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		Customer Part Number	

Smart Keyless Function Specification

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1 Basic Information

Overview

This function specification aims to organize and summarize customer input data for smart keyless controllers and remote controls. This function specification requires final confirmation from the customer. Once this function specification is confirmed by both parties, it will serve as the primary basis for constraining product functions. Any changes must be documented with detailed historical records.

Smart Keyless Configuration OE Numbers :

Customer Product No. Customer NO.	WellySun Product No.
	J71.KEYL003.0
	J71.KEYL003.1

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2 System Architecture Diagram

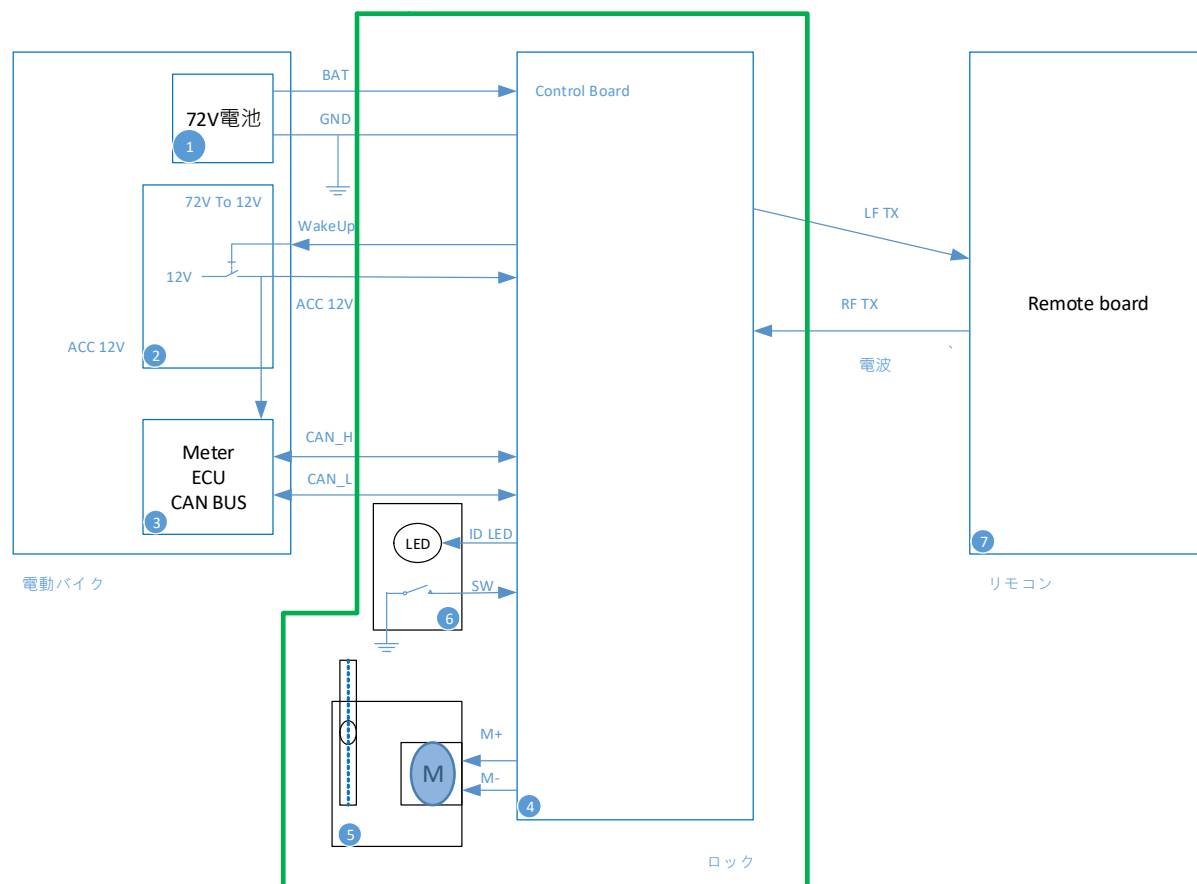


Figure (1) System Architecture Diagram

System Architecture Description :

1. **Electric Motorcycle:** Divided into 3 components, described as follows :

- ① 72V Battery: Electric motorcycle battery, provides power to the electric motorcycle and power used during control board ID Check
- ② 72V to 12V Converter: Power used after successful control board ID Check
- ③ Meter CAN BUS: After successful ID Check, 12V powers the electric motorcycle wake-up, communicates with control board via CAN BUS

2. **Controller:** Divided into 3 components, described as follows :

- ④ Control Board (PCBA) : Smart keyless control board with the following functions :
 1. Access SW button detection wake-up
 2. Uses LF/RF for identity identification
 3. LED indicator lights show system status
 4. Motor driver supplies lock/unlock functionality
 5. 2 Hall sensors indicate lock/unlock positions
 6. WakeUp output power to wake up vehicle system
- ⑤ Motor Module: Includes 1 set of DC motor for lock/unlock and 2 magnets indicating lock positions

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- ⑥ LED indicator light and Access SW button
- 3. Remote Control
- ⑧ Receives LF and returns RF to control board for identity identification

Controller Specifications

1. Part Number :
2. RF Reception Frequency: 433MHz±250KHz
3. RF Modulation: FSK
4. LF Transmission Frequency: 125KHz±2.5KHz
5. LF Modulation: ASK
6. Identity Recognition Distance: 1~3M (MAX) at 72V
7. Operating Temperature: -20°C~80°C
8. Storage Temperature: -30°C~85°C
9. Rated Voltage: DC72V, Voltage Range 65V~80V
10. Standby Current: Below 1mA
11. Has backup key programming learning function
12. Has CAN BUS communication, complies with ISO11898, data rate 500K, standard frame (11bit), no termination resistor required
13. Radio waves comply with FCC certification requirements

Remote Control Specifications

1. RF Transmission Frequency: 433MHz±250KHz
2. RF Modulation: FSK
3. LF Reception Frequency: 125KHz±3.75KHz
4. LF Modulation: ASK
5. Operating Temperature: -20°C~60°C
6. Storage Temperature: -40°C~85°C
7. Rated Voltage: DC 3V
8. Minimum Operating Voltage: Above 2.4V
9. Encoding Type: Rolling code
10. Static Current Consumption: Below 10μA
12. Battery Original Configuration: Panasonic CR2032
13. Battery Life: 24 months (calculated at 4 times per day) (at storage temperature 5~35°C)

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3 Controller Main Connector Pin Function Definition

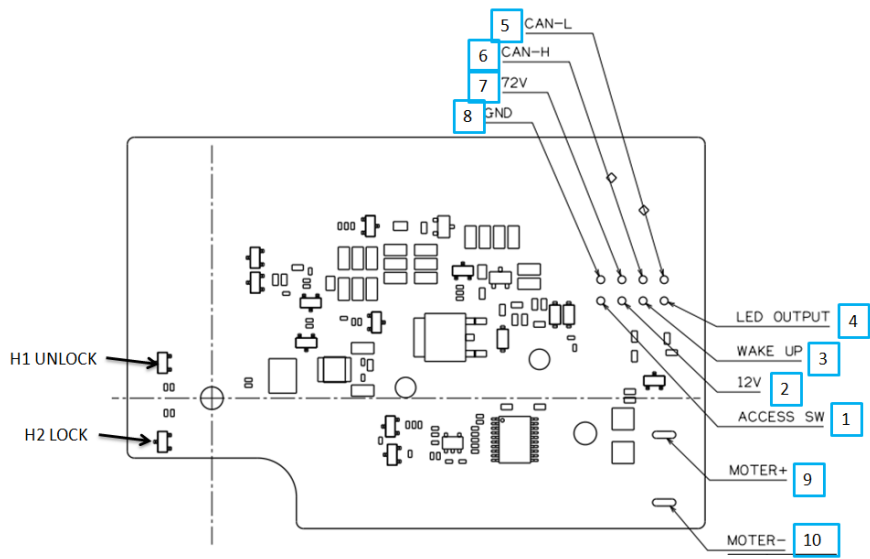


Figure (2) Main Connector PIN Definition

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Pin Definition Description:

[illegible]

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4 Operation Description

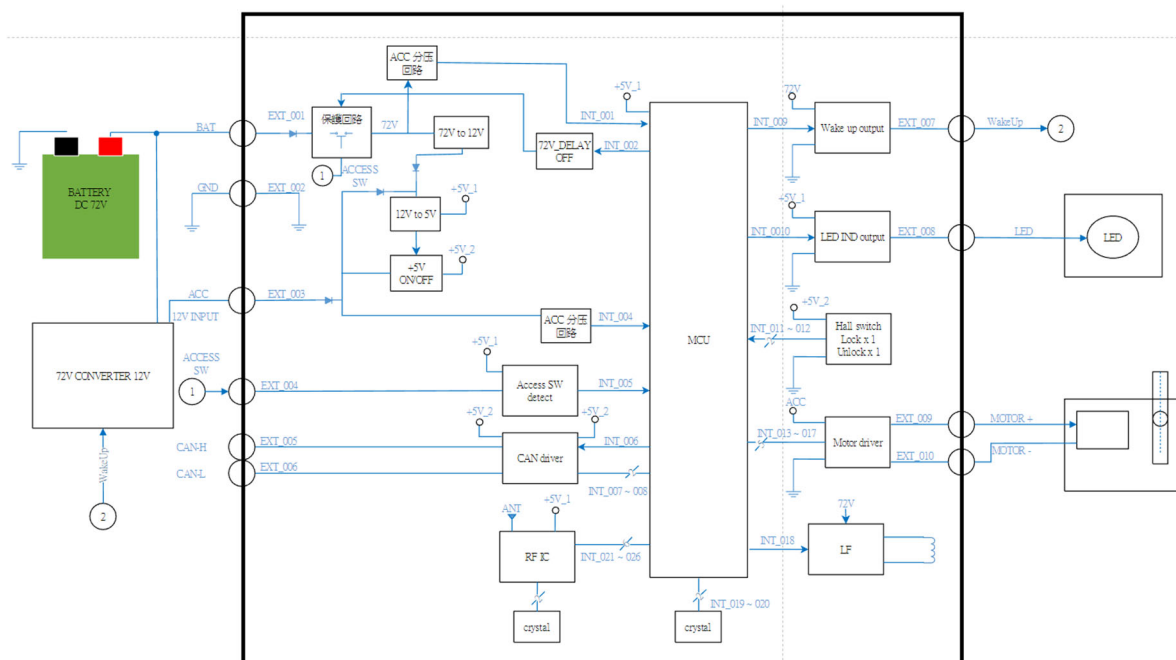


Figure (3) Controller Internal Block Diagram

[Operation Instructions]

- When the controller is powered on (BAT 72V), the system is in KEY OFF mode
- When Access SW button is pressed for more than 200ms and less than 3 seconds then released, the SWITCH circuit opens. Controller wakes up for identity identification (retry attempts: 3 times)
- If identity identification succeeds, output WakeUp and light LED, enter KEY ON state.
If identity identification fails, flash LED 2 times (2Hz) then close SWITCH circuit
- After outputting WakeUp, input 12V from ACC to controller
- Start CAN communication (send KEY status, LOCK status, LF RSSI value during authentication, remote control battery status, ACC power level, transmission cycle 100ms)
- A. When LOCK side Hall Switch is ON, control motor until UNLOCK side hall switch turns ON then stop motor; if current abnormality is detected during operation, immediately stop motor, enter KEY OFF state, LED flashes (4Hz), close LED, SWITCH circuit and WakeUp circuit after 60 seconds. If motor runs over 500ms and UNLOCK hall switch has not reached ON state, stop motor power, enter KEY OFF state, LED flashes (4Hz), close LED, SWITCH circuit and WakeUp circuit after 60 seconds.
B. When LOCK side Hall Switch is OFF and UNLOCK side Hall Switch is ON, already unlocked, motor does not operate and directly enters KEY ON
C. When LOCK side and UNLOCK Hall Switches are not in expected states, motor does not operate, CAN sends warning
- In KEY ON state, if CAN communication vehicle speed is 0 and ACCESS SW is pressed again (200ms or more), enter KEY OFF state, LED flashes in KEY OFF state (4Hz)
- In KEY OFF state, press ACCESS SW for more than 3 seconds, motor starts operating until LOCK side hall switch detects ON then stops motor (abnormal handling same as point 6)
- After entering KEY OFF state from KEY ON, start counting 60 seconds, close LED, SWITCH circuit and WakeUp after 60 seconds
- After successful locking, close LED, maintain CAN communication for 3S, close SWITCH circuit

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and WakeUp after 3S

[Identity Identification]

- Controller LF sends ID and random seed to remote control. Remote control receives correct ID then calculates key based on seed and returns key. Controller receives key and verifies if key is correct. If correct, identity identification succeeds. Detailed process shown in diagram below.

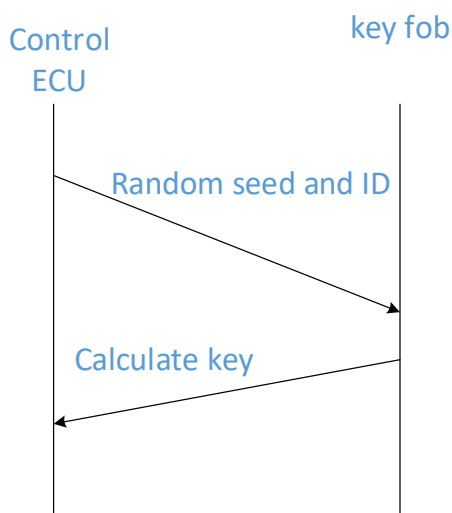


Figure (4) Identity Identification Process

Motor Operation Unlock/Lock Success Truth Table

	H1 unlock	H2 lock	Motor+	Motor-
Unlock	0	1	1	0
Lock	1	0	0	1
Abnormal	1	1		
Abnormal	0	0		

Fault Diagnosis Description:

1. When motor is driven, if Hall sensor cannot reach expected position for more than 500ms, it is determined as fault
2. When motor is driven, if current exceeds 5A, motor driver must be turned off within 5ms (adjust based on actual load testing)
3. Start detection 3 seconds after KEY ON. If CAN lost continuously exceeds 10 cycles, fault is established, CAN warning, LED indicator continuously flashes (1Hz)
4. ACC 12V detection: if less than 9V or greater than 16V, fault is established (hysteresis $\pm 0.5V$ 500ms), CAN warning, LED indicator continuously flashes (1Hz)
5. BAT 72V detection: if less than 65V or greater than 80V, fault is established (hysteresis $\pm 2V$ 500ms), CAN warning
6. ACCESS SW button stuck detection during KEY ON: if continuous for 10 seconds, CAN warning, LED indicator continuously flashes (1Hz)

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[Sub-key Learning Method]

#For function demo use#

Under KEY OFF, PIN 2 (ACC) externally connected to 12V, master key nearby

Press ACCESS SW for 3 seconds. Under KEY OFF, detect ACC 12V±1V, start identity identification.

After success, indicator light stays on then enters sub-key learning mode:

In learning mode, press unlearned remote control button to learn that remote control ID. If successful, LED indicator flashes once (1Hz), representing learning of 1 sub-key. If flashes twice, indicates 2 sub-keys learned, and so on. Maximum 4 sub-keys can be learned. If 4 sub-keys already learned, LED continuously flashes rapidly (4Hz), warning that maximum is reached and no more can be learned. If duplicate learning occurs, rapidly flashes 3 times (4Hz).

In learning mode, if no remote control ID is received for more than 30 seconds, automatically exit learning mode and enter KEY OFF mode.

In learning mode, if PIN2 (ACC) 12V is removed, exit learning mode and enter KEY OFF mode.

In learning mode, if master key is pressed, all learned sub-keys will be cleared.

One controller will only have one master key. Sub-keys can only be learned through the master key, and the master key cannot be cleared.

Master Key Learning Method

Under KEY OFF, PIN 2 (ACC) externally connected to 12V, press ACCESS SW for 3 seconds. Under KEY OFF, detect ACC 12V±1V. If no master key exists, indicator light will start flashing (1Hz), then enter master key learning mode:

In master key learning mode, press remote control button to learn that remote control ID. If learning successful, indicator light stays on constantly.

In this mode, if master key is learned repeatedly, rapidly flash 3 times (4Hz) then stay on constantly.

In this mode, if master key has been learned, learning other remote controls will have no response.

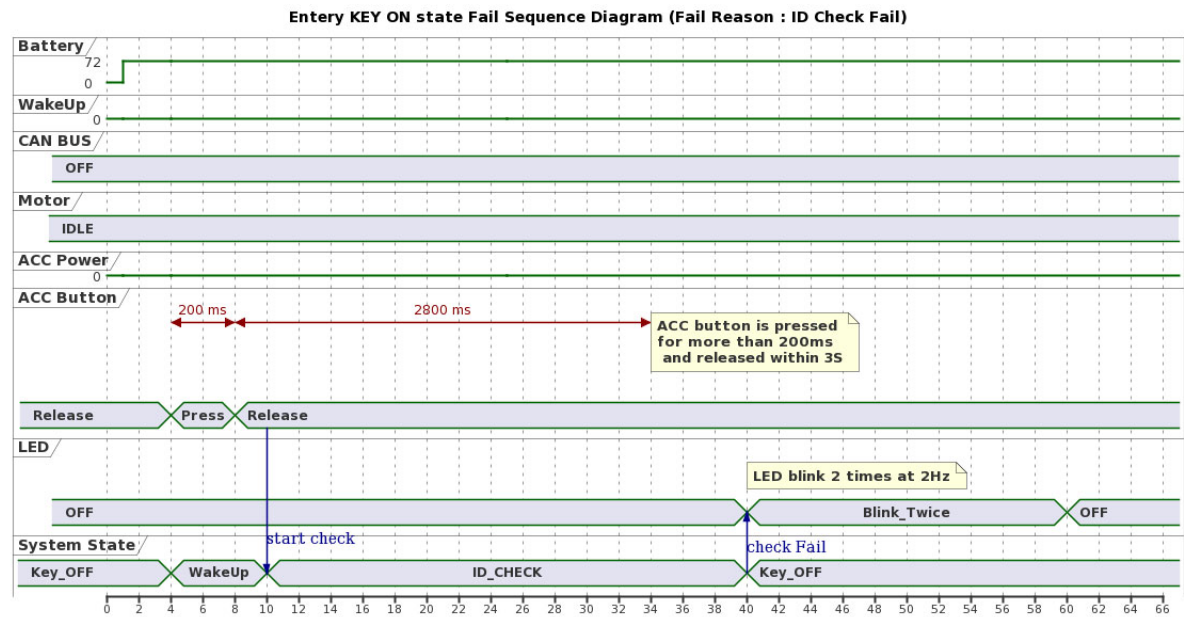
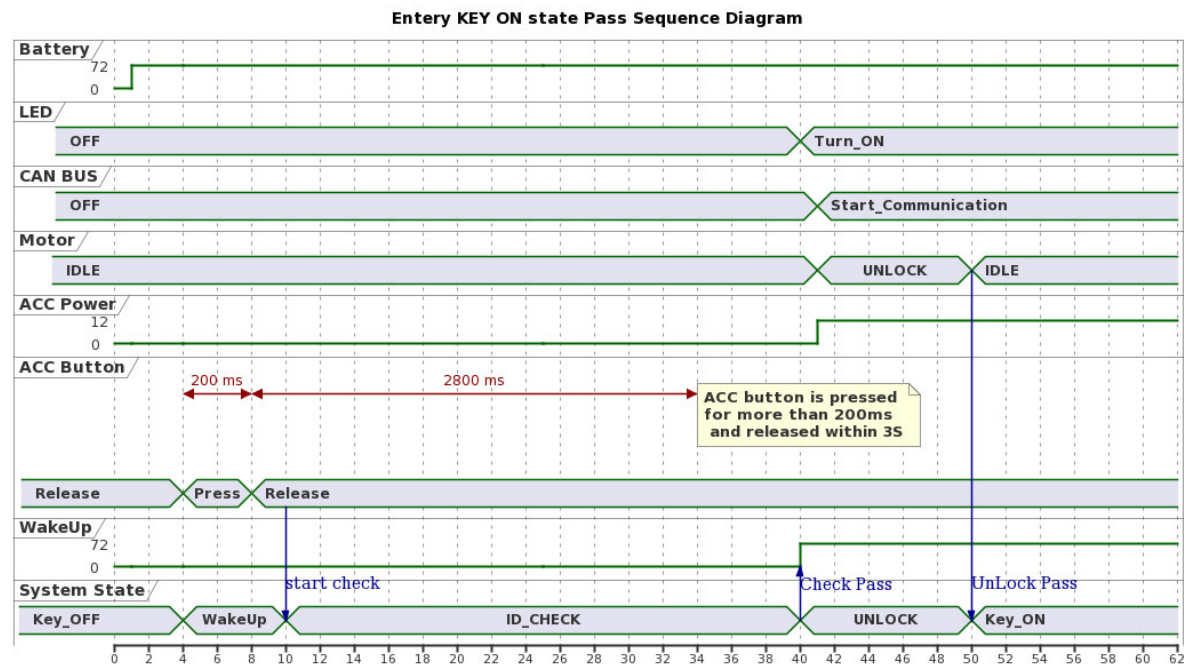
CAN BUS Message Description

1. When CAN BUS OFF, recovery mechanism will be executed, recover once every 10ms
2. CRC algorithm does not check validity
3. Rolling count also does not check validity

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Status Timing Diagrams

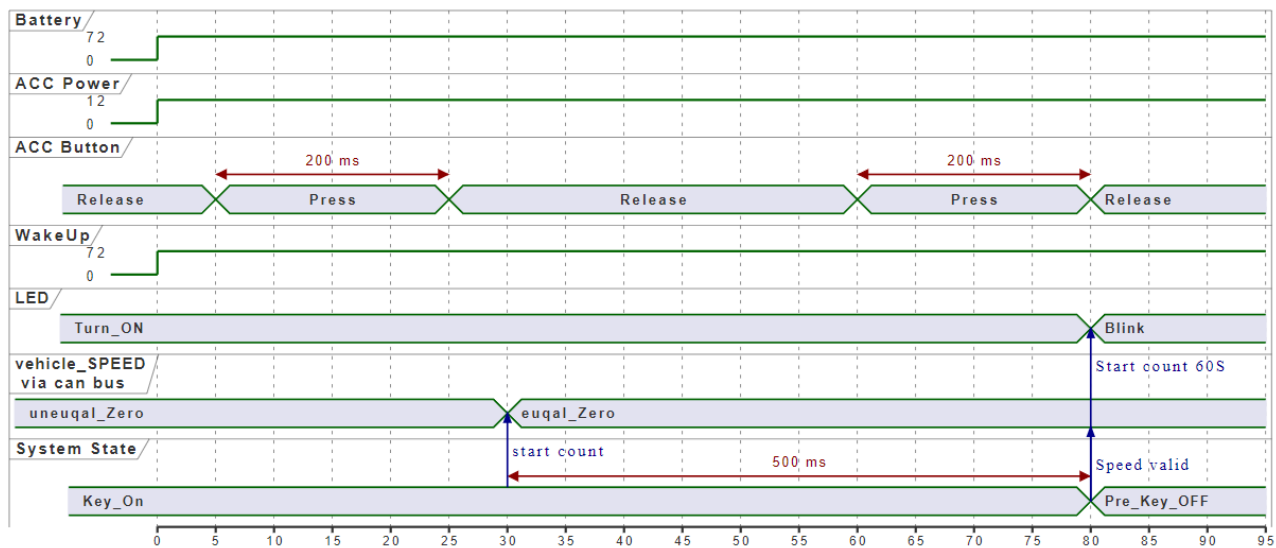




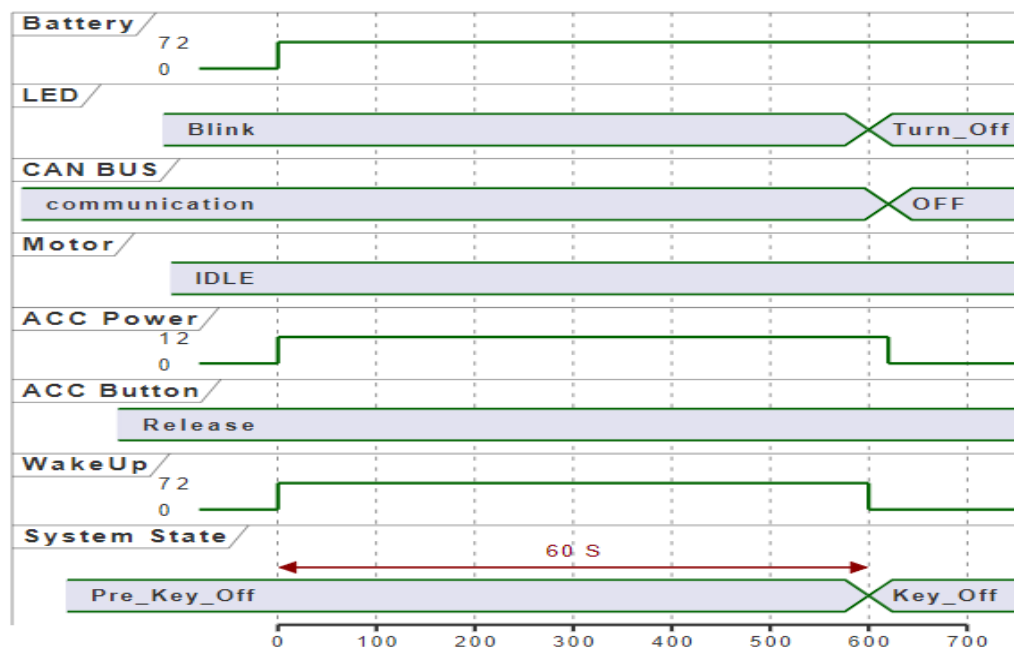
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Entry LED Blink 60S state from KEY_ON State Sequence Diagram



KEY OFF countdown 60S Sequence Diagram



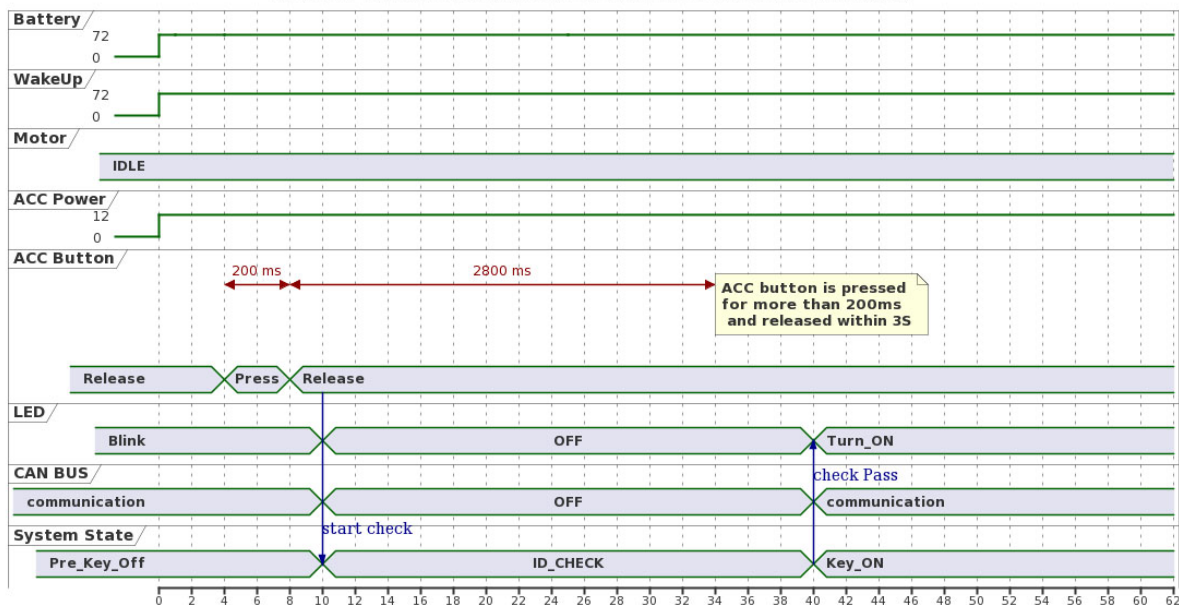
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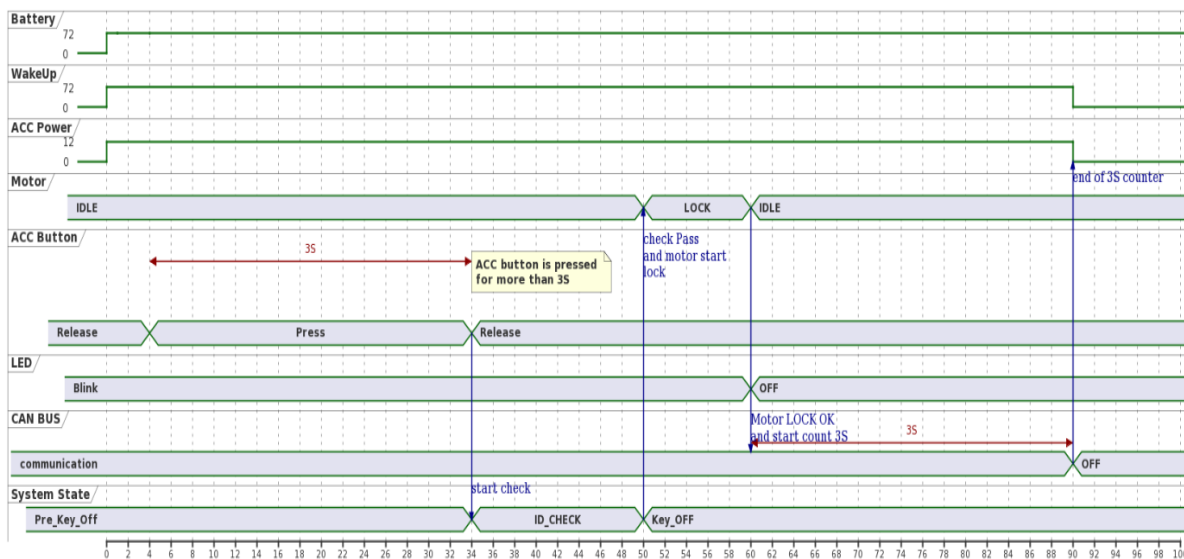
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Entry KEY ON state from KEY OFF LED Blink 60S state Sequence Diagram



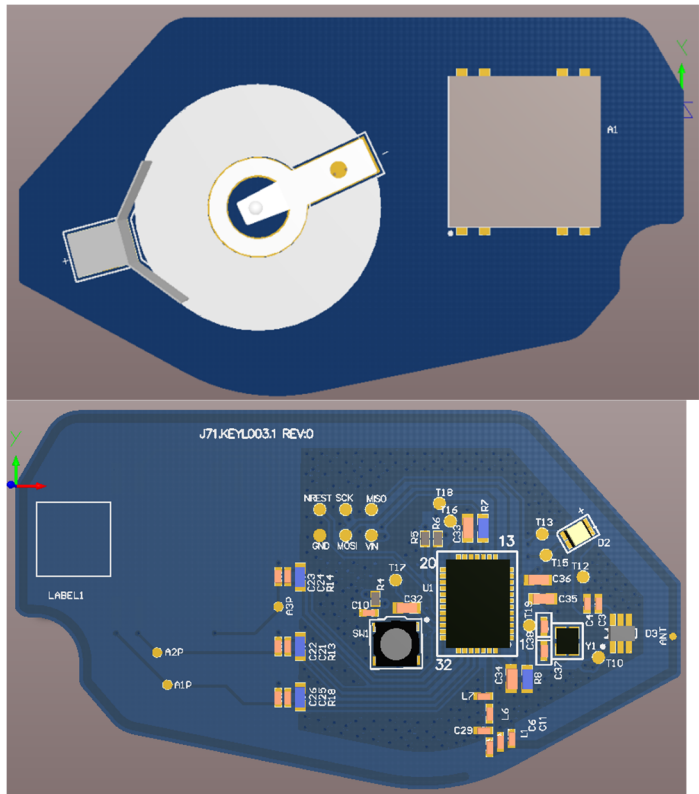
Motor Lock pass and CAN BUS keep 3S Sequence Diagram



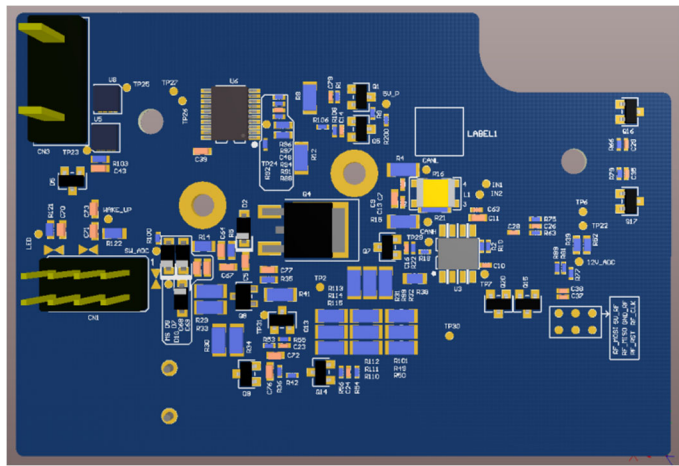
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5 Remote Control Appearance

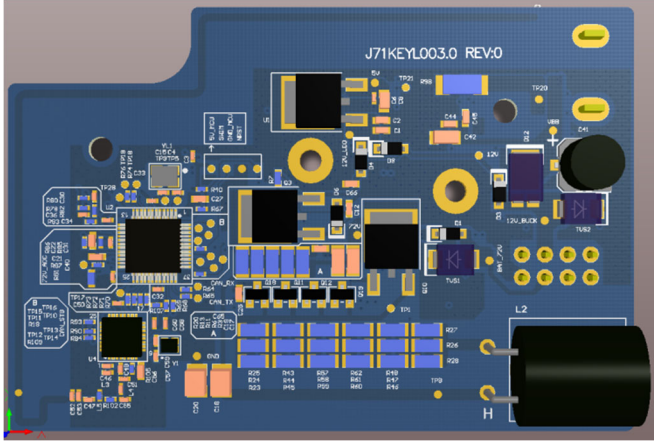


6 Controller Appearance

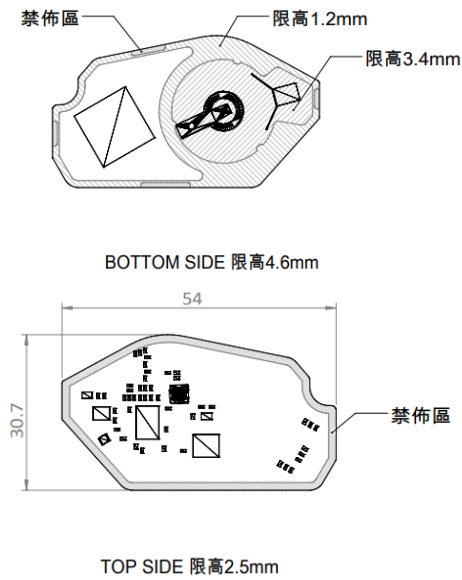


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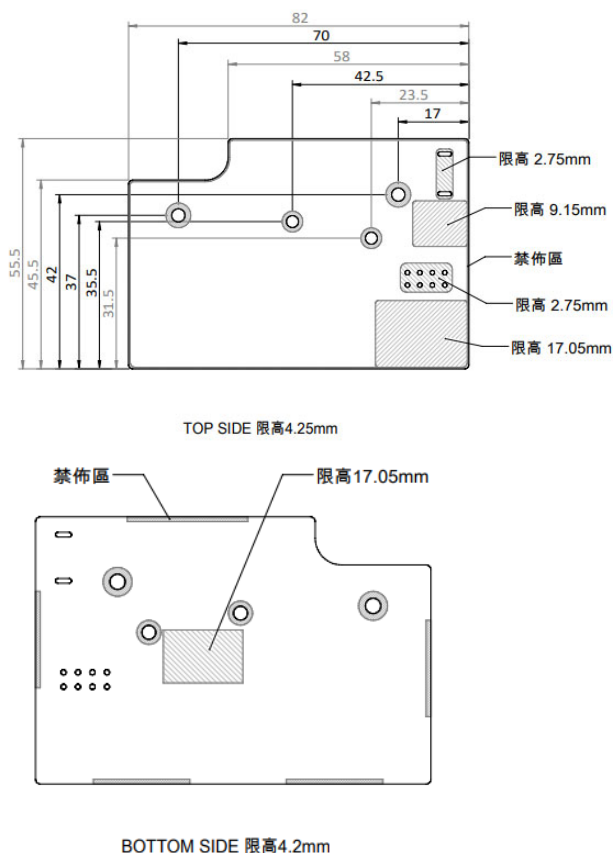
7 Remote Control Height Limit and Restriction ZoneS



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8 Controller Height Limit and Restriction Zones



9 Controller and Remote Control Verification Specifications

FCC Certification

10 Product Applicability Description

Controller Applicability Description:

1. This product specification is not the final effect and needs to be confirmed with actual vehicle.
2. Do not install rectifiers or large metal heat sinks and other metal objects within 30CM of product installation.
3. During identity identification, if there are other wireless communication electronic devices or high-power equipment nearby (such as charging stations, electrical boxes, Taiwan Power substations, wireless base stations, etc.), communication quality and communication distance will be affected.

Remote Control Applicability Description:

1. Shell coating or filler must not contain metal components.
2. During vehicle search or identity identification, if there are metal objects around the remote control (such as coins, keys, jewelry, etc.), communication quality and communication distance will be affected.

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Federal Communications Commission (FCC) Statement

15.21

You are cautioned that changes or modifications not expressly approved by the part responsible for compliance could void the user's authority to operate the equipment.

15.105(b)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- 1) this device may not cause harmful interference, and
- 2) this device must accept any interference received, including interference that may cause undesired operation of the device.

FCC RF Radiation Exposure Statement

The device is designed to comply with the limits for exposure to RF energy set by the Federal Communications Commission (FCC) of the United States, Industry Canada (IC) of Canada, and the regulating entities of other countries.

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