

Tuya Serial Port Communication Protocols

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Product Information

Product name: Tuya IoT interface

Product ID: bgqmvtsajekilsku

Product function:

DP ID	DP Name	Data Transmission Type	Data Type	Function Attribute	Remarks
101	Digital Input 1	Only report	bool		The DigitalInput_1 reads the state of digital input number 1.
102	Digital Input 2	Only report	bool		The DigitalInput_2 reads the state of digital input number 2.
103	Digital Input 3	Only report	bool		The DigitalInput_3 reads the state of digital input number 3.
106	Analog Input 1	Only report	value	Values range : 0-4095, Pitch: 10, Unit :	The AnalogInput_1 reads the value of an analog input number 1.
107	Analog Input 2	Only report	value	Values range : 0-1023, Pitch: 1, Unit:	The AnalogInput_2 reads the value of an analog input number 2.
108	Analog Input 3	Only report	value	Values range : 0-1023, Pitch: 1, Unit:	The AnalogInput_3 reads the value of an analog input number 3.
111	Digital Output 1	Issue and report	bool		The DigitalOutput_1 reads and writes on digital output number 1.
112	Digital Output 2	Issue and report	bool		The DigitalOutput_2 reads and writes on digital output number 2.
113	Digital Output 3	Issue and report	bool		The DigitalOutput_3 reads and writes on digital output number 3.
114	Digital Output 4	Issue and report	bool		The DigitalOutput_4 reads and writes on digital output number 4.
					The DigitalOutput_5

115	Digital Output 5	Issue and report	bool		tput_5 reads and writes on digital output number 5.
116	Analog Output 1	Issue and report	value	Values range : 0-255, Pitch: 1, Unit:	The AnalogOutput_1 reads and writes on analog output number 1.
117	Analog Output 2	Issue and report	value	Values range : 0-255, Pitch: 1, Unit:	The AnalogOutput_2 reads and writes on analog output number 2.
118	Analog Output 3	Issue and report	value	Values range : 0-255, Pitch: 1, Unit:	The AnalogOutput_3 reads and writes on analog output number 3.
119	AV1	Only report	string	Maxium Length : 255	
120	AV2	Only report	string	Maxium Length : 255	
121	AV3	Only report	string	Maxium Length : 255	
122	AV4	Only report	string	Maxium Length : 255	
123	AV5	Only report	string	Maxium Length : 255	
124	AV6	Only report	string	Maxium Length : 255	
125	AV7	Only report	string	Maxium Length : 255	
126	AV8	Only report	string	Maxium Length : 255	
127	AV9	Only report	string	Maxium Length : 255	

Communication Protocol

- Serial port communication conventions

Bits per second: 9600

Data bits: 8

Parity: None

Stop bits: 1

Flow control: None

MCU: control board control chip, interworking with a Tuya module over a serial port

- Frame format description

Field	Length (Byte)	Description
Frame header	2	Fixed value of 0x55aa
Version	1	Used during upgrade and exten

		sion
Command word	1	Detailed frame type
Data length	2	Big endian
Data	xxxx	
Checksum	1	Reminder of the byte sum starting from the frame header to 256

- Communication protocols – Basic protocols

1. Heartbeat detection

- 1.1 After being powered on, a module sends heartbeat packets continuously until it receives a response. After receiving a response, the module sends heartbeat packets at 15s intervals.

- 1.2 The MCU periodically checks whether the module is working properly based on heartbeat packets.

2. Querying product information

- 2.1 Product ID (PID): PIDs are generated on the Tuya Smart platform to record information about products on the cloud.

- 2.2 MCU software version number: The version number is in *x.x.x* format, where *x* is a decimal number within the range of 0 to 9.

- 2.3 Network configuration mode:

The default, low-power, and special network configuration modes are available. Typically, the default network configuration mode (00) is used.

- 2.3.1. Default network configuration: By default, a module enters the smart network configuration mode upon first power-on. If no other commands are received, the module is always in network configuration state.

- 2.3.2. Low-power network configuration: To meet different customer requirements, Tuya's modules also support the low-power mode. A module enters this mode in the following scenarios:

- (1) Network configuration is not performed within 10s after a module is ready for network configuration and then the module is restarted within 3 minutes.

- (2) Network configuration is not performed within 3 minutes after a module is ready for network configuration.

After a module enters the low-power mode, network configuration for it stops and the network configuration status indicator stops blinking.

- 2.3.3. Special network configuration: Before a module enters the low-power mode, the system checks whether the module has been connected to the cloud before.

- (1) Network configuration is not performed within 10s after a module is ready for network configuration and then the module is restarted within 3 minutes: If the module has never been connected to the cloud, the module enters the low-power mode. If the module has been connected to the cloud before, the module uses the previous routing information to connect to the router.

- (2) Network configuration is not performed within 3 minutes after a module is ready for network configuration: If the module has never been connected

to the cloud, the module enters the low-power mode. If the module has been connected to the cloud before, the module uses the previous routing information to connect to the router.

Example: {"p":"RN2FVAgXG6WfAktU","v":"1.0.0","m":0}

p indicates the product ID, and the value is RN2FVAgXG6WfAktU. **v** indicates the MCU version, and the value is 1.0.0. **m** indicates the network configuration mode, and the value is 0 (0: default network configuration; 1: low-power network configuration; 2: special network configuration).

55	aa	03	01	00	2a	7b	22	70	22	3a	22	52	4e	32	46
Frame header						{	"	P	"	:	"	R	N	2	F
56	41	67	58	47	36	57	66	41	6b	74	55	22	2c	22	76
V	A	g	X	G	6	W	f	A	k	t	U	"	,	"	v
22	3a	22	31	2e	30	2e	30	22	2c	22	6d	22	3a	30	7d
"	:	"	1	.	0	.	0	"	,	"	m	"	:	0	}
0c															
Parity bit															

3. Querying the module working mode set by the MCU

A module supports cooperative processing by the MCU and module and processing by the module alone for network configuration and indicator control.

3.1 Cooperative processing by the MCU and module

The module notifies the MCU of the current Wi-Fi status over a serial port. The MCU displays the Wi-Fi status. After the MCU receives a reset request, it directs the module to reset over a serial port.

3.2 Processing by the module

The module's GPIO drives the LED to show the Wi-Fi status. The module is reset through GPIO input.

If the MCU selects processing by the module, skip the following description of protocols 4 to 6. In processing by the module mode, the module triggers a reset when it detects that the GPIO input is at a low level for more than 5s.

4. Device network connection status

4.1 A device has the following network connection states: (1) Smart network configuration (2) AP mode (3) The Wi-Fi is configured, but the device fails to connect to the router. (4) The Wi-Fi is configured, and the device successfully connects to the router. (5) The device connects to the router and the cloud. (6) Low-power mode In processing by the module mode, the LED indicator states are as follows: State 1: The indicator blinks at 250 ms intervals. State 2: The indicator blinks at 1500 ms intervals. State 3 or 6: The indicator is off. State 4 or 5: The indicator is steady on.

4.2 When the module detects that the MCU has restarted or gone offline and then online, the module sends the Wi-Fi status to the MCU.

4.3 When the Wi-Fi status of the module changes, the module sends the status to the MCU.

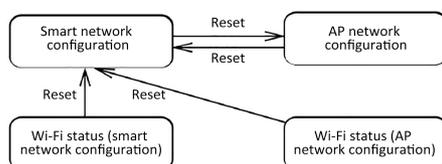
4.4 When Processing by the module mode, the MCU does not need to implement the protocol.

Device Network Connect		
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ion Status	Description	State Value
State 1	Smart network configuration	0x00
State 2	AP mode	0x01
State 3	The Wi-Fi is configured, but the device fails to connect to the router.	0x02
State 4	The Wi-Fi is configured, and the device successfully connects to the router.	0x03
State 5	The device connects to the router and the cloud.	0x04
State 6	The Wi-Fi device is in low-power mode.	0x05

5. Resetting the Wi-Fi

If a module has connected to the network, reset the Wi-Fi to enable the device to enter the network configuration state. After the Wi-Fi is reset, the module enters smart network configuration by default.



6. Selecting a network configuration mode

A module can change between the smart and AP network configuration modes, as shown in the preceding figure. It enters a network configuration mode based on the corresponding protocol command.

7. Command delivery and status reporting

For details about product DP command delivery and status report protocols, see Table 11-1 Communication protocol (product functions) commands.

8. Conditions for reporting the MCU working status

8.1 Using the 08 command word to query: After the MCU receives a command to query the MCU working status, the MCU reports the status of all data points (DPs), such as the switch and mode.

8.2 Proactive reporting: When the MCU status is changed and the MCU status is controlled through a control board button but not an app, the MCU proactively reports its status to the module.

8.3 Scheduled reporting: If the timing function is enabled, the MCU reports the countdown remaining time every minute.

9. (Optional) Support for MCU firmware upgrade

(1) The MCU can select firmware upgrade based on actual requirements. To enable firmware upgrade for a product, log in to the Tuya Smart platform, select the product on the **Product** page, click **Advanced Features** and click **Settings** next to **Firmware Updates Center**.

(2) An app triggers MCU firmware upgrades. The module is used only as the data transmission channel for MCU firmware upgrades.

(3) The MCU firmware upgrade modes include forcible hardware upgrade (not

recommended), notification upgrade, forced upgrade, and automatic upgrade. You can select a mode when uploading the firmware to the Tuya Smart platform.

(4) The firmware can only be upgraded to a later version.

9.1 Upgrade startup

The firmware can be upgraded automatically or manually. In automatic upgrade mode, the module automatically starts the MCU upgrade process if it detects a new MCU firmware version on the cloud. In manual upgrade mode, the module starts the MCU upgrade process only after you confirm the upgrade on your app.

9.2 Upgrade package transmission

(1) The upgrade package data is transmitted in package offset (unsigned short) + package data format.

(2) If the MCU receives 4-byte frame data and the package offset is greater than or equal to the firmware size, package transmission ends.

For example, the upgrade file is 530 bytes (reply is not required for the last data packet).

(1) In the first data packet, the offset is 0x00000000 and the length is 256 bytes.

0x55aa 00 0b 0104 00000000 xx...xx XX

(2) In the second data packet, the offset is 0x00000100 and the length is 256 bytes.

0x55aa 00 0b 0104 00000100 xx...xx XX

(3) In the third data packet, the offset is 0x00000200 and the length is 18 bytes.

0x55aa 00 0b 0016 00000200 xx...xx XX

(4) In the last data packet, the offset is 0x00000212 and the length is 0 bytes.

0x55aa 00 0b 0004 00000212 xx...xx XX

10. (Optional) Obtaining the local time

Only products that support MCU time synchronization need the local time.

11. Wi-Fi function test

To test the Wi-Fi during mass production of a product, scan the specified SSID of "tuya_mdev_test". The scanning result and signal strength percentage are returned. We recommend that you invoke the product testing command 5s after the module is powered on and initialized.

Table 11-1 Communication protocol (basic protocol) commands

		Frame Header and Version	Comm and Word	Data Length	Data	Checksum
Heartbeat detection	Sent by the module	0x55aa, 0x00	0x00	0x0000		0xff
	Reported by the MCU	0x55aa, 0x03	0x00	0x0001	0x00 (first packet) or 0x01 (later packets)	Checksum
	Sent					

	by the module	0x55aa, 0x00	0x01	0x0000		0x00
Querying product information	Reported by the MCU	0x55aa, 0x03	0x01	0x002a	Mode: 0: default network configuration 1: low-power network configuration 2: special network configuration Format: {"p": "bgqmvtsa", "v": "1.0.0", "m": 0}	Checksum
Querying the module working mode set by the MCU	Sent by the module	0x55aa, 0x00	0x02	0x0000		0x01
	Reported by the MCU (cooperative processing by the MCU and module)	0x55aa, 0x03	0x02	0x0000		Checksum
	Reported by the MCU (processing by the module)	0x55aa, 0x03	0x02	0x0002	The first and second bytes indicate the GPIO SNs of the Wi-Fi status indicator and Wi-Fi reset button, respectively.	Checksum
Reporting the Wi-Fi status	Sent by the module	0x55aa, 0x00	0x03	0x0001	Wi-Fi status: 0x00 : smart network configuration mode, in which the indicator blinks quickly 0x01 : AP mode, in which the Wi-Fi indicator blinks slowly 0x02 : The Wi-Fi is configured, but the device fails to connect to the router. The indicator is off. 0x04 : The device connects to the router and the cloud. The indicator is steady on.	Checksum
	Reported by the MCU	0x55aa, 0x03	0x03	0x0000		Checksum
Resetting the Wi-Fi	Sent by the MCU	0x55aa, 0x03	0x04	0x0000		Checksum
	Reported by the module	0x55aa, 0x00	0x04	0x0000		0x03
	Reported by the MCU (smart)	0x55aa, 0x03	0x05	0x0001	0x00	Checksum

Selecting a network configuration mode (smart or AP network configuration)	work configuration					
	Reported by the MCU (AP mode)	0x55aa, 0x03	0x05	0x0001	0x01	Checksum
	Sent by the module	0x55aa, 0x00	0x05	0x0000		0x04
Querying the MCU working status	Sent by the module	0x55aa, 0x00	0x08	0x0000		Checksum
	Reported by the MCU	0x55aa, 0x03	0x07	N	Data of all DPs as the initial values to be displayed in the app	Checksum
Upgrade startup	Sent by the module	0x55aa, 0x00	0x0a	0x0004	Number of bytes in the firmware upgrade package	Checksum
	Reported by the MCU	0x55aa, 0x03	0x0a	0x0001	Upgrade package subcontract transmission size: 0x00: default 256byte (compatible with old firmware) 0x01:512byte 0x02:1024byte	Checksum
Upgrade package transmission	Sent by the module	0x55aa, 0x00	0x0b	0x0004 <i>Data package length</i>	The first four bytes indicate the package offset, followed by bytes indicating the data package content.	Checksum
	Reported by the MCU	0x55aa, 0x03	0x0b	0x0000		Checksum
(Optional) Obtaining the local time	Reported by the MCU	0x55aa, 0x03	0x1c	0x0000		Checksum
	Sent by the module	0x55aa, 0x00	0x1c	0x0008	The data contains eight bytes. Data[0] indicates whether the local time is obtained. The value 0 indicates a failure to obtain the local time, and the value 1 indicates that the local time has been obtained. Data[1] indicates the year, and the value 0x00 indicates 2000. Data[2] indicates the month, and the value range is from 1 to 12. Data[3] indicates the day, and the value range is from 1 to 31. Data[4] indicates the hour, and the value range is from 0 to 23. Data[5] indicates the minute, and the value range is from 0 to 59. Data[6] indicates the second, and the value range is from 0 to 59. Data[7] indicates the week, and the value range is from 1 to 7.	Checksum

Testing the Wi-Fi function (Note: Scan the specified SSID of "tuya_mdev_test".)	Reported by the MCU	0x55aa, 0x03	0x0e	0x0000		Checksum
	Sent by the module	0x55aa, 0x00	0x0e	0x0002	The data contains two bytes. If Data[0] is 0x00, the test failed. If Data[0] is 0x01, the test was successful. When Data[0] is 0x01, Data[1] indicates the signal strength, and its value range is from 0 to 100. A larger value indicates a stronger signal strength, and the value 100 indicates the strongest signal strength. When Data[0] is 0x00 and Data[1] is 0x00, the specified SSID is not scanned. When Data[0] is 0x00 and Data[1] is 0x01, the authkey is not burned into the module.	Checksum

• Communication protocols – Functional protocols

Communication protocol (product function) commands

ID	Function Name		Frame Header and Version	Command Word	Data Length	DP ID	Date Type	Data Length	Function Command	Checksum
101	Digital Input 1	Reported by the MCU	0x55aa 0x03	0x07	0x00 0x05	0x65	0x01	0x00 0x01	off:0x00 on:0x01	Checksum
102	Digital Input 2	Reported by the MCU	0x55aa 0x03	0x07	0x00 0x05	0x66	0x01	0x00 0x01	off:0x00 on:0x01	Checksum
103	Digital Input 3	Reported by the MCU	0x55aa 0x03	0x07	0x00 0x05	0x67	0x01	0x00 0x01	off:0x00 on:0x01	Checksum
106	Analog Input 1	Reported by the MCU	0x55aa 0x03	0x07	0x00 0x08	0x6a	0x02	0x00 0x04	0x0-0xffff	Checksum
107	Analog Input 2	Reported by the MCU	0x55aa 0x03	0x07	0x00 0x08	0x6b	0x02	0x00 0x04	0x0-0x3ff	Checksum
108	Analog Input 3	Reported by the MCU	0x55aa 0x03	0x07	0x00 0x08	0x6c	0x02	0x00 0x04	0x0-0x3ff	Checksum
111	Digital Output 1	Sent by the module	0x55aa 0x00	0x06	0x00 0x05	0x6f	0x01	0x00 0x01	off:0x00 on:0x01	Checksum
		Reported by the MCU	0x55aa 0x03	0x07	0x00 0x05	0x6f	0x01	0x00 0x01		Checksum
112	Digital Output 2	Sent by the module	0x55aa 0x00	0x06	0x00 0x05	0x70	0x01	0x00 0x01	off:0x00 on:0x01	Checksum
		Reported by the MCU	0x55aa 0x03	0x07	0x00 0x05	0x70	0x01	0x00 0x01		Checksum
113	Digital Output	Sent by the module	0x55aa 0x00	0x06	0x00 0x05	0x71	0x01	0x00 0x01	off:0x00	Checksum

	ut 3	Reported by the MCU	0x55aa 0x03	0x07	0x00 0 x05	0x71	0x01	0x00 0 x01	on:0x01	Checksum
114	Digital Output 4	Sent by the module	0x55aa 0x00	0x06	0x00 0 x05	0x72	0x01	0x00 0 x01	off:0x00 on:0x01	Checksum
		Reported by the MCU	0x55aa 0x03	0x07	0x00 0 x05	0x72	0x01	0x00 0 x01		Checksum
115	Digital Output 5	Sent by the module	0x55aa 0x00	0x06	0x00 0 x05	0x73	0x01	0x00 0 x01	off:0x00 on:0x01	Checksum
		Reported by the MCU	0x55aa 0x03	0x07	0x00 0 x05	0x73	0x01	0x00 0 x01		Checksum
116	Analog Output 1	Sent by the module	0x55aa 0x00	0x06	0x00 0 x08	0x74	0x02	0x00 0 x04	0x0-0xff	Checksum
		Reported by the MCU	0x55aa 0x03	0x07	0x00 0 x08	0x74	0x02	0x00 0 x04		Checksum
117	Analog Output 2	Sent by the module	0x55aa 0x00	0x06	0x00 0 x08	0x75	0x02	0x00 0 x04	0x0-0xff	Checksum
		Reported by the MCU	0x55aa 0x03	0x07	0x00 0 x08	0x75	0x02	0x00 0 x04		Checksum
118	Analog Output 3	Sent by the module	0x55aa 0x00	0x06	0x00 0 x08	0x76	0x02	0x00 0 x04	0x0-0xff	Checksum
		Reported by the MCU	0x55aa 0x03	0x07	0x00 0 x08	0x76	0x02	0x00 0 x04		Checksum
119	AV1	Reported by the MCU	0x55aa 0x03	0x07	N	0x77	0x03	N	0x00-0xff	Checksum
120	AV2	Reported by the MCU	0x55aa 0x03	0x07	N	0x78	0x03	N	0x00-0xff	Checksum
121	AV3	Reported by the MCU	0x55aa 0x03	0x07	N	0x79	0x03	N	0x00-0xff	Checksum
122	AV4	Reported by the MCU	0x55aa 0x03	0x07	N	0x7a	0x03	N	0x00-0xff	Checksum
123	AV5	Reported by the MCU	0x55aa 0x03	0x07	N	0x7b	0x03	N	0x00-0xff	Checksum
124	AV6	Reported by the MCU	0x55aa 0x03	0x07	N	0x7c	0x03	N	0x00-0xff	Checksum
125	AV7	Reported by the MCU	0x55aa 0x03	0x07	N	0x7d	0x03	N	0x00-0xff	Checksum
126	AV8	Reported by the MCU	0x55aa 0x03	0x07	N	0x7e	0x03	N	0x00-0xff	Checksum
127	AV9	Reported by the MCU	0x55aa 0x03	0x07	N	0x7f	0x03	N	0x00-0xff	Checksum