TRU35 Radio

Manual for Users

Version	Date	description	Modified by
V1.0	2017.11.15	first draft	TW
V1.1	2018.07.11	Modify the modulation method; modify the RF power stability	Yang Ruru

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I. Overview

TRU35 is a high-power, small-size half-duplex digital radio designed by using advanced 32-bit cortex M4 microcontroller technology, wireless transceiver RF technology, and digital communication technology, this radio selects high-quality RF components, excellent EMC and EMI processing, and shell & heat sink integration technology. It has the advantages of high transmission power, long transmission distance, integrated transmission and receiving, simple installation and use, high cost performance, stable and reliable.

II. Functions

- Receiving and transmitting are integrated in one, half duplex, fast switching
- Radio relay function greatly improves the transmission distance
  TRU35 can send the received data through other frequency points, increasing the communication distance and expanding the signal coverage.
- Level 2 surge protection, reverse polarity protection
  The TRU35 adopts a level 2 surge protection to protect the radio from damage when the instantaneous input voltage or current exceeds the normal range. Even if the positive and negative polars are connected inversely, the radio will not be damaged.
- Standing wave detection protection
  TRU35 adopts standing wave detection protection to prevent damage to the instrument caused by long open and short circuits.
- Thermal protection
  TRU35 can adjust the transmitting power adaptively, automatically reduce the power when the instrument temperature is too high, and automatically increase the power when the instrument temperature decreases, to ensure that the instrument is always in a stable power range, and will not be damaged due to overheating.
- Protection- IP67
- Without assembly, integrated shell, high overall heat conduction efficiency and good heat dissipation

- Bluetooth configuration and Bluetooth datalink functionality
  TRU35 can configure and set its mode, protocol, air interface baud rate, frequency, high or low power through handheld via Bluetooth connection. It can also receive RTK data through Bluetooth and send it out through radio.
- Standard 16 channels for transmitting and receiving, users can configure and use according to the situation
- Under the condition of high transmission power, the transmission distance can reach 14 kilometers (depend on the base station height and the surrounding environment)

III. Main Technical Indicators

3.1 General Indicators

Frequency range: 410MHz-470MHz
Operating mode: half-duplex
Channel spacing: 25KHz
Frequency stability: ≤±1.0ppm
Modulation method: GMSK/4FSK
Air transmission rate: 9600bps, 19200bps
Antenna interface impedance: 50ohm
Rated working voltage: 12.5V (working voltage range: 10.8V-15V)
Weight: 1680g
Volume: 165mm×125mm×80mm

3.2 Receiving Indicators

Sensitivity: better than -116dBm@BER 10-5,9600bps
Common channel rejection: >-12dB
Blocking: >70dB
Adjacent channel selectivity:>52dB@25KHz
Spurious immunity: >55dB

3.3 Transmission Indicators

RF output power: 10W/30W (input voltage is 12.5V)
RF power stability: ±1.5dB
Adjacent channel rejection: >50dB

IV. User Interface

4.1 LED Display

The top panel of TRU35 has 5 LED indicators that display current working status of radio.

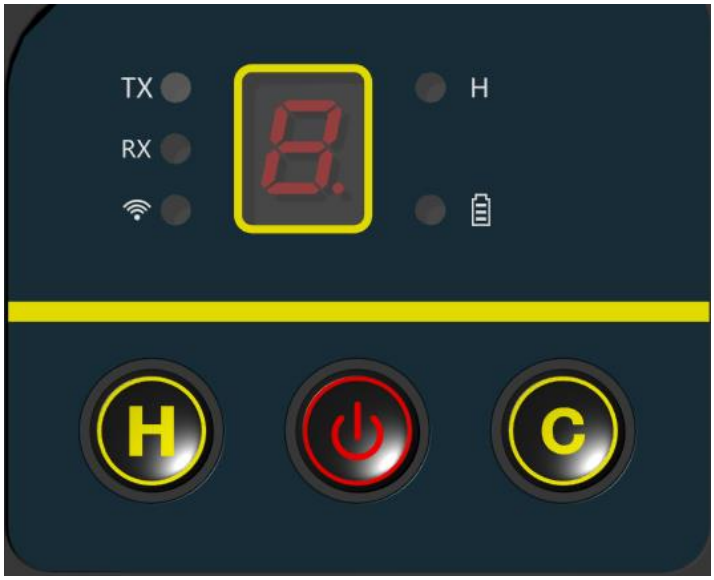

Figure 4-1

Table 4-1 Indicators

Indicators	Color	Function
Power Indicator 	Green	Solid green when power on, flashes in 1Hz when it is in undervoltage (when the voltage is lower than 11.3V, the flashing light warns that data can be transmitted normally; when the voltage is below 10. 5V, the flashing light warns and stops transmitting data), and flashes when it is in high temperature (when the temperature is higher than 90°C, the flashing light warns and stops transmitting data).

High and low power indicator 	Green	Light is on for high power, off for low power
Data transmitting indicator 	Green	Flash according to the transmission frequency, the default status is off.
Data receiving indicator 	Green	Flash according to the receiving frequency, the default status is off.
Bluetooth indicator 	Blue	Bluetooth indicator is solid on when B/T is connected; Bluetooth indicator is off when B/T is disconnected; Bluetooth indicator flashes when data is transmitted through B/T.

4.2 Buttons

There are 3 buttons on the TRU35 panel that allow users to perform some simple settings for TRU35, such as switching high and low power, channel switching, and power on/off.

Table 4-2 Buttons

Button	**Function**

High and low power switching 	Switch between high and low transmitting power
Power on/off 	Power on and off
Channel switch 	Switch radio working channel (only TX channel can be switched, RX channel must be switched through the TRU35 configuration tool) Note: configuration tool is included in Surpad.

4.3 Display

The digital tube on TRU35 panel displays the current transmitting channel, and the transmitting frequency is generally different for different channels.

Table 4-3 Display function table

Digital Tube	Function
	To display the current channel: 1~9~0 indicates 1~10 channels respectively a ~ f indicates 11~16 channels respectively

V. Interface

The front and rear end of TRU35 have interfaces, which are the external radio antenna interface and the power/serial port respectively.

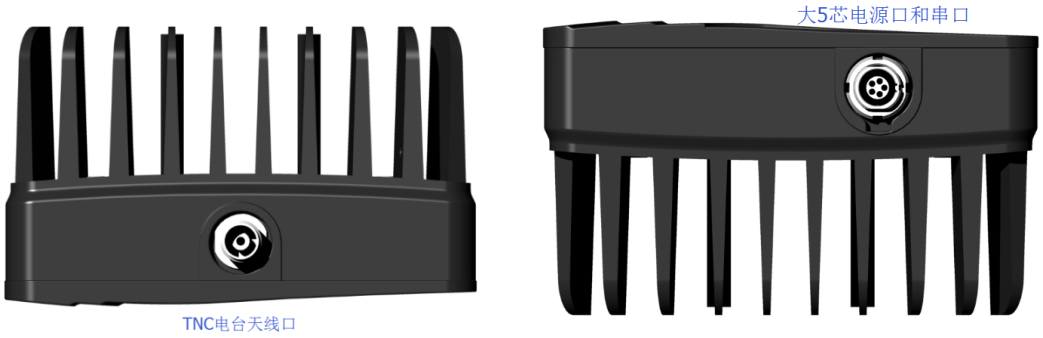

Figure 5-1

Table 5-1 Communication interface

Communication interface	**Function**
Radio antenna interface	TNC interface to connect the external large radio antenna
Power/serial port	● The large 5-pin is to connect the radio, the small 5-pin is to connect the RTK, and the fish clip is used to connect to the external automotive electrical frequency ● Frequency change line, large 5 pin is to connect radio, serial port is to connect PC

5-pin power port and serial port

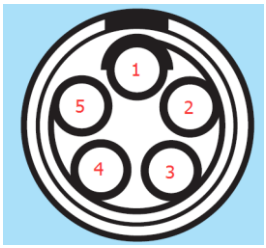

Figure 5-2 5-pin power port and serial port

Table 5-2 5-pin definitions

5-pin interface		
Pin serial number	**Input/output**	**Pin definition**
1	Input	VCC，5.5-16V
2	Input/Output	GND
3	Input	RXD
4	Input/Output	GND
5	Output	TXD

VI. TRU35 Configuration Tool

The TRU35 configuration tool is available in three versions: Android, Windows mobile, and PC. Users can install different app versions according to their needs. Android version will be the example to introduce the specific operation method.

6.1 Connection Methods

Run the configuration tool (in Surpad) and select the correct Radio type and Connection way.

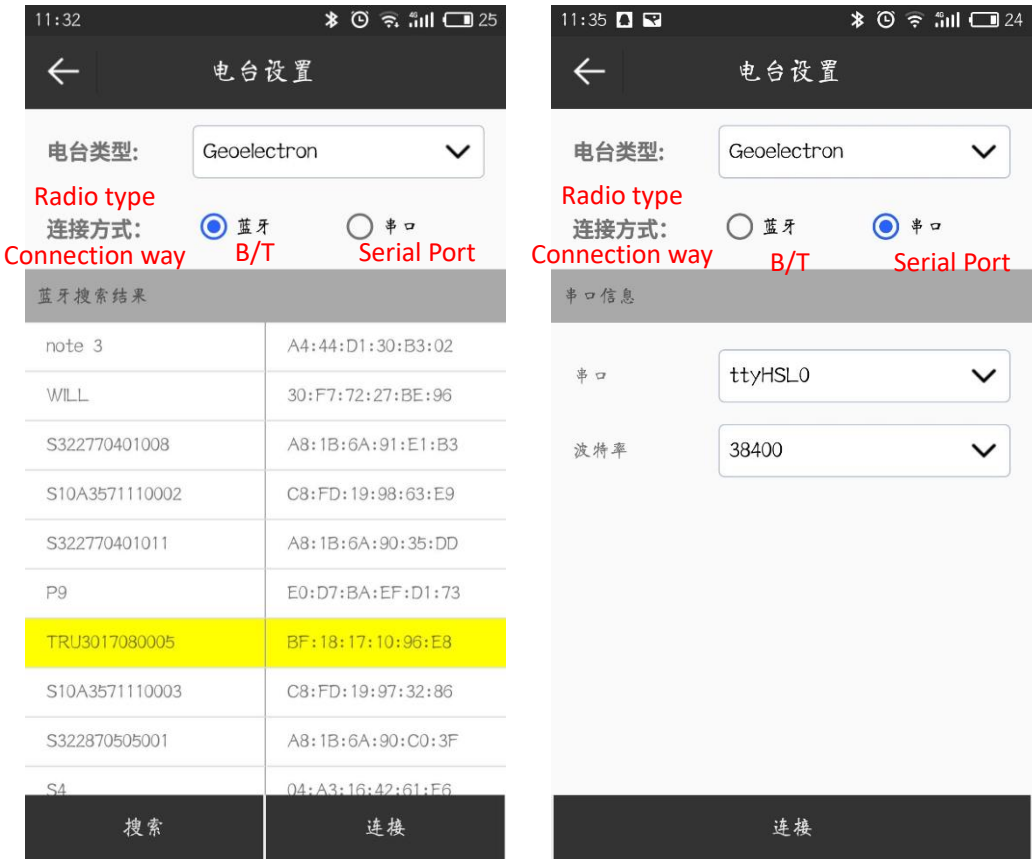

Figure 6-1

Note: When using Bluetooth connection, need to search for the serial number displayed on the TRU35 type label. After the Bluetooth connection is successful, the Bluetooth indicator will be solid on. When using serial port connection, need to use a frequency change cable to connect TRU35 to the handheld or PC, and set the appropriate serial port baud rate. When it is the first time to connect, a pairing window will pop up asking for a key, the default key is 1234, as shown in Figure 6-2.

Figure 6-2

6.2 Settings

6.2.1 Parameter settings

On this page, users can set the channel frequency, select the radio protocol, transmitting baud rate, turn the relay function on or off, and set low voltage and high temperature warning thresholds, as shown in Figure 6-3.

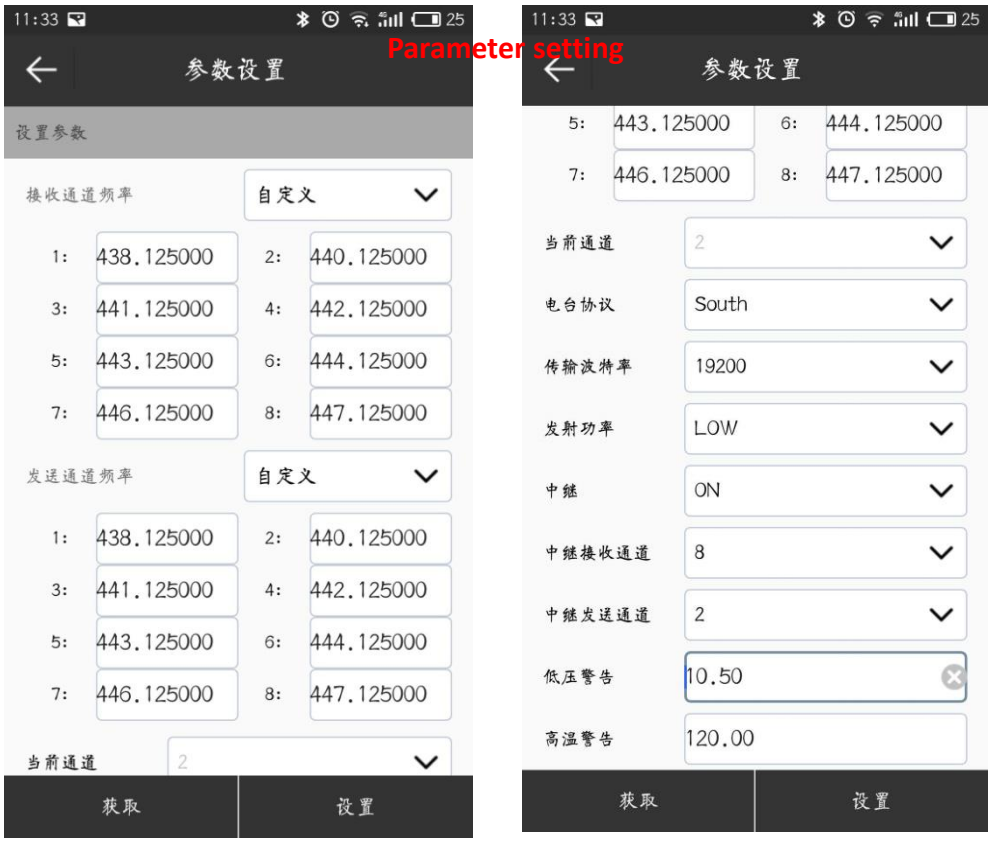

Figure 6-3

Note:

1. The setting of channel frequency needs to refer to the frequency supported by the radio antenna.

2. In Relay, the frequency of receiving channel should be consistent with the Base station; the frequency of transmitting channel should be consistent with the Rover station.

3. In Relay, the radio protocol must be consistent with the Base station and Rover station;

3. In Relay, the receiving channel frequency and the transmitting channel frequency cannot be the same;

4. The default value of TRU35 low voltage warning is 10.5V. When the supply voltage is below 11.3V, the power indicator will flash but still transmit data normally; when it is below 10.5V, the power indicator will flash and stop transmitting data;

5. The default value of TRU35 high temperature warning is 90 ℃. When the temperature exceeds 90℃, the power indicator will flash and stop transmitting data.

6.2.2 Channel Detection

On this page, users can detect the signal strength of customed frequency points and default frequency points, as shown in Figure 6-4.

Note: This function requires an antenna to be connected.

Figure 6-4

Figure 6-5

6.2.3 Device Information

On this page, users can view the specific configuration information

of TRU35 radio, as well as the current temperature, voltage, etc., as shown in Figure 6-5.

6.2.4 Temperature Control

On this page, users can set the temperature threshold and power gain of TRU35, as shown in Figure 6-6. The default temperature threshold for primary temperature control is 60°C and for secondary temperature control is 85°C. When the device temperature reaches the threshold, the transmitting power is automatically reduced, and the amount of power decrease is determined by the set power gain, the greater the absolute gain value, the more the single decrease value.

Note:

1. Temperature threshold range: -100~1000°C;
2. Power gain range: -60~60°C;
3. The value of the primary temperature threshold must be less than the value of the secondary temperature threshold.

Figure 6-6

Figure 6-7

6.2.5 Radio control

On this page, users can set the serial port baud rate of radio, shut

down, restart, restore factory settings, etc., as shown in Figure 6-7.

6.2.6 Firmware Upgrade

On this page, users can perform firmware upgrade operations on TRU35 radio, as shown in Figure 6-8. Click the folder icon on the right and select the firmware to be upgraded. During the upgrade, the power indicator on the TRU35 screen will flash in 5HZ. Once the upgrade is complete, TRU35 will automatically restart.

Figure 6-8

VII. Working Mode

TRU35 radio usually has two modes of operation: one is to cooperate with the Base station as an external radio to transmit data; the other is to receive the data sent by the Base station as a relay station and transmit data through other frequency points.

7.1 Basic Large Radio

1) Serial port mode

Connect TRU35 radio to the Base station, set the receiver working mode to Base station mode through SurPad (a software of Geoelectron) or receiver's WebUI, and set the data link mode as External Radio. After setup is complete, the TX indicator of the TRU35 radio will flash, indicating that the radio is transmitting data.

2) Bluetooth mode

Log in to the WebUI of Base station, set the working mode to Base station mode, set the data link mode as Bluetooth, search for the serial number displayed on radio type label to connect to TRU35, then click Save. At this time, the Bluetooth indicator and TX indicator of TRU35 will flash, indicating that the radio is receiving data from the Base station through Bluetooth and transmitting the received data.

7.2 Radio Relay

Use the TRU35 configuration tool to enable the radio relay function, see Chapter 6 for details of the configuration method. The relay station will transmit the data received from the Base station through another frequency point.

Note: In radio relay mode, the data link of the Base station is required to select the built-in radio mode (send data directly to the relay station), or transmit data to the relay following Part 7.1.

FCC warning statements:

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.

Caution: Any changes or modifications to this device not explicitly approved by manufacturer could void your authority to operate this equipment.

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.

The device has been evaluated to meet general RF exposure requirement This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.
This equipment should be installed and operated with minimum distance 200cm between the radiator & your body.