Schematic diagram of SVAD control board Fig.26

Description of control board terminals and jumpers:

● **BA/BMS network connection terminals: A+/B-, RS485 communication mode, connected to BA/BMS network host computer.**

● **Thermostat connection terminals: A+/B-, RS485 communication interface; GND: ground wire; +12V: power supply;**

Connecting the thermostat, the four terminals A+/B-, GND and +12V are respectively connected to the corresponding terminals of the thermostat with communication cables.

One thermostat is connected to multiple SVADs for one-control-multiple, multiple-control and group-control wiring. It is enough to connect the A+/B- of this terminal on each SAVD control board with a daisy chain communication cable.

● **Power terminal:** GND\24V power input. The power requirement of the control board is 24V, AC24V, or DC24V.

● **Reheating equipment terminal:** This terminal is a passive output terminal, used to control the start /stop of the reheating equipment.

● **Indoor temperature sensor terminal:** connect the NTC10K temperature sensor to test the indoor air temperature.

- **Supply air temperature sensor terminal:** connect to NTC10K temperature sensor to test the primary air temperature.
- **Occupied sensor terminal:** connect the occupied sensor.
- **Stepper motor terminal:** connected to the stepper motor.
- **Hall sensor terminal:** connect Hall sensor (Damper function sensor).
- **WiFi external antenna connection seat:** connect to WiFi external antenna.
- **Air flow sensor terminal:** connect the air flow sensor that output 0~10 V signal.
- **CO2 concentration sensor terminal:** connect the CO2 concentration sensor that output 0~10V output signal; the 0~10V output signal corresponds to the CO2 concentration 0 ~ 2000ppm.
- **Relative humidity sensor terminal:** connect the relative humidity sensor that output 0 ~ 10 V output signal; the 0 ~ 10 V output signal corresponds to the relative humidity 0 ~ 100% ;
- **Reserved I/O terminals:** reserved input/output terminals, Analog connected to sensors with 0~10V signals, etc., or connected to control dehumidification or humidification equipment circuits. As an extended function, Modbus will allow the reading and writing of the necessary parameter signal or output control signal;
- **Jumper instructions:**
- **Motor direction jumper:** Factory set, no change.
- **Occupied/unoccupied mode selection jumper :**

    When selected as "Disabled", SVAD will always execute the occupied mode, and the occupied/unoccupied mode cannot be modified in the engineer mode of the thermostat or remote control type and mobile phone APP and on the BA/BMS, the status of occupied sensor will also not work.

    When selected as "Enable", SVAD will be able to modify the occupied/unoccupied mode status in the engineer mode of the thermostat or the remote control type and the mobile phone APP and on the BA/BMS.

    When the occupied/unoccupied mode is in the "automatic" state, SVAD will execute the occupied mode or unoccupied mode according to whether there are people in the room detected by occupied sensor.

- **Indoor temperature sensor selection jumper:**

    When selected as "Disabled", SVAD will use the temperature sensor on the thermostat to sense the indoor temperature.

    When selected as "Enabled", SVAD will use the indoor temperature sensor connected to the control board sensor to sense the indoor temperature.

    The standard is "Enable", the indoor temperature sensor is installed on the SVAD, or installed in the remote return diffuser.

● **Thermostat enable selection jumper:**

Wire connect to thermostat.Jumper for the thermostst at the control board must set to thermostst mode. Other is multiple diffusres connected to each other. If a wire connection fails, then ER3 is displayed.

The SVAD control board offers a selectable jumper for whether the thermostat is enabled. When the jumper is in the "enable" position, any connection or communication failure between the thermostat and the BA/BMS will trigger an ER3 alarm on the controller, mobile app, and BA.

When the jumper is set to the "disabled" position, any connection or communication failure between the thermostat/remote control and the BA/BMS will not trigger an ER3 alarm on the mobile app or BA/BMS. However, if a thermostat is connected to the SVAD control board at this time, the ER3 alarm will be displayed on the thermostat.

3. Relevant information on network communication of SVAD:

The SVAD utilizes the widely recognized MODBUS-RTU communication protocol for RS485 half-duplex communication. The host device reads data using function number 0x03, writes data using function number 0x10/0x06, and employs 16-bit CRC verification. The system does not respond to verification errors.

● **Basic description of the communication protocol:**

(1) Working mode: RS485 master-drone mode; the upper computer of the BA/BMS network is the master.

(2) Physical interface: A(+), B(-) Two-wire system.

(3) Baud rate: 9 600 ~ 38400, the default is 9 600.

(4) Byte format: 10 -bit format (1 start bit + 8 data bits + 1 stop bit).

(5) Transmission method: RTU format.

(6) Control board address: 1 ~ 255, 0 is broadcast (ALL).

(7) Command code: 03 (read thermostat), 06 (write thermostat), 10 (write thermostat multi-register).

(8) CRC check code: CRC-16 (see Modbus protocol standard).

(9) CRC check method: no check.

(10) Data frame interval More than 200ms.

(11) Communication interval time: 200ms .

(12) Wire size 2 core shielded cable 18-22 AWG and total length not exceed 600m.

Register address	Point name	Description	Default	Data type	Ranges	Read and write
40001, 00000	REHEAT-EN	Reheat function enable	0	Unsigned	0 = False 1 = True	R/W
40002, 00001	OCC-OVERRIDE	Occupancy override	1	Unsigned	0= Auto 1= Occupied 2= Unoccupied	R/W
40003, 00002	FORCE-POS	Forced damper position	101	Unsigned	101= Auto 0%~100%	R/W
40004, 00003	OPER-MODE	Operating mode	0	Unsigned	0= Cooling 1= Heating 2= Auto	R/W
40005, 00004	ON-OFF	On / off	0	Unsigned	0= Off 1= On	R/W
40006, 00005	DPR-MODE	Damper mode	0	Unsigned	0 = Auto 1 = On 2 = Off	R/W
40007, 00006	ZN-T	Effective zone temperature	--	Signed	-90~500 (magnification 10 times)	R
40008, 00007	OCC-T-SP	Occupied temperature setpoint	24	Unsigned	160~300 (magnification 10 times)	R/W
40009, 00008	SA-T	Supply air temperature value	--	Signed	-90~500 (magnification 10 times)	R
40010, 00009	EFF-DPRPOS	Effective damper position	--	Unsigned	0 ~100%	R
40011, 00010	REHEAT-STATE	Reheat state	--	Unsigned	0 = Off 1 = On	R
40012, 00011	AIRFLOW	Air flow	--	Unsigned	Reserved	R
40013, 00012	BAUD-RATE	Baud rate	0	Unsigned	0 = 9600 1 = 14400 2 = 19200 3 = 38400	R/W
40014, 00013	ER1	ER1 room temperature sensor failure alarm	--	Unsigned	0 = No alarm 1 = Alarm	R
40015, 00014	ER2	ER2 Supply air temperature sensor failure alarm in automatic mode	--	Unsigned	0= No alarm 1 = Alarm	R
40016, 00015	ER3	ER3 thermostat communication failure alarm	--	Unsigned	0= No alarm 1 = Alarm	R
40017, 00016	ER10	ER10 motor stall alarm	--	Unsigned	0= No alarm 1 = Alarm	R

Register address	Point name	Description	Default	Data type	Ranges	Read and write
40018, 00017	ER9	E9 CO_2 alarm concentration exceeds the limit standard	--	Unsigned	0= No alarm 1 = Alarm	R
40019, 00018	EFF-OCC	Effective occupancy	--	Unsigned	0 = UNOCC 1 = OCC 2 = Shutdown	R
40020, 00019	AF-CMH	Airflow CMH	--	Unsigned	0~3500 CMH	R
40021, 00020	AF-CFM	Airflow CFM	--	Unsigned	0 ~2000 CFM	R
40022, 00021	AF-L/S-CMH	Airflow L/s calculated from CMH	--	Unsigned	0~1000 L/s	R
40023, 00022	AF-L/S-CFM	Airflow L/s calculated from CFM	--	Unsigned	0~1000 L/s	R
40024, 00023	ZN-CO2	Zone CO_2 level	--	Unsigned	0 ~2000ppm	R
40025, 00024	CO2-SP		600	Unsigned	0 ~2000ppm	R/W
40026, 00025	ZN-RH	Zone relative humidity	--	Unsigned	0 ~100%	R
40027, 00026	LTG-C	Light command	0	Unsigned	0 = Off 1 = On 2 = Auto	R/W
40028, 00027	LTG-STATE	Light state	--	Unsigned	0 = Off 1 = On	R
40029, 00028	AF-PAR-A	Airflow parameter A (FS)*	0	Unsigned	0 ~65535 (magnification 10	R/W
40030, 00029	AF-PAR-B	Airflow parameter B (FS)*	0	Signed	-32767~32767 (magnification 10 times)	R/W
40031, 00030	AF-PAR-C	Airflow parameter C (FS)*	0	Unsigned	0= Linear formula 1= Power function formula	R/W
40032, 00031	ADDRESS	Device address	1	Unsigned	1~255	R/W
40033, 00032	EFF-T-SP	Effective temperature setpoint (1)*	--	Unsigned	160~320 (magnification 10 times)	R

Nots:

1. 40001 is PLC ADDRESS (BASE 1), 00000 is PROTOCOL ADDRESS (BASE 0)

2. (FS)* - Factory set point

3. (1)* - Depend on occupied, unoccupied, cooling mode and heating mode (+ or - 2℃)

4. Mobile App:

Ver2.1 and above SVAD control panels include Wi-Fi functionality, enabling internet connection via Wi-Fi, syncing with "Tuya" data, and linking to the mobile app for SAVD monitoring.

To connect and monitor SVAD using your smartphone, install the "Royal Service" APP from Android or Apple app stores. Then, follow the installation and setup procedure below.

After installing the app, you can configure Wi-Fi network distribution and code matching with the SVAD:

Ⅰ. Before network distribution and code matching, the SVAD must be in a state of waiting for network distribution and code matching.

Ⅱ. Based on Wi-Fi network distribution and code matching needs, set the SVAD to one-control-one mode using the thermostat, and configure the address code for Wi-Fi network distribution and code matching.

Ⅲ. Setting Wi-Fi at the thermostat. Long press the M+F button at the same time to make the thermostat icon 🛜 flash, entering or resetting the Wi-Fi distribution network and code matching state.

Ⅳ. On your smart phone, Open the Royal Service APP while the thermostat icon 🛜 is flashing. Various equipment icons from Royal Service Air Conditioning will appear in the "Add Device" column. Click on the SVAD needing network distribution and code matching. Click the corresponding model icon, then "Add." Enter the 2.4GHz Wi-Fi network name and password with a strong signal in the area or room. Perform network distribution and code matching operations. The Wi-Fi connection and Tuya server connection are successful when the icon🛜is constantly lit.

The SVAD is always in a state of waiting for network distribution before networking or after being "removed" by a connected mobile phone without re-networking. During this time, you can directly use your smartphone for network distribution and code matching operations, whether connected to a thermostat or remote control.

Royal Service Air Conditioning Factory resets each SVAD to a network distribution waiting state before leaving the factory. At the project site, you can directly use a mobile phone for network distribution and code matching operations.

If, during the project commissioning stage, an SVAD is successfully configured but not "removed" from the mobile phone, the customer may need to reconfigure the network. In this case, if the SVAD is equipped with a thermostat or remote control, press and hold the F button in one-control-one mode to force it into standby network status, allowing customers to use their mobile phones for network distribution operations.

If the SVAD is not equipped with a thermostat or remote control, contact the on-site commissioning engineer to "remove" the distribution network from the original mobile phone, restoring the SVAD to a network distribution waiting state. If you still have questions, please contact your local Royal Service Air Conditioning dealer or the relevant department at Royal Service Air Conditioning.

For SVADs that have been successfully configured, if additional mobile phones require app monitoring, follow these steps:

Ⅱ.Share the SVAD app device from the initial mobile phone with the new mobile phone. Once successful, the new mobile phone can monitor it using the app.

Ⅲ.A SVAD can be shared to any mobile phone with the app installed. Alternatively, log in to another mobile phone with an existing "Royal Service" APP account to monitor the SVAD.

A mobile phone can configure any unconfigured SVAD.

Within the app, group your successfully configured SVADs (not shared) by "adding rooms." Create a "smart scene" and use "one-click execution" to perform group control and operations.

When SVAD and mobile phone are paired with the network, it is best to turn on the Bluetooth function of the mobile phone , which is helpful for successful code matching and network distribu-

Let's explain the installation, configuration and use of the "Royal Service" APP on smartphones:
"Royal Service" APP overview

● **Overview**

The "Royal Service" APP is a versatile control client for the company's smart products in high-end commercial buildings and smart factories. It serves as an operating platform for users to control and manage SVAD variable air diffusers and intelligently categorize and control devices by room. The app supports setting up home administrators and ordinary members for home rights management. Its modular functional design allows flexible addition of different equipment and panels, connecting different products to the same client for easy, linked control.

● **Software operating environment**

Support Android 4.5, IOS 11 and above systems.

● **Register and log in**

The app supports registration using a mobile phone number or email address.
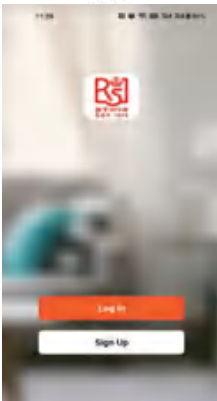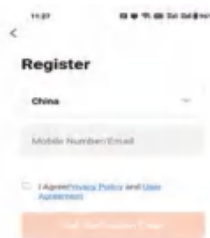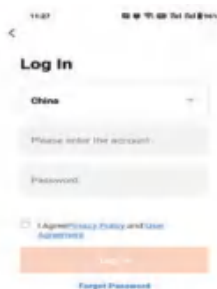
| Fig.27 | Fig.28 | Fig.29 |

● **Adding a Device:**

After opening the app, you'll see the screen as shown in Figure 30. Click the "+" in the upper corner and select "Add Device." Choose the device type, such as "SVAD Variable Air Diffuser," and proceed to the next screen. Enter your Wi-Fi password and click "Next." Ensure that the SVAD Variable Air Diffuser is in the network distribution state, then click "Next" to continue.
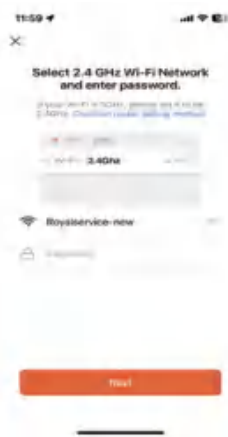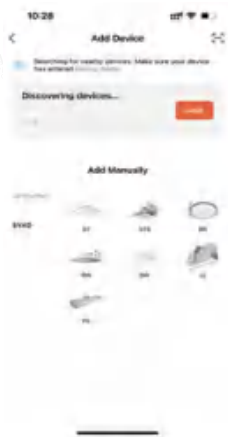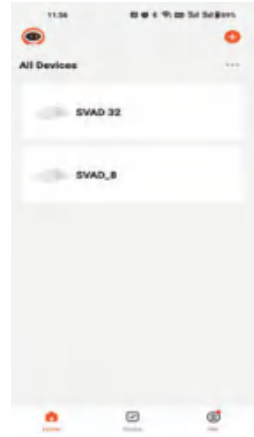
Fig.30   Fig.31   Fig.32

If the SVAD variable air diffuser is not in the waiting network state, follow these steps:

Ⅰ.If equipped with a thermostat or remote control, press and hold the F button on the thermostat to put the SVAD in the waiting network status.

Ⅱ.If not equipped with a thermostat or remote control, contact the on-site commissioning engineer and request them to "remove" the distribution network of the SVAD on the original mobile phone to restore the waiting network status.

Ⅲ.If issues remain, contact your local Royal Service Air Conditioning distributor or the relevant department at the company.

Once the SVAD variable air diffuser is in the waiting network distribution state and you click "Next," the network distribution process will officially begin, and the app will proceed through the steps as shown in Figures 33-35.
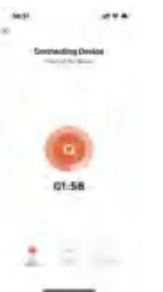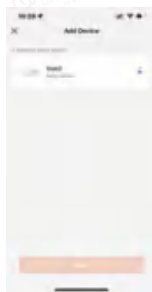
Fig.33   Fig.34   Fig.35   Fig.36   Fig.37

When Figure 34 is displayed, it indicates successful network distribution and code match-ing. Click "+" to add the device to the app, and an interface like Figure 35 will appear. You can then further adjust settings, edit the name and code of the SVAD variable air diffuser, and group different SVAD using the "room label" function for easier management and monitoring.

If Figure 36 is displayed, it indicates network distribution failure. Attempt reconfiguring the network, using a different Wi-Fi network, or ensuring the SVAD can connect to the selected Wi-Fi network. If necessary, resolve signal issues by extending the SVAD Wi-Fi signal line, repositioning the Wi-Fi router, or adding Wi-Fi amplifiers.

After successful device configuration, click "Home" at the bottom of the app. An interface like Figure 37 will display the SVAD variable air diffuser's name in the list. Click the name and code of the configured SVAD to enter its control panel. (1) When the SVAD is online, you can access the panel (including connect to WIFI, Tuya Server). (2) If the SVAD is offline (not connect to WIFI, Tuya server), the app will show it as offline. (3) Utilize the "room label" feature for quick device classification and management.

● **Monitor and operate SVAD:**

After completing network distribution and code matching between the mobile phone and SVAD, you can monitor the successfully distributed SVADs using the "Royal Service App."

To monitor a specific SVAD, click the drop-down arrow in the upper left corner of the "Home" interface in the app, locate the "Home" where the SVAD is, and click to enter. The app will display an interface like Figure 38, showing all the Royal Service Air Conditioning smart devices, including SVADs, that have been successfully distributed in the "home." The interface also displays "rooms" (groups) for these devices and pre-set "one-click execution" icons for unified operation groups.

To monitor a particular SVAD variable air diffuser, click on its icon to access the operation and monitoring interface, as shown in Figure 39 on the left.
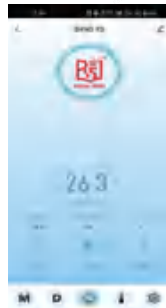
Fig.38   Fig.39   Fig.40   Fig.41

I.In the interface, the rotating hexagon surrounding the Royal Service LOGO signifies the SVAD is operating (On state); when stationary, the SVAD is closed (Off state).

II.Press "M" to access "Operation Mode" settings (Figure 40), and move "√" to choose the operating mode.

III.Press "D" for "Damper Operation Mode" settings (Figure 41), and move "√" to select the operating mode.

IV.Click the central iconto toggle SVAD between "On" and "Off."

V.Click the thermometer icon to modify and reset the "temperature setting value" (Figure 42).

VI.Press the gear icon for the "Settings" interface (Figure 43). Input corresponding password values to access "engineer mode" (Figures 44, 45) or "special setting mode" (Figure 46). The latter sets SVAD parameters for specific requirements, while the former sets basic parameters. Only authorized engineers should access "engineer mode" to avoid affecting SVAD's operation.
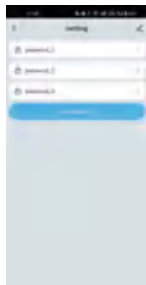
| Fig.42 | Fig.43 | Fig.44 | Fig.45 | Fig.46 |

To share a single device to other users:

I.Each SVAD can only be networked by one mobile phone. If others wish to monitor the SVAD, the control page must be shared with the relevant mobile phones.

II.Click one of the Device, and then go to the device control page, On the device control page, click the pencil icon (upper right) to access the device settings. Find and click "Shared Device" and "Add Shared." Enter the other party's APP account (mobile phone number or email used   network-allocated APP account.

III.Devices can be shared with any "home" member in the mobile APP or with other contacts.
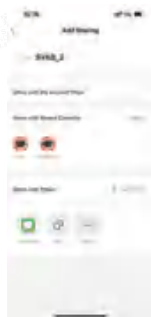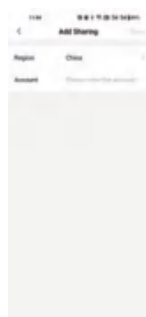
| Fig.47 | Fig.48 |

Share Home devices:

Enter the App homepage, click "Me" > "Home Management." Then enter the "home" that needs to be set, click "Add Member" and an invitation code will be generated for the invited contacts.

The invited contact clicks "Join a home" in their "Home Management" and enters the invitation code to join. This shares all devices in the "Home" without needing to share individual devices. See Fig49~Fig55.
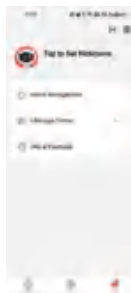

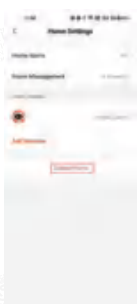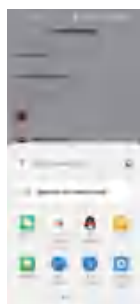Fig.49   Fig.50   Fig.51
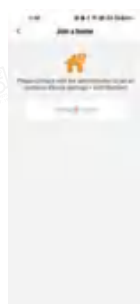

Fig.52   Fig.53   Fig.54   Fig.55

Share account password:

Share the account password with other mobile phones, allowing them to log in and monitor devices under the shared account. The same account has same permissions and operations on different devices.

● Scenes:

In the "scene" function, users can set up smart devices and use "automation" or "Tap-to Run" for intelligent and group control of devices, including SVAD variable air diffusers.

In "automatic" mode, use "If" and "Then" to set up automatic operation control under various conditions. Devices will be controlled according to the set conditions.

In "Tap-to Run" mode, create a task and tap it to run. This enable easy control of your smart devices.
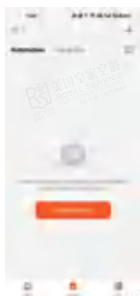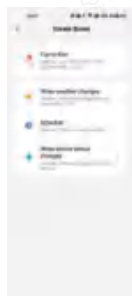
Fig.56   Fig.57

● **Tap-to-Run Function**

Ⅰ.Click "Create Scene" > "Launch Tap-to-Run" > "New Tap-to-Run" to access the interface (Figures 57-59).

Ⅱ.In Figure 59, choose "Tap-to Run" and select a "Task" type: "Run the device," "Select Smart Scene," or "Delayed the action."

Ⅲ.Select "Run the device" to view controllable devices (Figure 60). Click the device icon for which you want to set up "Tap-to Run."

Ⅳ.See a list of operable functions for the selected device (Figure 61). Click the function to set as "Tap-to Run" and configure settings as needed (Figure 62).

Ⅴ.Save settings and click "Next" to complete the "Tap-to Run" setup for the chosen device and function.

Ⅵ.To set up "Tap-to Run" for other functions or devices, repeat the above steps. Identical settings on multiple devices will be combined into a single "Tap-to Run" for one-click cluster control.
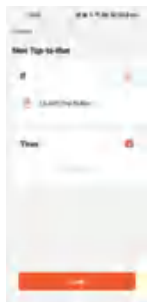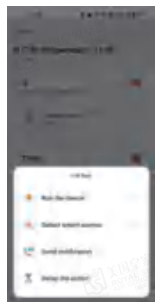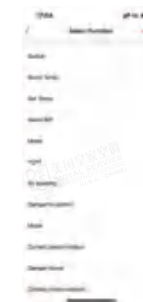

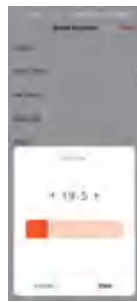Fig.58   Fig.59   Fig.60   Fig.61   Fig.62

In "Automatic" mode, configure settings to run automatically based on triggers: "When the Weather Changes," "Timing," or "When the Equipment Status Changes."

For "When the Weather Changes," enable your mobile phone's location services or set the device's location. The APP will determine local weather conditions.

Select local weather parameters: "Temperature," "Humidity," "Weather," "PM2.5," "Air Quality," "Sunrise and Sunset," and "." Configure devices to perform tasks such as "Run the device" "Select Smart Scenes," "Send Notification" or "Delayed the action" under specified conditions.

Choosing "Run the device" task will execute the selected function under chosen weather conditions, similar to the "Tap-to Run" function.

Select "Select Smart Scene" to pick a previously set up "Tap-to Run" or "Automation" function (Figures 63-68).

For "Schedule," configure devices to perform specific operations at a set time.

"When the device status changes", it means that the device can be set to execute the task (Including "Run the device", "select smart scene", "send notification ", "delay the action")
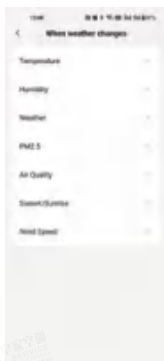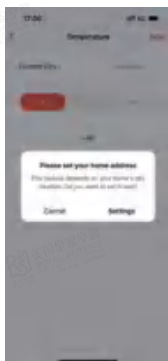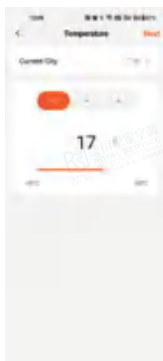

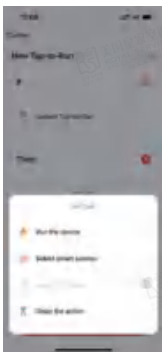Fig.63   Fig.64   Fig.65

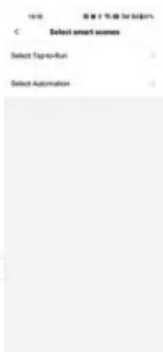Fig.66   Fig.67   Fig.68