

Zapi FC2086 Status Codes

Controller Adjustments

The ZAPI™ transistor motor controller can store and display Error Codes (Alarms). It is also possible to modify the controller Setup for individual preferences. Communication with the controller is possible by four methods:

1. LED - An LED may be installed in trucks that do not use a dash display. The LED flashes error codes to the technician for diagnosis. The LED would be installed on the bottom of the ZAPI™ controller. The LED is installed in the connector port
2. Dash Display - Some trucks are equipped with an optional dash display or MDI. Error codes are shown on the LCD when the wrench symbol and red light are lit. The format is AL XX where XX is the error code.
3. ZAPI Handset - A diagnostic handset is available thru your Hyster or Yale dealer. The handset makes it possible to diagnose faults and modify controller settings.
4. Personal Computer - The controller can also be connected to a PC equipped with special software and cables. The PC can read, store, and change settings on the controller.

Proper use of these four methods and list of diagnostic codes are explained in this section.

NOTE:

General error code information is provided by the Dash Display and Red LED at the base of the controller. In most instances, it will be necessary to use a handset or a PC to further define the possible causes and test procedures.

Dash Display	Controller LED	Handset or PC	CONDITION
No LEDs or LCDs illuminated	LED OFF	Handset does not operate	<p>Dash display, controller LED, and truck inoperative</p> <p>TRUCK RESPONSE</p> <p>Travel and hydraulic functions disabled.</p> <p><u>POSSIBLE CAUSES AND TEST PROCEDURES</u></p> <ul style="list-style-type: none">• B+ and/or B missing at controller. <p>Confirm battery is connected and of proper voltage. Verify key switch is ON. Verify brake override circuit is connected in run position. Verify continuity between batteries negative (at battery) and B power wire connection (at controller).</p> <p>If no continuity, check:</p> <p>Power wiring between battery and controller. Check for +24V at D-4, A-3, and A-6.</p> <p>If no continuity, check:</p> <p>Fuse 2 for open. Key switch continuity in ON position. Wiring battery + to main contactor to fuse 2 to key switch, to controller A-6 connection.</p> <ul style="list-style-type: none">• Defective battery charger <p>Disconnect wires 2D and 12 from leads to battery charger. Use test lead to connect 2D and 12. If truck operates, check charger fuses, repair or replace battery charger.</p> <ul style="list-style-type: none">• Defective motor controller. <p>Check for battery voltage between A-6 and B-power wire connection at controller. If correct battery voltage, replace controller.</p>

Dash Display	Controller LED	Handset or PC	CONDITION
No LEDs or LCDs illuminated	LED OFF	No error codes present	<p>Dash display and/or controller LED inoperative.</p> <p>TRUCK RESPONSE</p> <p>Travel and hydraulic functions normal.</p> <p><u>POSSIBLE CAUSES AND TEST PROCEDURES</u></p> <ul style="list-style-type: none">• Open connection between dash display and controller. Verify harness connections at MDI and connector

B on controller.
 Verify continuity of wires between MDI and controller.

- Defective dash display.

Connect handset to controller and confirm communication to handset.
 If handset operates correctly, replace MDI.

- Defective LED.

Disconnect LED and connect handset. If handset works, replace LED.

Dash Display No LEDs or LCDs illuminated	Controller LED LED OFF	Handset or PC NO COMMUNICATION	CONDITION Dash display and/or controller LED inoperative. TRUCK RESPONSE Travel and hydraulic functions normal. POSSIBLE CAUSES AND TEST PROCEDURES • Defective controller. Connect handset to controller and confirm communication to handset. If handset will not communicate with controller, replace controller.
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Dash Display No Alarm	Controller LED LED OFF - No Flashes	Handset or PC INCORRECT START	CONDITION Improper startup sequence by operator. TRUCK RESPONSE Traction and hydraulic functions disabled. POSSIBLE CAUSES AND TEST PROCEDURES • Throttle or hydraulic function selected at key ON. Steer handle in run position at key ON. Return steer handle to full upright position. Return throttle to neutral. Release all hydraulic function controls. If fault remains, attach handset and go to test menu. • Check brake switch, it should be off. If steer handle is in vertical position and reading is not OFF, check brake switch for damage, interference, or shorts. • Check accelerator - Should be 0 volts at neutral. If not, repeat control card calibration. If this does not correct the problem, replace control card. • Check hydraulic inputs – Should be 0 volts. If not, recalibrate tiller card. Follow auto-learn procedure listed in steering. If this does not clear fault, check buttons for damage or interference. Replace damaged or faulty buttons.
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Dash Display AL66	Controller LED Continuous Flashing	Handset or PC BATTERY LOW	CONDITION Battery discharged and requires charging. TRUCK RESPONSE Hydraulic lift function disabled. POSSIBLE CAUSES AND TEST PROCEDURES • Battery voltage is low. Charge or replace battery. • Controller voltage calibration is incorrect. Install handset. Go to test menu and select Battery Voltage. Compare tester voltage to voltage measured by an accurate digital voltmeter between B+ and B terminals. Pull down tiller handle to engage contactor for this measurement. If these two voltages are more than 1.5
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volts difference, replace controller.

Dash Display AL99	Controller LED Continuous Flash	Handset or PC BATTERY KO	CONDITION Improper battery connection or defective battery. TRUCK RESPONSE Traction and hydraulic functions disabled. POSSIBLE CAUSES AND TEST PROCEDURES <ul style="list-style-type: none">• Incorrect battery selected. Verify correct battery voltage for truck.• Damaged or extremely discharged battery. Disconnect battery and check voltage at connector. Inspect battery for correct water level and damage. Repair or replace battery.• Defective or damaged connection to battery. Inspect cable crimps and cables from battery to connector. Inspect cable crimps and cables from battery contactor to controller and contactor.
Dash Display AL01	Controller LED 1 Flash	Handset or PC VACC NOT OK	CONDITION Connection/communication error between tiller card and traction controller. TRUCK RESPONSE Traction and hoist functions disabled. POSSIBLE CAUSES AND TEST PROCEDURES <ul style="list-style-type: none">• Control card throttle calibration is out of range. Install handset. Go to tester function of handset. If accelerator output is >1V (20%) and the enable switch is open, recalibrate control card.• Control card throttle damaged or defective. If card cannot be recalibrated, replace card.
Dash Display AL01	Controller LED 1 Flash	Handset or PC PUMP VACC NOT OK	CONDITION Connection/communication error between control card and traction controller. TRUCK RESPONSE Traction and hoist functions disabled. POSSIBLE CAUSES AND TEST PROCEDURES <ul style="list-style-type: none">• A lift/lower switch is damaged or defective. Install handset. Go to tester function. Check lifting control and EVP voltage.” Check on/off switches for smooth, linear operation. Replace damaged switches.• Control card lift/lower switch calibration is out of range. Install handset. Go to tester function. Check lifting control and EVP voltage. Output of hydraulic controls should be less than 1V (20%) at neutral. Recalibrate control card.• Control card is damaged or defective. Replace card.
Dash Display AL01	Controller LED 1 Flash	Handset or PC FORW + BACK	CONDITION Connection/communication error between control card and traction controller. TRUCK RESPONSE Traction and hoist functions disabled. POSSIBLE CAUSES AND TEST PROCEDURES <ul style="list-style-type: none">• Control card throttle device is damaged or defective. Install handset. Go to tester function. If forward

Dash Display AL01	Controller LED 1 Flash	Handset or PC SERIAL ERROR #1	<p>switch and backward switch are both on at the same time, card is damaged. Replace control card.</p> <p>CONDITION Connection/communication error between control card and traction controller.</p> <p>TRUCK RESPONSE Traction and hoist functions disabled.</p> <p>POSSIBLE CAUSES AND TEST PROCEDURES</p> <ul style="list-style-type: none"> • Loose or damaged electrical connection between control card and controller. Verify connection at controller. Verify wire harness connection at base of steer handle. Verify connection at control card. • Damaged or defective control card. Measure voltage at pin 5, connector C, on the controller. With control card disconnected, this should be about 12V; with the card connected, it should be about 5V. 0V or 12V with the card connected means that the card is damaged. Replace control card.
Dash Display AL01	Controller LED 1 Flash	Handset or PC INPUT ERROR #1	<p>CONDITION Connection/communication error between control card and traction controller.</p> <p>TRUCK RESPONSE Traction and hoist functions disabled.</p> <p>POSSIBLE CAUSES AND TEST PROCEDURES</p> <ul style="list-style-type: none"> • Traction reversing switch is not connected. Install handset. Go to tester function. Check for operation of traction reversing switch. Verify that traction reversing switch cover is making contact with switch on control card. Check wires in control handle arm are secure. • Damaged or defective control card. Replace control card.
SW Version 1.08 AL21			
Dash Display AL01	Controller LED 1 Flash	Handset or PC INPUT ERROR #2	<p>CONDITION Connection/communication error between control card and traction controller.</p> <p>TRUCK RESPONSE Traction and hoist functions disabled.</p> <p>POSSIBLE CAUSES AND TEST PROCEDURES</p> <ul style="list-style-type: none"> • Traction reversing switch is not connected. Install handset. Go to tester function. Check for operation of traction reversing switch. Verify that traction reversing switch cover is making contact with switch on control card. • Damaged or defective cable. Check steer handle control cable for loose connections or broken wires. • Damaged or defective control handle card. Replace control card.
Dash Display AL02	Controller LED 2 Flashes	Handset or PC CONTACTOR CLOSED	<p>CONDITION Main contactor circuit is damaged.</p> <p>TRUCK RESPONSE Traction and hydraulic functions disabled.</p>

Dash Display AL4	Controller LED 4 Flashes	Handset or PC EVP NOT OK
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POSSIBLE CAUSES AND TEST PROCEDURES

- Main contactor tips are welded closed.
Disconnect power leads at contactor. Use meter to confirm open circuit across power terminals. If short circuit is measured, replace contactor.
- Problem in motor field circuit.
Verify electrical connections between motor field and controller.
Check motor field for shorts to chassis.
- Controller is damaged.
Replace controller.

CONDITION

Lowering valve will not operate correctly.

TRUCK RESPONSE

Traction and hydraulic functions disabled.

POSSIBLE CAUSES AND TEST PROCEDURES

- Damaged or loose electrical connection to lowering valve.
Verify electrical connections between valve coil and controller.
- Lowering coil damaged.
Check lowering valve coil for correct resistance. Coil resistance should be approximately 33 ohms. Replace coil if damaged.
- Lowering valve cartridge is damaged.
Replace lowering valve cartridge.

Dash Display AL5	Controller LED 5 Flashes	Handset or PC EB DRIVER KO
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CONDITION

Electric brake does not release or remains released at all times.

TRUCK RESPONSE

Traction and hydraulic functions disabled.

POSSIBLE CAUSES AND TEST PROCEDURES

- Damaged or loose electrical connection to brake.
Verify electrical connection between electric brake and controller.
- Check brake coil for correct coil resistance.
Disconnect brake. Measure brake coil resistance in both directions. Coil resistance should be between 27.36 and 30.24 ohms.
- Damaged controller.
Activate the brake switch. Use voltmeter to measure voltage on wire 2C and 17 with brake connected in circuit. If both measurements are 24V and the alarm is displayed, then controller is damaged.

Dash Display AL6	Controller LED 6 Flashes	Handset or PC V FIELD NOT OK
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CONDITION

Voltage measured at field connections is not correct.

TRUCK RESPONSE

Traction and hydraulic functions disabled.

POSSIBLE CAUSES AND TEST PROCEDURES

- Cable connection to motor field is loose or damaged.
Verify connection of field wires to motor and controller.
- Check condition of crimps on wires connecting to F1 and F2.

Dash Display	Controller LED	Handset or PC	CONDITION
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AL6	6 Flashes	I = 0 EVER	<p>Motor current levels do not exceed a preset minimum value while driving.</p> <p>TRUCK RESPONSE Traction and hydraulic function disabled.</p> <p>POSSIBLE CAUSES AND TEST PROCEDURES</p> <ul style="list-style-type: none"> • Damaged or loose electrical connections to traction motor. <p>Verify electrical connections between traction motor and controller.</p> <ul style="list-style-type: none"> • Traction motor armature resistance is too low. <p>Check traction motor armature for shorts.</p> <ul style="list-style-type: none"> • Controller is damaged. <p>Cycle key switch. Place steer handle in drive position and select throttle. If the truck starts to drive but then stops and presents code AL6, replace controller.</p>
Dash Display	Controller LED	Handset or PC	CONDITION
AL6	6 Flashes	HIGH FIELD CURR, BW HIGH FLD CURR, FW HIGH FLD CURR	<p>High field current values measured by controller.</p> <p>TRUCK RESPONSE Traction and hydraulic functions disabled.</p> <p>POSSIBLE CAUSES AND TEST PROCEDURES</p> <ul style="list-style-type: none"> • Field wires are loose, damaged, or shorted. <p>Verify connection of field wires to motor and controller.</p> <ul style="list-style-type: none"> • Motor field winding is shorted or too low. <p>Check motor field for correct resistance and continuity. It should measure approximately 0.5 ohms.</p> <ul style="list-style-type: none"> • Failure of current sensor in controller. <p>Replace controller.</p> <ul style="list-style-type: none"> • Failure of field current driver in controller. <p>Replace controller.</p>
Dash Display	Controller LED	Handset or PC	CONDITION
AL6	6 Flashes	NO FIELD CURR	<p>Low field current values measured by controller.</p> <p>TRUCK RESPONSE Traction and hydraulic functions disabled.</p> <p>POSSIBLE CAUSES AND TEST PROCEDURES</p> <ul style="list-style-type: none"> • Cable connection to motor field is loose or damaged. <p>Verify connection of field wires to motor and controller.</p> <ul style="list-style-type: none"> • Motor field winding is open or too high. <p>Check motor field for correct resistance and continuity. It should measure approximately 1.5 ohms.</p> <ul style="list-style-type: none"> • Field current sensor in controller has failed. <p>Replace controller.</p> <ul style="list-style-type: none"> • Main contactor circuit damaged or disconnected. <p>Verify electrical connection between controller and contactor.</p> <p>Check contactor coil for correct resistance of 52.0 ohms.</p> <ul style="list-style-type: none"> • Field current drivers in controller are damaged. <p>Replace controller.</p>
SW Version 1.08 AL60			
Dash Display	Controller LED	Handset or PC	CONDITION
AL6	6 Flashes	STBY I HIGH	<p>Controller detects motor current during standby mode.</p> <p>TRUCK RESPONSE Traction and hydraulic functions disabled.</p> <p>POSSIBLE CAUSES AND TEST PROCEDURES</p> <ul style="list-style-type: none"> • Damaged controller. <p>Replace controller.</p>
SW Version 1.08 AL61			

Dash Display AL7	Controller LED 7 Flashes	Handset or PC THERMAL PROTECT	<p>CONDITION Controller temperature is out of operating range.</p> <p>TRUCK RESPONSE Traction functions reduced below -10 C (14 F) and above 75 C (167 F). Traction and hydraulic functions disabled above 90 C (194 F).</p> <p>POSSIBLE CAUSES AND TEST PROCEDURES</p> <ul style="list-style-type: none"> • Controller temperature is too hot/cold. Move truck to cooler or warmer location and allow controller to return to operating temperature. • Controller temperature miscalibrated. Install handset. Go to tester function and check temperature. Controller and vehicle temperature should be same as room temperature at initial startup. If these temperatures differ, replace controller. • Controller temperature sensor damaged. Replace controller. • Controller damaged. Replace controller.
Dash Display AL8	Controller LED 8 Flashes	Handset or PC POWER FAILURE #1	<p>CONDITION Short circuit in device connected to controller.</p> <p>TRUCK RESPONSE Traction and hydraulic functions disabled.</p> <p>POSSIBLE CAUSES AND TEST PROCEDURES</p> <ul style="list-style-type: none"> • Overcurrent detected in driven component. Check main harness for damaged or shorted connections to main contactor, brake, and electric valve coils. Check main contactor, brake, and electric valve coils for correct resistance values. Main contactor = 52 ohms Brake coil = 29 ohms Electric valve coils = 17.7 ohms Value should be within ±10% at room temperature.
Dash Display AL10	Controller LED LED ON (No Flashing)	Handset or PC EEPROM KO	<p>CONDITION Fault in the memory area where parameters are stored.</p> <p>TRUCK RESPONSE Traction and hydraulic functions disabled.</p> <p>POSSIBLE CAUSES AND TEST PROCEDURES</p> <ul style="list-style-type: none"> • Controller damaged. Recycle key switch OFF and ON If fault remains, replace controller.
Dash Display AL10	Controller LED LED ON (No Flashing)	Handset or PC CAPACITOR CHARGE	<p>CONDITION Main controller capacitors did not charge within 500 ms of key ON.</p> <p>TRUCK RESPONSE Traction and hydraulic functions disabled.</p> <p>POSSIBLE CAUSES AND TEST PROCEDURES</p> <ul style="list-style-type: none"> • Loose or damaged wire connection. Inspect and confirm wire connections at contactor, pump motor, and traction motor. • Short circuit in harness. Disconnect main harness and check for shorts. • Short circuit in component coil. Disconnect battery. Disconnect all drive motor,

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AL11

pump motor, solenoid, brake, and coil connections at the component end of the harness. Tape or secure the wire ends to prevent shorts. Discharge controller by placing 200 , 2W resistor across B+ and B terminals. Reconnect battery and turn key ON. Use voltmeter to observe voltage across B+ and B . If there is no voltage increase, replace controller. If there is a steady voltage increase to battery voltage, connect each accessory one at a time until the fault occurs to identify damaged component.

- Damaged controller.
Replace controller.

CONDITION

Measured voltage at traction motor inputs does not match battery voltage.

TRUCK RESPONSE

Traction and hydraulic functions disabled.

POSSIBLE CAUSES AND TEST PROCEDURES

- Loose or damaged cable connections to motor. Verify motor armature cables and connections.
- Ground between motor windings and chassis. Check for grounds between motor chassis and terminals.
- Damaged controller.

Voltage at –T terminal on controller should be the same as the +B terminal.

Replace controller.

CONDITION

Voltage measured at field connections is not correct.

TRUCK RESPONSE

Traction and hydraulic functions disabled.

POSSIBLE CAUSES AND TEST PROCEDURES

- Cable connection to motor field is loose or damaged. Verify connection of field wires to motor and controller.
- Motor field winding is shorted to chassis. Check motor field for shorts to chassis.

Measure motor field resistance. Motor field should be approximately 1.5 ohms .

- Field current driver circuit has failed.

Use a voltmeter to measure between F1 and B- and F2 and B- with battery connected and key ON. Voltage should measure 1/2 the voltage between B+ and B- .

Replace controller.

- Field current drivers in controller are damaged. Replace controller Verify motor field cable connections.

CONDITION

Watchdog hardware circuit is not OK.

TRUCK RESPONSE

Traction and hydraulic functions disabled.

POSSIBLE CAUSES AND TEST PROCEDURES

- Watchdog hardware circuit is damaged.

Clear the fault log and recycle key switch OFF, then ON. Operate truck to test. If alarm returns, replace controller.

Dash Display AL10	Controller LED LED ON (No Flashing)	Handset or PC VMN NOT OK
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AL12

Dash Display AL10	Controller LED LED ON (No Flashing)	Handset or PC VFIELD NOT OK
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SW Version 1.08
AL13

Dash Display AL10	Controller LED LED ON (No Flashing)	Handset or PC WATCHDOG
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SW Version 1.08
AL15

Dash Display **Controller LED** **Handset or PC**
AL10 LED ON (No Flashing) Driver Shorted

SW Version 1.08
AL14

CONDITION
Voltage measured at field connections is not correct.

TRUCK RESPONSE

Traction and hydraulic functions disabled

POSSIBLE CAUSES AND TEST PROCEDURES

- Cable connection to motor field is loose or damaged. Verify connection of field wires to motor and controller.
- Motor field winding is shorted to chassis. Check motor field for shorts to chassis.
- Main Contactor coil shorted/open. Check contactor coil for correct resistance of 45 to 55 ohms

Dash Display **Controller LED** **Handset or PC**
AL94 OFF NONE

CONDITION
Controller is installing hourmeter memory to MDI display if controller has been replaced.

TRUCK RESPONSE

Traction and hydraulic functions disabled for 1 minute.

POSSIBLE CAUSES AND TEST PROCEDURES

- No fault is occurring. Controller will send hourmeter data to MDI and truck will operate as soon as transfer is complete. Wait approximately 60 seconds.