T900-40-SMA User Manual

900MHz Data Transmission Module Version: 20230410V5.0



Contents

1.Produc	t Overview	3
2.Technie	cal Parameters	3
3. Mecha	anical Drawings&Weight	5
4.Produc	t Connector	6
4.1	J30J-15pin Schematic Diagram	6
4.2	J30J-15pin Pin Definition	6
5.Produc	t Status Indicator	7
6.AT Cor	nmand/Register Description	8
6.1	AT Command	8
6.2	AT Command Register List	8
7.Point-t	o-Point Networks	15
7.1	Configuration Preparations	16
7.2	Working Mode	
7.3	Use Factory Defaults	
7.4	Master Setting	19
7.5	Slave Setting	20
7.6	Repeater Setting	21
8.Point-t	o-Multipoint Networks	22
8.1	Configuration Preparations	22
8.2	Working Mode	23
8.3	Use Factory Defaults	25
8.4	Master Setting	26
8.5	Slave Setting	27
8.6	Repeater Setting	28
8.7	Examples of Point-to-multipoint Network Address Setting	29
9.Mesh V	Vith Center Networks	30
9.1	Configuration Preparations	30
9.2	Working Mode	31
9.3	Use Factory Defaults	32
9.4	Master Setting	33
9.5	Slave Setting	34
9.6	Packet Length Limit	35

1.Product Overview

T900-40-SMA (10W) is one of the digital radio stations in the T900 series. It is mainly used for transmission of high-power long distance industrial data. It has the characteristics of small volume, good integration and high sensitivity. The T900-40-SMA operates in the 902~928MHz band. The T900-40-SMA comes in two models, the T900-40A-SMA and the T900-40B-SMA. The only difference is the transmission distance. In a good environment, the maximum transmission distance of the T900-40A-SMA is 100KM, and the maximum transmission distance of the T900-40B-SMA is 200KM.

2.Technical Parameters

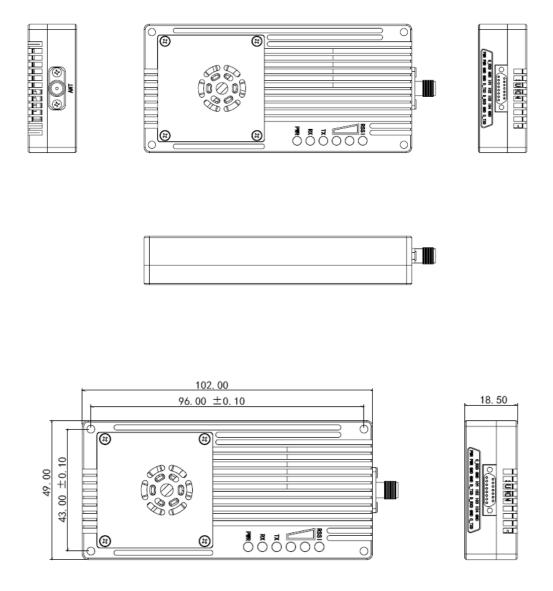
•	Frequency Range:	902-928MHz
•	Spread Spectrum Mode:	FHSS
•	Data Encryption:	256-bit physical layer encryption
•	Range of Communication:	Up to 100KM/200KM
•	Output Power:	10W (40dBm)
•	Orifice Speed:	Up to 276.4kbps
•	Serial Port Baud Rate:	Up to 921.6kbps
•	Working Temperature:	-40°C+85°C
•	Power Supply Voltage:	DC15~26V, Typical value +24V

Power Supply Voltage	100% data full peak current (A)	100% data full power
		average current (A)
15V	3.20A	2.10A
18V	2.80A	1.74A
24V	2.00A	1.30A
26V	1.85A	1.20A

• Sensitivity:

Orifice speed	10 ⁻⁷ BER	100KM Maximum user	200KM maximum
		speed	user speed
276.4kbps	-106 dBm	136kbps	128kbps
230.4kbps	-107 dBm	116kbps	104kbps
172.8kbps	-108 dBm	82kbps	74kbps
115.2kbps	-109 dBm	48kbps	42kbps
57.6kbps	-110 dBm	14kbps	10kbps

3.Mechanical Drawings

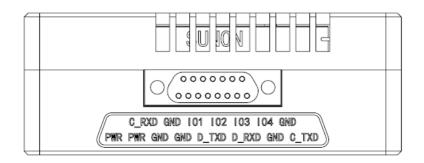


T900-40-SMA Dimensional Diagram

- T900-40-SMA Size: 111mm*49mm*18.5mm (with SMA head).
- T900-40-SMA Weight:137g

4.Product Connector

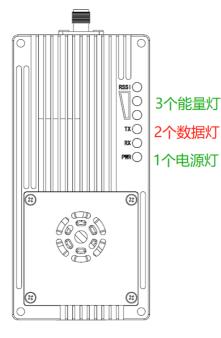
4.1 J30J-15pin Schematic Diagram



4.2 J30J-15pin Pin Definition

No.	Pin name	Description	Direction
1	PWR	The power terminal is positive	I
2	PWR	The power terminal is positive	I
3	GND	The power terminal is negative	I
4	GND	The power terminal is negative	I
5	D_TXD	Data serial port transmits data TX	0
6	D_RXD	Data serial port receives data RX	I
7	GND	The data serial port is grounded GND	0
8	C_TXD	Control serial port transmits data TX	I
9	C_RXD	Control serial port receives data RX	0
10	GND	The control serial port is grounded GND	0
11	101	* reserve *	10
12	102	* reserve *	IO
13	103	* reserve *	IO
14	104	* reserve *	IO
15	GND	grounding	0
Note: Please confirm whether the serial port of the module is TTL			
level or RS232 level.			

5.Product Indicator Meaning



Power PWR (Green)

The power light lights up to indicate that the device is powered on.

Transmit Lamp TX (red)

When the TX lights up, it indicates that the module is sending data.

Receive Lamp RX (red)

When the RX lights up, it indicates that the module is receiving data.

Receiving signal strength lamp (RSSI 3 green lamps)

A greater number of energy lights indicates a greater strength of signal reception.

The RSSI lamp represents the strength of the received signal		
Numbers of RSSI energy lights on	Energy received dBm	
All 3 RSSI lights are on	About -50dBm	
2 RSSI lights are on	About-80dBm	
1 RSSI lights is on	About -95dBm	

Module Type	Mode	T900-40-SMA Indicator Status		
		RX	ТХ	RSSI 123
All	AT command	Turn off	Turn off	Turn off
	configuration mode			
Master	Normal operation	Flashing when receiving	Turn on (steady light)	Proportional to the strength of
		data		the received signal
Slave	Non-synchronization	Turn off	Turn off	Cycle light every 860ms
Slave	Synchronization	Turn on (steady light)	Flashing when sending	Proportional to the strength of
			data	the received signal
Repeater	Non-synchronization	Flashing alternately	Flashing alternately	Cycle light every 860ms
		with the sending light	with the receiving light	
Repeater	Synchronization	Flashing when receiving	Flashing when sending	Proportional to the strength of
		data	data	the received signal
		Otherwise on	Otherwise on	

6.AT Command/ Register Description

6.1 AT Command

AT command (both upper and	Description
lower case accepted)	
ATI1	Query the hardware version number
ATI2	Query the firmware version number
ATI3	234234 Query the software version number
ATI4	Query the SN number
AT&V	Display 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	Write register Sxxx to the value yyy
ATSxxx /?	Display the help documentation for register Sxxx
AT&Fn	Load the factory default configuration:
	7 : Factory default settings for point-to-multipoint master
	8 : Factory default settings for point-to-multipoint slave
	9 : Factory default settings for point-to-multipoint repeater
	10: Factory default settings for point-to-point master
	11: Factory default settings for point-to-point slave
	12: Factory default settings for point-to-point repeater

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

6.2 AT Command Register List

Register Number	Description
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

6.2.1 S101 Operating Mode

The operating mode defines the role of each device on the network. Each T900 module can be configured in any mode and take on any role in the network.

- Values
 - 0 Master 1 - Repeater
 - 2 Slave
- 2 Slave
- Master: There is one master in each network. In point-to-point and point-tomultipoint networks, it is used to synchronize the entire network.
- Repeater: In the network, it is used to extend the transmission distance, enhance the coverage of the network, and connect with the master or repeater.
- Slave: The slave is directly connected to the master or the repeater.

6.2.2 S102 Serial Baud Rate

S102 is used to set the baud rate of the data serial port. When the serial port rate is changed, please note that the serial port baud rate of the device connected to the T900 should be modified.

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

Orifice Speed 6.2.3 S103

	Values (bps)
The S103 determines the communication rate of the	0 - 172800 (
entire network. Each device on the network must be	1 - 230400
entire network. Each device on the network must be	2 - 276480
configured to the same rate. The higher the rate, the	3 - 57600
configured to the same rate. The flight the rate, the	4 - 115200

higher the network throughput, but the worse the sensitivity. The sensitivity difference between adjacent modes is about 1dB.

S104 **Network Address (ID)** 6.2.4

All devices on a network must have the same with different network address. Devices network

Values (0~4294967295) Default 1234567890

Values (0~65535)

0

Default

0 - 172800 (Default)

addresses do not communicate with each other. When multiple networks are operating simultaneously in the same area, the network address of each network must be guaranteed to be unique.

Unit Address 6.2.5 S105

On the same network, unit address is used for identification on the network, and each device should have a unique unit address.

For a point-to-point network, the default value is 0. The device automatically assigns the unit address. Users do not need to set this parameter. Users can also manually assign the non-0 unit addresses. In the same network, if automatic allocation is used, the unit address of all devices is set to 0. If manual assignment is used, you can set the unit address S105, synchronous address S118, and target address S140 for each device to ensure that the network topology is correct.

For a point-to-multipoint networks, 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 transmitting power of the local device.

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

6.2.7 S110 Serial Data Format

The data format of the serial port supports only 8N1.

Values
1 - 8N1 (Default)

Values (0~255)

3

Default

6.2.8 S113 Packet Retransmissions

This register determines the maximum number of times the packet can be retransmitted. The number of the

retransmission is used to ensure the robustness of the system in complex environment or weak signal. Retransmission can cause additional data transfer, which can reduce system throughput. The maximum number of packet transmissions is the number of data retransmissions plus one.

6.2.9 S114 Repeater Index

In point-to-point mode, the register takes effect when the working mode is repeater and the unit address

Values (1~254) Default 1

is 0. This register indicates the relative position of the repeater on the network. No additional configuration is required on the master and slaves to add or remove repeater devices on a point-to-point network. When the repeater device is started, it automatically connects to the point-to-point network, and when it is shut down, the network is reconnected.

When multiple repeaters are used, please ensure that the serial numbers of the repeaters from the master to the slave increase monotonously, which can be discontinuous.

6.2.10 S118 Sync Address

You can set the synchronization address of the master device and the slave device to specify the synchronization

Values (0~65535) Default 0

address of the current device from the local device (S105) to the device (S118).

On the point-to-point network, when the local address (S105) is set to 0, the address is automatically assigned, and there is no need to set the synchronous address. 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, you must manually set the correct synchronization address for each device.

For details, see Section 8.7.

6.2.11 S123 RSSI From Master RSSI (dBm)

Indicates the received signal strength of the slave or -255 repeater. The value corresponds to pins RSSI1, RSSI2, and RSSI3.

Values (dBm) -255 ~ 0 (read only)

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 or repeater. The value corresponds to pins RSSI1, RSSI2, and

Values (dBm) -255 ~ 0 (read only) RSSI3。

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 one network, the network type of all devices must be the same.

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

6.2.14 S140 Destination Address

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

 Values (0~65535)

 Default
 0

On a 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, you must manually set the correct destination address for each device.

For details, see Section 8.7.

Values 0 - Point to Multipoint (point to multipoint) 1 - Point to Point (point to point)

14

6.2.15 S141 Repeater Y/N

This register is invalid on a point-to-point network where addresses are automatically assigned (unit address S105 is 0) but must be set to 0. In this case, the network automatically identifies whether the repeater exists. You do not need to set this parameter.

When manually assigning addresses, this register is set based on whether a repeater exists 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 and currently only

RS232 mode is supported. In the future, it will support RS485 full duplex, RS485 half-duplex, and SBUS $_{\circ}$

6.2.17 S143 Repeater Index Use GPIO

To make it easy for the repeater to change the sequence number, you can configure the repeater sequence number using GPIO [4:1].

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

When S143 is 1, the repeater sequence 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. Therefore, a maximum of 16 repeaters can be configured.

Values (0~1)

0 - without repeater (Valid only on the master side)
(Default)
1 - with repeater (Valid only on the master side)

Values 0- Use the S114 register (Default)

1- Use the GPIO[4:1] to indicate the relay serial number

Values
0 - RS232 (Default)

6.2.18 S159 Encryption Enable

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

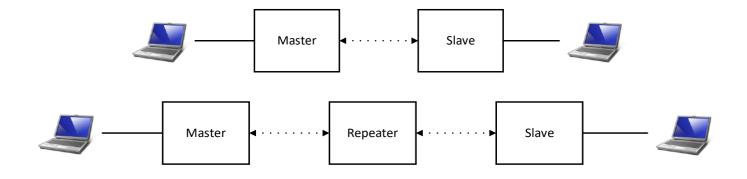
6.2.19 S160 Encryption Key

When using encryption, set a 256bit key for encryption and decryption. The same secret key must be configured at both ends to receive the correct data.

7.Point-to-Point Networks

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

The point-to-point networks can also be used in some special cases: When multiple slaves or repeaters are deployed, the master selects the desired slaves for communication by configuring the destination address S140.



0- Turn off the encryption(Default)1 - Turn on the encryption

Values 256bit secret key

7.1 Configuration Preparations

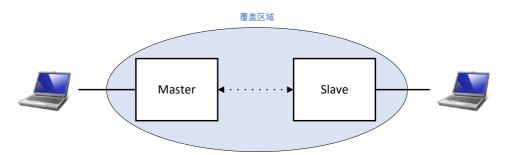
Before configuration, you must use the development board or user-designed hardware to provide power supplies and serial ports for the T900 module. The data serial port can be configured with registers using AT commands, and the control serial port can be configured with registers using API protocols. For details about 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.

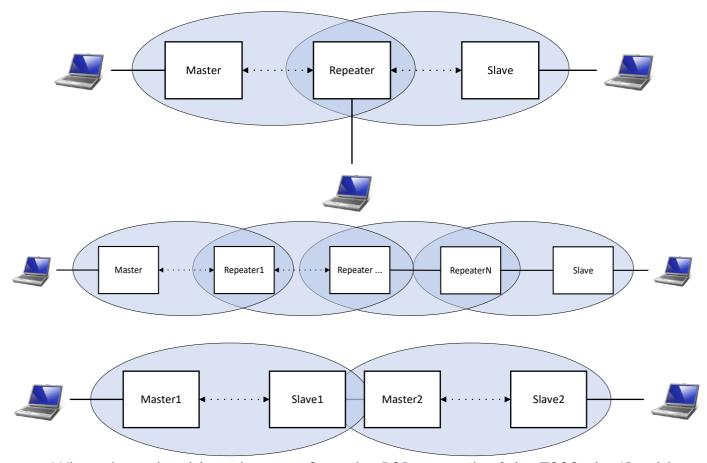
The master provides synchronization signals for the whole network to ensure that all devices can communicate normally.

The slave end is the final node of the network and communicates directly with the master or repeater. When there is no user data transfer in the point-to-point network, the slave device will only synchronize with the master and will not send any information in the network.



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

Adding repeaters to the network reduces the total throughput of the network by half, but only by half and not as the number of repeaters increases. If a relay is required and the throughput is considered, another solution is to place two devices back-toback at the repeater site. One is the slave of the upstream network and the other is the master of the downstream network. The serial ports of the two devices are connected in wired mode.



When the unit address is set to 0 on the P2P network of the T900, the IP address is automatically assigned. Users do not need to set the unit address, synchronous address, and destination address.

The T900's point-to-point repeater mode is very flexible and easy to use. Adding a repeater device in a point-to-point network does not need additional configurations for the master and the slave. You only need to set the repeater to the same network ID, orifice rate, and set the repeater sequence number. After switching on, the existing network will automatically detect whether a repeater has joined. The repeater number must increase from the master to the slave in order but can be discontinuous. Pay

attention to the repeater location to ensure link stability.

The working mode configuration register is 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 the factory defaults sets all registers to default values. Using the default settings has the following benefits:

- To speed up the configuration process. If there is no special requirement, use the default configuration.
- Troubleshoot issues. If communication cannot be established due to the adjustment of the settings, simply restore the factory defaults and any incorrect adjustments will be overwritten.

For most networking applications, the factory defaults are sufficient for all the functions required for point-to-point networking. No matter how complex the special requirements, you can start from the factory default settings configuration. All work modes and network types have corresponding factory default settings commands.

- ◆ AT&F10 --- Factory default settings for the point-to-point master
- ◆ AT&F11 --- Factory default settings for the point-to-point slave
- ◆ AT&F12 --- Factory default settings for the point-to-point repeater

```
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 /?
at&f /?
Factory Defaults
&F7 - PMP Master
&F8 - PMP Slave
&F9 - FMP Repeater
&F10 - PP Master
&F11 - PP Slave
&F12 - PP Repeater
OK
```

Master Setting 7.4

		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	
		OK at&v T900 900MHz Hardwaz Firmwaz Softwaz	A Hopping Radio re Version TZ6 re Version 000 re Version 000 Number 123456	0136B 1-2022062						
		NetWorl Synchr Serial Repeat Encryp	ss Link Rate k Address(ID) onous Address Baud Rate	S118= S102= S141= S159=	=0 E 0 =1234567890FU =0 D =7 G S =0 R =0 R	estination erial Chanu	r(dBm) s Addres nel Mod dex Use ndex	e S142 Gpio S143 S114	=30 =0 =0 =0	
		OK								
A)	AT&F1	0 -	Restore the	factory o	default settir	ngs for the	point	-to-point	master.	
B)	AT&W	-	Save setting	parame	ters.					
C)	AT&V	-	Display the o	current s	ettings.					
D)	S133	-						•	t-to-point network.	
E)	S103	-							e set to the same. The hig	her the
		ne grea	iter the throu	• •					•	
F)	S104	-			. ,				must be the same. It is stro	ongly
				the defa	ult setting 1	23456789	0. To c	change the	e network address, use	
	ATS104	4=xxxx								
	S102	-	The baud ra		•					
	S101	-	The working				-	-		
I)	S105	-	The unit add	aress is s	et to U to au	itomatical	iy assi	gn the add	aress.	

After the configuration is completed, run the AT&W command to save the current settings. Run the ATA command to exit the AT command mode and the settings take effect.

7.5 Slave Setting

```
显示
通讯端口
          串口设置
                          发送
                                多字符串
                                           小工具
                                                  帮助
                                                         回报作者
                                                                    PCB打样
at&f11
OK
at8w
OK
at&v
T900
900MHz Hopping Radio System
Hardware Version TZ60136B
Firmware Version 0001-20220623-0A
Software Version 0001-20220623-0A
Serial Number 123456
                                                                        (H
Network Type
                       S133=1
                                       Operating Mode
                                                               S101=2
Wireless Link Rate
                       S103=0
                                       Output Power(dBm)
                                                               S108=30
NetWork Address(ID)
                       S104=1234567890 Unit Address
                                                               S105=0
Synchronous Address
                       S118=0
                                       Destination Address
                                                               S140=0
                                                               S142=0
Serial Baud Rate
                                       Serial Channel Mode
                       S102=7
Repeater Y/N
                       S141=0
                                       Repeater Index Use Gpio
                                                              S143=0
                       S159=0
Encryption Enable
                                       Repeaters Index
                                                               S114=1
RSSI Form Master(dBm)
                       S123=-255
                                       RSSI Form Slaver(dBm)
                                                              S124=-255
OK
```

- J) AT&F11 Restore the factory default settings for the point-to-point slave.
- K) AT&W Save setting parameters.
- L) AT&V Display the current settings.
- M) S133 The network type must be set to 1, corresponding to point-to-point network.
- N) S103 The wireless link rate on all devices on the network must be set to the same. The higher the rate, the greater the throughput, the lower the rate, and the better the sensitivity.
- S104 The network addresses (ids) of all devices on the network must be the same. It is strongly recommended not to use the default setting 1234567890. To change the network address, use ATS104=xxxxxxxx
- 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, corresponding to the slave.
- R) S105 The unit address is set to 0 to automatically assign the address.

After the configuration is complete, run the AT&W command to save the current Settings. Run the ATA command to exit the AT command mode and the settings take effect.

7.6 Repeater Setting

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&w C T900 900MHz Hopp Hardware Ve Firmware Ve Software Ve Serial Numb	ersion TZ60: ersion 0001- ersion 0001-	136B -20220	623-0A								
Network Typ Wireless Li NetWork Add Synchronous Serial Baud Repeater Y/ Encryption RSSI Form W OK	nk Rate bress(ID) s Address d Rate /N Enable	S11 S10 S14 S15	3=0 4=1234 8=0	D E 567890 G	Outp Unit Dest Seri Repe Repe	ating Mo ut Power Address ination al Chann ater Ind aters In Form Sl	(dBm) Address el Mode ex Use dex	Gpio	S101= S108= S105= S140= S142= S142= S143= S124=	30 0 0 0 0 1	

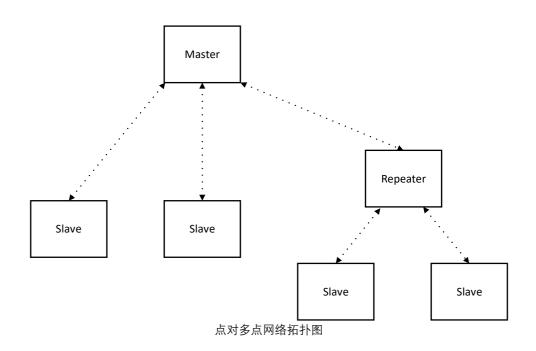
- A) AT&F12 Restore the factory default settings for the point-to-point repeater.
- B) AT&W Save setting parameters.
- C) AT&V Display the current settings.
- D) S133 The network type must be set to 1, corresponding to point-to-point network.
- E) S103 The port rates of all devices on the network must be the same. The higher the rate, the greater the throughput, the smaller the rate, and the better the sensitivity.
- F) S104 The wireless link rate on all devices on the network must be set to the same. It is strongly recommended not to use the default setting 1234567890. To change the network address use 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 repeater.
- I) S105 The unit address is set to 0 to automatically assign the address.
- J) S114 The repeater sequence number represents the position of the repeater in the network, the closer to the master, the smaller the sequence number, and it can be discontinuous.

After the configuration is completed, run the AT&W command to save the current Settings. Run the ATA command to exit the AT command mode and the settings take effect.

8.Point-to-Multipoint Networks

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

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



8.1 Configuration Preparation

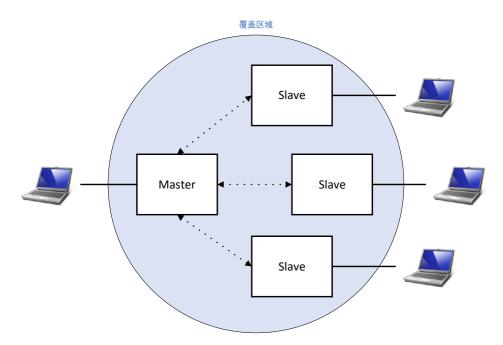
Before configuration, you must use the development board or user-designed hardware to provide power supplies and serial ports for the T900 module. The data serial port can be configured with registers using AT commands, and the control serial port can be configured with registers using API protocols.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

8.2 Working Mode

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

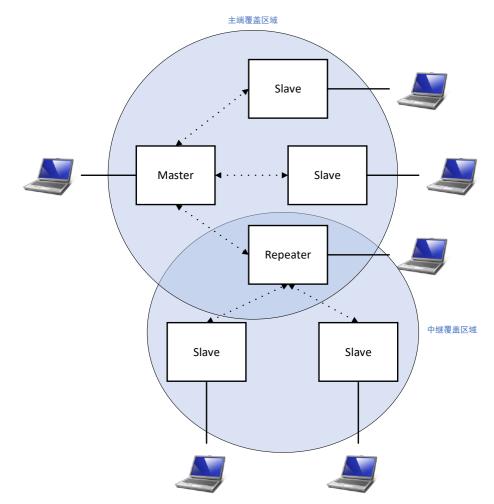
The master provides synchronization signals for the entire network to ensure normal communication between all devices.

The slave is the final node of the network and communicates directly with the master or repeater. When there is no user data transfer in the point-to-multipoint network, the slave device will only synchronize the master and will not send any information on the network.



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

Adding repeaters to the network reduces the total throughput of the network by half, but only by half and not as the number of repeaters increases. If a repeater is required and the throughput is considered, another solution is to place two devices back-to-back at the repeater site. One is the slave of the upstream network and the other is the master of the downstream network. The serial ports of the two devices are connected in wired mode.



The repeater of a point-to-multipoint network cannot be automatically added like a point-to-multipoint network. You need to manually configure registers S105, S118, and S140 to determine the network topology.

The working mode configuration register is S101. Run the following command:

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

8.3 Use Factory Defaults

The factory defaults 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. To speed up the configuration process. If there is no special requirement, please use the default configuration.
- 2. Troubleshoot issue. If communication cannot be established due to adjustments to the settings, simply restore the factory defaults and any incorrect adjustments will be overwritten.

For most networking applications, the factory defaults provide all the functionality required for point-to-multipoint network. No matter how complex the special requirements are, you can start from the factory default settings configuration. All work modes and network types have corresponding factory default settings.

- ◆ AT&F7 --- Factory default settings for the point-to-multipoint master
- ♦ AT&F8 --- Factory default settings for the point-to-multipoint slave
- ◆ AT&F9 --- Factory default settings for the point-to-multipoint repeater

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 De &Fa - FMP &F9 - FMP &F10 - PP &F11 - PP &F12 - PP OK	Master Slave Repeater Master Slave							

8.4 Master Setting

		通讯游	制 串口设置	显示发送	多字符串	小工具	帮助	回报作者	PCB打样	_
		Hardwa Firmwa Softwa	A Hopping Radio re Version TZ60 re Version 0001 re Version 0001 Number 123456	136B 202206230.						_
		Wirele NetWor Synchr Serial Repeat Encryp	k Type ss Link Rate k Address(ID) onous Address Baud Rate er Y/N tion Enable orm Master(dBm)	S133=0 S103=0 S104=123 S118=0 S102=7 S141=0 S159=0 S123=-25	E Out 567890 Uni G Ser H Rep Rep	tination ial Cham	r(dBm) s Addres nel Mod dex Use ndex	le S142 Gpio S143 S114	=30 =0 =0 =0	
		OK								
A)	AT&F7	7 _	Restore the fa	ctory defau	It Settings	of the po	oint-to	point ma	ster.	
B)	AT&W	/ _	Save setting p	arameters.						
C)	AT&V	-	Display the cu	irrent settin	gs.					
D)	S133	-	The network t	ype must b	e set to 0,	correspo	onding	to point-t	o-multipoint networ	k.
E)	S103	-	The wireless li	nk rate on a	all devices	on the n	etwork	must be s	et to the same. The	higher the
		ne grea	ater the throug	•					•	
F)	S104	-							st be the same. It is	strongly
				ne default se	etting 1234	567890.	To cha	ange the n	etwork address use	
		4=xxx>								
	S102	-	The baud rate		-		t of the	e connecte	ed device.	
H)	S141	-	Whether a rep							
I)	S101	-	The working r			-		-	aster.	
J)	S105	-	For the unit a				•			
K)	S118	-	For the synch	ronize addr	esses, see	Section S).7 for	example.		

L) S140 - For the target address, see Section 9.7 for example.

After the configuration is completed, run the AT&W command to save the current Settings. Run the ATA command to exit the AT command mode and the Settings take effect.

8.5 Slave Setting

		通讯端口	串口设置	記示 发送	多字符串 小工具	帮助	回报作者	PCB打样
		Hardware Firmware Software	oping Radio S Version TZ601 Version 0001- Version 0001- nber 123456	36B 20220625-0A				
		Serial Bau Repeater M Encryption	Link Rate ddress(ID) 15 Address 1d Rate //N	S133=0 D S103=0 E S104=123456 S118=0 K S102=7 G S141=0 H S159=0 S123=-255	Operating M Output Powe 57895 Unit Addres Destination Serial Chan Repeater In Repeaters I RSSI Form S	er(dBm) ss unel Mode udex Use G index	S114	=30 =0 =0 =0 =0
		ок						
,	AT&F8	- Res	tore the facto	ory default se	ttings for the poi	nt-to-mu	ıltipoint s	lave.
,	AT&W		e setting para					
,	AT&V	•	play the curre	•				
,	S133				to 0, correspond			
,	S103							t to the same. The high
		-			wer the rate, the			
,	S104			. ,				be the same. It is strong
		=xxxxxxxxx		aeiduit Settini	g 1234567890. To	J change	the netw	UIN AUULESS USE
	S102			the serial po	ort matches that o	of the con	nected d	levice
,	S141		ether a repea	-				
,	S101		-		et to 2, correspo	nding to t	he slave.	
,	S105		•		tion 9.7 for an ex	-		
,	S118				s, see Section 9.7		iple.	
L)	S140	- For	the target ac	ldress, see Se	ection 9.7 for exa	mple.		

After the configuration is completed, run the AT&W command to save the current Settings. Run the ATA command to exit the AT command mode and the settings take effect.

8.6 Repeater Setting

A) B) C) D) E)

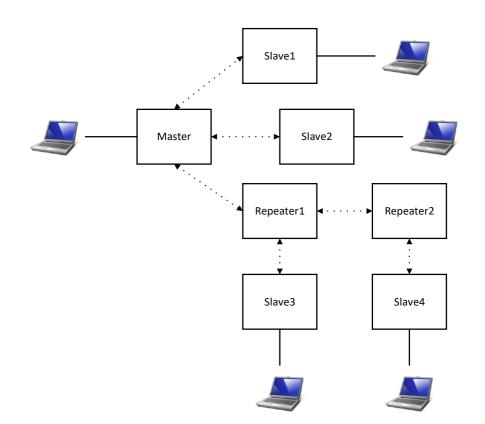
F)

G) H) J) K) L)

	通讯端	们 串口设置	显示发送	\$ 多字符串	小工具	帮助	回报作者	PCB打样	
	Hardwa Firmwa Softwa		0136B 1-20220625- 1-20220623-						
	NetWorl Synchr Serial Repeat Encryp	ss Link Rate k Address(ID) onous Address Baud Rate	S118=0 S102=7 S141=0 S159=0	G Out G Ser H Rep Rep	tination ial Cham	r(dBm) s Addres nel Mod dex Use ndex	le S142 Gpio S143 S114	=30 =0 =0 =0 =0	
	OK								
				h sit f					
AT&F9 AT&W		Restore the fa	-	lit settings fo	or the poi	int-to-	multipoint	repeater.	
AT&V	_	Display the cu		as					
S133	_	The network		-	orrespon	dina ta	point-to-	multipoint.	
S103	_				•	-	•	•	e. The higher the
rate, tł	ne grea	ter the throug							5
S104	-	The network	addresses (i	ds) of all dev	vices on t	he net	work must	be the same	e. It is strongly
recom	mende	d not to use tl	ne default s	etting 12345	67890. T	o chan	ge the netv	work addres	s use
	4=xxxx	XXXX.							
S102	-	The baud rate		•		of the o	connected	device.	
S141	-	Whether a re							
S101	-	The working			•	-	•	ater.	
S105	-	For the local							
S118	-	For the synch					ample.		
S140	-	For the targe	t address, se	e Section 9.	i tor exa	mple.			

After the configuration is completed, run the AT&W command to save the current Settings. Run the ATA command to exit the AT command mode and the settings take effect.

8.7 Examples for Configuring Point-to-Multipoint Network Addresses.



A point-to-multipoint network has one master, four slaves, and two repeaters. Slave 1, slave 2, and repeater 1 are synchronized to the master, repeater 2 is synchronized to repeater 1, slave 3 is synchronized to repeater 1, and slave 4 is synchronized at repeater 2. If S141 of the master is 1, there are repeaters on the network. The unit address and synchronization address of each device are set in the following table:

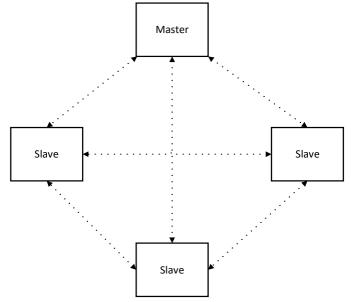
	Local address S105	Synchronous addressS118	Target address S140
Master	1	0	0
repeater1	2	1	0
repeater2	3	2	0
slave1	4	1	0
slave2	5	1	0
slave3	6	2	0
slave4	7	3	0

On the same point-to-multipoint network, the unit address of each device must be unique and non-zero. The synchronization address is set to the unit address of its upper-level device. The destination address is usually set to 0, or the unit address of a device if you need to specify receiving a device.

9.Mesh With Center Networks

A central Mesh network is a special point-to-multipoint network. The center of the network is still the master, and all the slaves can exchange data with each other but do not forward data. The Mesh network with a center needs to be configured with the network type register S133=2. This network type does not support repeaters.

The master can use the target address S140 to temporarily select a particular slave to communicate with and filter out data transfer requests from other devices.



The Mesh with Center Network topology

9.1 Configuration Preparations

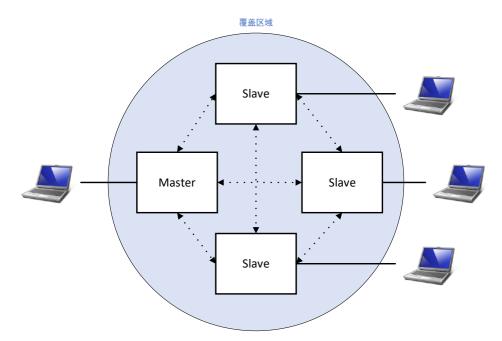
Before configuration, you must use the development board or user-designed hardware to provide power supplies and serial ports for the T900 module. The data serial port can be configured with registers using AT commands, and the control serial port can be configured with registers using API protocols.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

9.2 Working Mode

The T900's centered Mesh network supports only two operating modes: master and slave. The repeater is not supported.

The master provides synchronization signals for the whole network to ensure that all devices can communicate normally.

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



For a Mesh network with a center, registers S105, S118 and S140 need to be configured in advance to determine the network topology.

The working mode configuration register is S101. Run the following command:

- ♦ ATS101=0 --- Master
- ◆ ATS101=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.To speed up the configuration process and use the default configuration if you don't need it.

2. Troubleshoot issue. If communication cannot be established due to adjustments to the settings, simply restore the factory defaults and any incorrect adjustments will be overwritten.

For most web applications, the factory defaults are sufficient for all the functions required for a centralized Mesh network. No matter how complex the special requirements, you can start from the factory default settings configuration. All work modes and network types have corresponding factory default settings.

- ◆ AT&F4 --- Factory default settings for the Mesh-with-Center master.
- ◆ AT&F5 --- Factory default settings for the Mesh-with-Center slave.

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
```

Master Setting 9.4

		通讯游	い まし	口设置	显示	发送	多字符串	小工具	帮助	回报作者	PCB打样	
		Hardwa Firmwa Softwa		ion TZ60 ion 0001 ion 0001	0136B L-20220)623-0A						
		NetWor Synchr Serial Repeat Encryp	ss Link k Addre: onous <i>H</i> Baud Ra	ss(ID) Address ate able	S10 S11 S11 S10 S14 S15)3=0)4=1234 .8=0	0ut 567890 Uni Des Ser Rep Rep	tination ial Chann	r(dBm) s Addres nel Mod dex Use ndex	le S142 Gpio S143 S114	=30 =0 =0 =0 =0	
		OK										
A)	AT&F7	 	Restor	e the fa	actory	defaul	t settings	for the n	nesh-v	vith-cente	r master.	
B)	AT&W	-		etting p	-		0					
Ć)	AT&V	-		y the ci			JS.					
D)	S133	-	The ne	etwork t	type n	nust be	e set to 2 v	vith a cei	ntral N	lesh for pa	airs.	
E)	S103	-	The wi	reless I	ink rat	e on a	II devices	on the n	etwork	must be s	set to the	same. The higher the
	rate, th	ne grea								ne sensitivi		
F)	S104	-	The ne	etwork	addres	sses (ic	ls) of all d	evices or	the n	etwork mu	ist be the	same. It is strongly
	recom	mende	d not t	o use th	ne def	ault se	tting 1234	567890.	To cha	ange the n	etwork ad	ldress use
	ATS10	4=xxxx	XXXX									
G)	S102	-	The ba	aud rate	e of th	e seria	l port mat	ches tha	t of the	e connecte	ed device.	
H)	S141	-	Wheth	ier a re	peater	exists	on the ne	twork or	not, tl	he value m	nust be set	t to 0.
I)	S101	-	The wo	orking i	mode	must k	be set to 0	, corresp	onding	g to the m	aster side	
J)	S105	-	For the	e unit a	ddress	s, refer	to the exa	ample in	point-	-to-multip	oint netwo	orks.
K)	S118	-	For the	e sync a	addres	s, refe	r to the ex	ample in	n point	-to-multip	oint netw	orks.
L)	S140	-	For the	e destir	nation	addres	ss, refer to	the exar	mple ir	n point-to	-multipoir	nt networks.

After the configuration is completed, run the AT&W command to save the current Settings. Run the ATA command to exit the AT command mode and the settings take effect.

9.5 Slave Setting

J)

		通讯端L	1 串口设置	显示	发送	多字符串	小工具	帮助	回报作者	PCB打样	
		Hardware Firmware Software	opping Radio Version TZ6 Version 000 Version 000 umber 123456	0136B 1-202200 1-202200							_
		NetWork Synchron Serial B Repeater Encrypti	Link Rate Address(ID) ous Address aud Rate	S118 S102 S141 S159	8=0 E 12345 8=0 K 2=7 G 1=0 H	Out 567895 Uni Des Ser Rep Rep	tination ial Cham	r(dBm) s Addres nel Mod dex Use ndex	e S142 Gpio S143 S114	=30 =0 =0 =0 =0	
		ок									
A)	AT&F8	- Re	store the fac	ctory de	fault se	ettings for	the mes	h-with	-center sla	ive.	
B)	AT&W		ve setting p								
C)	AT&V		splay the cu		-						
D)	S133		e network ty	•							
E)	S103									to the same. The	higher t
		-	the through	-					-		
F)	S104									be the same. It is	
				e detaul	t settin	ng 123456	7890. To	chang	e the netw	ork address use	
\sim		1=xxxxxxx Th		of the -	orial		oo that -	ftha a			
,	S102		e baud rate								
	S141		-							be set to 0.	
l) A)	S101 S105		e working m					-			
A) B)	S105 S118		r the unit ac						-		
ь) С)	S110 S140		r the sync ac							i networks. Iltipoint network	10
U) 1)	3140				JI E 55, I		с слаттр	ie in po			

After the configuration is completed, run the AT&W command to save the current Settings. Run the ATA command to exit the AT command mode and the settings take effect.

9.6 Packet Length Limit

In the case of a central Mesh network, when the channel access mode is TDMA, each device communicates with each other. When multiple devices send data, the data output from serial ports will interleave each other. To ensure the integrity of data packets, the length of data packets must be smaller than the maximum length sent by a single time slot. When the channel access mode is selected 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