G-4510 Series

User's Manual

Power Saving PAC (with solar charger)

Version 1.1.2 July 2022

Service and usage information for

G-4510 Series



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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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1. Introduction

The G-4510 series are M2M (Machine to Machine) Power Saving PAC with a cellular transceiver and Solar Charger. It can be used in hydrologic monitoring or mudslide monitoring system. With optional GPS model, the G-4510 can also be a GPS tracking system for vehicle management system or maritime system.

The features of G-4510 series: Solar Charger, Ethernet interface, optional GPS module, 3 digital inputs, 3 digital outputs, 8 analog inputs, 1 relay, 1 RS-232 and 1 RS-485 port. G-4510 can be used in various application fields to transfer data over 4G, 3G, GPRS, SMS, Ethernet or serial bus through its optional 4G / NB communication module. The G-4510 series built-in MiniOS7 provide the same development environment with I-7188/I-7186 series. It is easier for I-7188/I-7186 users to apply the G-4510 series.



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2. Hardware Specifications

2.1 G-4510 Series

G-4510	G-4510D
	

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2.2 G-4510 Series Specifications

Hardware Specification

Item		G-4510	G-4510D
CPU		80 MHz internal microprocessor	
SRAM/Flash		512K/512K , real time clock, watchdog timer	
NVRAM		31 bytes, battery backup, data valid up to 10 years	
EEPROM		16 KB, retention > 40 years. 1,000,000 erase/write cycles	
Comm. Interface			
COM ports		COM1:5-wire RS-232; COM2: RS-485	
Ethernet		10/100 Base-TX Ethernet controller	
Digital Input			
Input Channel		3	
Input Type		Source(Dry Type), Common Ground	
Off Voltage Level		+1 V max.	
On Voltage Level		+3.5 ~ +30 V	
Isolated Voltage		Non-isolated	
Digital Output			
Output Channel		3	
Output Type		3 Open Collector (Sink/NPN)	
Load Voltage		+30 VDC max.	
Load Current		100 mA max.	
Isolated Voltage		Non-isolated	
Analog Input			
Input Channel		8	
Resolution		12 - bit	
Input Range/Type		0 ~ 20 mA	
Sample Rate		1 KHz max. (Read one channel)	
Accuracy		+/- 2 LSB (+/- 0.0097 mA)	
Isolated Voltage		2500Vrms 3000Dc to DC	
Relay			
Output Channel		1	
Type		Form C	
Input Range		2A@30 Vdc ; 0.25 A @250 Vac	
Mechanical endurance		typ. 10^8 operations	
GPS Interface			
Support Channels		32	
Sensitivity		Tracking = up to -159 dBm (with external LNA) Cold start = up to -146 dBm (with external LNA)	
Acquisition Time		Hot start (Open Sky) = 2 s(typical) Cold start (Open Sky) = 36 s(typical)	
Protocol Support		NMEA 0183 version 3.01	
LCD Interface			
General	Effective display area	-	80.61 mm x 14.37 mm (W x H)
	Module Dimension	-	93 mm x 70 mm x 1.6 mm (W x H x T)
Life Time		-	Expected life is more than 100,000 hours under normal operation
Power (Solar Input)			
Protection		Power reverse polarity protection	
Frame Ground Protection		ESD, Surge, EFT, Hi-Pot	

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Power Requirement	+10 V_{DC} ~ +30 V_{DC} , (Max. Voltage of Solar Panel must less +30V)	
Power Consumption	Deep Sleep: < 10 mA@12V_{DC}; Deep Sleep(With LCD): < 11 mA@12V_{DC}; Sleep: < 15 mA@12V_{DC}; Idle: 90 mA @ 24 V_{DC}; Data Link: 150 ~ 400 mA (peak) @ 24 V_{DC}	
Lead Acid Battery Requirement		
Battery	12V Lead-Acid Battery	
Charging Voltage	Voltage of Power Input must be over +16V	
Low Voltage Protect	Low Voltage disconnect = 11.1V / Low Voltage reconnect = 12.6V	
LED Indicators		
System	Red	
4G	Yellow	
GPS	Green	
Charging / Fault	Green / Red	
Mechanical		
Casing	Metal	
Dimensions	47 mm x 142 mm x 168 mm (W x L x H)	
Installation	DIN-Rail and Wall mount	
Environment		
Operating Temperature	-20 ~ +70 °C	-15 ~ +55 °C
Storage Temperature	-40 ~ +80 °C	-20 ~ +70 °C
Humidity	5~90% RH, non-condensing	

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2.3 Order Accessories Specifications

Hardware Specification

Module(Optional)	EC21-AU	EC25-E	BG96
Category	LTE category 1	LTE category 4	LTE Cat-M1/NB1/EGPRS
Frequency Bands			
LTE-FDD	B1/B2/B3/B4/B5/B7/B8/B28	B1/B3/B5/B7/B8/B20	B1/B2/B3/B4/B5/B8/B12/B13/B18/ B19/B20/B26/B28
LET-TDD	B40	B38/B40/B41	B39 (For Cat M1 Only)
WCDMA	B1/B2/B5/B8	B1/B5/B8	--
GSM/EGPRS	850/900/1800/1900MHz	900/1800Mhz	850/900/1800/1900MHz
Area			
Region	Latin America, Australia, New Zeland, Taiwan	EMEA, Korea, Thailand, India	Global
Certification	Carrier:Telstra Regulatory:FCC /Anatel/NCC/JATE/TELEC/ RCM Others:WHQL	Carrier: Vodafone/Deutsche Telekom/ SKT/Telefónica/T-Mobile/KT/ LGU+ Regulatory: GCF/ CE/ KC/ NCC/ RCM/ FAC/ NBTC/ ICASA Others: WHQL	Carrier: Vodafone (Global) Deutsche Telekom Telefónica(Europe)/ Verizon/AT&T/T-Mobile/Sprint/ U.S. Celluar (North America) Telus/Rogers /Bell (Canada) SKT/LGU+ (South Korea) NTT DOCOMO/SoftBank /KDD(Japan)/Telstra (Australia) Regulatory: GCF (Global),CE (Europe) FCC/PTCRB (North America) IC (Canada) IFETEL (Mexico) CCC (China) KC (South Korea) NCC (Taiwan) JATE/TELEC (Japan) RCM (Australia) NBTC (Thailand) IMDA (Singapore) Others: RoHS Compliant
Environment			
Temperature Range	-40°C ~ +80°C	-40°C ~ +85°C	-40°C ~ +80°C
Dimensions	51.0mm × 30.0mm × 4.9mm		

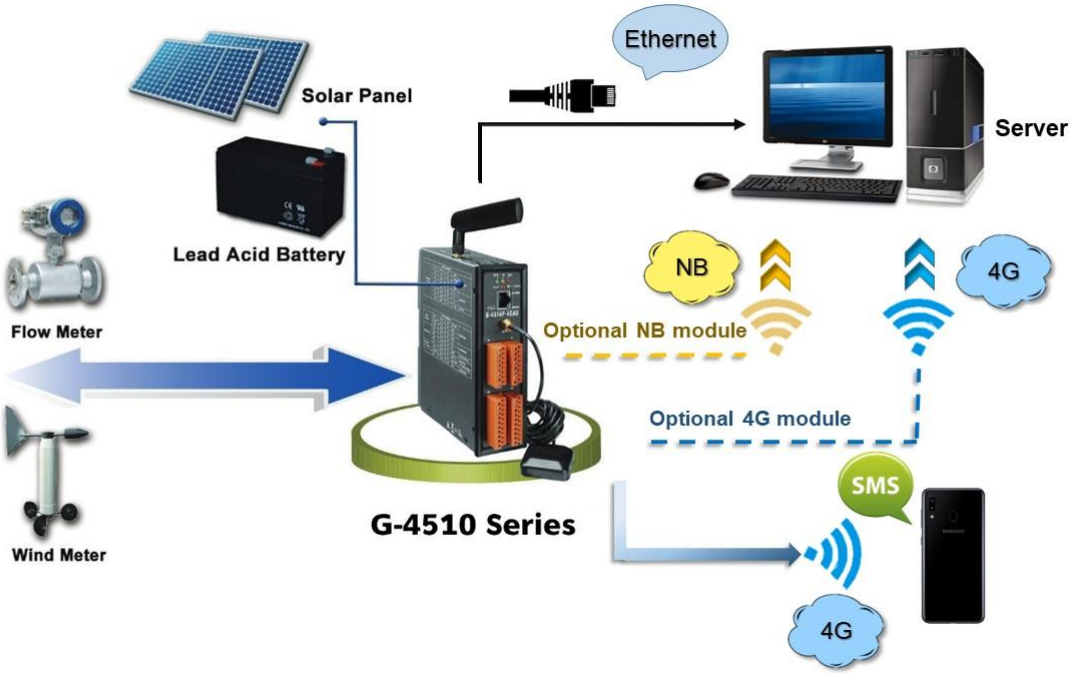
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Module(Optional)	EC20-CE	LE910C4-WWX
Category	LTE category 4	LTE category 4
Frequency Bands		
LTE-FDD	B1/B3/B8	B1/B2/B3/B4/B5/B7/B8/B12/ B13/B14/B19/B20/B26/B28
LET-TDD	B38/B39/B40/B41	--
WCDMA	B1/B8	B1/B2/B4/B5/B8/B19
GSM/EGPRS	900/1800MHz	850/900/1800/1900MHz
Area		
Region	China, India	EMEA, North America, APAC, LATAM
Certification	Regulatory: SRRC/NAL/CCC Others: RoHS Compliant	Carrier: AT&T/ Verizon Regulatory: GCF/ CE/ FCC/ NCC/ PTCRB/ IFETEL
Environment		
Temperature Range	-40°C ~ +80°C	-40°C ~ +85°C
Dimensions	51.0mm × 30.0mm × 4.9mm	

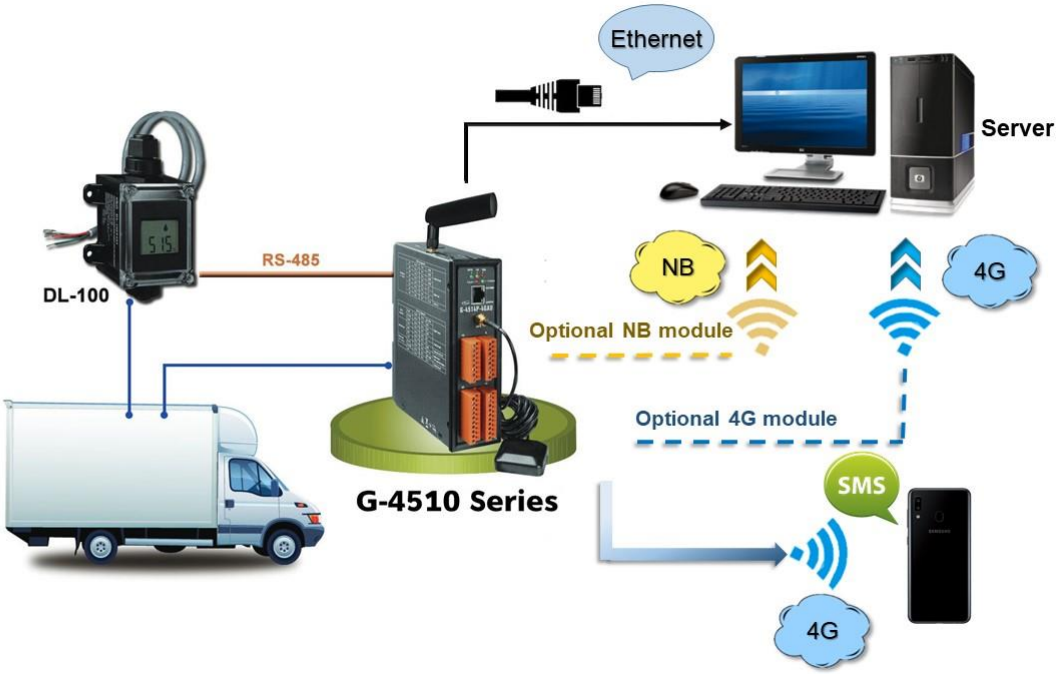
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3. Application Architecture

3.1 Hydrologic / Wind Monitoring Application

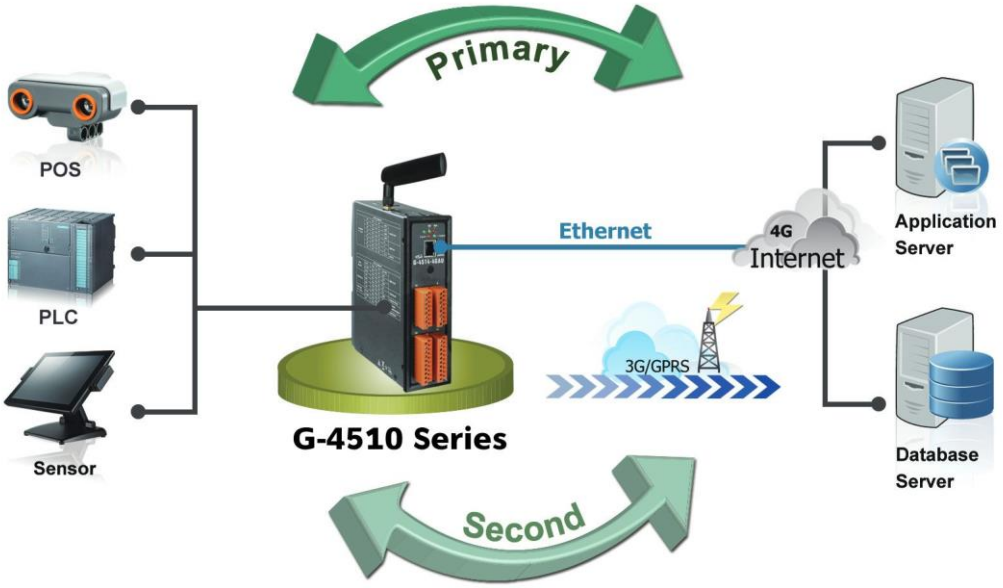


3.2 Car Monitor / Tracking System



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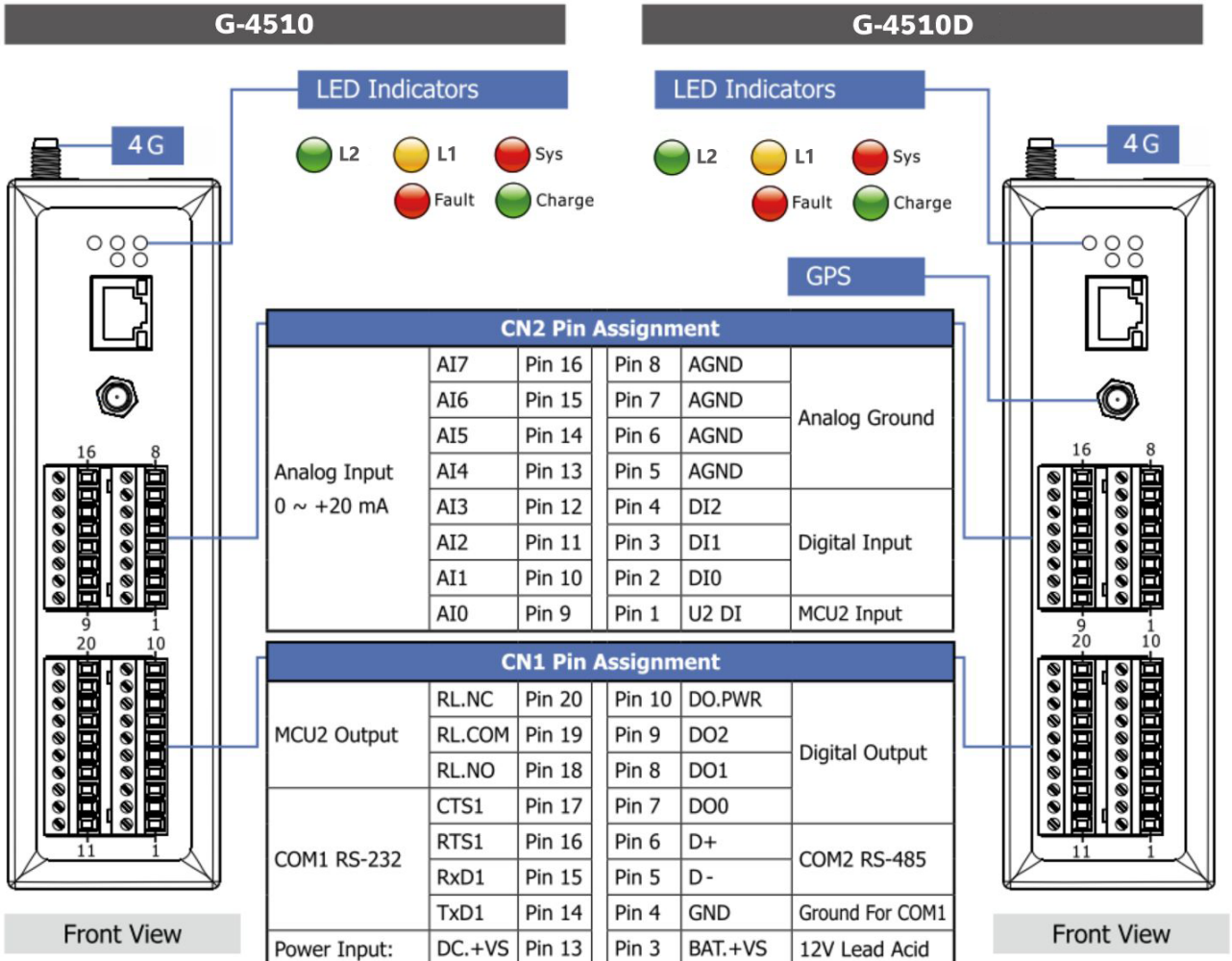
3.3 Redundancy Communication system



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4. Hardware

4.1 Pin Assignments



CN2 Pin Assignment

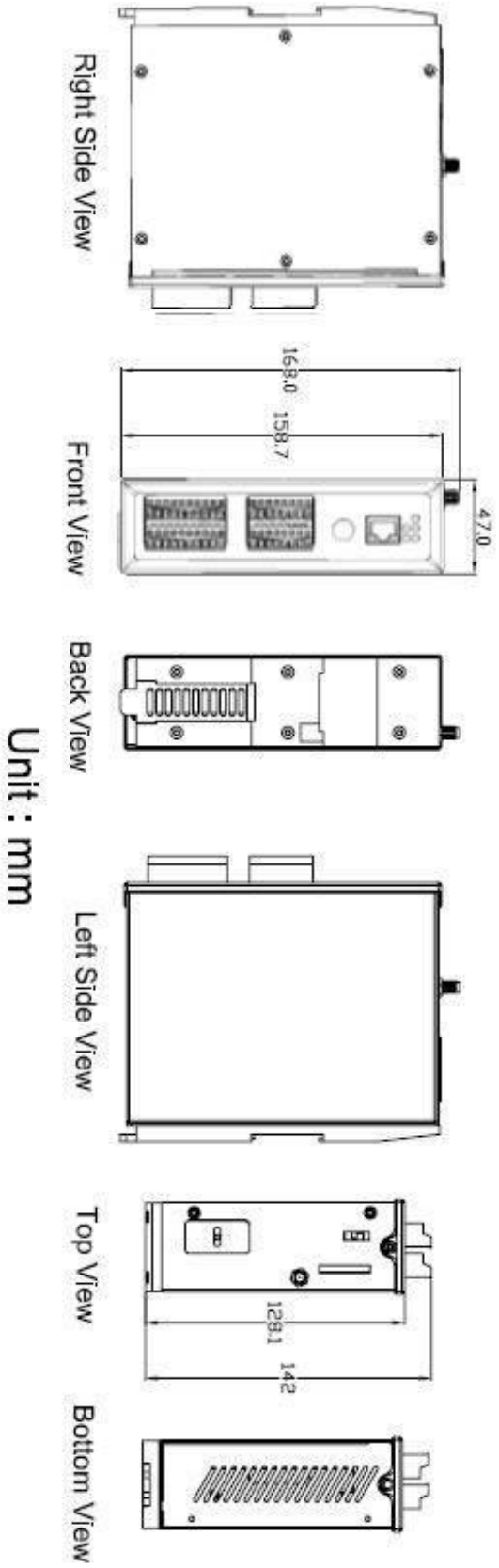
Analog Input 0 ~ +20 mA	AI7	Pin 16	Pin 8	AGND	Analog Ground
	AI6	Pin 15	Pin 7	AGND	
	AI5	Pin 14	Pin 6	AGND	
	AI4	Pin 13	Pin 5	AGND	
	AI3	Pin 12	Pin 4	DI2	Digital Input
	AI2	Pin 11	Pin 3	DI1	
	AI1	Pin 10	Pin 2	DI0	
	AI0	Pin 9	Pin 1	U2 DI	MCU2 Input

CN1 Pin Assignment

MCU2 Output	RL.NC	Pin 20	Pin 10	DO.PWR	Digital Output
	RL.COM	Pin 19	Pin 9	DO2	
	RL.NO	Pin 18	Pin 8	DO1	
COM1 RS-232	CTS1	Pin 17	Pin 7	DO0	
	RTS1	Pin 16	Pin 6	D+	COM2 RS-485
	RxD1	Pin 15	Pin 5	D-	
	TxD1	Pin 14	Pin 4	GND	Ground For COM1
Power Input: +10 ~ +30 VDC	DC.+VS	Pin 13	Pin 3	BAT.+VS	12V Lead Acid
	DC.GND	Pin 12	Pin 2	BAT.+GND	Battery
	N/A	Pin 11	Pin 1	F.G.	Frame Ground

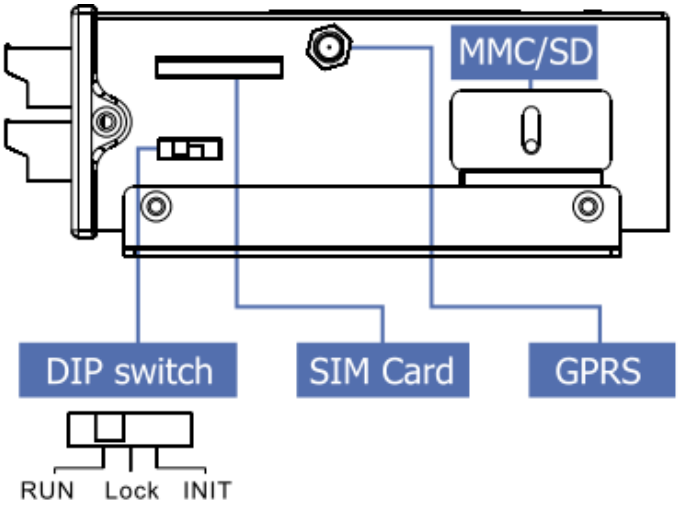
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4.2 Dimensions



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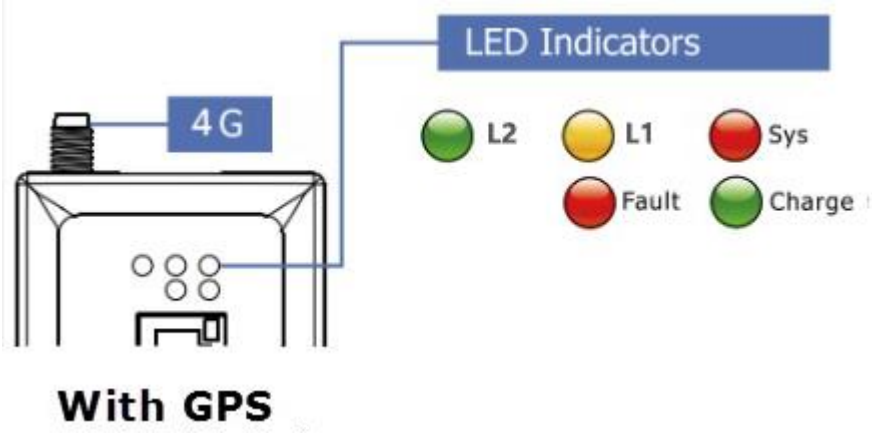
4.3 Operation Mode Switch



Operation Mode Switch	
RUN	OS can execute autoexec.bat
	Flash can be read/write.
Lock	OS can execute autoexec.bat
	Flash is read only (lock).
INIT	OS can not execute autoexec.bat
	Flash can be read/write.

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4.4 LED Indicators



There are five LED indicators to help users to judge the various conditions of G-4510 Series. The description is as follows：

A. Sys (Red)：System LED is programmable.

B. L1 (Yellow)：The modem LED can indicate the status of 4G module.

4G Module Normal	4G Module Exception	Data Transmission
ON 2 sec and OFF 1 sec	OFF or ON 1 sec and OFF 2 sec	Blinking (0.2 sec)

C. L2 (Green)(Option)：The GPS LED can indicate the status of GPS module.

GPS Fail	Search GPS	Receive GPS data
Always OFF	Always ON	Blinking (1 sec)

D. Charging (Green)：Charging status indicator.

Charging	Not Charging
Always ON	Always OFF

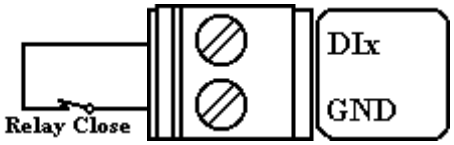
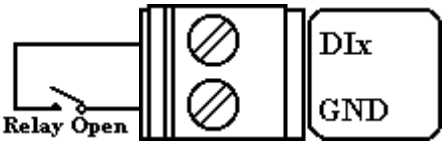
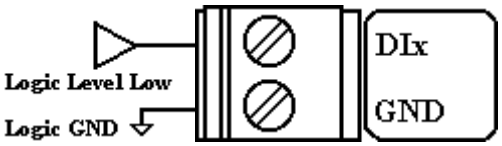
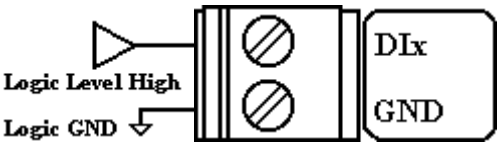
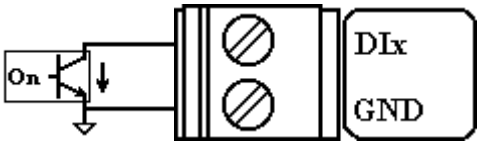
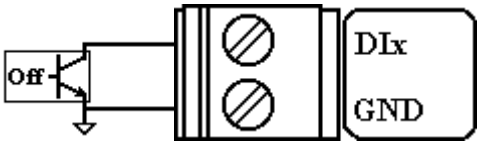
E. Fault (Red)：Charging Fault indicator.

Normal	Fault
Always OFF	Always ON

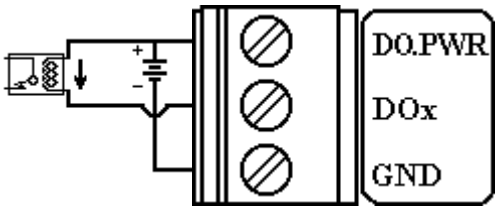
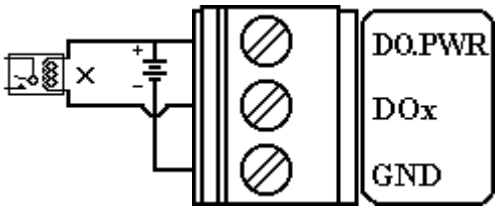
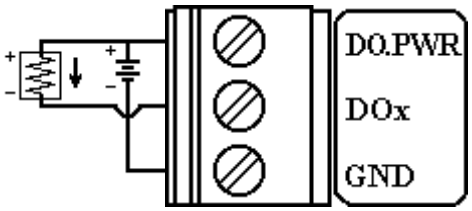
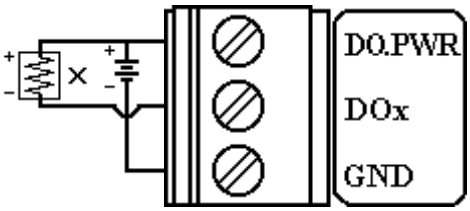
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4.5 Wire Connection

➢ Digital Input Wire Connection

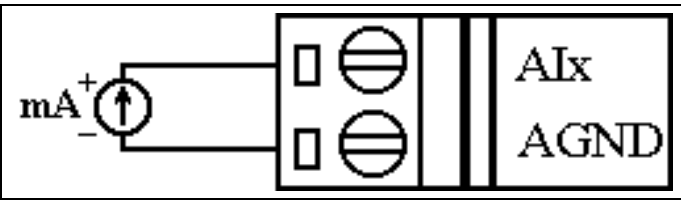
Input Type	ON State DI value as 0	OFF State DI value as 1
Relay Contact		
TTL/CMOS Logic		
Open Collector		

➢ Digital Output Wire Connection

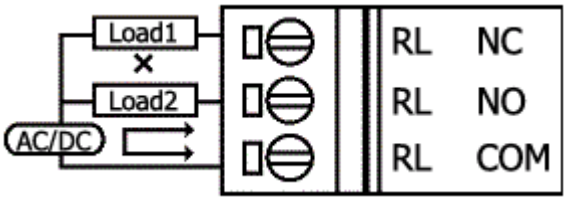
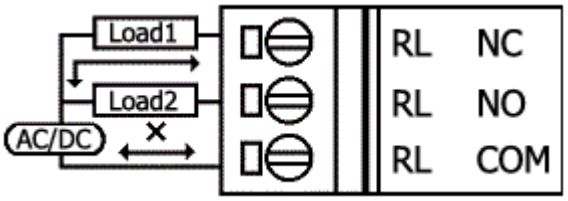
Input Type	ON State DO value as 1	OFF State DO value as 0
Drive Relay		
Resistance Load		

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- Current Input Wire Connection

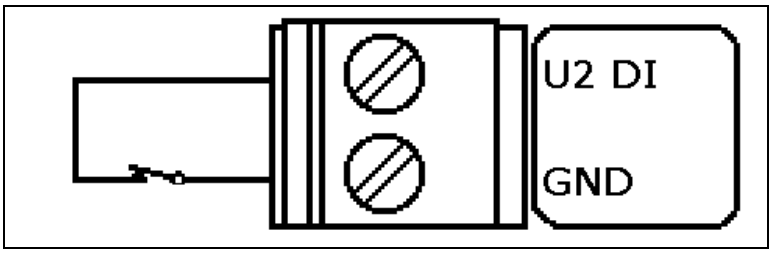
Input Type	

- Relay Wire connection

Relay Output ON	Relay Output OFF
	

4.6 Wake up from Sleep Mode

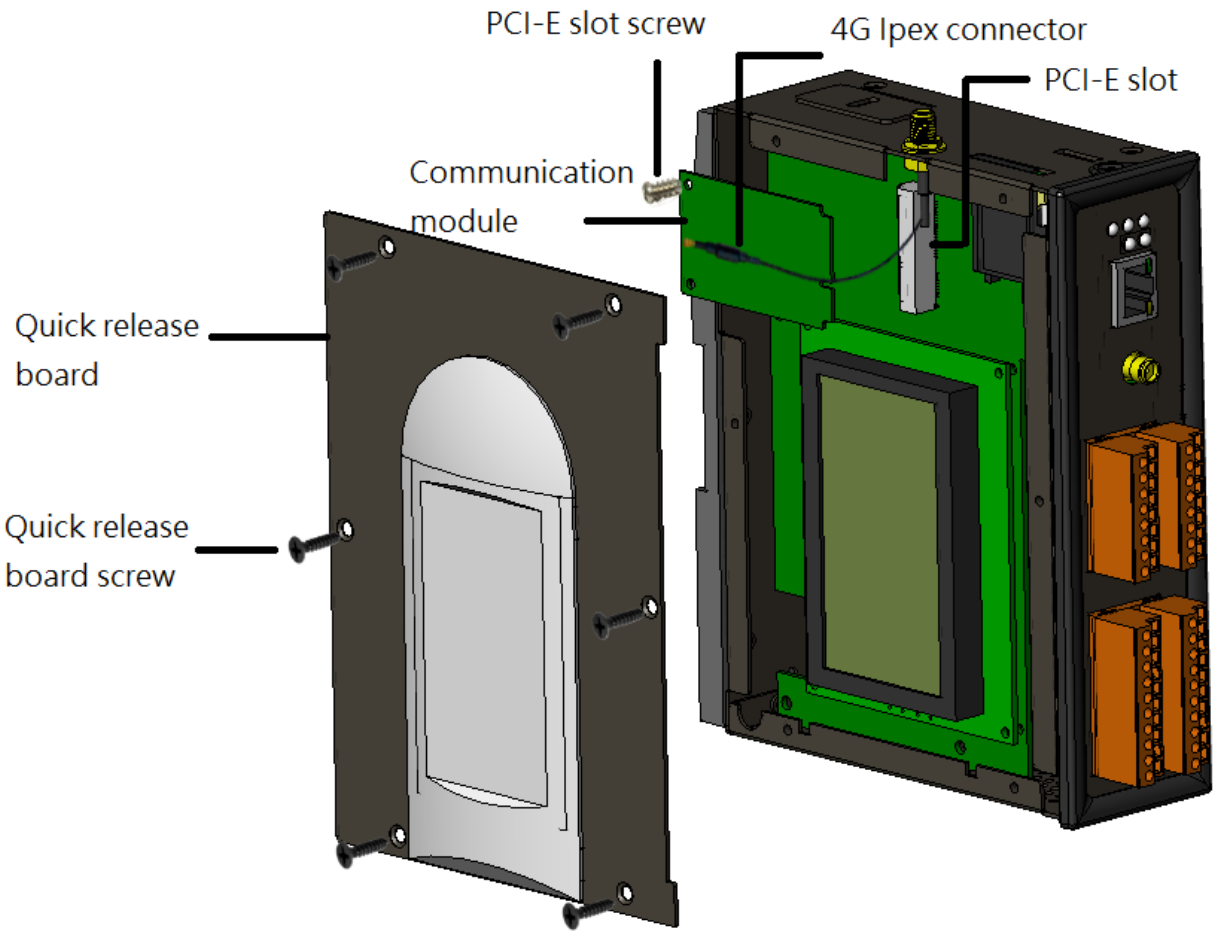
1. When G-4510 was in sleep mode, you can connect the Pin "U2 DI" (MCU2 DI) to GND. to awaking G-4510 from sleep mode.
2. You will read "U2 DI" as 0, when you connect "U2 DI" to GND.



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4.7Assembly process

4.7.1 Assembling exploded drawing



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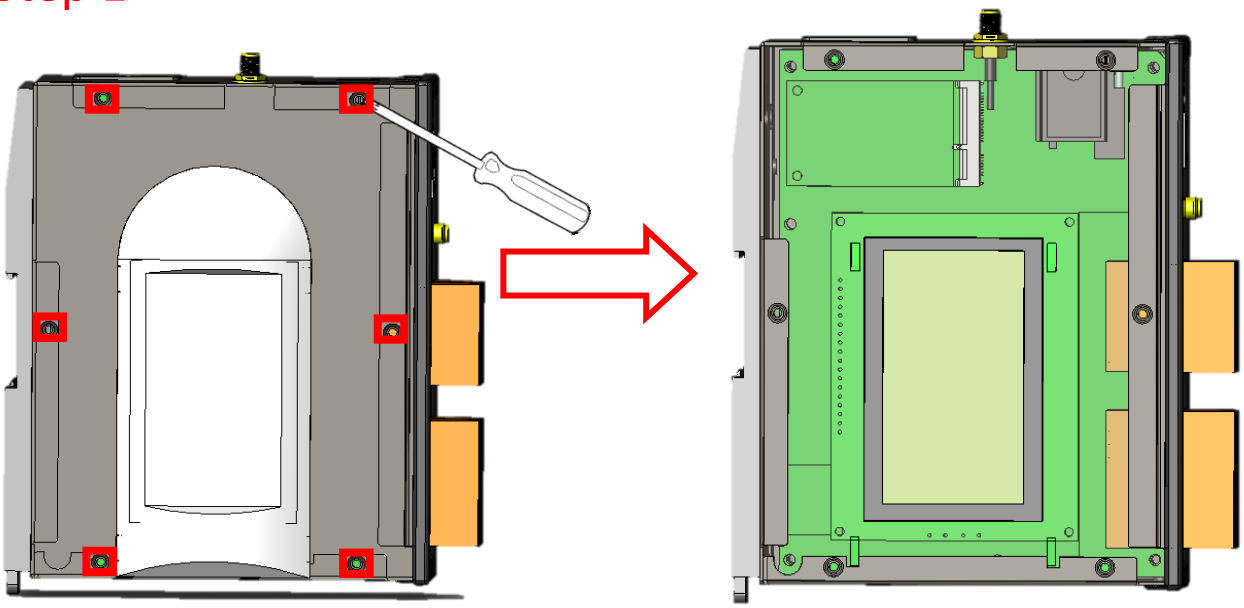
4.7.2 Communication module assembly

- When the communication module is purchased, please refer to the following installation method for installation:
  ※Please refer to the order information at the bottom of the G-4510 order page for the optional communication modules.

1. Remove the 6 screws on the quick release board and remove the quick release board
2. Insert the communication module into the PCI-E slot and lock the screws
3. Connect the 4G Ipex plug to the communication module Main position
   (The Main position of each module can be found in Appendix)
4. Refer to 4.7.3 Communication module switch setting, set the switch to the corresponding module
5. Install the quick release board and lock the 6 screws on the quick release board

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Step 1



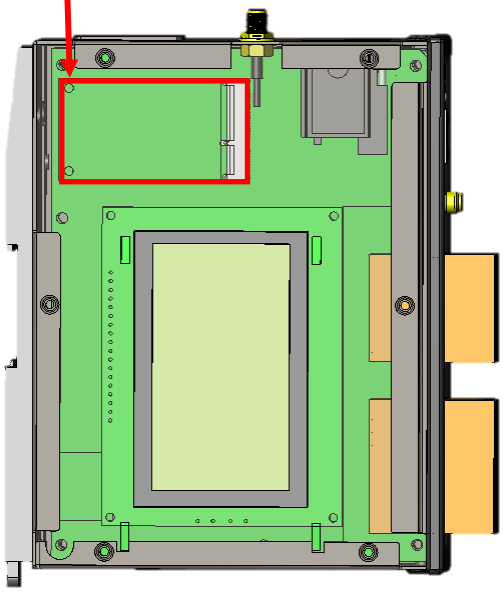
Step 2



Communication module

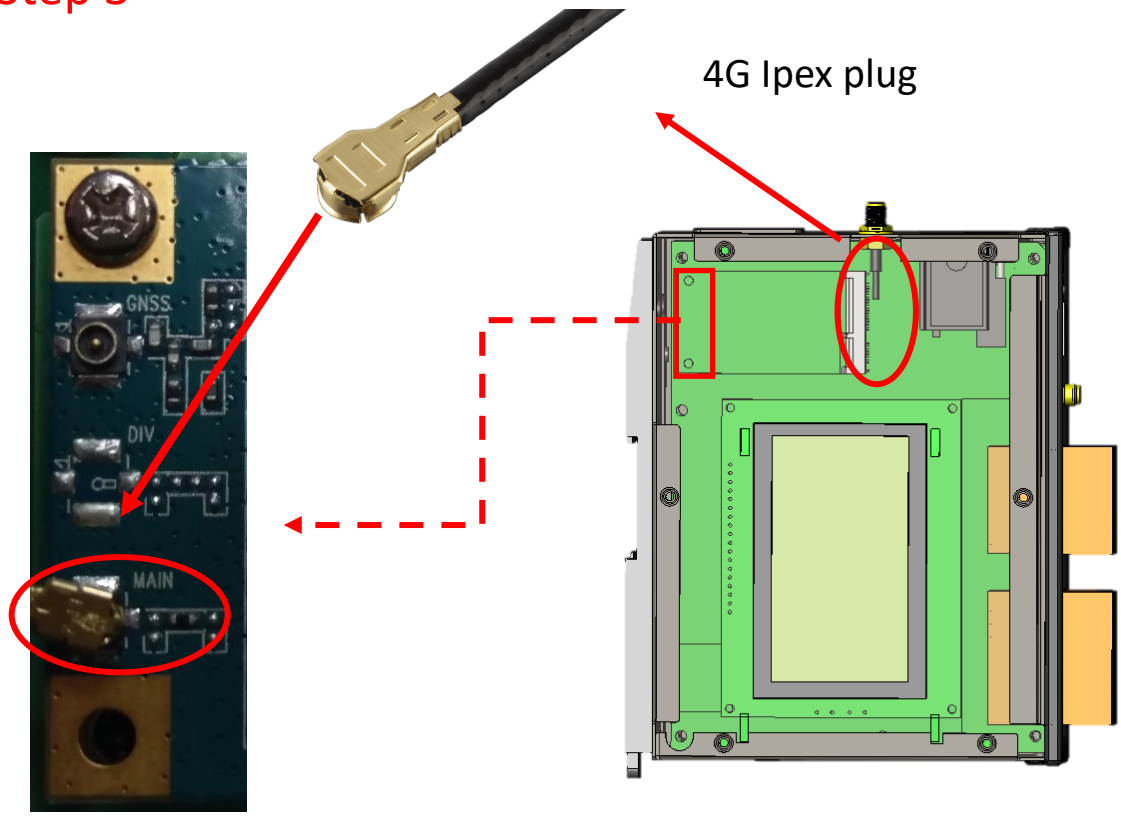


PCI-E screws

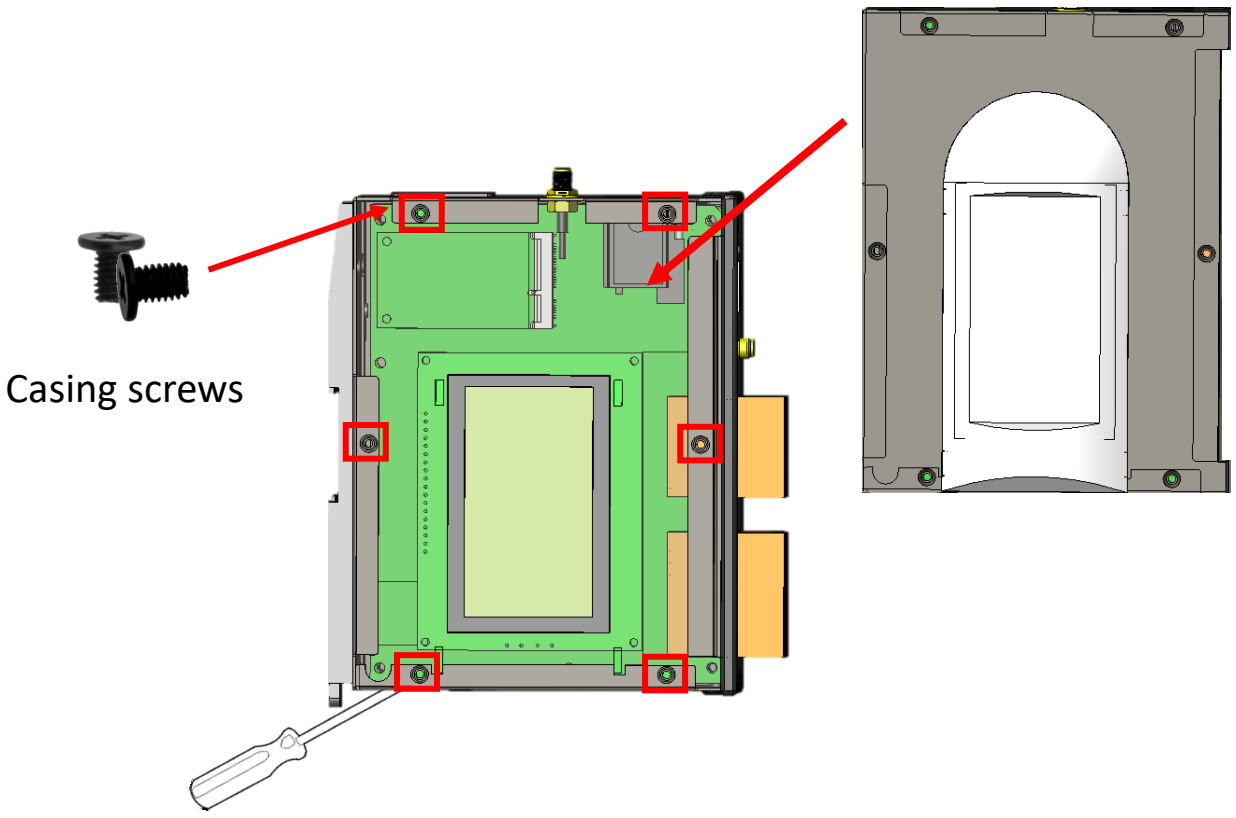


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Step 3



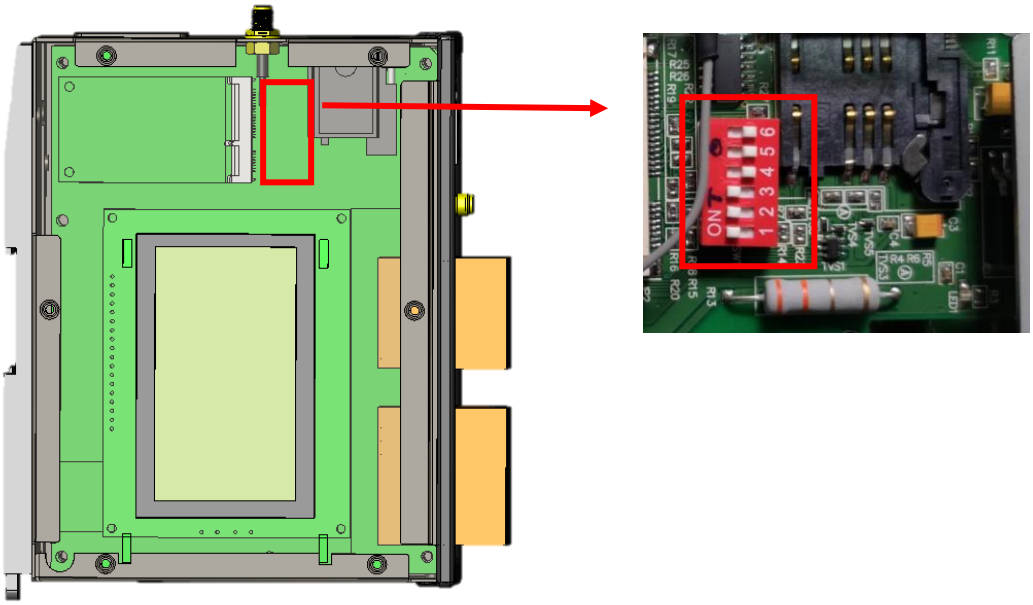
Step 4

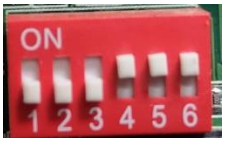


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4.7.3 Communication module switch setting

➢ Please set the switch according to the purchased module model

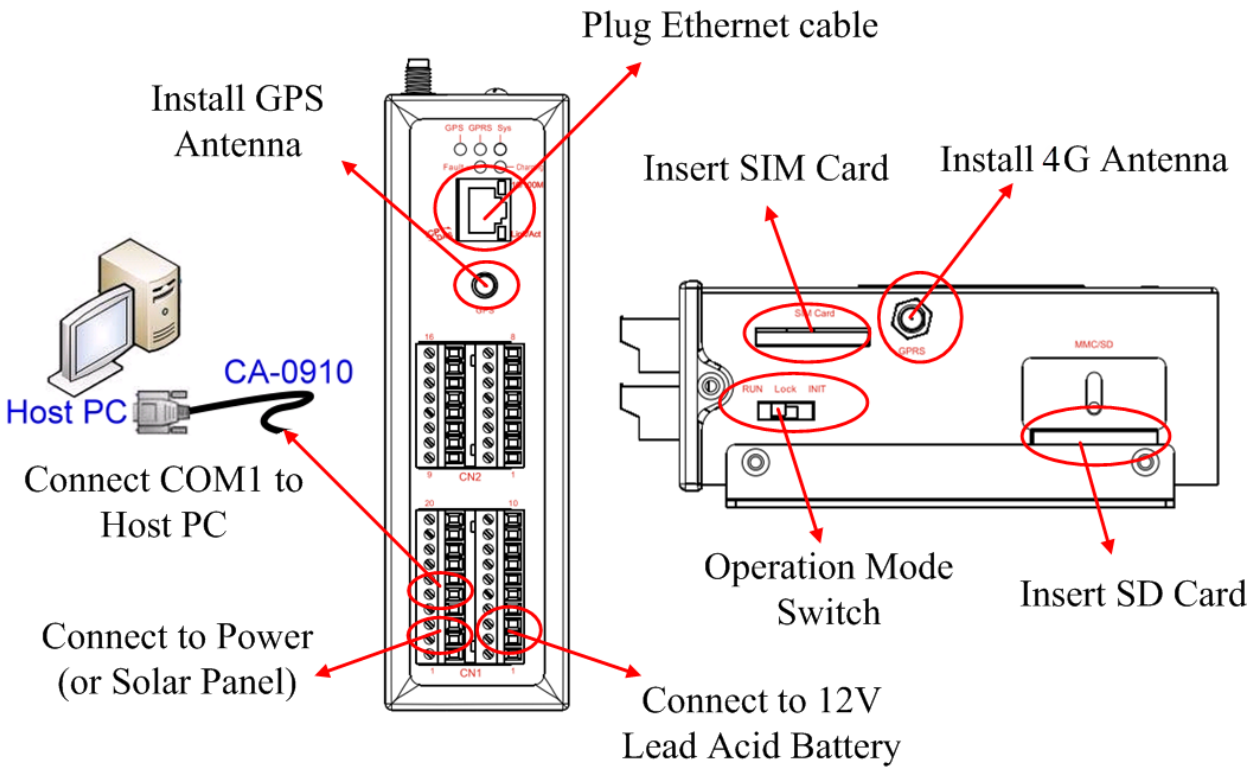


EC2x Series、BG9x Series	LE910Cx Series
Switch Position 1、2、3 OFF 4、5、6 ON 	Switch Position 1、2、3 ON 4、5、6 OFF 

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4.8 Installation

1. Install 4G antenna. (Installed in ANT1 position)
   ※ANT2 is the GPS antenna installation position
2. Plug in the normal SIM card (Before apply the SIM card, confirm it is OK by mobile phone.)
3. Connect the DC.+VS and DC.GND to the power supply or Solar Panel.
4. Connect BAT.+VS and BAT.GND to the 12V Lead Acid Battery.



WARNING! HOT SURFACE DO NOT TOUCH

The product's enclosure may be with high temperature, do not touch before cooling or else will be burned.

SAFETY INSTRUCTION NOTES

The unit installation to final system and the DC source (SELV, Limited Power Source) that is intended to connect with power input pins (DC.+VS / DC.GND) should be complied with requirements of EN 60950-1. Be sure before connect to input pins.

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5. Power Saving and Charger

5.1 Power Saving

Sleep Mode

This mode will shut down 7186 CPU, all I/O(3DI, 3DO, 8AI, exclude MCU2 I/O) and GPS, but 4G module still works.

- Power Consumption：14~15 mA@12V
- How to awake G-4510：
  (1) Sleeping Time is finished.
  (2) Trigger U2_DI.(connect U2_DI to GND.; read U2_DI as 0)
  (3) Make a phone call to G-4510

Deep Sleep Mode

This mode will shut down all interface, but exclude MCU2 I/O.

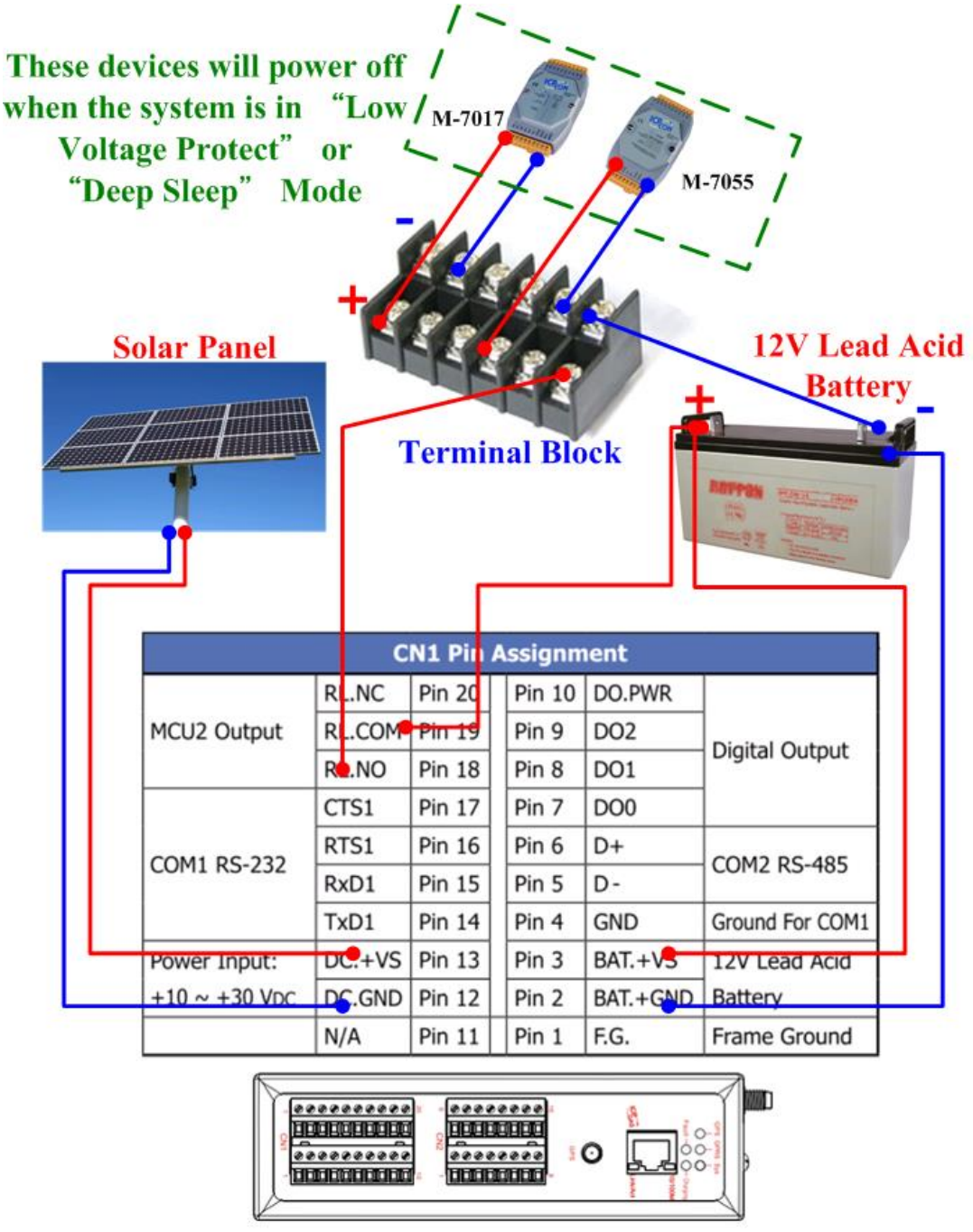
- Power consumption：9~10 mA@12V
- How to awake G-4510：
  (1) Sleeping Time is finished.
  (2) Trigger U2_DI.(connect U2_DI to GND.; read U2_DI as 0)

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Low Voltage Protection

Default value is disabled, and you can enable this function by your program. This function will prevent the battery to over-discharging. When the voltage of the battery is less 11.1V, G-4510 will go into Low Voltage Protect Mode that will turn off all system power. And then G-4510 will wake up if the voltage of the battery is over 12.6V after charging.

- Low Voltage disconnect Voltage = 11.1 V
- Low Voltage reconnect Voltage = 12.6 V
- How to use：please refer to the figure' s wire connection below, and MCU2 library demo code.



CN1 Pin Assignment					
MCU2 Output	RL.NC	Pin 20	Pin 10	DO.PWR	Digital Output
	RL.COM	Pin 19	Pin 9	DO2	
	RL.NO	Pin 18	Pin 8	DO1	
COM1 RS-232	CTS1	Pin 17	Pin 7	DO0	
	RTS1	Pin 16	Pin 6	D+	COM2 RS-485
	RxD1	Pin 15	Pin 5	D-	
	TxD1	Pin 14	Pin 4	GND	Ground For COM1
Power Input: +10 ~ +30 VDC	DC.+VS	Pin 13	Pin 3	BAT.+VS	12V Lead Acid Battery
	DC.GND	Pin 12	Pin 2	BAT.+GND	
	N/A	Pin 11	Pin 1	F.G.	Frame Ground

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5.2 How to Choose the Battery

This section will discuss how to choose a suitable battery for your system. Because the alive time of the system is depending on your system power consumption and your battery capacity, we will calculate with some conditions below.

➢ **Example 1：**



Conditions：

- The system has a 24V external power
- It must work in 2 week when the external power is shut-down.
- The system transmits the data to the server every 10 minutes. (1 minute for full work, and 9 minutes for sleeping)
- Power consumption of deep sleep mode is 7.2 mA@12V
- Average power consumption of full work is 245 mA@12V

Calculation：

- Average power consumption = 245 x (1/10) + 7.2 x (9/10) = 31 (mA)
- 31 (mA) x 24 (hours) x 14 (days) = 10416 mAh
- We may choose "12V, 14Ah Lead Acid Battery" for this system.
- Because 10% battery capacity is low battery voltage state, we don't work in this state. We use 90% battery capacity to calculate.
- Double check the battery capacity：
  14Ah x 90% x 1000 = 12600 mAh > 10416 mAh
  → We will choose a **"12V, 14Ah Lead Acid Battery"** for this system.

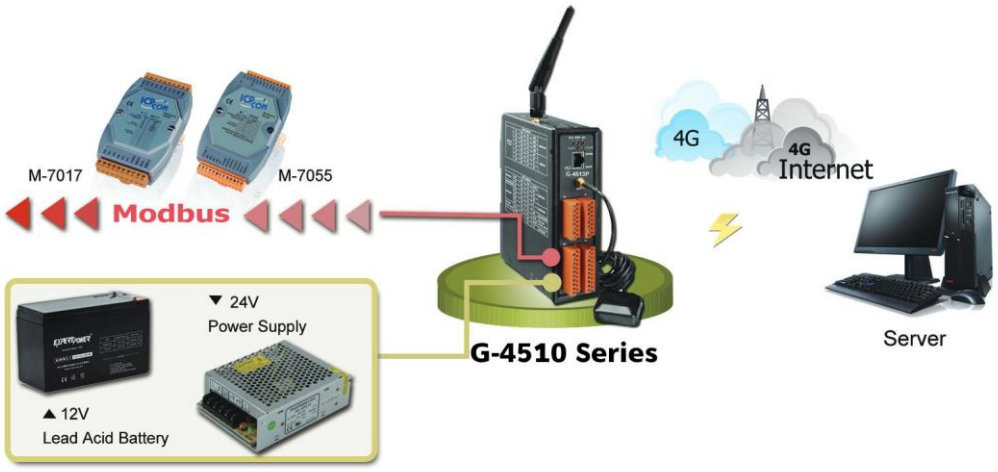
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Please refer Table 5.2.1 to choose the battery for other report frequency：

Table 5.2.1

Report Frequency	Average power consumption	power consumption of 14 days (mAh @12V)
Every minute (No Sleep)	245	82320
Every 10 minutes	31	10416
Every hour	11.2	3763.2
Every day	7.4	2486.4
Every Month	7.2	2419.2

➢ **Example 2：**



Conditions：

- The system has a 24V external power.
- It must work in 2 week when the external power is shut-down.
- The system transmits 3 Modbus devices data to the server every 10 minutes. (1 minute for full work, and 9 minutes for sleeping)
- The system will power off all Modbus devices by "MCU2 Relay Output" when it's in Deep Sleep Mode.
- Power consumption of deep sleep mode is 7.2 mA@12V
- Average power consumption of full work is 424 mA@12V

Calculation：

- Average power consumption = 424 x (1/10) + 7.2 x (9/10) = 49 (mA)
- 424 (mA) x 24 (hours) x 14 (days) = 16430.4 mAh

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- We may choose "12V, 22Ah Lead Acid Battery" for this system.
- Because 10% battery capacity is low battery voltage state, we don't work in this state. We use 90% battery capacity to calculate.
- Double check the battery capacity:
  22Ah x 90% x 1000 = 19800 mAh > 16430.4 mAh
  → We will choose a **"12V, 22Ah Lead Acid Battery"** for this system.

Please refer Table 5.2.2 to choose the battery for other report frequency：

Table 5.2.2

Report Frequency	Average power consumption	power consumption of 14 days (mAh @12V)
Every minute (No Sleep)	424	142464
Every 10 minutes	48.9	16430.4
Every hour	14.1	4737.6
Every day	7.5	2520
Every Month	7.2	2419.2

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5.3 How to Choose the Solar Panel

This section will discuss how to choose a suitable solar panel for your system. The power of solar panel must be more than the power consumption of the system, and we will calculate with some conditions below.

Things you must know before you calculate

Charging voltage：must be more than +16V
Max. Charge Current：2A
Sun hours：an average value. If the average daily solar radiation of the area is 3 kW/m2 , the sun hours of this area is 3 hours

➢ **Example：**



Conditions：

- Power consumption of deep sleep mode is 7.2 mA@12V
- Average power consumption of the system is 245 mA@12V
- The system transmits the data to the server every 10 minutes. (1 minute for full work, and 9 minutes for sleeping)
- Sun hours is 4 hours/day.
- Using 10W solar panel

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Calculation：

- Solar panel Max. current = 10 (w) / 12 (V) = 0.833 (A) = 833 (mA)
- Usually the charging current may be effected by many factor, like angle, building and other environment factor…etc.
- Here we use 1/2 Max. current to calculate
- 1/2 Max. Current = 833/2 = 416 mA
- Average current = 416 x 4 / 24 = 69 (mA/hr)
- Refer to Table 5.3.2, We can know "Average power consumption" is 31 mA for this system. (refer to Table 5.3.2 or section 5.2)

  → We can know **10W solar Panel is suitable** for this system, because 69 > 31

Table 5.3.1

Solar panel (W)	Max. Current (mA)	1/2 Current (mA)	Sun hours	Average Current for a day (mA/hr)
10	833	416	4	69
20	1666	833	4	138
30	2500	1250	4	208
40	3333	1666	4	277
50	4166	2083	4	347

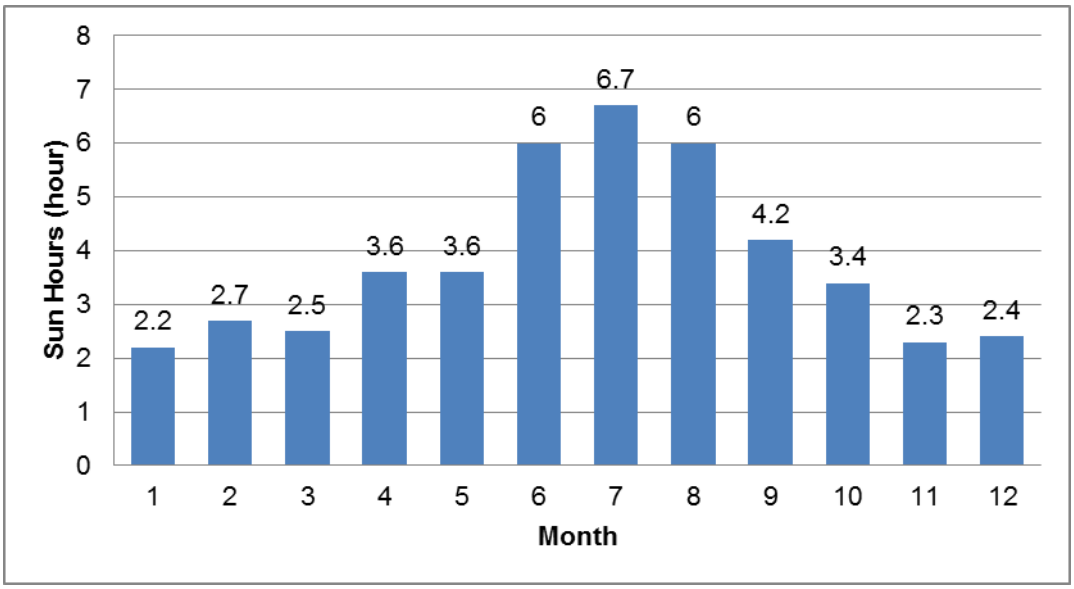
Table 5.3.2

Report Frequency	Average power consumption	power consumption of 14 days (mAh @12V)
Every minute (No Sleep)	245	82320
Every 10 minutes	31	10416
Every hour	11.2	3763.2
Every day	7.4	2486.4
Every Month	7.2	2419.2

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Things you must know about "sun hours"

Usually the "sun hours" is variable with the season. You need use the Min. sun hours to calculate and choose the solar panel and the battery.
For example, if the sun hours of month is like the figure below, you must use 2.2 hours to calculate but not 6.7 hours.



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6. APIs and Demo References

6.1 API for Local I/O

Function definition	Description
X305IO_Init	Initial I/O
X305IO_GetLibVersion	Get X305IO_LIB Version
X305IO_Read_AD_CalibrationGain	Read AD Calibration Gain
X305IO_Read_AD_CalibrationOffset	Read AD Calibration Offset
X305IO_AnalogIn	Read value from assign AI channel
X305IO_Read_All_DI	Read All DI
X305IO_Read_One_DI	Read the value form assign DI channel
X305IO_Write_All_DO	Write All DO
X305IO_Write_One_DO	Write the value to the assign DO channel
X305IO_Read_All_DO	Read All DO state
X305IO_Read_One_DO	Read the DO state form the assign DO channel.
X305IO_AnalogIn_SetChannel	Set the AI channel that users want to read.
X305IO_AnalogIn_Hex	Read the value from the specific A/D channel (12 bits)
X305IO_AnalogIn_HexToFloat	Transfer the AI value from 12 bits to float

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6.1.1 X305IO_Init

Initial X305IO.

Syntax

```
int X305IO_Init(void);
```

Parameters

None

Return values

0：success
<>0：error

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6.1.2 X305IO_GetLibVersion

Get X305IO_Lib Version.

Syntax

```
unsigned X305IO_GetLibVersion(void);
```

Parameters

None

Return values

Version Number

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6.1.3 X305IO_Read_AD_CalibrationGain

Read the A/D Calibration Gain.

Syntax

```
float X305IO_Read_AD_CalibrationGain(void);
```

Parameters

None

Return values

Calibration Gain of the AD channels

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6.1.4 X305IO_Read_AD_CalibrationOffset

Read the A/D Calibration Offset.

Syntax

```
float X305IO_Read_AD_CalibrationOffset(void);
```

Parameters

None

Return values

Calibration Offset of the AD channels

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6.1.5 X305IO_AnalogIn

Read the value from the assign AI channel.

Syntax

```
float X305IO_AnalogIn(
    int iChannel
);
```

Parameters

iChannel

0：channel 0
1：channel 1
2：channel 2
3：channel 3
4：channel 4
5：channel 5
6：channel 6
7：channel 7

Return values

0.0mA ~ 20.0mA

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6.1.6 X305IO_Read_All_DI

Read all DI values of the G-4510 series.

Syntax

```
int X305IO_Read_All_DI(void);
```

Parameters

None

Return values

0x00~0x07

Example

When DI0 Ground
DI1 Open
DI2 Open

value = X305IO_Read_All_DI( );

value = 0x6

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6.1.7 X305IO_Read_One_DI

Read the value from the assign DI channel.

Syntax

```
int X305IO_Read_One_DI(
    int iChannel
);
```

Parameters

iChannel

0：channel 0

1：channel 1

2：channel 2

Return values

1：open

Logic high level (+3.5V ~ +30V)

0：close to GND

Logic low level (0V ~ +1V)

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6.1.8 X305IO_Write_All_DO

Write to all DO values of the G-4510 series.

Syntax

```
void X305IO_Write_All_DO(
    int iOutValue
);
```

Parameters

iOutValue
0x0~0x7

Return values

None

Example

X305IO_Write_All_DO(6);

After function execute：
DO0 OFF
DO1 ON
DO2 ON

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6.1.9 X305IO_Write_One_DO

Write the specific value to the assign DO channel.

Syntax

```
void X305IO_Write_One_DO(
    int iChannel, int iStatus
);
```

Parameters

iChannel

0：channel 0
1：channel 1
2：channel 2

iStatus

0：Status is OFF
1：Status is ON

Return values

None

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6.1.10 X305IO_Read_All_DO

Read all DO values of the G-4510 series.

Syntax

```
int X305IO_Read_All_DO(void);
```

Parameters

None

Return values

0x0~0x7

Example

When DO0 OFF
DO1 ON
DO2 ON

Value = X305IO_Read_All_DO( );

Value = 0x6

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6.1.11 X305IO_Read_One_DO

Read the state from the assign DO channel.

Syntax

```
int X305IO_Read_One_DO(
    int iChannel
);
```

Parameters

iChannel

0：channel 0

1：channel 1

2：channel 2

Return values

0：OFF

1：ON

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6.1.12 X305IO_AnalogIn_SetChannel

Set the specific AI channel that users want to read.

Syntax

```
int X305IO_AnalogIn_SetChannel(
    unsigned iChannel
);
```

Parameters

iChannel

0：channel 0
1：channel 1
2：channel 2
3：channel 3
4：channel 4
5：channel 5
6：channel 6
7：channel 7

Return values

0：Set up success
-1：Set iChannel number error

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6.1.13 X305IO_AnalogIn_Hex

Read the value of the assign AI channel assigned by X305IO_AnalogIn_SetChannel function.

Syntax

```
int X305IO_AnalogIn_Hex(void);
```

Parameters

None

Return values

After Read assign AI channel value.

Example

```
X305IO_AnalogIn_SetChannel(0);     // Set channel 0
X305IO_AnalogIn_Hex( );
```


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6.1.14 X305IO_AnalogIn_HexToFloat

Set the AI value from 12 bits to float format.

Syntax

```
float X305IO_AnalogIn_HexToFloat(
    int iValue
);
```

Parameters

iValue

A value want to 12 bits transform float.

Return values

The transferred AI value by float format.

Example

Set the channel 0 to read, and then transform the value to float.

```
float AdValue;

X305IO_AnalogIn_SetChannel(0);
AdValue=X305IO_AnalogIn_HexToFloat(X305IO_AnalogIn_Hex( ));
```


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6.2 API for MMC/SD



Required library and header files:
SD_Vnnn.LIB and microSD.h

Function definition	Description
pc_init	Initializes the SD socket library
pc_open	1. Open an existing file and return a file handle 2. Creates a new file
pc_close	Closes a file and release a file handle.
pc_read	Reads the specified file
pc_write	Writes the specified file
pc_seek	Moves the file pointer to relative offset from the current offset
pc_tell	Gets current offset of the file pointer
pc_eof	Checks whether the end-of-file is reached
pc_format	Formats the SD card as FAT (FAT32)
pc_mkdir	Creates a directory or subdirectory
pc_rmdir	Removes an existing directory
pc_move	Renames an existing file or a directory, including the subdirectory
pc_del	Deletes the specified file
pc_deltree	Deletes the specified directory or subdirectory
pc_isdir	Checks whether the file is a directory
pc_isvol	Checks if is a volume
pc_size	Gets the size of the specified file
pc_set_cwd	Sets the current working directory

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pc_get_cwd	Gets the pathname of the current working directory
pc_gfirst	Moves the pointer to the first element
pc_gnext	Moves the pointer to the next element
pc_gdone	Moves the pointer to the last element
pc_get_freeSize_KB	Gets the free space of the SD memory card
pc_get_usedSize_KB	Gets the used space of the SD memory card
pc_get_totalSize_KB	Gets the total size of the SD memory card
pc_get_attributes	Gets the file attributes
pc_set_attributes	Sets the file attributes
pc_get_errno	Gets the error number

API for starting SD card

1. pc_ Init()
   Before using any SD functions, pc_init() must be called to initialize the SD.

API for enabling/disabling SD card

2. pc_open()
   Before writing/reading data to/from the SD card, pc_open() must be called to open the file.

3. pc_close()
   After the data has finished being written/read to/from the SD, pc_close() must be called to close the file with a file handle.

API for writing data to the SD card

4. pc_write()
   After using pc_open() to open the file, pc_write() must be called to read data from the SD.

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For example, writing data to the SD:

```
#include <string.h>
#include <stdio.h>
#include "upac5000.h"
#include "microSD.h"
void main(void)
{
    int fd, iRet;
    InitLib();
    if(pc_init())
        Print("Init microSD ok\r\n");
    else
    {
        Print("Init microSD failed\r\n");
        iRet=pc_get_errno();
        switch(iRet)
        {
            case PCERR_BAD_FORMAT: //1
                Print("Error 01: format is not FAT\r\n");
                break;
            case PCERR_NO_CARD: //2
                Print("Error 02: no microSD card\r\n");
                break;
            default:
                Print("Error %02d: unknow error\r\n", iRet);
                break;
        }
    }
    fd=pc_open("test.txt", (word) (PO_WRONLY|PO_CREAT|PO_APPEND),
    (word) (PS_IWRITE|PS_IREAD));
    if(fd>=0)
    {
        pc_write(fd, "1234567890", 10); /* write 10 bytes */
        pc_close(fd);
    }
}
```


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API for reading data from the SD card

5. pc_read()
   After using pc_open() to open the file, pc_read() must be called to read data from the SD.

For example, reading data from the SD:

```
#include <string.h>
#include <stdio.h>
#include "upac5000.h"
#include "microSD.h"
void main(void)
{
    int fd, iRet;
    unsigned char Buffer[80];
    InitLib();
    if(pc_init())
        Print("Init microSD ok\r\n");
    else
    {
        Print("Init microSD failed\r\n");
        iRet=pc_get_errno();
        switch(iRet)
        {
            case PCERR_BAD_FORMAT: //1
                Print("Error 01: format is not FAT\r\n");
                break;
            case PCERR_NO_CARD: //2
                Print("Error 02: no microSD card\r\n");
                break;
            default:
                Print("Error %02d: unknow error\r\n", iRet);
                break;
        }
    }
    fd=pc_open("test.txt", (word) (PO_RDONLY), (word) (PS_IWRITE|PS_IREAD));
    if(fd>=0)
    {
        iRet=pc_read(fd, Buffer, 10);    /* reads 10 bytes */
```


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```
            Buffer[10]=0; /* adds zero end to the end of the string */
            pc_close(fd);
            Print("%s", Buffer);
        }
}
```

For more demo program about the microSD, please refer to:
CD:\napdos\g-4510\software\demo\basic\microSD\
http://ftp.icpdas.com/pub/cd/usbcd/napdos/g-4510/software/demo/basic/microsd/

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6.3 API for LCD

Function definition	Description
LCD_Init	Initialize the library
LCD_BackLight_On	Turn on the LCD backlight
LCD_BackLight_Off	Turn off the LCD backlight
LCD_ShowText	Display one character on the LCD panel
LCD_ClrScrn	Clear the LCD panel
LCD_StandByMode	Enter the stand by mode
LCD_NormalMode	Restore the LCD to normal mode
LCD_GotoPosition	Move the cursor to the specified position
LCD_CursorDisplay	Set the Cursor display status
LCD_LineReverse	Select one of four line and reverse the display
LCD_LineRestore	Select one of four line and restore the display
LCD_GetLibDate	Gets the create date of funciton library
LCD_GetLibVersion	Gets the version number of function library

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6.3.1 LCD_Init

Initialize parameters about LCD functions in the library.

Syntax

```
void LCD_Init(void);
```

Parameters

None

Return values

None

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6.3.2 LCD_BackLight_On

Turn on the LCD backlight.

Syntax

```
void LCD_BackLight_On(void);
```

Parameters

None

Return

None

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6.3.3 LCD_BackLight_Off

Turn off the LCD backlight.

Syntax

```
void LCD_BackLight_Off(void);
```

Parameters

None

Return values

None

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6.3.4 LCD_ShowText

Display one character on the LCD panel, and the cursor will right-shifted by one character position automatically.

Syntax

```
void LCD_ShowText(
    uchar Text
);
```

Parameters

Text

Display character

Return values

None

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6.3.5 LCD_ClrScrn

Clear the LCD panel.

Syntax

```
void LCD_ClrScrn(void);
```

Parameters

None

Return values

None

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6.3.6 LCD_StandByMode

Enter the stand by mode, and it can be terminated by either LCD_NormalMode() or other function.

Syntax

```
void LCD_StandByMode(void);
```

Parameters

None

Return values

None

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6.3.7 LCD_NormalMode

Restore the LCD to normal mode when it is in the stand by mode.

Syntax

```
void LCD_NormalMode(void);
```

Parameters

None

Return values

None

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6.3.8 LCD_GotoPosition

Move the cursor to the specified position.

Syntax

```
void LCD_GotoPosition(
    int Line,
    int Offset
);
```

Parameters

Line

One of four line numbers (1 to 4)

Offset

Cursor position (1 to 8)

Return values

None

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6.3.9 LCD_CursorDisplay

Set the Cursor display status.

Syntax

```
void LCD_CursorDisplay(
    int Display,
    int Blink
);
```

Parameters

Display

Cursor display on/off

1: Display on

0: Display off

Blink

Character blink on/off

1: Display on

0: Display off

Return values

None

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6.3.10 LCD_LineReverse

Select one of four line and reverse the display.

Syntax

```
void LCD_LineReverse(int Line);
```

Parameters

Line

One of four line numbers (0 to 4)

Return values

None

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6.3.11 LCD_LineRestore

Select one of four line and restore the display.

Syntax

```
void LCD_LineRestore(
    int Line
);
```

Parameters

Line

One of four line numbers (0 to 4)

Return values

None

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6.3.12 LCD_GetLibDate

Gets the create date of funciton library.

Syntax

```
void LCD_GetLibDate(
    unsigned char *LibDate
);
```

Parameters

LibDate

Gets the create date of funciton library

Return values

None

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6.3.13 LCD_GetLibVersion

Get the version number of function library.

Syntax

```
unsigned LCD_GetLibVersion(void);
```

Parameters

None

Return values

Return the current version number.

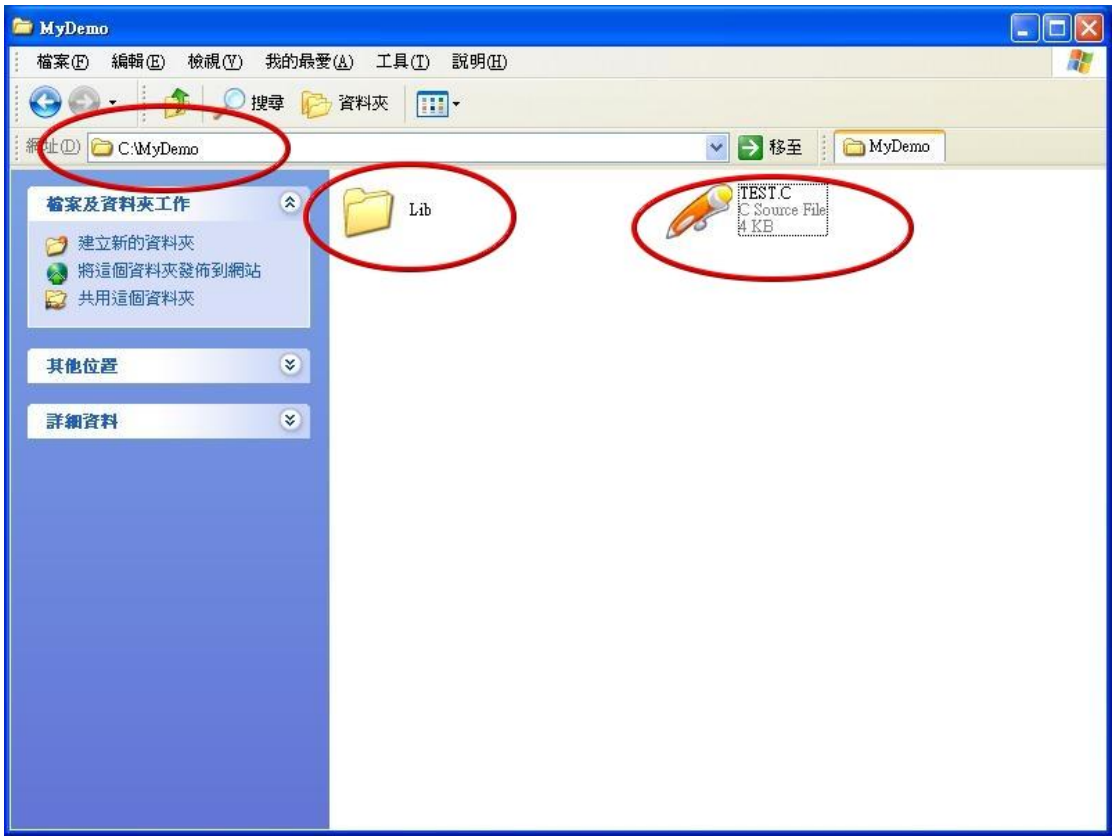
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7. Program Download Procedure

Here, it is considered that how to build an execution file and how to run this program on the G-4510 series.

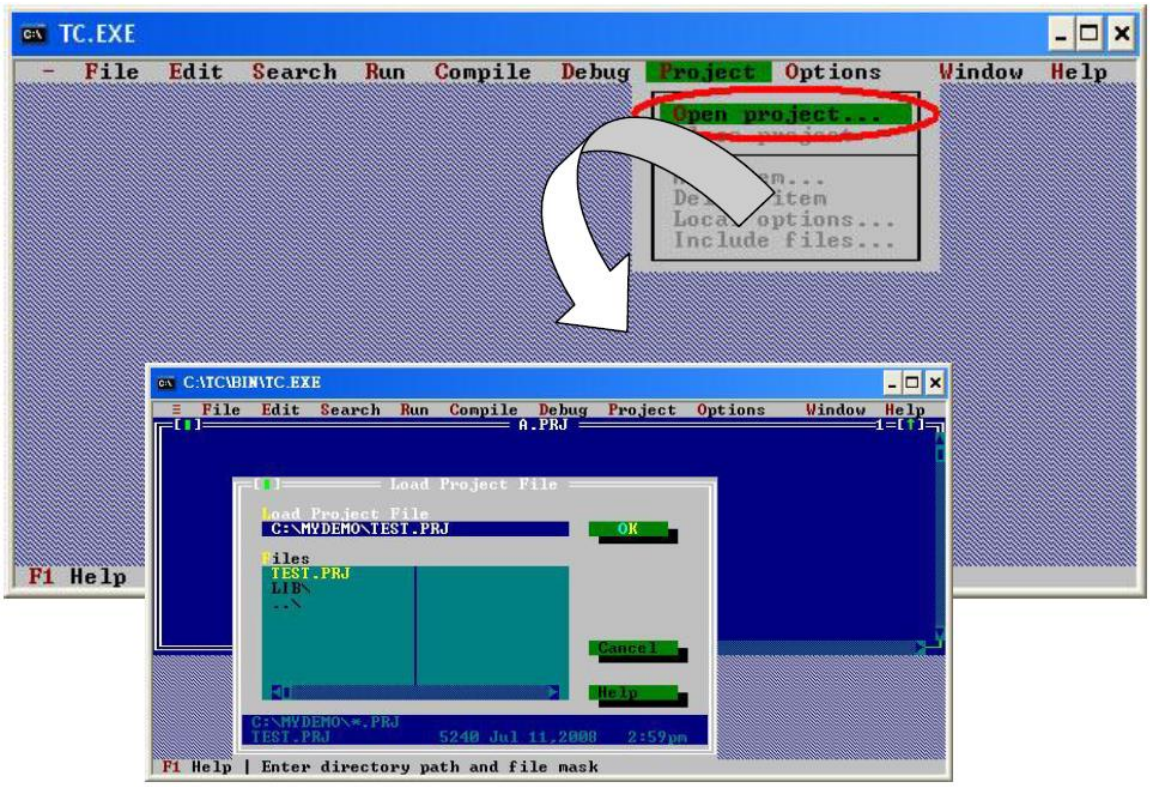
Library	Description
G4500.LIB	G-4510 and DI/O、AI functions
GSM.LIB	GPRS functions
SD_Vnnn.LIB	MMC/SD functions
TCP_DM32.LIB	Ethernet functions
LCD.LIB	LCD functions

Step 1：Create a folder name "MyDemo" in the C disk, and copy the lib folder and users program into the MyDemo folder.

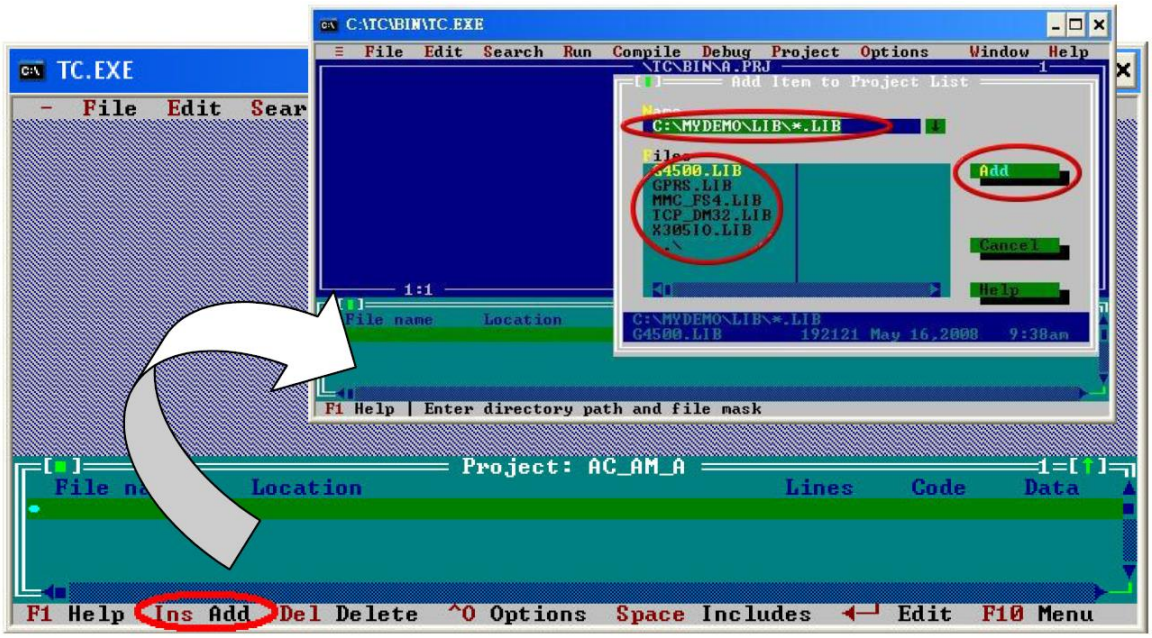


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Step 2：Run the TC++1.01development. Click the "Project\Open project…" create new project named "TEST.PRJ".

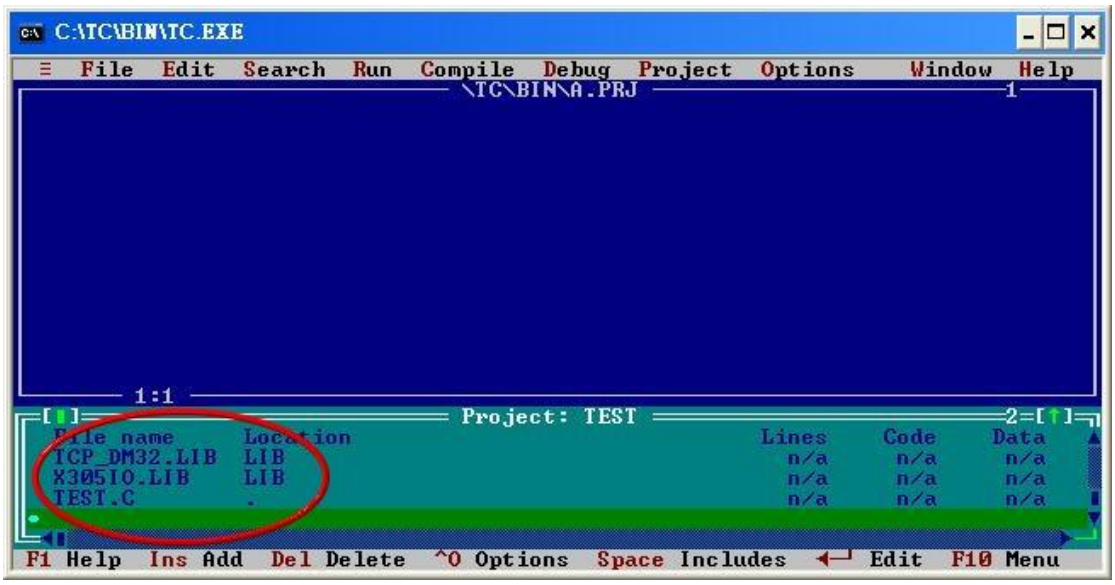


Step 3：Use the "Add" function to add the library file into MyDemo project.

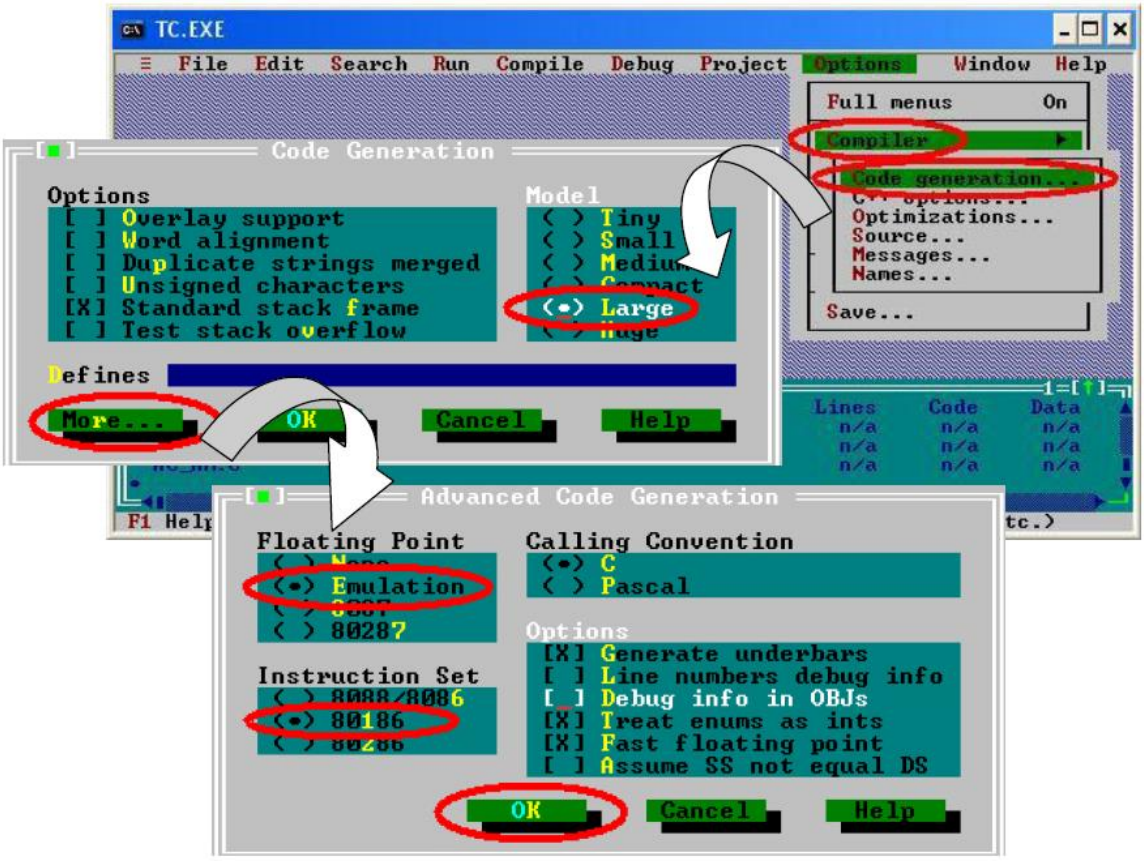


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Step 4：Following the step3, add another library and TEST.C into MyDemo project.

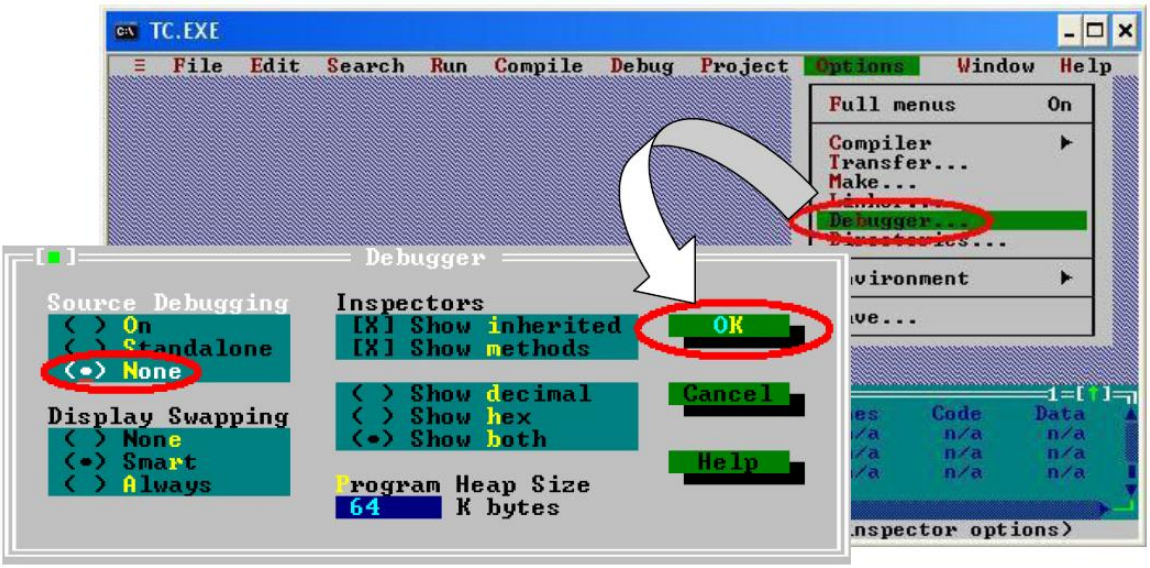


Step 5：Click the "Options/Compiler/Code generation…" to set the compile mode to the large mode. Click "More…" to set the "Floating point" and "Instruction Set" parameters. The Emulation and 80186 will be used respectively. Then, click OK button to save the configuration.

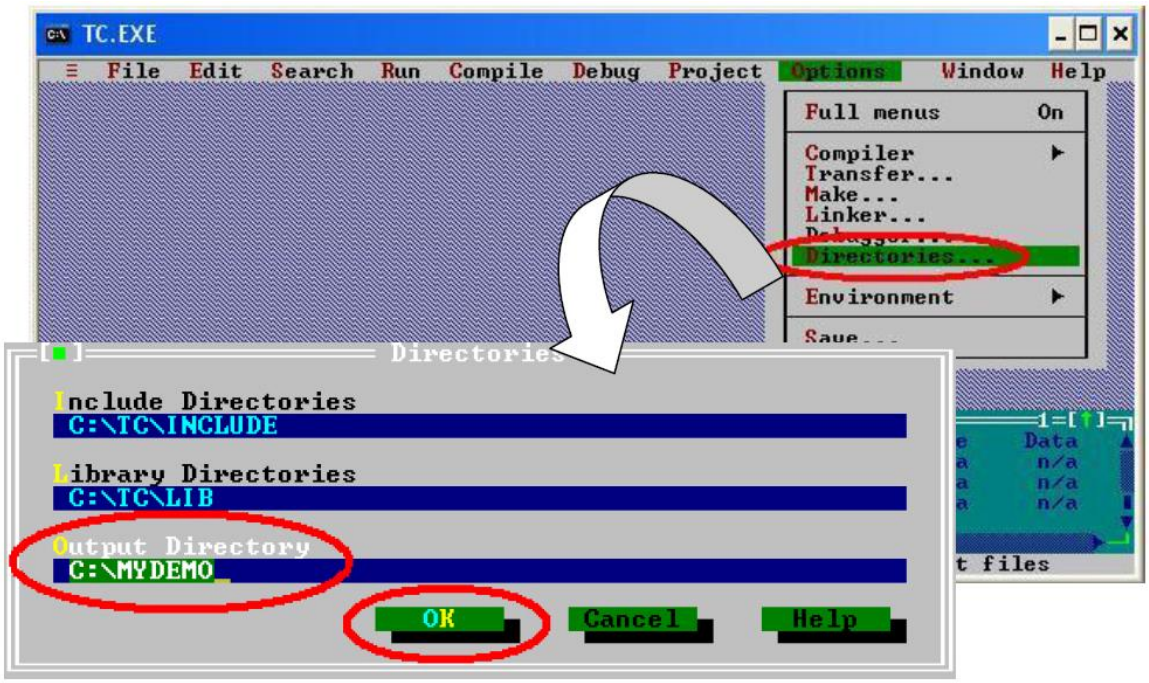


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Step 6：Click the "Option/Debugger... " to set the "Source Debugging" parameter. Here, select the "None" for the "Source Debugging".

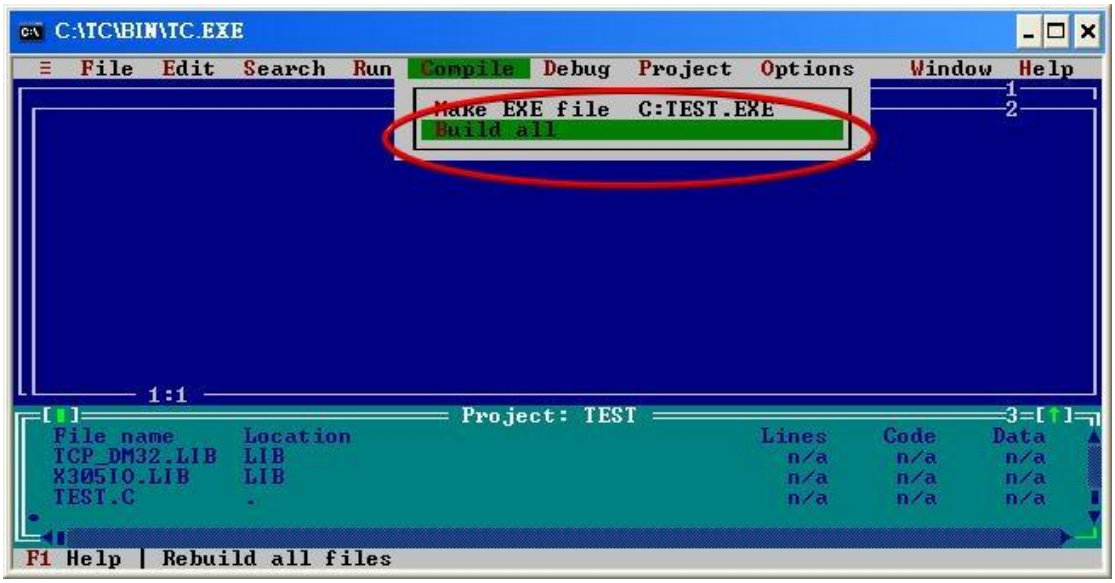


Step 7：Click the "Option/Directories... " to set the "Output Directory" parameter. Here, set the "C:\MyDemo" for the "Output Directory" parameter.

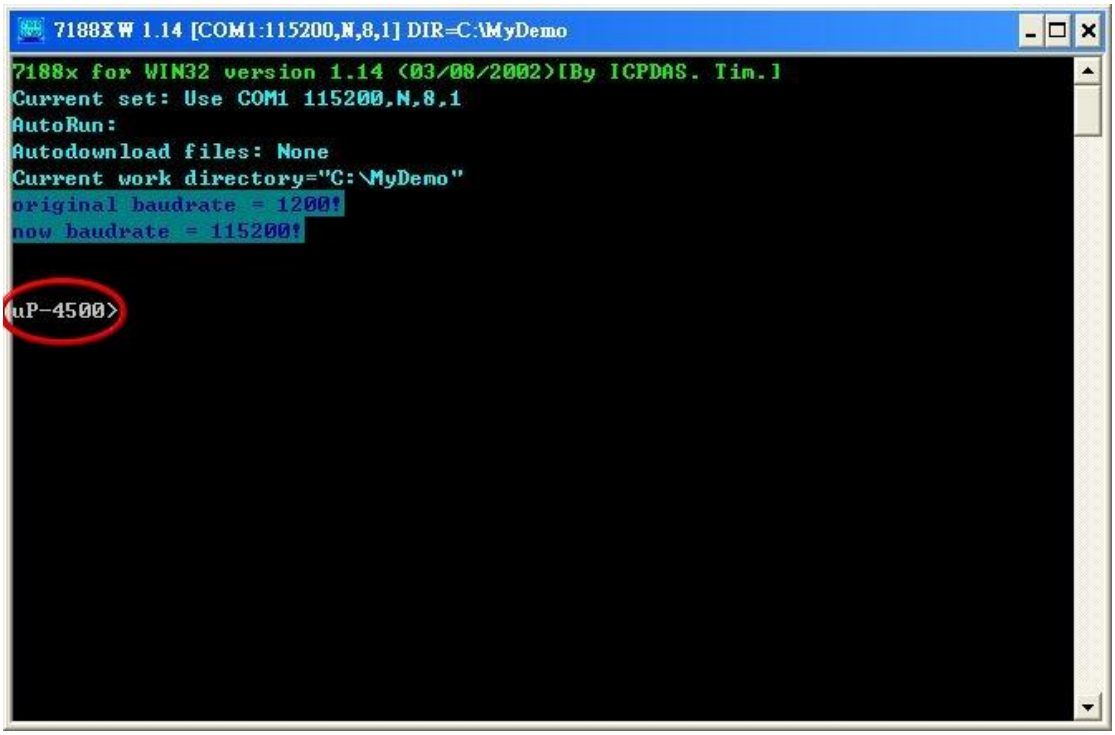


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Step 8：After finishing all the parameters setting, click the "Compile/build all" to produce the execution file name "TEST.exe".

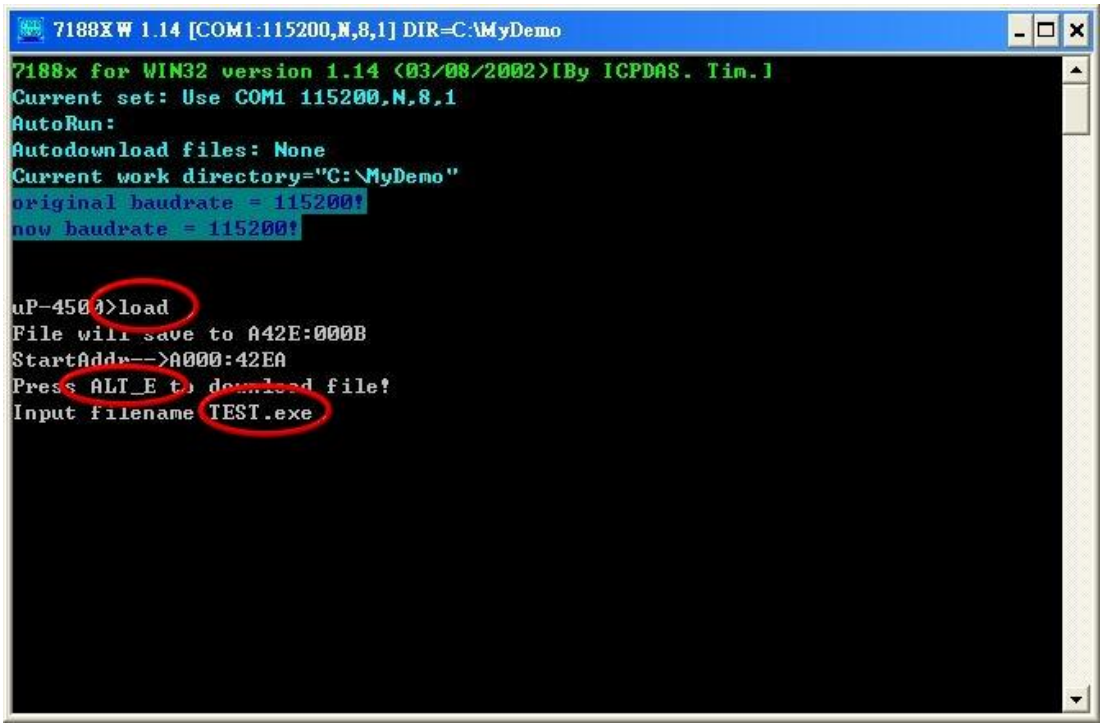


Step 9：Copy the file 7188XW.exe into the MyDemo folder. Then, double-click the 7188XW.exe file.The 7188XW.exe can be found in the Osimage folder. And G-4510 series COM1 connected to the PC RS-232.

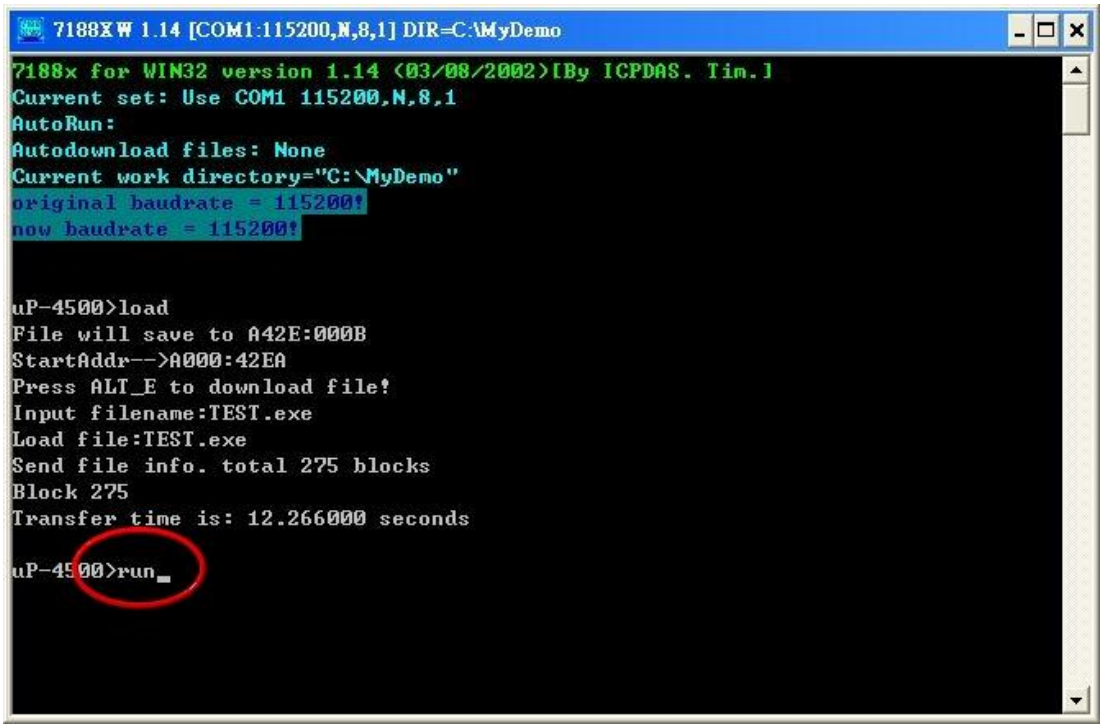


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Step 10：Key the command, "load" in the 7188xw.exe program. Then, follow the hint command to press "Alt+E" and input the file name, "TEST.exe", to download the execution file.



Step 11：After finishing the download procedure, key in the command, "run", to implement the execution file, "TEST.exe".



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8. Appendix

8.1 Communication Module Reference Contact

EC20-CE	EC21-AU	EC25-E
Main -- ●	Main -- ●	Main -- ●
		

BG96	LE910C4-WWX
Main -- ●	Main -- ●
	

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9. Revision History

Revision	Date	Author	Description
1.0.0	2020/02/10	Amon	Release version
1.1.0	2020/08/12	Amon	Modfiy optional module & GPS.
1.1.1	2020/12/23	Amon	Modfiy model number
1.1.2	2022/07/13	Amon	Model number correction, new support module, switch setting

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