2. Operating Instructions

2.1 I/O Settings

2.1.1 Introduction to Communication Modes

The communication interface is J1. This module has two communication interfaces that cannot be used simultaneously: UART and I2C interfaces. The module has three communication modes: auto detection mode, UART communication mode, and I^2C communication mode. The auto detection mode belongs to the module factory configuration. After the module is powered on (or reset), after about 7ms initialization time, the module enters the "working mode detection" state, and the communication mode of the module is determined according to the sequence of detecting software configuration—detecting hardware configuration—auto detection mode.

1. Detecting software configuration

Detecting software configuration refers to fixing the communication mode to UART or I^2C after the module is powered on according to the configuration result of "setting equipment working mode" in equipment control commands. This setting will not lost after power-off. If configured to I^2C mode, the module directly enters I^2C mode; if configured to UART mode, the module directly enters UART mode, the UART baud rate is the baud rate saved inside the module, and the baud rate can be modified by "setting baud rate" in equipment control commands.

2. Detecting hardware configuration

When the software configuration working mode is auto detection mode, the module does not enter a specific communication mode, but further detects the hardware configuration. The detection principle is to determine which communication mode to use based on the pin level state of the module. The J1-6, J1-7, and J1-8 pin level checks take precedence over J1-2 and J1-3. The specific definition of J1 interface is shown in Sheet 2.1.

When any of J1-6, J1-7, and J1-8 pins is low, the module reads the level state every 1ms for 50 consecutive times. If the level states of J1-6, J1-7, and J1-8 are not changed, the module will enter I^2C mode.

When either of J1-2 and J1-3 pins is low, the module reads the level state every 1ms for 50 consecutive times. If the level states of J1-2 and J1-3 are not changed, the module will enter UART working mode.

Sheet 2.1 Definition of Pin

Pin	Symbol	Type	Power-on state	Description
J1-1	/INT	Output	High level	Interrupt output pin, open collector; In I^2C communication mode, after the command is executed, this pin outputs low level; when responding to auto detection command and enabling interrupt output, when any card is detected, this pin outputs low level
J1-2	SCL	Input	High level	I^2C data input pin, module with 4.7K pull-up
J1-3	SDA	Input/Output	High level	I^2C data input/output pin, module with 4.7K pull-up
J1-4	GND	PWR	—	Negative power terminal

J1-5	VCC	PWR	—	Positive power terminal
J1-6	RXD	Input	High level	UART receiver, TTL level
J1-7	TXD	Output	High level	UART transmitter, TTL level
J1-8	CON	Input	High level	Control pin for RS-485 communication (0: input; 1: output), module auto control, TTL level

Note: the square bonding pad is the 1st pin. 3.3V module J1-5 is connected to 3.3V power supply, and 5V module J1-5 is connected to 5V power supply.

3. Auto detection mode

When the software configuration and hardware configuration do not set the module as UART communication mode or I^2C communication mode, the module will enter the auto detection mode. In this mode, both UART and I^2C interfaces are in the receiving state, if the module detects valid baud rate from the UART communication line, the module uses UART communication; if the module receives SLA from the I^2C bus (the factory default of SLA is 0xB2), the module uses I^2C communication. As long as one of the interfaces receives valid data first, the module will definitely communicate with the outside world in this way and close the other interface.

In auto detection mode, the UART needs to receive 0x20 twice to enter the UART communication mode. The first receiving of 0x20 is used to calculate the baud rate. The principle is to obtain the time interval of two falling edges by capturing the two falling edges in 0x20 bytes and calculate the baud rate. The second receiving of 0x20 is used to determine whether the calculated baud rate is correct. After the module successfully receives 0x20 twice, it will reply 0x06. Because this detection mechanism is easily interfered, it is not possible to send data content other than 0x20 to the module before the module calculates the correct baud rate. Otherwise, it is easy to calculate the error baud rate, causing no response to the module's command with the current baud rate.

In order to ensure that the module can successfully switch to UART communication mode with the fixed baud rate from the auto detection mode, the recommended operation method is: in addition to the necessary communication interface, an additional I/O interface shall be connected to the module's EN reset pin. The module is reset every time before it is sent 0x20 twice. After resetting, there will be at least 7ms delay, and then the module can enter the auto detection mode and receive 0x20 normally.

4. UART communication mode

Users can set the module as UART communication mode after power-on by the “setting baud rate” and “setting equipment working mode” in equipment control commands. This method belongs to software configuration. For details of commands, please refer to Chapter IV. For hardware configuration UART communication mode, please refer to "detecting hardware configuration". In the UART communication mode, after the module is powered on, it will read the serial interface setting information (such as module address and baud rate) stored in the module to initialize the communication interface. The host can select the same baud rate as the module and directly perform serial interface communication with the module.

5. I^2C communication mode

Similar to the UART communication mode, users can also set the module as I^2C communication mode after power-on by the “setting equipment working mode” command. In this mode, the host can directly communicate with the module via the I^2C interface. The communication address is

0xB2 by default. Of course, users can also rewrite it to other values by the “setting equipment working mode” command.

For methods of hardware configuration I^2C communication mode, please refer to "detecting hardware configuration". Unlike the software configuration, when J1-8 is in high level, the module uses the default address 0xB2 (can be modified by software), and when J1-8 is in low level, the module address will be determined by levels of J1-6 and J1-7. The address byte is 1011 0 (J1-6) (J1-7)x, and x is the read-write bit, for example, if both J1-6 and J1- 7 are connected to high levels, the device address is 1011 011x (0xB6).

Special note: after the module address is modified in the I^2C communication mode, the host needs to read the return command frame with the original address to enable the new address, or power off the module to enable the new address.

2.1.2 Antenna Interface Settings (J2)

Sheet 2.2 Definition of Antenna Interface Pin J2

Pin	Symbol	Type	Description
J2-1	TX1	Output	Antenna output drive 1
J2-2	GND	Ground	Antenna ground
J2-3	TX2	Output	Antenna output drive 2
J2-4	RX	Input	In dual antenna applications, the pin needs to be shorted to TX2; when TX1 and TX2 drive one antenna at the same time, the pin cannot be shorted to TX2.
J2-5	GND	Ground	Antenna ground
J2-6	NC	—	Empty pin

2.1.3 Contact IC Card and Power Control Interface Settings（J3）

Sheet 2.3 Definition of Contact IC Card and Power Control Interface Pin J3

Pin	Symbol	Type	Description
J3-1	SAM_VCC	PWR	Positive power terminal of contact IC card
J3-2	SAM_RST	Output	RST pin controlled by contact IC card
J3-3	SAM_GND	PWR	Negative power terminal of contact IC card
J3-4	SAM_CLK	Output	CLK pin controlled by contact IC card
J3-5	SAM_I/O	Input/ Output	Data input/output pin controlled by contact IC card
J3-6	RUN	Input	Communication/operation indication, active-low
J3-7	3.3V	Output	Power supply 3.3V output terminal, can provide 100mA current output
J3-8	EN	Input	The module reset control pin, and the internal 10K resistor is pulled up to VCC. When it is set low, the whole module will be reset. The active-low time is T_{min}=50ns.

Note: the square bonding pad is the 1st pin. The entire module can be reset by controlling the level of pin EN.

2.1.4 Serial Interface (J6)

Sheet 2.4 Definition of Pin J6

Pin	Symbol	Type	Description
J6-1	VCC	PWR	Positive power terminal, connected to J1-5
J6-2	RXD	Input	Serial interface receiving pin
J6-3	TXD	Output	Serial l interface transmiting pin
J6-4	GND	PWR	Negative power terminal

2.2 Typical Applications

2.2.1 UART Interface Application

Communication with the host can be realized through the module's J1.6/J6-2 and J1.7/J6-3 interfaces as long as the host provides a UART interface.

1. UART application in auto detection mode

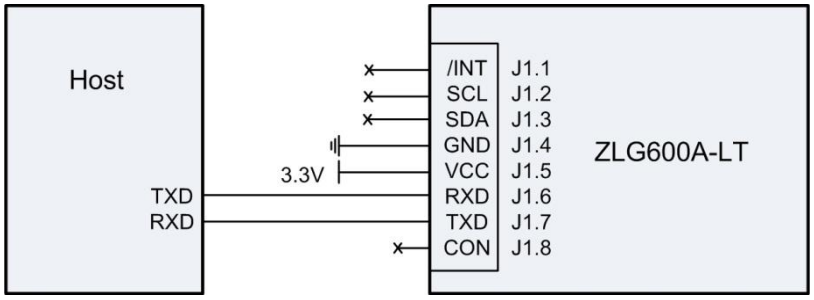

Figure 2.1 UART typical application in auto detection mode

As shown in Figure 2.1, in this application, the host only needs to provide the UART interface to connect with the module, and the other communication interfaces of the module can be left suspended. In this application, after the module is powered on, the baud rate detection needs to be performed before the host command is executed. The baud rate detection involves sending 0x20 twice consecutively, and the module will determine the communication baud rate and reply 0x06. Without this operation, the module does not respond to commands sent by any host. Figure 2.2 shows the baud rate setting flow chart:

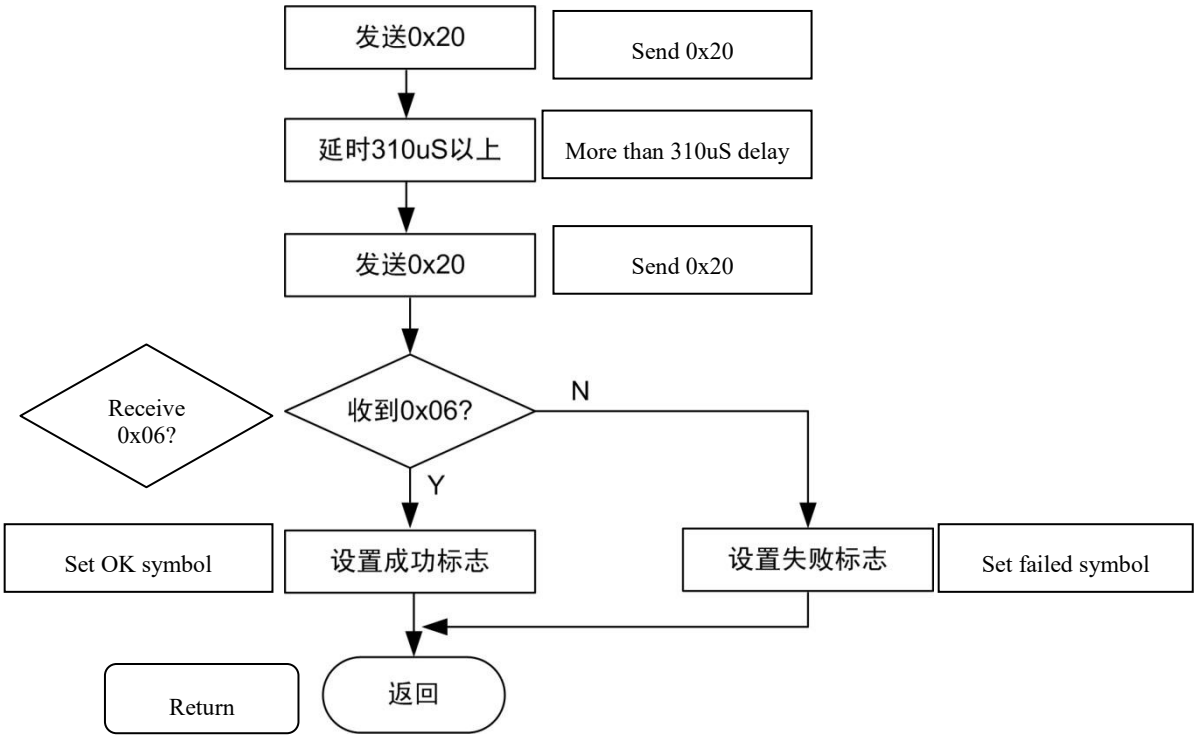

Figure 2.2 Determination of communication baud rate

2.2.2 I²C Interface Application

I²C communication with the host can be realized through the module's J1.1~J1.3 interfaces as long as the host provides any three I/O interfaces.

Note: J1-2 and J1-3 pins of ZLG600S series of modules are not pulled up internally. In practical applications, users should externally pull up, and the two pins of ZLG600A series of modules have been pulled up.

1. I²C application in auto detection mode

As shown in Figure 2.3, in this application, the host only needs to provide an I²C interface and an I/O interface (for detecting the response of the module) to connect with the module, and the other communication interfaces of the module can be pulled up or left suspended (connection pull-up is recommended). In this mode, the module I²C slave address is fixed to 0xB2.

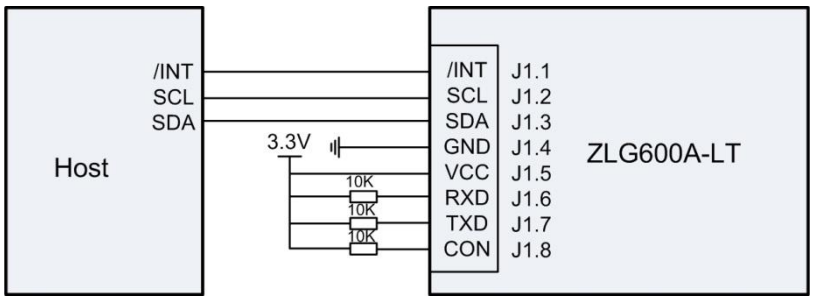

Figure 2.3 I²C typical application in auto detection mode

2.2.3 Multi-slave Solution Application

In order to adapt to the application of I²C multi-slave, the internal address of the module can be set by commands. The module address consists of one byte, the lowest bit is the read-write bit, which

conforms to the I²C address format, so up to 127 slaves can be set (0x00 is not available).

First of all, the module should be configured by commands first, mainly to configure the module's working mode, module address and other information that will not lost after power-off, and aftering setting of the working mode, this setting will take effect only after the module is re-powered; only by strictly performing the two previous operations, modules can be connected together to form a multi-slave solution application.

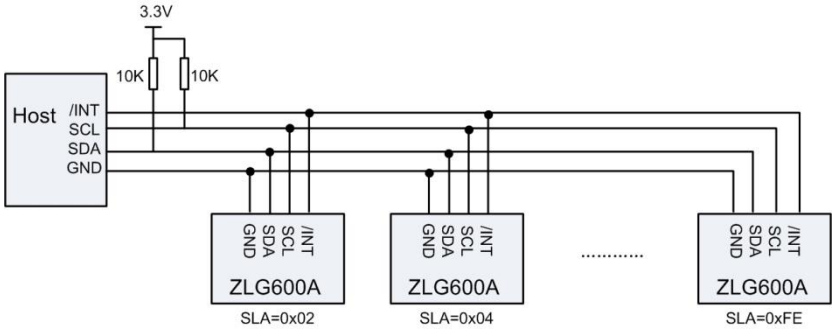

Figure 2.4 I²C multi-slave connection diagram

Figure 2.4 shows I²C multi-slave connection diagram, wherein the addresses of the slave can be set to 127 types from 0x02 to 0xFE. Before connecting, each slave module should be configured to I²C working mode by commands, and the module address can be set as your wish. For the configuration of commands, please refer to “equipment control commands→ setting working mode”.

Note: in the I²C communication mode, both the new frame format and the old frame format support multi-slave connection, and details of the two frame formats are described below.

OEM/Integrators Installations User Manual

The ZLG600A Series Card Reader Module developed by Guangzhou ZHIYUAN Electronics Co., Ltd. These modules have the characteristics of low cost, easy to use, reliable, diverse and small size. They can also be applied in various fields such as finance, software encryption, medical and health care, transportation ticketing, leisure and entertainment management. They can fully take the place of ZLG600SP Series modules.
ZLG600A-ANT is the antenna of ZLG600A Card Reader. This antenna is a coil antenna. Its operating frequency is 13.56MHz and it is used to transceive NFC signals.

The module is limited to OEM installation only.

This product is mounted inside of the end product only by professional installers OEM. They use this module with changing the power and control signal setting by software of end product within the scope of this application. End user cannot change this setting.

This device is intended only for OEM integrators under the following conditions:

1) The antenna must be installed such 20cm is maintained between the antenna and users, the antenna is a Inductive loop coil antenna.
2) The transmitter module may not be co-located with any other transmitter or antenna.

As long as these two conditions are met, further transmitter test will not be required. However, integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

The OEM integrator has to be aware no to provide information to the end user regarding how to install or remove this RF module in the user manual of the end product with integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

If the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module.

This exterior label can use wording such as the following:

“**Contains Transmitter Module FCC ID: ZLZ-ZLG600A-T2**”

When the module is installed inside another device, the user manual of this device must contain below warning statement:

Frederal Communication Commission Interference Statement

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.

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 generate, 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.

Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

Caution:

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

That separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093 and different antenna configurations.