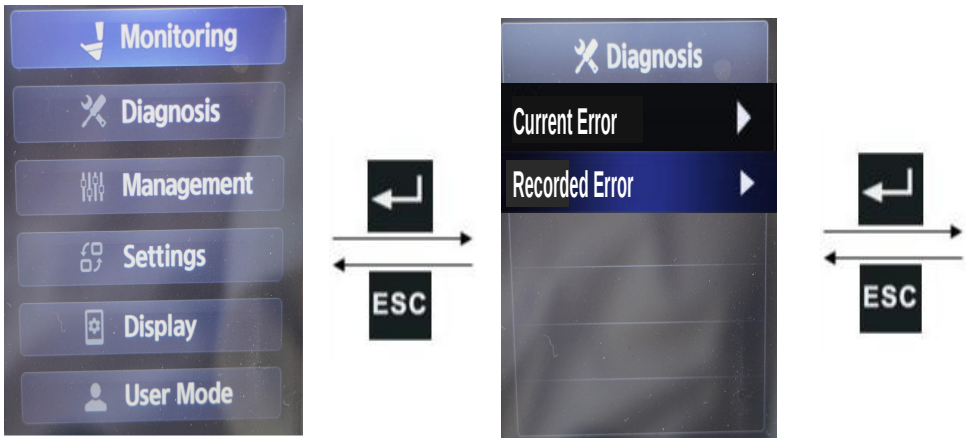
② Diagnosis

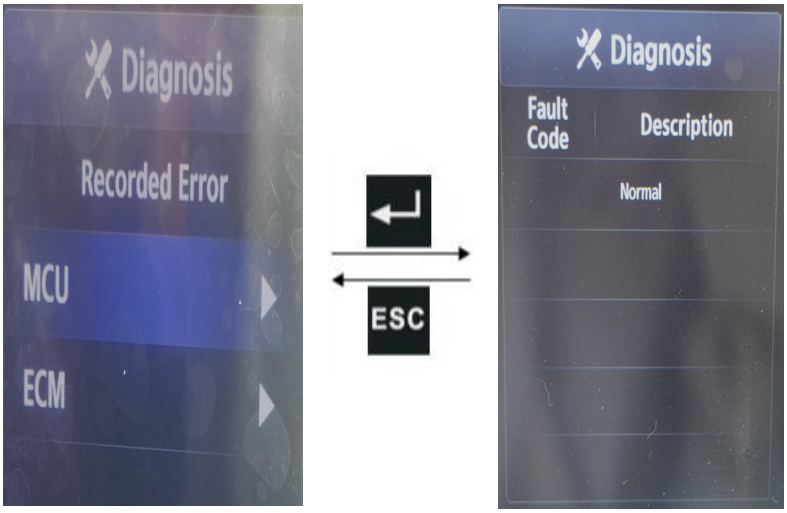
a. Current Error



- You can check for current CMCU or engine ECM failures.

b. Recorded Error





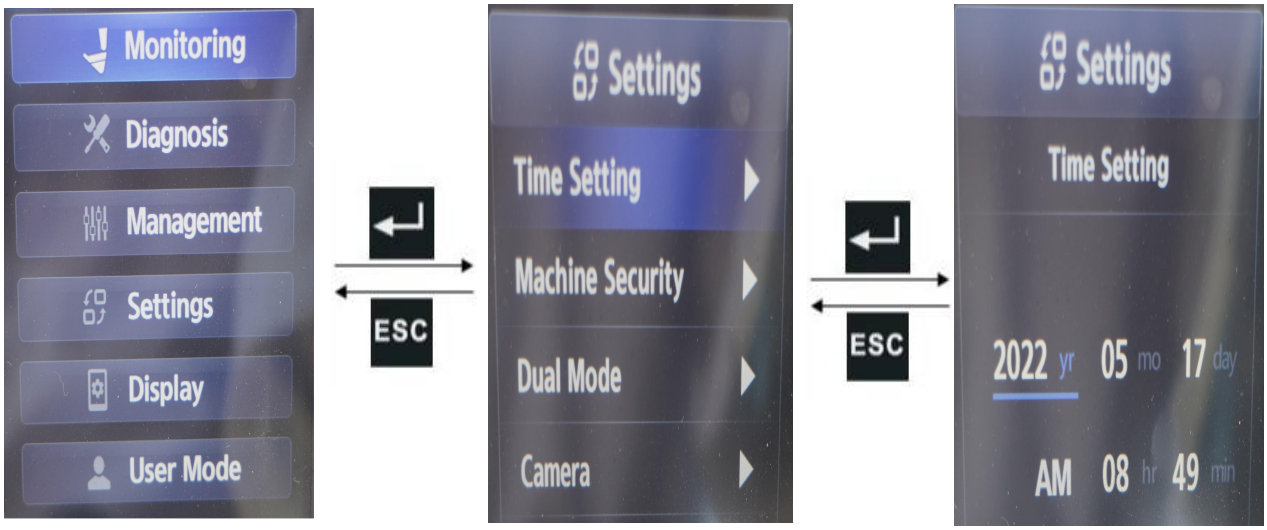
- You can check past CMCU or engine ECM failures.

(3). **Management**

- The exchange cycle and remaining time of consumables can be confirmed.
- Remaining time initialization: The remaining time can be initialized.
- Change the switching period: You can set the switching period.

(4).**Settings**

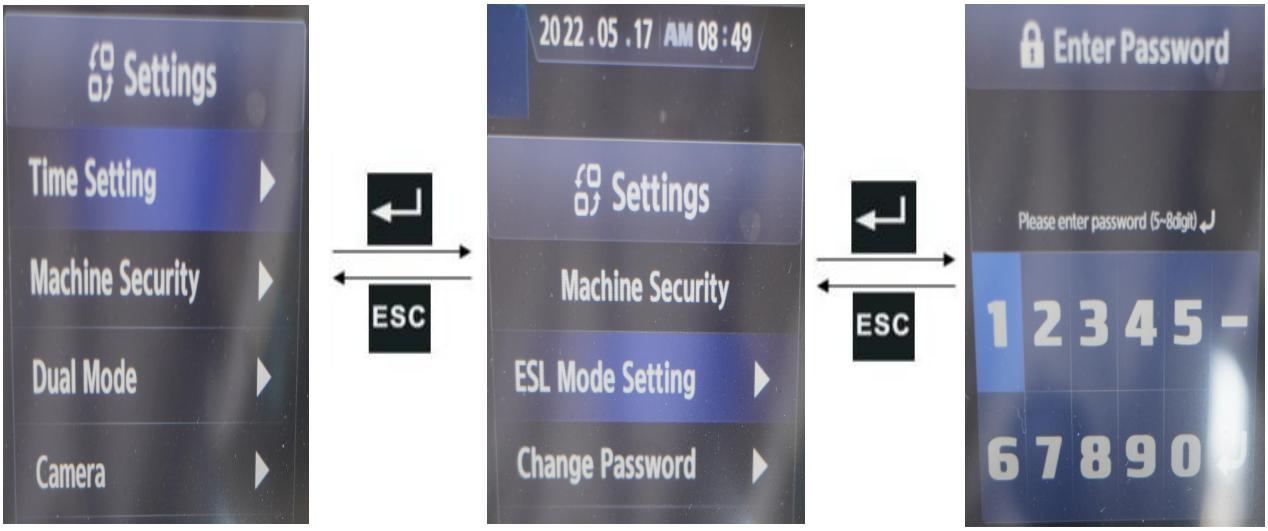
① Time Setting



- Year, month, day, hour, minute.

② Machine Security

a. **Set startup limits**

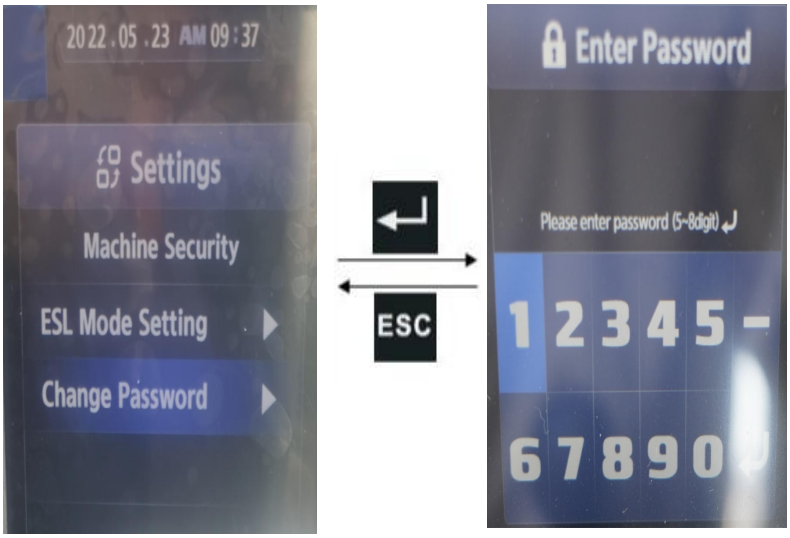


- Features to prevent theft and unauthorized device startup.

If you continue to select the start limit setting, ask for a password when the start switch is ON. :

- Disable setting does not use the function.
- When setting 'continue operation', the driver will ask for a password when starting the engine.
- The password is required when the driver starts the engine for the first time when the action is set after the specified time. No password is required for a restart during a cycle time. The maximum period can be set to 7 days.

b. **Change password**

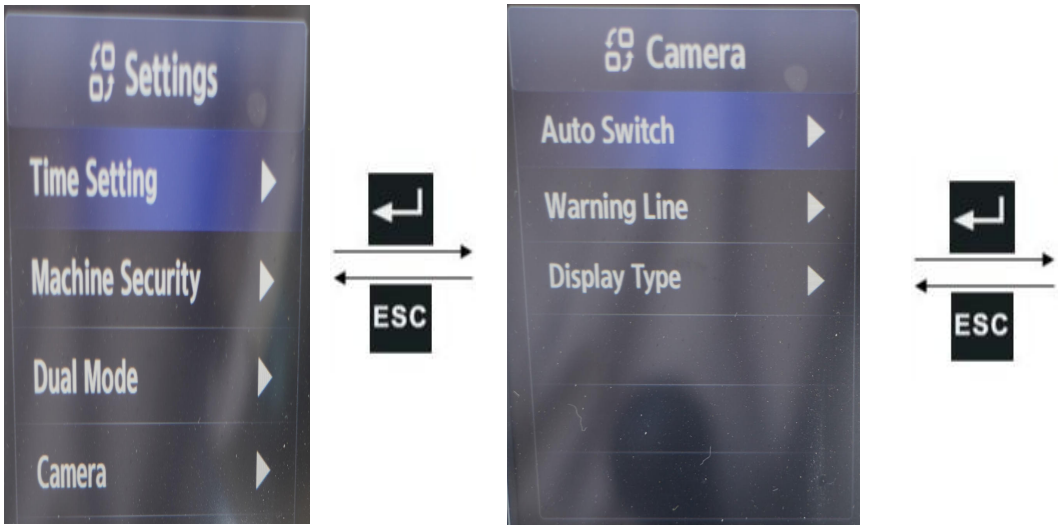


- The password is 5 to 8 digits. Enter the password and press ↵
- The initial password is 00000.

③ Dual Mode

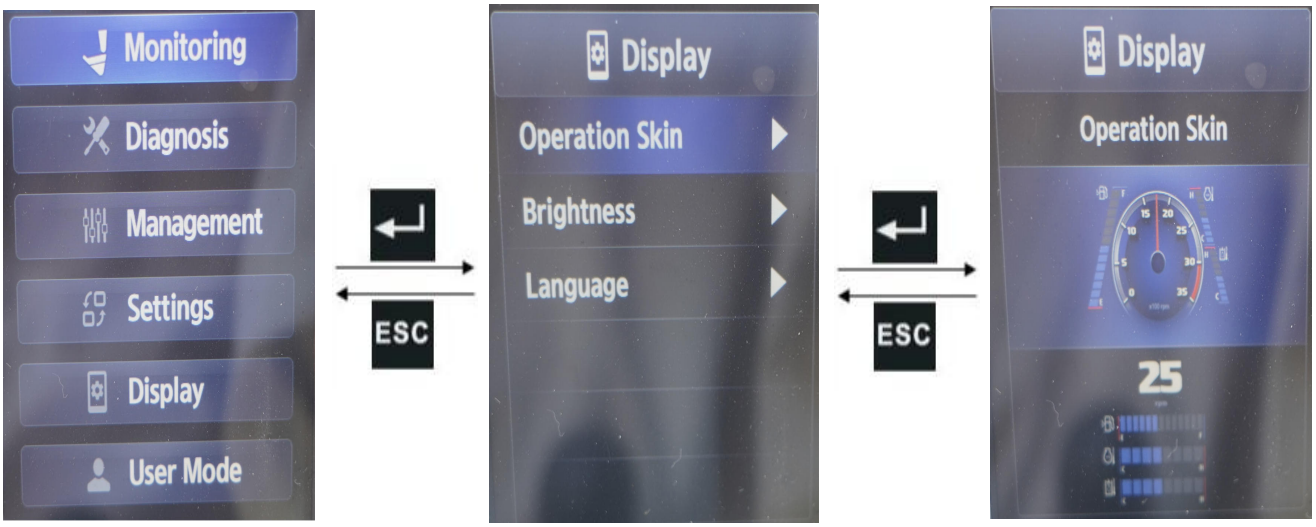
- You can change the mode of the device.

④ Camera



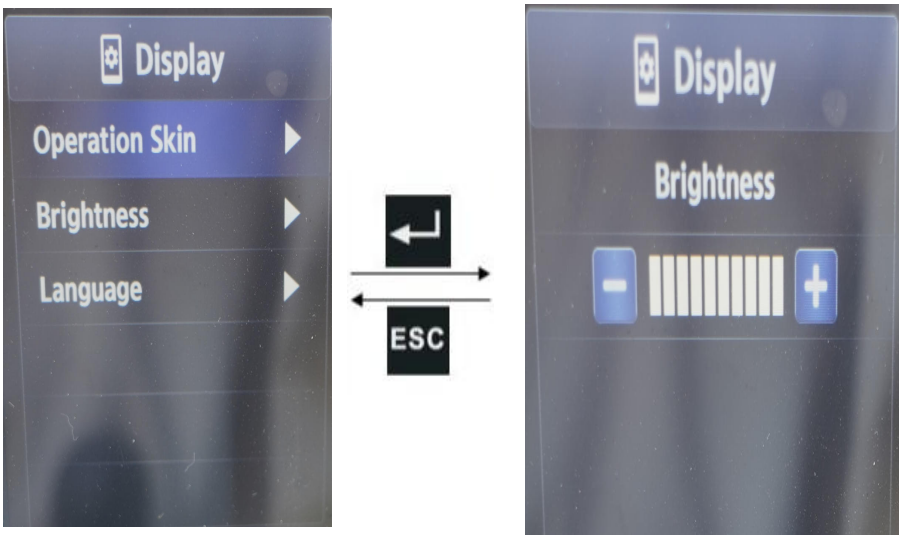
(5).**Display**

① Operation Skin



- You can set the screen type. (Analog/digital)

② Brighteness



- You can set the screen brightness.

③ Language

- You can select the language you want to use and all tags will be changed to the chosen language.

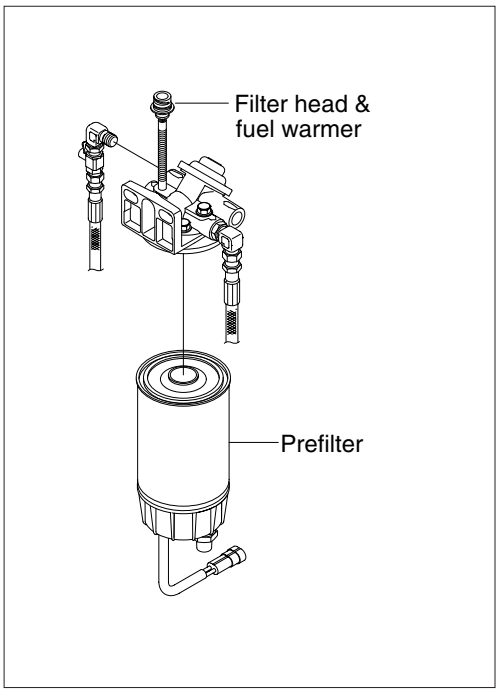
(6).**User Mode**

- You can set and store the values of engine high-speed idling RPM, autotorque reduction RPM and EPPR valve input current respectively in user mode (U).
- The menu is only accessible when user mode (U) is selected.

GROUP 13 FUEL WARMER SYSTEM

1. SPECIFICATION

1) Rated voltage : 24 V
2) Rated Power : 260 ±50 W



2. OPERATION

1) The current of fuel warmer system is automatically controlled without thermostat according to fuel temperature.
2) At the first state, the 15 A current flows to the fuel warmer and engine may be started in 1~2 minutes.
3) If the fuel starts to flow, ceramic-disk in the fuel warmer heater senses the fuel temperature to reduce the current as low as 1.5 A.
   So, fuel is protected from overheating by this mechanism.

3. ELECTRIC CIRCUIT