

## **Controller EV48-400 faults and alarms V3.0**

# Chapter 1 Fault Indication

Fault identification: (LED indicator light)

| state     |                    | Description of LED display information                                                                                                                                                                     |
|-----------|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| red light | green light        |                                                                                                                                                                                                            |
| OFF       | OFF                | The system is not power on                                                                                                                                                                                 |
| OFF       | Normally on        | The system is being powered on or restored to factory Settings                                                                                                                                             |
| OFF       | Breathing flashing | Normal system operation                                                                                                                                                                                    |
| flashing  | flashing           | System failure<br>Fault code = Blinking green times * 10 + blinking red times<br>For example:<br>Eg: Fault code 24 The green indicator blinks twice and the red indicator blinks four times in a unit time |

## Chapter 2 Alarm severities

Class 1: Main circuit breaker is open, motor is prohibited from working, and motor command (accelerator) fails.

Class 2: Motor prohibited from operation, and motor command (accelerator) fails.

Class 3: Battery is undervoltage, limiting the maximum motor speed.

Class 5: Limit maximum output torque of a motor.

Class 6: Limit maximum motor speed.

Class 15: Power output port overcurrent fault, faulty port output prohibited.

Class 20: Warning.

### Chapter 3     Fault Overview

| Fault code | Fault level | The fault name                              | note |
|------------|-------------|---------------------------------------------|------|
| 1          | 1           | battery voltage too high.                   |      |
| 2          | 1           | battery voltage too low.                    |      |
| 3          | 20          | Accelerator startup wrong                   |      |
| 4          | 20          | Maintenance time reached                    |      |
| 5          | 1           | Flash memory error                          |      |
| 6          | 1           | Bus voltage too low                         |      |
| 7          | 20          | Bus voltage too high                        |      |
| 8          | 1           | Drive motor overcurrent                     |      |
| 11         | 1           | The main contactor faulty                   |      |
| 12         | 3           | battery capacity low.                       |      |
| 13         | 5           | Drive motor temperature too high            |      |
| 15         | 1           | Drive motor current offset                  | 0    |
| 17         | 1           | The main contactor coil overcurrent         |      |
| 20         | 5           | Controller temperature too high             |      |
| 27         | 1           | Controller current over threshold           |      |
| 37         | 1           | The 5V output of the controller is too low  |      |
| 38         | 1           | The 12V output of the controller is too low |      |
| 39         | 2           | Motor stall                                 |      |
| 40         | 15          | DRIVE1 output over current                  |      |
| 41         | 15          | DRIVE2 output over current                  |      |
| 42         | 15          | DRIVE3 output over current                  |      |
| 43         | 15          | DRIVE4 output over current                  |      |
| 44         | 15          | DRIVE5 output over current                  |      |
| 45         | 15          | DRIVE6 output over current                  |      |
| 46         | 15          | DRIVE7 output over current                  |      |
| 47         | 2           | Solenoid brake control coil open fault      |      |

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|     |    |                                                                   |  |
|-----|----|-------------------------------------------------------------------|--|
| 48  | 6  | Mechanical failure of electromagnetic brake                       |  |
| 49  | 1  | Battery charger connected                                         |  |
| 61  | 2  | Drive motor temperature too high                                  |  |
| 62  | 2  | The direction switch is activated simultaneously                  |  |
| 63  | 20 | The interlock switch not activated                                |  |
| 64  | 20 | Wrong start sequence                                              |  |
| 66  | 2  | Controller temperature too high                                   |  |
| 71  | 2  | Controller temperature sensor faulty                              |  |
| 74  | 1  | Drive motor encoder failure                                       |  |
| 83  | 1  | Flash no parameters                                               |  |
| 84  | 1  | flash memory parameter overrun                                    |  |
| 85  | 20 | Wrong starting sequence                                           |  |
| 87  | 1  | The system parameters do not match the<br>firmware version        |  |
| 88  | 1  | The system parameters do not match the<br>firmware type           |  |
| 89  | 1  | The system parameters do not match the<br>firmware product number |  |
| 91  | 6  | Steering sensor failure                                           |  |
| 92  | 2  | Pedal accelerator error                                           |  |
| 95  | 2  | The motor temperature sensor short circuit                        |  |
| 97  | 2  | The motor temperature sensor open circuit                         |  |
| 98  | 1  | Bus capacitor precharge failure                                   |  |
| 100 | 2  | The external meter communication is faulty                        |  |
| 101 | 6  | The CAN bus communication is faulty                               |  |

## Chapter 4      Fault description and solution

### **Battery voltage too high**

Fault code :1

Fault level :1

Fault diagnosis: According to internal measurement of the control unit, the bus voltage exceeds the set maximum allowed threshold. A solution to the problem:

1. Check whether the battery string cable is properly connected to the electric control system.
2. Check whether the battery voltage is normal.
3. Determine the overvoltage threshold
4. Replace the controller.

### **Battery voltage too low**

Fault code :2

Fault level :1

Fault diagnosis: The control unit measures the battery string voltage lower than the set minimum allowed threshold. A solution to the problem:

1. Check the battery string voltage.
2. Check whether the battery string cables are connected incorrectly and whether the positive and negative electrode connectors are corroded.
3. Check the battery string status: If the battery electrolyte is partially exhausted, the controller undervoltage protection fault may occur
4. Ensure that the overvoltage threshold is proper
5. Replace the controller

### **Accelerator startup wrong**

Fault code :3

Fault level :20

Fault: The accelerator is activated before the LOCK signal is activated

A solution to the problem:

1. Release the accelerator pedal
2. Check the setting of accelerator pedal calibration to see whether the setting of minimum and maximum voltage of accelerator pedal is accurate. If not, recalibrate the accelerator pedal, which can be set by

monitoring software or instrument of the upper computer.

3. Check the accelerator cable connection.
4. Replace the accelerator
5. Replace the controller

#### **maintenance time reached**

Fault code :4

Fault level :20

Fault diagnosis Cause: The maintenance period ends.

A solution to the problem:

1. Re-assign the value of the maintenance timer in the controller through FJ monitoring software or instrument
2. Turn off this function (no maintenance prompt is required) and restart the electric control

#### **Flash failure error**

Fault code :5

Fault level :1

A controller fails to read or write data from the flash memory

A solution to the problem:

1. Replace the Controller

#### **Bus voltage too low**

Fault code :6

Fault level :1

Fault diagnosis: According to internal measurement of the control unit, the bus voltage is lower than the set minimum allowed threshold. A solution to the problem:

1. Check whether the main circuit breaker works properly.
2. Check the cable harness connected to the coil of the main circuit breaker
3. Check whether the main fuse is in good condition.
4. Check whether the battery string voltage is normal
5. Ensure that the undervoltage threshold is proper
6. Replace the controller.

**Bus voltage too high**

Fault code :7

Fault level :20

Fault diagnosis: The bus voltage exceeds the set value, and the output current is restricted according to the fault diagnosis.

1. Check whether the battery is properly connected
2. Check whether battery string parameters are consistent

**Drive motor overcurrent**

Fault code :8

Fault level :1

Fault cause: The output current of the controller exceeds the threshold.

A solution to the problem:

1. Check whether there is a short circuit between the UVW three-phase cable connection between the drive module and the motor (short circuit between the three-phase cables or a phase cable and the forklift frame), and check whether the motor coil has a burning smell.
2. Disconnect the UVW cable of the power module, and use a multimeter to check whether the resistance value between the +/-B terminal of the module and the UVW terminal is symmetrical. If the resistance value of one phase is found to be significantly different from the other phases, the controller can be identified

It has burned out and needs to be replaced.

**The main contactor faulty**

Fault code :11

Fault level :1

Lent Fault cause: The system is powered on, and the voltage of the precharged capacitor cannot be released. A solution to the problem:

1. Replace the main circuit breaker.
2. Replace the controller.

**Battery capacity low**

Fault code :12

Fault level :3

Fault Diagnosis Cause: The voltage of the battery string is lower than the minimum discharge threshold. A solution to the problem:

1. Monitor the battery string voltage, stop the operation, and charge the battery string
2. Check whether battery string parameters are correctly set

#### **Drive motor temperature too high**

Fault code :13

Fault level :5

Fault diagnosis: The measured motor temperature exceeds the user-set "Traction motor overtemperature Protection Point" temperature. A solution to the problem

First check whether the connection between the motor temperature sensor and the main line is normal. If the fault occurs when the motor is not hot:

1. Use a handheld multimeter, put it in resistance measurement mode, measure the resistance value between the two lines of the motor temperature sensor, compare with the true value table of the motor temperature sensor, if the measured value is inconsistent with the actual temperature of the motor, then replace the temperature sensor.
2. Replace the controller.

If the fault occurs when the motor is very hot:

1. If the temperature value read from the monitoring software or instrument of the upper computer is consistent with the actual temperature of the motor, check whether the motor housing clean, motor heat dissipation is normal.
2. Test whether the drive motor is working normally, whether there is brake lock or other abnormal conditions.

#### **Drive motor current offset**

Fault code :15

Fault level :1

Fault diagnosis: The phase current of the driving motor is not zero when the system is started. A solution to the problem:

1. Check whether the system battery and motor are well insulated
2. Replace the controller.

#### **The main contactor coil overcurrent**

Fault code :17

Fault level :1

The fault causes: The main contactor coil current is too high, which is out of the operating range.

1. Check whether the control coil of the main contactor is short-circuited to the wire harness.
2. Check whether the resistance value of the main contactor control coil is within the normal range.
3. Replace the controller.

#### **Controller temperature too high**

Fault code :20

Fault level :5

Fault Diagnosis The fault causes: The power unit temperature exceeds 80 ° C. A solution to the problem:

1. The fault may be caused by insufficient heat dissipation. Check the heat dissipation between the control unit and the aluminum plate as well as between the aluminum plate and the frame. Note: you can read the temperature of the motor power module through your own upper computer software or instrument.
2. If the heat dissipation measures of the above modules are all good, it is necessary to check whether the drive motor works normally and the electrical conduction if it does not work normally

Power module overheating; Second, replace the power module.

3. Replace the controller

#### **Controller current over threshold**

Fault code :27

Fault level :1

Fault diagnosis. The fault causes: The output current of the controller exceeds a set threshold. A solution to the problem:

1. Ensure that the threshold is set properly
2. Check whether there is a short circuit between the UVW three-phase cable connection between the drive module and the motor (short circuit between three-phase cables or a phase cable and the forklift frame), and check whether the motor coil has a burning smell.
3. Disconnect the UVW cable of the power module, and use a multimeter to check whether the resistance value between the +/-B terminal of the power module and the UVW terminal is symmetrical. If the resistance value of one phase is found to be significantly different from the other phases, the power module can be determined to be burned out and the power module needs to be replaced.
4. Replace the controller

#### **The 5V output of the controller is too low**

Fault code :37

Fault level :1

Fault diagnosis the fault causes: the 5V output voltage of the control unit is lower than 4.3V.

A solution to the problem:

1. Check whether the 5V output is grounded, and check whether the wiring of each motor encoder is correct.
2. Exclude external devices that use the 5V output of the control unit one by one.

3. Replace the controller.

### **The 12V output of the controller is too low**

Fault code :38

Fault level :1

Fault diagnosis the fault causes: the 12V output voltage of the control unit is lower than 10.8V

1. Check whether the 12V output is grounded. It may be caused by the following wiring errors:

accelerator pedal

steering sensor

instrument

2. Exclude external components that use 12V output from the controller one by one.
3. Replace the controller.

### **Motor stall**

Fault code :39

Fault level :6

The fault causes: the motor has a rotation command, but the actual speed is 0, according to the fault solution:

1. Check whether the motor encoder is normal
2. Whether the setting of driving current is reasonable and meets the requirements of working conditions
3. The actual working condition (climbing slope) exceeds the design value of the vehicle.

### **Controller power port (Drive1 to Drive7) output overcurrent**

Fault code :40~46 (corresponding to Drive1~Drive7)

Fault level :15

Cause of failure: Through the internal measurement of the control unit, Drive1~Drive7 port output current exceeds the threshold. Solution:

1. Check whether Drive1~Drive7 port connection load is too large
2. Check whether the cable harness connecting Drive1~Drive7 ports has a short circuit

3. Replace the control unit

#### **solenoid brake control coil open fault**

Fault code :47

Fault level :2

Fault cause: Controller internal detection, electromagnetic brake control coil disconnection fault  
solution:

1. Check whether the broken resistance value of the electromagnetic brake control coil is reasonable
2. Replace the electromagnetic brake
3. Ensure that the output port of the controller driver is correct
4. Replace the controller

#### **Mechanical failure of electromagnetic brake**

Fault code :48

Fault level :6

The fault causes: the electromagnetic brake is released, and the controller detects that the motor still speeds according to a fault solution:

1. Check that the type of the electromagnetic drive matches the load of the vehicle
2. Check the cable harness of the control coil corresponding to the electromagnetic drive
3. Replace the controller

#### **The charger is connected**

Fault code :49

Fault level :1

Fault cause: The charger is connected, and the whole car limits movement.

Solution: Disconnect the battery charger.

#### **Motor temperature is too high**

Fault code :61

Fault level :1

Fault diagnosis: The measured motor temperature exceeds the maximum allowed temperature set by the user.

A solution to the problem:

First check whether the connection between the motor temperature sensor and the main line is normal.

If the fault occurs when the motor is not hot:

1. Use a handheld multimeter, put it in resistance measurement mode, measure the resistance value between the two lines of the motor temperature sensor, compare with the true value table of the motor temperature sensor, if the measured value is inconsistent with the actual temperature of the motor, then replace the temperature sensor

2. Replace the controller.

If the fault occurs when the motor is very hot:

1. If the temperature value read from the monitoring software or instrument of the upper computer is consistent with the actual temperature of the motor, check whether the motor housing is clean and whether the heat dissipation of the motor is normal

2. Test whether the drive motor is working normally, whether there is brake lock or other abnormal conditions.

### **The direction switch is activated simultaneously**

Fault code :62

Fault level :2

Fault cause: The controller receives a motor speed instruction given by the ECU, which is not 0. However, the controller is activated in the forward direction and in the given direction. A solution to the problem:

1. Check the direction switch
2. Check the cable harness

### **Wrong start sequence**

Fault code :64

Fault level : 20

Either the front or back switches are activated during startup or when the LOCK signal is activated.

A solution to the problem:

1. Release the direction switch
2. If the direction switch is not activated, check whether the direction switch connection terminal is correctly connected to the main cable connection terminal. The monitoring software can be used for auxiliary detection.
3. Replace the direction switch.

#### 4. Replace the controller

##### **Controller temperature too high**

Fault code :66

Fault level :1

Fault diagnosis The fault causes: The temperature of the power module of the driving motor exceeds 95 ° C.

A solution to the problem:

1. The fault may be caused by insufficient heat dissipation. Check the heat dissipation between the power module and the aluminum plate as well as between the aluminum plate and the frame. Note: you can read the temperature of the motor power module through your own upper computer software or instrument.

2. If the heat dissipation measures of the above modules are good, it is necessary to check whether the drive motor is working properly. If the power is not working properly, it will cause power

Module overheating; Second, replace the power module.

3. Replace the controller.

##### **Controller temperature sensor faulty**

Fault code :71

Fault level :2

The fault causes: the feedback voltage of the power unit temperature sensor is out of the normal range, which causes a short-circuit or disconnection.

Replace the controller.

##### **Drive motor encoder failure**

Fault code :Drive

Fault level :1

The fault causes: the encoder (A or B) channel signal is lost during the motor working. A solution to the problem:

1. Check whether the encoder is correctly connected

2. If the cables are correctly connected, replace the encoder.

3. Replace the controller.

##### **Flash no parameters**

Fault code :83

Fault level :1

Fault cause: The flash memory has no default parameters. A solution to the problem:

1. Reset the controller and power it on again
2. Replace the controller

#### **Flash memory parameter overrun**

Fault code :84

Fault level :1

Fault diagnosis Cause: The values read in the flash memory are out of the normal range.

A solution to the problem:

1. Reset the controller and power it on again
2. Replace the controller.

#### **Wrong starting sequence**

Fault code :85

Fault level :20

The fault causes: The accelerator is activated at the same time that the direction switch is activated.

1. Release the accelerator.
2. Check whether the accelerator wiring harness is correct

#### **The system parameters do not match the firmware version.**

Fault code :87

Fault level :1

Fault diagnosis Fault cause: The firmware version does not match the system default parameter version (old and new versions). A solution to the problem:

1. Check whether the firmware version corresponds to the default parameter version and load the correct firmware or E2 file

#### **The system parameters do not match the firmware type**

Fault code :88

Fault level :1

Fault diagnosis Cause: The firmware does not match the system default parameter types (in different application domains). A solution to the problem:

1. Check whether the firmware type corresponds to the current default parameter and load the correct firmware or E2 file

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### **The system parameters do not match the firmware product number**

Fault code :89

Fault level :1

Fault Diagnosis Fault cause: The firmware does not match the default system parameters. A solution to the problem:

1. Check the product number of the firmware and the current default parameters, and load the correct firmware or E2 file

### **Steering sensor failure**

Fault code :91

Fault level :6

Fault causes: The feedback voltage of the steering sensor is out of the calibration range. A solution to the problem:

1. Check whether the steering sensor is correctly connected:
2. If the wiring is fine, recalibrate the clockwise, intermediate and counterclockwise values of the steering sensor.
3. Replace the steering sensor and recalibrate.

### **Pedal accelerator error**

Fault code :92

Fault level :2

A fault occurs when the accelerator pedal feedback voltage value is greater than halfway through the trip, and the switch signal is still not activated. A solution to the problem:

1. Check the value setting of "Accelerator pedal Calibration" to see whether the minimum and maximum voltage values of the accelerator pedal are set accurately. If not, recalibrate.
2. Replace the accelerator pedal.
3. Replace the controller.

### **The motor temperature sensor short circuit.**

Fault code:95

Fault level:1

Fault cause: The feedback resistance value of the motor temperature sensor exceeds the normal range and approaches 0.   Solution:

1. Check whether the connection between the temperature sensor of the driving motor and the main cable is normal.

2. Replace the temperature sensor of the driving motor.

3. Replace the controller.

#### **The motor temperature sensor open circuit**

Fault code :97

Fault level :5

Fault diagnosis: The driving motor temperature sensor feedback resistance value exceeds the normal range and approaches infinity. A solution to the problem:

1. Check whether the connection between the temperature sensor of the driving motor and the main cable is normal.

2. Replace the temperature sensor of the driving motor.

3. Replace the controller.

#### **Bus capacitor precharge failure**

Fault code :98

Fault level :1

Fault diagnosis: During startup self-check, the voltage of a precharged capacitor increases slowly. A solution to the problem:

1. Ensure that +B and -B are properly connected

2. Replace the controller.

#### **External meter communication is faulty**

Fault code :100

Fault level :1

Fault diagnosis: The controller does not receive data from an external instrument during a fixed period of time (configurable).

A solution to the problem:

1. Check whether the cable harness is properly connected to the CAN bus

2. Check whether the external meter is running properly

3. Replace the controller.

#### **The CAN bus communication is faulty**

Fault code :101

Fault level :2 or 11

Fault cause: The communication unit data (BMS) is not received at the agreed time, according to a fault solution:

1. Check whether the communication unit is lost.
2. Check whether the communication line between the communication unit and the electric control is in good contact.
3. Replace the communication unit
4. Replace the controller.

Chapter 5    Lithium Battery Failure Description ( CAN Protocol)

| Fault code | type                                                                 | level | Fault code | type                                                            | level |
|------------|----------------------------------------------------------------------|-------|------------|-----------------------------------------------------------------|-------|
| 103        | The battery has a large differential pressure                        | 20    | 107        | The temperature of the lithium battery string is high           | 20    |
| 113        | The battery pressure difference is too large. Procedure              | 6     | 115        | The temperature of the lithium battery string is too high       | 6     |
| 129        | The battery pressure difference is too high                          | 1     | 126        | The temperature of the lithium battery string is too high       | 1     |
| 156        | The voltage of the battery is high                                   | 20    | 108        | The temperature of the lithium battery string is low            | 20    |
| 157        | The voltage of the battery is too high. Procedure                    | 6     | 116        | The temperature of the lithium battery string is too low        | 6     |
| 131        | The voltage of the battery is too high                               | 1     | 127        | The temperature of the lithium battery string is too low        | 1     |
| 158        | The battery voltage is low                                           | 20    | 170        | SOC is low                                                      | 20    |
| 159        | The voltage of the battery is too low. Procedure                     | 6     | 114        | SOC is too low                                                  | 3     |
| 124        | The voltage of the battery is too low                                | 1     | 119        | SOC is too low                                                  | 1     |
| 109        | The temperature of individual batteries varies greatly               | 20    | 166        | The discharge current of the lithium battery string is large    | 20    |
| 117        | The temperature difference between individual batteries is too large | 6     | 167        | The discharge current of the lithium battery string is too high | 6     |
| 128        | The temperature of each battery is too different                     | 1     | 133        | The discharge current of the lithium battery string is too high | 1     |
| 106        | Lithium battery pack has high voltage                                | 20    | 110        | The lithium-ion battery pack leaks electricity                  | 20    |
| 161        | The voltage of the lithium battery string is too high                | 6     | 172        | Lithium-ion battery packs leak badly                            | 6     |
| 132        | Lithium battery pack voltage is too high                             | 1     | 173        | The lithium-ion battery pack leaks badly                        | 1     |
| 162        | The lithium battery pack is low                                      | 20    | 176        | The BMS is faulty                                               | 20    |
| 120        | The voltage of the lithium battery string is too low                 | 6     | 134        | The BMS has a serious internal fault                            | 6     |
| 125        | Lithium battery pack voltage is too low                              | 1     | 135        | BMS has a very serious internal failure                         | 1     |
| 185        | Lithium battery solenoid high temp protection while charging         | 1     | 194        | Lithium battery solenoid high temp warning while charging       | 6     |
| 189        | Lithium battery solenoid high temp protection while discharging      | 1     | 195        | Lithium battery solenoid high temp warning while discharging    | 6     |
| 190        | Lithium battery single cell overvoltage protection while charging    | 1     | 196        | Lithium battery single cell overvoltage warning while charging  | 6     |
| 191        | Lithium battery overcurrent protection while charging                | 1     | 197        | Lithium battery overcurrent warning while charging              | 6     |
| 192        | Lithium battery low temp protection while charging                   | 1     | 198        | Lithium battery low temp warning while charging                 | 6     |
| 193        | Lithium battery high temp protection while charging                  | 1     | 199        | Lithium battery high temp warning while charging                | 6     |

