

## GROUP 9 SELF-DIAGNOSTIC SYSTEM (R450LC-7A up to #0117, R500LC-7A up to #0057)

### 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

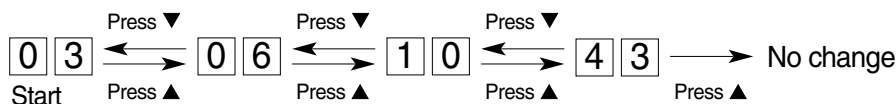
Co : Er & Buzzer sound

2) No problem

CHECK Er : 00

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

CHECK Er : 03

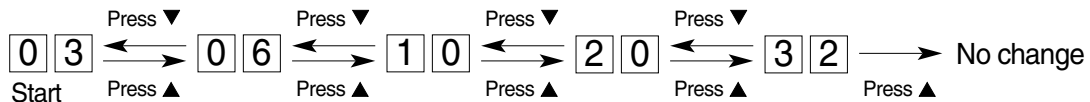


### 3. RECORDED ERROR DISPLAY

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 **☒** and **☑** 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. ECM FAULT CODES DISPLAY

If any fault code is received from ECM, cluster turns ON the "Engine check" and sound the buzzer.

The fault codes are displayed on the cluster as the same as current error display.

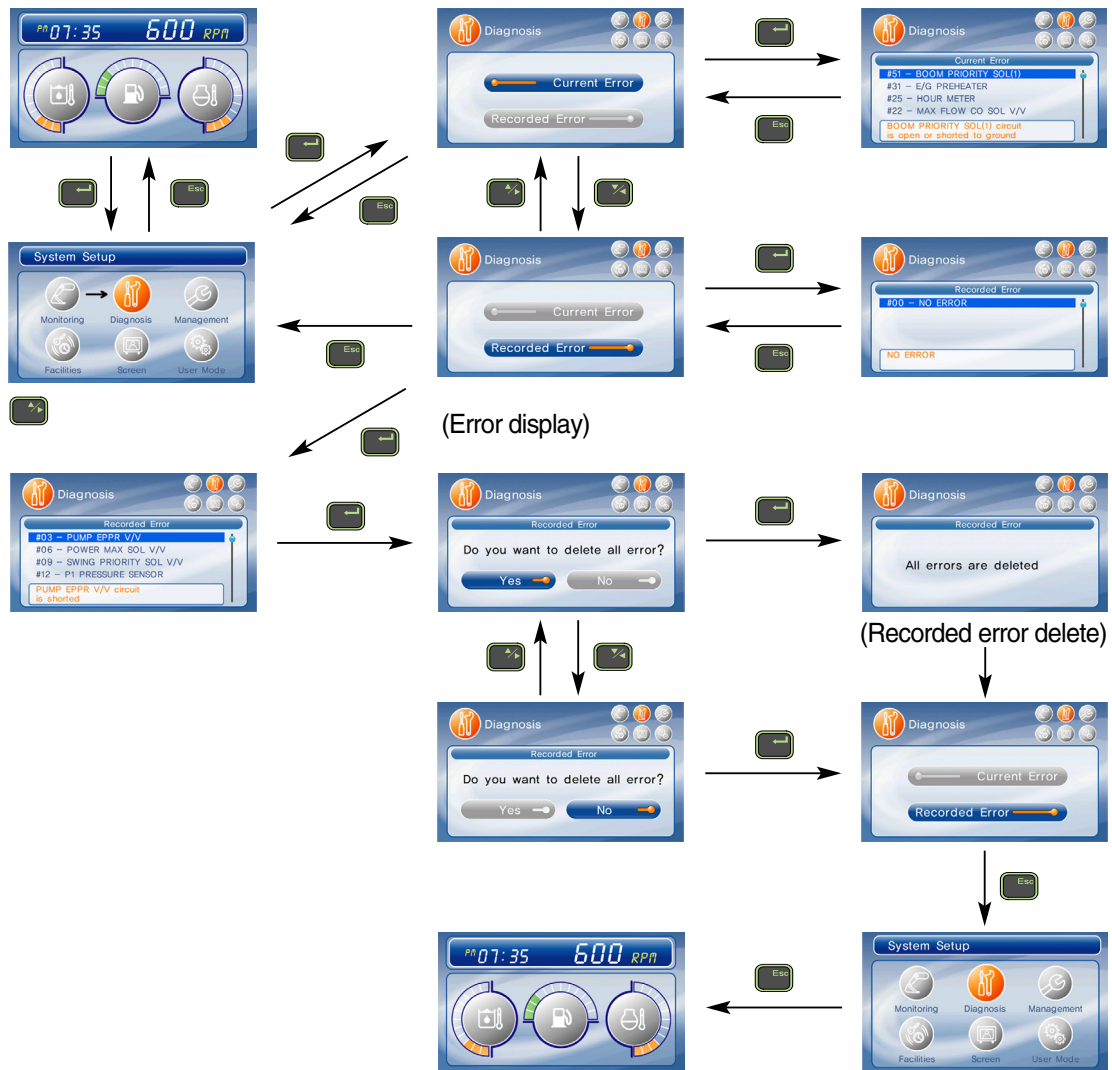
ex) CHECK Er : 143

# GROUP 9 SELF-DIAGNOSTIC SYSTEM (R450LC-7A #0118 and up, R500LC-7A #0058 and up)

## 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.

## 2. CURRENT ERROR DISPLAY



## 5. ERROR CODES TABLE

Error code No.	Description
1	Short circuit in accel actuator 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
6	Short circuit in power boost 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(24V) line
15	Boom down pressure circuit is shorted to power supply(24V) line
16	Accel actuator 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
21	Power boost 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
32	Travel alarm buzzer 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

Error code No.	Description
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
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 +
51	Boom priority solenoid circuit is open or shorted to ground
56	Travel alarm buzzer circuit is shorted to battery +
58	Boom priority solenoid circuit is shorted to battery +

## 6. ENGINE FAULT CODE INFORMATION (For QSM11)

Fault code No.	Reason	Effect(only when fault code is active)
111	Error internal to the ECM related to memory hardware failures or internal ECM voltage supply circuits.	Engine will not start.
115	No engine speed signal detected at both engine position sensor circuits.	Engine will die and will not start.
121	No engine speed signal detected from one of the engine position sensor circuits.	None on performance.
122	High voltage detected on the intake manifold pressure circuit.	Derate in power output of the engine.
123	Low voltage detected on the intake manifold pressure circuit.	Derate in power output of the engine.
131	High voltage detected at the throttle position signal circuit.	Severe derate(power and speed). Limp home power only.
132	Low voltage detected at the throttle position signal circuit.	Severe derate(power and speed). Limp home power only.
133	High voltage detected at the remote throttle position signal circuit.	None on performance if remote throttle is not used.
134	Low voltage detected at the remote throttle position signal circuit.	None on performance if remote throttle is not used.
135	High voltage detected at the oil pressure circuit.	No engine protection for oil pressure.
141	Low voltage detected at the oil pressure circuit.	No engine protection for oil pressure.
143	Oil pressure signal indicates oil pressure below the low oil pressure engine protection limit.	Progressive power and speed derate with increasing time after alert. If engine protection shutdown feature is enable, engine will shut down 30 seconds after red lamp starts flashing.
144	High voltage detected at the coolant temperature circuit.	Possible white smoke. Fan will stay on if controlled by the electronic control module (ECM). No engine protection for coolant temperature.
145	Low voltage detected at the coolant temperature circuit.	Possible white smoke. Fan will stay on if controlled by electronic control module (ECM). No engine protection for coolant temperature.
147	A frequency of less then 100Hz was detected at the frequency throttle signal pin of the actuator harness connector at the ECM.	Calibration dependent power and speed derate.
148	A frequency of more than 100Hz was detected at the frequency throttle signal pin of the actuator harness connector at the ECM.	Calibration dependent power and speed derate.
151	Coolant temperature signal indicates coolant temperature above 104° C(220°F).	Progressive power derate with increasing time after alert. If engine protection shutdown feature is enabled, engine will shut down 30 seconds after red lamp starts flashing.
153	High voltage detected at the intake manifold temperature circuit.	Possible white smoke. Fan will stay on if controlled by electronic control module (ECM). No engine protection for coolant temperature.
154	Low voltage detected at the intake manifold temperature circuit.	Possible white smoke. Fan will stay on if controlled by electronic control module (ECM). No engine protection for coolant temperature.
155	Intake manifold temperature signal indicates temperature above 87.8° C(190°F).	Progressive power derate with increasing time after alert. If engine protection shutdown feature is enabled, engine will shut down 30 seconds after red lamp starts flashing.
187	Low voltage detected on the ECM voltage supply line to some sensors(VSEN2 supply).	Engine will run derated. No engine protection for oil pressure and coolant level.

Fault code No.	Reason	Effect(only when fault code is active)
211	Additional machine diagnostic codes have been logged. Check other ECM's for diagnostic codes.	None on engine performance.
212	High voltage detected at the oil temperature circuit.	No engine protection for oil temperature.
213	Low voltage detected at the oil temperature circuit.	No engine protection for oil temperature.
214	Oil temperature signal indicates oil temperature above 123.9° C(225° F).	Progressive power derate with increasing time after alert. If engine protection shutdown feature is enabled, engine will shut down 30sec after the red lamp starts flashing.
219	Low oil level was detected in the Centinel™ makeup oil tank.	None on performance. Centinel™ deactivated.
221	High voltage detected at the ambient air pressure circuit.	Derate in power output of the engine.
222	Low voltage detected at the ambient air pressure circuit.	Derate in power output of the engine.
223	Incorrect voltage detected at the Centinal™ actuator circuit by the ECM.	None on performance. Centinel™ deactivated.
227	High voltage detected on the ECM voltage supply line to some sensors(VSEN2 supply).	Engine will run derated. No engine protection for oil pressure and coolant level.
234	Engine speed signal indicates engine speed is greater than 2730 rpm.	Fuel shutoff valve closes until engine speed falls to 2184 rpm.
235	Coolant level signal indicates coolant level is below the normal range.	Progressive power derate with increasing time after alert. If engine protection shutdown feature is enabled, engine will shut down 30 seconds after red lamp starts flashing.
237	Duty cycle of the throttle input signal to the primary or secondary engine for multiple unit synchronization is less than 3 percent or more than 97 percent.	All engines(primary and secondary) are shut down with increasing time after alert if hard-coupled. Only secondary engines are shut down with increasing time after alert if soft-coupled.
241	The ECM lost the vehicle speed signal.	Engine speed limited to maximum engine speed without vehicle speed sensor parameter value Cruise Control. Gear-Down Protection and Road Speed Governor will not work (automotive only).
242	Invalid or inappropriate vehicle speed signal detected. Signal indicates an intermittent connection or VSS tampering.	Engine speed limited to maximum engine speed without vehicle speed sensor parameter value Cruise Control. Gear-Down Protection and Road Speed Governor will not work (automotive only).
245	Less than 6 VDC detected at fan clutch circuit when on. Indicates an excessive current draw from the ECM or faulty ECM output circuit.	The fan may stay on at all times.
254	Less than 6 VDC detected at FSO circuit when on. Indicates an excessive current draw from the ECM or a faulty ECM output circuit.	The ECM turns off the FSO supply voltage. The engine will shut down.
255	Externally supplied voltage detected going to the fuel shutoff solenoid supply circuit.	None on performance. Fuel shutoff valve stays open.
285	The ECM expected information from a multiplexed device but did not receive it soon enough or did not receive it at all.	At least one multiplexed device will not operate properly.
286	The ECM expected info from a multiplexed device but only received a portion of the necessary information.	At least on multiplexed device will not operate properly.
287	The machine vehicle electronic control unit (VECU) detected a fault with its throttle pedal.	The engine will only idle.

Fault code No.	Reason	Effect(only when fault code is active)
288	The machine vehicle electronic control unit (VECU) detected a fault with its remote throttle.	The engine will not respond to the remote throttle.
293	High voltage detected at the machine temperature sensor signal pin of the 31-pin machine connector.	No engine protection for machine temperature.
294	Low voltage detected at the machine temperature sensor signal pin of the 31-pin machine connector.	No engine protection for machine temperature.
295	An error in the ambient air pressure sensor signal was detected by the ECM.	Engine is derated to no air setting.
297	High voltage detected at the machine pressure sensor signal pin of the 31-pin machine connector.	No engine protection for machine pressure.
298	Low voltage detected at the machine pressure sensor signal pin of the 31-pin machine connector.	No engine protection for machine pressure.
299	Engine shutdown by device other than key switch before proper engine cool down resulting in filtered load factor above maximum shutdown threshold.	No action taken by the ECM.
311	Current detected at No.1 injector when voltage is turned off.	Current to injector is shut off.
312	Current detected at No.5 injector when voltage is turned off.	Current to injector is shut off.
313	Current detected at No.3 injector when the voltage is turned off	Current to injector is shut off.
314	Current detected at No 6 injector when the voltage is turned off.	Current to injector is shut off.
315	Current detected at No.2 injector when the voltage is turned off.	Current to injector is shut off.
319	Real time clock lost power.	None on performance. Data in the ECM will not have accurate time and date information.
321	Current detected at No.4 injector when the voltage is turned on.	Current to injector is shut off.
322	No current detected at No.1 injector when the voltage is turned on.	Current to injector is shut off.
323	No current detected at No.5 injector when the voltage is turned on.	Current to injector is shut off.
324	No current detected at No.3 injector when the voltage is turned on.	Current to injector is shut off.
325	No current detected at No.6 injector when the voltage is turned on.	Current to injector is shut off.
331	No current detected at No.2 injector when the voltage is turned on.	Current to injector is shut off.
332	No current detected at No.4 injector when the voltage is turned on.	Current to injector is shut off.
341	Severe loss of data from the ECM.	Possible no noticeable performance effects OR engine dying OR hard starting. Fault information, trip information and maintenance monitor data may be inaccurate.
343	Internal ECM error.	Possible none on performance or severe derate.
349	A frequency greater than calibrated threshold was detected at the tail shaft governor signal pin of the 31-pin machine connector.	Calibration dependent power and speed derate.
352	Low voltage detected on the ECM voltage supply line to some sensors (VSEN 1 supply).	Engine is derated to no air setting.

Fault code No.	Reason	Effect(only when fault code is active)
386	High voltage detected on the ECM voltage supply line to some sensors (VSEN 1 supply).	Engine is derated to no air setting.
387	High voltage detected on the ECM voltage supply line to the throttle(VTP supply).	Engine will only idle.
415	Oil pressure signal indicates oil pressure below the very low oil pressure engine protection limit.	Progressive power derate with increasing time from alert. If engine protection shutdown feature is enabled, engine will shut down 30 seconds after red lamp starts flashing.
418	Water has been detected in the fuel filter.	Possible white smoke, loss of power, or hard starting.
419	An error in the intake manifold pressure sensor signal was detected by the ECM.	Engine is derated to no air setting.
422	Voltage detected simultaneously on both the coolant level high and low signal circuits OR no voltage detected on both circuits.	No engine protection for coolant level.
426	Communication between the ECM and the J1939 data link has been lost.	None on performance. J1939 devices may not operate.
428	High voltage detected at water-in-fuel sensor.	None on performance.
429	Low voltage detected at water-in-fuel sensor.	None on performance.
431	Voltage detected simultaneously on both the idle validation off-idle and on-idle circuits.	None on performance.
432	Voltage detected at idle validation on-idle circuit when voltage at throttle position circuit indicates the pedal is not at idle OR voltage detected at idle validation off-idle circuit when voltage at throttle position circuit indicates the pedal is at idle.	Engine will only idle.
433	Voltage signal at intake manifold pressure circuit indicates high intake manifold pressure but other engine characteristics indicate intake manifold pressure must be low.	Derate to no air setting.
434	Supply voltage to the ECM fell below 6.2 VDC for a fraction of a second OR the ECM was not allowed to power down correctly (retain battery voltage for 30 seconds after key off).	Possible no noticeable performance effects OR possibility of engine dying OR hard starting. Fault information, trip information and maintenance monitor data may be inaccurate.
435	An error in the oil pressure sensor signal was detected by the ECM.	None on performance. No engine protection for oil pressure.
441	Battery voltage below normal operating level.	Possible no noticeable performance effects OR possibility of rough idle.
442	Battery voltage below normal operating level.	None on performance.
443	Low voltage detected on the ECM voltage supply line to the throttle(s) (VTP supply).	Engine will only idle.
489	Auxiliary speed frequency on input pin indicated that the frequency is below a calibration dependent threshold.	Engine will only idle.
527	Less than 17.0 VDC detected at the dual output A signal pin of the 31-pin machine connector.	No action taken by the ECM.
528	Less than 17.0 VDC detected at the dual output B signal pin of the 31-pin machine connector.	No action taken by the ECM.
529	Less than 17.0 VDC detected at the dual output B signal pin at the ECM.	No action taken by the ECM.
551	No voltage detected simultaneously on both the idle validation off-idle and on-idle circuits.	Engine will only idle.
581	High voltage detected at the fuel inlet restriction sensor signal pin.	Fuel inlet restriction monitor deactivated.



Fault code No.	Reason	Effect(only when fault code is active)
582	Low voltage detected at the fuel inlet restriction sensor signal pin	Fuel inlet restriction monitor deactivated.
583	Restriction has been detected at the fuel pump inlet.	Fuel inlet restriction monitor warning is set.
596	High battery voltage detected by the battery voltage monitor feature.	Yellow lamp will be lit until high battery voltage condition is corrected.
597	ICON™ has restarted the engine three times within three hours due to low battery voltage (automotive only) OR low battery voltage detected by the battery voltage monitor feature.	Yellow lamp will be lit until low battery voltage condition is corrected. The ECM may increase idle speed and deactivate idle decrement switch if idle speedup is enabled. The engine will run continuously if ICON™ is active (automotive only).
598	Very low battery voltage detected by the battery voltage monitor feature.	Red lamp lit until very low battery voltage condition is corrected.
611	Engine shutdown by operator before proper engine cool down resulting in filtered load factor above maximum shutdown threshold.	No action taken by the ECM.
951	A power imbalance between cylinders was detected by the ECM.	Engine may have rough idle or misfire.