

OKAI

ES400A Operator Guide



Catalogue

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1. Modification record

Time	Description	Modified by
2020.8.1	Creation	Xiandi Chen
2020.12.23	Amend the content of section 2.4.1.2	Xiandi Chen
2021.02.24	Amend the content of section 2.4.2.1.3 and 3.1.3	Yaoji Wang
2022.7.29	Update	Xiandi Chen





2. Introduction

2.1. Cautions

All of the following functions are supported by OKAI scooters, but the client's server and APP support are required.

2.2. Vehicle Security

2.2.1. Communication and Equipment Security

OKAI establishes a customer-specific encryption key for each customer, which is used in the encryption system of electronic components (IOT, ECU, BMS, battery lock, straight pole lock, meter, the same below). The electronic parts of each customer cannot be exchanged. After the exchange, the encryption key is wrong, and the device cannot be verified. As a result, the vehicle cannot be unlocked, and it is impossible to ride.

Because OKAI electronic components adopt CAN BUS communication method, all electronic components can mutually verify whether each other is a legal device.

2.3. Vehicle Introduction Diagram



2.4. Function Introduction

2.4.1. IoT

OKAI's IOT is equivalent to the core brain of the vehicle, and it is used in conjunction with other hardware and equipment to realize functions such as controlling OKAI scooters, monitoring scooters data, and discovering current failures of the scooters. OKAI's IOT plays an important role in the normal operation of the scooter. Inside the IOT, there is a SIM card slot, into which an authorized SIM card is inserted to connect the IOT to the server. We have standard operating procedures (SOP)* "Install SIM card and configure ES400 network parameters" to help you perform this operation. Soon after, the IOT was able to receive commands from the server and control the scooter accordingly when connected. The configuration set in each command affects the behavior of the indicator, which makes manipulating the indicator very simple. After the client's scooter and server connected, the server opens a TCP port to monitor and generate a socket ID, which allows mutual communication (receiving and sending data).

All electronic components of OKAI Scooter and the IOT are connected through CAN BUS. The IOT can directly participate in the control of all electronic components, including collecting and reading the data of the electronic components. The IOT can also update the firmware of the instrument, ECU, BMS, helmet box, battery lock, cable lock, and hardware of the IOT through the FOTA function.

Please refer to *"How to connect to the server" for the specific operations you should do after receiving the bulk goods.



2.4.1.1. IOT Security

During the riding and charging of the scooter, if the server sends an OTA command to make an electronic component of the scooter perform OTA operation, IOT will directly refuse to upgrade. During the OTA process, IOT will not be able to monitor the status of each electronic component. OKAI believes this is risky, so it refuses to upgrade during riding and charging.

2.4.1.2. Speakers and audio frequency

IOT speakers can play **Lock**, **Unlock**, **Power On**, **Alarm**, **Locate**, **Mechanical Lock Locking**, and **Mechanical lock Unlocking** seven-section audio. The speaker volume is adjustable and can be set to any step of 0-7 through a server to the IOT. The volume can be appropriately reduced at night to prevent excessive volume from causing disturbance

- Play **Lock** audio when the scooter is successfully locked
- Play **Unlock** audio when the scooter is successfully unlocked
- Play **Power On** audio when the IOT is re-powered (for example, the battery is reconnected when the battery is changed) and the restart is successful
- Play **Alarm** audio when continuous vibration is detected or the battery door is opened abnormally
- Play **Locate** audio when server send command RTO.QUERY, meanwhile, headlight will flash for 10s
- Play **Mechanical lock Unlocking** audio when the mechanical lock is successfully unlocked and the door is successfully opened
- Play **Mechanical lock Locking** audio when the mechanical lock is successfully locked and the door is closed

2.4.1.3. LED

The IOT breathing lamp is used to confirm the current mode of the IOT.

ZK Series LED Definition			
No.	White LED	Red LED	Description
1	Off	Off	In INACTIVE mode
2	Alternating Flashing		In TEST mode
3	On(Breathing for ZK105)	Off	In NORMAL mode: Normal
4	Off	Flashing	In NORMAL mode: ECU fault
5	Off	On	In NORMAL mode: IOT fault

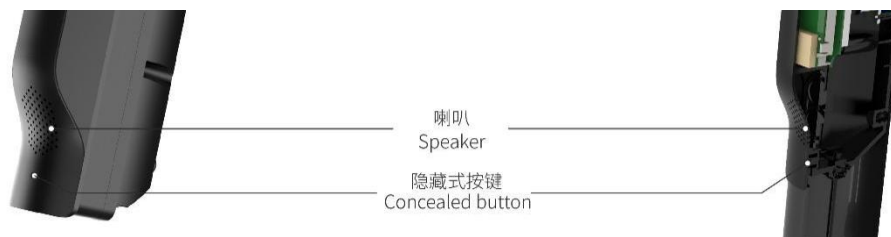
In general, the IOT of the sample scooter customer received defaults to test mode (red and white flashing alternately); The IOT mode of mass production in transit is inactive; After receiving the mass production and activating, the central control is in normal mode (white breathing light).

2.4.1.4. The difference of a demo sample and mass production

1. The functions of poking the pinhole are different.

Sample: Poke the pinhole on the surface of IOT for 2sec.

Mass production: Poke the pinhole on the surface of IOT for 5sec.



2. Demo sample (default test mode) and MP (default normal mode)

Test mode: flashing red and white breathing lights.

Normal mode: flashing white breathing lights.

Test mode: without vibration alarm.

Normal mode: with vibration alarm function.

Test mode: Supporting the way in which using USB cable and ZK_series ZK_series manage_tool to send command.

Normal mode: the way in which using USB cable and ZK_series ZK_series manage_tool to send commands is disabled. Only receive data from Bluetooth, NFC and server.

NFC and Bluetooth use the dynamic password and report it to the server for security.

Test mode is only available for our sample and for testing.

2.4.1.5. IOT Spare Battery

There is a spare battery inside the IOT, which is different from the main battery for powering the scooter. Under normal circumstances, when the main battery has power, it will continue to supply power to the spare battery until the spare battery is fully charged. When the main battery is exhausted, the backup battery will supply power to the IOT to send background data.

In addition, a spare battery is used to support GPS operation after disconnection. In this case, the emergency battery will report the location of the vehicle every four hours by default for about 15 days to help you determine the location of the vehicle. Please note that the emergency battery does not need to be manually recharged. It is charged by the main battery and only works when the main battery is exhausted.



2.4.1.6. **GPS**

OKAI attaches great importance to the function of helping customers search for vehicles when the vehicle loses connection. At present, all vehicles are equipped with LTE/GSM advanced bicycle trackers. The GPS receiver has superior sensitivity and fast positioning (FTFF), so it can quickly locate the vehicle. In addition, assisted GPS (AGPS) is also designed to enhance the vehicle positioning function and improve positioning accuracy. With the cooperation of GPS and AGPS, the vehicle will always be monitored or tracked by the back-end server regularly. When the main battery is exhausted, the spare battery of the IOT will support the background GPS data reporting. For details, please refer to <Spare Battery>.

2.4.1.7. **Freely set speed / no level speed regulation**

In order to drive your vehicle legally and safely, we insist on setting the speed. Due to different laws and regulations in different countries, please consult your government to know the local speed limit and use the server to change the speed configuration. Meeting the requirements of the local government and improving customer satisfaction has always been the focus and pursuit of our product improvement, so we can change the speed limit at any time. For example, in Germany, the maximum speed allowed is 20km/h, so it can be achieved only by setting this configuration through instructions.

2.4.1.8. **Alarm**

OKAI's scooters have two alarm mechanisms: in the case of deliberately opening the battery cover and continuous vibration, the alarm will be triggered conditionally. The two situations are different here, so that you can learn more.

Battery door alarm

The battery cover can only be opened by commands from the IOT. Any forced opening will trigger the IOT alarm, and the alarm sound is played by the IOT speaker.

Continuous vibration alarm

When the vehicle encounters continuous vibration, the IOT triggers a vibration alarm. This kind of continuous vibration alarm is to ensure that the alarm will not be triggered by accidental touch and avoid unnecessary complaints.

2.4.1.9. **NFC Function**

The NFC function can unlock and lock the vehicle. The NFC password is a dynamic password, which is only reported to the server. For more details, please refer to the +ACK:GTHBD command information.

2.4.1.10. **Bluetooth Function**

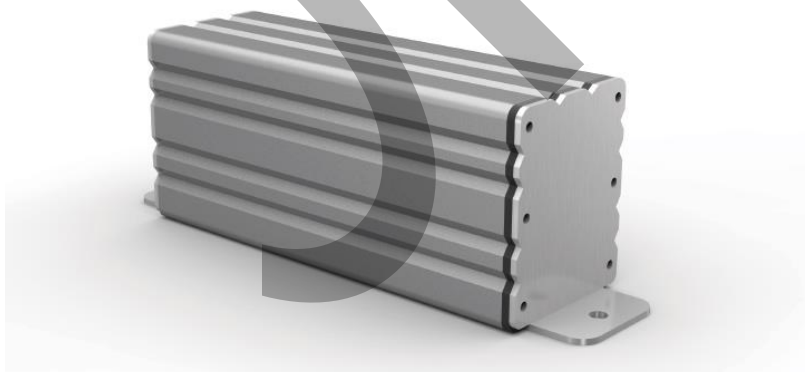
Bluetooth can unlock or lock the ECU lock, read ECU information, control LED, locate the vehicle, alarm and query vehicle information, etc. The Bluetooth password is a dynamic password, which is only reported to the server. For more details, please refer to the +ACK:GTHBD command information.

2.4.1.11. **Car locating**

OKAI scooter is equipped with a car locating command. After the car locating command is issued through the server, the IOT speaker can play the car locating audio and flash the headlights for 10 seconds to help OKAI customers find the car.

In order to avoid disturbing people at night, you can disable audio playback when sending a car locating command and only let the headlights flash for 10 seconds

2.4.2. **Electronic Control Unit (ECU)**



2.4.2.1. Security

2.4.2.1.1. Abnormal shutdown protection

In order to protect the safety of the user while riding, if the server sends the RTO.Lock command to lock the scooter by mistake, the ECU will not immediately lock the scooter after receiving the instruction, but will stop the drive motor and let the scooter slide without power. Wait for the speed <2m/h to lock the scooter.

2.4.2.1.2. Prevent the car from flying out

In order to prevent the user from accidentally pressing the accelerator and brake lever during the unlocking period, which may cause the user to be unable to ride after being unlocked, or the scooter will start immediately after sliding, OKAI ECU will show 18E, 19E, 20E on the display to prompt the user to release the accelerator and brake

2.4.2.1.3. Start mode: assist start mode

In order to prevent the user from accidentally pressing the accelerator, causing the scooter to start suddenly. The ECU of OKAI scooters adopts a power-assisted start mode, which requires the user to kick backwards with their feet to make a forward push. When the speed of the scooter reaches 4km/h, the scooter can be started.

2.4.2.1.4. Electronic Brake Function

In order to improve the stability and safety of the brakes, the ECU of the OKAI scooter has an electronic brake function, which can ensure that the scooter is braked in time when the mechanical brake is damaged. In addition, the electronic brake enhances the braking force, and in conjunction with the mechanical brake, the braking force can provide a timely braking force for the scooter. You can also send commands through IOT to adjust the gear position of the electronic brake (0-10 gears)

2.4.2.1.5. Self-Detection When power on

After receiving the unlocking command, the ECU of OKAI Scooter will automatically detect whether the vehicle wire is short-circuited, whether the MOS is damaged, etc., and if an abnormality is detected, the error code will be showed on the display and reported to the IOT



Server, and prohibit riding until the fault is resolved. You can refer to Chapter 4.1 <Fault Code> to solve the corresponding error

2.4.2.2. **Riding mode adjustment: soft mode and sport mode**

In order to cater to the riding experience of different groups of people, the ECU of OKAI scooters adopts two different riding modes: in the soft mode, the acceleration is slower; in the sport mode, the acceleration is faster. Users can switch between different modes through IOT to fully experience the riding effect of OKAI scooters.

2.4.2.3. **Fault Code**

- When OKAI ECU receives the unlocking command, it will automatically detect whether the vehicle wire is short-circuited, whether the MOS is damaged, etc., if an abnormality is detected, the error code will be displayed on the instrument and reported to the server through IOT
- OKAI ECU will monitor the status of the scooter in real time when riding. When the motor is overheated and the MOS driven by the ECU is overheated, it will display the error code on the meter and report it to the server through IOT. Riding is prohibited to protect user safety.

2.4.3. Battery



2.4.3.1. Battery display and buttons

There are LCD display and button on OKAI battery, by which users can view voltage, temperature, error code and other information. For the introduction of error codes, please refer to chapter 4.1

Functions of buttons:

- Press the key to wake up the LCD screen.
- Short press to switch: voltage, power percentage and temperature.
- When charging, short press to switch: voltage, power percentage and temperature. At the same time, the unit symbol flashes.
- Long press 5S to enter the engineering mode, display the current error code, and press 5S again to exit the engineering mode.
- Long press for 10s to reset the battery.

2.4.3.2. Battery specification

Es400a scooter battery is composed of Panasonic 18650-3200mah-3c cell, which has two different specifications: 13S3P(9.6Ah) and 13S5P(16Ah), The maximum discharge current is 20A, the maximum charging current is 5a, and the working temperature is - 20 °C - 60 °C.

2.4.3.3. BMS

OKAI scooter battery is installed with BMS system.

- The lithium battery BMS can monitor the power, manage the charge-discharge and protect the safety of the battery pack. It also provides the electrical interface and CAN interface. Lithium battery BMS is the core of the whole battery pack, which can be divided into monitoring function, charge and discharge management function, protection function and communication function.
- Monitoring function: Monitor the voltage, current and temperature of the battery pack in real-time, and update battery power accordingly. One of the core functions of lithium battery BMS is to accurately display the remaining capacity of the battery.
- Charge and discharge management function: the charging and discharging operation of the battery is managed by controlling the charging and discharging system in the control circuit.
- Protection function: Based on the voltage, current and temperature provided by the monitoring function, the battery pack is protected. It includes over-voltage protection, under voltage protection, over-current protection, short-circuit protection, over temperature protection, etc.
- Communication function: as a member of CAN communication, BMS can directly report the temperature, current, voltage and other data to the IOT, and send the data to the server through the IOT.

2.4.4. Display



2.4.4.1. Error code display

OKAI scooter meter can obtain the error code of each component through CAN bus, and display the error code on the meter. At the same time, the maintenance light will be on that indicates the vehicle needs repairing. If there is an error, the user will know at once, and stop using the scooter, at the same time, inform the server of the error

2.4.4.2. Speed display

OKAI's scooter meter can display two different speed units: km / h and mph. Customers can send commands to IOT through the server to adjust the two different speed units at any time.

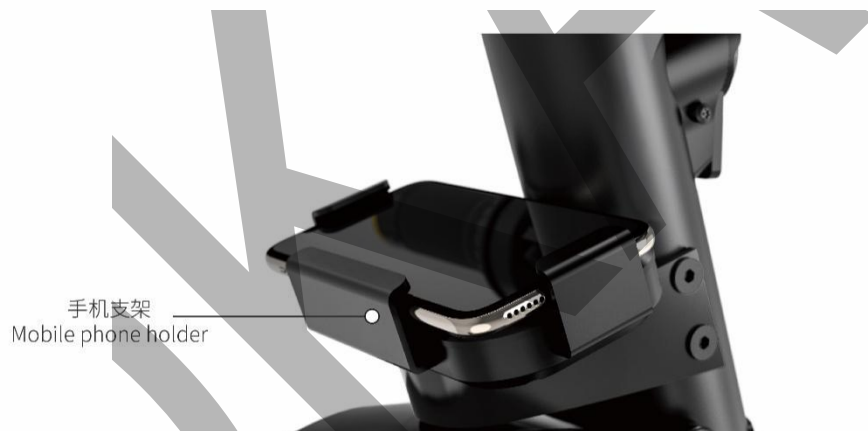
2.4.4.3. Power display

The battery has power display function, the battery power information can be read through the vehicle data and fed back to the meter. The meter divides the battery power from 0% to 100% into four grids, each of which accounts for 25% of the battery power.

2.4.4.4. Charging display

The meter will display the charging animation and display the current power percentage when charging. It can be very intuitive to observe that the car is in charging status and the current power.

2.4.5. Mobile phone holder



OKAI scooter has a mobile phone holder with fixtures at both ends. You can choose to add wireless charging function. If you chose it, wireless charging will be enabled only after unlocking the scooter. When the user puts the mobile phone on the charging board, the mobile phone will make charging response according to the mobile phone manufacturer's settings (only the mobile phone models that can support wireless charging are supported). Once the user returns the car and the scooter is locked, the wireless charging is automatically turned off.

2.4.6. Stem lock



There is a stem lock at the lower end of the front pipe, which is used to lock the scooter on the parking post. The IOT of the sample scooter is in the test mode. When you press and hold the button for more than 1 s to unlock the scooter, the stem lock will automatically unlocked. In formal order , customers need to unlock the stem lock through commands.

2.4.7. Battery Lock



The battery lock of OKAI scooter can be directly controlled by the IOT. Through CAN bus, the IOT sends the unlocking command to the battery lock. When the battery lock is unlocked, the battery cover will pop up automatically. As long as you press down the battery cover, it will automatically lock.

For better testing the battery lock on sample scooters, when the IOT is in the test mode, press the button on the IOT to active the scooter, the battery lock will be opened at the same time, and the battery cover will pop up automatically.

When the IOT is in normal mode (bulk cargo), the server can only send the battery lock command to the IOT to unlock the battery lock

If the battery pedal is accidentally locked when the battery is not loaded, please refer to the "abnormal state battery lock opening" tutorial in Chapter 4.2

If the battery has run out, just charge the scooter through the charging port on the scooter. After a few minutes, you can open the battery lock and replace it with a new one.



2.4.8. Front headlight

OKAI scooter is equipped with a headlight at the front of the scooter, which will light up automatically when the scooter is unlocked.

2.4.9. Tail light

OKAI scooter is equipped with a tail light at the rear fender. The tail light will be turned on when the scooter is unlocked and turned off when it is locked. When the brake lever is pulled, the tail light status can be adjusted by the central control: highlight or flash



3. User instruction

3.1. Operation after receive the scooter

In general, before the mass production order is placed, client will purchase OKAI sample scooter for testing the functionalities and defectiveness. Since the IoT for sample is under test mode and for production is normal mode, thus the operation is going to be a bit different. We here will describe two cases separately. Please see reference

Notes

- Don't put samples to the entire fleet as a mass product.
- Don't use a new order spare part to the samples if you are going to use the spare part on mass products.
- The electric parts of samples and mass products cannot be exchanged to use.

3.1.1. The difference between different modes

Difference	Test Mode	Normal Mode
LED status	Red and white breathing	White breathing
Alarm	Without vibration alarm	With vibration alarm
Operation	Support using USB cable and Manage_Tool to send command.	Only receive command from Bluetooth and server.

3.1.2. Sample scooter

If you have received our sample scooter, we suggest to charge the scooter for an hour first. You can tell if it's fully charged based on the battery level shown on the meter display. Please prepare the following things in advance:

- The serial cable that comes with the sample scooter
- Install the SIM card and SOP pack (SOP for install the SIM card, serial cable drive, ZK_Series_Manage_Tool)
- A computer with Windows system

Then please use the SOP of installing the SIM card to complete the rest steps of operation in order to get connected to the server.



3.1.3. Mass production

If you're receiving our mass production, please reference the following steps to active the IoT and get connected to the server:

- Charge the scooter for more than an hour, at this time the meter display is under status of blank screen and will not shows anything
- OKAI will provide a list of matching ICCID and QR code list, please use the ICCID codes within this list to active the SIM card
- Use an appropriate pin to stick in the power button on the IoT for more than 5 seconds to activate the IoT, for details please reference to <Button for power on/off switch>.
- If it's activated successfully, you'll hear the power on sound track as your configuration setting, and the breath light on the IoT will turns to white color. If the charger is still plugged in, the meter display will show the battery level in a percentage form. Please wait for 10 minutes, and the IoT will connected to the server within this period.

3.1.4. How to ride the scooter

- Unlock the scooter (IoT in test mode: Long press the button for more than 2 seconds to unlock the scooter; IoT in normal mode: Needs the server to send RTO.Unlock to unlock the scooter directly)
- Make sure the throttle and brake lever are both in situ, meter display function normally
- Pedal the ground and slide the scooter
- When the speed of scooter is above 3km/h, press the throttle and activate the motor
- Adjust the speed by adjusting the throttle's track

3.1.5. Charging the scooter

There are two ways to charge the ES400A:

- Open the battery batch, charge the battery pack directly
- Charge the scooter by connecting the charger to the charging port on the scooter

When charging the scooter directly by connecting to the charging port, meter display will shows the charging status to let you know the scooter is in charging, detail please reference to <charging display>; meanwhile the meter will also shows the charging battery level, detail please reference to meter's <battery level display>.

Note: When the IoT is not activated, the meter display does not show the battery level.

4. Maintenance Instruction

4.1. Error code

4.1.1. Error code instruction and solution

Error code	Error name	Error cause	The solution
02E	Battery under voltage	The ECU detects that the battery voltage is under 43V.	<ul style="list-style-type: none"> ● Charge the battery, the error code will go away. ● Change the ECU. ● Change the battery.
		The sampling circuit of the ECU is damaged.	
		The battery is damaged.	
03E	Motor phase line fault	During self-test when unlocking, the ECU detects the motor phase line is short-circuited.	<ul style="list-style-type: none"> ● Check if the connection between the ECU and the motor is short- circuited. ● Change the Motor ● Change the ECU.
04E	Motor stalling	When the motor isn't rotating, the drive current is higher than 6A for 2.5 seconds.	<ul style="list-style-type: none"> ● Dismiss locked-rotor state. ● Check if the connection between the ECU and the motor is short- circuited. ● Change the Motor ● Change the ECU.
05E	ECU upper MOSFET damaged	During self-test when unlocking, the ECU detects the upper MOSFET is	<ul style="list-style-type: none"> ● Change the ECU.

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		damaged or breakdown.	
06E	ECU lower MOSFET damaged	During self-test when unlocking, the ECU detects the lower MOSFET is damaged or breakdown.	<ul style="list-style-type: none"> ● Change the ECU.
07E	Motor hall fault	Motor hall wires are in poor contact.	<ul style="list-style-type: none"> ● Check if the connect between the motor line and the ECU is in poor contact. ● Change the motor. ● Change the ECU.
		Any one of motor hall wires A/B/C is disconnected.	
		Any one of motor hall wires A/B/C is shorted to the ground wire.	
		Any two of motor hall wires A/B/C are shorted to each other.	
		The hall sampling circuit of the ECU is damaged.	
08E	Motor over-heated	The ECU detects that the temperature of the motor is over 115℃.	<ul style="list-style-type: none"> ● Stop riding, wait for the error code to go away after cooling down. ● Change the motor. ● Change the ECU.
		The temperature sampling circuit of the motor is abnormal.	
		The temperature sampling circuit of the ECU is abnormal.	
09E	Throttle fault	Throttle fault.	<ul style="list-style-type: none"> ● Check if the throttle is flooded. ● Check if the connections are loose. ● Change the throttle. ● Change the meter.
		The throttle signal wire or the power wire is open circuit.	
		The throttle signal wire and the power wire/the ground wire are short-circuited.	
10E	Left brake lever fault	Left brake fault	<ul style="list-style-type: none"> ● Check if the left brake lever is flooded. ● Check if the connections are loose. ● Change the left brake lever. ● Change the meter.
		The left brake signal wire or the power wire is open circuit.	
		The left brake signal wire and the power wire/the ground wire are short-circuited.	
14E	Right brake lever fault	Right brake fault	<ul style="list-style-type: none"> ● Check if the right brake lever is flooded. ● Check if the connections are loose. ● Change the right brake lever. ● Change the meter.
		The right brake signal wire or the power wire is open circuit.	
		The right brake signal wire and the power wire/the ground wire are short-circuited.	

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15E	Lost firmware of the ECU	The ECU failed to update the program.	<ul style="list-style-type: none"> ● Re-send the update command. ● Change the ECU.
18E	The throttle not at the original position	During self-test when power on, the meter detects that the throttle isn't at the original position.	<ul style="list-style-type: none"> ● Turn the throttle to original position. ● Check if the connections are loose. ● Change the throttle. ● Change the meter.
		The throttle signal wire and the power wire/the ground wire are short-circuited.	
		The ground wire is open circuit.	
		The sampling circuit of the meter is damaged.	
		The throttle is damaged.	
19E	The left brake lever not at the original position	During self-test when power on, the meter detects that the left brake lever isn't at the original position.	<ul style="list-style-type: none"> ● Turn the left brake lever to original position. ● Check if the connections are loose. ● Change the left brake lever. ● Change the meter.
		The left brake signal wire and the power wire/the ground wire are short-circuited.	
		The sampling circuit of the meter is damaged.	
		The left brake lever is damaged.	
20E	The right brake lever not at the original position	During self-test when power on, the meter detects that the right brake lever isn't at the original position.	<ul style="list-style-type: none"> ● Turn the right brake lever to original position. ● Check if the connections are loose. ● Change the right brake lever. ● Change the meter.
		The right brake signal wire and the power wire/the ground wire are short-circuited.	
		The sampling circuit of the meter is damaged.	
		The right brake lever is damaged.	
25E	The ECU heartbeat fault	The meter hasn't detect the ECU heartbeat for more than 5 minutes.	<ul style="list-style-type: none"> ● Check if the connection of the ECU is loose. ● Change the ECU.
26E	The IoT heartbeat fault	The meter hasn't detect the IoT heartbeat for more than 5 minutes.	<ul style="list-style-type: none"> ● Check if the connection of the IoT is loose. ● Change the IoT.



27E	The BMS heartbeat fault	The meter hasn't detect the BMS heartbeat for more than 5 minutes.	<ul style="list-style-type: none"> ● Check if the connection of the battery is loose. ● Change the battery.
28E	Illegal IoT or ECU	Authentication match between the IoT and the ECU failed.	<ul style="list-style-type: none"> ● Change the IoT. ● Change the ECU.

4.1.2. Battery Error Code Declare and Solution

Error code	Error name	Error cause	The solution
E01	Failed to communicate with protection chip	protection chip damaged	<ul style="list-style-type: none"> ● Do not connect the power supply and let the load stand for 3 minutes. ● If it cannot be eliminated, please scrap it.
		hardware of communication bus damaged	
E02	Metering device damage	Hardware failed	<ul style="list-style-type: none"> ● Press the switch for 15 seconds to start the restart function. If it cannot be eliminated, please scrap it.
E03	Flash chip damaged	Hardware failed	<ul style="list-style-type: none"> ● Please scrap disposal.
E04	Drop event	Free fall detected	<ul style="list-style-type: none"> ● Do not connect the power supply and let the load stand for 3 minutes. ● If it cannot be eliminated, please scrap it.
E05	Charge MOSFET damage	Current sensor damaged	<ul style="list-style-type: none"> ● Please scrap disposal.
		MOSFET damaged	
E06	Discharge MOSFET damage	Current sensor damaged	<ul style="list-style-type: none"> ● Please scrap disposal.
		MOSFET damaged	
E07	MCU ROM damage	Hardware failed	<ul style="list-style-type: none"> ● Please scrap disposal.
E08	MCU RAM damage	Hardware failed	<ul style="list-style-type: none"> ● Please scrap disposal.



E09	Cell temperature sensor damage	Sensor damaged or wires was dropped, both RCL1 & RCL2 were damaged	<ul style="list-style-type: none"> Please scrap disposal.
E10	Large charging /discharging temperature difference	$\Delta T(\text{cell}) > 15^{\circ}\text{C}(1\text{s})$, don't allow charging $\Delta T(\text{cell}) > 25^{\circ}\text{C}(1\text{s})$, stop discharging	<ul style="list-style-type: none"> Do not connect to the power supply and let the load stand for 1 hour. If it cannot be eliminated, please scrap it.
E11	Charging fuse damaged	Hardware failed	<ul style="list-style-type: none"> Please scrap disposal.
E12	Discharging fuse damaged	Hardware failed	<ul style="list-style-type: none"> Please scrap disposal.
E13	Cell imbalance	The voltage error of cell too high	<ul style="list-style-type: none"> Please scrap disposal.
14E	Cell drop	The nickel strip break	<ul style="list-style-type: none"> Please scrap disposal.
E15	Configuration error	The configured parameters do not match the program default parameter range	<ul style="list-style-type: none"> Factory settings are abnormal, please contact after-sales.
E16	Charging over current	Wrong charger connected(Charger mismatch)	<ul style="list-style-type: none"> Do not connect to the power supply and let the load stand for 30 minutes before charging with the normal standard charger. If it cannot be eliminated, please scrap it.
E17	Under voltage first layer protection	Battery was fully discharged, Cell voltage $< 3.2\text{V}$ for 1 hour	<ul style="list-style-type: none"> Charging with standard charger, voltage $> 46\text{V}$
E18	Under voltage second layer protection	Battery was fully discharged, Battery voltage too low	<ul style="list-style-type: none"> Charging with standard charger, voltage $> 40\text{V}$
E19	Over voltage first layer protection	High battery voltage, cell voltage $> 4.25\text{V}$	<ul style="list-style-type: none"> Discharge treatment, voltage $< 53.5\text{V}$
E20	Over voltage second layer protection	Battery voltage is too high, pack voltage $> 56.5\text{V}$	<ul style="list-style-type: none"> Discharge treatment, pack voltage $< 52\text{V}$
E21	Over current first layer protection	Discharge current $> 25\text{A}$, lasting for 10 seconds	<ul style="list-style-type: none"> Do not connect the power supply and let the load stand for 3 minutes. If it cannot be eliminated, please scrap it.
E22	Over current second layer protection	Discharge current $> 40\text{A}$, lasting for 2 seconds	<ul style="list-style-type: none"> Do not connect the power supply and let the load stand for 3 minutes. If it cannot be eliminated, please scrap it.

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E23	Over current third layer protection	Discharge current > 60A, lasting for 320 milliseconds.	<ul style="list-style-type: none"> ● charge
E24	Over current fourth layer protection	Discharge current > 100A, lasting for 400 microseconds	<ul style="list-style-type: none"> ● charge
E25	Over legal charging temperature	$T(\text{cell}) > 55^{\circ}\text{C}$ (5s)	<ul style="list-style-type: none"> ● Recover if temperature lower than 50°C (5s)
E26	Over legal discharging temperature	$T(\text{cell}) > 70^{\circ}\text{C}$ (5s)	<ul style="list-style-type: none"> ● Recover if temperature lower than 65°C (5s)
E27	Charging under temperature	$T(\text{cell}) < 0^{\circ}\text{C}$ (5s)	<ul style="list-style-type: none"> ● Recover if temperature higher than 5°C (5s)
E28	Discharging under temperature	$T(\text{cell}) < -15^{\circ}\text{C}$ (5s)	<ul style="list-style-type: none"> ● Recover if temperature higher than -10°C (5s)
E29	MOSFET over heating	$T(\text{MOSFET}) > 110^{\circ}\text{C}$	<ul style="list-style-type: none"> ● Recover if temperature lower than 80°C (1s) ● If it cannot be recovered, please scrap it
		MOSFET damaged	
E30	Large temperature difference	MCU temperature too high	<ul style="list-style-type: none"> ● Recover if temperature lower than 60°C (1s)
E31	Pre-discharge error	Lost communication with CAN bus and output current >1A	<ul style="list-style-type: none"> ● Do not connect the power supply and let the load stand for 3 minutes. ● If it cannot be recovered, please scrap it.
E32	Impact event	Impact detected	<ul style="list-style-type: none"> ● Do not connect the power supply and let the load stand for 3 minutes. ● If it cannot be eliminated, please scrap it.

5. Maintenance tutorial

5.1. Vehicle maintenance

Maintenance Manual					
ES-400/400A Vehicle Model					
No.	Maintenance of content	Maintenance mileage			
		500km/15 days for first maintenance	regular maintenance for 1000 km	regular maintenance for 1500 km	regular maintenance for more than 1500 km (every 15days)
1	Check whether the vehicle anti-cursor is normal or not	•	•	•	•
2	Check whether the vehicle can be charged normally.	•	•	•	•
3	Check if there are any damaged parts from the appearance	•	•	•	•
4	Check whether the housing of the front and rear lamps is damaged and whether the function is normal. If there is any abnormality, replace the headlights or taillights.	•	•	•	•
5	Check whether the sound of the bell is clear and loud. If the sound is dull, replace the bell	•	•	•	•

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6	Check whether the shock absorber spring is invalid. If the shock absorber spring is stuck, you need to apply oil or replace the front fork assembly		•	•	•
7	Check whether the front steering is smooth and free of jams. If jams occur, check or repair the front fork and the frame		•	•	•
8	Check whether the kickstand can work normally, if the kickstand is shaking, you need to check and repair or replace the kickstand			•	•
9	Check whether the tires are worn, if the tire pattern is severely worn, the tires need to be replaced			•	•
10	Check whether the screws have fallen off, and check whether the specified torque meets the standard. The screws need to be tightened. Refer to Appendix 1 for important parts screw torque	•	•	•	•

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11	Check the braking system. The braking distance is on dry roads, the speed is 20km/h, and the load is 75kg. It is normal to use the single left brake and single right brake, and the braking distance is less than 5m. Otherwise, you need to adjust the brake or replace the brake system.	•	•	•	•
12	Check whether the acceleration handle (referring to the throttle) can control the speed normally, whether the rotation is stuck, and whether the rebound is stuck. If you can't control the speed, you need to replace the handle when turning and rebounding.	•	•	•	•
13	ECU。 Let the motor idling, check whether the speed is normal and ride to test whether the motor is smooth, if the motor speed is abnormal or the motor is stuck, the motor or ECU needs to be replaced.			•	•

6. Storage and transportation methods

6.1. Vehicle and battery storage

6.1.1. Store within one month

Fully charge the scooter, then lock the scooter, and store it in a relatively cool, dry and ventilated environment (25°C, 65%RH), away from fire and high temperature. Recharge after one month, then can use it normally

6.1.2. Long-term storage

Charge the battery to 75%, open the battery lock, switch the IOT to the inactive mode, make sure that the LED light of the IOT is off (enter the inactive mode), and then remove the battery. The battery and the scooter should be stored in a cool and dry place. In a ventilated environment (25°C, 65%RH), keep away from fire and high temperature.

Battery storage solutions recommended by OKAI:

Take out the battery every three months, charge the battery to 100%, discharge the battery to 0%, and finally charge the battery to 75% to continue storage.

Note: If it is really impossible, charge the battery to 75% every three months, but the battery life will be lost.

OKAI recommended IOT storage solutions:

Connect the battery to the scooter every three months and activate the IOT. Wait for the IOT's backup battery to charge to 100%, then switch the IOT to the inactive mode. Make sure that the IOT LED is off (enter the inactive mode), and then Take out the battery. The battery and the scooter should be stored in a relatively cool, dry and ventilated environment (25°C, 65%RH), away from fire and high temperature.

6.2. Vehicle and battery transportation

6.2.1. Short-distance vehicle transportation (within half a month)

Charge the battery to 75%, switch the IOT to the inactive mode, make sure that the LED light of the IOT is off (enter the inactive mode), load the scooter for transportation, after arriving at the destination, press and hold the button on the IOT for more than 5 seconds to activate IOT.

6.2.2. Long-distance vehicle transportation (within two months)




Charge the battery to 75%, switch the IOT to the inactive mode, make sure that the LED light of the IOT is off (enter the inactive mode), load the scooter for transportation, and after arriving at the destination, charge the scooter for more than one hour, and then Long press the button on the IOT for more than 5 seconds to activate the IOT.

6.2.3. Battery transportation

- It is forbidden to mix batteries with other goods.
- Do not immerse the battery in water or make the battery wet.
- It is forbidden to stack the battery more than 7 layers or turn the battery upside down.
- It is forbidden to transport the battery when the ambient temperature is higher than 65°C.

7. Appendix





7.1. Appendix 1-Screw Torque of Important Parts

No	important parts	Screw fixing position	Screw torque
1	Hidden brake lever		9-12N.m
2	Hidden brake lever (right)		
3	(central control system 2)		3-5N.m

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4	pole clamp		22-28N.m
5	Handlebar head and handlebar tube		4-9N.m
6	Left and right protecting cover		2-5N.m
7			

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8	rear cover		3-5N.m
9	rear fender		9-12N.m
10	Lock buckle		3-6N.m
11	double support		22-28N.m