User Manual

RTU-140

(4G remote terminal device)

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Important Information

Warranty

All products manufactured by ICP DAS are under warranty regarding defective materials for a period of one year, beginning from the date of delivery to the original purchaser.

Warning

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Contact us

If you encounter any problems while operating this device, feel free to contact us via mail at: service@icpdas.com . We guarantee to respond within 2 working days.

1. Introduction

The RTU-140 is a smart 4G remote terminal with GPS. It can be used in M2M applications to transmit data from GPS and Modbus devices over a defined time via LTE / WCDMA. Data from GPS and Modbus devices can also be stored in a Micro SD card as a remote data logger. With a simple I/O linkage function, the RTU-140 can be remotely controlled in the field.
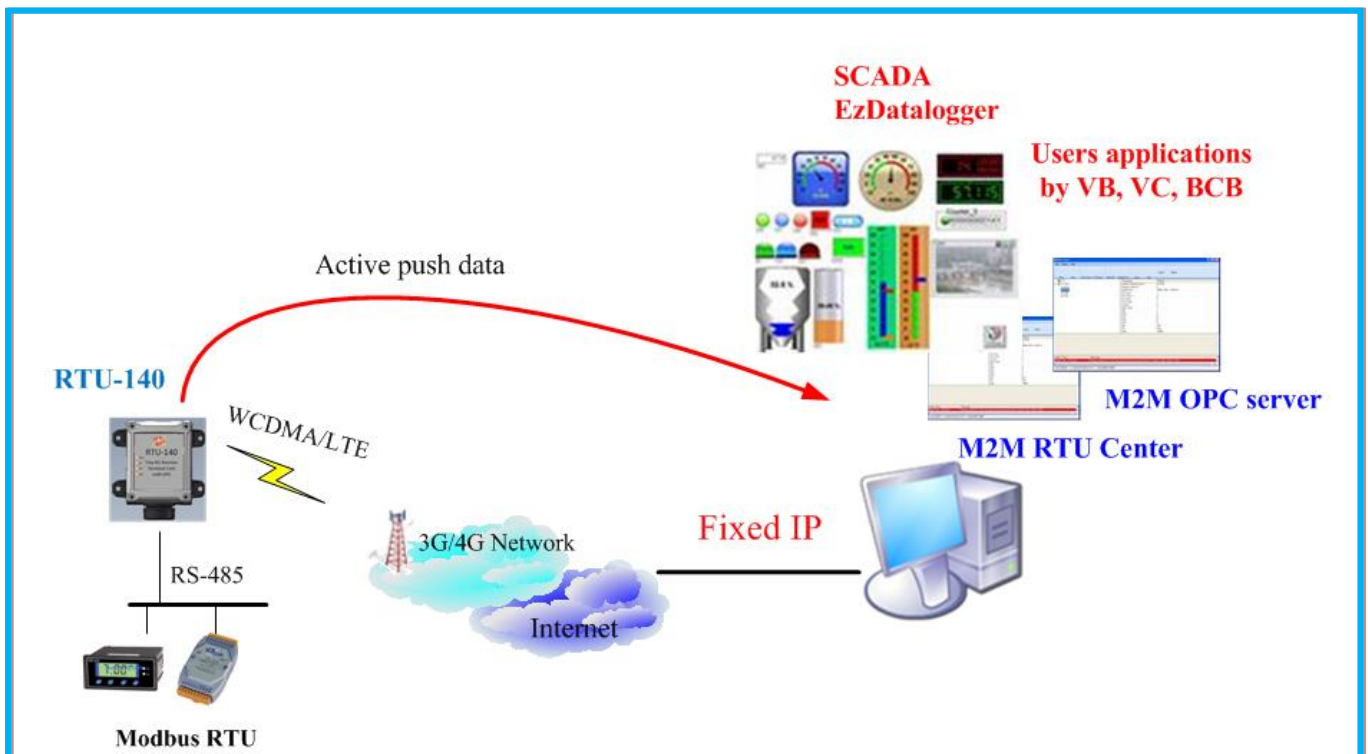
M2M RTU Development Tools SDK- M2M RTU API

Users are provided to develop their own applications for the G-4500 RTU, GT-540-3GWA and RTU-140 series. (need to be used with M2M RTU Center)

Detailed description and software download:

http://ftp.icpdas.com/pub/cd/usbcd/napdos/m2m/rtu/m2m_rtu_win32_api

M2M Software - RTU Center

M2M RTU Center is the management software of M2M RTU series. It has powerful functions, can conveniently manage remote M2M RTU devices, and has excellent IO data processing capability, which improves the convenience of users managing several RTU devices, and is

effective. Reduce the hassle of processing large amounts of IO data. Applicable to RTU-140, G-4514 RTU and other M2M RTU product lines. It can monitor the built-in IO, GPS data and connected Modbus RTU devices of M2M RTU products. Users can use any SCADA software (eg InduSoft, iFix...) to match the M2M OPC Server and M2M RTU Center or directly use the Ez Data logger software from ICP DAS to easily establish a remote device monitoring system.

Detailed description and software download:

http://ftp.icpdas.com/pub/cd/usbcd/napdos/m2m/rtu/rtu_center/software/

Support OPC server

For the M2M OPC server provided by ICP DAS, it is easy to integrate ICP DTU products into various SCADA systems.

Detailed description and software download:

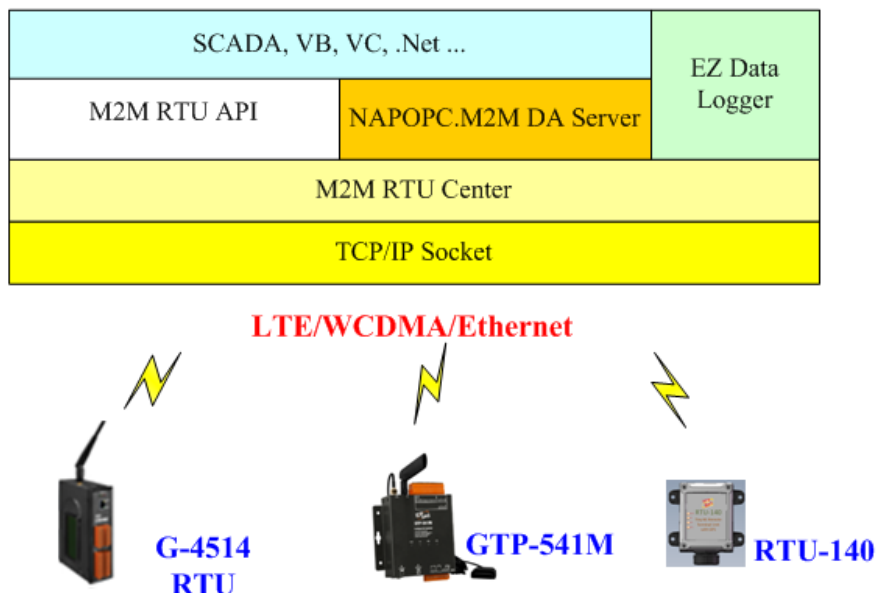http://ftp.icpdas.com/pub/cd/usbcd/napdos/m2m/rtu/napopc.m2m

Support EzDatalogger

From now on, Ez Data logger supports WCDMA/GPRS RTU products.

Detailed description and software download:

http://www.icpdas.com/products/Software/ez_data_logger/ez_data_logger.html

1.1 Features

◼ Soft and hard

- ◆ Support for WCDMA 850/2100 MHz

- ◆ Support LTE-FDD B1/B3/B5/B7/B8/B28

- ◆ Automatic / continuous 3G / 4G connection management

- ◆ RS-485 supports up to 3 ModBus RTU devices

- ◆ Support for M2M OPC Server and M2M API tools

- ◆ Support data log file stored on Micro SD card

- ◆ Support 3.7V backup lithium battery (optional)

- ◆ Support input power +10VDC~+30VDC

- ◆ IP66 waterproof

- ◆ Support GPS function

◼ application

- ◆ Hydrological monitoring system

- ◆ Line management system

- ◆ Power management system

- ◆ I/O data recorder

RTU-140 architecture diagram
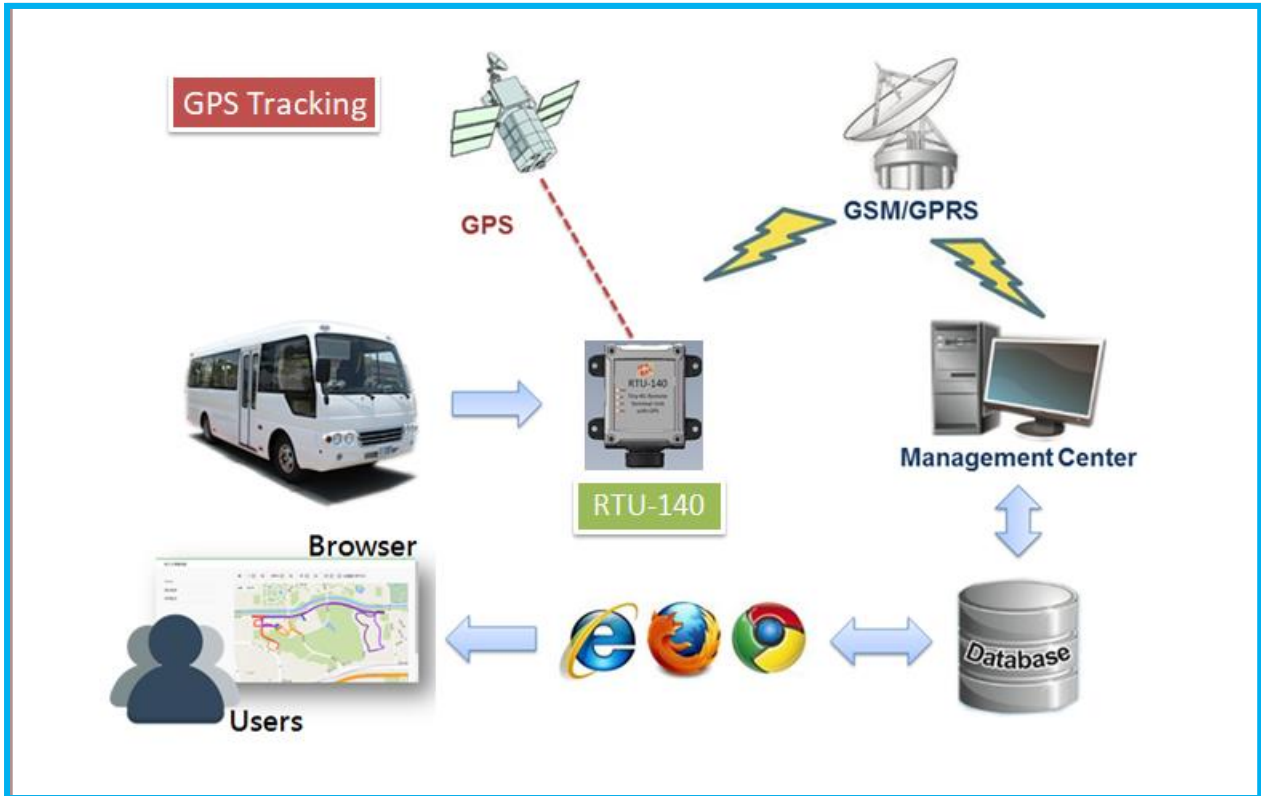
1.2 specification

| Module	RTU-140
System	
CPU	32 bit, Microprocessor
Micro SD Interface	4 GB Max.
4G System	
LTE-FDD Frequency band	B1/B3/B5/B7/B8/B28
3G System	
Frequency band	WCDMA 850/2100 MHz
GPS System	
Satellite navigation system	GPS + GLONASS
Sensitivity	Tracking = up to -165 dBm; Acquisition = up to -148 dBm
Positioning time	Cold / Warm / Hot Start Time：35 / 30 / 1 sec. at open sky and stationary
Support agreement	NMEA 0183 version 4.0
Sequence	
Utility Port	USB: only for settings
COM 1	RS-485: D+, D-（Used to connect to ModBus RTU devices）
Power supply	
Power input	2W; +10V_{DC} ~ +30V_{DC}. Support 3.7V lithium battery backup
Power consumption	Idle: 36mA @ 24VDC; Data transmission: 60mA @ 24VDC; Full load: 65mA @ 24VDC;Sleep: 65mA @ 3.7VDC;
Power input range	+10 V_{DC} ~ +30 V_{DC}
Mechanism	
Shell	Plastic
Size(W x L x H)	94 mm x 82 mm x 55 mm (long*width* high)
Waterproof level	IP66
Installation form	DIN rail; wall mount

Indicator light	
LEDs	4 indicator LEDs
Surroundings	
Operating temperature	-25 ℃ ~ +75 ℃
Storage temperature	-30 ℃ ~ +80 ℃
Humidity	5 ~ 95% , non-condensing

2. Hardware appearance

■ Appearance and foot configuration
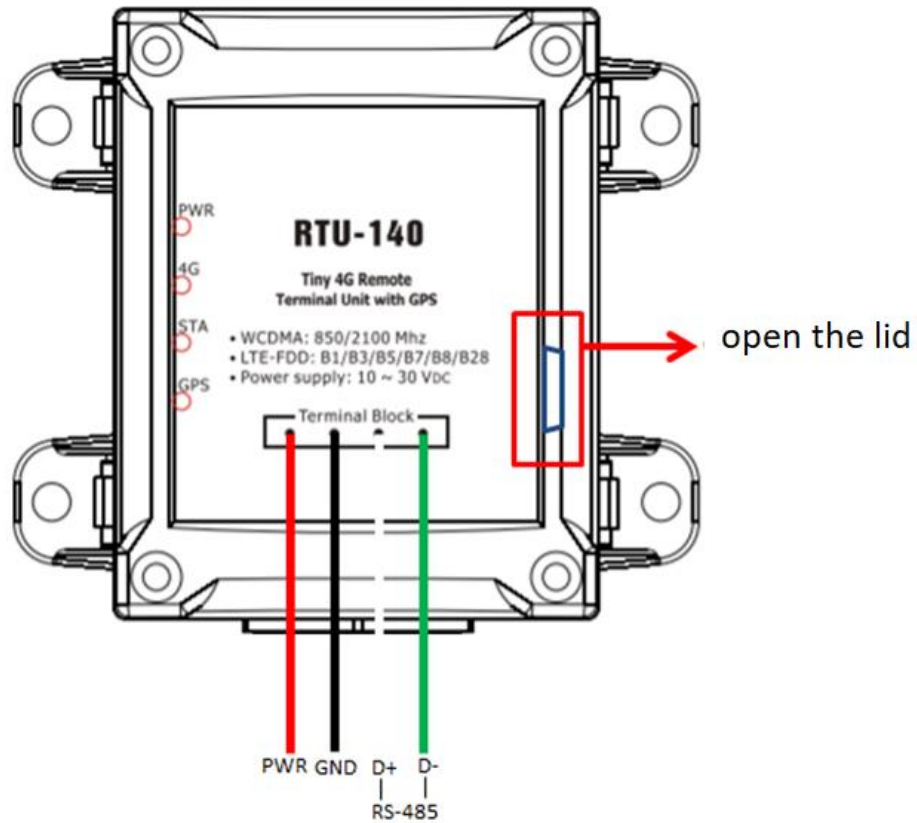
COM Port and Power Input		
Pin		**Description**
Power Input： **+10V**DC **~** **+30V**DC	**Black**	P.GND
	Red	PWR
COM **RS-485**	**Green**	D-
	White	D+
Utility Port	**Red frame**	Micro USB

2.1 LED indicator

The RTU-140 provides four LED indicators. The table below will indicate the status indication of the LED light.
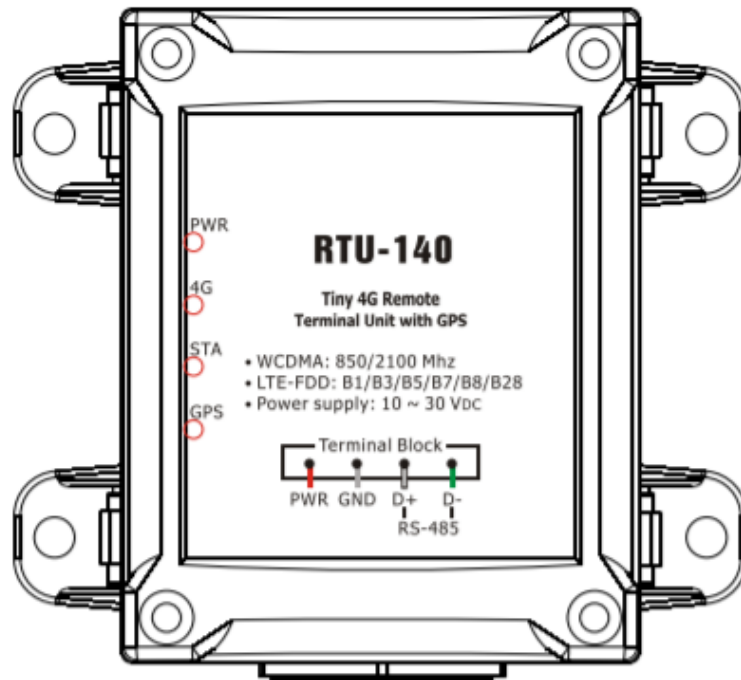
| LED Name	LED Status	LED Description
PWR	Hengliang	Power supply
	Flashes every 0.5 seconds	Battery charging
4G	Hengliang	4G network search
	Flashes every 0.2 seconds	Data transfer / 4G network registration completed
	Flashes once every 0.8 seconds	3G network registration completed
	Not bright	Power off or sleep state
STA	Flashes every 0.05 seconds	Pin code error
	Flashes every 0.25 seconds	Modem communication
	Flashes every 0.5 seconds	Modem idle
GPS	Flash once per second	GPS successfully positioned
	Hengliang	GPS is not yet positioned

2.2 Install SIM card

(1) Insert a confirmed SIM card (you can test it with your phone first), as shown below
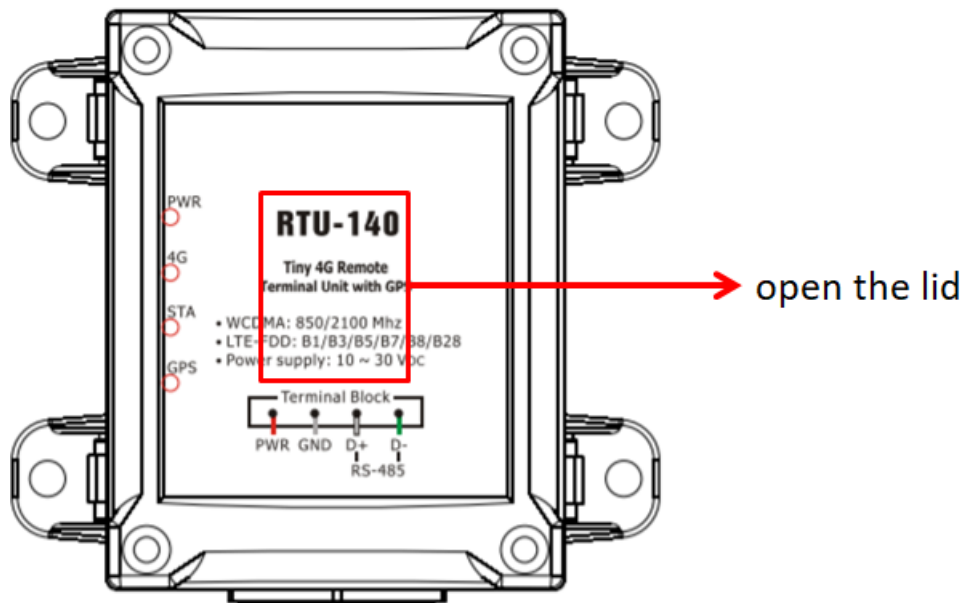
(2) Connect DC.+VS (PIN3) and DC.GND (PIN2) to the power supply or install the battery
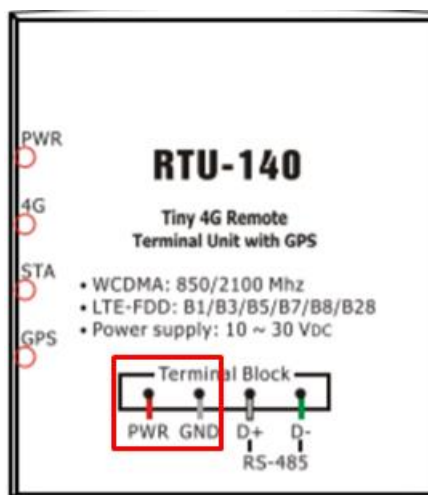
3. Environment settings before installing RTU-140 Utility

Users can use the GTP-541M Utility to set parameters or view debug messages. This program requires a .NET Framework 2.0 or higher runtime environment and FTDI USB Device to be executed on the PC. You can download .NET Framework 2.0, .NET Framework 3.5 and FTDI Device from the following URL.

◆Microsoft .NET Framework 2.0

https：//www.microsoft.com/en-us/download/details.aspx?id=1639

◆Microsoft .NET Framework 3.5

https：//www.microsoft.com/en-us/download/details.aspx?id=21

◆FTDI Device

https://www.ftdichip.com/Drivers/D2XX.htm

3.1 Install RTU-140_Utility

Execute RTU-140_Setup_V100.exe.　The installation screen is as follows:

(1)Select the installation directory, the default path is "C:\ICPDAS\RTU-140 _Utility", after confirming, press "Next" to continue
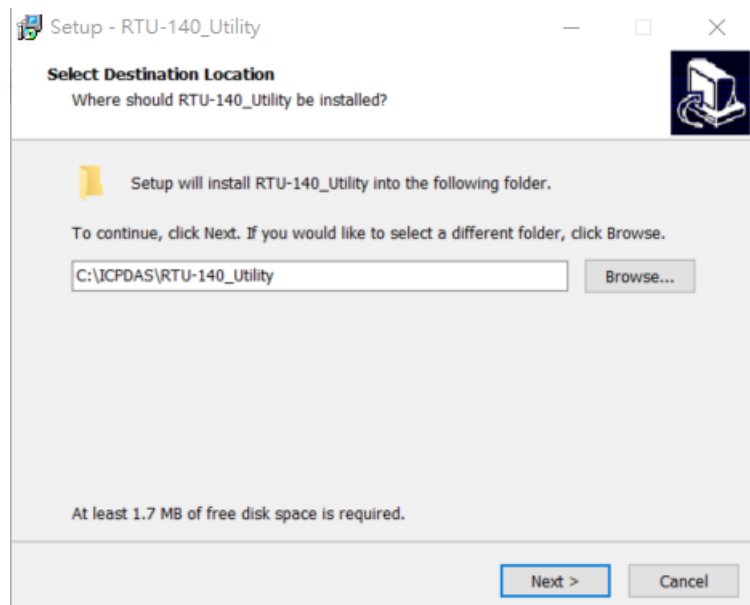
(2)Select the path in "All Programs", after confirming, press "Next" to continue
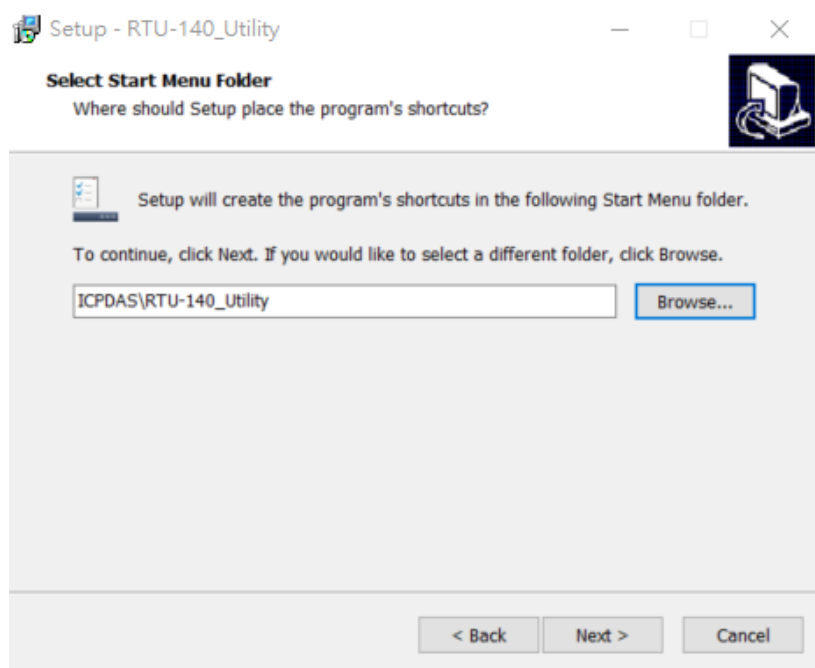
(3)Choose whether to create a shortcut on the desktop, after confirming, press "Next" to continue
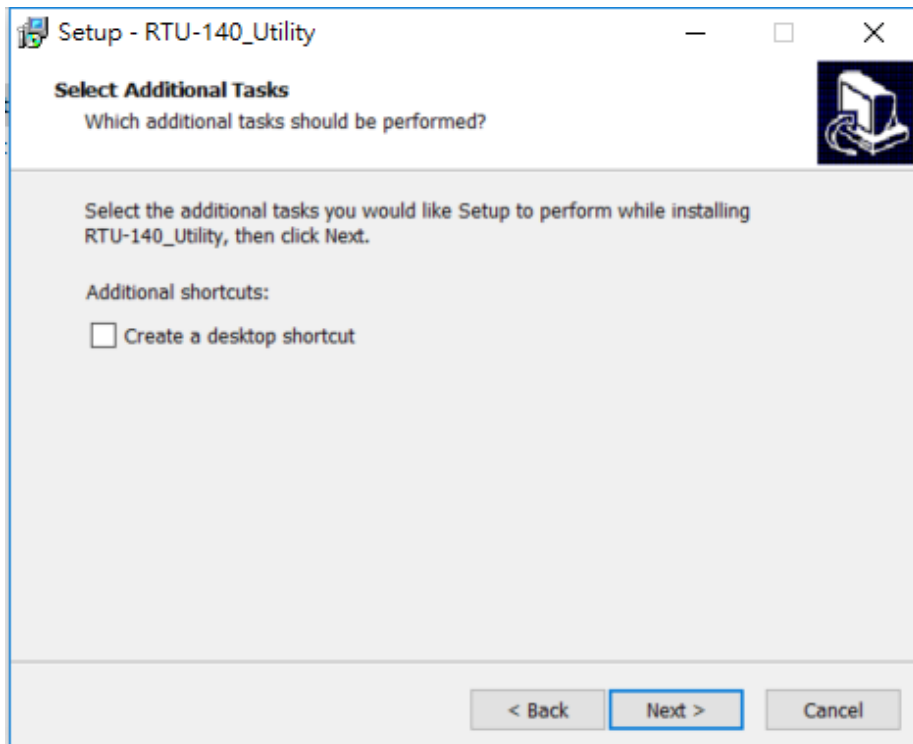
(4)Select "Install" to start the installation.
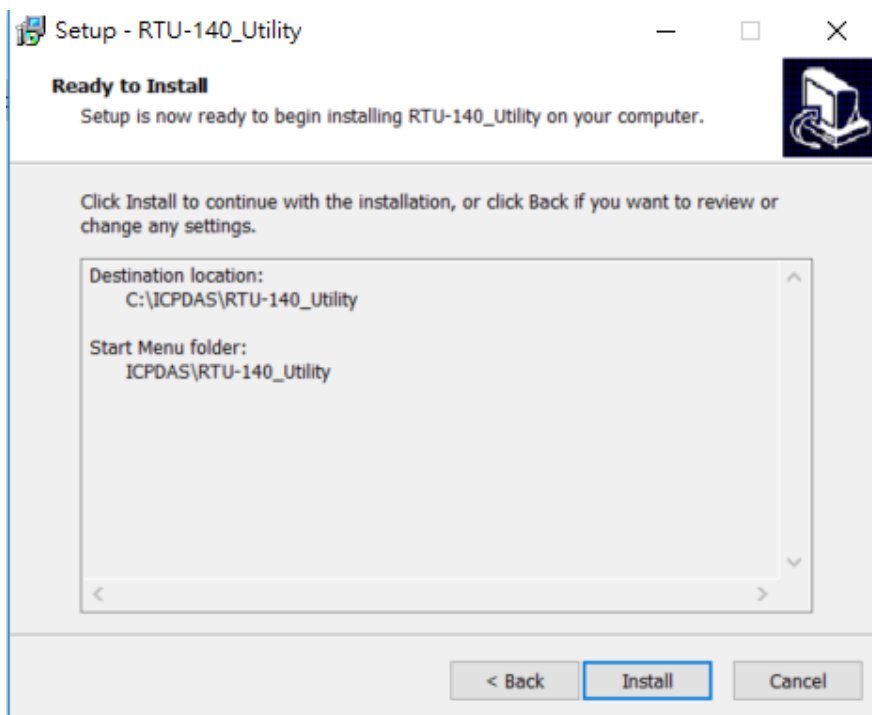
(5)The installation is complete
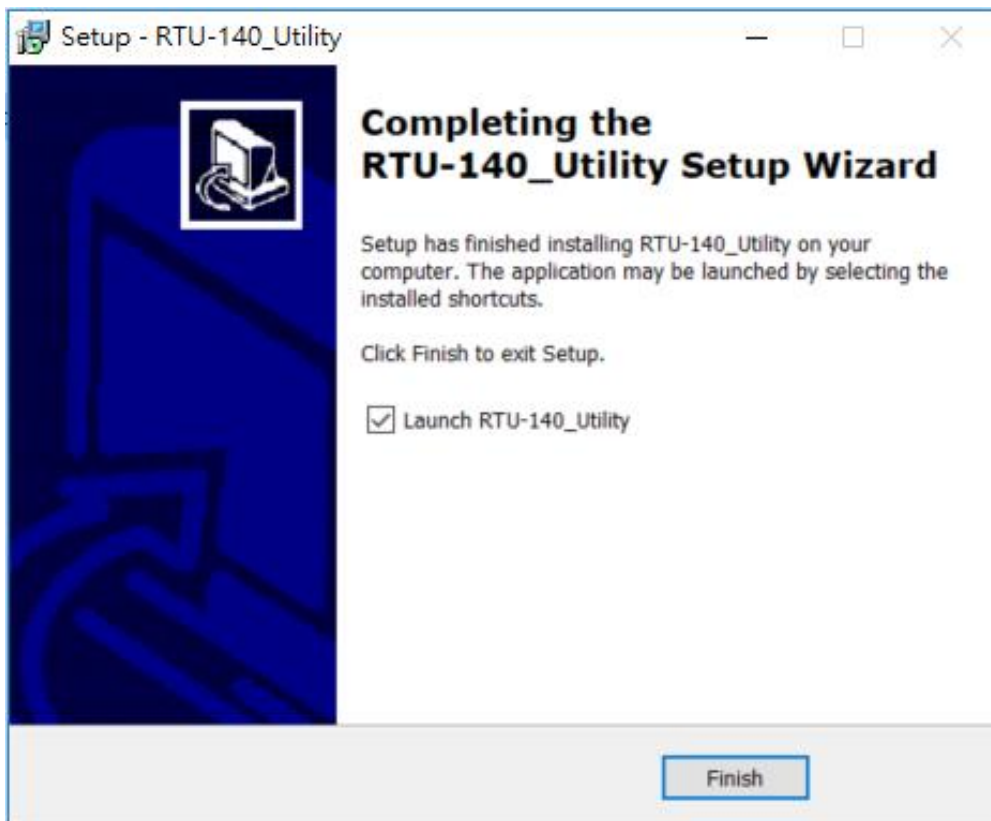
4. Turn on the Utility operation instructions.

一、 **Confirmation before opening Utility**

    1. Confirm that the USB port in the red box below the RTU-140 is connected to the PC.
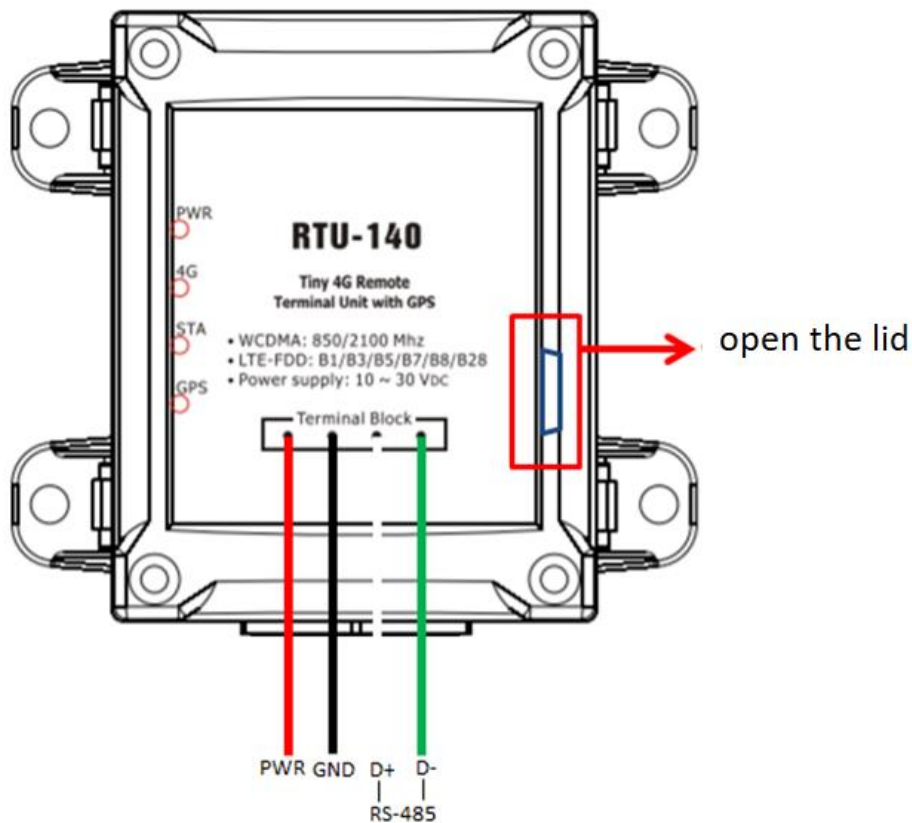
    2. Turn on the RTU-140 power supply and confirm that the PWR light is on normally and you can start operating the Utility.exe.

5. Utility main screen description

The RTU-140 Utility layout mainly includes the following parts, which are described as follows:
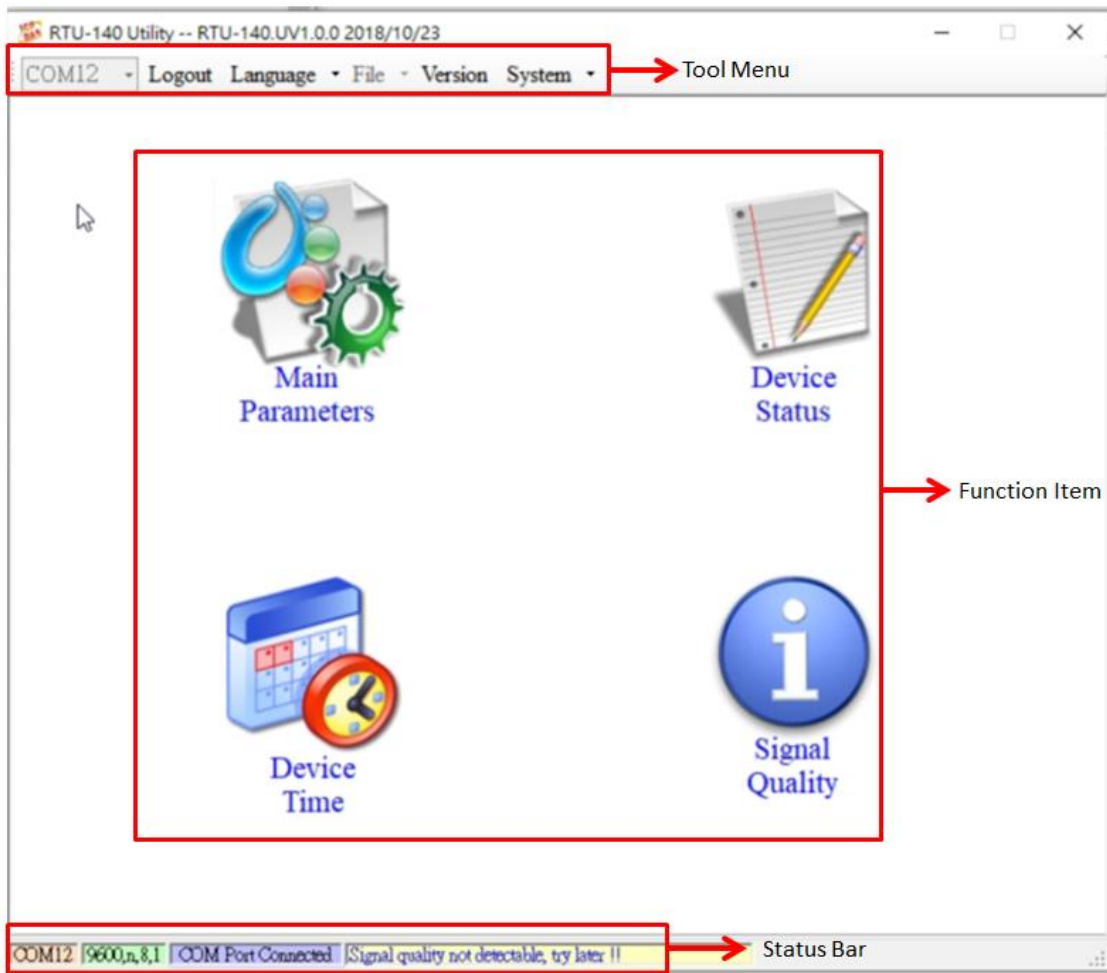
Tool Menu

◆COM：

Select PC-side COM PORT connected to RTU-140

◆Login/Logout：

Before you can do anything with the RTU-140, you must log in. After the login is successful, the option will become Logout, and the options in the Utility will allow the operation. If the SMS machine has been reopened or turned off, you must log in again.

◆Language:

RTU-140 Utility interface text selection, currently only supports English

◆Version：

RTU-140 Firmware and Utility version information

◆System：

Recover to Factory Settings, Restart RTU-140 (Reset RTU-140) and Debug three functions

Function Item

◆Main Parameter：
RTU-140 related settings.

◆Device Status:

Check SD Card, GPRS and GPS status.

◆Device Time：

Query and set the RTU-140 device time.

◆Signal Quality：

Query the signal strength of the current device.

Status Bar

Display information about the operation of the RTU-140 Utility, from left to right, in order

(1)PC-side COM Port number used by the Utility.

(2)Transmission parameter setting of COM Port.

(3)The current connection status of the COM Port.

(4)The result of each operation, such as the success of the "storage" action.

5.1 Select the operating interface language

In the drop-down menu Language, you can select the interface text of the RTU-140 Utility. Currently, only the English version is supported.
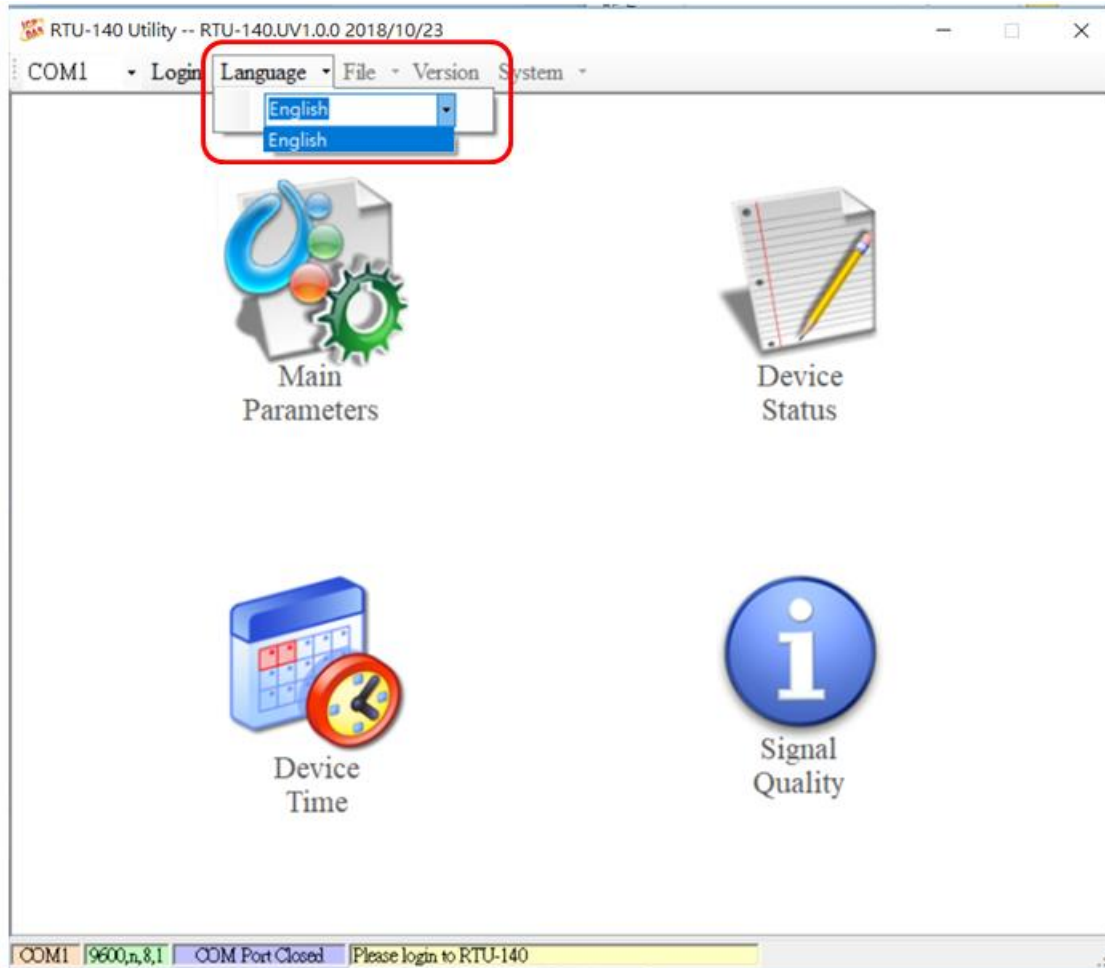
5.2 Login

To set the parameters of the RTU-140, you must log in first through the login window, as explained below:

      (1)   Select the COM Port number on the computer and RTU-140 connection

      (2)   Press "Login"
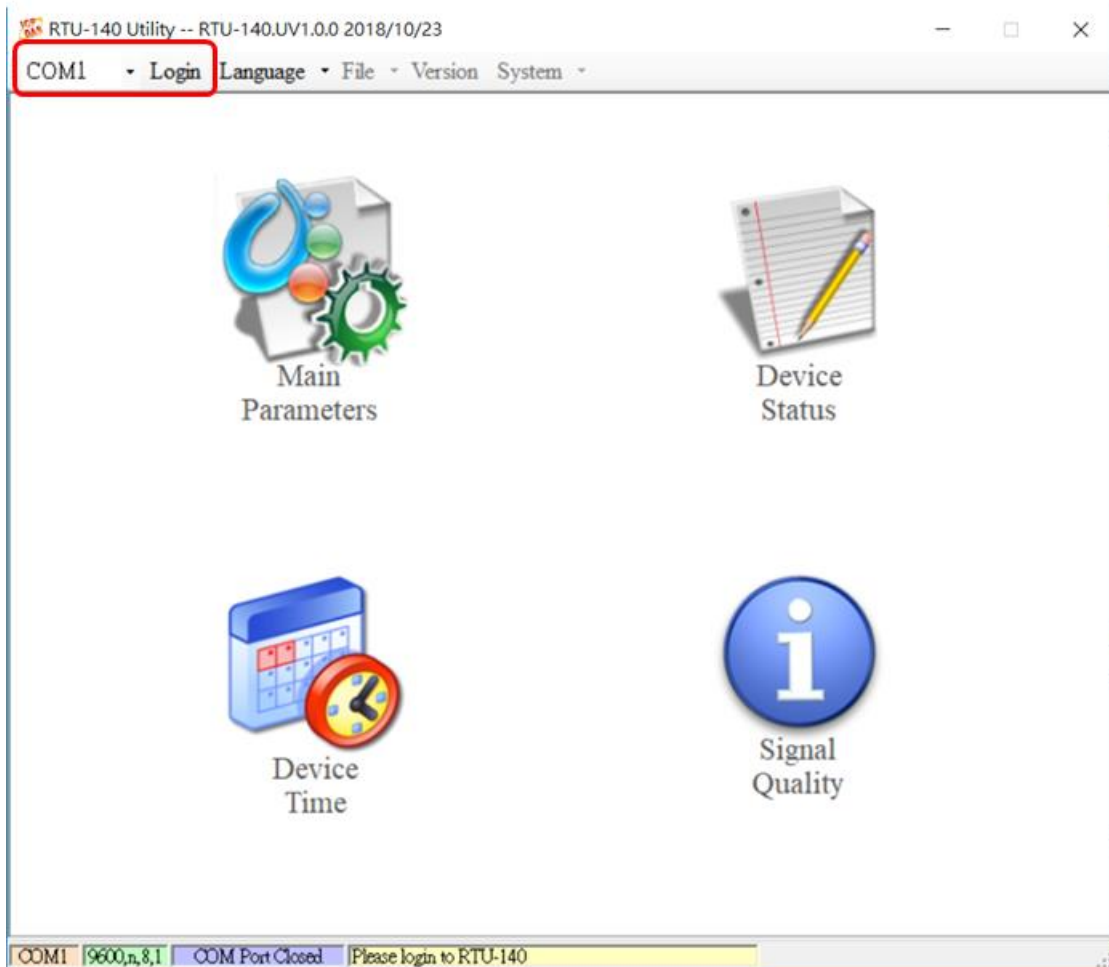
If the PIN code recorded in the RTU-140 is incorrect, the status light of the RTU-140 will flash once every 50ms after power-on. When logging in, the Utility will ask for the PIN code or PUK code. The description is as follows:

(1) Request a PIN code

If the PIN code in the SIM card is still valid, a window asking for the PIN code will appear, as shown below. If the PIN code is entered incorrectly and exceeds the number of allowed errors, the PIN code will be invalid. A window asking for the PUK code will appear.
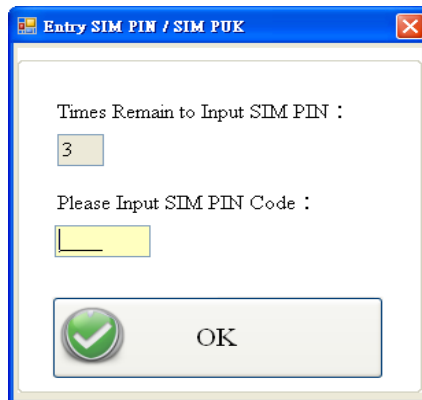
(2) Request to enter PUK code and new PIN code

If the PIN code in the SIM card fails, a window asking for the PUK code will appear, as shown below. If the PUK code is continuously input incorrectly and exceeds the number of allowed errors, the SIM card will be invalidated. Therefore, please confirm the correct PUK code before inputting.
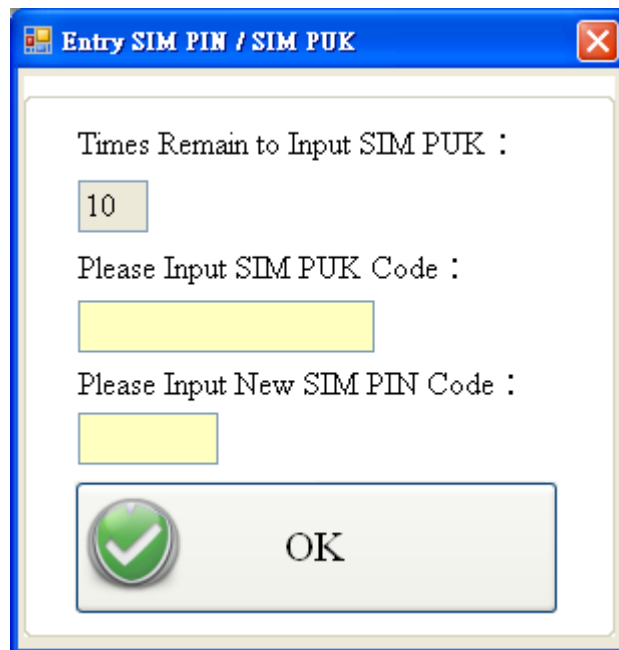
If the entered PIN or PUK code is correct, wait for the STA indicator to flash once after 1 second, then perform other functions.

5.3 Main Parameters Main parameter

In the "Main Parameters" window, the tree structure on the left page is a classification of parameters, which are divided into two categories, Main Info and Modbus Device, and the right page is the parameter name and the current set value. Click on the desired value. After the set value, press the left mouse button again to modify the parameters.

5.3.1 Main Info Parameter Description

(1) System Info
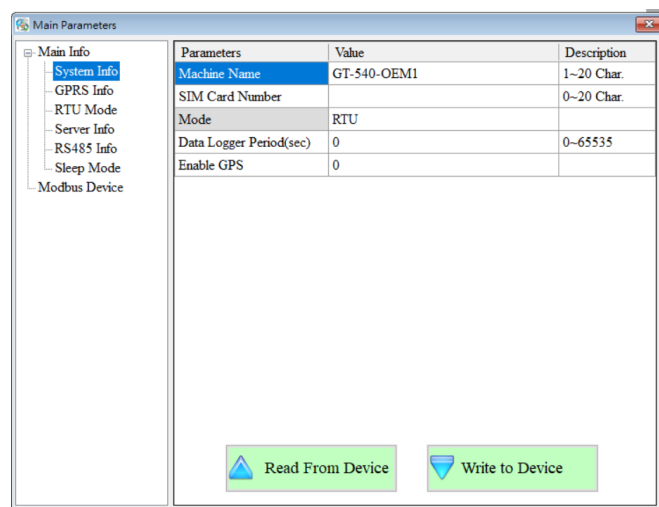
Parameter name	Description
Machine Name	Device name (1 ~ 20 char)
SIM Card Number	SIM card phone number plugged into the RTU-140(0 ~ 20 char)
Mode	RTU mode: Through the custom communication protocol of ICP DAS, the data is uploaded to the designated PC periodically, and the software "M2M RTU series management software" provided by ICP DAS is installed on the PC to receive the data of the RTU device.
Data Logger Period(sec)	In the data log file, the time interval of each record is in seconds. If it is 0, the function of I/O data record is turned off.(0 ~ 65535 seconds)

Enable GPS	Whether to activate the GPS function, Enable: Start, Disable: Close.

(2) GPRS Info
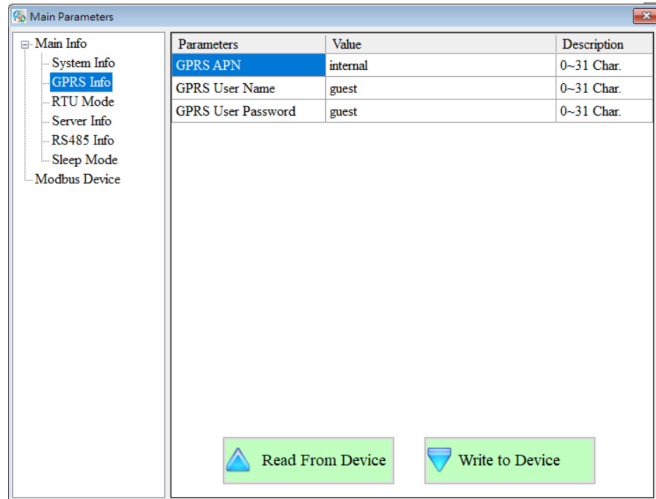
Parameter name	Description
GPRS APN	The Access point name required to log in to the GPRS system is provided by the carrier who applied for the SIM card. (0 ~ 31 char)
GPRS User Name	The account number required to log in to the GPRS system is provided by the carrier who applied for the SIM card. (0 ~ 31 char)
GPRS User Password	The password required to log in to the GPRS system is provided by the carrier who applied for the SIM card.(0 ~ 31 char)

(3)　　RTU Mode
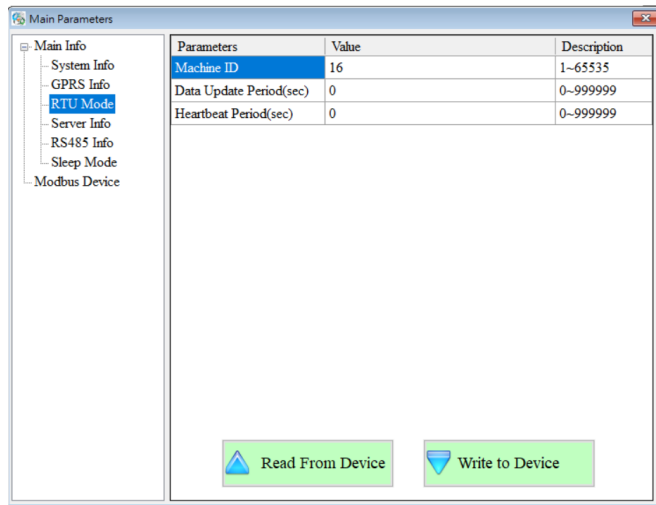
Parameter name	Description
Machine ID	The ID of the RTU-140 device in RTU mode. In the receiving software "M2M RTU Center" of the remote PC, the ID of this device must be added before receiving the data uploaded by this device.(1 ~ 65535)
Data Update Period(sec)	The time interval for uploading data, in seconds. If it is 0, this function is off. (0 ~ 999999 seconds)
Heartbeat Period(sec)	The time interval for transmitting the heartbeat packet. The purpose of this packet is to tell the remote PC that the device is still alive.(0 ~ 999999 seconds)

(4)   Server Info
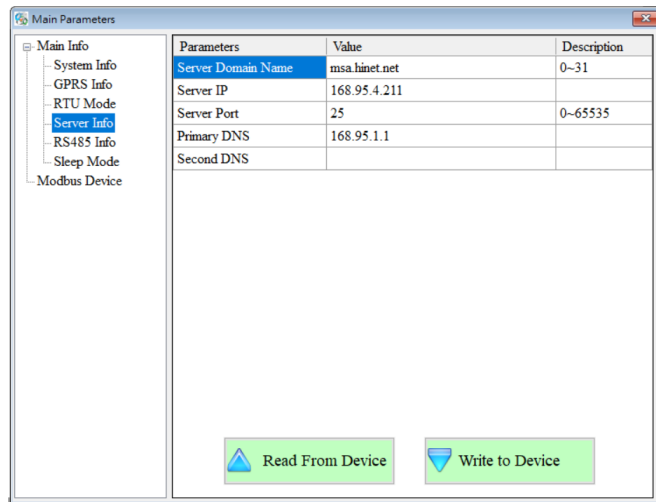
Parameter name	Description
Server Domain Name	The domain name of the server. In RTU mode, it refers to the remote PC (0 ~ 31 char) that executes "M2M RTU Center".
Server IP	The IP address of the server. In RTU mode, it refers to the remote PC that executes the "M2M RTU Center".
Server Port	The network nickname used by the server. In RTU mode, it must be specified as 10000 (0 ~ 65535)
Primary DNS	The primary DNS IP address. If you specify the server by domain name, you need to specify the primary DNS IP.
Second DNS	Secondary DNS IP. If the primary DNS cannot be connected, it will try to connect to this DNS IP.

(5)   RS-485 Info
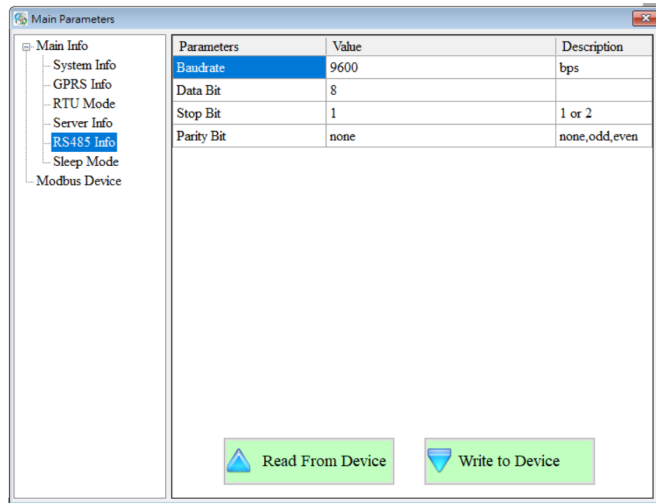
Parameter name	Description
Baudrate	Specify the transmission rate of COM2 (RS-485)
Data Bit	Specify the number of data bits of COM2 (RS-485)
Stop Bit	Specify the number of stop bits for COM2 (RS-485)
Parity Bit	Specifies how the parity check is performed. None: no check, odd: odd bit check, even: even bit check

(6)   Sleep Mode
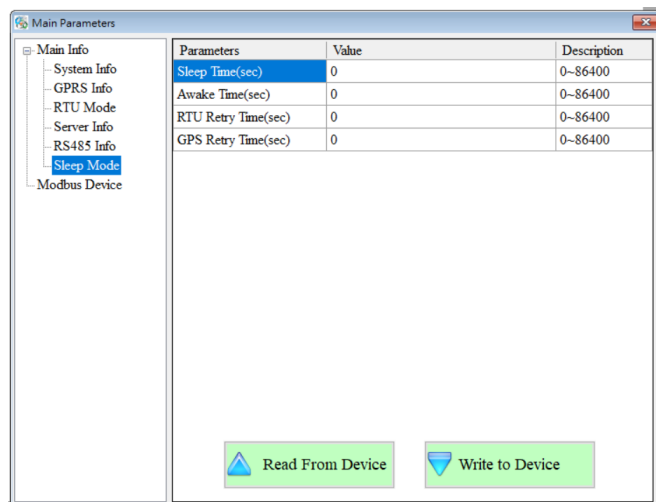
Parameter name	Description
Sleep Time(sec)	sleeping time. (0 ~ 86400)
Awake Time(sec)	Wake up time. (0 ~ 86400)
RTU Retry Time(sec)	RTU reconnection time (0 ~ 86400)
GPS Retry Time(sec)	GPS reconnection time (0 ~ 86400)

5.3.2 Modbus Device

The RTU-140 allows up to three Modbus RTU devices to be connected to the M-8000 series of ICP DAS products, as well as Modbus RTU devices from other companies. The number of I/O channels supported by each Modbus RTU device is as follows:

DI : 32 Channels

DO : 32 Channels

AI :16 Channels

AO :16 Channels
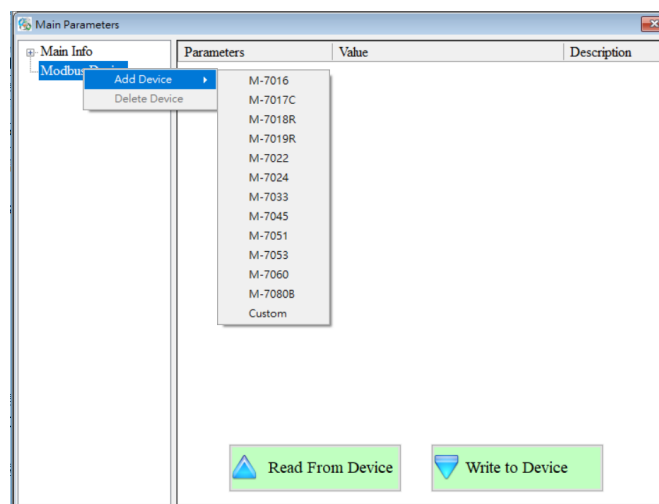
1.   Add a new Modbus RTU device

To join a Modbus RTU device to the RTU-140, you can do the following:

(1)   Click on "Modbus Device" in the tree view and press the right mouse button

(2)   Click on "Add Device"

(3)   Select the name of the Modbus RTU device. If it is not the M-8000 series produced by ICP DAS, please select "Custom".

2. Remove a Modbus RTU device

To remove a Modbus RTU device from the RTU-140, you can do the following:

(1) Click on the name of the Modbus RTU device you want to remove in the tree view and press the right mouse button.

(2) Click on "Delete Device" to complete the removal.
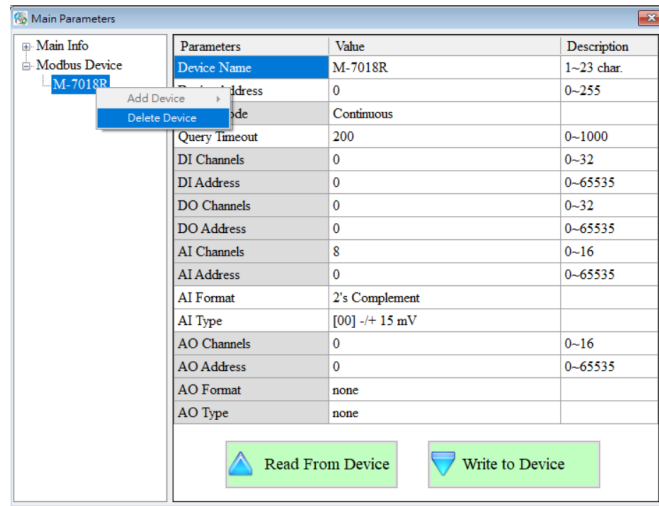
3. Parameter Description

Parameter name	Description
Device name	The name of the Modbus RTU device
Device Address	Address of Modbus RTU device
DI Channels	DI channel number
DI Address	Read the start address of the DI data
DO Channels	DO channel number
DO Address	Read the start address of the DO data
AI Channels	AI channel number
AI Address	Read the start address of the AI data
AI Format	AI data format, custom Modbus RTU device only supports 16-bit data length
AI Type	Type of AI
AO Channels	AI channel number
AO Address	Read the start address of the AO data
AO Format	AO data format, custom Modbus RTU device only supports 16-bit data length
AO Type	Type of AO

5.4　Device Status

Through this window, you can check the status of each peripheral device, including SD card, GPRS and GPS communication status.

Description of operation options:

　　　(1) Read：Update the current status of the RTU-140

Field description：

　(1) SD Card

　　　1.　Status：Micro SD current status

　　　2.　Free Size(Byte)：Micro SD card free space

　(2) GPRS

　　　1.　Status: GPRS connection status, Connected means connected to the remote server

　　　2.　Error Code: The code of the current connection status

　(3) GPS

　　　1.　Status：Is the GPS function turned on?

　　　2.　Data：$GPRMC connect currently received

5.5 Device Time parameter description

Through this window, you can change and query the RTU-140 time, and get the next count value return time. The following are the operation options and field descriptions:
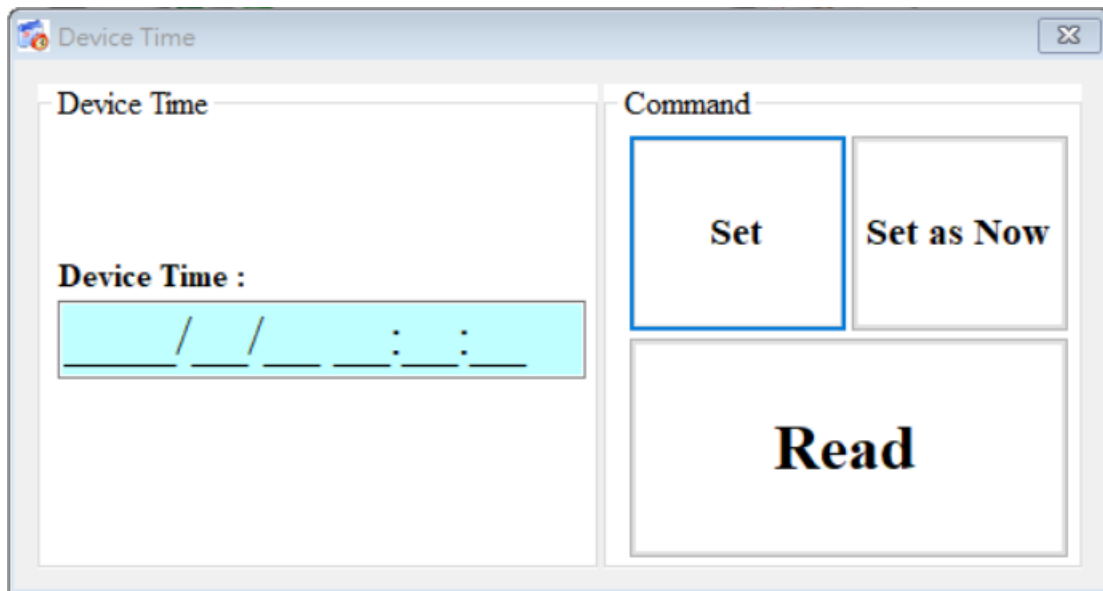
Description of the field:

(1) Device TIme：It can disply the time of RTU-140 and input the time of RTU-140 to be set.

Operation option description：

(1) Set as Now: Set the time of RTU-140 based on the time of the PC.

(2) Set: Set the time of the RTU-140 according to the field of the device time.

(3) Read: The current time of the RTU-140 can be read and displayed in the window.

5.6 Signal Quality

This window can be used to query the strength of the GSM signal received on the RTU-140.
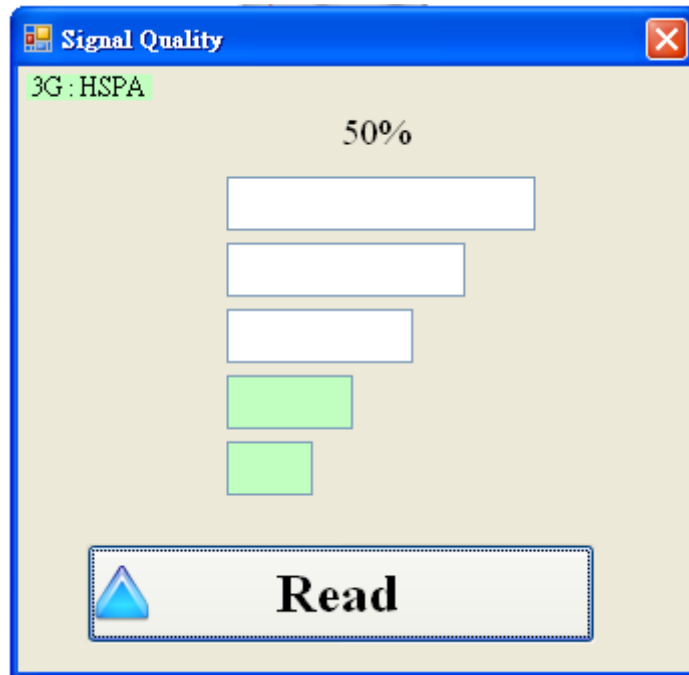
Field description：

The signal strength is expressed in 5 segments and shows the current signal strength percentage

Operation option description：

(1) Read：Read the current GPRS signal strength and type from RTU-140

5.7 Version

Click "Version" in the toolbar to display the version of RTU-140 Utility and the version information of the firmware that can be queried. The description is as follows:
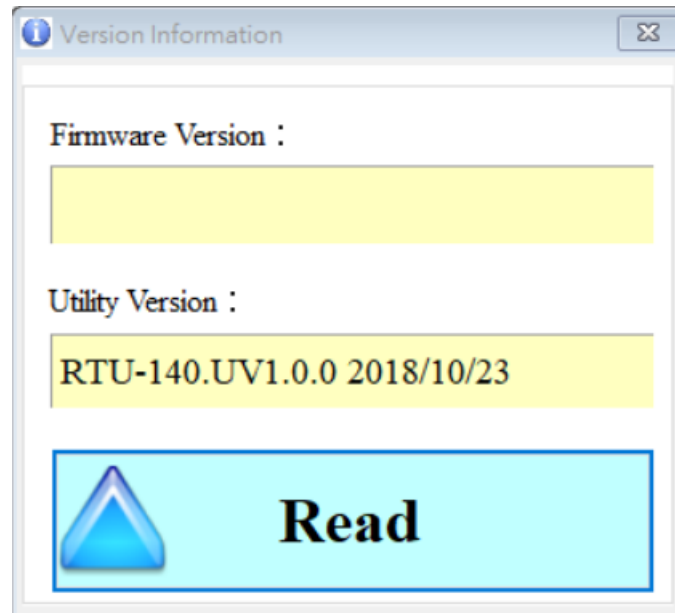
Field description：

  (1) Firmware Version: Displays the firmware version information.

  (2) Utility (tool software version): Display version information of RTU-140 Uitlity

Operation option description：

  Read: Read the firmware version information from RTU-140 and display it in the window.

5.8 System

The drop-down menu "System" has three functions: Recover to Factory Settings, Restart RTU-140 and Debug. The function description and operation mode are as follows:

5.8.1 Recover to Factory Settings

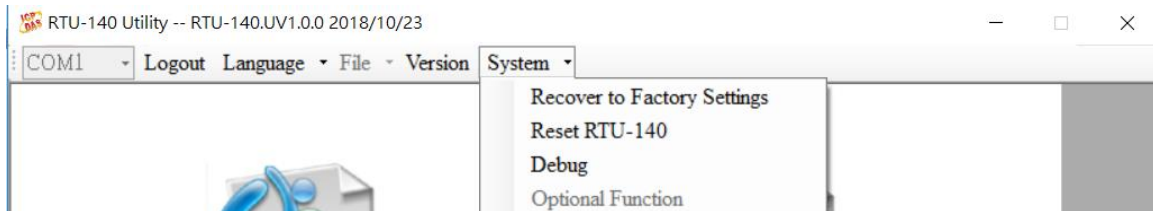This option restores the parameters to the factory settings as follows:：

    (1) Confirm that the STA indicator is blinking

    (2) Click "System→Reply Factory Preset"

5.8.2 Reset RTU-140

This option restarts the RTU-140 in software mode as follows:：

    (1) Confirm that the STA status light is flashing

    (2) Click "System→ restart RTU-140"

5.8.3 Debug

The Debug window can display the Debug message and save the message as a file for the detection and resolution of the problem.
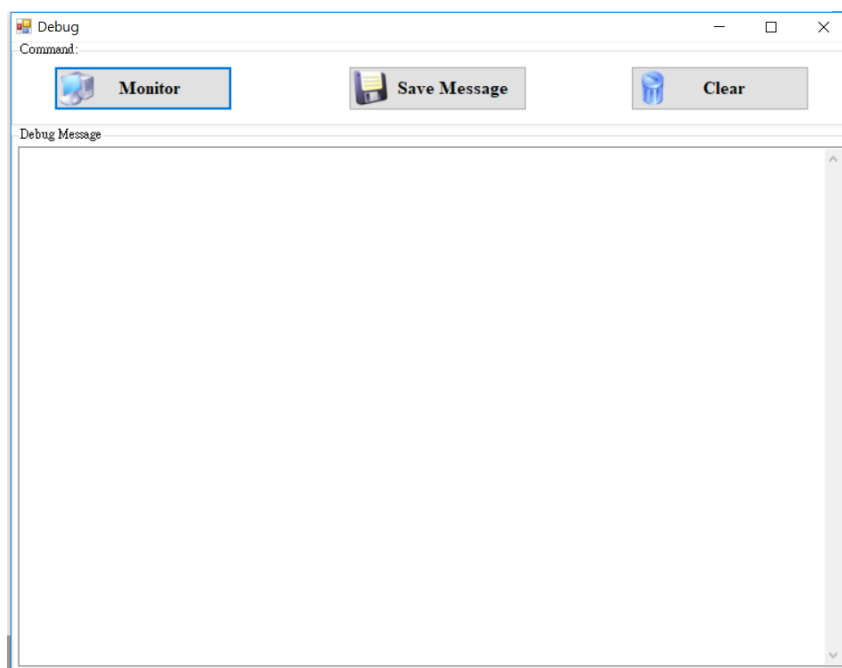
Operation option description：

    (1)   Monitor: Press this button, RTU-140 will output Debug message to Utility and display it in the Debug message bar below.

    (2)   Save message: Save the information in the Debug message bar as a file.

    (3)   Clear: Clear the information in the Debug message bar.

5.9 I/O data logger

If the parameter "Data Logger Period" is not set to 0, the data logging function will be enabled. The data can include the I/O of the RTU-140 itself, the I/O of the Modbus RTU device, and the $GPRMC data of the GPS. The file is stored in the type of ".csv". The different job modes, the naming method of the log file and the format of the file content will be the same, but there will be different file movement trajectories. The following is the way to move files in different modes:

(1) RTU Mode：

The log file currently being written will be replaced with the file name written at 00:00 every day. In this mode, the time to change the file name is as follows：

1. 00:00 every morning
2. Change Modbus RTU equipment
3. Change record interval
4. Change the type of DI to Counter
5. Change the function of whether GPS is activated

5.10 Log file naming

The I/O data log file is stored in the type of ".csv", and its file naming method is based on the time when the file is created. For example, yyyymmdd_HHMMSS_Period.csv, the description is as follows：

1. Yyyy: the first year
2. Mm: month
3. Dd: date
4. HH: 24 hours system
5. MM: points
6. SS: seconds
7. Period: the time interval between each record in the data log file

5.11 Record file format

The content of the log file will be distinguished by "," to distinguish each field. The first data of each file is the name of each field, and the second data is the actual data value. The data format is sequentially recorded date and time, RTU-140's own I/O data, up to 3 Modbus RTU I/O data and GPS data. The following is an example of the most complete log file, Modbus RTU device data. And GPS data will be determined according to the actual settings.

Date	CI0	CI1	DI2	DI3	DI4	DI5	DO0	DO1	AI0	Module [M-7016] Addr.	DI0	DO0
20100520 175518	119	230	0	1	1	0	0	0	0.059	5	1	0
20100520 175519	119	230	0	1	1	0	0	0	0.058	5	1	0

DO1	DO2	DO3	AI0	AI1	AO0	Module [M-7060] Addr.	DI0	DI1	DI2	DI3	DO0
0	0	0	0.033	0.671	1.500	5	1	0	0	0	1
0	0	0	0.034	0.671	1.500	5	1	0	0	0	1

DO1	DO2	DO3	Module [M-7080B] Addr.	DO0	DO1	CI0	CI1
0	0	0	1	0	0	655361	5961
0	0	0	1	0	0	655361	5961

5.12 Automatically delete log files

At 00:00 in the morning, the RTU-140 will check the remaining space of the micro SD. If it is less than 50MB, the files in the directory will be deleted automatically until the remaining space is larger than 50MB. The deleted files will be prioritized.

Appendix A. Manual Revision History

This chapter provides a revised record of this user manual.

The following table provides the date and description of each revision of this file.

version	publish time	Author	Description
1.0.0	2019/02/13	Jeromy	First release