ZW370 WHEEL LOADER TECHNICAL MANUAL TROUBLESHOOTING

PART NO. TT97C5-E-00

HITACHI

Technical Manual
Troubleshooting

ZW 370
Wheel Loader

Hitachi Construction Machinery
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Service Manual consists of the following separate Part No.

Technical Manual (Operational Principle)	: Vol. No.TO97C5-E
Technical Manual (Troubleshooting)	: Vol. No.TT97C5-E
Workshop Manual	: Vol. No.W97C5-E

Cautions Regarding Troubleshooting

Important points

The important points for troubleshooting is to carefully read the operation manual and shop manual to get enough information on the operation, circuits, structure, and function of each component. If you have enough knowledge of each component and system, you can easily determine the cause of the problem.

There may be various causes for each problem, therefore experience will be needed to determine which is the actual cause of the problem.

It is necessary to know the normal operation of each component. In addition, it is also important to know the abnormal condition when a problem occurs. This chapter shows various examples of past problems, and describes possible causes and remedies for each problem.

Before starting troubleshooting

To prevent incorrect diagnosis, talk with the persons concerned, particularly with the operator, to get enough information on the problem. If possible, check the machine by repeating the symptom.

If the problem cannot be repeated, do not provide any repair service.

For instance, assume that the operator complains that the boom power is low, and the rim-pull is also low. In this case, there are two possible causes; low hydraulic power and low rim-pull. The remedies against both causes are much different from each other.

If you hastily determine the wrong cause without checking the actual condition of the problem, it will take too much time and expense to solve the problem. As a result, you will not be trusted by the user.

The following questions will be helpful in determining of the cause. Answer the questions to prevent an incorrect diagnosis.

1. Did the problem occur suddenly?
2. When did the operator notice the problem?
3. Is there any past problem that may be the cause of this problem?
4. When the problem occurred, what kind of work was the operator doing?
5. Has the machine had the same kind of problem before?
6. Has the machine been repaired or inspected recently?
7. Does the machine have any other problem?

Troubleshooting

- Check before determination of cause
  A problem may be caused by poor daily maintenance, such as lack of grease, low or improper oil or a clogged filter. Be sure to check the machine for oil level, appearance, unpleasant odor, etc. to prevent time loss due to other unnecessary tests.

- Inspection procedure
  As a rule, check the easy-to-be-repaired system first (excluding the cases where the cause can be easily determined based on the past experiences).

  This machine is controlled by electrical, hydraulic, and mechanical systems. The most easy-to-be-repaired system is the electrical system. Check the electrical system first. If no problem is detected in the electrical system, check the hydraulic system, and then the mechanical system.

Note
Check the error code on the MODM at first !

8. Machine moves reverse when starting to climb up on a slope using inching brake.

Check before starting work.

1. Check the error code No. shown on the MODM.

Possible cause	Symptoms / check point: After pedal release, too much time is required to move.	Solution
Large time lag in clutch engagement	*	Refer to description of time lag (No.5) *
Inching set-up condition abnormal	◯	Set-up normally
Defective inching sensor	◯	Replacement

8. ELS (Efficient Loading System) does not work. (Excavating and scooping tractive power does not become up during ELS working condition)

Check before starting work.

1. Check the error code No. shown on the MODM.

Possible cause	Symptoms / check point: Pressing ELS switch, it does not function.	Without pressing ELS switch, if functions.	At upper position of lower kickout setting, ELS works.										Solution
ELS switch defective	○												Repair
Solenoid valve coil or wiring failure	○												Disassembly & repair
Solenoid valve spool stuck	○												Disassembly & repair
Relief valve set pressure is extremely low.		○											Disassembly & repair
Main controller failure	○		○										Replacement
Kickout sensor defective or link, rod bent			○										Replacement or repair
Speed sensor failure	○												Replacement
Pump defective	○												Refer to (No.1)

Electrical Group

1. Instrument panel does not indicate properly.

Check before starting work.
1. Check the fuses.
2. Lamp test
   Turn the starter switch key to "ON" position and leave it there for 3 seconds. Check the indicator lamps.
3. Check the error code No. shown on the MODM.

Possible cause	Symptoms / check point	One of the monitor lamps will not light after setting the starter key to ON.	Two or more monitor lamps will not light after setting the starter key to ON.	During operation, one of the monitor lamps lights improperly. *	During operation, two or more monitor lamps light improperly. *	Pointer of the speedometer does not move.	One of the gauge pointers does not move.	All the gauge pointers do not move.	One of the gauges does not indicate properly. *	Pointers of all the gauges are deflected to their limits.	Hour meter does not operate.	Speed indicated on the instrument panel does not correspond with the speed set by the shift lever.	T/M (transmission) solenoid valve does not operate based on the speed set by the shift lever.	Solution
Bulb of monitor lamp burnt out		○												Bulb replacement
Defective sensor or improper wiring				○		○	○		○					Sensor replacement
Disconnected or defective electrical circuit		○				○	○	○		○	○	○		Repairing cable
Loose connector			○			○	○	○		○	○			Connector check & re-connection
T/M controller failure alarm turned on			○											Inspection & repair
Defective controller		○	○	○	○	○	○	○	○	○	○	○	○	Controller replacement
Defective inside mechanism of gauge or meter						○	○		○	○	○			Replacement
Defective board of instrument panel								○						Replacement
T/M solenoid valve improperly connected.												○	○	Properly connect
Gauge circuit grounded improperly.									○	○				Inspection & repair

Remarks

* If the gauge and warning lamps do not agree there probably is a defect in the wiring. Stop immediately and diagnose the defect.

FAULT CODE/ LAMP	DESCRIPTION	ZW370
EG1358 Yellow	Accelerator Pedal Position Sensor 1 Circuit - voltage above normal or shorted high.	
EG1359 Yellow	Accelerator Pedal Position Sensor 1 Circuit - voltage below normal or shorted low.	
EG1361 Yellow	Remote Accelerator Pedal Position Sensor 1 Circuit - voltage below normal or shorted low.	
EG1376 Orange	Engine Camshaft Speed / Position Sensor - data erratic, intermittent, or incorrect.	
EG1595 Yellow	Remote Accelerator Pedal Position Sensor 1 Circuit - voltage above normal or shorted high.	
EG1597 Orange	Engine Control Module Critical Internal Failure - bad intelligent device or component.	
EG1845 Orange	Water in Fuel Indicator Sensor Circuit - voltage above normal or shorted to high source.	
EG1846 Orange	Water in Fuel Indicator Sensor Circuit - voltage below normal or shorted to low source.	
EG1852 Yellow	Water in Fuel Indicator - data valid but above normal operational range - moderately severe level.	
EG1911 Yellow	Injector Metering Rail 1 Pressure - above normal operating range.	
EG2185 Yellow	Sensor Supply Voltage #4 Circuit - shorted high.	
EG2186 Yellow	Sensor Supply Voltage #4 Circuit - shorted low.	
EG2215 Yellow	Fuel Pump Delivery Pressure - data valid but below normal operational range - moderately severe level.	
EG2249 Yellow	Fuel Pump Delivery Pressure Sensor Circuit - shorted low.	
EG2261 Orange	Fuel Pump Delivery Pressure - data valid but above normal operational range - least severe level.	
EG2262 Orange	Fuel Pump Delivery Pressure - data valid but below normal operational range - least severe level.	
EG2265 Yellow	Fuel Priming Pump Control Signal Circuit - shorted high.	
EG2266 Yellow	Fuel Priming Pump Control Signal Circuit - shorted low.	
EG2311 Yellow	Fueling Actuator #1 Circuit Error - condition exists.	
EG2321 None	Engine Speed Sensor #1 - data erratic, intermittent, or incorrect.	
EG2322 None	Engine Speed Sensor #2 - data erratic, intermittent, or incorrect.	
EG2697 Orange	Accelerator Pedal Position Sensor Circuit and Idling Position Detection Switch Circuit - data erratic, intermittent, or incorrect.	
EG2963 None	Engine Coolant Temperature High - warning.	
EG2964 None	Intake Manifold Temperature High - warning.	
EG2973 Yellow	Intake Manifold Pressure Sensor Circuit - data erratic, intermittent, or incorrect.	

(09D20E)

Measurement for Performance Check

03

Cause of extremely high or low measurement value and solution

Minimum no-load speed (LI) or maximum no-load speed (HI) low

Possible cause	Solution
Insufficient warm up	Warm up
Malfunctioning accelerator pedal or harness	Inspection & repair
Clogged fuel filter	Clean
Defective fuel pump	Repair
Defective fuel injection nozzle	Repair
Valve clearances incorrect	Adjustment
Insufficient compression pressure	Repair

The engine speed is too high in torque converter stall mode.

Possible cause	Solution
Slipping transmission clutch or defect inside of transmission	Disassembly & repair
Defect inside torque converter	Disassembly & repair

The engine speed is too low in torque converter stall mode.

Caused by reduction in engine power

Possible cause	Solution
Clogged air cleaner element	Cleaning
Improper type of fuel	Fuel replacement
Clogged fuel filter or suction strainer	Clean or replace
Frozen fuel / wax build up	Use antifreeze mixture
Malfunctioning accelerator pedal or harness	Inspection & repair
Defective fuel pump	Repair
Defective fuel injector nozzle	Repair
Insufficient compression pressure	Repair
Hydraulic load is extremely large	Inspection & repair
Malfunctioning torque converter	Inspection & repair

The engine speed is too high in multiple control valve relief mode.

Possible cause	Solution
Relief valve pressure too low	Adjustment or disassembly
Defective pump / pump seals	Disassembly & repair

The engine speed is too low in multiple control valve relief mode.

Possible cause	Solution
Engine low power	Inspection & repair
Extremely high relief pressure of multiple control valve	Adjustment

The engine speed is too high in torque converter stall plus multiple control valve relief mode.

Possible cause	Solution
Slipping transmission clutch or defect inside of transmission or T/C	Disassembly & repair
Relief pressure too low	Adjustment
Defective pump / pump seals	Disassembly & repair

The engine speed is too low in torque converter stall plus multiple control valve relief mode.

Possible cause	Solution
Engine low power	Inspection & repair
Extremely high relief pressure of multiple control valve or steering valve	Adjustment
Malfunctioning torque converter	Repair

Loading/Steering Circuit Relief Valve

Loading circuit relief valve setting pressures

⚠ WARNING

Unexpected movement of the machine may cause an accident resulting in injury or death.
Therefore, to provide repair service with the engine running, be sure to observe the following items:
- Park the machine on level ground.
- Apply the parking brake.
- Block the tires with chocks to prevent the tires from moving.
- Determine the signals between the service man.
- Prohibit any person from walking into dangerous areas.
    - Near articulation areas of the machine
    - Under the machine
    - Around the engine
    - In front of or behind the machine

⚠ CAUTION

Be careful, you may get burned if the high pressure oil spouts out. To prevent such an accident, be sure to release the residual pressure from the pipe, and open the cap of the hydraulic tank before removing the plug from the pressure measurement port.

⚠ CAUTION

Do not touch the fan or V-belt of the engine or a high-temperature section if the engine is running. An accident resulting in injury may occur.
Be sure to stop the engine before you open the access panel of the engine room. Keep all guards in place.
Avoid high temperature components even when the engine is stopped.

Measurement instruments

Pressure gauge

30 MPa (300 kgf/cm^2) (5,000 psi)
(for loading line with 3 m (10 ft.) hose and steering line with 1.5~3 m (4~10 ft.) hose)

5 MPa (50 kgf/cm^2) (1,000 psi)
(for pilot line) with 2~3 m (6~10 ft.) hose

Note
For safety, route the gauge to an area where it may be safely read by the person doing the test.

Gauge port

	Gauge port location	Port size
Main relief pressure	(1), (2), (3)	(1), (2), (3) G (PF) 1/4 with O-ring
Overload relief pressure	(1), (2), (3)	
Pilot line pressure (Reducing valve)	(4)	(4) G (PF) 3/8 with O-ring

Adjusting pilot line pressure

Loosen the lock nut and adjust the pressure by the adjusting screw.

Turn clockwise the adjusting screw to raise the pilot line pressure.

IMPORTANT
After the completion of the adjustment of the pilot line pressure, be sure to tighten the lock nut.

Accumulator Circuit Charging Time

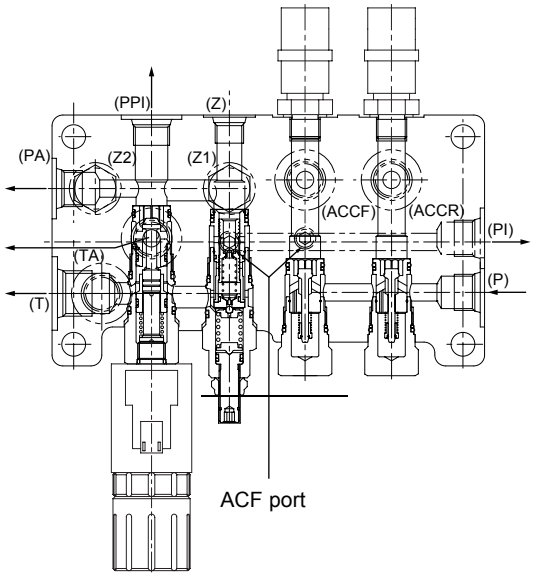
⚠ WARNING

Unexpected movement of the machine may cause an accident resulting in injury or death.
Therefore, to provide repair service with the engine running, be sure to observe the following items:

- Park the machine on level ground.
- Apply the parking brake.
- Block the tires with chocks to prevent the tires from moving.
- Determine the signals between the service men.
- Prohibit any person from walking into dangerous areas.
  - Near articulation areas of the machine
  - Under the machine
  - Around the engine
  - In front of or behind the machine

⚠ CAUTION

Be careful, you may get burned if the high pressure oil spouts out. To prevent such an accident, be sure to release the residual pressure from the pipe, and open the cap of the hydraulic oil tank before removing the plug and hose from the pressure measurement port.



Valve assembly

95V2E03003

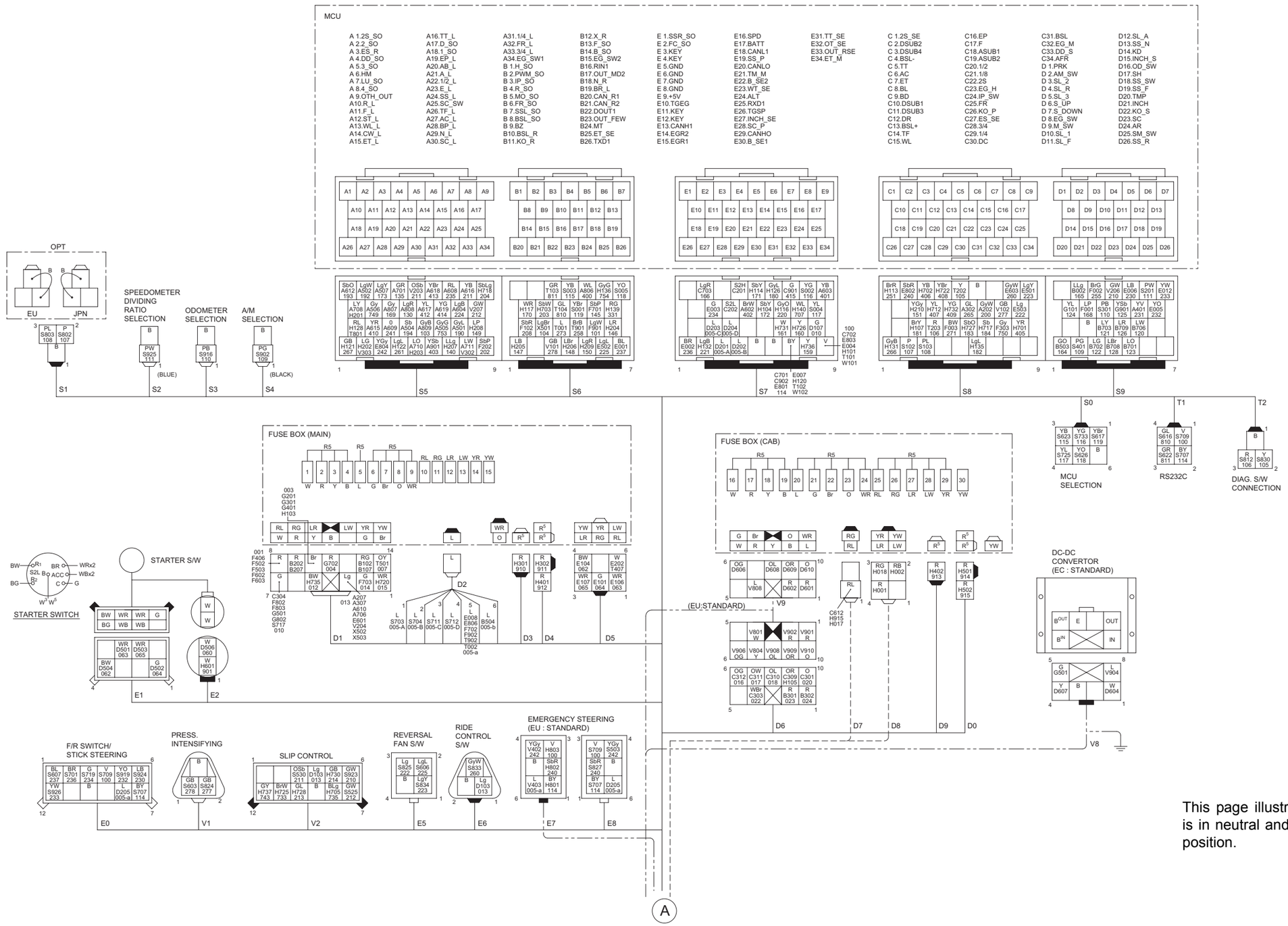
Measurement instrument

- Hydraulic pressure gauge
  20 MPa (200 kgf/cm^2) (3,000 psi)
- Stop watch

Gauge installation position

- Valve assembly ACF port
  size Rc (PT) 1/8

Electrical Wiring Diagram (2/3) (S/N 9001~9048)



This page illustrates the transmission is in neutral and key switch is in OFF position.

Electrical wiring diagram abbreviation chart

INSTRUMENT PANEL	
WL	Radiator water level warning lamp
C	Charge lamp
AC	Air cleaner clogging alarm
TT	T/M oil temperature alarm
WT	Engine water temperature alarm
EP	Engine oil pressure alarm
BP	Brake oil pressure alarm
CE	MCU error (failure alarm)
+	+24 V power supply
ES	Secondary steering
FR	Reversal fan indication lamp
EG2	Engine warning lamp
EG1	Engine protection lamp
EG3	Engine stop lamp
SS	FR switch, S/S switch indication lamp
WTM	Engine water temperature gauge (sensor)
TTM	T/M oil temperature gauge (sensor)
	—
(+)	Instrument panel illumination
TF	T/M oil filter clogging alarm
	—
	—
F	Fuel level lamp (F)
3/4	Fuel level lamp (3/4)
1/2	Fuel level lamp (1/2)
1/4	Fuel level lamp (1/4)
EMP	Fuel level lamp (E)
GND	GND (–)
+	+ 24 V power supply
	—
	—
	—
	—
N	Neutral
–	GND (–)
1	1st speed indication
2	2nd speed indication
3	3rd speed indication
4	4th speed indication

INSTRUMENT PANEL	
P	Parking brake lamp
A	AUTO lamp
AB	Auto brake lamp
SM	Meter (Speed/Tacho) +
SM	Meter (Speed/Tacho) –
	—
TC	Declutch lamp
PH	Preheating lamp
WL	Work lamp
W	Central alarm lamp
GND	GND (–)
	—
	—
H	High-beam lamp
L	Turn signal (left) lamp
R	Turn signal (right) lamp
	—
GND	Hour meter (–)
HM	Hour meter (+)

MCU	
A1	Efficient loading system solenoid valve
A2	2nd speed solenoid valve
A3	Secondary steering motor relay
A4	Ride control solenoid valve
A5	3rd speed solenoid valve
A6	Hour meter
A7	T/C lock-up solenoid valve
A8	4th speed indicator relay
A9	E/G torque selection
A10	Back-up lamp
A11	Fuel level lamp (F)
A12	Steering oil pressure warning lamp
A13	Radiator water level warning lamp
A14	Central warning lamp
A15	E/G coolant temperature warning lamp
A16	T/M oil temperature warning lamp
A17	D solenoid valve
A18	1st speed solenoid valve
A19	E/G oil pressure warning lamp

MCU	
A20	Auto brake lamp
A21	Auto shift indicator lamp
A22	Fuel level lamp (1/2)
A23	Fuel level lamp (E)
A24	S/S indicator lamp
A25	Traction control selection
A26	T/M oil filter warning lamp
A27	Air cleaner warning lamp
A28	Brake pressure warning lamp
A29	Neutral indicator lamp
A30	Traction control indicator lamp
A31	Fuel level lamp (1/4)
A32	Reversal fan indicator lamp
A33	Fuel level lamp (3/4)
A34	E/G droop selection 2
B1	H solenoid valve
B2	—
B3	Pressure intensifying solenoid valve
B4	R solenoid valve
B5	Modulation valve (SPCC)
B6	Reversal fan solenoid valve
B7	S/S solenoid valve L
B8	E/G idle selection
B9	Buzzer
B10	Lower kickout relay
B11	Lift kickout relay
B12	MCU fault relay
B13	L solenoid valve
B14	Auto brake solenoid valve
B15	E/G droop selection 1
B16	Communication RINI
B17	—
B18	Neutral relay
B19	Brake lamp
B20	—
B21	—
B22	Communication DOUT1
B23	—
B24	Meter output (Speed/Tacho)

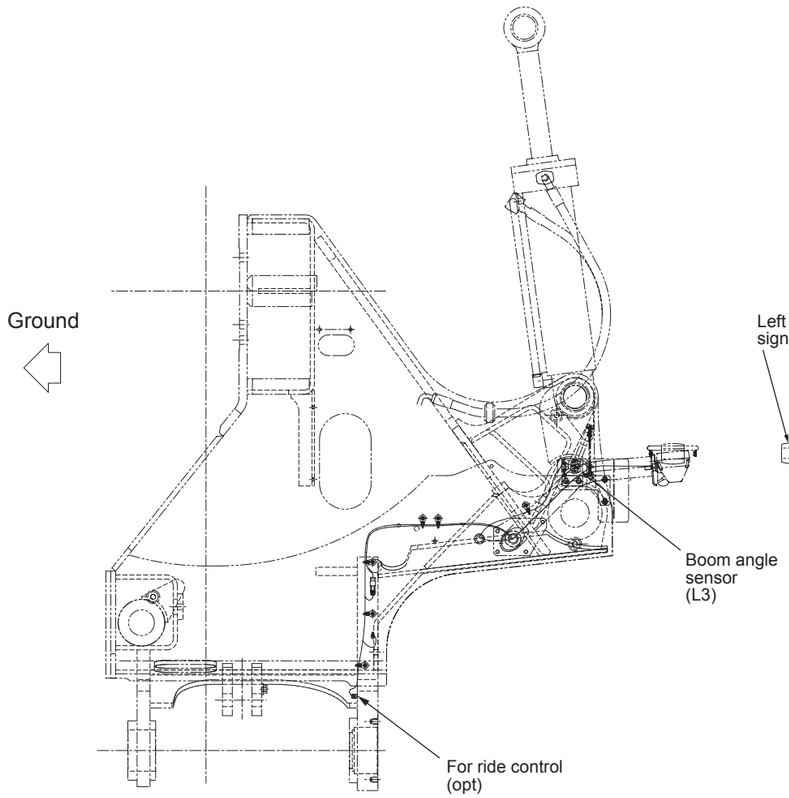
MCU	
B25	E/G coolant temperature sensor (S/N 9001~9150)
	E/G water temperature sensor (for inspection) (S/N 9151~)
B26	Communication TXD1
E1	S/S solenoid valve R
E2	Fan speed control solenoid valve
E3	Power supply +24 V
E4	Power supply +24 V
E5	Power supply GND
E6	Power supply GND
E7	Power supply GND
E8	Power supply GND
E9	+5 V output
E10	Tacho-graph E/G speed
E11	Power supply +24 V
E12	Power supply +24 V
E13	Communication CAN H1
E14	E/G speed sensor 2 (not used)
E15	E/G ECM
E16	Machine speed sensor
E17	Power supply
E18	Communication CAN L1
E19	S/S potentiometer
E20	Communication CAN L0
E21	T/M oil temperature gauge
E22	Brake oil pressure sensor 2
E23	Hydraulic oil temperature sensor
E24	Alternator
E25	Communication RXD1
E26	Tacho-graph machine speed
E27	Declutch sensor (brake oil pressure sensor)
E28	Spare analog input
E29	Communication CAN H0
E30	Brake oil pressure sensor 1
E31	T/M oil temperature sensor
E32	Air temperature probe
E33	—
E34	E/G coolant temperature gauge

MCU	
C1	Efficient loading system oil pressure sensor
C2	Specification change 1
C3	Specification change 2
C4	Spare digital input
C5	T/M oil temperature switch (not used)
C6	Air cleaner clogging switch
C7	E/G coolant temperature switch (not used)
C8	—
C9	—
C10	Spare digital input
C11	Hydraulic oil level switch
C12	Reset switch (S/N 9001~9250)
	New ECO mode selection (S/N 9251~)
C13	Lower kickout set-up
C14	T/M oil filter clogging switch
C15	Radiator water level switch
C16	E/G oil pressure switch
C17	Fuel level F switch
C18	Spare analog input
C19	T/M pressure sensor
C20	Fuel level 1/2 switch
C21	Fuel level 1/8 switch
C22	Efficient loading system switch
C23	E/G mode selection switch
C24	Pressure intensifying switch
C25	Reversal fan (manual) switch
C26	Boom angle sensor
C27	Secondary steering oil pressure sensor
C28	Fuel level 3/4 switch
C29	Fuel level 1/4 switch
C30	Recall switch (S/N 9001~9250)
	New declutch selection (S/N 9251~)
C31	Lower kickout switch (S/N 9001~9150)
	Auto/Full auto selection (S/N 9151~)
C32	Spare digital input
C33	Ride control switch
C34	Auto fan reversal switch

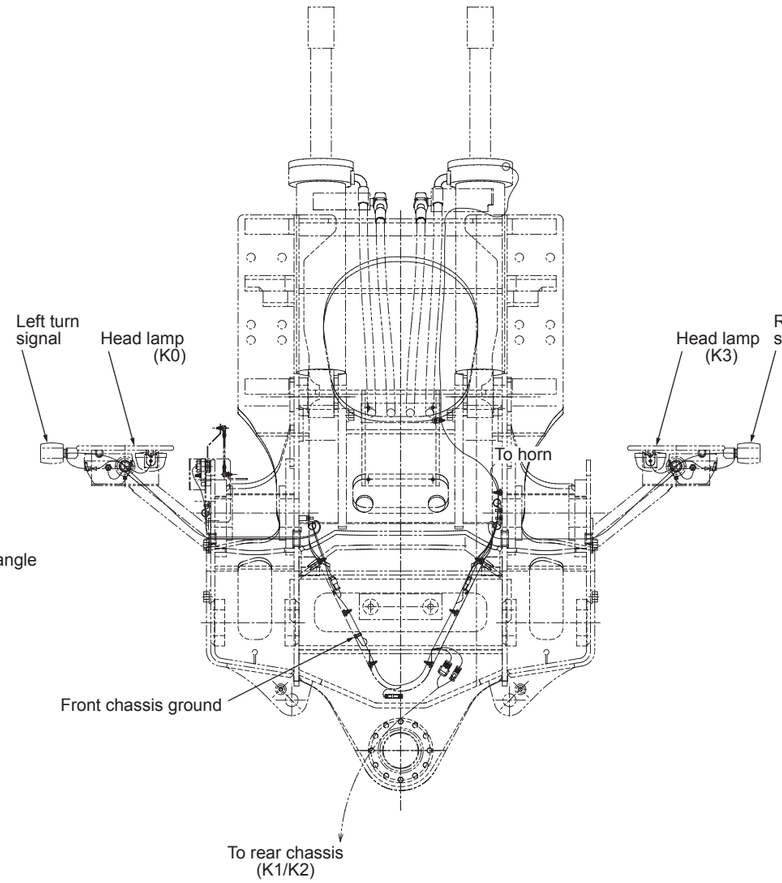
MCU	
D1	Parking switch
D2	Auto/Manual selection
D3	Shift lever 2
D4	Shift lever R
D5	Shift lever 3
D6	Shift up switch
D7	Shift down switch
D8	E/G speed sensor selection
D9	Meter selection
D10	Shift lever 1
D11	Shift lever F
D12	Shift lever A
D13	Spare digital input (S/N 9001~9150)
	F34 change point selection (S/N 9151~)
D14	Downshift button
D15	Declutch set up
D16	Odometer selection
D17	Shift hold switch
D18	S/S shift selection switch
D19	S/S shift switch F
D20	—
D21	Declutch switch
D22	Kickout set up
D23	Traction control switch
D24	Armrest switch
D25	Tire diameter selection (S/N 9001~9150)
	F23 change point selection (S/N 9151~)
D26	S/S shift switch R

Electrical Equipment Layout

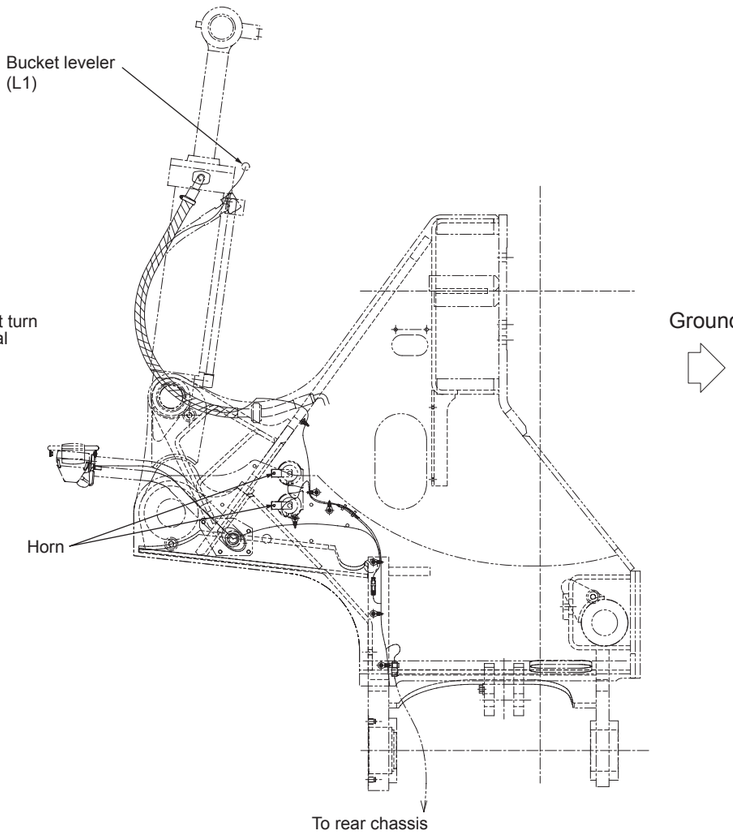
Front chassis



LH

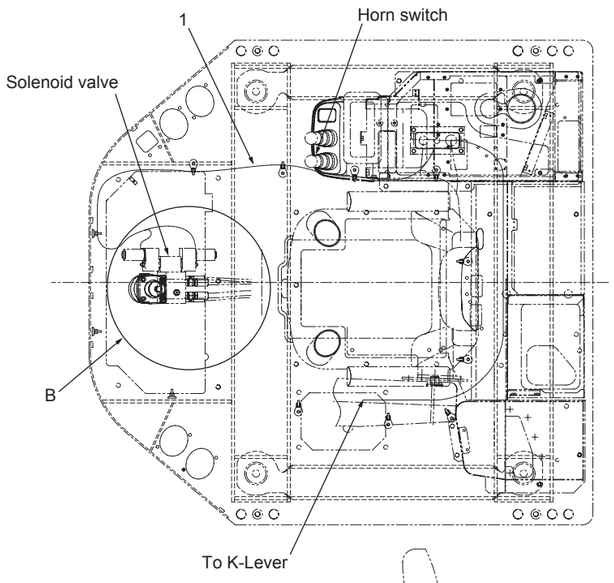


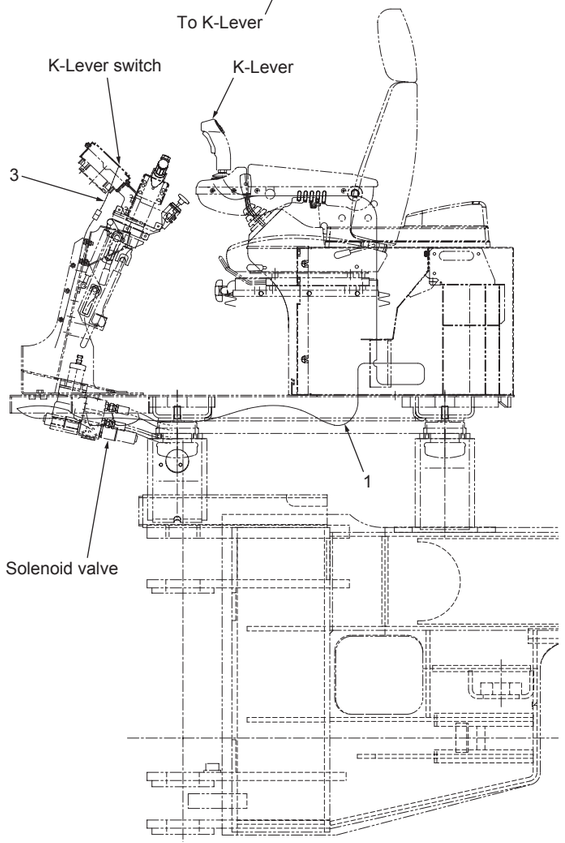
Top view

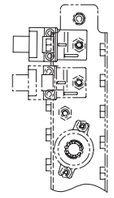


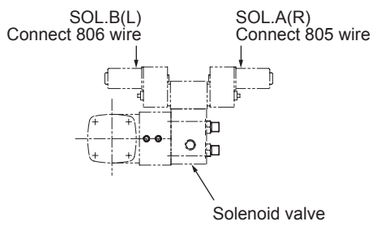
RH

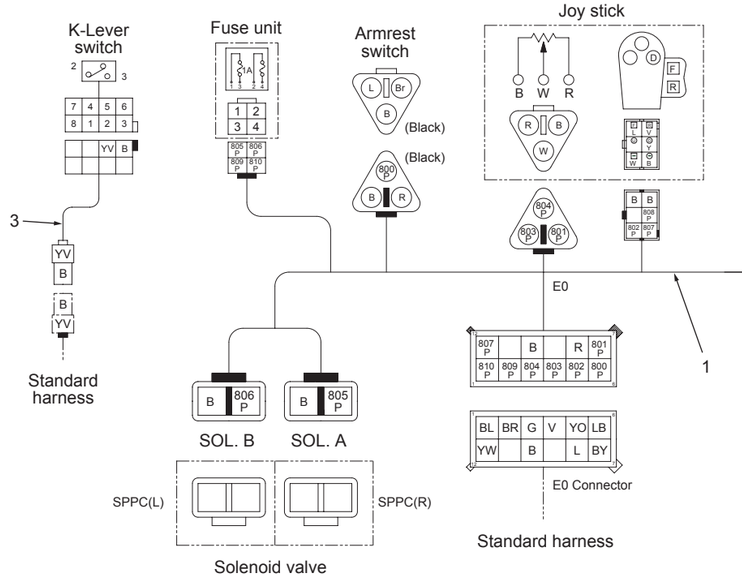
Electrical Equipment Layout (K-Lever)

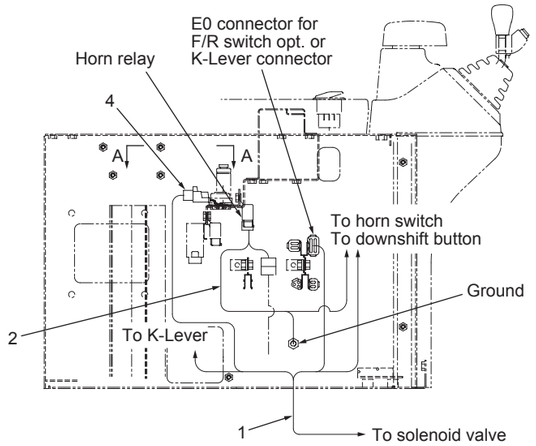


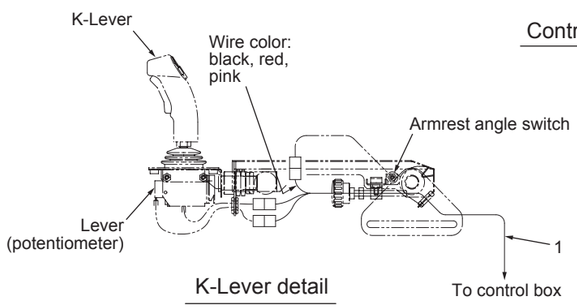


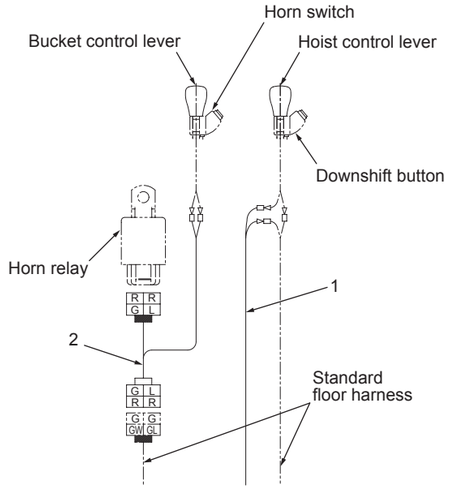












1. Cable assembly
2. Cable assembly
3. Cable assembly
4. Fuse unit

Note
Refer to the electrical connection diagram for the K-Lever electrical connection diagram.

For adjusting the speed of the K-Lever, refer to the K-Lever section on "MODM Parameter Setting Monitor" page 62-92.

MODM: Input/Output Monitor - Input/Output Signal Correspondence Table

	0	1	2	3	4	5	6	7
INPUT 1	Shift lever F	Shift lever R	Shift lever 1	Shift lever 2	Shift lever 3	Shift lever A	Shift-up	Shift-down
INPUT 2	Transmission pressure switch	Kick-down	Declutch switch	Declutch setup	Parking switch	Engine speed sensor selection (ECM output/sensor output)	A/M selection (automatic/manual)	Meter selection (speedometer/tachometer)
INPUT 3	Speedometer dividing ratio selection (large size tire/small size tire)	F/R switch F	F/R switch R	Spare input	F/R switch selection ON/OFF switch	Stick steering (K-Lever) arm rest switch	Shift hold switch	Traction control switch
INPUT 4	Engine mode selection (economical/normal)	Spare input	Pressure increase switch	Ride control switch	Kickout setup	Odometer selection (only forward/forward and backward)	Efficient loading system (ELS) switch	Lower kickout switch
INPUT 5	Lower kickout setup	Spare input	Clear fault log	Alternator neutral point voltage	Spare input	Opt 1	Hydraulic oil level switch	Opt 2
INPUT 6	Brake differential pressure switch	Brake oil level switch	Engine oil pressure switch	Engine coolant temperature switch	Transmission oil temperature switch	Transmission oil filter switch	Air cleaner clogging switch	Radiator water level switch
INPUT 7	Fuel level 3/4	Fuel level 1/2	Fuel level 1/4	Fuel level 1/8	Fuel level F	Reversal fan	Auto fan reversal	Error log recall

	0	1	2	3	4	5	6	7
OUTPUT 1	1st speed solenoid valve	2nd speed solenoid valve	3rd speed solenoid valve	4th speed solenoid valve	F solenoid valve	R solenoid valve	H solenoid valve	Brake solenoid valve
OUTPUT 2	D solenoid valve	LU solenoid valve	Ride control solenoid valve	Efficient loading system (ELS) selection solenoid valve	Alternate idle relay	Pressure increase solenoid valve	Reversal fan solenoid valve	Brake lamp
OUTPUT 3	Selection switch indicator lamp	Reversal fan indicator lamp	Brake oil pressure warning lamp	Engine oil pressure warning lamp	Engine coolant temperature warning lamp	Transmission oil temperature warning lamp	Transmission oil filter warning lamp	Air cleaner warning lamp
OUTPUT 4	Back lamp	Secondary steering motor relay	Hour meter driving	Engine curve selection 1 (torque)	Neutral relay	MCU failure relay	Kickout coil	Lower kickout relay
OUTPUT 5	Slip control indicator lamp	Auto shift indicator lamp	Neural indicator lamp	Auto brake indicator lamp	Central warning lamp	Radiator water level warning lamp	Steering oil pressure warning lamp	Fuel level F
OUTPUT 6	Fuel level 3/4	Fuel level 1/2	Fuel level 1/4	Fuel level E	Slip control selection	Engine curve selection 3 (ISC)	Engine curve selection 1 (droop)	Buzzer