
T900-MINI-T05 User Manual

(Dual serial port data transmission)

900MHz 1W Data transmission radio
Version: 202309010V1.0



Version history

Datw	Version	Modification description
20230910	V1.0	Initial version

Catalogue

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1.Product overview

The T900-MINI-T05 is a dual serial data radio in the T900 series. T05 adopts dual serial port design to meet customers' requirements for multiple serial ports. The equipment has the characteristics of small volume, good integration, and high sensitivity. The T900-MINI-T05 operates in the 902~928MHz band. In a good environment, the maximum transmission distance can reach 60km.

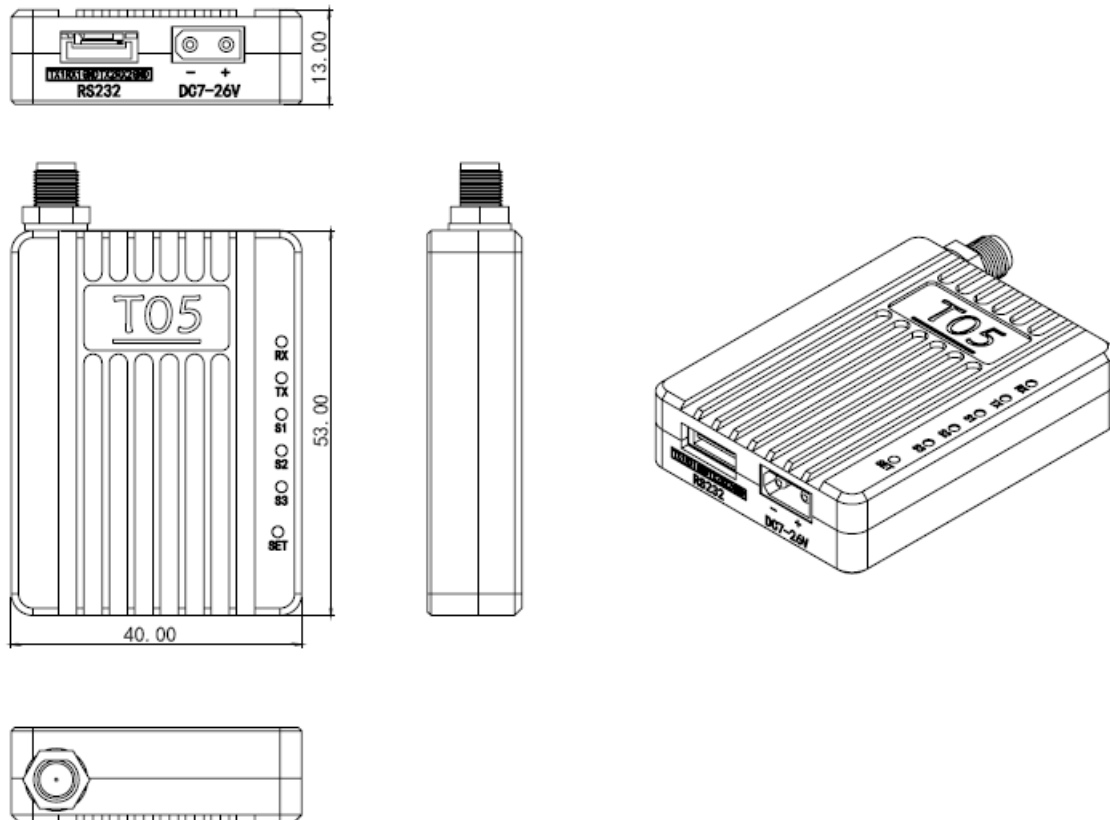
2.Product characteristics

- Working frequency: 902-928MHz
- Spread spectrum system: FHSS
- Data encryption: AES256
- Communication range: Up to 60km
- Output power: 1W (30dBm)
- Orifice speed: Up to 276.4kbps
- Serial baud rate: Up to 921.6kbps
- Working temperature: -40°C~+70°C
- ◆ Sensitivity:

Orifice speed	10 ⁻⁷ BER	Maximum user rate
276.4kbps	-106 dBm	108kbps
230.4kbps	-107 dBm	92kbps
172.8kbps	-108 dBm	64kbps
115.2kbps	-109 dBm	38kbps
57.6kbps	-110 dBm	11kbps

3.Product dimension and weight

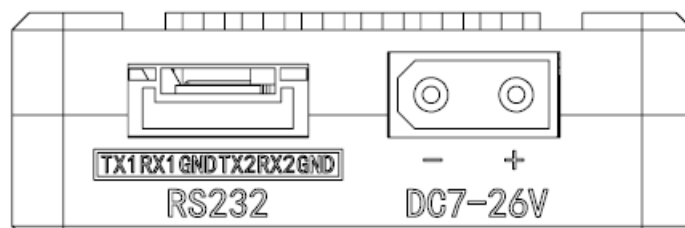
3.1 T05 Dimensional diagram



- ◆ Dimension(L*W*H): 62mm*40mm*13mm (including SMA 9mm)
- ◆ Weight: 43.5g

4.Product interface definition

4.1 T05 Interface diagram



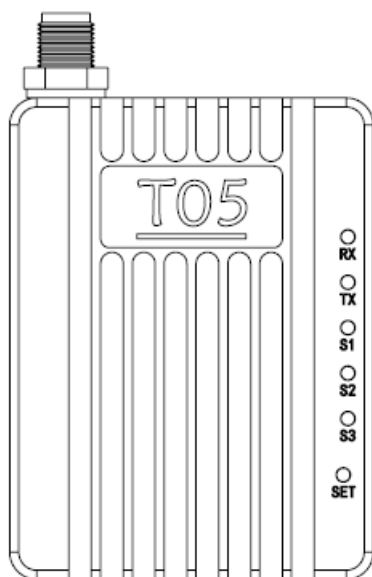
The device adopts GH1.25-6PIN connector and XT30 connector, and the serial port level is RS232 level or TTL level. The interface is GH1.25-6PIN seat, and the power supply is DC7~26V.

4.2 T05 Interface definition

Interface definition			
Num	Interface	Instructions	Note
1	GH1.25-6PIN Serial port	Serial port 1 Yellow line: TX1 Serial port 1 White line: RX1 Serial port 1 Black line: GND Serial port 2 Yellow line: TX2 Serial port 2 White line: RX2 Serial port 2 Black line: GND	Note The serial port screen is TTL or RS232
2	XT30 Power supply	DC 7~26V	

Peak current and Average current at different voltages		
T05 Supply voltage	100% full data transmission Peak current (A)	100%full data transmission Average current (A)
7V	1.03A	0.76A
12V	0.60A	0.44A
24V	0.30A	0.22A
26V	0.28A	0.20A

5.Product status light meaning



Transmit light TX (red)

When the TX light is on, the module is sending data.

Receive light RX (red)

When the RX light is on, it indicates that the module is receiving data.

Power on and configuration the SET button

Press and hold the SET button and power on. The release button will enter the AT command is used to configure parameters.

Receiving signal strength light (3 green RSSI)

The greater the number of energy lights, the greater the signal reception strength.

The RSSI lamp represents the strength of the received signal	
RSSI Number of energy lights	Received energy dBm
All three RSSI lights are on	About -50dBm
Two RSSI lights are on	About -80dBm
One RSSI light is on	About -95dBm

Module type	Mode	T900-MINI series light status		
		RX light	TX light	RSSI 123 light
ALL	AAT command configuration mode	OFF	OFF	OFF
Master	Work	Blinking when receiving data	On	Proportional to the strength of the received signal
Slave	Unsynchronized	OFF	OFF	Light up every 860ms cycle
Slave	Synchronized	On	Blinking when sending data	Proportional to the strength of the received signal
Relay	Unsynchronized	Flashes alternately with the transmit light	Alternate flashing with receiving light	Light every 860ms cycle
Relay	Synchronized	Blinking when receiving data Otherwise on	Blinking when sending data Otherwise on	Proportional to the strength of the received signal

When the master and slave devices are successfully paired, the power lights and TX lights of the master device are steady on, and the power lights and RX lights of the slave device are steady on. If the master/slave pairing fails, the RSSI of the slave device is always in search state. In this case, you need to check the configured parameters again. When data is being sent or received over the serial port, the RX indicator of the master device and the TX indicator of the slave device blink.

6.AT Command / Register specification

6.1 AT Command

AT Command	Instructions
ATI1	Query the hardware version number
ATI2	Query the firmware version number
ATI3	Query the software version number
ATI4	Query the SN serial number
AT&V	Displays the current parameter list
AT&W	Save the current parameter table
ATA	Exit the AT command configuration mode and enter the data mode
ATSxxx?	Query the value of register Sxxx
ATSxxx=yyy	The value of register Sxxx is written as yyy
ATSxxx /?	Displays the help documentation for register Sxxx
AT&Fn	Load the factory default configuration 7 : The factory default setting of the point-to-multipoint master end 8 : Point-to-multipoint slave factory default Settings 9 : The factory default setting of the point-to-multipoint repeater. 10: The factory default Settings of the point-to-point master end 11: Point to point slave factory default Settings 12: The factory default setting of the point-to-point repeter

Note: All register changes must be saved using the AT&W command to take effect.

6.2 AT command register list

Register number	Instructions
S101	Operating Mode
S102	Serial Baud Rate
S103	Wireless Link Rate
S104	Network Address (ID)
S105	Unit Address
S108	Output Power (dBm)
S110	Serial Data Format
S113	Packet Retransmissions
S114	Repeater Index
S118	Sync Address
S123	RSSI From Master RSSI (dBm)
S124	RSSI From Slave RSSI (dBm)
S133	Network Type
S140	Destination Address
S141	Repeater Y/N
S142	Serial Channel Mode
S143	Repeater Index Use GPIO
S159	Encryption Enable
S160	Encryption Key
S244	Channel Access Mode
S221	Unit Address Max for TDMA
S220	TDMA TX TIME SLOT

6.2.1 S101 Operating Mode

The working mode defines the role of each device in the network. Each T900 module can be configured in any mode and play any role in the network.

Values
0 - Master
1 - Repeater
2 - Slave

- Master: There is only one in each network. In point-to-point and point-to-multipoint networks, it is used to synchronize the entire network.
- Repeater: In the network, it is used to expand the transmission distance, enhance the network coverage, and connect with the main end or repeater.
- Slave: The slave end is directly connected to the master end or repeater.

6.2.2 S102 Serial Baud Rate

S102 Used to set the baud rate of the data serial port. When the serial port rate is changed, change the baud rate of the serial port on the device connected to the T900.

Values (bps)	
0- 230400	6 - 14400
1- 115200	7 – 9600(Default)
2- 57600	8 - 7200
3- 38400	9 - 4800
4- 28800	15 - 460800
5- 19200	16 - 921600

6.2.3 S103 Wireless Link Rate

S103 determines the communication rate of the entire network, and each device in the network must be configured with the same rate. The higher the rate, the higher the network throughput, but the worse the sensitivity. The sensitivity difference between adjacent modes is about 1dB.

Values (bps)
0 – 172800 (Default)
1 - 230400
2 - 276480
3 - 57600
4 - 115200

6.2.4 S104 Network Address (ID)

All devices on the same network must have the same network address. Devices with different network addresses do not communicate with each other. When multiple networks in an area are running at the same time, ensure that the network address of each network is unique.

Values (0~4294967295)
Default 1234567890

6.2.5 S105 Unit Address

In the same network, the local address is used for identification in the network, and each device should have a unique local address.

Values (0~65535)
Default 0

On a point-to-point network, the default value is 0. The device automatically assigns the local address. Users can also manually assign non-0 local addresses. In the same network, if automatic allocation is used, the local addresses of all devices are set to 0. If manual assignment is used, users can set the local address S105, synchronous address S118, and target address S140 for each device to ensure that the network topology is correct.

On a point-to-multipoint network, each device must be manually assigned a non-0 device address.

For details, see Section 8.7.

6.2.6 S108 Output Power (dBm)

S108 is used to set the transmit power of the local device.

Values (dBm)
30- 3W
33- 5W
35- 7W
40 - 10W (Default)

6.2.7 S110 Serial Data Format

Data The serial port supports only 8N1 data format.

Values
1 - 8N1 (Default)

6.2.8 S113 Packet Retransmissions

This register determines the maximum number of packet retransmissions. The number of retransmissions is used to ensure the robustness of the system in complex environments or weak signals. Retransmission will cause additional data transmission, which will reduce system

Values (0~255)
(Default) 3

throughput. The maximum transmission times of a packet is the number of data retransmission times plus one.

6.2.9 S114 Repeater Index

In point-to-point mode, the register takes effect only when the working mode is repeater and the local address is 0. This register indicates the relative position of the relay in the network. You can add or remove repeater devices on a point-to-point network without configuring the master and slave devices. When the relay device is started, it automatically accesses the point-to-point network, and when it is turned off, the network is reconnected.

Values (1~254)
(Default) 1

When multiple repeaters are used, ensure that the serial numbers of the repeaters are incremented monotonically from the master end to the slave end and can be discontinuous.

6.2.10 S118 Sync Address

You can set the synchronization address of the repeater device and the slave device to specify the device that synchronizes the current device with the local address (S105) as the synchronization address (S118).

Values (dBm)
-255 ~ 0 (Default)

On a point-to-point network, when the local address (S105) is set to 0, an address is automatically assigned. When the local address (S105) is not 0, the synchronous address must be set to determine the network topology.

On a point-to-multipoint network, each device must manually set the correct synchronization address.

For details, see Section 8.7.

6.2.11 S123 RSSI From Master RSSI (dBm)

Indicates the received signal strength of the slave end or repeater. The value corresponds to pins RSSI1, RSSI2, and RSSI3.

Values (0~65535)
(Default) 0

S123 of the repeater device indicates the signal strength of the upper device and S124 indicates the signal strength of the lower device.

6.2.12 S124 RSSI From Slave RSSI (dBm)

Indicates the received signal strength of the master end or repeater. The value corresponds to pins RSSI1, RSSI2, and RSSI3.

Values (dBm)
-255 ~ 0 (Default)

S123 of the repeater device indicates the signal strength of the upper device and S124 indicates the signal strength of the lower device.

6.2.13 S133 Network Type

This register is used to set the network type. On a network, the network type of all devices must be the same.

Values
0 - Point to Multipoint
1 - Point to Point

- Point-to-multipoint: The master end broadcasts data to all devices, and all slave devices send data back to the master end. (There can be 0 or more repeaters)
- Point-to-point: Only the master and slave endpoints communicate with each other. (Can have 0 or more relays)

6.2.14 S140 Destination Address

The master and reporter devices can set the destination address, which is used to specify the address of the subordinate device connected to the local device.

Values (0~65535)
(Default) 0

In the point-to-point network, when the local address is set to 0, the address is automatically assigned without setting the target address. When the local address is not 0, the destination address must be set to specify the network topology.

On a point-to-multipoint network, each device must manually set the correct destination address. For details, see Section 8.7.

6.2.15 S141 Repeater Y/N

On a peer-to-peer network where addresses are automatically assigned (local address S105 is 0), this register is invalid, but must be set to 0. In this case, the network automatically identifies the reporter and does not need to set it.

Values (0~1)
0-No Repeater (master end only) (Default)
1-Have Repeater(Valid only on the master side)

When an address is assigned manually, this register is set based on whether a relay is present in the current network.

6.2.16 S142 Serial Channel Mode

This register configures the working mode of the data serial port. The default is RS232. Currently, only RS232 mode is supported. In the future, it will support RS485 full duplex, RS485 half-duplex, and SBUS.

Values
0 - RS232 (Default)

6.2.17 S143 Repeater Index Use GPIO

To make it easier for the repeater to change the serial number, the user can use GPIO[4:1] to configure the repeater serial number.

Values
0- Use the S114 register (Default)
1-Use GPIO[4:1] to indicate the repeater number

When S143 is 0, the repeater number is S114. The value ranges from 1 to 254.

When S143 is 1, the repeater number is GPIO[4:1]+1, which ranges from 1 to 16. If GPIO is used as the repeater number, the repeater number ranges from 1 to 16, and a maximum of 16 repeaters can be configured.

6.2.18 S159 Encryption Enable

The T900 provides 256bit data encryption, which is turned on or off via the S159 register.

Values
0-Turnoff encryption(Default)
1- Open encryption

6.2.19 S160 Encryption Key

When using encryption, set a 256bit key for encryption and decryption. To receive correct data, configure the same key on both ends.

Values
256bit Encryption Key

6.2.20 S244 Channel Access Mode

The channel access mode specifies how the slave end accesses the network.

Values
0 - RTS/CTS
1 - TDMA
2 - TDMA_AUTO

In RTS/CTS mode, data from the slave end needs to be sent to the master end. After the

master end agrees to allocate resources, the slave end sends data. In TDMA mode, the master end distributes data uniformly, and the slave end sends data according to the allocation. The TDMA mode supports only two network types, point-to-multipoint and centered Mesh.

TTDMA_AUTO will be primarily adaptive to the amount of user data. Compared to TDMA mode, it is simpler to use.

Both modes have their advantages and disadvantages, RTS/CTS mode is more efficient in half-duplex network, while TDMA mode is more suitable for master and slave data independently.

6.2.21 S221 Unit Address Max for TDMA

This register is used to specify the maximum address for master polling in TDMA mode. In TDMA mode, the polling address of the master end is from the local address S105+1 of the master end to the maximum address. The local address S105 set on the slave end should be in these addresses; otherwise, the network cannot be accessed.

Values (0~65535)
Default 6

In TDMA mode, for example, one master end + six slave ends, S221=7, S244=1

	Unit Address S105	Sync Address S118	Destination Address S140
Master	1	0	0
Slave1	2	1	0
Slave 2	3	1	0
Slave 3	4	1	0
Slave 4	5	1	0
Slave 5	6	1	0
Slave 6	7	1	0

In this configuration, the start IP address of the master end is 1+1=2, the range is 2 to 7, and the slave end 1 to 6 is sent one by one.

The polling time of each address is 20ms. Therefore, the total polling time of six addresses is 120ms. In this case, the transmission delay from the end to the master end ranges from 0 to 120ms. The master end is not affected by polling, and the latency ranges from 0 to 20ms.

6.2.22 S220 TDMA tx time slot

This register is used to specify the maximum number of TDMA slots allocated in TDMA_AUTO mode. It is mainly used to allocate the required number of time slots according to the amount of data sent. The default value is 15.

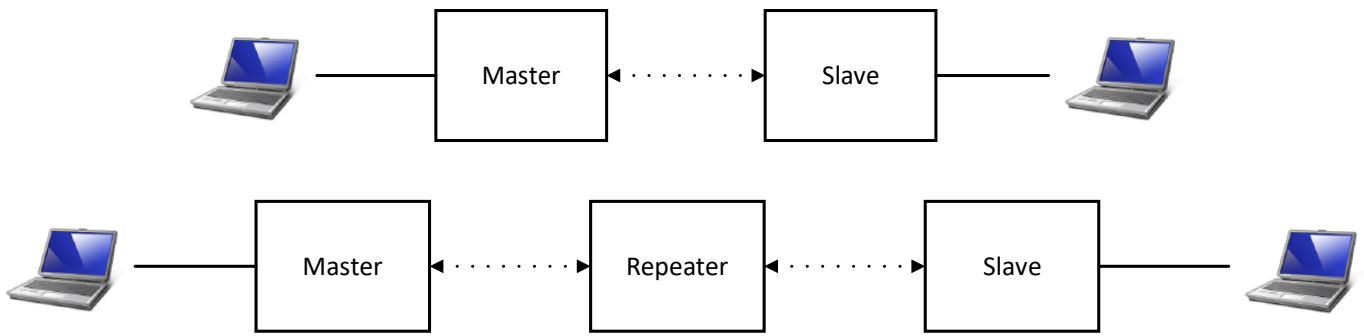
Values (0~65535)
Default 15

For example, if the air port is 276400bps, set 15 to enable users to continuously send a maximum of 5.1KB/s of data. 15 time slots can be occupied consecutively to send data.

7.Point-to-point networks

In A point-to-point network, the T900 module can be used to establish a data path between point A and point B. Point A can be the master end and point B can be the slave end. When point A and point B cannot be directly connected, you can add a repeater node. The network type register S133=1 must be configured for the point-to-point network.

Point-to-point networks can also be used in special scenarios: When multiple slave ends or repeaters are deployed, the master end selects the desired slave end for communication by configuring target address S140.



7.1 Configuration preparation

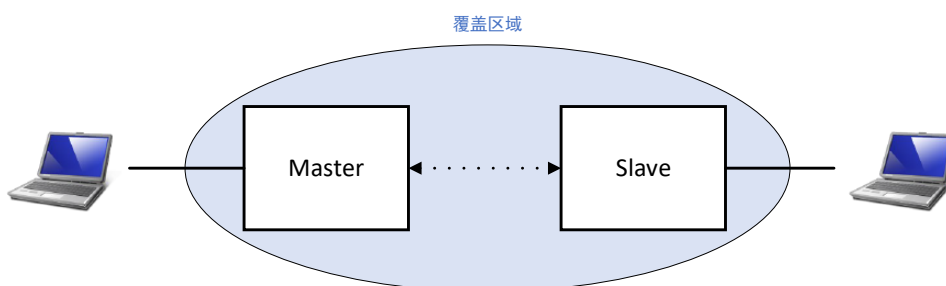
Before configuration, use the development board or user-designed hardware to provide power supplies and serial ports for the T900. The data serial port can be configured with the AT command, and the control serial port can be configured with the API protocol. For details about the interfaces, see Chapter 3 Hardware Description.

7.2 Working mode

The T900's point-to-point network operates in three modes: master, slave, and repeater.

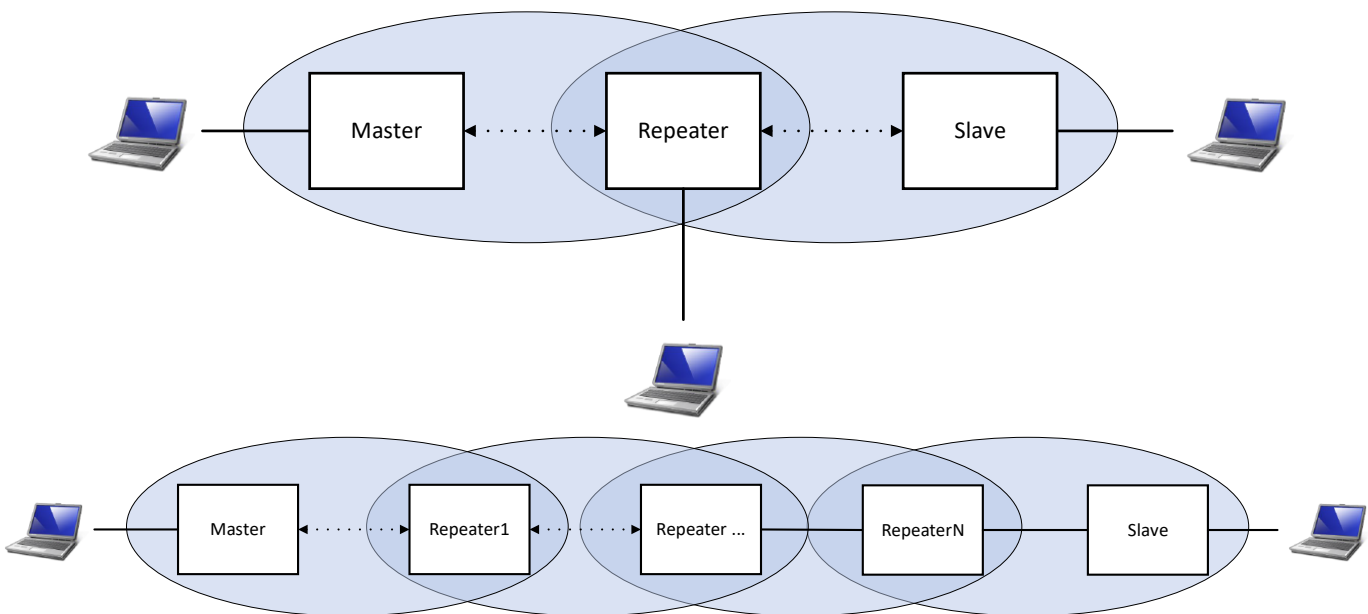
The master end provides synchronization signals for the entire network, ensuring that all devices can communicate properly.

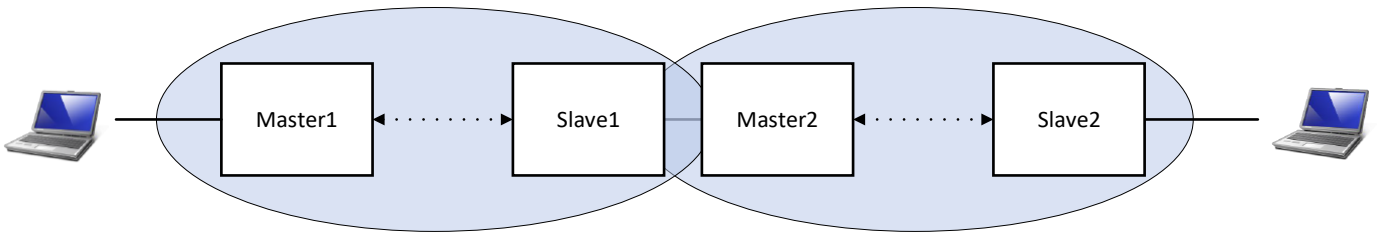
The slave end is the final node of the network and communicates directly with the master end or repeater. When no user data is transmitted on the peer-to-peer network, the slave device only synchronizes with the master device and does not send any information on the network.



The repeater can extend the coverage area of the master end and forward data. The repeater synchronizes with the master or upper-level repeater and sends synchronization signals to lower-level devices. The repeater device can also be used as the slave end to send and receive data through the data serial port. The output data is only the data sent by the upper device, and the data sent by the lower device is not output. However, the input data is confused with the data sent by the lower device and sent to the upper device.

Adding relays to a network reduces the total throughput of the network by half, but only by half and does not decrease as the number of relays increases. If there is a relay requirement and the throughput is considered, another solution is to place two devices back-to-back at the repeater site, one is the slave end of the upstream network and the other is the master end of the downstream network. The serial ports between the two devices are connected in wired mode. Both devices need their own antennas, and the antenna positions and device configurations need to be carefully considered.





When the local address is set to 0 for the T900 point-to-point network, the address is automatically assigned. Users do not need to set the local address, synchronous address, and destination address.

The T900's point-to-point relay mode is very flexible and easy to use. Adding a repeater device to a point-to-point network requires no additional configuration for the master and slave terminals. You only need to set the repeater to the same network ID, air interface rate, and repeater serial number. After the system starts, the existing network automatically detects whether a repeater is added. The repeater number must increase from the master end to the slave end but can be discontinuous. Pay attention to the repeater location to ensure link stability.

To configure the working mode register as S101, run the following command

- ATS101=0 --- Master
- ATS101=1 --- Repeater
- ATS101=2 --- Slave

7.3 Use factory defaults

The factory default Settings command can be used to quickly configure and deploy the T900 module, providing a fixed default configuration for each type of configuration. Using factory defaults sets all registers to default values. Using the default Settings has the following benefits:

- Speed up the configuration process. If there is no special requirement, use the default configuration.
- Troubleshoot, if adjusting the Settings prevents communication from being established, simply restore the factory defaults and any incorrect adjustments will be overwritten.
-

For most networking applications, the factory default Settings will satisfy all the functions required for peer-to-peer networking. No matter how complex the special needs, can be configured from the factory default Settings. All working modes and network types have factory default Settings.

- ◆ AT&F10 --- P-to-p master factory default Settings
- ◆ AT&F11 --- P-to-p slave factory default Settings
- ◆ AT&F12 --- P-to-p repeater factory default Settings



```
通讯端口 串口设置 显示 发送 多字符串 小工具 帮助 回报作者 PCB打样
at&f /?
Factory Defaults
&F7 - PMP Master
&F8 - PMP Slave
&F9 - PMP Repeater
&F10 - PP Master
&F11 - PP Slave
&F12 - PP Repeater
OK
```

7.4 Master setup

```
通讯端口 串口设置 显示 发送 多字符串 小工具 帮助 回报作者 PCB打样
at&f10 A
OK
at&w B
OK
at&v C
T900
900MHz Hopping Radio System
Hardware Version TZ60136B
Firmware Version 0001-20220623-0A
Software Version 0001-20220623-0A
Serial Number 123456

Network Type           S133=1 D           Operating Mode         S101=0 H
Wireless Link Rate     S103=0 E           Output Power(dBm)     S108=30
NetWork Address(ID)   S104=1234567890 F  Unit Address           S105=0 I
Synchronous Address   S118=0
Serial Baud Rate       S102=7 G           Destination Address   S140=0
Repeater Y/N          S141=0             Serial Channel Mode   S142=0
Encryption Enable     S159=0             Repeater Index Use Gpio S143=0
RSSI Form Master(dBm) S123=-255          Repeaters Index       S114=1
RSSI Form Slaver(dBm) S124=-255

OK
```

- A) AT&F10 - Restore the factory default Settings of the point-to-point master end.
- B) AT&W - Save setting parameter.
- C) AT&V - Displays the current Settings.
- D) S133 - The network type must be set to 1, corresponding to point-to-point.
- E) S103 - The air interface rates of all devices on the network must be set to the same rate. The higher the rate, the greater the throughput, the smaller the rate and the better the sensitivity.
- F) S104 - The network address (ID) of all devices on the network must be the same. It is strongly recommended not to use the default setting 1234567890. Change the network address using ATS104=xxxxxxx.
- G) S102 - The baud rate of the serial port matches that of the connected device.
- H) S101 - The working mode must be set to 0, corresponding to the master end.
- I) S105 - If the local address is set to 0, the address is automatically assigned.

After the configuration is complete, run the AT&W command to save the current parameters, and run the ATA command to exit the AT command mode.

7.5 Slave setup

```
通讯端口 串口设置 显示 发送 多字符串 小工具 帮助 回报作者 PCB打样
at&f11 A
OK
at&w B
OK
at&v C
T900
900MHz Hopping Radio System
Hardware Version TZ60136B
Firmware Version 0001-20220623-0A
Software Version 0001-20220623-0A
Serial Number 123456

Network Type           S133=1 D           Operating Mode         S101=2 H
Wireless Link Rate     S103=0 E           Output Power (dBm)    S108=30
NetWork Address(ID)   S104=123456789 F   Unit Address          S105=0 I
Synchronous Address   S118=0
Serial Baud Rate       S102=7 G           Destination Address   S140=0
Repeater Y/N          S141=0
Encryption Enable     S159=0
RSSI Form Master (dBm) S123=-255          Repeater Index Use Gpio S143=0
                                Repeaters Index      S114=1
                                RSSI Form Slaver (dBm) S124=-255

OK
```

- J) AT&F11 - Restore the factory default Settings of the point-to-point slave end.
- K) AT&W - Save setting parameter.
- L) AT&V - Displays the current Settings.
- M) S133 - The network type must be set to 1, corresponding to point-to-point.
- N) S103 - The air interface rates of all devices on the network must be set to the same rate. The higher the rate, the greater the throughput, the smaller the rate and the better the sensitivity.
- O) S104 - The network address (ID) of all devices on the network must be the same. It is strongly recommended not to use the default setting 1234567890. Change the network address using AT\$S104=xxxxxxx.
- P) S102 - The baud rate of the serial port matches that of the connected device.
- Q) S101 - The working mode must be set to 2 for the slave end.
- R) S105 - If the local address is set to 0, the address is automatically assigned.

After the configuration is complete, run the AT&W command to save the current parameters, and run the ATA command to exit the AT command mode.

7.6 Repeater setup

```
通讯端口 串口设置 显示 发送 多字符串 小工具 帮助 回报作者 PCB打样
at&f12 A
OK
at&w B
OK
at&v C
T900
900MHz Hopping Radio System
Hardware Version TZ60136B
Firmware Version 0001-20220623-0A
Software Version 0001-20220623-0A
Serial Number 123456

Network Type           S133=1 D           Operating Mode         S101=1 H
Wireless Link Rate     S103=0 E           Output Power (dBm)    S108=30
NetWork Address (ID)   S104=1234567890 F Unit Address           S105=0 I
Synchronous Address    S118=0             Destination Address    S140=0
Serial Baud Rate       S102=7 G           Serial Channel Mode    S142=0
Repeater Y/N          S141=0             Repeater Index Use Gpio S143=0
Encryption Enable      S159=0             Repeaters Index        S114=1 J
RSSI Form Master (dBm) S123=-255          RSSI Form Slaver (dBm) S124=-255

OK
```

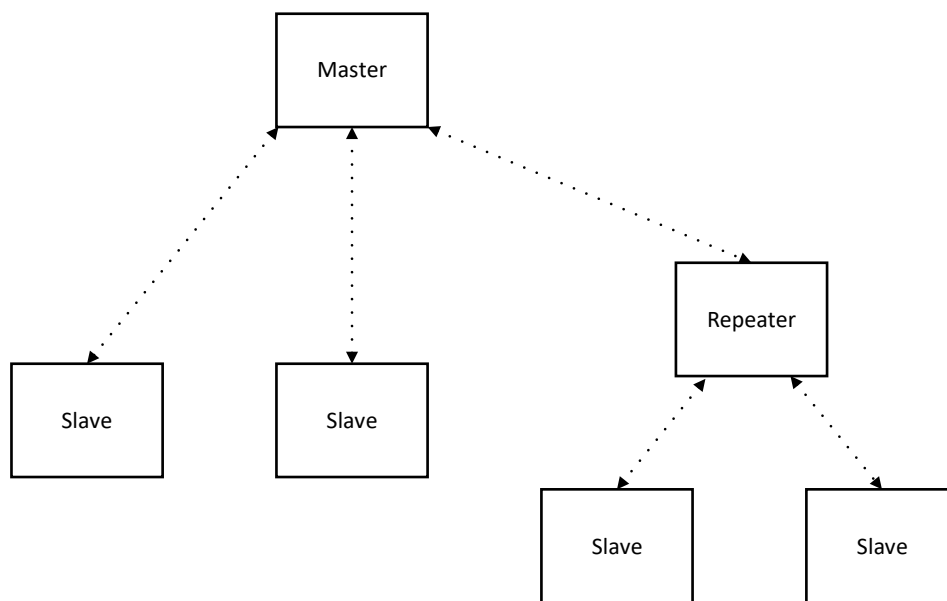
- A) AT&F12 - Restore the factory default Settings of the point-to-point repepter.
- B) AT&W - Save setting parameter.
- C) AT&V - Displays the current Settings.
- D) S133 - The network type must be set to 1, corresponding to point-to-point.
- E) S103 - The air interface rates of all devices on the network must be set to the same rate. The higher the rate, the greater the throughput, the smaller the rate and the better the sensitivity.
- F) S104 - The network address (ID) of all devices on the network must be the same. It is strongly recommended not to use the default setting 1234567890. Change the network address using ATS104=xxxxxxx.
- G) S102 - The baud rate of the serial port matches that of the connected device.
- H) S101 - The working mode must be set to 1, corresponding to the repepter.
- I) S105 - If the local address is set to 0, the address is automatically assigned.
- J) S114 - The repepter number indicates the position of the repepter on the network. The closer the repepter is to the main end, the smaller the repepter number is.

After the configuration is complete, run the AT&W command to save the current parameters, and run the ATA command to exit the AT command mode.

8.Point-to-multipoint network

In a point-to-multipoint network, the master end can be directly connected to multiple slave ends or can be connected to multiple slave ends through repeaters. The repeater also has the function of the slave end and can communicate with the master end, but its uplink data will be confused with the uplink data of the slave end. Point-to-multipoint networks need to be configured with the network type register S133=0.

The master end can use destination address S140 to temporarily select a specific slave end or repeater to communicate with and filter out data transmission requests from other devices.



点对多点网络拓扑图

8.1 Configuration preparation

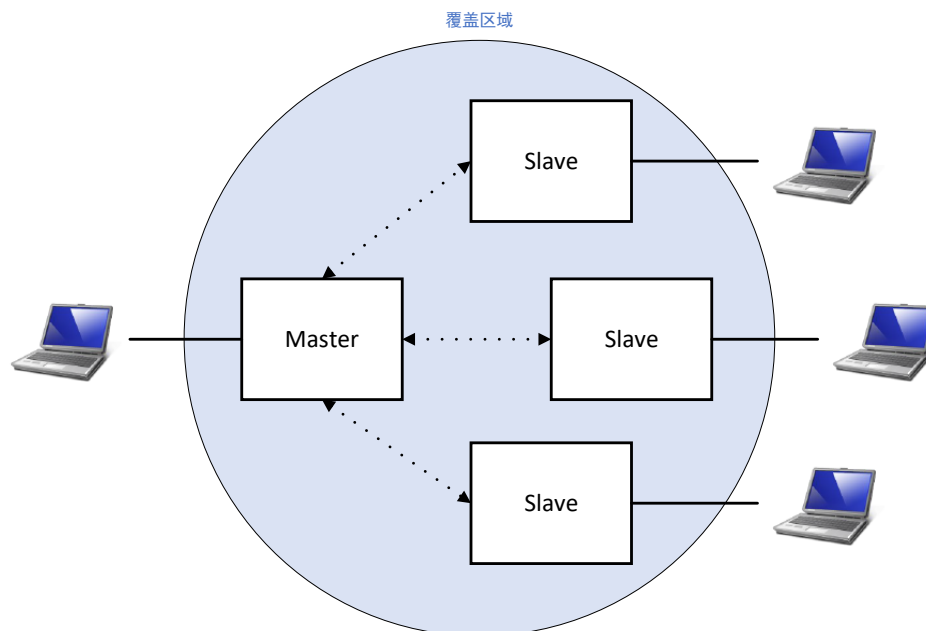
Before configuration, use the development board or user-designed hardware to provide power supplies and serial ports for the T900. The data serial port can be configured with the AT command, and the control serial port can be configured with the API protocol. For details about the interfaces, see Chapter 3 Hardware Description.

8.2 Working mode

The T900's point-to-multipoint network operates in three modes: master, slave, and repeater.

The master end provides synchronization signals for the entire network, ensuring that all devices can communicate properly.

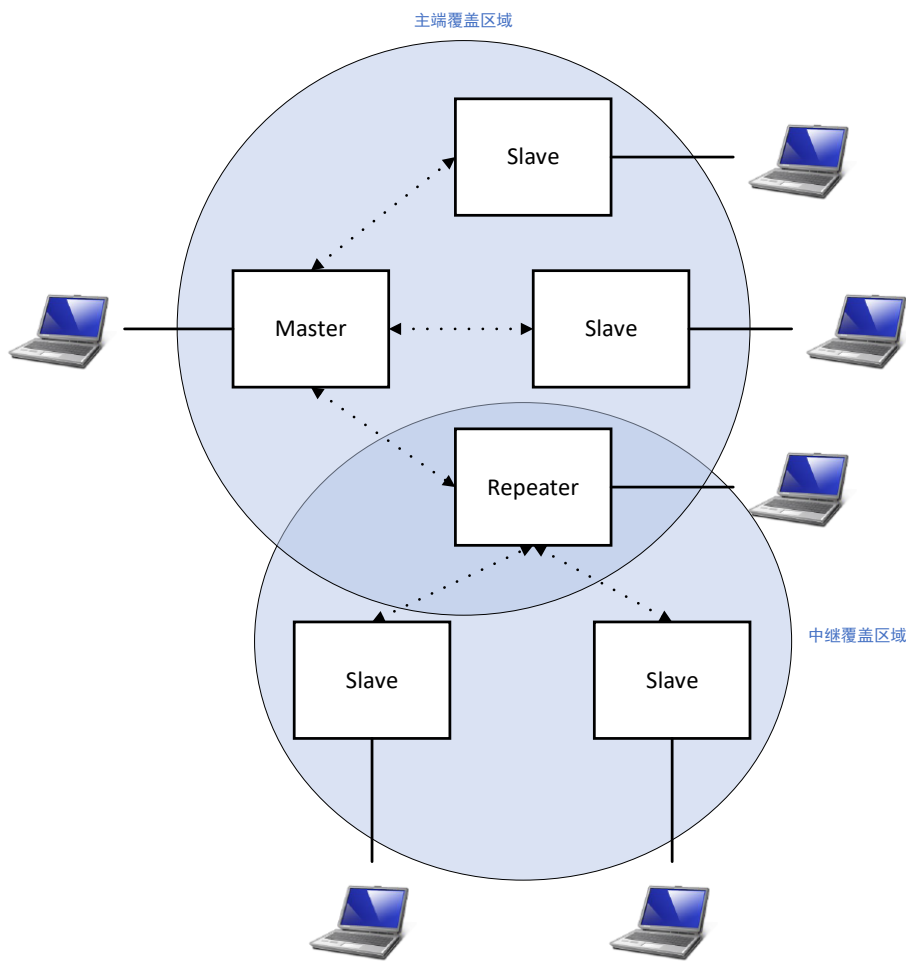
The slave end is the final node of the network and communicates directly with the master end or repeater. When no user data is transmitted on the point-to-multipoint network, the slave device only synchronizes with the master device and does not send any information on the network.



The repeater can extend the coverage area of the master end and forward data. The repeater synchronizes with the master or upper-level repeater and sends synchronization signals to lower-level devices. The repeater device can also be used as

the slave end to send and receive data through the data serial port. The output data is only the data sent by the upper device, and the data sent by the lower device is not output. However, the input data is confused with the data sent by the lower device and sent to the upper device.

Adding relays to a network reduces the total throughput of the network by half, but only by half and does not decrease as the number of relays increases. If there is a relay requirement and the throughput is considered, another solution is to place two devices back-to-back at the repeater site, one is the slave end of the upstream network and the other is the master end of the downstream network. The serial ports between the two devices are connected in wired mode. Both devices need their own antennas, and the antenna positions and device configurations need to be carefully considered.



Repeaters for point-to-multipoint networks cannot be automatically added like for point-to-multipoint networks. Registers S105, S118, and S140 need to be manually

configured in advance to determine the network topology.

To configure the working mode register as S101, run the following command

- ◆ ATS101=0 --- Master
- ◆ ATS101=1 --- Repeater
- ◆ ATS101=2 --- Slave

8.3 Use factory defaults

The factory default Settings command can be used to quickly configure and deploy the T900 module, providing a fixed default configuration for each type of configuration. Using factory defaults sets all registers to default values. Using the default Settings has the following benefits:

1. Speed up the configuration process. If there is no special requirement, use the default configuration.
2. Troubleshoot, if you can't establish communication by adjusting the Settings, simply restore the factory defaults and any incorrect adjustments will be overwritten.

For most networking applications, the factory default Settings will satisfy all the functions required for point-to-multipoint networking. No matter how complex the special needs, can be configured from the factory default Settings. All working modes and network types have factory default Settings.

- ◆ AT&F7 --- The factory default setting of the point-to-multipoint master end.
- ◆ AT&F8 --- The factory default setting of the point-to-multipoint slave end.
- ◆ AT&F9 --- The factory default setting of the point-to-multipoint repeater end.

```

通讯端口 串口设置 显示 发送 多字符串 小工具 帮助 回报作者 PCB打样
at&f /?
Factory Defaults
&F7 - PMP Master
&F8 - PMP Slave
&F9 - PMP Repeater
&F10 - PP Master
&F11 - PP Slave
&F12 - PP Repeater
OK

```

8.4 Master setup

```

通讯端口 串口设置 显示 发送 多字符串 小工具 帮助 回报作者 PCB打样
at&f7 A
OK
at&w B
OK
at&v C
T900
900MHz Hopping Radio System
Hardware Version TZ60136B
Firmware Version 0001-20220623-0A
Software Version 0001-20220623-0A
Serial Number 123456

Network Type           S133=0 D           Operating Mode         S101=0 I
Wireless Link Rate    S103=0 E           Output Power (dBm)    S108=30 J
Network Address (ID)  S104=1234567890 F Unit Address           S105=0 L
Synchronous Address  S118=0 K           Destination Address   S140=0
Serial Baud Rate      S102=7 G           Serial Channel Mode   S142=0
Repeater Y/N         S141=0 H           Repeater Index Use Gpio S143=0
Encryption Enable     S159=0
RSSI Form Master (dBm) S123=-255          Repeaters Index       S114=1
RSSI Form Slaver (dBm) S124=-255
OK

```

- A) AT&F7 - Restore the factory default Settings of the point-to-multipoint master end.
- B) AT&W - Save setting parameter.
- C) AT&V - Displays the current Settings.
- D) S133 - The network type must be set to 0, corresponding to point-to-multipoint.
- E) S103 - The air interface rates of all devices on the network must be set to the same rate. The higher the rate, the greater the throughput, the smaller the rate and the better the sensitivity.
- F) S104 - The network address (ID) of all devices on the network must be the same. It is strongly recommended not to use the default setting 1234567890. Change the network address using AT\$S104=xxxxxxx.
- G) S102 - The baud rate of the serial port matches that of the connected device.
- H) S141 - Whether a repeater exists on the network.
- I) S101 - The working mode must be set to 0, corresponding to the master end.
- J) S105 - Unit Address, Refer to the example in Section 9.7.
- K) S118 - Sync Address, Refer to the example in Section 9.7.
- L) S140 - Destination address, Refer to the example in Section 9.7.

After the configuration is complete, run the AT&W command to save the current parameters, and run the ATA command to exit the AT command mode.

8.5 Slave setup

```

通讯端口 串口设置 显示 发送 多字符串 小工具 帮助 回报作者 PCB打样
at&f8 A
OK
at&w B
OK
at&v C
T900
900MHz Hopping Radio System
Hardware Version TZ60136B
Firmware Version 0001-20220625-0A
Software Version 0001-20220623-0A
Serial Number 123456

Network Type           S133=0 D           Operating Mode         S101=2 I
Wireless Link Rate     S103=0 E           Output Power(dBm)     S108=30
NetWork Address(ID)    S104=1234567890 F  Unit Address          S105=0 J
Synchronous Address    S118=0 K           Destination Address    S140=0
Serial Baud Rate        S102=7 G           Serial Channel Mode    S142=0
Repeater Y/N           S141=0 H           Repeater Index Use Gpio S143=0
Encryption Enable      S159=0
RSSI Form Master(dBm)  S123=-255          Repeater Index         S114=1
RSSI Form Slaver(dBm) S124=-255
OK

```

- A) AT&F8 - Restore the factory default Settings of the point-to-multipoint slave end.
- B) AT&W - Save setting parameter.
- C) AT&V - Displays the current Settings.
- D) S133 - The network type must be set to 0, corresponding to point-to-multipoint.
- E) S103 - The air interface rates of all devices on the network must be set to the same rate. The higher the rate, the greater the throughput, the smaller the rate and the better the sensitivity.
- F) S104 - The network address (ID) of all devices on the network must be the same. It is strongly recommended not to use the default setting 1234567890. Change the network address using AT S104=xxxxxxx.
- G) S102 - The baud rate of the serial port matches that of the connected device.
- H) S141 - Whether a repertor exists on the network.
- I) S101 - The working mode must be set to 0, corresponding to the master end.
- J) S105 - Unit Address, Refer to the example in Section 9.7.
- K) S118 - Sync Address, Refer to the example in Section 9.7.
- L) S140 - Destination address, Refer to the example in Section 9.7.

After the configuration is complete, run the AT&W command to save the current parameters, and run the ATA command to exit the AT command mode.

8.6 Repeater setup

```

通讯端口 串口设置 显示 发送 多字符串 小工具 帮助 回报作者 PCB打样
at&f9 A
OK
at&w B
OK
at&v C
T900
900MHz Hopping Radio System
Hardware Version TZ60136B
Firmware Version 0001-20220625-0A
Software Version 0001-20220623-0A
Serial Number 123456

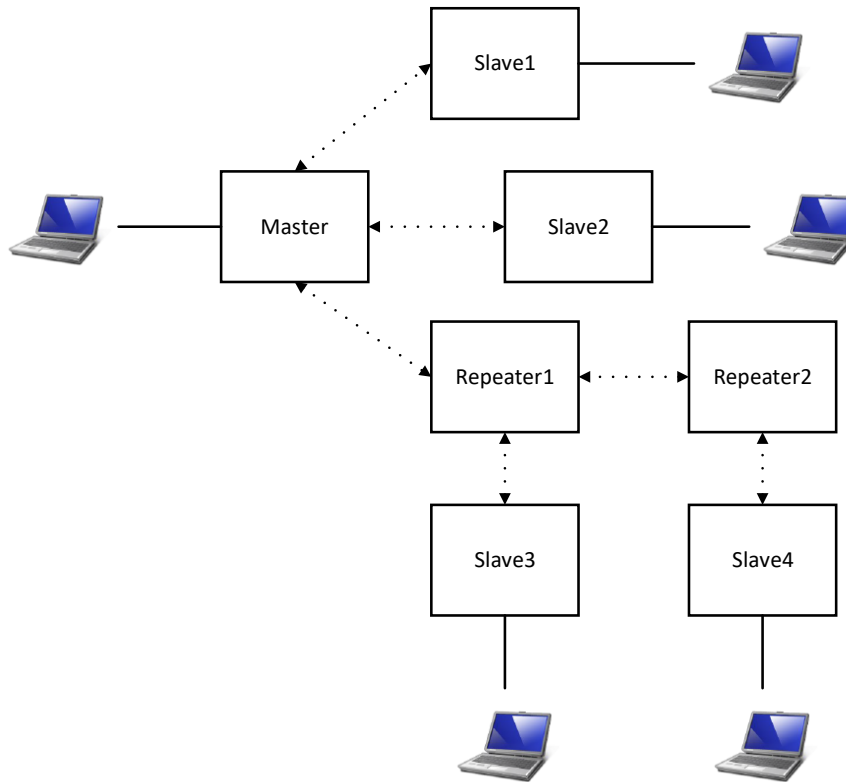
Network Type           S133=0 D           Operating Mode         S101=1 I
Wireless Link Rate     S103=0 E           Output Power (dBm)    S108=30 J
NetWork Address (ID)   S104=1234567890 F  Unit Address           S105=0
Synchronous Address    S118=0 K           Destination Address   S140=0
Serial Baud Rate       S102=7 G           Serial Channel Mode    S142=0
Repeater Y/N          S141=0 H           Repeater Index Use Gpio S143=0
Encryption Enable     S159=0
RSSI Form Master (dBm) S123=-255          RSSI Form Slaver (dBm) S124=-255

OK
```

- A) AT&F9 - Restore the factory default Settings of the point-to-multipoint repeater end.
- B) AT&W - Save setting parameter.
- C) AT&V - Displays the current Settings.
- D) S133 - The network type must be set to 0, corresponding to point-to-multipoint.
- E) S103 - The air interface rates of all devices on the network must be set to the same rate. The higher the rate, the greater the throughput, the smaller the rate and the better the sensitivity.
- F) S104 - The network address (ID) of all devices on the network must be the same. It is strongly recommended not to use the default setting 1234567890. Change the network address using ATS104=xxxxxxx.
- G) S102 - The baud rate of the serial port matches that of the connected device.
- H) S141 - Whether a repertor exists on the network.
- I) S101 - The working mode must be set to 0, corresponding to the master end.
- J) S105 - Unit Address, Refer to the example in Section 9.7.
- K) S118 - Sync Address, Refer to the example in Section 9.7.
- L) S140 - Destination address, Refer to the example in Section 9.7

After the configuration is complete, run the AT&W command to save the current parameters, and run the ATA command to exit the AT command mode.

8.7 Example for configuring point-to-multipoint network addresses



A point-to-multipoint network has one master end, four slave ends, and two repeater ends. Slave end 1, slave end 2, and repeater 1 are synchronized with the master end, repeater 2 is synchronized with repeater 1, slave end 3 is synchronized with repeater 1, and slave end 4 is synchronized with repeater 2. If S141 at the master end is 1, the repeater exists on the network. The following table describes the local address and synchronization address Settings of each device.

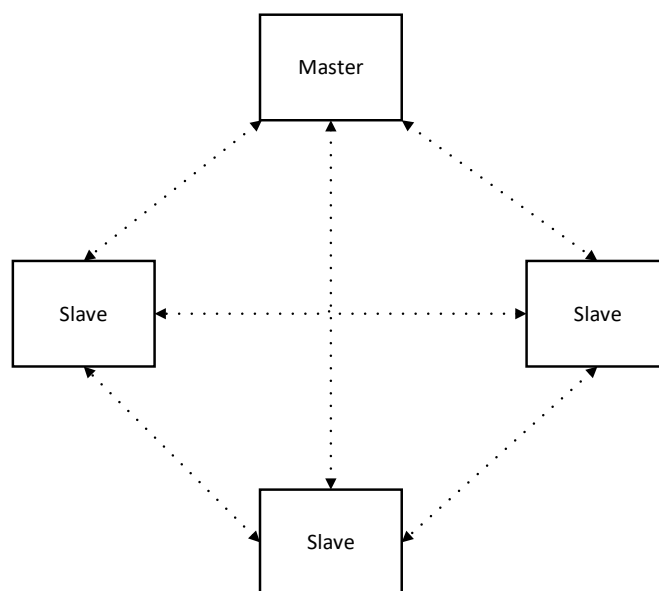
	Unit Address S105	Sync Address S118	Destination address S140
Master	1	0	0
Repeater1	2	1	0
Repeater2	3	2	0
Slave1	4	1	0
Slave 2	5	1	0
Slave 3	6	2	0
Slave 4	7	3	0

In the same point-to-multipoint network, the local address of each device must be unique and non-zero. The synchronization address is set to the local address of the parent device. The destination address is usually set to 0, or if you need to specify a device to receive, the local address of a device.

9. Have a central Mesh network

Centralized Mesh network is a special point-to-multipoint network. The center of the network is still the master end, and all the slave ends can exchange data but do not forward data. A Mesh network with a center needs to configure the network type register S133=2. This network type does not support repeater.

The master can use destination address S140 to temporarily select a specific slave to communicate with, filtering out data transmission requests from other devices.



Topological graph of the central Mesh network

9.1 Configuration preparation

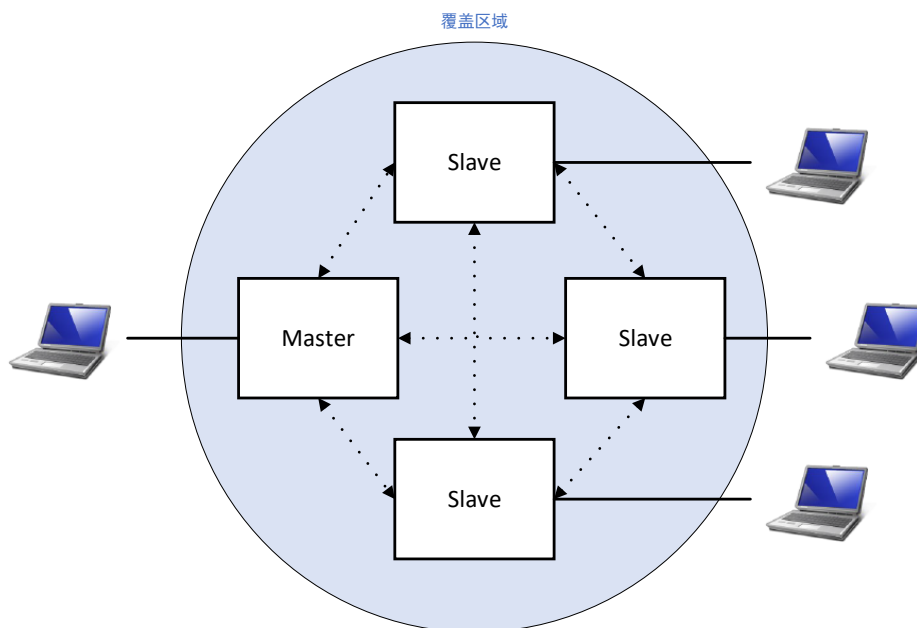
Before configuration, use the development board or user-designed hardware to provide power supplies and serial ports for the T900. The data serial port can be configured with the AT command, and the control serial port can be configured with the API protocol. For details about the interfaces, see Chapter 3 Hardware Description.

9.2 Working mode

The T900 centralized Mesh network supports only two working modes: master and slave and does not support relay.

The master end provides synchronization signals for the entire network, ensuring that all devices can communicate properly.

The slave end is the final node of the network and communicates directly with the master or slave end. When no user data is transmitted on the point-to-multipoint network, the slave device only synchronizes with the master device and does not send any information on the network.



A Mesh network with a center needs to configure registers S105, S118 and S140 in advance to determine the network topology.

To configure the working mode register as S101, run the following command

- ◆ AT&S101=0 --- Master
- ◆ AT&S101=2 --- Slave

9.3 Use factory defaults

The factory default Settings command can be used to quickly configure and deploy the T900 module, providing a fixed default configuration for each type of configuration. Using factory defaults sets all registers to default values. Using the default Settings has the following benefits:

- 1, speed up the configuration process, if there are no special requirements, use the default configuration
- 2, troubleshooting, if the adjustment Settings cannot establish communication, just restore the factory default Settings, any incorrect adjustment will be overwritten.

For most networking applications, the factory default Settings meet all the functions required for a centralized Mesh network. No matter how complex the special needs, can be configured from the factory default Settings. All working modes and network types have factory default Settings.

- ◆ AT&F4 --- The main end of the central Mesh has factory default Settings.
- ◆ AT&F5 --- There are center Mesh slave factory default Settings.

```
通讯端口 串口设置 显示 发送 多字符串 小工具 帮助 回报作者 PCB打样
at&f /?
Factory Defaults
&F4 - Mesh With Center Master
&F5 - Mesh With Center Slave
&F7 - PMP Master
&F8 - PMP Slave
&F9 - PMP Repeater
&F10 - PP Master
&F11 - PP Slave
&F12 - PP Repeater
OK
```

9.4 Master setup

```
通讯端口 串口设置 显示 发送 多字符串 小工具 帮助 回报作者 PCB打样
at&f7 A
OK
at&w B
OK
at&v C
T900
900MHz Hopping Radio System
Hardware Version TZ60136B
Firmware Version 0001-20220623-0A
Software Version 0001-20220623-0A
Serial Number 123456

Network Type           S133=0 D           Operating Mode         S101=0 I
Wireless Link Rate     S103=0 E           Output Power(dBm)     S108=30
NetWork Address(ID)    S104=1234567890 F  Unit Address           S105=0 J
Synchronous Address    S118=0 K           Destination Address    S140=0 L
Serial Baud Rate        S102=7 G           Serial Channel Mode    S142=0
Repeater Y/N           S141=0 H           Repeater Index Use Gpio S143=0
Encryption Enable      S159=0
RSSI Form Master(dBm)  S123=-255          Repeaters Index        S114=1
RSSI Form Slaver(dBm) S124=-255

OK
```

- A) AT&F7 - Restore the factory default Settings of the main end of the central Mesh.
- B) AT&W - Save setting parameter.
- C) AT&V - Displays the current Settings.
- D) S133 - The network type must be set to 2, for which there should be a central Mesh.
- E) S103 - The air interface rates of all devices on the network must be set to the same rate. The higher the rate, the greater the throughput, the smaller the rate and the better the sensitivity.
- F) S104 - The network address (ID) of all devices on the network must be the same. It is strongly recommended not to use the default setting 1234567890. Change the network address using AT S104=xxxxxxx.
- G) S102 - The baud rate of the serial port matches that of the connected device.
- H) S141 - Whether a repeter exists in the network, the value must be set to 0.
- I) S101 - The working mode must be set to 0, corresponding to the master end.
- J) S105 - Unit address, set up the same point to multipoint network.
- K) S118 - Sync address, set up the same point to multipoint network.
- L) S140 - Destination address, set up the same point to multipoint network.

After the configuration is complete, run the AT&W command to save the current parameters, and run the ATA command to exit the AT command mode.

9.5 Slave setup

```
通讯端口 串口设置 显示 发送 多字符串 小工具 帮助 回报作者 PCB打样
at&f8 A
OK
at&w B
OK
at&v C
T900
900MHz Hopping Radio System
Hardware Version TZ60136B
Firmware Version 0001-20220625-0A
Software Version 0001-20220623-0A
Serial Number 123456

Network Type           S133=0 D           Operating Mode         S101=2 I
Wireless Link Rate     S103=0 E           Output Power(dBm)     S108=30 J
NetWork Address(ID)    S104=1234567890 F  Unit Address           S105=0
Synchronous Address   S118=0 K           Destination Address   S140=0
Serial Baud Rate       S102=7 G           Serial Channel Mode   S142=0
Repeater Y/N          S141=0 H           Repeater Index Use Gpio S143=0
Encryption Enable     S159=0
RSSI Form Master(dBm) S123=-255          Repeater Index        S114=1
RSSI Form Slaver(dBm) S124=-255

OK
```

- A) AT&F8 - Restore the factory default Settings of the main end of the central Mesh.
- B) AT&W - Save setting parameter.
- C) AT&V - Displays the current Settings.
- D) S133 - The network type must be set to 2, for which there should be a central Mesh.
- E) S103 - The air interface rates of all devices on the network must be set to the same rate. The higher the rate, the greater the throughput, the smaller the rate and the better the sensitivity.
- F) S104 - The network address (ID) of all devices on the network must be the same. It is strongly recommended not to use the default setting 1234567890. Change the network address using `ATS104=xxxxxxx`.
- G) S102 - The baud rate of the serial port matches that of the connected device.
- H) S141 - Whether a repertor exists in the network, the value must be set to 0.
- I) S101 - The working mode must be set to 2, corresponding to the master end.
- J) S105 - Unit address, set up the same point to multipoint network.
- K) S118 - Sync address, set up the same point to multipoint network.
- L) S140 - Destination address, set up the same point to multipoint network.

After the configuration is complete, run the AT&W command to save the current parameters, and run the ATA command to exit the AT command mode.

9.6 Packet length limit

In a central Mesh network, when the channel access mode is TDMA mode, because each device is interworking with each other, when multiple devices send data, the data output from the serial port will interleave each other. To ensure the integrity of the data packet, the data packet length must be smaller than the maximum length of a single time slot. When the channel access mode is TDMA-AUTO, there is no limit on the packet length.

Orifice speed	Maximum length of a single packet
276.4kbps	175 bytes
230.4kbps	140 bytes
172.8kbps	100 bytes
115.2kbps	55 bytes
57.6kbps	15 bytes