User Manual

Version 1.0.0 March 2017

RTU-531PM

(Intelligent 3G Remote Terminal Unit with GPS)

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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

ICP DAS assumes no liability for any damage resulting from the use of this product.ICP DAS reserves the right to change this manual at any time without notice. The information furnished by ICP DAS is believed to be accurate and reliable. However, no responsibility is assumed by ICP DAS for its use, not for any infringements of patents or other rights of third parties resulting from its use.

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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 IoT (Internet of Things) has been a much discussed topic in recent years. Using the IoT concept, it is easy to integrate the environment of heterogeneous network and let all of the things into be digitized making life more convenient.

The RTU-531PM is an intelligent 3G Remote Terminal Unit with GPS, with high cost-effective cost, for industry applications. RTU-531PM is the Intelligent Active 3G Remote Terminal Unit product. Within the high performance 32 bit CPU, RTU-531PM is suit for the hard industrial environment. It features 3G module, 4 digital inputs, 2 digital outputs, 4 analog Input, 2 thermistor inputs, 1 RS-232, micro SD interface and GPS interface. It can be used in M2M application fields to transfer the local I/O via WCDMA/GPRS by the defined period or DI/AI triggers.

The simple I/O linkage function of RTU-531PM can reach the real time control in the local field. The local I/O and GPS data can also be stored in the SD card to become a remote data logger.

Therefore, RTU-531PM is an ideal solution for environmental monitoring and remote device management for M2M applications. Meanwhile, it is supplied with easy-to-use API and OPC server Software that streamline application development process, freeing system integrators from dealing with complex communication protocols of WCDMA/GPRS and the Internet.

1.1 Features

- **Hardware**
  - Support GPRS 850/900/1800/1900 MHz frequency
  - Support WCDMA 850/900/1900/2100 MHz frequency
  - Supports input voltage 10~30VDC
  - Power Reverse Polarity Protection
  - 1 x Utility port for Configuration
  - 1 x RS-485 port, 4 x DI, 2 x DO, 4 x AI, 2 x Thermistor and GPS
  - Support Micro SD(4GB Max.)
  - RoHS

- **Software**
  - Automatic/continuous WCDMA/GPRS Link Management
  - Support data logger in Micro SD card.
  - Easy-to-use API tool for users to develop their applications by various program development tools
  - Support M2M OPC server for SCADA system

1.2 Specification

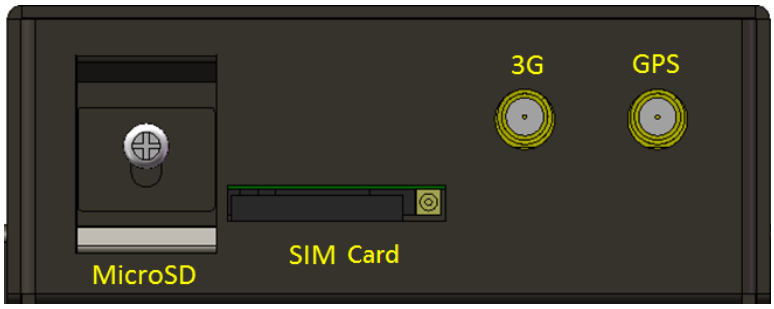
Module	RTU-531PM
System	
CPU	ARM Microprocessor
WDT(Watchdog)	Yes
SD Card interface	4GB Max.
2G System	
Frequency Band	850/900/1800/1900 MHz
GSM/GPRS	GPRS multi-slot : class 10/8
	GPRS mobile station : class B
	Compliant to GSM phase 2/2+
	- Class 4(2W @ 900 MHz)
	- Class 1(1W @ 1800/1900 MHz)
	Coding schemes : CS 1, CS 2,CS 3,CS 4
3G System	
Frequency Band	850/900/1900/2100 MHz
Power Class	Class 3(250mW @ WCDMA/HSPA)
COM Port	
COM 1	RS-232 : TXD,RXD,GND(for Utility)
GPS Interface	
Support Channels	56
Sensitivity	Tracking = up to -161 dBm (with external LNA)
	Cold start = up to -148 dBm (with external LNA)
Acquisition Time	Hot start (Open Sky) = 2 s(typical)
	Cold start (Open Sky) = 29 s(typical)
Protocol Support	GPRMC format (NMEA 0183 version 3.01)
Digital Input	
Channels	4
Off Voltage Level	+3V Max.
On Voltage Level	+7 ~ +24V

Digital Output	
Channels	2
Load Voltage	+30V Max.
Load Current	100mA Max.
Analog Input	
Channels	4
Resolution	16 bit
Input Range	±10V
Thermistor Input	
Channels	2
Wiring	2-Wire
Power	
Required Supply Voltage	+10 ~ +30 V_{DC}
Mechanical	
Installation	DIN-Rail
Dimensions(W x L x H)	89mm x 124mm x 35mm
Environment	
Operating Temperature	-25 ~ +75°C
Storage Temperature	-40 ~ +80°C
Humidity	5 ~ 95% RH，non-condensing

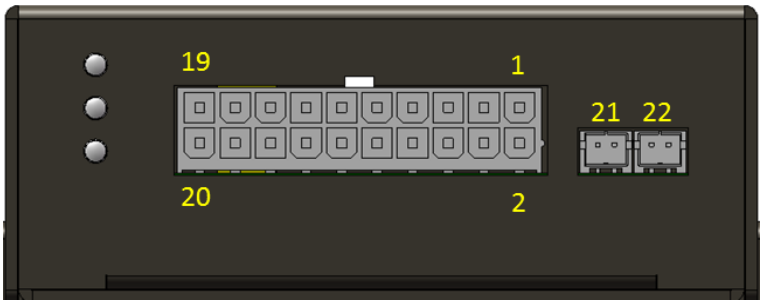
2. Getting Started

■ Appearance and Pin Assignments

- Top View

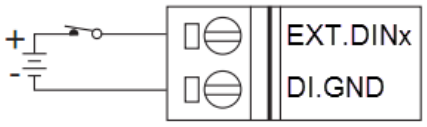
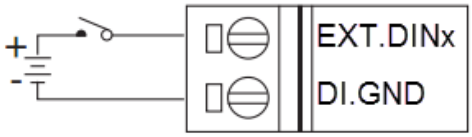


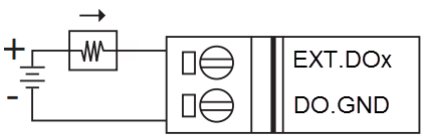
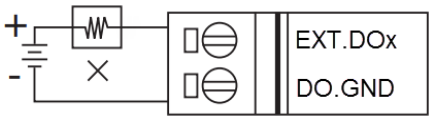
- Bottom View

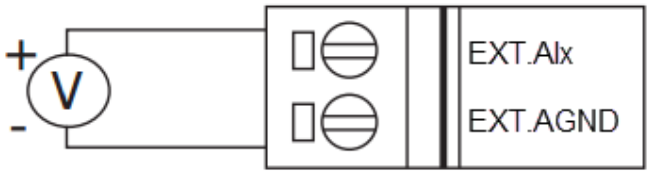


Pin	Description	Pin	Description	Pin	Description
1	AI2	9	DI2	17	N/A
2	AI3	10	DI3	18	N/A
3	AI0	11	DI0	19	PWR
4	AI1	12	DI1	20	P.GND
5	AGND	13	GND	21	THM1
6	DO.GND	14	DI.GND	22	THM0
7	DO0	15	TxD	-	-
8	DO1	16	RxD	-	-

■ DI/DO/AI Internal Structure and Wire Connection

Digital Input		
Input Type	ON State Read back as 1 (DINx > 7V)	OFF State Read back as 0 (DINx < 3V)
Wet Contact		

Digital Output		
Output Type	ON State Read back as 1	OFF State Read back as 0
Open Collector Output (Resistance Load)		

Analog Input


2.1 LED Indicator

There are four LED indicators to help users to judge the various conditions in the RTU-531PM. The description is as the following:

LED Name	LED Status	LED Description
EXT (Red)	ON	The power of the module is ON
	OFF	The power of the module is OFF
3G (Green)	Blanking pre 3 sec	3G modem normal(2G network)
	Twinkling twice per 3 sec	3G modem normal(3G network)
	OFF	3G modem fail
STA (Yellow)	Blinking (250 ms)	Network registered. GPS searching for satellite.
	Blinking (1 s)	Network registered. GPS is positioned.
	Blinking (50 ms)	Wrong PIN/PUN code.
	Always ON	Not registered.

2.2 Installation

Please follow the steps to install the RTU-531PM.

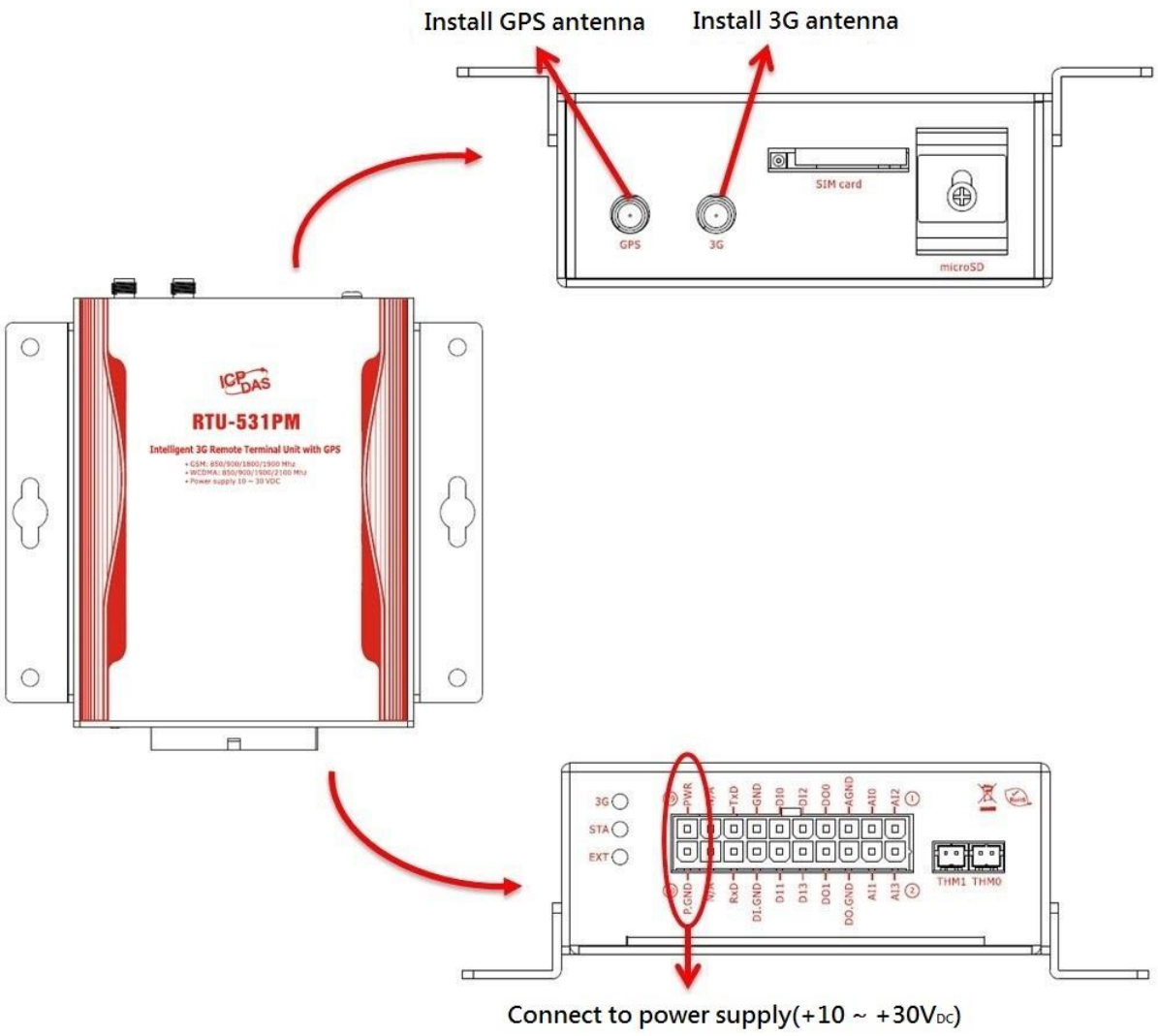
(1) Install GSM/GPRS antenna and GPS antenna.

(2) Plug in the normal SIM card (Before apply the SIM card, confirm it is OK by mobile phone.)

(3) Connect Pin.19 and Pin.20 to power supply(+10 ~ +30V_{DC}).

(4) Open the power supply and wait 30~50 seconds, RTU-531PM will registered and work.

(5) If RTU-531PM in an open environment, wait about 1 minute after start then LED indicator will flash once a second. That means GPS has been located to complete.



3. RTU-531PM Utility

User can set the parameters or see the debug information with the Utility. It needs the runtime environment with .NET Framework 2.0 or above to execute the in the PC. You can download the .NET Framework 2.0 and .NET Framework 3.5 on the Microsoft website. Please download and install it before you use the utility.

◆ Download Microsoft .NET Framework 2.0

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

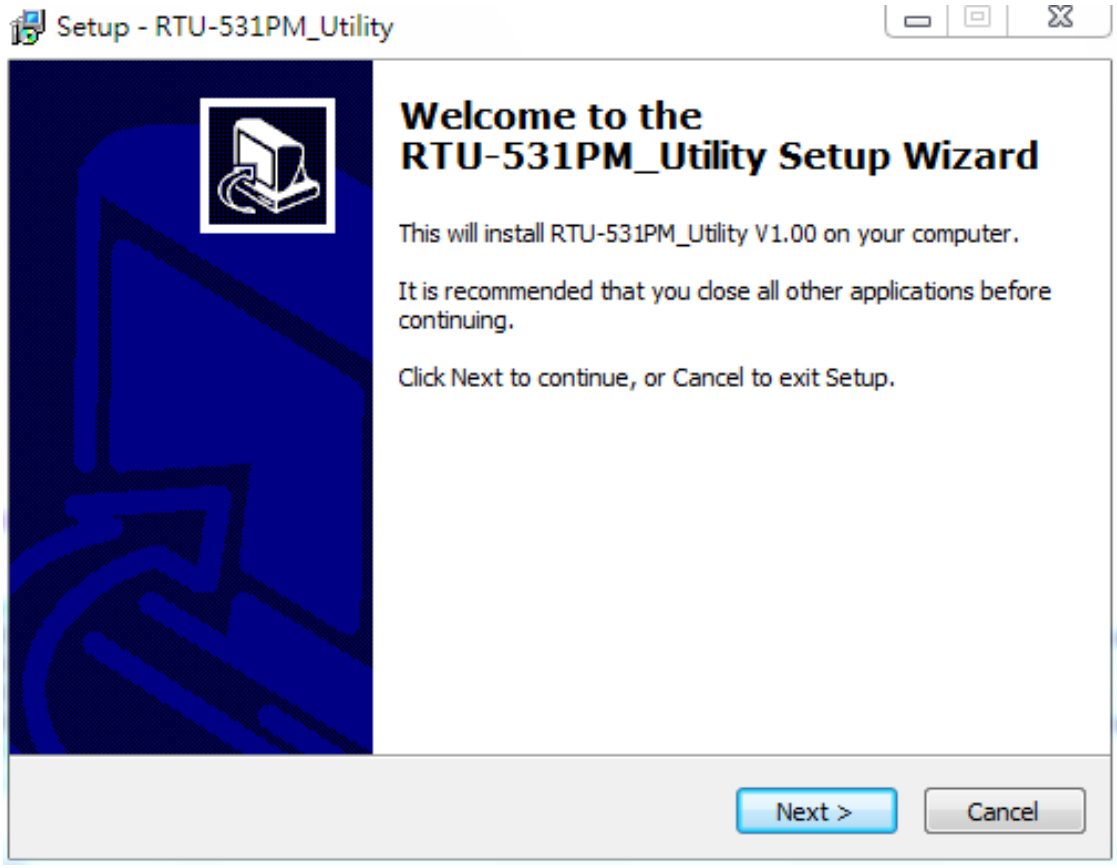
◆ Download Microsoft .NET Framework 3.5

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

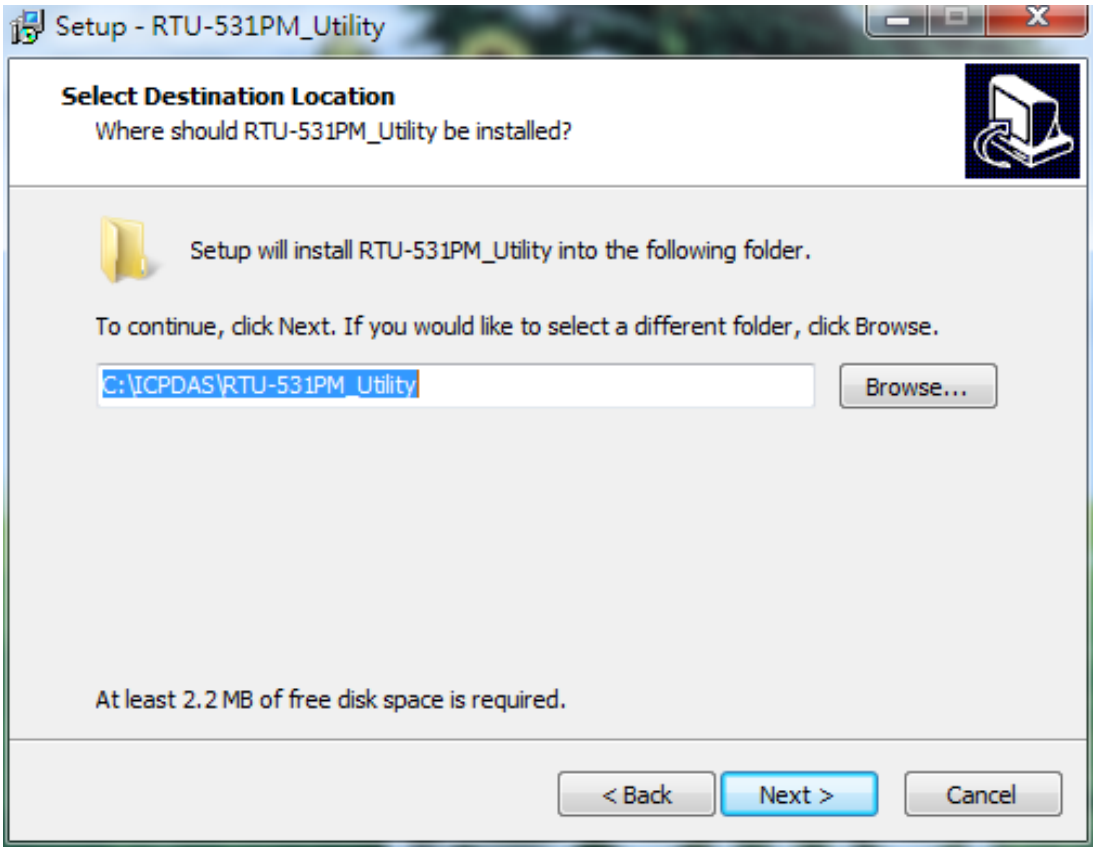
3.1 Install the RTU-531PM Utility

Plug in the shipment CD into the PC. Execute ”RTU-531PM_Utility_Setup_Vxxx.exe”(xxx is version number). The installation figure is as follows:

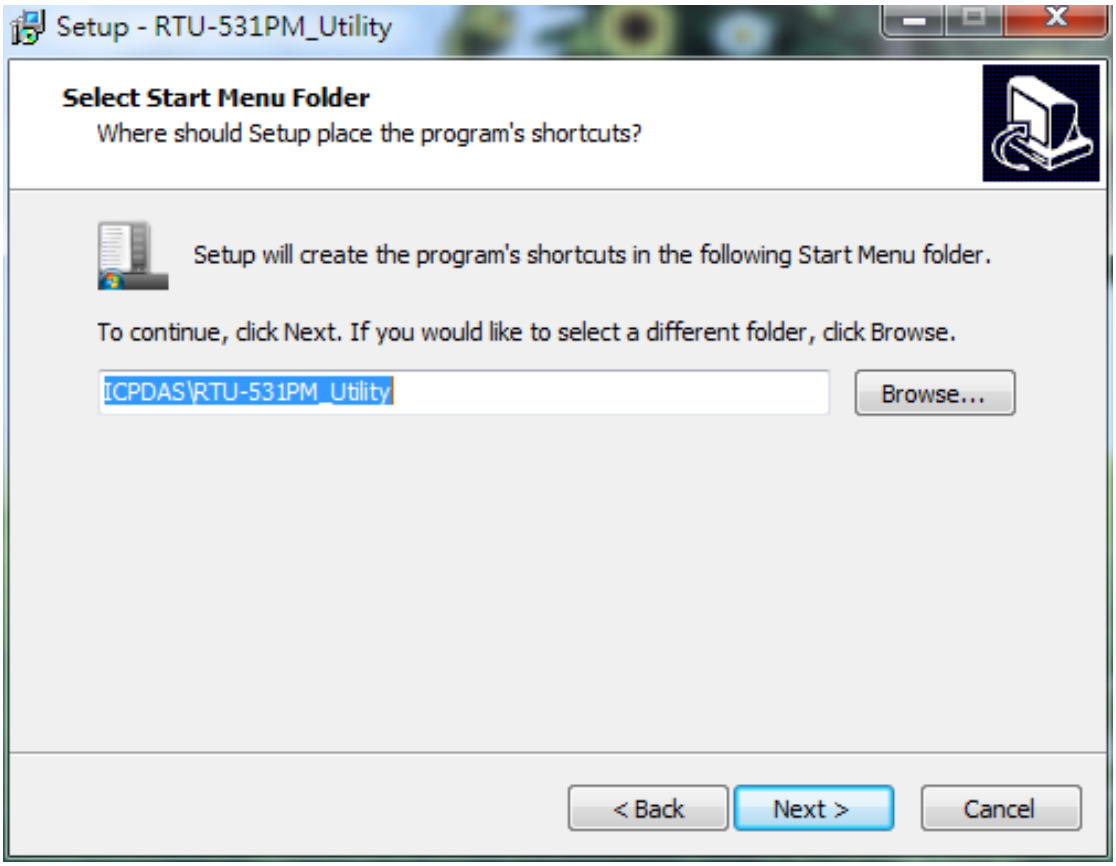
(1) Press “Next” to start the installation procedure.



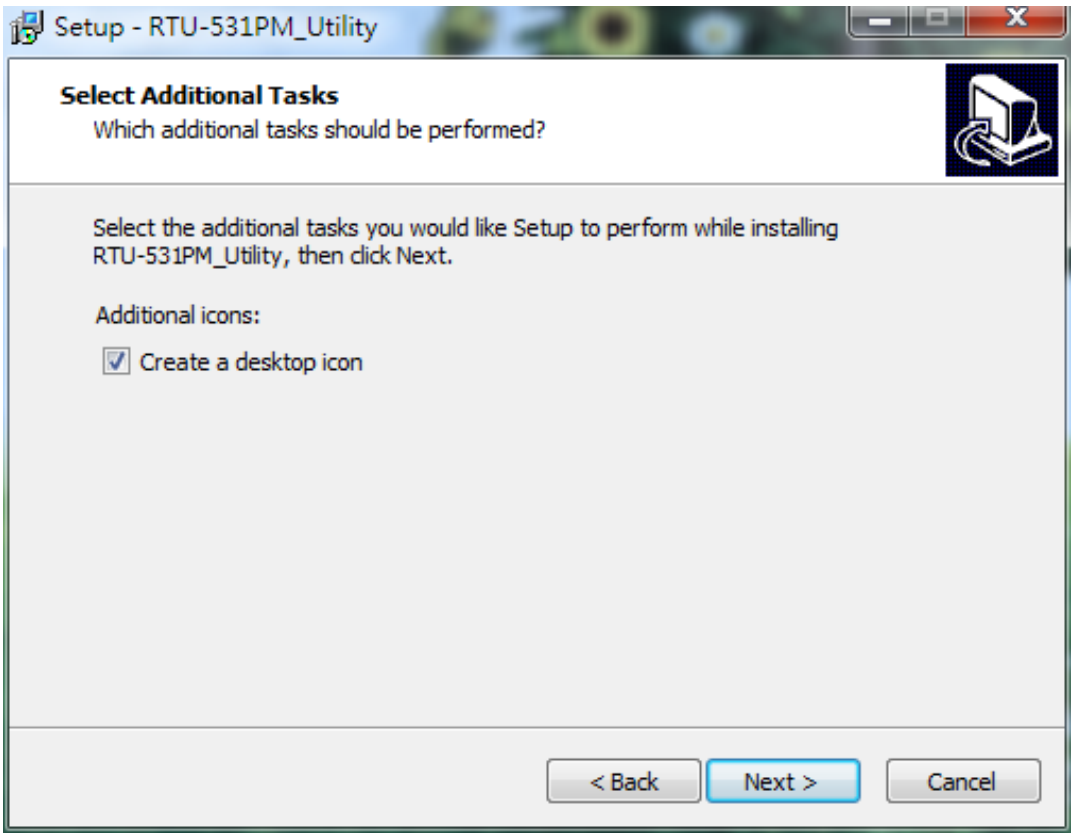
(2) Select the installation path and press “Next” to continue.



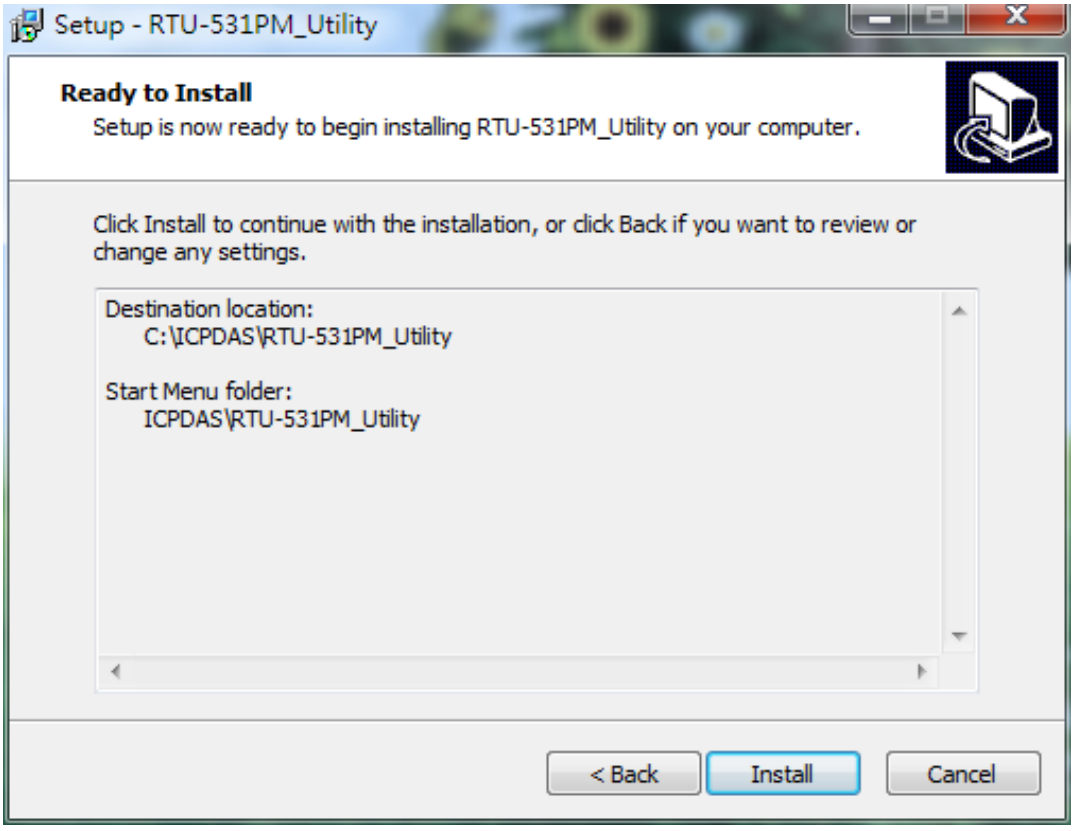
(3) Select the “Start Menu Folder”, press “Next” to the next step.



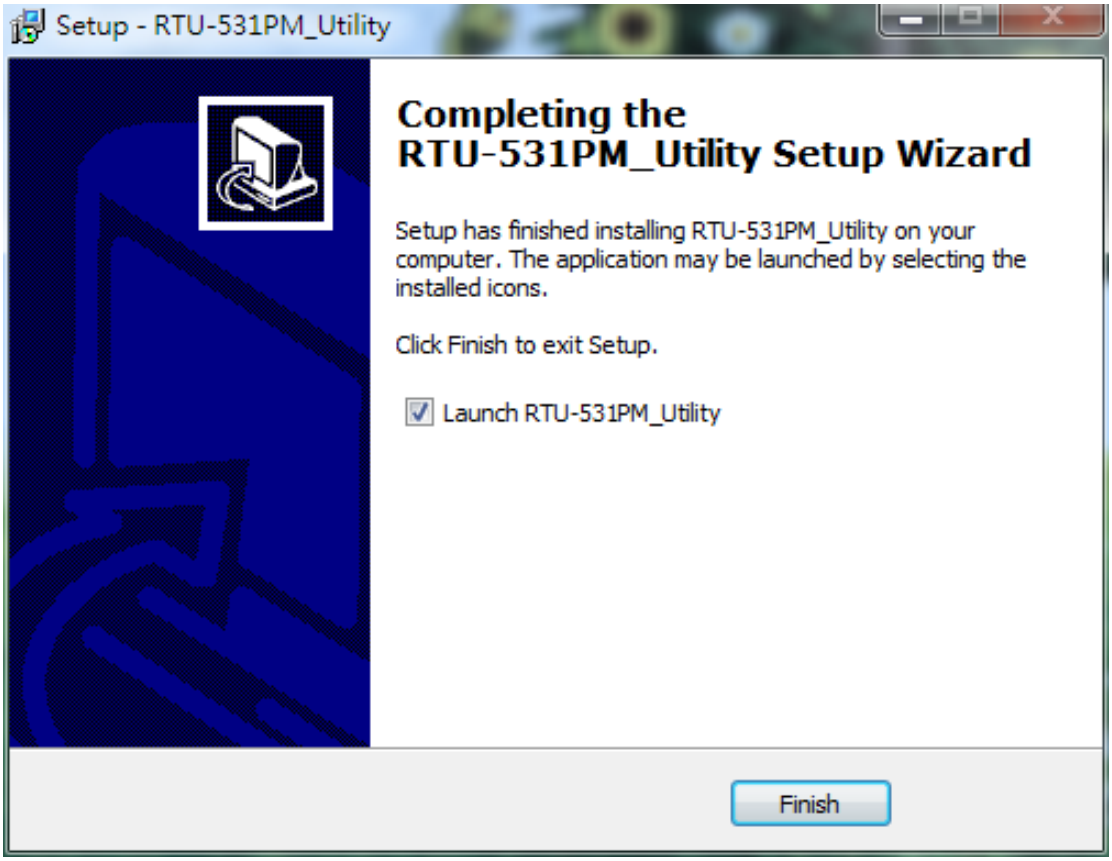
(4) Select additional tasks. Press “Next” to the next step.



(5) Click ”Install” to start to install the M2M Utility.



(6) Click “Finish” to finish installing M2M Utility.



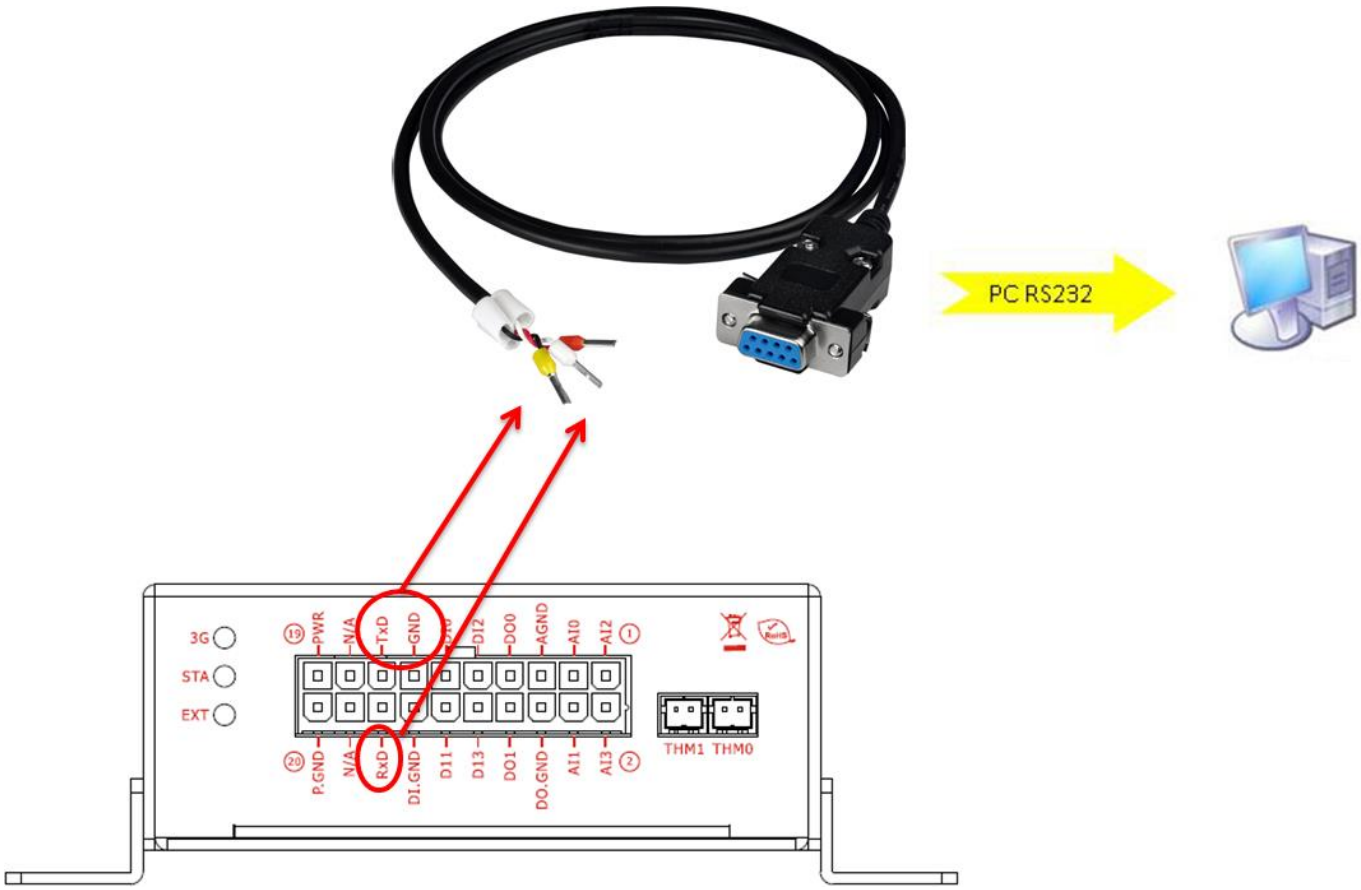
3.2 Start to use Utility

Please check the following steps when the RTU-531PM connect to PC.

(1) STA is blinking:

LED Name	LED Status	LED Description
STA (Yellow)	Blinking(250 ms)	Network registered. GPS searching for satellite.
	Blinking(1 s)	Network registered. GPS is positioned.

(2) Please connect the RTU-531PM and PC with RS-232 cable:



(3) Please keep power supply ON during you are wiring the RS-232.

3.3 Utility Parameters

3.3.1 Login

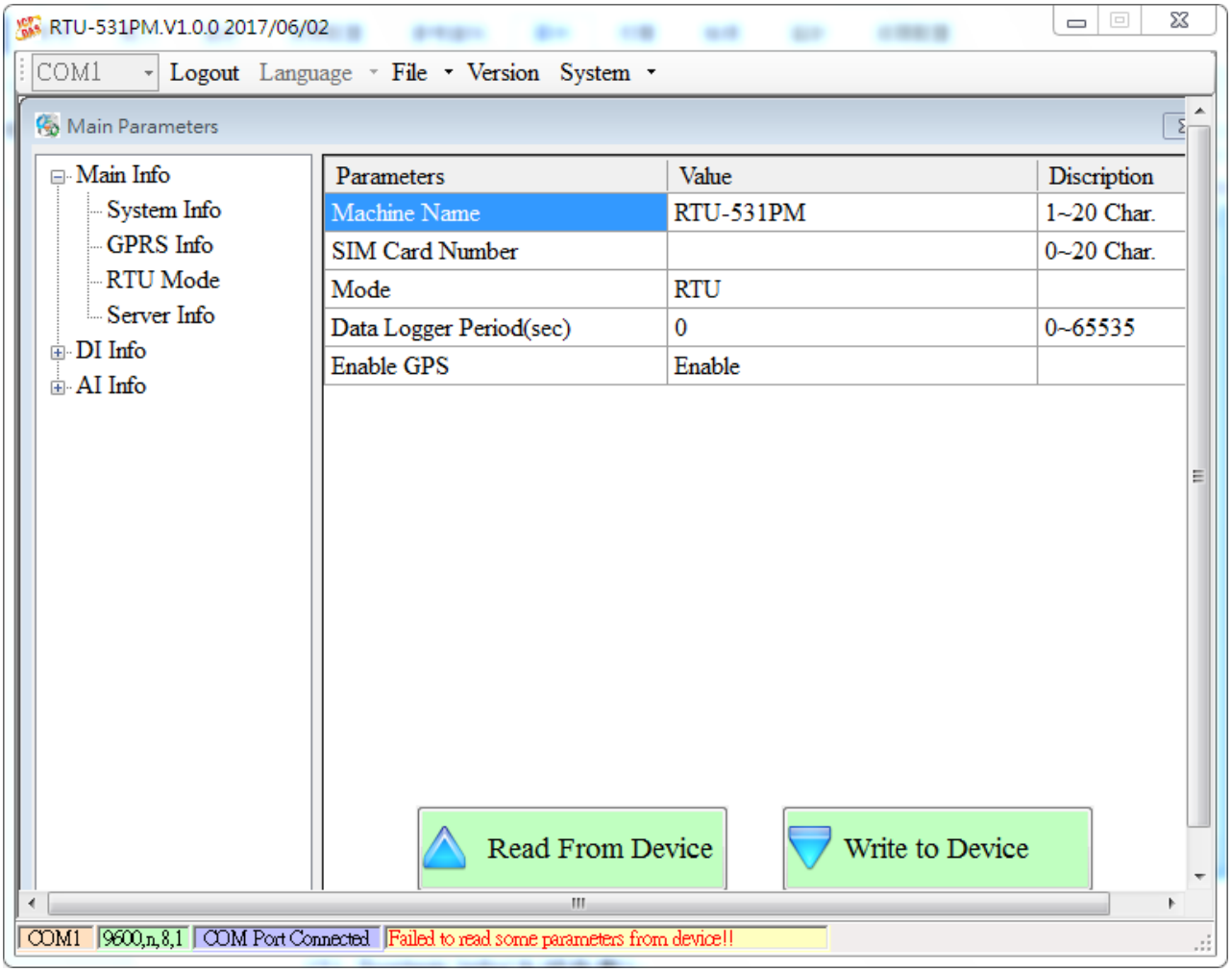
It needs to login to RTU-531PM to set its parameters. The description is below:

(1) Select the COM port number of PC.

(2) Press ”Login”.

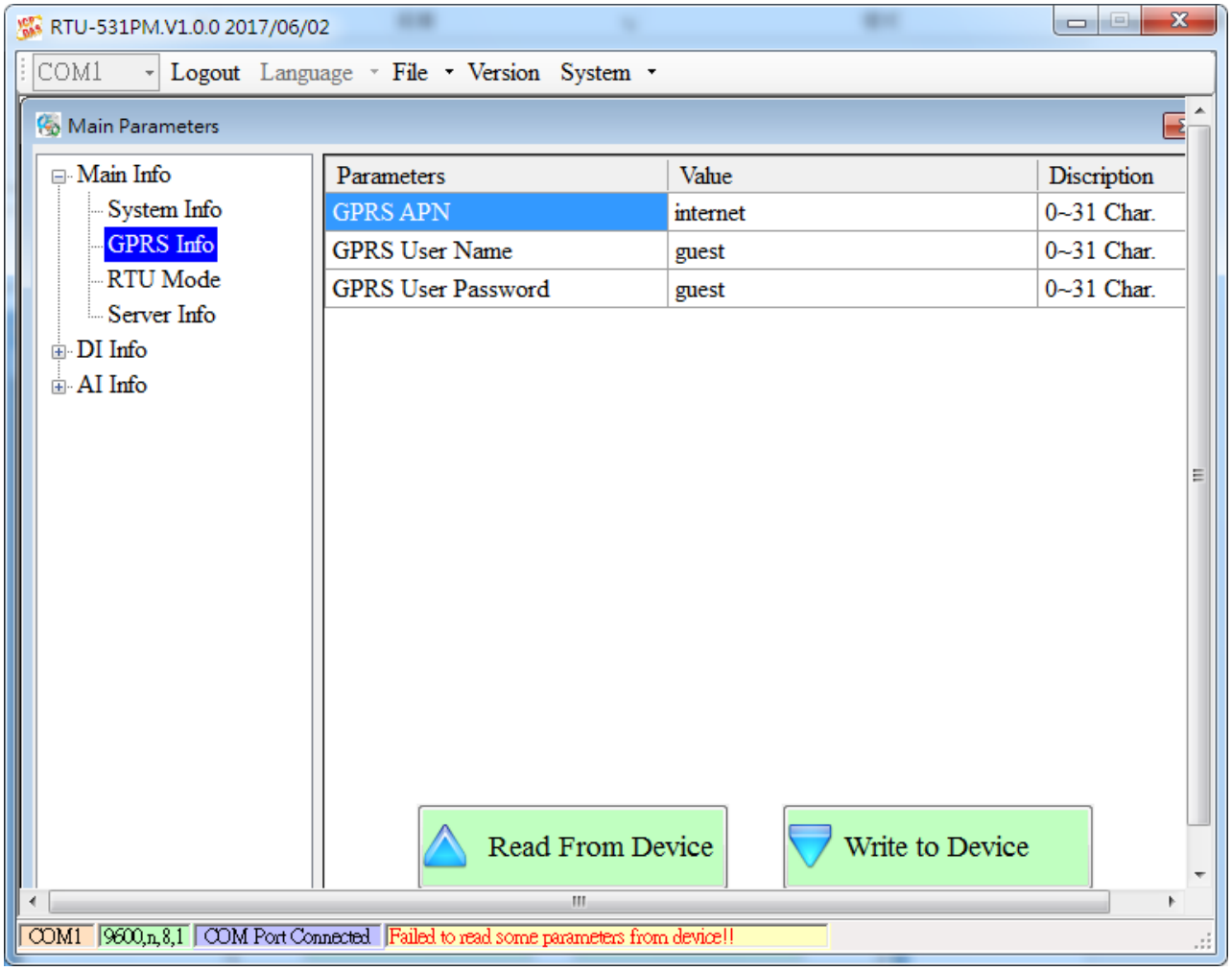
3.3.2 Main Info

(1) System Info



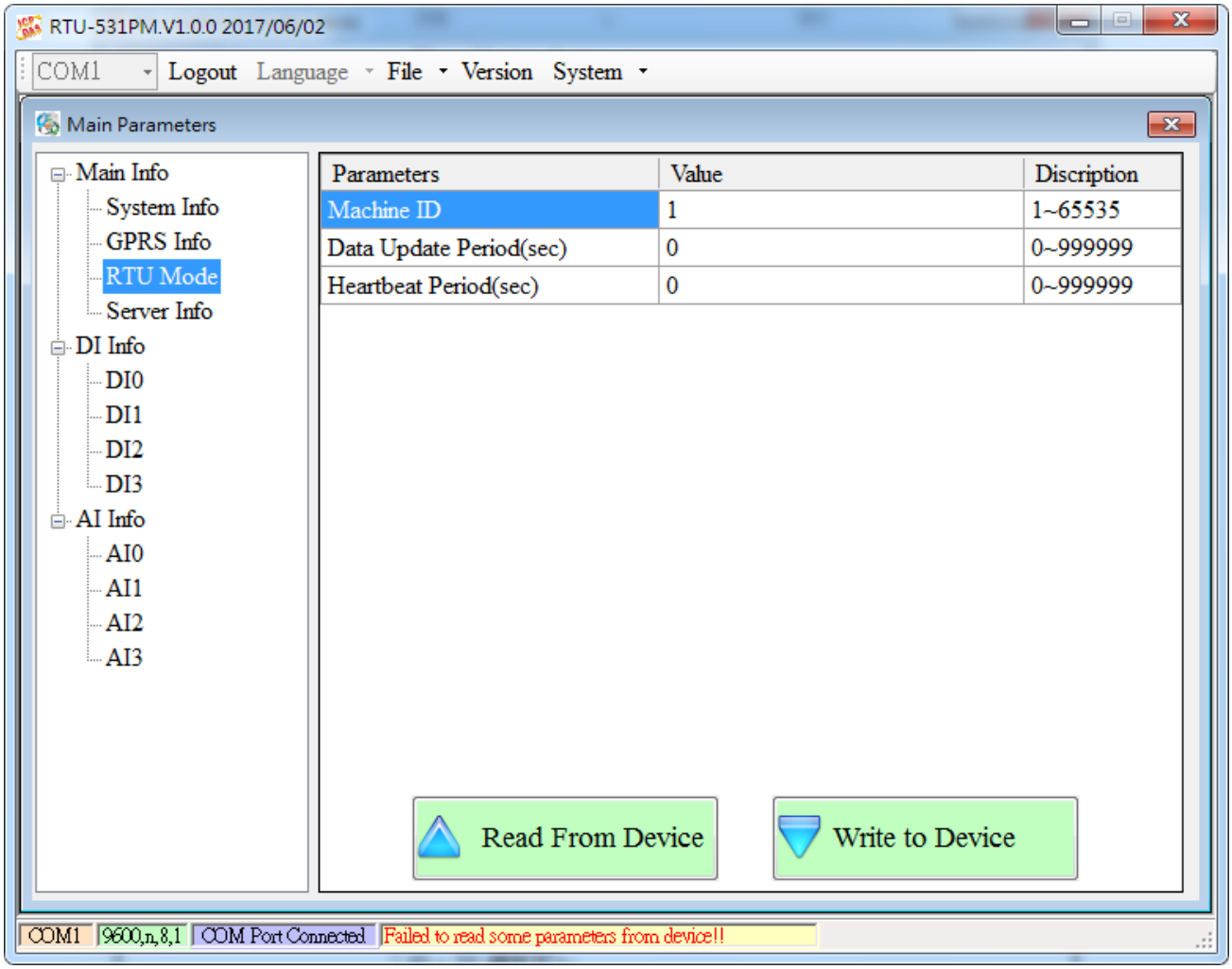
Parameters	Description
Machine Name	Device Name.(Range : 1~20 characters)
SIM Card Number	This text field can show or input the phone number of the plug-in SIM card. (Range : 0~20 characters)
Mode	RTU mode: In this mode, RTU-531PM would transfer I/O data (local I/O, Modbus device or GPS data) to the M2M RTU center by WCDMA/GPRS connection periodically.
Data Logger Period(sec)	This time is used for recording I/O data to I/O logger files periodically by second unit. If the value is 0, this I/O data logger function is disabled. (Range : 0~65535 sec)
Enable GPS	Enable: Enable the GPS function. Disable: Disable the GPS function.

(2) GPRS Info



Parameters	Description
GPRS APN	The setting is important factor when connecting to a WCDMA/GPRS network. Check with your WCDMA/GPRS service provider for details. Access point name (APN) is the name used to identify a general packet radio service (WCDMA/GPRS) bearer service in the 2G/3G mobile network. The APN defines the type of service that is provided in the packet data connection. You can get this APN by ISP. (Range : 0~31 Characters)
GPRS User Name	The setting is important factor when connecting to a WCDMA/GPRS network. Check with your WCDMA/GPRS service provider for details. (Range : 0~31 Characters)
GPRS User Password	The setting is important factor when connecting to a WCDMA/GPRS network. Check with your WCDMA/GPRS service provider for details. (Range : 0~31 Characters)

(3) RTU Mode

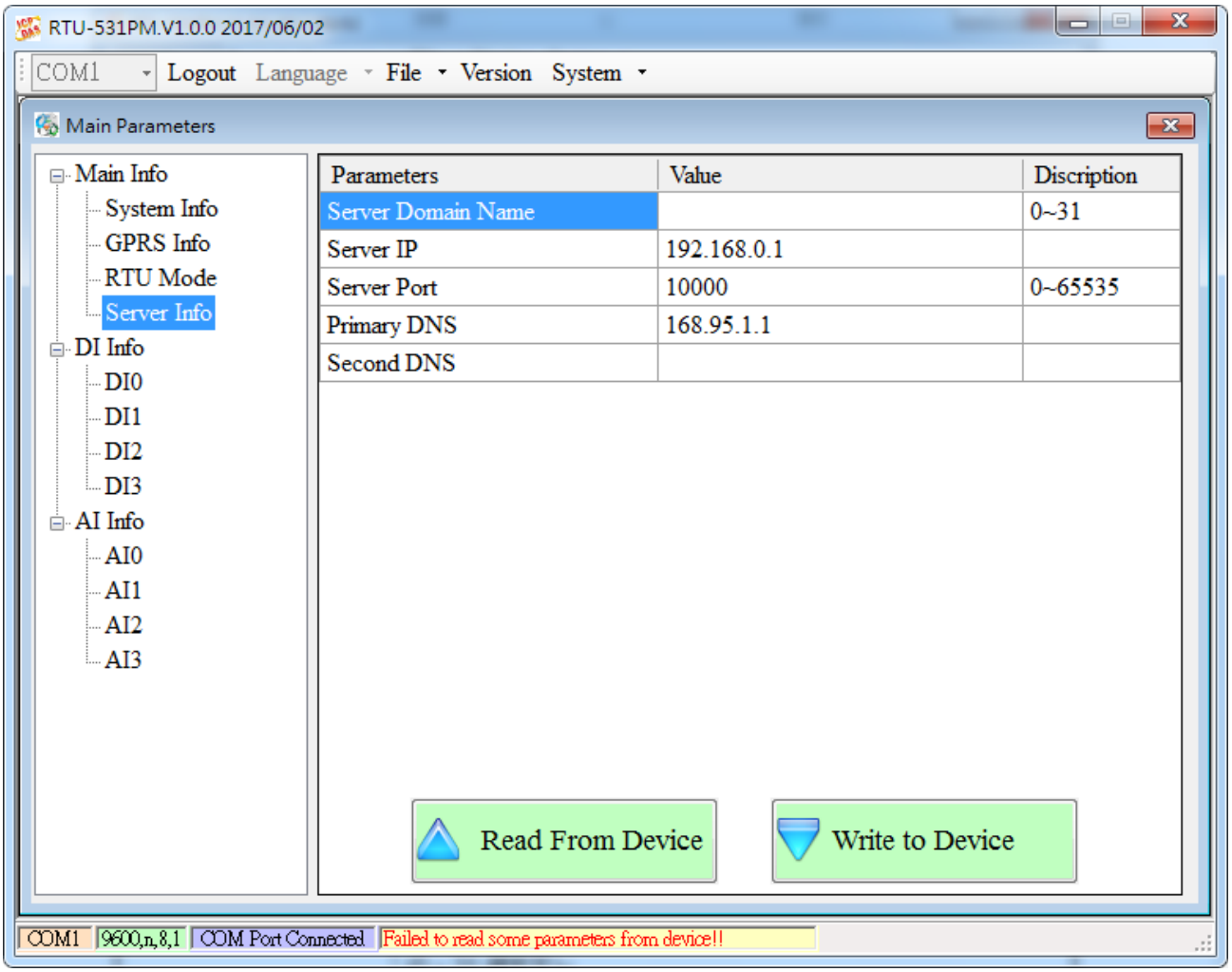


Parameters	Description
Machine ID	The device Station ID would be shown in the RTU Center software. It can identify the different device in the Remote OPC Server. (Range: 1 ~ 65535)
Data Update Period	Set the report time interval. The GTP-500M would send the data to M2M RTU Center periodically depending on this update time. The based unit is second.(Range: 0 ~ 999999 sec)
Heartbeat Period	Set the heartbeat time interval. When the GTP-500M update time is too long to terminate the WCDMA/GPRS connection by ISP, the heartbeat time will report smaller package to keep WCDMA/GPRS connection. (unit: sec) (Range: 0 ~ 999999 sec) Note: Some ISP companies would terminate the WCDMA/GPRS connection when the connection has not any data flow for some time.

Warning

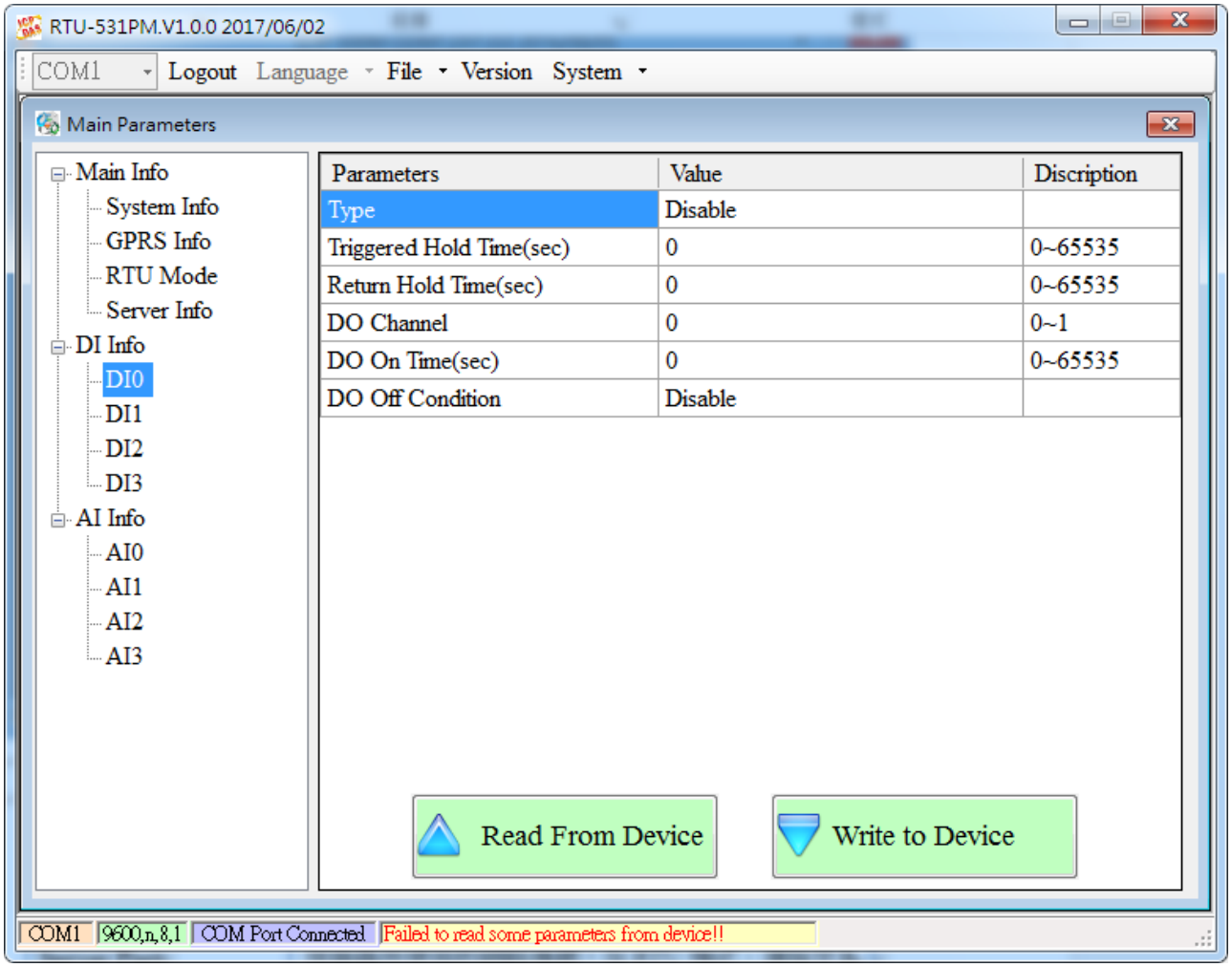
The RTU-531PM's Machine ID setting cannot be repeated and the M2M RTU Center needs to add the corresponding ID.

(4) Server Info



Parameters	Description
Server Domain Name	The server domain name. In RTU mode, it indicates the PC running M2M RTU Center. (Range : 0 ~ 31 Characters)
Server IP	The IP address of the server It indicates the PC running M2M RTU Center.
Server Port	The port of the server is used to connect to a TCP Server. In RTU mode, the port is 10000.
Primary DNS	The primary Domain name server IP
Second DNS	The secondary Domain name server IP

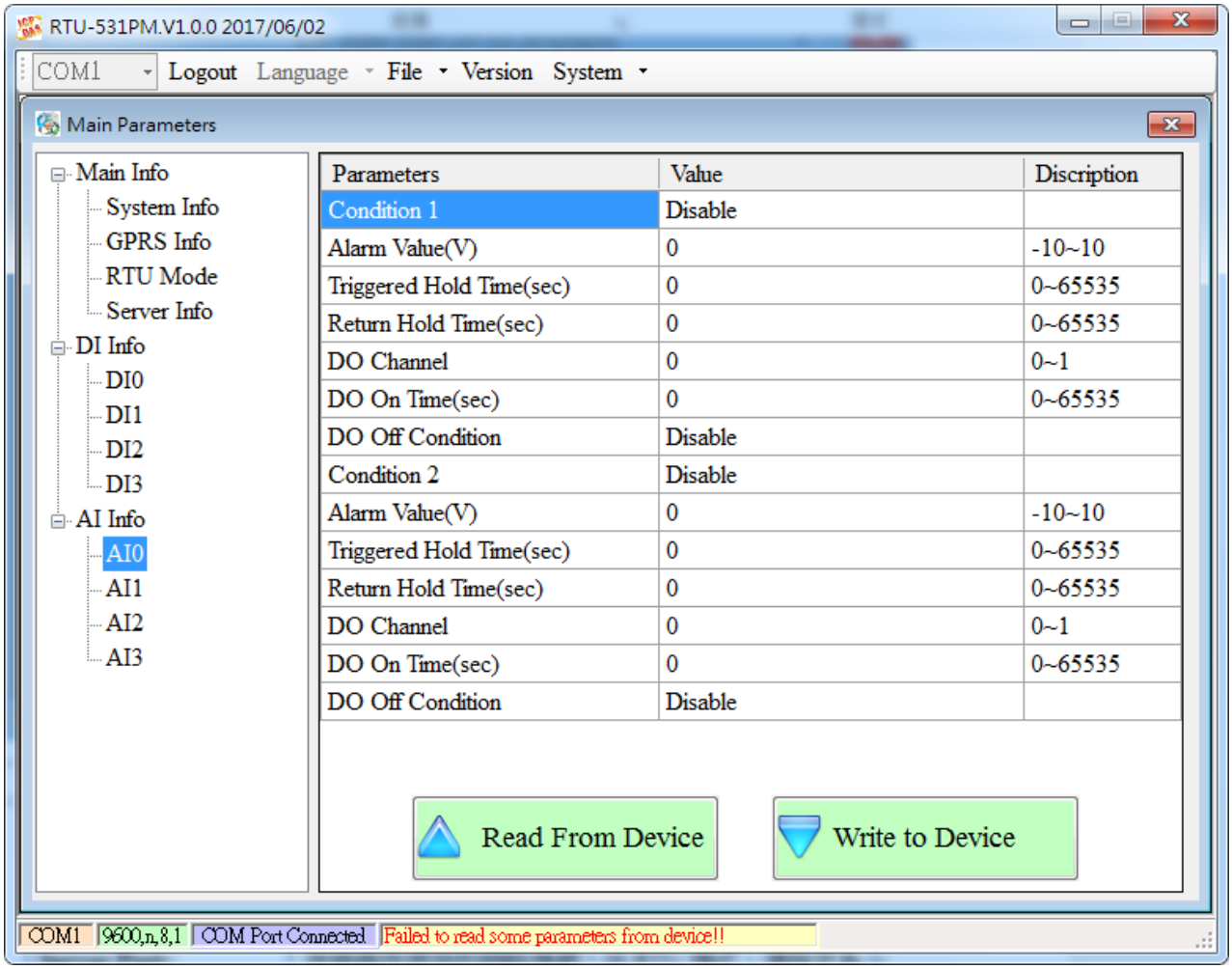
3.3.3 DI Info



Parameters	Description
Type	The function is used to set the type of DI channel: 1.Disable: Disable the linkage function between DI and DO channels. 2.DI NO: The DI channel is normal Open. When the DI channel is close (high), it is the trigger signal of GTP-500M. 3.DI NC: The DI channel is normal close. When the DI channel is open (low), it is the trigger signal in the system. 4.DI Counter: Set the DI channel as counter mode.
Triggered Hold Time	This value represents the holding time of the DI signal for triggering the event. The unit is second. (Range : 0 ~ 65535 sec)
Return Hold Time	When the trigger condition is activated, it needs to keep the non-trigger status to be triggered again according to the “Return Hold Time”. The unit is second. (Range : 0 ~ 65535 sec)
DO Channel	The text will define which DO channel will output according to the DI triggering.

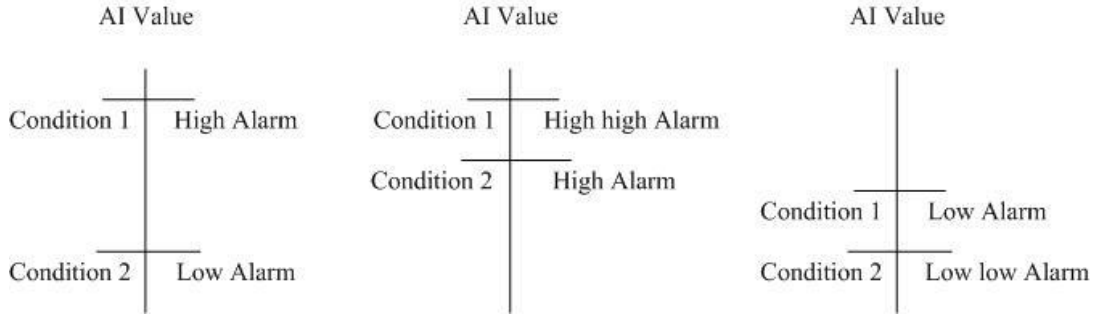
	(Channel 0 ~ 1)
DO On Time	The DO channel would keep outputting according to this time, when DI channel is triggered and “DO Off Condition” is “time”. The unit is second. (Range : 0 ~ 65535 sec)
DO Off Condition	These conditions of the DO terminating outputting when DO is output by DI trigger. 1.Disable: Disable the DO linkage with DI channel. 2.Time: The DO output would keeping “ON” according to the “DO on Time” when DI is triggered. 3.Input Status: The DO channel output would be kept contiguously according to the time of the “Return Hold Time” when the DI returns to the non-trigger status.

3.3.4 AI Info



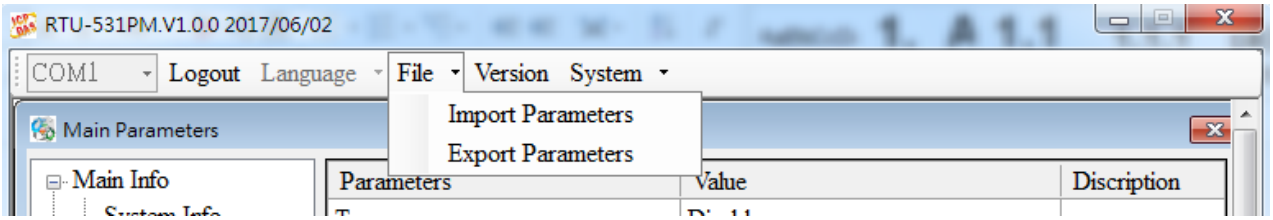
Parameters	Description
Condition 1	There are three modes of the AI triggers in this condition. 1.Disable : Disable the DO linkage 2.High Alarm : The DO is activated when the AI exceeds the alarm value. 3.Low Alarm : The DO is activated when the AI is lower than the alarm value.
Alarm Value	The alarm value of AI channel.(Range : 0 ~ 20 mA)
Triggered Hold Time	This value represents the holding time of the AI signal for triggering the event. The unit is second. (Range : 0 ~ 65535 sec)
Return Hold Time	When the trigger condition is activated, it needs to keep the non-trigger status to be triggered again according to the “Return Hold Time”. The unit is second. (Range : 0 ~ 65535 sec)
DO Channel	The DO channel will be activated according to the AI alarm. (Channel 0 ~ 1)

DO On Time	The DO channel would keep outputting by this time, when AI alarm is triggered and “DO Off Condition” is “time”. The unit is second. (Range : 0 ~ 65535 sec)
DO Off Condition	These conditions of the DO terminating outputting when DO is output by AI trigger. 1.Disable: Disable the DO linkage with AI channel. 2.Time: The DO output would keeping outputting according to the “DO on Time” when AI alarm is triggered. 3.Input Status: The DO channel output would be kept contiguously according to the time of the “Return Hold Time” when the AI returns to the non-trigger status.
Condition 2	The second condition of AI trigger. The trigger modes are as condition 1.
Alarm Value	The alarm value of AI channel.(Range : 0 ~ 20 mA)
Triggered Hold Time	This value represents the holding time of the AI signal for triggering the event. The unit is second. (Range : 0 ~ 65535 sec)
Return Hold Time	When the trigger condition is activated, it needs to keep the non-trigger status to be triggered again according to the “Return Hold Time”. The unit is second. (Range : 0 ~ 65535 sec)
DO Channel	The DO channel will be activated according to the AI alarm. (Channel 0 ~ 1)
DO On Time	The DO channel would keep outputting by this time, when AI alarm is triggered and “DO Off Condition” is “time”. The unit is second. (Range : 0 ~ 65535 sec)
DO Off Condition	These conditions of the DO terminating outputting when DO is output by AI trigger. 1.Disable: Disable the DO linkage with AI channel. 2.Time: The DO output would keeping outputting according to the “DO on Time” when AI alarm is triggered. 3.Input Status: The DO channel output would be kept according to the time of the “Return Hold Time” when the AI returns to the non-trigger status.



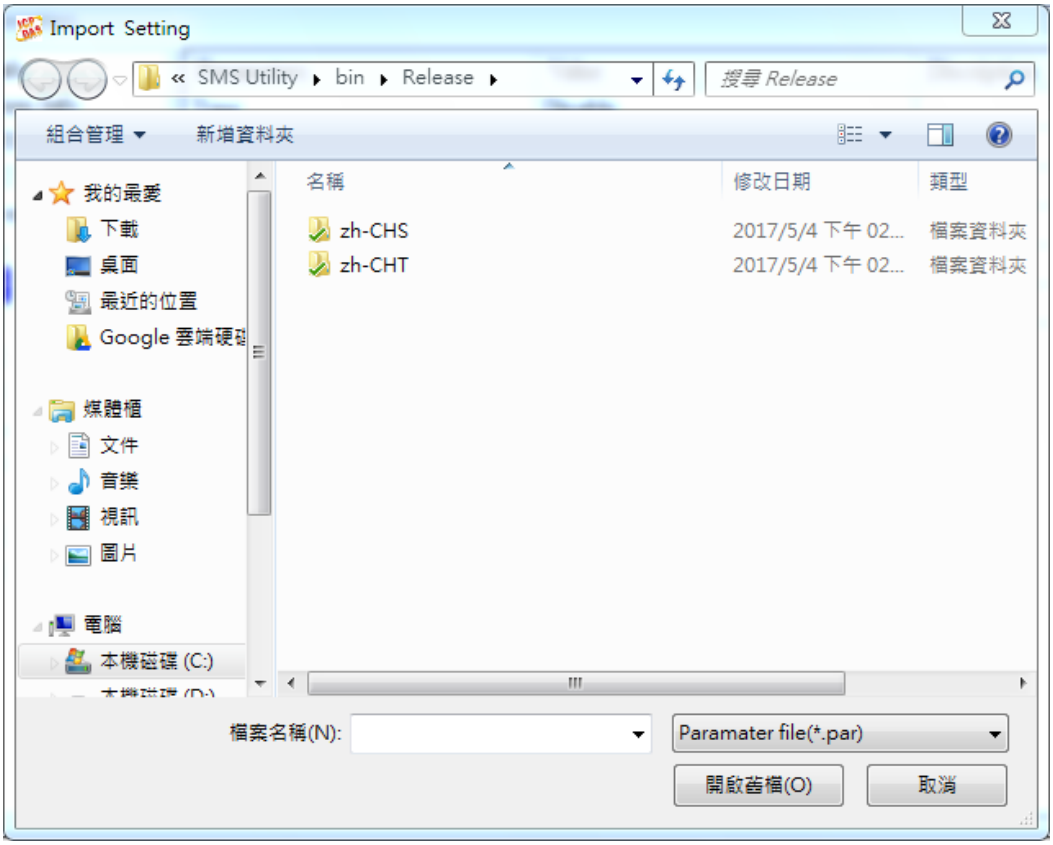
3.4 Import/Export Parameters

There are Import Parameters and Export Parameters in the list as the figure. These functions would be enabled as “Main Parameters” window is open.



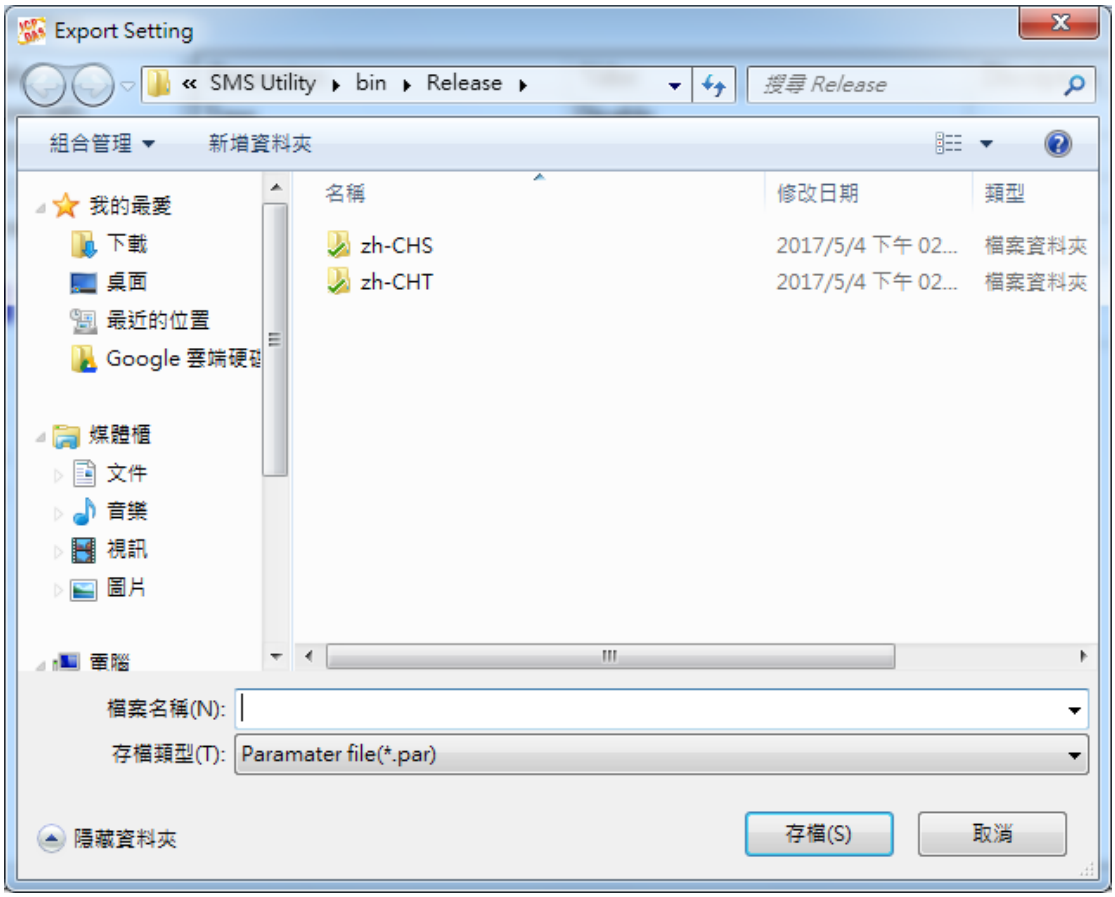
3.4.1 Import Parameters

This function would read these parameters from *.par and show in “Main Parameters” window. When pressing ”Import Parameters” button, the following window would pop-up. Select the path and the file to finish the importing process.



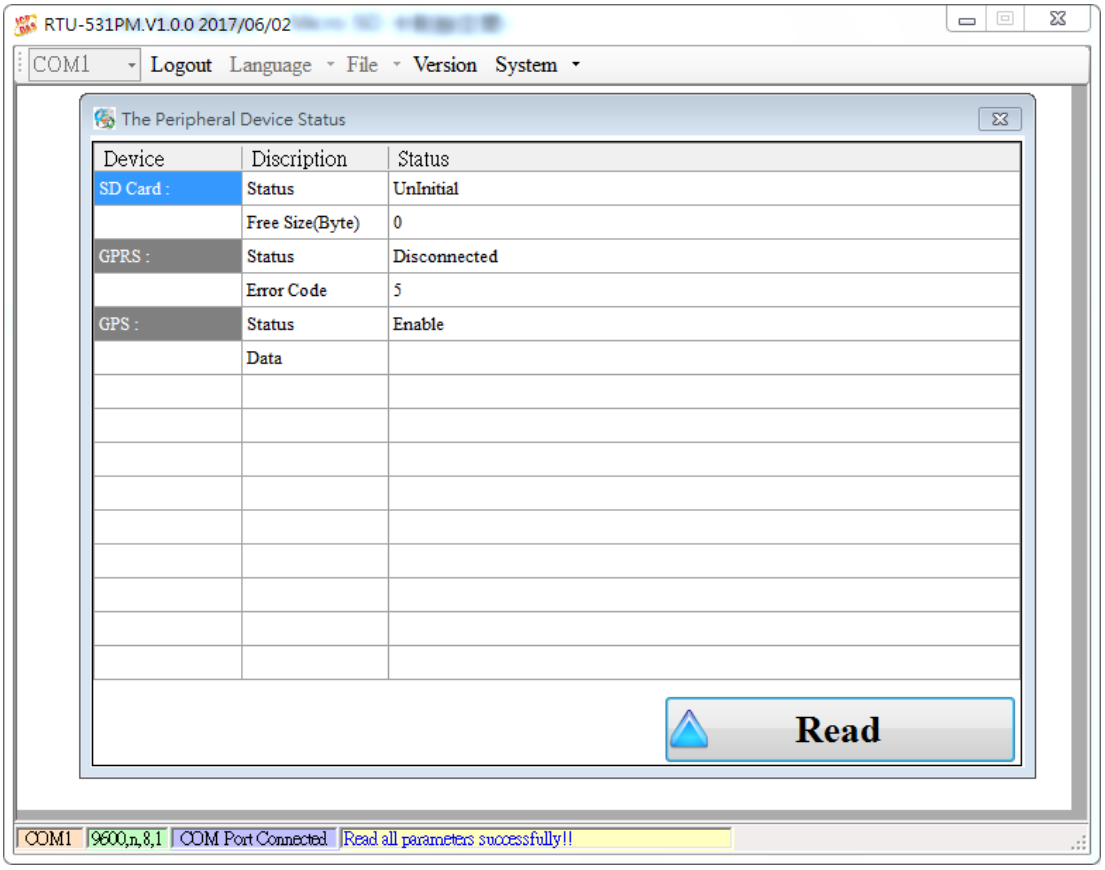
3.4.2 Export Parameters

This function would export these parameters to the *.par file. When pressing ”Export Parameters” button, the following window would pop-up. After selecting the path and set the file name, press “SAVE” button to finish the process.



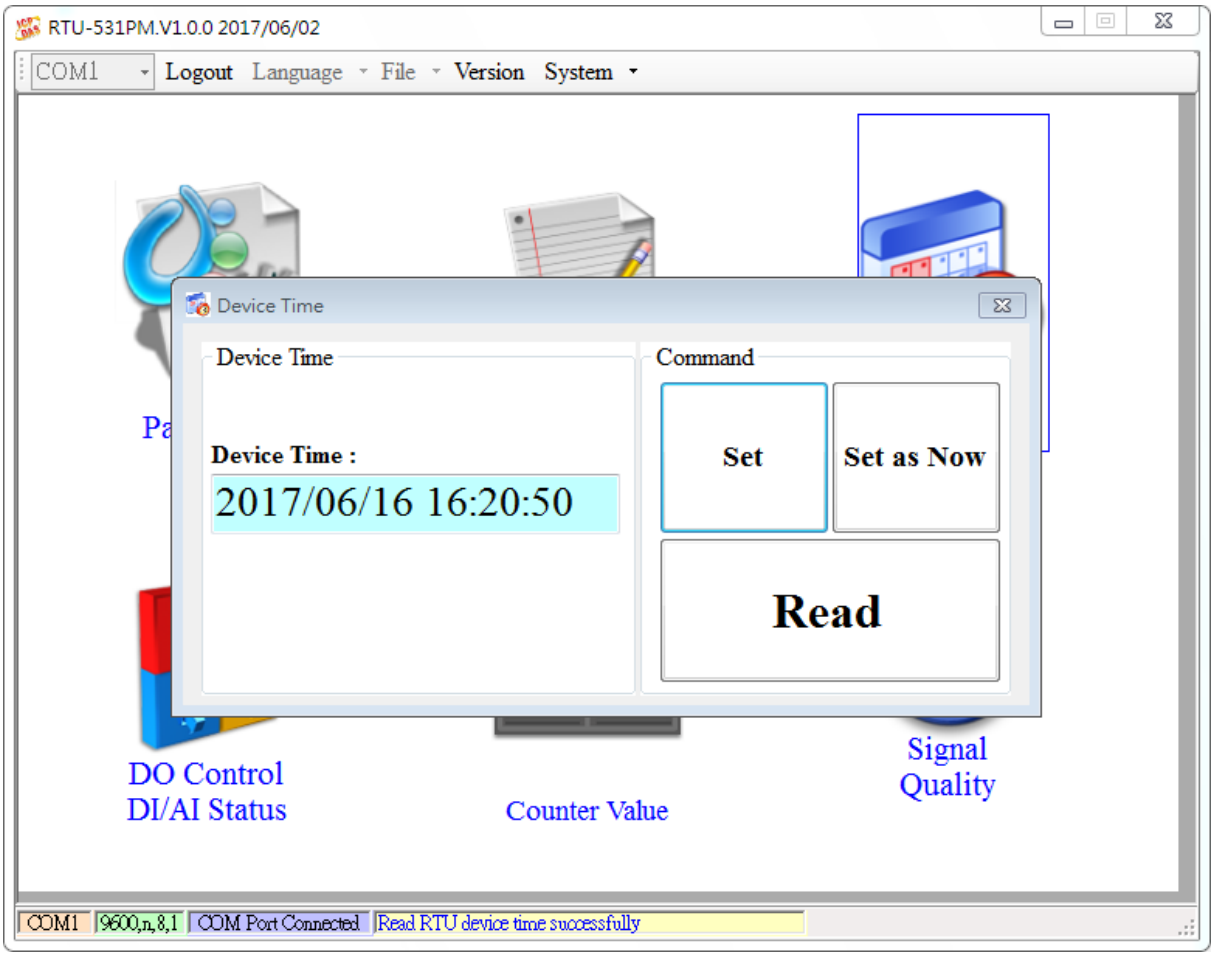
3.5 Device Status

The window would show the status of micro SD card, WCDMA/GPRS connection and GPS information.



Operation description		
Read	Pressing this button would update the status of the RTU-531PM.	
Field instruction		
SD Card	Status	Shows the status of micro SD card. (OK- normal, Error- abnormal).
	Free Size	The remainder space of SD card.
GPRS	Status	Shows the status of WCDMA/GPRS connection.
	Error Code	This code is for the connection status.
GPS	Status	Shows the GPS function is enable or disable.
	Data	The current $GPRMC data of GPS.

3.6 Device Time



Operation description	
Set as Now	Set the time of RTU-531PM according to the time of PC.
Set	Set the time of RTU-531PM according to the time of the field.
Read	This button would read the time of RTU-531PM.
Field instruction	
Device Time	Show or set the time of RTU-531PM.

3.7 Counters Value

This window provides the function to inquire and modify the counter values of DI0 ~ DI3.

The explanation of operation and text field is below:

Operation description	
Read	Read the current counter value and alarm settings from RTU-531PM. If the DI channel is not set as counter, the counter value is 0.
Set Value	Change the counter value into RTU-531PM according to the "Set Value" field.
Field instruction	
Name	The DI name of DI0 ~ DI3.
Value	The current counter value (maximum: 999999999).
Set Value	Change the counter value into RTU-531PM according to the "Set Value" field.

When the DI channels are set as counter and data logger is enabled, the CIx field would be added in csv files as the figure below. (x: the number of DI channel).

A	B	C	D	E	F	G	H	I	J
Date	CI0	CI1	DI2	DI3	DI4	DI5	DO0	DO1	AI0
20100223 175626	11111	22222	0	0	0	0	0	0	-0.494
20100223 175636	11111	22222	0	0	0	0	0	0	-0.497
20100223 175704	11111	22222	0	0	0	0	0	0	-0.494
20100223 175714	11111	22222	0	0	0	0	0	0	-0.494

3.8 DO control/DI status/AI Status

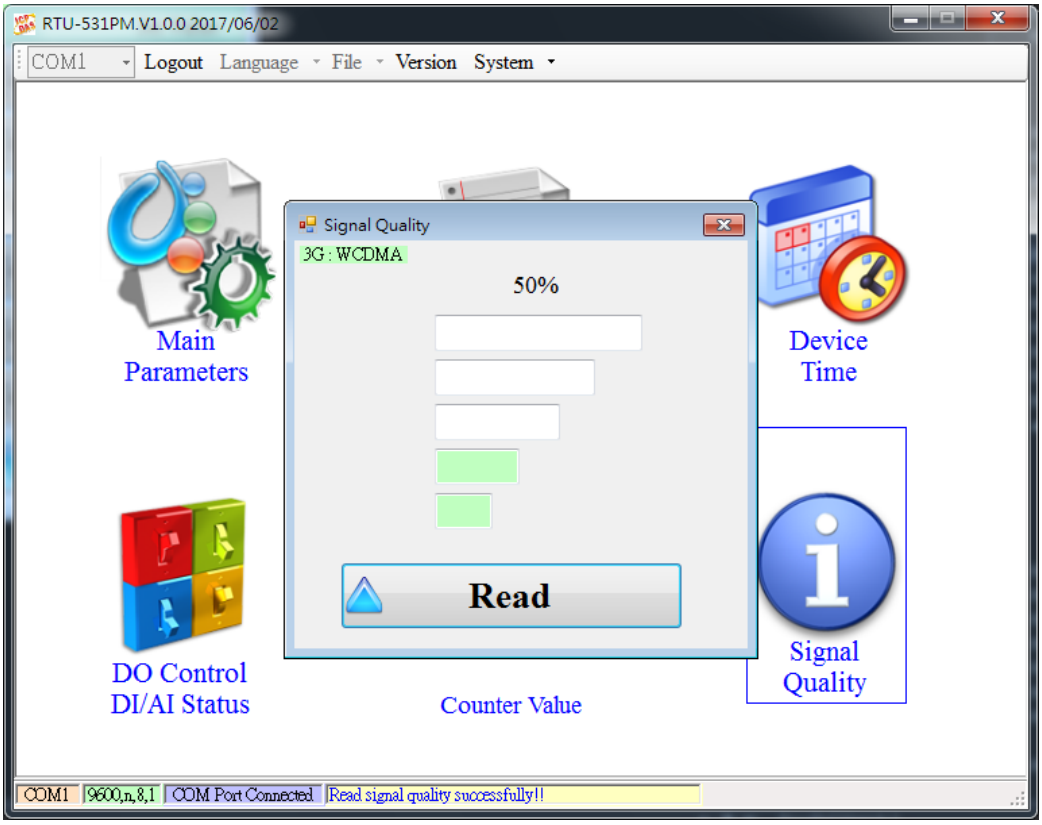
If RTU-531PM login without expansion board, this function will be unable. This function is used to control DO0 and DO1 channels and show the status of DI channels and AI value.

Operation description		
Read	Read back the status of DI/DO and AI value from RTU-531PM.	
DO n : ON	Set the DO output on.	
DO n : OFF	Set the DO output off.	
Field instruction		
DI n Status	Gary	The voltage logic is low.
	Red	The voltage logic is high.
AI n Value	The AI current value(mA).	

Thermistor n Status	The thermistor value.

3.9 Signal Quality

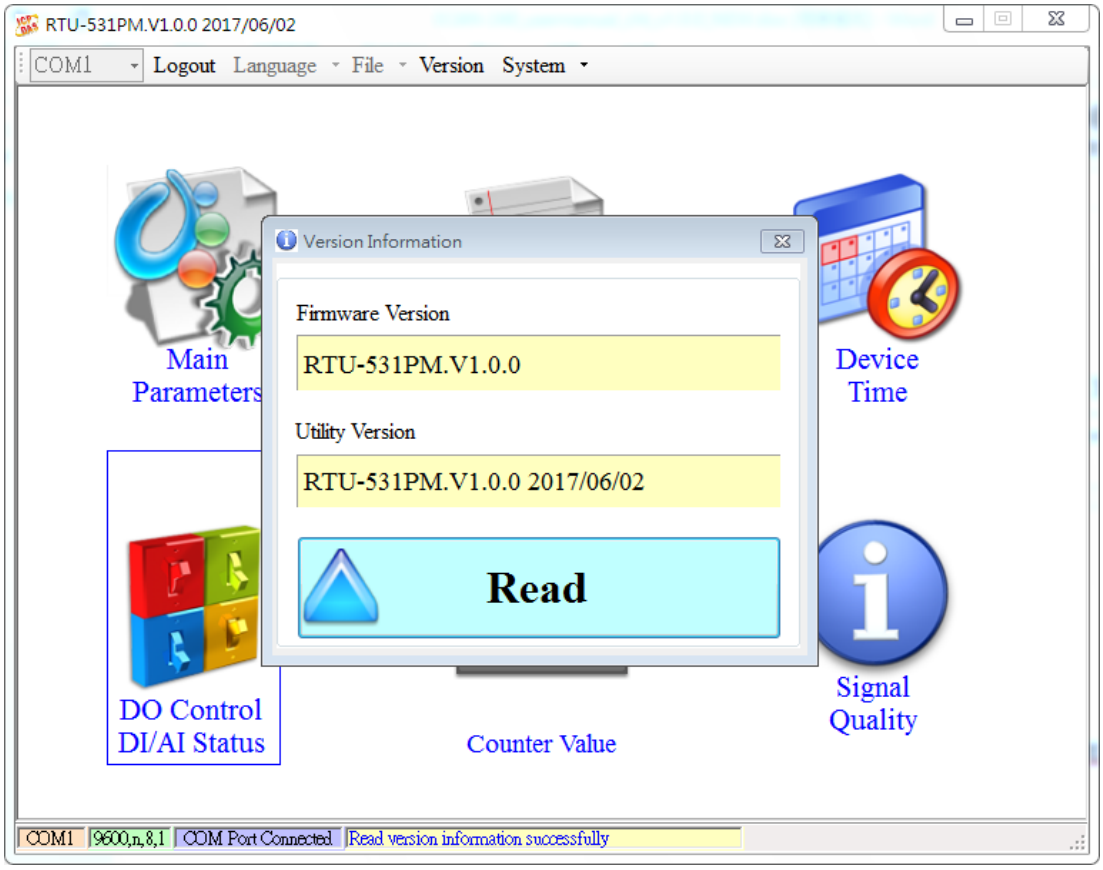
This window can show WCDMA/GPRS signal strength. The strength is divided into 5 sections shown in percentage. And the top-left corner of the window can show the signal type.



Operation description	
Read	Read the WCDMA/GPRS signal strength.

3.10 Version

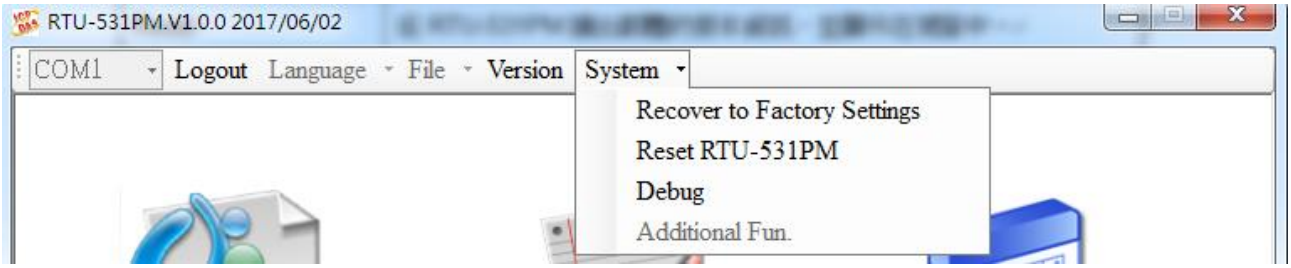
Press "Version" in tool menu, and the window would show the version of Utility and firmware.



Operation description	
Read	Read the version information from RTU-531PM.
Field instruction	
Firmware Version	Show the firmware version of RTU-531PM.
Utility Version	Show the Utility version of RTU-531PM.

3.11 System

"System" menu item has 3 functions. They are "Recover to Factory Settings", "Reset RTU-531PM" and "Debug". As the figure below.



3.11.1 Recover to Factory Settings

The function is used to recover GTP-500M as factory settings including password.

- Make sure the STA led is blanking per 1 sec.
- Select the Recover to Factory Settings.

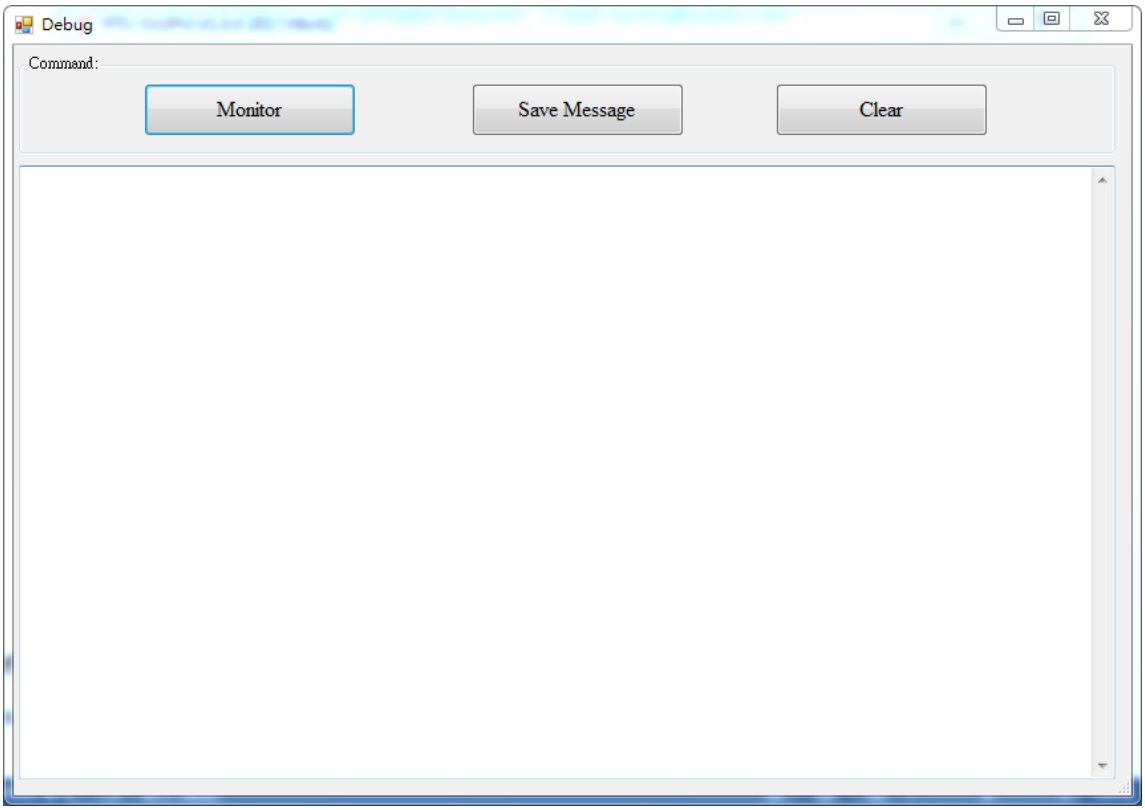
3.11.2 Reset RTU-531PM

The function is used to reset GTP-500M by software.

- Make sure STA led is blanking per 1 second.
- Select "Reset GTP-500M" button to reset RTU-531PM.

3.11.3 Debug

In this Debug mode, users can test mail function and show debug messages. The test or debug messages could be saved as the file.



Operation description	
Monitor	This function can transfer the debug messages from RTU-531PM and show in the Window.
Save message	Save the debug messages as files.
Clear	Clear the information in the debug filed.

4. I/O Data Logger

The data logger would be enabled as the “Data Logger Period” is not 0. The logger files would be saved as .csv file in micro SD card. The different modes provide the different file path, but the same file name and data format.

4.1.1 The naming rule of logger file name

The file of I/O data logger is csv type. The naming rule is according to the time of creating file. The description is as follows.

參數	描述
yyyy	Year
mm	Month
dd	Day
HH	Hour(24h)
MM	Minute
SS	Second
Period	Data Logger Period

4.1.2 Delete Data Logger File Automatically

At 24 o’clock every day , the GTP-500M would check the free space of micro SD card, if the free space of the micro SD card has less than 50MB, it would delete the oldest data logger files in the path of LOGFILE automatically until the free space has larger than 50MB.

Appendix A. Revision History

This chapter provides revision history information to this document.

The table below shows the revision history.

Revision	Date	Description
1.0.0	June 2017	