Industrial Mini RTU

TG501 Series User Guide

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About This Guide

Thank you for choosing Bivocom Industrial Cellular RTU TG501 Series.

Please thoroughly read this user guide before you configure and install the device.

This manual is compatible with below models

Model	Description
TG501-LF	Industrial LTE/WCDMA RTU
TG501-W	Industrial WCDMA RTU
TG501-M	Industrial LTE CAT M1/NB-IoT RTU

Summary of Changes

Date	Version	Notes	Editor
27-12-2019	V1.0	Initial new version	Harry Huang

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1. Introduction

1.1 Overview

TG501 Series RTU is a type of industrial cellular Remote Terminal Unit which adopts high-powered industrial 32-bits CPU, with multi-layer software detection and hardware protection mechanism to ensure reliability and stability of the device, to realize real time data acquisition, storage, control, alarm and transmission, as well as security of data transmission. It supports worldwide carrier 4G FDD-LTE, TDD-LTE, and3G/HSPA/UMTS/WCDMA, EVDO, TD-SCDMA, EDGE, CDMA 1X and GPRS, as well as LTE CAT M1/NB-IoT. It has rich interfaces, digital input, digital output, analog input, relay, RS232, RS485, allows you to connect to different types of sensors and equipment.

TG501 has rich interfaces, including 2x RS232, 1x RS485, 3x analog input, 2x digital input, 2x relay output, 1x power input(5-35V), 1x power output(12V), pulse input and TTL are customizable.

1.2 Applications

TG501 has been widely used for remote monitoring and control applications, such as, hydrology, water resources, water pollution, water treatment, reservoir dam, mountain flood disaster, geological disaster, meteorology, environmental protection, new energy resources, etc.
Typical application as below.

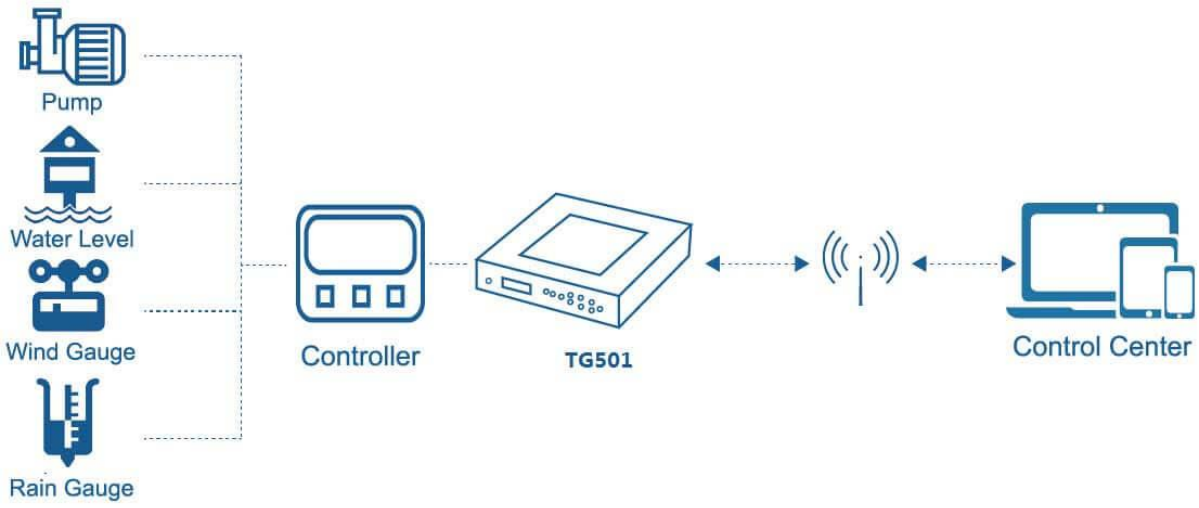


Figure 1: Diagram of RTU application

1.3 Dimensions

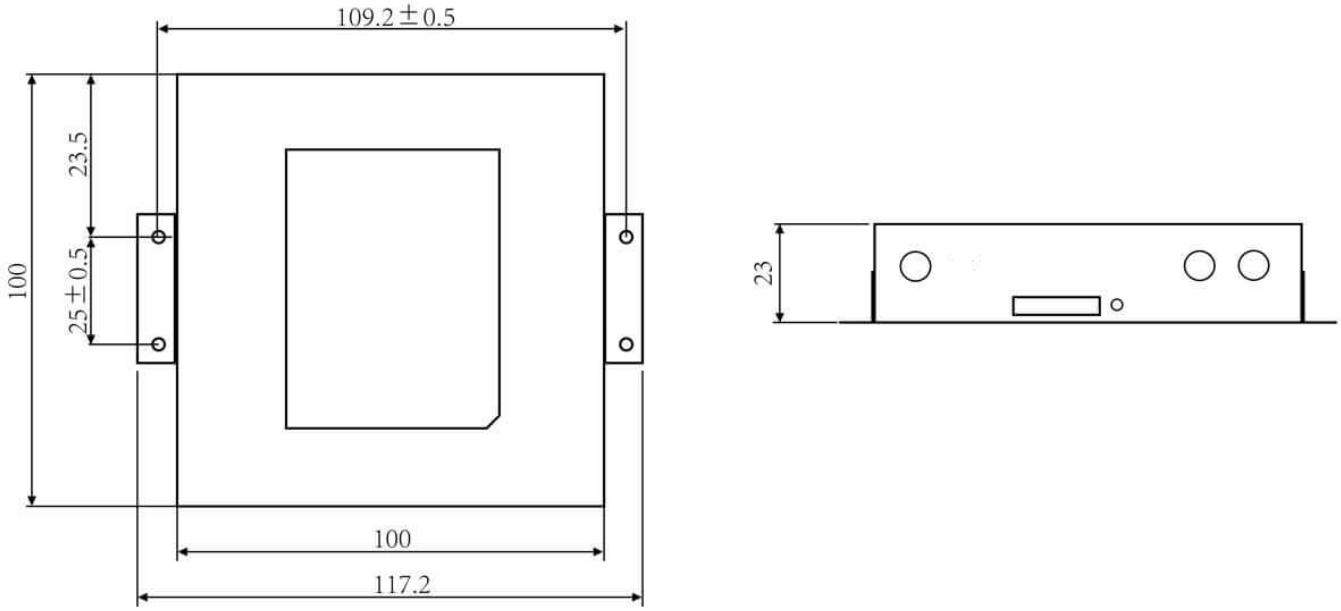


Figure 2: Dimensions of TG501

1.4 Specification

Interface	Description
System	**CPU:** Industrial 32-bit CPU **Flash:** 512KB **SRAM:** 256KB **Data Storage Flash:** 16MB
Cellular Interface	**Antenna Connector** 1 × 50 Ω SMA Female, or 2(Option) **SIM Slot** 1 **ESD Protection** 15KV
Serial Interface	**Connector** Terminal block, 3.5 mm female socket with lock **Ports** 2 × RS232(1 for debug) + 1 × RS485 **Baud Rate** 300bps to 230400bps **ESD protection** 8KV for RS232, 15KV for RS485
Analog Input	**Number of Ports:** 3 x 16-bit AD, supports 4-20mA current signal input, and 0-5V voltage signal input is optional
Digital Input	**Number of Ports:** 2

	Logic 0: Wet contact 0-3VDC, or dry contact close Logic 1: Wet contact DC 5-30V, or dry contact open
Relay	**Number of Ports:** 2 Max switching voltage: 30VDC/250VAC Max switching current: 5A
Power Output	**Number of Ports:** 1 Default is 12V, rated output current is 1A, built in overcurrent protection
Power Supply and Consumption	**Connector** Terminal block **Standard Power** DC 12V/1.5A **Input Voltage** 5-35 VDC **Data Acquisition** 40mA～45mA@12VDC **Communication** 40mA～60mA@12VDC **Idle Consumption** ＜1mA@12VDC
Physical Characteristics	**Ingress Protection** IP30 **Housing & Weight** Metal, 320g (0.71lbs) **Dimensions** 100 x 100 x 23mm (3.94 x 3.94 x 0.91 in) **Mounting** Desktop, Wall mount, DIN Rail (option)
Environmental	**Operating Temperature** -35°C to +75°C (-31℉ to +167℉) **Storage Temperature** -40°C to +80°C (-40℉ to +176℉) **Relative Humidity** 0% to 93% (non-condensing) at 25°C/77℉ **Ethernet Isolation** 1.5 kV RMS
Software	**Network Protocols:** MQTT*, Transparent (TCP Client/Server, UDP Client/Server), Modbus Gateway (Modbus RTU to Modbus TCP), DNS, etc. **Management:** Config Tool, Cloud DMP (Device Management Platform)
Others	**LED Indicators:** System, Online, Power, Error **Built-in:** Watchdog, RTC, Timer **Approvals:** CE*, RCM*, FCC* **Warranty Period:** Standard: 12 Months Extended: 2-5 Years3
Standard Package Content	TG501 RTU Power Adapter(DC 12V/1.5A, EU/US/UK/AU plug optional) Mag-mount Cellular Antenna (SMA Male, 1 meter, 5dBi) RS232 Cable (DB9 Female, 1 meter) 10-Pin Terminal Block, 1X 12-Pin Terminal Block Wall mount kit Quick Start Guide

1.5 Definition of PIN and cables

1.5.1 Definition of PIN

There are 22 PINs in total as below, the PIN 8, 9, 11, 12, 16, 17, 18 are customizable.

Figure 3: I/O and order

1	2	3	4	5	6	7	8	9	10	11	12
VIN+	VIN-	GND	TX	RX	A	B	DI1/A	DI2/B	GND	RS232/DI3/TTL	RS232/DI4/TTL

13	14	15	16	17	18	19	20	21	22
VDD_OUT_12V	GND	ADC1	ADC2/DO1	ADC3/DO2/PI1	NC/ADC4/PI2	K1+	K1-	K2+	K2-

Number and order of Pin

No.	Port Definition	Function Description	Customizable
1	VIN+	Power VIN+ input	
2	VIN-	Power VIN- input	
3	GND	CH 0(debug) RS232 GND	
4	RXD0	CH 0(debug) RS232 RX	
5	TXD0	CH 0(debug) RS232 TX	
6	A0	RS485 A	
7	B0	RS485 B	
8	DI0	Digital Input 0	A1

9	DI1	Digital Input 1	B1
10	GND	CH 1 RS232 GND	
11	RXD1	CH 1 RS232 RX	DI2/TTL/PI0
12	TXD1	CH 1 RS232 TX	DI3/TTL/PI1
13	VDD_OUT	Power VDD Output (12V)	
14	GND	Power GND	
15	ADC0	CH 0 analog input	
16	ADC1	CH 1 analog input	DO0
17	ADC2	CH 2 analog input	DO1
18	NC	NULL (reserved)	ADC3
19	K0+	CH 0 Relay K0+	
20	K0-	CH 0 Relay K0-	
21	K1+	CH 1 Relay K1+	
22	K1-	CH 1 Relay K1-	

1.5.2 Definition of Cables

TG501 utilizes industrial terminal block, so we suggest you use materials of cable 28-16AWG. Definition of cable for power and RS232 are as below.

1) Power Adapter (Output 12VDC/1.5A)

Color of cable	Power Output Polarity
Red	VIN+(Anode)
Black	VIN-(Cathode)

Figure 4: power adapter

2) Power Supply Cable

Input range: 5-35VDC, power>4W, we suggest you use our standard power supply.

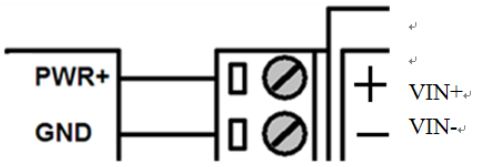


Figure 5: Power cable connection

3) RS232 Cable (with DB9 female interface)

Color of Cable	Definition of cable	Corresponding DB9-M Pin Number
Brown	RX	2
Blue	TX	3
Black	GND	5

4) RS232 Cable

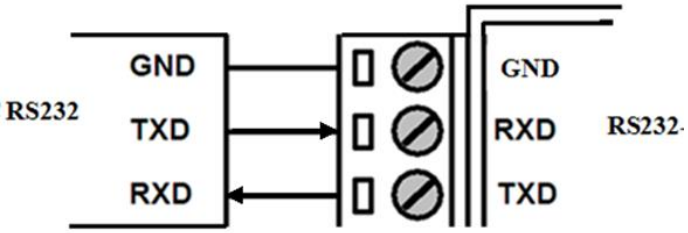


Figure 6: RS232 cable connection

5) RS485 Cable

For example, RS485 water level sensor.

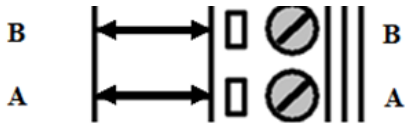


Figure 7: RS485 cable connection

6) Digital Input: (Wet contact)

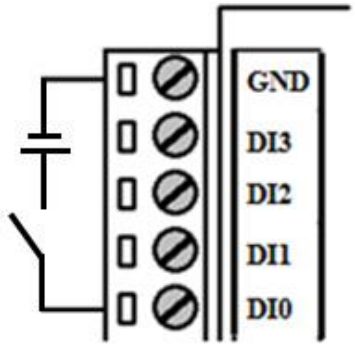


Figure 8: Digital input

7) Analog Input(4-20mA)

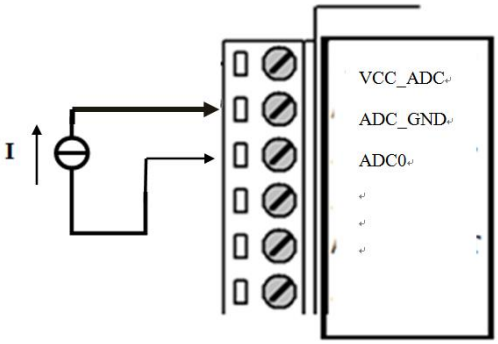


Figure 9: Analog input

8) Two-wire current loop sensor: (Current 4-20mA)

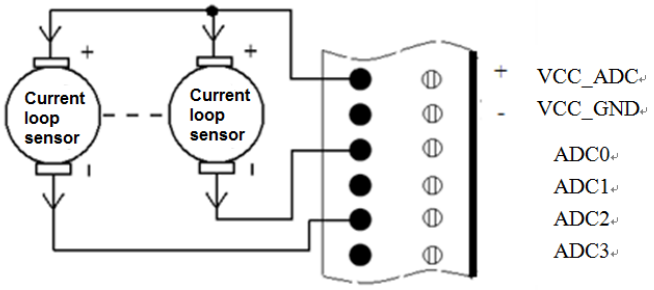


Figure 10: 2-wire current loop sensor

9) Relay Output

Max switch voltage 30VDC, max switch current 1A, max switch power 30W)

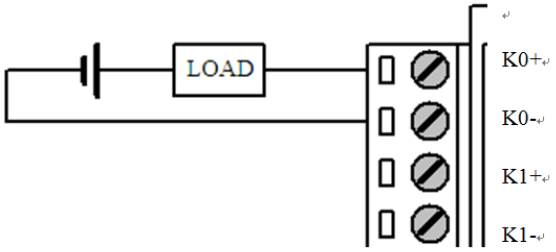


Figure 11: Relay Output

10) Digital Output (Optional)

Open Collector output, rated drive current 50mA, rated drive voltage 35VDC, that is to say, R+Rload>20UΩ, U<=35VDC.

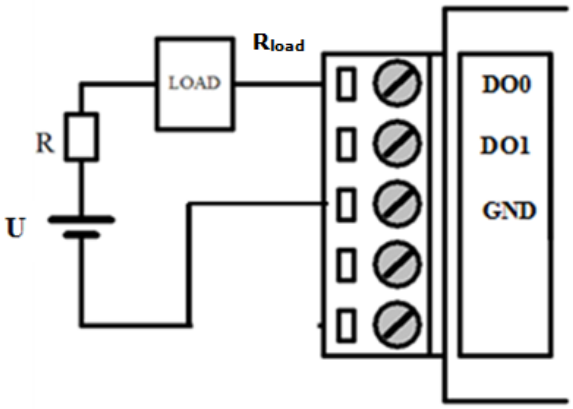


Figure 12: Digital output

1.6 Power supply requirement

Devices are often used in complex environments, in order to adapt to the complex application environment and improve the stability of the system, the equipment uses advanced power technology. Users can use BIVOCOM 12VDC/1.5A power adapter to supply power to the device, or directly supply power to the device with DC 5-35V power supply. When the user supplies power to the device with an external power supply, the stability of the power supply must be ensured (the ripple is less than 300mV, and the instantaneous voltage does not exceed 35V), and the power supply is guaranteed to be more than 4W (excluding the power consumption of the external sensor).

Using Bivocom standard 12VDC/1.5A power adapter is highly recommended.

1.7 LED Indicators

TG501 has 4 LED indicators, ‘Power’, ‘System’, ’Online’, ‘Error’, as follows.

LED Indicator	Status	Description
Power	On	Power on
System	Blink	Device is operating
Online	On	Device is online, connecting to remote server via cellular network
Error	On	Error alarm

1.8 Mounting

This device supports 4 screw holes of 6mm diameter, support M4 screw, which can be used for Bivocom wall mount kits or DIN-Rail kits.

1.9 Lightning protection instructions

When this device is connected to outdoor sensors (rain gauge, water level gauge, etc.), we suggest you take lightning protection measures (such as installing lightning arresters, etc.) to improve the safety level of the device.

2. Getting Started

2.1 Package Checklist

The following components are included in your TG501 package.
Check the list before installation. If you find anything missing, Please feel free to contact Bivocom.

- ✓ TG501 RTU
- ✓ Power Adapter(DC 12V/1.5A, EU/US/UK/AU plug optional)
- ✓ Mag-mount Cellular Antenna (SMA Male, 1 meter, 5dBi)
- ✓ RS232 Cable (DB9 Female, 1 meter)
- ✓ 10-Pin Terminal Block, 1X 12-Pin Terminal Block,
- ✓ Wall mount kit(Option)

Cellular Antenna RS232 Cable 10-pin, 12-pin terminal block Power Adapter TG501

Figure 13: Standard Package

2.2 Installation

2.2.1 Install SIM/UIM Card

TG501 supports normal SIM/UIM only, so if you're using a Micro SIM or Nano SIM card, you may need to use a Micro SIM or Nano SIM to Normal SIM adapter.
Make sure your RTU is powered off, then use a needle object(such as a pen) to push the button near the SIM tray, it will flick out. Put the SIM/UIM card to SIM tray with right direction, insert it to RTU and make sure it's locked and tightly matched.

Warning: Never install SIM/UIM card when RTU is powered on.

2.2.2 Install the terminal blocks

There are 2 terminal blocks in the package(10-pin and 12pin), please install all of them to allow you to connect your sensors/PLC/microcontrollers to TG501, and power supply.

2.2.3 Fasten cellular antenna

TG501 supports 1 SMA male cellular antenna-ANT1, (Dual cellular antenna-ANT2, GPS antenna-ANT 3 are optional), fasten the antenna to TG501(SMA female port), and make sure it is screwed tightly to ensure the strength of signal.

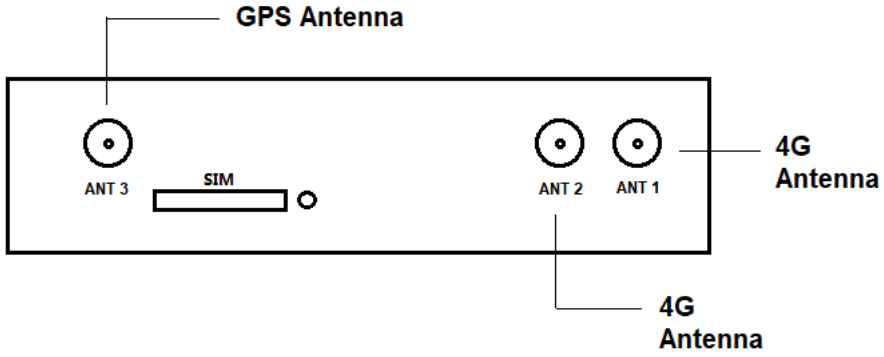


Figure 14: Antenna interfaces

2.2.4 Connect cable of power adapter to TG501

TG501 use terminal block for connecting power cable, please make sure you connect the red cable to VIN+, and black cable for VIN-, then use screwdriver to fasten the cable. Please refer to item 1.5.2.

Warning: Incorrect connection of the power cable may cause damage of device.

2.2.5 Connect TG501 to PC/Laptop via RS232

Use the RS232 cable to connect to the RS232 interface of TG501.
For definition of RS232 cable and RS232 serial port, please refer to item 1.5.2 respectively
If the PC or laptop doesn't have RS232 serial port, you may need a USB to RS232 adapter or cable.

2.2.6 Load the initial configuration

Open the configuration tool which you can go download from Bivocom website, or contact us to get this software, this config tool only supports Windows OS now.

Open the config tool,

1) Click ‘Config’ label, then click ‘Reload’ button, you will be indicated to power on the device to load the configuration from device initially.
2) Power on TG501, and wait for a while, the device will print the syslog in log column, there is an indication after finished the reload.
3) Now you are in configuration mode and able to change or set configurations according your demands. Please refer to item 3.1 for more details.

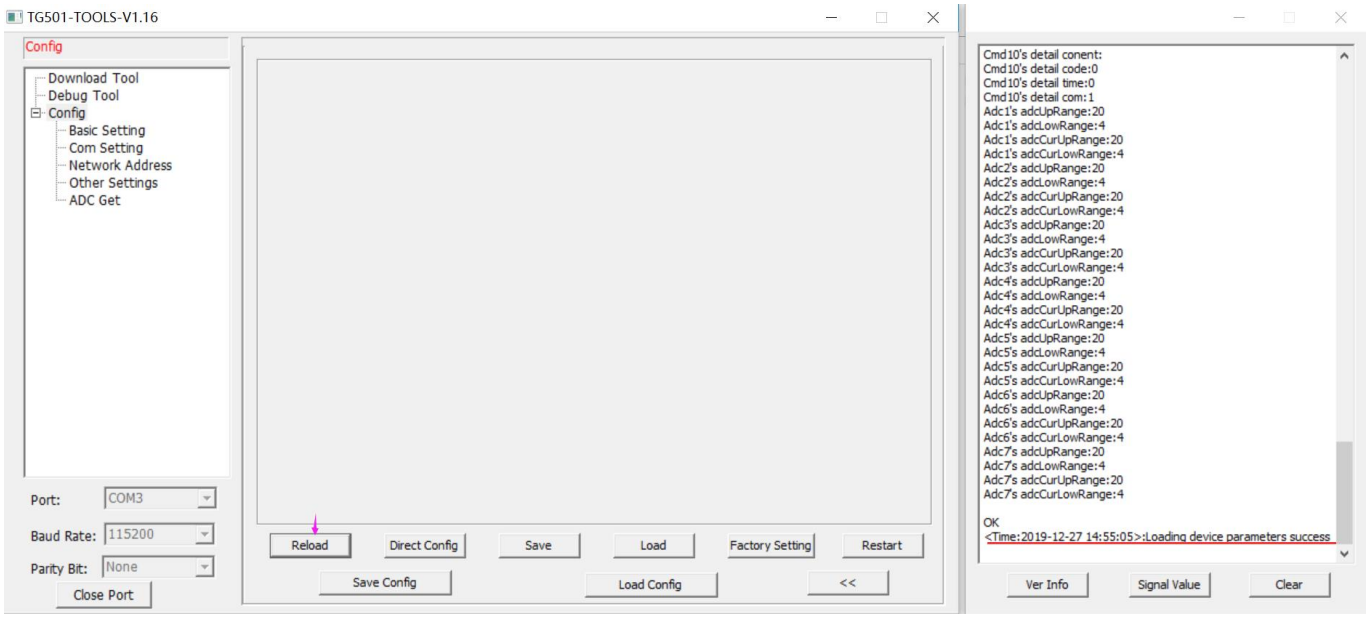


Figure 15: Config tool

2.2.7 Save the configuration

When you finish all the settings, please click the ‘Save’ button to save all your configuration. Then click the ‘Restart’ button or just power off/on to restart the device, and it will go into communication mode.

3. Configuration Tool Setting

In this chapter, you'll learn more details about how to configure the RTU via the configuration tool.

3.1 Config Tool

In the previous section, after finish the TG501 installation and connect it with your laptop via RS232 cable (you may need an RS232 to USB adaptor if your laptop doesn't support DB9 interface).

Open the RTU config tool, there are serial port settings of your laptop, select the right COM port, and Baud Rate (the default is 115200). Normally it will automatically detect the right port and has linked the connection by default. If not, please change it accordingly.

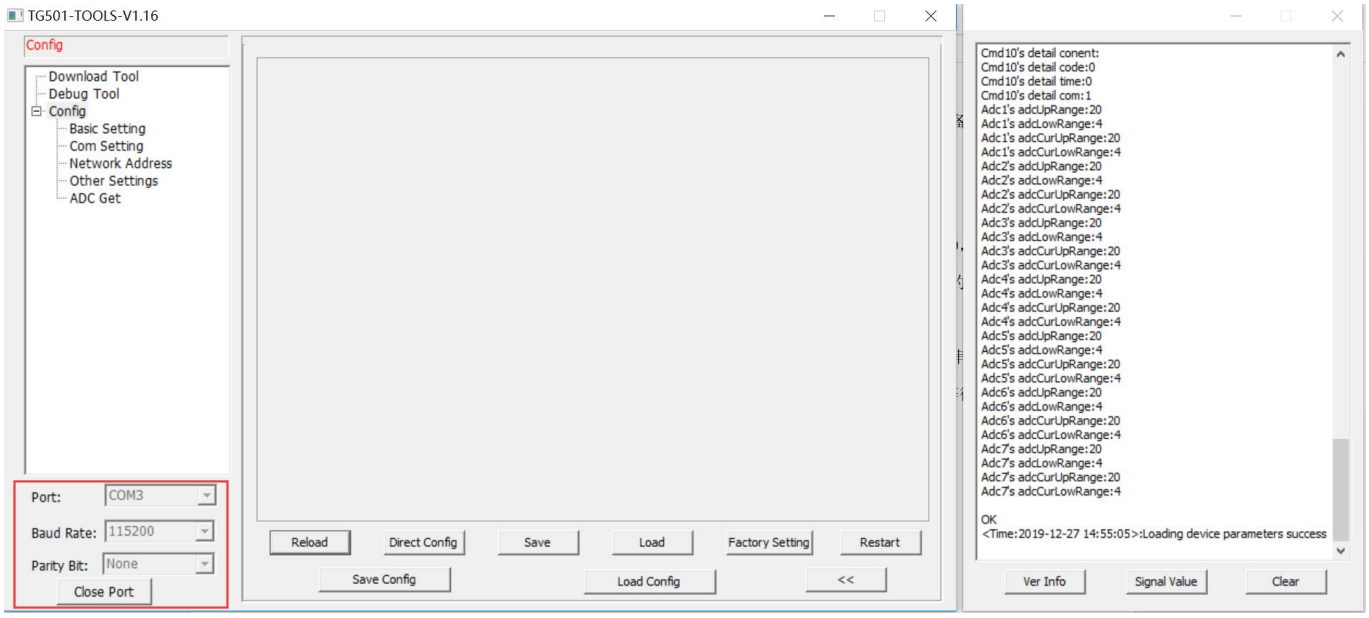
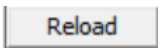
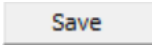


Figure 16: Serial Port Setting

Click 'Reload' button 

to reload the initial settings from the device, then you are allowed to configure all settings on the tool. Click 'Save' 

when settings changed. 'Restart' 

it to quit the configuration mode and go into work mode(communication mode).

Note: You have to 'Reload' it before change any settings when in work mode.

On the configuration tool board, you are also allowed to perform 'Factory Reset', 'Save Config' and 'Load Config', Check 'Version Info', 'Signal Value' and 'Clear' the syslog.

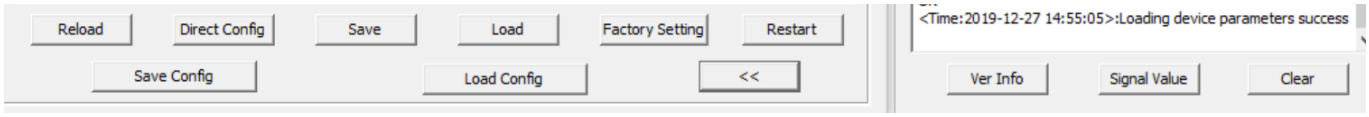


Figure 17: Reload

After entering into configuration mode, you are able to change all the settings on tool panel, as below detailed explanations.

3.1.1 Basic Setting

Click the 'Basic Setting' label, you are allowed to change the Device ID, SIM Card Number, Work Mode, and select the Modbus work mode, Modbus device address, update interval. Also RTC Setting.

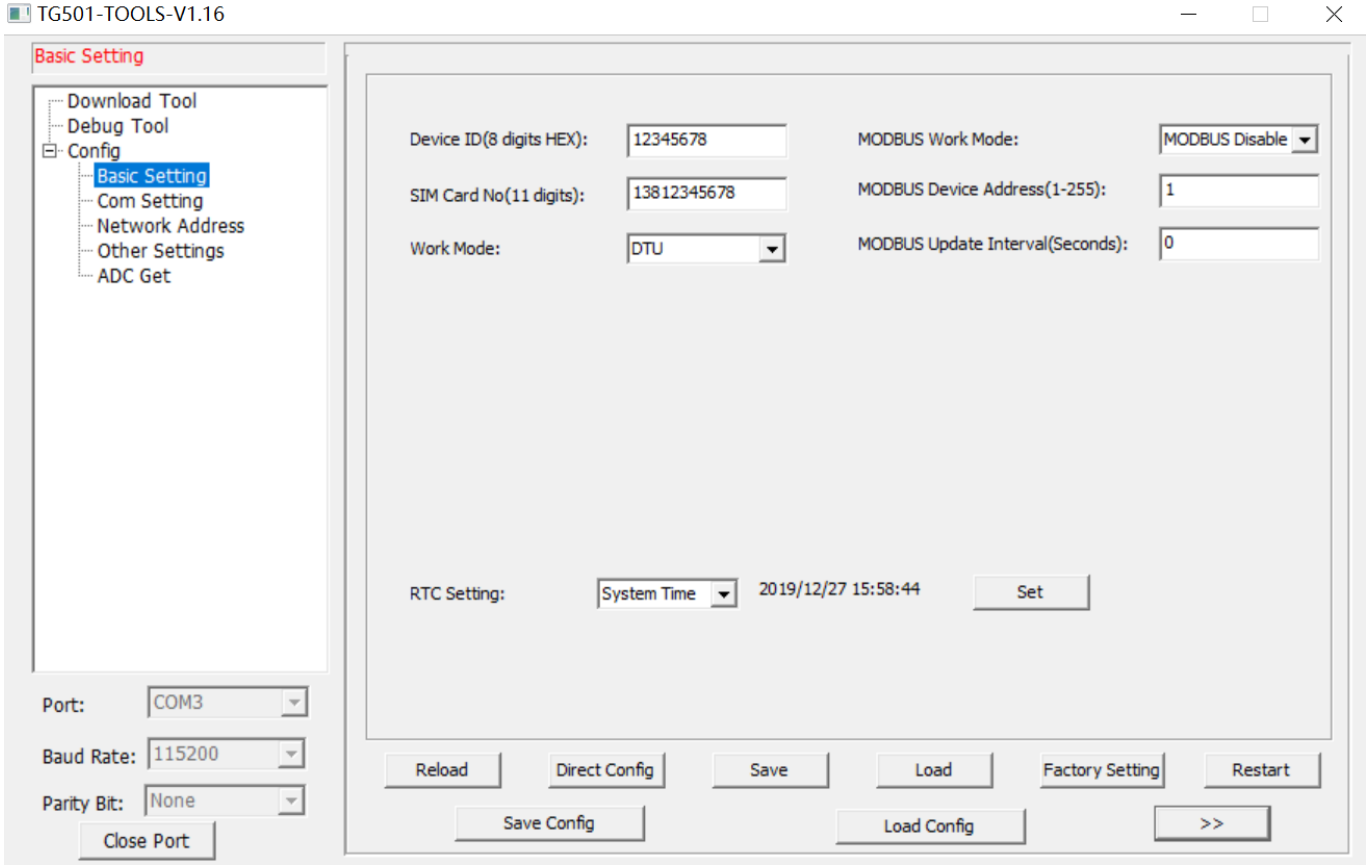


Figure 18: Basic Setting

Parameter Name	Description
Device ID	Setting the TG501 device ID, it is used for recognizing the device during register and keep alive with server. 8 digital HEX value only.
SIM card No.	Helpful for distinguishing the device.
Work Mode	TG501 supports DTU and MODEM modes
Modbus Work Mode	'Modbus Disable' to disable Modbus feature, while 'Network RTU' is for transparent transmit with serial ports, or read the device ADC/DI/Relay

Modbus Device Address	The Modbus slave device address, 1 is for TG501 itself that read ADC/DI/Relay states.
Modbus update Interval	The update interval of device upload Modbus data initiatively, 0 is for disable this feature.

3.1.2 Com Setting

Configure the com ports settings at “Com Setting” page, only the RS232-1 and RS485-0 be supported on standard TG501.

Note: RS485-1 setting only available if your TG501 is customized support up to 2-RS485 ports.

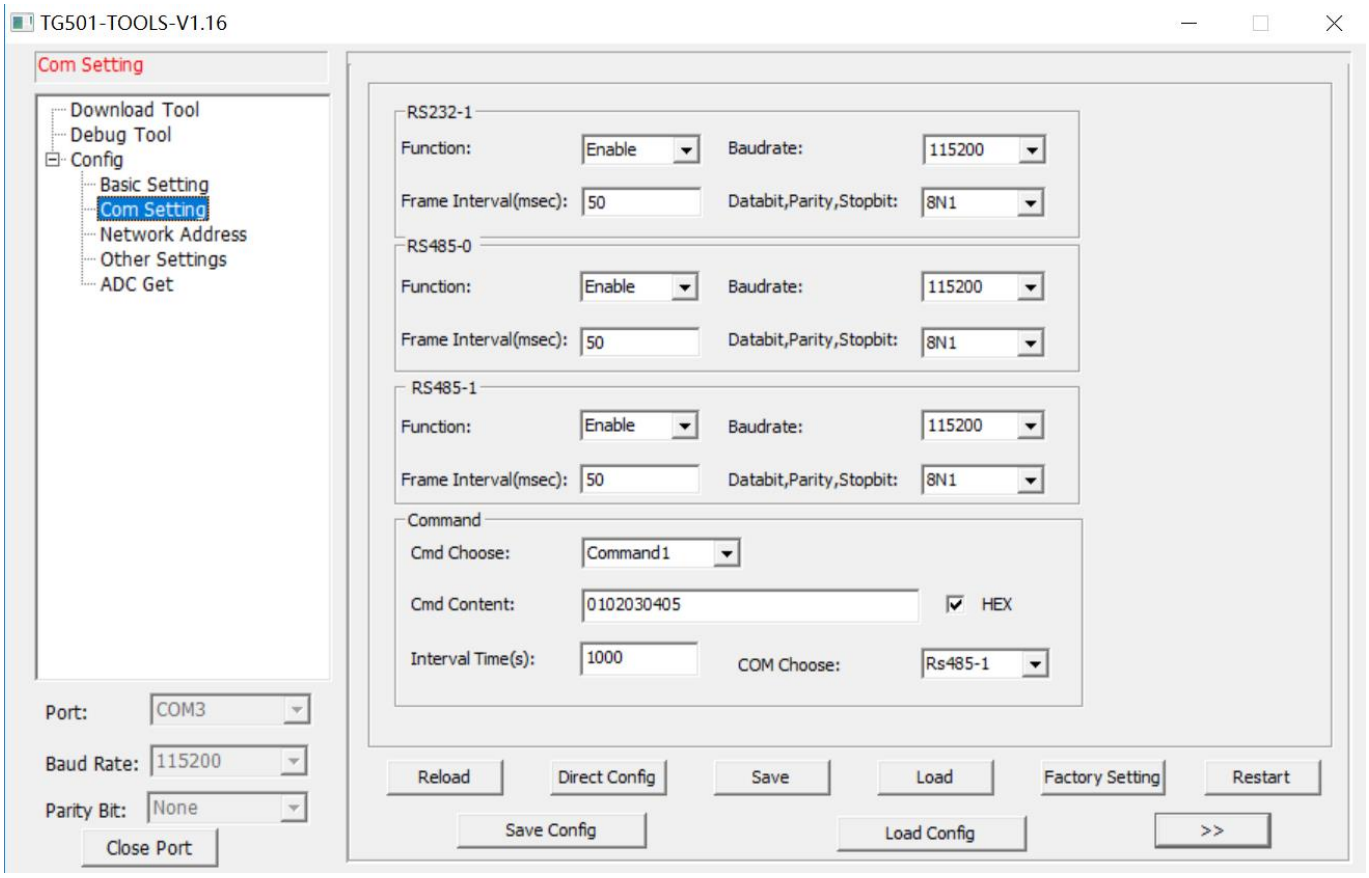


Figure 19: Com Setting

Parameter Name	Description
Function	Enable the serial com ports respectively, for standard TG501 RS232-1, RS485-0 are available. The RS485-1 will be valid only when your TG501 is customized to support 2-RS485.
Baud rate	Configure the baud rate of each serial port respectively.
Frame Interval	configure the frame interval of serial communication.

Databit, Parity, Stopbit	Set the Data bit, Parity, Stop bit for serial communication. 8E1, 8N1, 8O1 are available.
Cmd Choose	Configure the commands are sent from TG501 to slave devices, this is usually used on Modbus Master mode. You can set up 10 commands in total.
Cmd Content	Edit the command content
Hex	Choose String or HEX to send the command
Interval Time	Configure the interval of command sending
COM Choose	Select which serial com port be applied for this command individually.

3.1.3 Data center Setting

You can configure the data center for each serial com ports respectively on “Network Address” page, there are up to 5 data center can be configured.

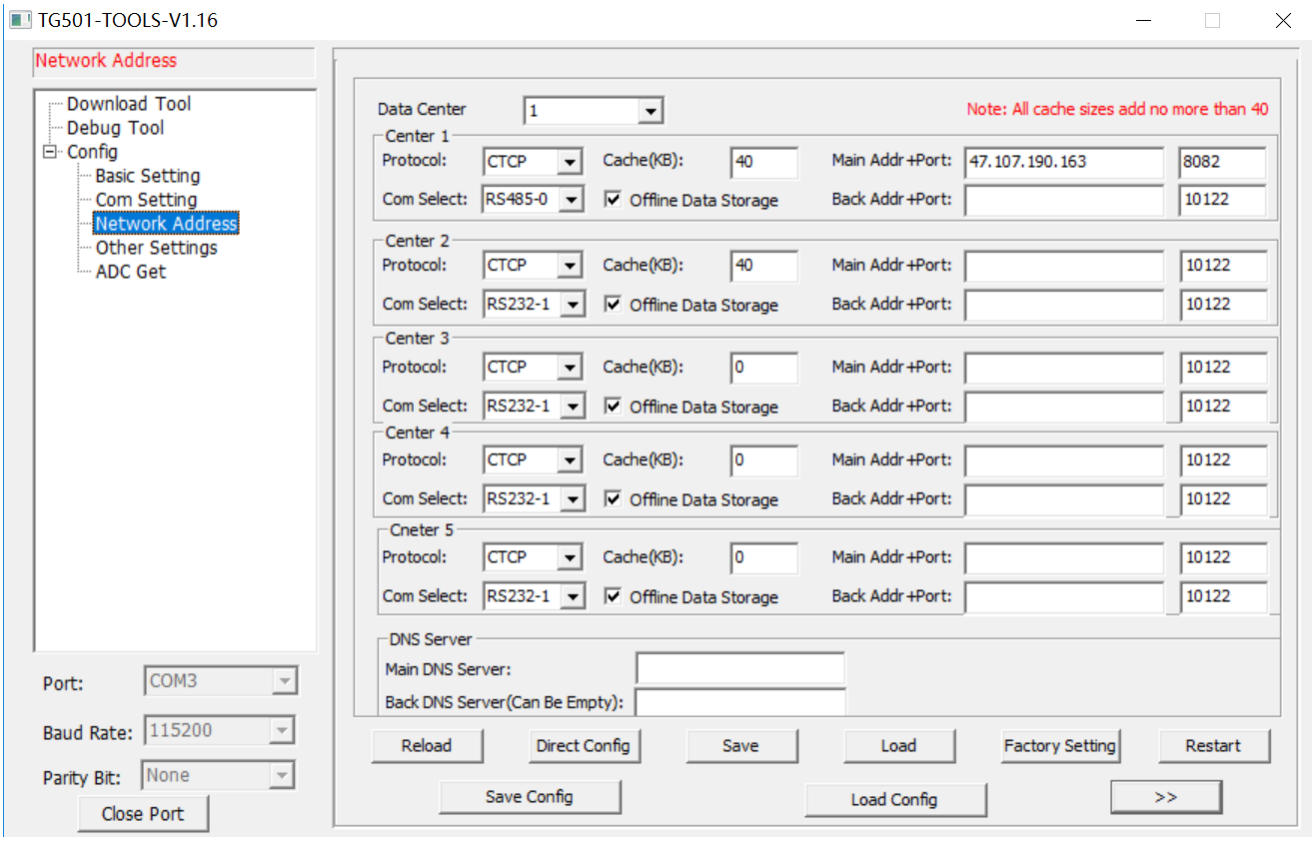


Figure 20: Data Center Setting

Parameter	Description
Data Center Number	Supports up to 5 data center, when choose number over 1(from 2-5), backup is invalid.
Center Protocol	Configure the protocol of com port communication, FTCP, CTCP, HTCP is for TCP protocol, the difference between those protocols are register data package, and we recommend you choose CTCP. UDP is for UDP protocol.
Cache	Configure the cache size of this communication channel, please note that all channels cache together should less than 40KB.
Center Addr+Port	Domain name or IP address supported.
Com Select	Choose the COM port to set
Offline Data Storage	Select whether to cache the data when the network fails, and it works only when the “Cache” field being configured valid value.
Main or Backup Center DNS Server Addr	When you use domain name for data center, you need a DNS server to convert the domain name to the IP address.

3.1.4 Other Setting

There are some other settings that may be requested to configure accordingly, like APN, heartbeat, etc.

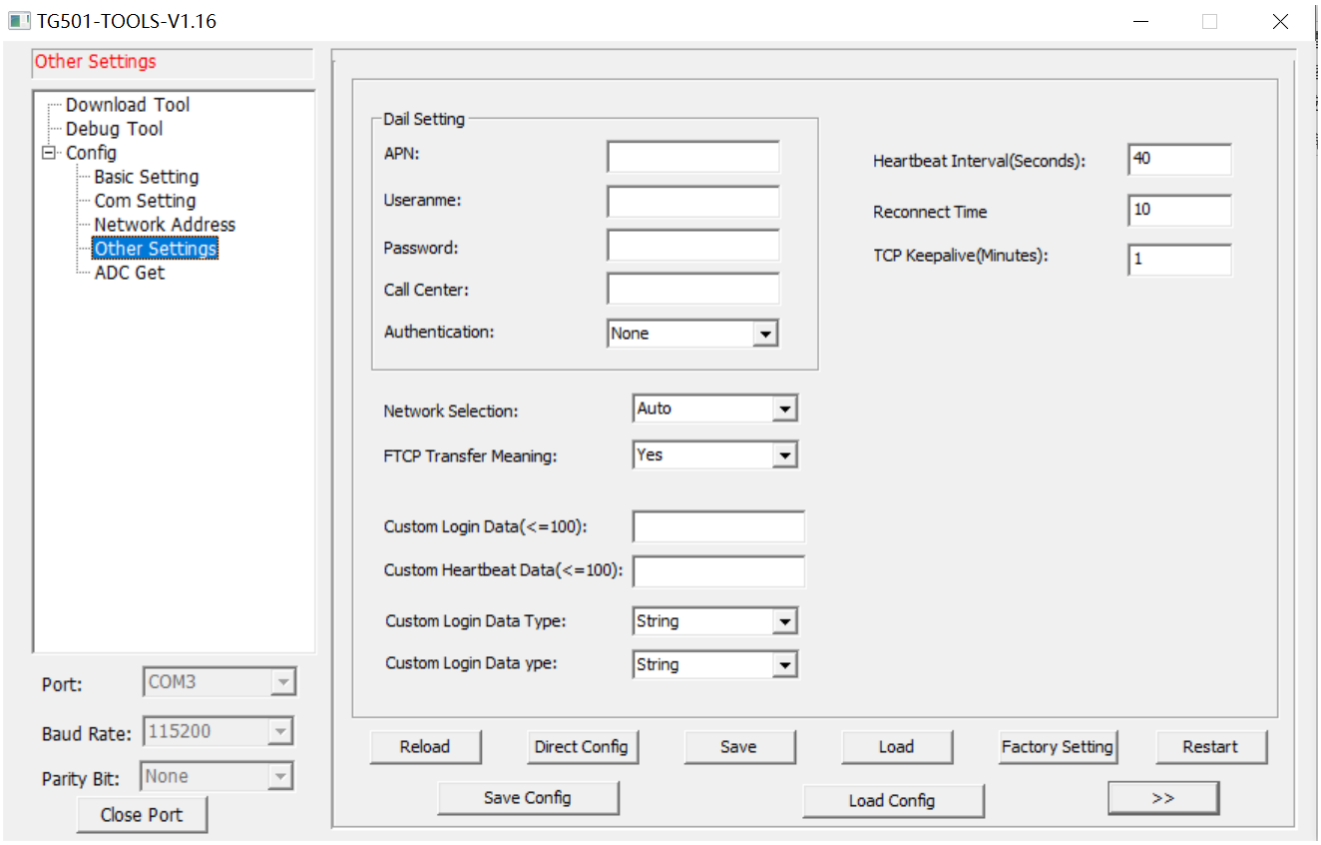


Figure 21: Other Settings

Parameter	Description
APN	APN of SIM card from your local carriers
Username	Username of APN
Password	Password of APN
Call Center	Call center number of APN
Heartbeat Interval	Heartbeat time, 60 seconds is suggested for TCP mode, and 31 seconds for UDP
Reconnect Time Interval	Waiting time for reconnection
TCP Keepalive	TCP level detection, keep it as default
Network Selection	Select the type of cellular network, LTE, GSM, or others.
FTCP Transfer Meaning	Choose whether to transfer the words during communication or not. If Yes, the device will transfer “0xfd” to “0xfd” and “0xed”, while “0xfe” to “0xfd” and “0xee”. If “No”, “0xfd” and “0xfe” perform fully transparent. You can ignore this setting if you choose CTCP.
Custom Login data	Customize the register package data, and it’s valid when the network protocol configured as CTCP or CUDP.
Custom Heartbeat data	Customize the heartbeat package data, it’s valid when the network protocol configured as CTCP or CUDP.
Custom Register/heartbeat data type	String or HEX

3.1.5 ADC Setting

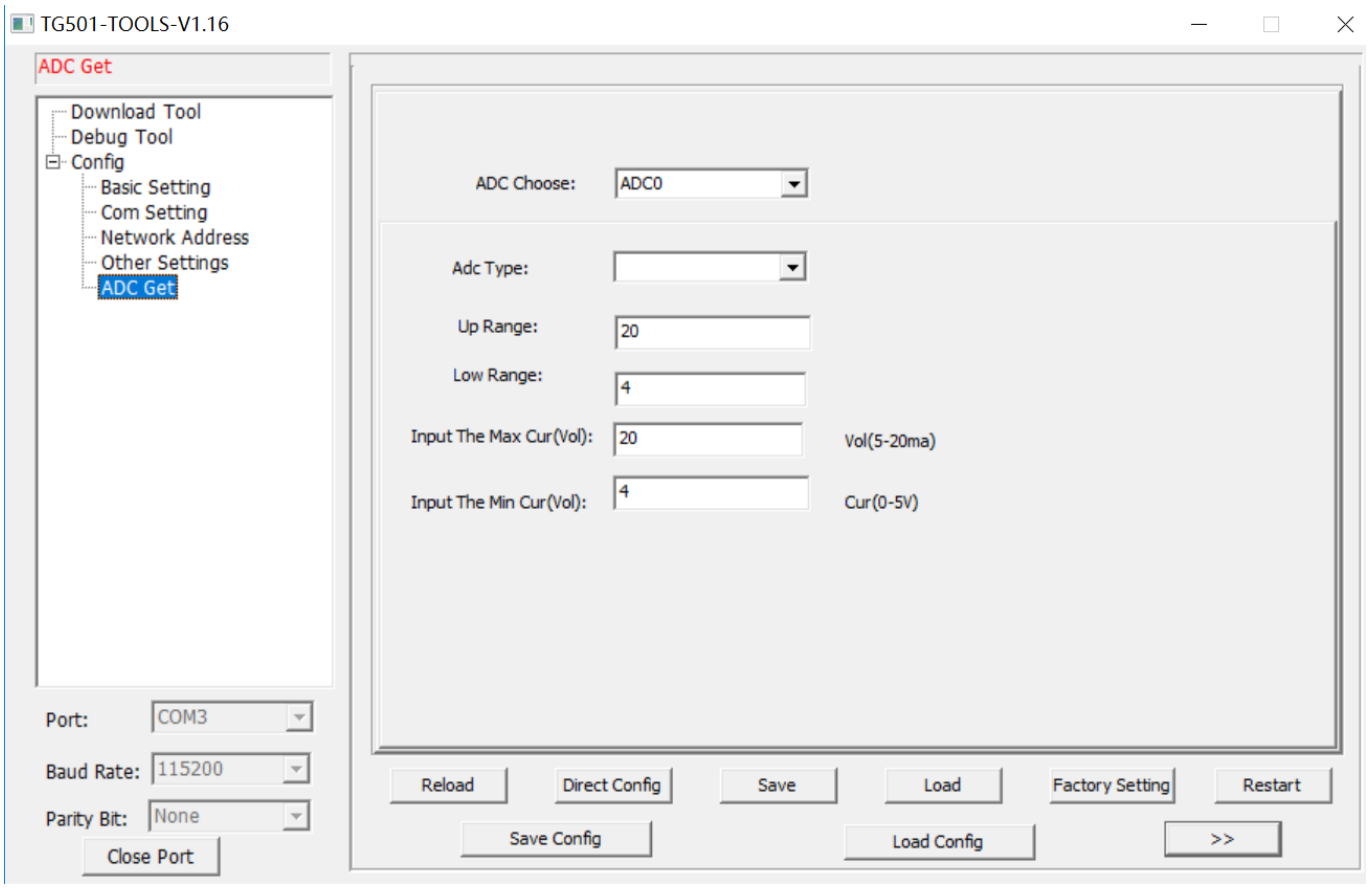


Figure 22: ADC Setting

Parameter Name	Description
ADC Choose	ADC0 to ADC2 is available for standard TG501, while ADC3 to ADC6 is for customized version TG501.
ADC type	Analog data type, Current or Voltage, the default is Current 4-20mA.
Upper Range	The upper range of analog input, refer to your sensor spec.
Lower Range	The lower range of analog input, refer to your sensor spec.
Input the Max Cur(Vol)	The upper range of the sensor corresponds to the current or voltage value input
Input the Min Cur(Vol)	The lower range of the sensor corresponds to the current or voltage value input

3.2 Modbus RTU Protocol

Please refer to Bivocom Modbus RTU protocol instruction for more details.

3.3 RTU Service Center Software

When use RTU TG501, you need our service center software to convert the data(analog input, digital input, etc) to real value, and set up the connection with your database server.

1) Go to www.bivocom.com to download this software and open it.
2) Click System, configure the service port the same as the port of RTU TG501 of item 3.1.5 above
3) Enable the database setting, configure the IP address(or domain name) and name of your database, as well as account and password.

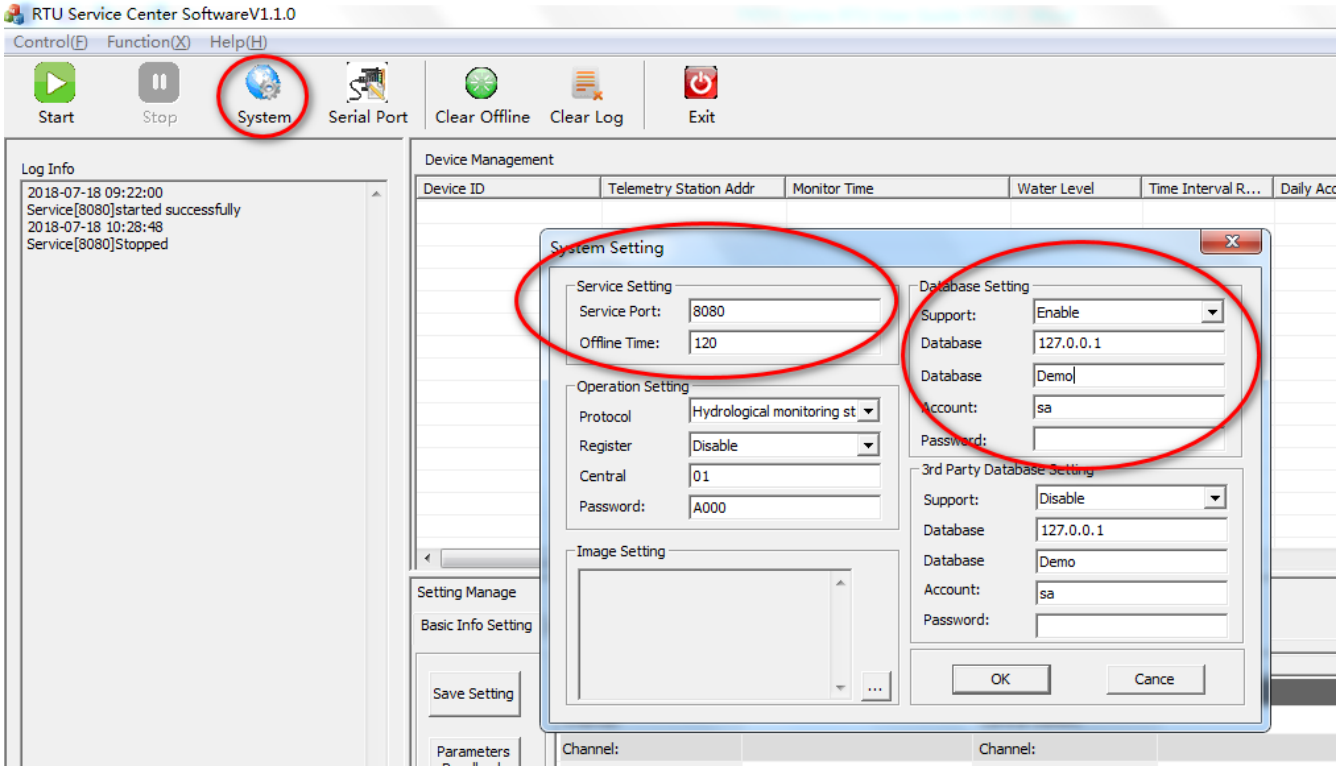


Figure 23: Service Center Software

4. Firmware Upgrade

4.1 Local Upgrade

Make sure the RTU TG501 is connected to your PC via RS232 cable, you can keep the device power off at this moment.

1) Click download

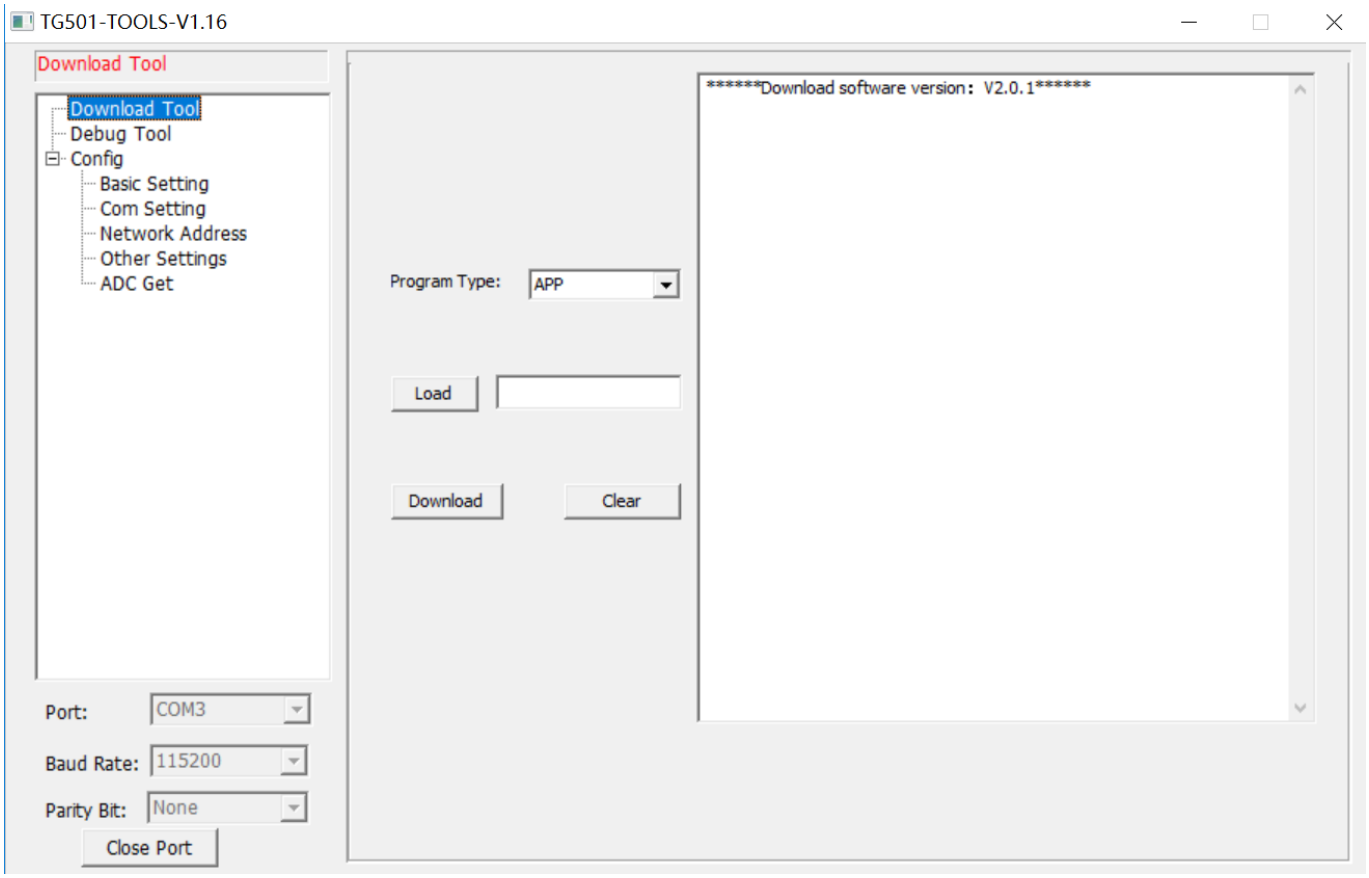


Figure 24: Download Tool

2) Click “Load”, and find the firmware you want to upgrade, then click download.

3) Power on the RTU, start to upgrade.

4) When it shows “download success ok”, that means firmware upgrade completed and successfully.

Appendix I AT Commands

1. Basic Setting

Configuration Item	AT Command	Description
Device ID	AT+IDNT=x	X: device ID Example：AT+IDNT=12345678
Modbus work mode	AT+MBCHNNL=x	Set Modbus work mode X: 0 disable MODBUS 1 Network RTU Example：AT+MBCHNNL=1
Device SIM Number	AT+SIMNO=xx	Set SIM Card No. Xx: the max length is 19 Example：AT+SIMNO=13812345678
Modbus Device Address（1-255）	AT+MBADDR=xx	Set the Modbus Device Address Xx: device address Example：AT+MBADDR=2
Work Mode	AT+PROTTXT=xx	Set Work Mode Xx: 0 DTU 1 MODEM Example: AT+PROTTXT=0
Modbus Update Interval	AT+MBUPSEC=xx	Xx: Second value Example: AT+MBUPSEC=10
RTC Setting	AT+EXCCLK=XX	Example: AT+EXCCLK=2019/04/19,16:51:00,5

2. Com Setting

Configuration Item	AT Command	Description
Function switch	AT+COMIFENyy=xx	yy: 1=RS232-1 2=RS485-0 xx: 0=disable 1=enable Example: AT+COMIFEN01=0
		yy:

Baud rate	AT+COMSPEEDyy=xx	1=RS232-1 2=RS485-0 xx: Baud rate Example: AT+TRANCOMSPEED01=115200
Frame Interval	AT+COMFRMINTRyy=xx	yy: 1=RS232-1 2=RS485-0 xx: frame interval value Example: AT+COMFRMINTR01=30
Databit, Parity, Stopbit	AT+COMPARITYyy=xx	yy： 1=RS232-1 2=RS485-0 x: 8N1,8E1,8O1 Example: AT+COMPARITY01=8E1
Command Content	AT+DETAILCONTyy=x	yy : 1-10 X:command content Example: AT+DETAILCONT03=01 03 00 00 00 22 C5 D3
hex	AT+DETAILCODEyy=x	yy : 1-10 X: 0=string 1=HEX Example: AT+DETAILCODE03=1
Interval Time	AT+DETAILTIMEyy=x	yy : 1-10 X: second Example: AT+DETAILTIME03=10
COM Choose	AT+DETAILCOMyy=x	yy : 1-10 X: 0 1 RS232-1 2 RS485-0 Example: AT+DETAILCOM03=2

3. Network Address

Configuration Item	AT Command	Description
Data Center	AT+SERNUM=x	Set the number of datacenter x：0-5，0=disable this feature Example: AT+SERNUM=1
Protocol	AT+TRANMODEyy=xx	Set the channel communication protocol yy：01-05=center No. x：0 ftcp 1 CTCP 2 HTCP 3 NUDP 4 CUDP 5 HUDP Example: AT+TRANMODE01=1
Cache	AT+SERSVLENyy=xx	yy：01-05=center No. x：Cache size Example: AT+SERSVLEN01=10
Main Addr	AT+MULTISERyy=xx	yy：01-05=main server，06-10=backup server xx：address Example: AT+MULTISER01=isodev.picp.net
Port	AT+MULTIPORTyy=xx	yy: 01-05=main server port accordingly, 06-10=backup server port x: 0-65535 Example: AT+MULTIPORT01=10121
Com Select	AT+SERCOMTYPEyy=xx	yy: 01-05 center No. xx: 0 Rs232-1 1 Rs485-0 Example: AT+SERCOMTYPE01=1
Offline Data Storage	AT+SERSVOFFyy=xx	yy: 01-05=center No. xx: 0 disable 1 enable Example: AT+SERSVOFF01=0
Main DNS Server	AT+MULTIDNS01=xx	xx：DNS address Example: AT+MULTIDNS01=8.8.8.8
Backup DNS Server	AT+MULTIDNS02=xx	xx：Backup DNS server Example: AT+MULTIDNS02=8.8.8.8

4. Other Settings

Configuration Item	AT Command	Description
APN	AT+APN=xx	xx：APN value Example: AT+APN=nbiot
APN Username	AT+USERNAME=xx	xx：APN username value Example: AT+USERNAME=test1
APN Password	AT+USERPASSWORD=xx	xx：APN password value Example: AT+USERPASSWORD=testpwd
Call center	AT+CALLNO=xx	Set the APN call center xx：call center value Example: AT+CALLNO=
Heartbeat Interval	AT+HRTSEC=x	x：0-65535 second, 0=disable heartbeat Example: AT+HRTSEC=40
Reconnect Time	AT+RECONSEC=x	x：0-65535 second Example: AT+RECONSEC=10
TCP Keepalive	AT+KPLVMIN=x	x：keepalive interval Example: AT+KPLVMIN=12
Network Selection	AT+NETMODE=x	X: 0 auto 1:GSM only 2:TD-SCDMA only 3:WCDMA only 4. CDMA only 5. HDR only 6. LTE only Example: AT+NETMODE=0
FTCP Transfer Meaning	AT+CONVERT=x	x : 0=No, 1=Yes, Example: AT+CONVERT=0
Custom Login Data	AT+SELFLGN=x	X: register data Example: AT+SELFLGN=hello
Custom heartbeat Data	AT+SELFHRT=x	Set the heartbeat data X: heartbeat data value Example: AT+SELFHRT=hello
Custom Login data type	AT+SELFLGNHEX=x	Set the custom register data type x : 0=string,1=hex Example: AT+SELFLGNHEX=0
Custom heartbeat data	AT+SELFHRTHEX=x	Set the custom heartbeat data type

Type		x : 0=string,1=HEX Example: AT+SELFLGNHEX=0

5. ADC Get

Configuration Item	AT Command	Description
ADC type	AT+ADCTYPEyy=xx	Set the ADC input type yy：00-02=adc0 to adc2 xx：0=current 1=voltage Example: AT+ADCTYPE02=0
Up Range	AT+ADCUPPRNGyy=xx	yy：01-08 = ADC0 to ADC7 xx：range value Example: AT+ADCUPPRNG01=120
Low Range	AT+ADCLOWRNGyy=xx	yy：01 to 08，= ADC0 to ADC7 xx：range value Example: AT+ADCLOWRNG01=10
Input the Max Cur(Vol)	ATADCCURUPLyy=xx	yy：00 to 02，=ADC0 to ADC2 xx: current range 4-20mA，voltage range 0-5V Example: AT+ADCTYPE02=0 AT+ADCCURUP02=23
Input the Min Cur(Vol)	AT+ADCCURLOWyy=xx	yy：00 to 02，=ADC0 to ADC3 xx: current range 4-20mA，voltage range 0-5V Example: AT+ADCCURLOW02=4

Appendix II Data Structure

No	Parameter	Description	Example
0	Unsigned 16bit AB	unsigned 16bit integer (2 byte), low byte first	Example: 01 03 02 11 22 0D 34 Note：HEX 2211 DEC 8721
1	Unsigned 16bit BA	unsigned 16bit integer (2 byte), high byte first	Example: 01 03 02 11 22 0D 34 Note: HEX 1122 DEC 4386
2	Signed 16bit AB	Signed 16bit integer (2 byte), low byte first	Example: 01 03 02 11 22 0D 34 Note: HEX 2211 DEC 8721
3	Signed 16bit BA	Signed 16bit integer (2 byte), high byte first	Example: 01 03 02 11 22 0D 34 Note: HEX 1122 DEC 4386
4	Unsigned 32bit ABCD	Unsigned 32bit integer (4 byte)	Example: 01 03 02 11 22 33 44 C6 C3 Note: HEX 44332211 DEC 1144201745
5	Unsigned 32bit BADC	Unsigned 32bit integer (4 byte）	Example: 01 03 02 11 22 33 44 C6 C3 Note: HEX 33441122 DEC 860098850
6	Unsigned 32bit CDAB	Unsigned 32bit integer (4 byte)	Example: 01 03 02 11 22 33 44 C6 C3 Note: HEX 22114433 DEC 571556915
7	Unsigned 32bit DCBA	Unsigned 32bit integer (4 byte)	Example: 01 03 02 11 22 33 44 C6 C3 Note: HEX 11223344 DEC 287454020
8	Signed 32bit ABCD	Unsigned 32bit integer (4 byte)	Example: 01 03 02 11 22 33 44 C6 C3 Note: HEX 44332211 DEC 1144201745
9	Signed 32bit BADC	Signed 32bit integer (4 byte)	Example: 01 03 02 11 22 33 44 C6 C3 Note: HEX 33441122 DEC 860098850
10	Signed 32bit CDAB	Signed 32bit integer (4 byte)	Example: 01 03 02 11 22 33 44 C6 C3 Note: HEX 22114433 DEC 571556915
11	Signed 32bit DCBA	Signed 32bit integer (4 byte)	Example: 01 03 02 11 22 33 44 C6 C3 Note: HEX 11223344 DEC 287454020

12	Float ABCD	Signed 32bit float (4 byte)	Example: 01 03 02 11 22 33 44 C6 C3 Note: HEX 44332211 Float 716.532288
13	Float BADC	Signed 32bit Float (4 byte)	Example: 01 03 02 11 22 33 44 C6 C3 Note: HEX33441122 Float 0.000000
14	Float CDAB	Signed 32bit Float (4 byte)	Example: 01 03 02 11 22 33 44 C6 C3 Note: HEX22114433 Float 0.000000
15	Float DCBA	Signed 32bit Float (4 byte)	Example: 01 03 02 11 22 33 44 C6 C3 Note: HEX11223344 Float 0.000000