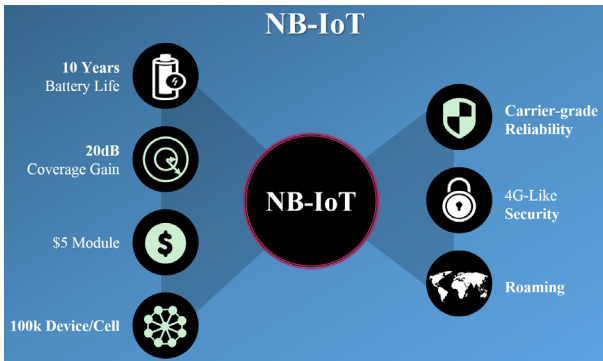


NB-IoT Solution

NB-IoT Introduction



▼ NB-IoT

NarrowBand-Internet of Things (NB-IoT) is a 3GPP standards-based Low Power Wide Area Network (LPWAN) technology which can exist together with current 2G, 3G, and 4G mobile network. It connects devices more simply and efficiently on already established mobile networks, and handles small amounts of fairly infrequent 2-way data communications, securely and reliably with an occupied bandwidth of 180kHz in downlink and uplink. The characteristics of the NB-IoT are: extended coverage, massive connections, low data rate, network security & reliability, low power consumption, low device cost and low deployment cost. Compared with LoRa, SigFox and other non-licensed band technologies of the LPWAN, NB-IoT operates in licensed spectrum and supported by the most mobile network operators, it is more advantageous in the future development.

NB-IoT Features

- Extended coverage
- Low power consumption
- Low component cost
- Low occupied bandwidth
- Massive connections

▼ Low Power Wide Area Network (LPWAN)

	Organization	Frequency Band	Transmission Distance	Baud Rate	Connection	Benefit
LoRa	LoRa Alliance	Sub-GHz (Unlicensed)	Urban: 3 ~ 5 km Suburban: 15 km	300bps ~ 50kbps	250k/cell	1. Mature industry chain. 2. Operate in unlicensed spectrum is no communication fee.
NB-IoT	3GPP	GSM/LTE Band (Licensed)	Urban: 3 ~ 5 km Suburban: 15 km	~50kbps	100k/cell	1. Don't have to reconstruct the network. 2. High security. 3. Supported by the most mobile network operators.
SigFox	SigFox Company	Sub-GHz (Unlicensed)	Urban: 10 km Suburban: 50 km	100bps	1000k/cell	1. Mature technology 2. Operating in unlicensed spectrum is no communication fee.

NB-IoT Application

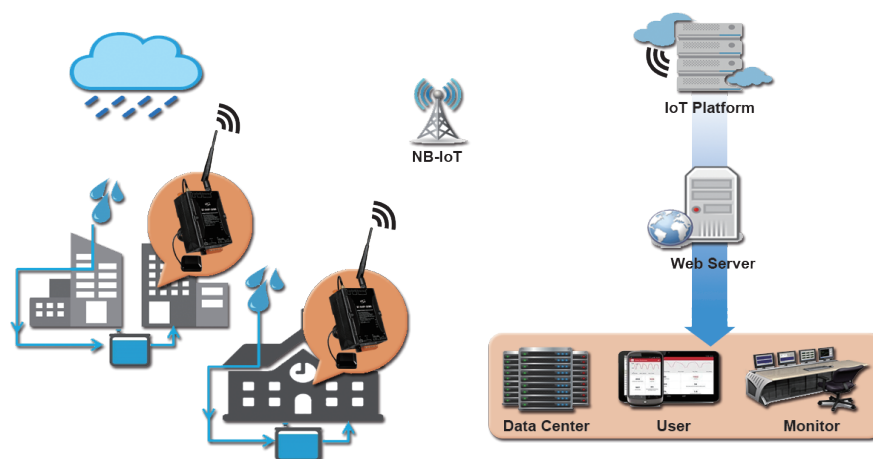
- Smart Home
 - Smart power meter, water meter, gas meter
- Smart City
 - Smart street lamp, parking management system
- Wearable device
 - Personal positioning, heartbeat and blood pressure monitoring
- Internet of Vehicle (IoV)
 - Vehicle location, anti-theft, traffic Information monitoring
- Industry 4.0
 - Smart grid, production management, quality monitoring
- Environmental monitoring
 - Water stage recorder, PM2.5 and water quality monitoring
- Smart Building
 - Smart sensor, air condition, elderly care



☞ Rainwater Retention System

Features:

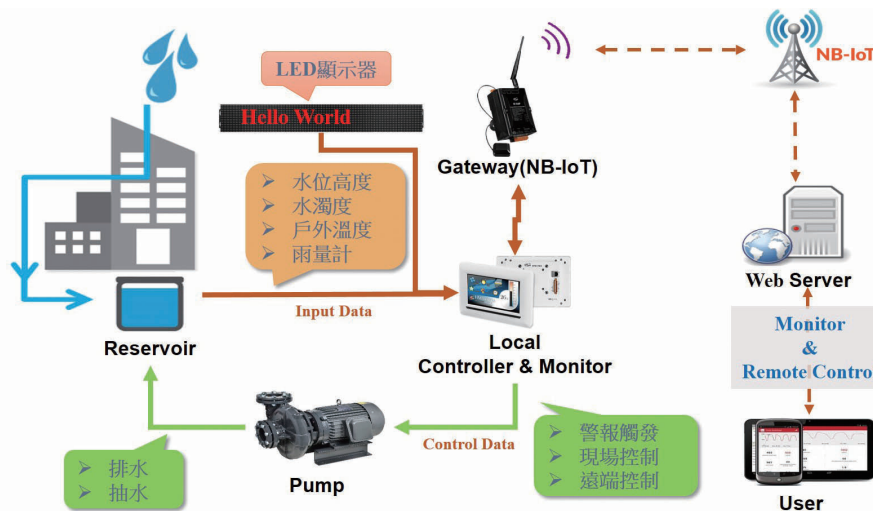
- ▶▶ Include sensing objects such as water level, turbidity, outdoor temperature and rain gauge.
- ▶▶ Transfer data by NB-IoT to save cost.
- ▶▶ Classify data in the cloud platform, using website and APP to monitor in any time.
- ▶▶ Users can use the data for purposes such as massive data analysis or system operation management.



Introduction:

Because the shortage of domestic water resources and the deterioration of the water environment, in addition to water conservation, the recycling and reuse of water has made considerable contributions to environmental protection and ecological conservation. Therefore, ICP DAS utilizes the most advanced technology - NB-IoT.

Using the low-power wireless communication network to build a rainwater storage system that monitors tap water and rainwater usage, learns the rainwater replacement rate, and monitors the remaining amount of rainwater and water quality information, user can use website and APP to get the efficiency of water recycling easily. NB-IoT communication technology is one of the Internet of Things which has power saving mechanism, and advantages such as low cost (low monthly fee), high reliability, extended coverage, that will greatly enhance the effectiveness of the system.



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☞ Inverter Monitor Application

Features:

- ▶▶ Remotely monitoring solar power generation and the environmental condition of the site.
- ▶▶ Using low-power and low monthly fee network to reduce operating costs.
- ▶▶ Analyze the historical data of solar power generation and adjust the power generation strategy in a timely manner.



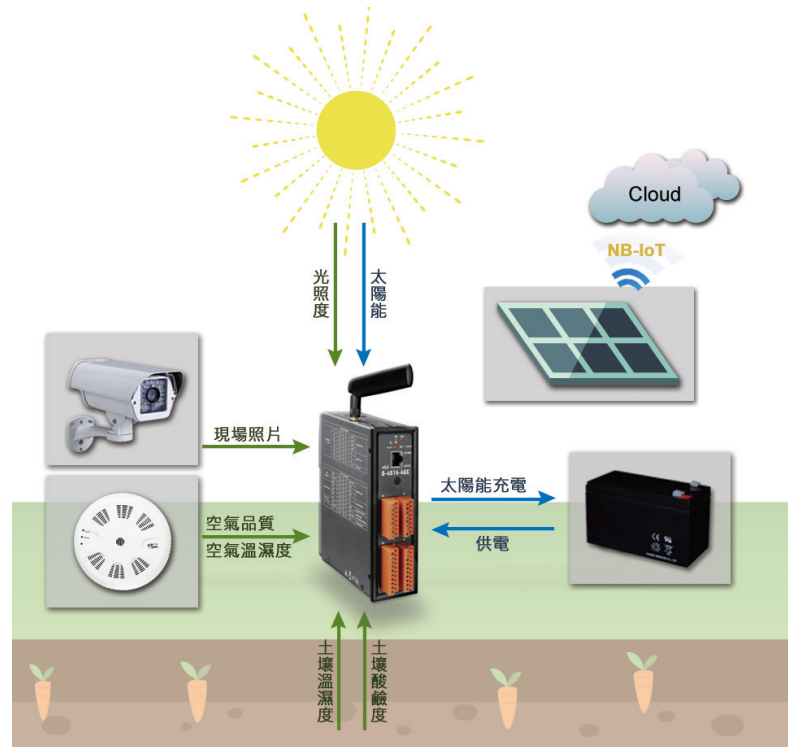
Introduction:

Nowadays, renewable energy is often discussed, among which solar energy is best known. Solar energy monitoring mainly uses 3G/4G networks to transmit data. However, the amount of returned data is just a little, user still has to pay the same monthly fee. Therefore, NB-IoT's advantage of low monthly rental fee will effectively reduce the maintenance cost of the manufacturer.

Smart AGRI Application

Features:

- ▶▶ Solar energy and battery will charge and discharge to be a self-contained system.
- ▶▶ Monitor plant growth environment by light, temperature, humidity, and air quality.
- ▶▶ Remotely monitor about soil pH, temperature and humidity, and allow farmers to respond any conditions immediately.
- ▶▶ The growth of the plant can be recorded for a long time through the cloud platform and on-site photos.



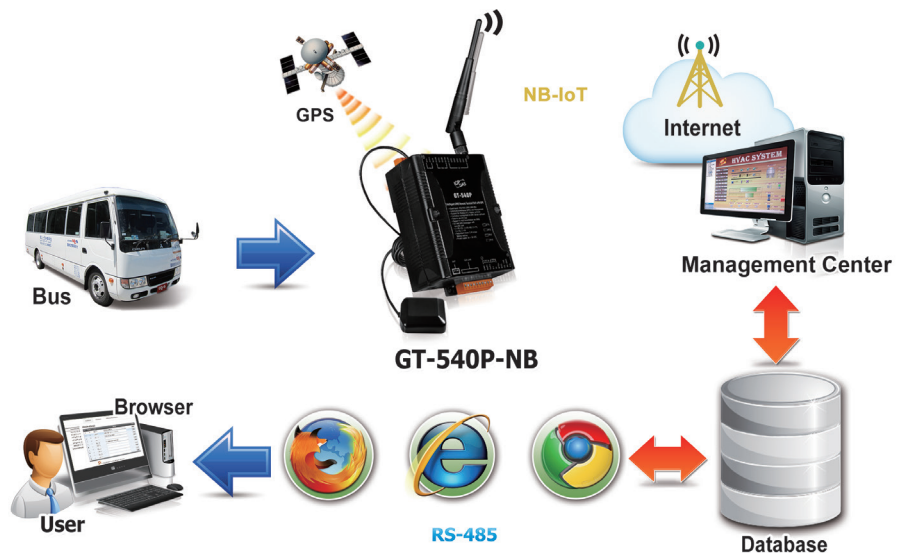
Introduction:

Information such as soil temperature and humidity, pH, sunshine and air temperature and humidity are very beneficial for agricultural cultivation. Farmers don't have to patrol the farmland frequently, but rely on this information doing some proper processing and management. In addition, the power-saving technology and solar energy of NB-IoT are helpful for monitoring system, it can maintain normal operation for a long time without external power supply, greatly reducing its cost.

Vehicle System

Features:

- ▶▶ Transmit low-volume GPS data by NB-IoT to reduce cost.
- ▶▶ Monitor vehicle location and route through database, web map, etc.
- ▶▶ Used GPS data in cargo tracking or fleet management.



Introduction:

Global Positioning System (GPS) is widely used in driving navigation, geo-monitoring, fleet management, cargo tracking, etc. User can manage the latitude and longitude coordinates of the GPS and UTC time through NB-IoT low power and low cost, vehicle rental management and time synchronization applications, etc., let GPS have more in-depth development and application in the field of industrial control.

NB-IoT Solution

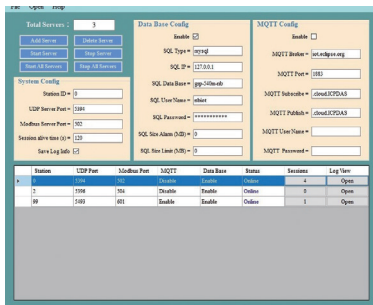
ICP DAS has long been focusing on new technologies and continues to develop products based on users. Therefore, in order to meet the various application needs of NB-IoT, ICP DAS has launched several product solutions with the assistance of NB-IoT Server. Customers can access data and remote control through Modbus TCP, MQTT and database, which will greatly reduce the cost of software development and environment deployment.

Product Solution:

Model Name	Description	Application
GTM-204M-NB	Industrial NB-IoT modem (RS-232/USB Interface)	Can be used with PLC, PC to achieve NB-IoT connection.
GT-540P-NB	Intelligent NB-IoT Remote Terminal Unit with GPS	6 DI, 2 DO, 1 AI, and allows 3 Modbus RTU devices to be connected in series via 1 RS-485, together with NB-IoT Server record data.
GRP-540M-NB	NB-IoT gateway	Automatically polling the IO data of the Modbus RTU/TCP device, and actively transmitting data to the NB-IoT Server or via the MQTT publish to the Broker. Users can also remotely control via Modbus TCP or MQTT.
G-4514-NB	Power saving NB-IoT solar charging PAC	3 DI, 3 DO, 8 AI, 1 Relay DO. It also has a solar/lead acid battery charger, and the writable program delivers data through the NB-IoT module.

NB-IoT Service Engine

NB-IoT Data collection and monitoring software

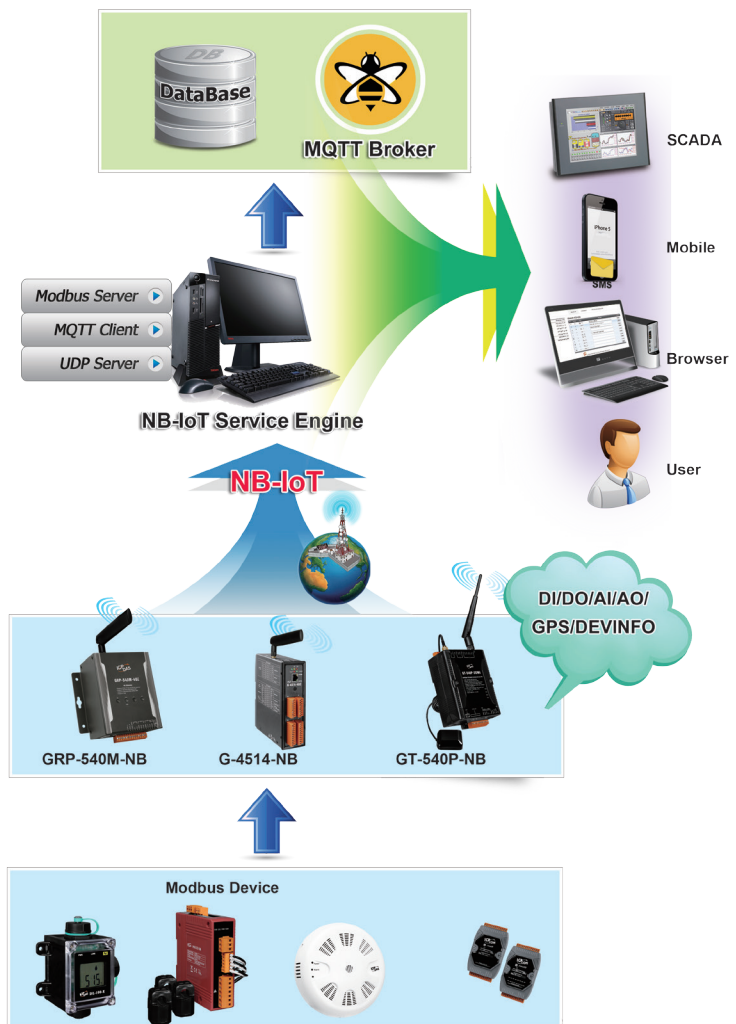


Features:

- Used UDP Server to receive data with proprietary encryption protocol.
- Support MQTT release and subscription, provide data access and remote control function.
- Support MySQL Database which writing data cyclically.
- Support Modbus Server, provide data access and remote control function about Modbus TCP protocol.

Application:

NB-IoT Server is a software for data collection and monitoring. It supports setting up multiple stations for different projects, each station can connect 2000 sessions, and can display the log messages of each station and the survival status of all sessions (including information such as signal, power, etc.) . The southbound interface has UDP Server for communication with devices such as GT-540P-NB and GRP-540M-NB, while the northbound interface provides MQTT, Modbus Server and database for users to access data. In addition, users can also remotely control Modbus I/O requirements by sending simple MQTT or Modbus TCP commands.



GTM-204M-NB

Industrial NB-IoT Modem (RS-232/USB interface)



Features:

- Frequency Band: B1 ,B3 ,B5 ,B8 ,B20 ,B28
- Data transmission and monitoring system
- NB-IoT automatic and reconnection mechanism
- Support TCP 、 UDP 、 MQTT 、 CoAP protocol, etc.
- Provide Standard AT Commands
- Built-in resettable system signal pin

Introduction:

GTM-204M-NB is an industrial M2M modem with RS-232 and USB interfaces. GTM-204M-NB utilizes convenient NB-IoT network to monitor remote devices, various flow meters or instant remote control. Built-in TCP/IP stack, users can connect to the Internet with simple control commands. The GTM-204M-NB features standard AT commands and can be easily combined with a variety of PLCs and PCs to implement NB-IoT connectivity.



Specifications:

GTM-204M-NB	
NB-IoT System	
Frequency Band	NB-IoT B1, B3, B5, B8, B20, B28
Device Interface	
COM Port	RxD, TxD, GND
Baud Rate	9600 bps ~ 115200 bps (default: 115200 bps)
USB	USB 2.0 (high speed)
USB driver	Windows XP/7/8/10, Windows Server 2012
Power	
Protection	Reverse Polarity Protection
Frame Ground Protection	ESD, Surge, EFT, Hi-Po
Power supply	+10 VDC ~ +30 VDC
Current Rating	30 ~ 15 mA / 10 ~ 30 VDC

GTM-204M-NB	
LED Indicator	
Power	Red
NB-IoT	Green
Reset Input	
Input Type	Isolated, 3750 Vrms
On Voltage Level	+3.5 VDC ~ +30 VDC
Off Voltage Level	+1 VDC max.
Input Resistance	3 kΩ, 0.25W
Mechanical	
Casing	Metal
Dimensions (W x L x H)	28 mm x 78.5 mm x 100 mm
Installation	DIN-Rail Mounting
Environmental	
Operating Temp.	-25°C ~ 70°C
Storage Temp.	-40°C ~ 80°C
Humidity	5~90% RH (Non-condensing)

GRP-540M-NB

NB-IoT Gateway

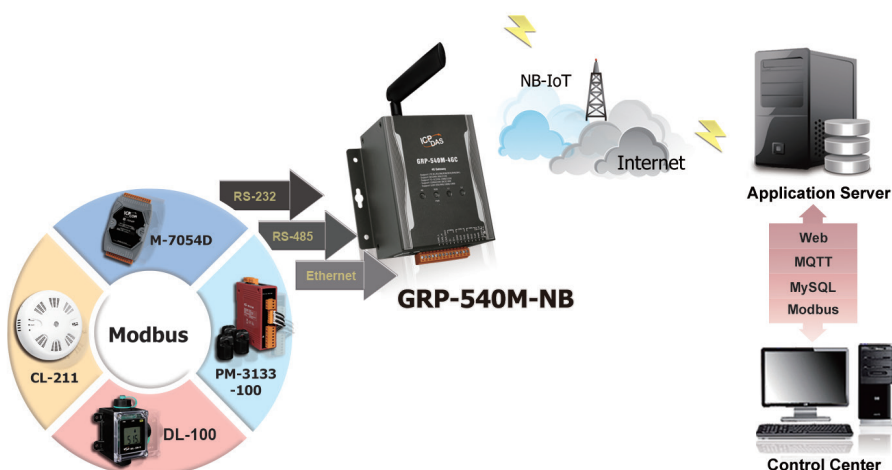


Features:

- Frequency Band: B1 ,B3 ,B5 ,B8 ,B20 ,B28
- Data collection automatically and remote control
- NB-IoT automatic and reconnection mechanism
- Support UDP 、MQTT protocol, etc.
- Provide Standard AT Commands
- 10/100 Base-TX Network controller
- GPS: 32 Channels
- Support Micro SD card
- High reliability

Introduction:

GRP-540M provided by ICP DAS is a gateway for Ethernet, serial port to NB-IoT. It can be used in M2M application fields to transfer Modbus I/O data to server via NB-IoT. With high-performance CPU, GRP-540M-NB can handle large amounts of data and operate in harsh industrial environments. When connected to the NB-IoT Server, users can also remotely control all Modbus devices connected to GRP-540M-NB.



Specifications:

GRP-540M-NB	
System	
CPU	ARM CPU
EEPROM	16 KB; Data retention: 40 years; 1,000,000 erase/write cycles
Real Time Clock (RTC)	Provide hour, minute, second, date, week, month, year
64-bit Hardware Serial Number	Yes
Watchdog Timer	Yes
LED Indicator	4 (RUN/PWR, NB-IoT, L1, L2)
Rotary Switch	Yes (0~9)
GPS System	
Channels	32
Protocol	NMEA 0183
Power	
Protection	Reverse Polarity Protection
Frame Ground Protection	ESD, Surge, EFT, Hi-Pot
Power supply	+10 VDC ~ +48 VDC
Power Consumption	4.8W (200 mA @ 24 VDC)

GRP-540M-NB	
NB-IoT System	
Frequency Band	NB-IoT B1, B3, B5, B8, B20, B28
Device Interface	
Ethernet	RJ-45, 10/100 Base-TX (Auto-negotiating, Auto MDI/MDI-X, LEDs)
COM1	RS-232 (Rx/D, Tx/D, GND); Non-isolated
COM2	RS-232 (Rx/D, Tx/D, GND); Non-isolated
COM3	RS-485 (D2+, D2-); 3000 VDC Non-isolated
CAN	CAN Bus (CAN_H, CAN_L)
Mechanical	
Casing	Metal
Dimensions	117 mm x 126 mm x 58 mm (W x L x H)
Installation	DIN-Rail or Screw Mounting
Environmental	
Operating Temp.	-25°C ~ 75°C
Storage Temp.	-30°C ~ 80°C
Humidity	5~95% RH (Non-condensing)

GT-540P-NB

Intelligent NB-IoT Remote Terminal Unit with GPS

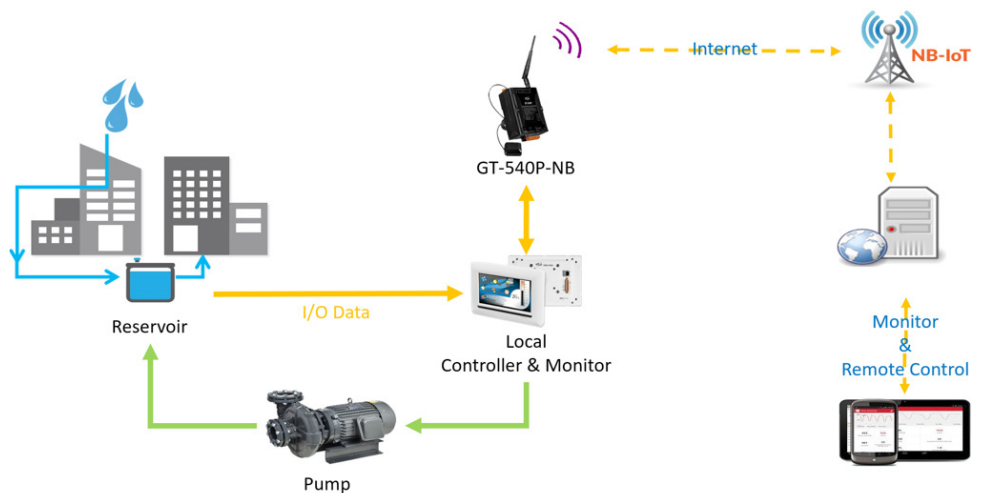


Features:

- Easy-to-use without writing program
- Support NB-IoT Service Engine
- NB-IoT automatic and reconnection mechanism
- Support UDP & MQTT & Modbus protocol
- Support 3.7V Li-ion Battery backup
- Be the GPRS I/O devices

Introduction:

GT-540P-NB is an intelligent Active GPRS Remote Terminal Unit with GPS. It can be used in M2M applications, and the data of I/O, GPS and Modbus devices of GT-540P-NB will be transmitted through LTE NB-IoT by predefined cycle time or triggered by DI/AI. It also has the function of I/O datalogger, which can store I/O and GPS data in SD card. In addition, the simple logic control of the local I/O allows the GT-540P-NB to perform control on the spot.



Specifications:

GT-540P-NB	
System	
CPU	32 bit, microprocessor
Micro SD 介面	4GB max.
Device Interface	
COM Port	COM1: Tx,D,RxD,GND (for function setting); COM2: RS-485 (for Modbus devices connecting)
GPS Interface	
Support Channels	16 channels with full view tracking, built-in high gain amplifier and bandpass filter
Sensitivity	-159 dBm
Acquisition Time	In the open area and at rest, the cold/warm time is 42 / 35 seconds respectively
重新抓取時間	0.1 秒

GT-540P-NB	
NB-IOT System	
Frequency Band	NB-IoT : B1 ,B3 ,B5 ,B8 ,B20 ,B28
Power	
Power supply	2W; Unregulated +10V DC ~ +30V DC with 3.7V 600 mAH Li-ion battery backup
Power Consumption	Idle: 75 mA @ 24 VDC; Data Link: 180 mA @ 24 VDC; Peak: 460 mA @ 24 VDC
LEDs	4 LEDs
Environmental	
Temperature	Operating : -25°C ~ 75°C Storage : -40°C ~ 80°C
Humidity	5~95% RH (Non-condensing)
Dimensions	91 mm x 132 mm x 52 mm (W x L x H)

G-4514-NB

Power Saving NB-IoT PAC with Solar charger

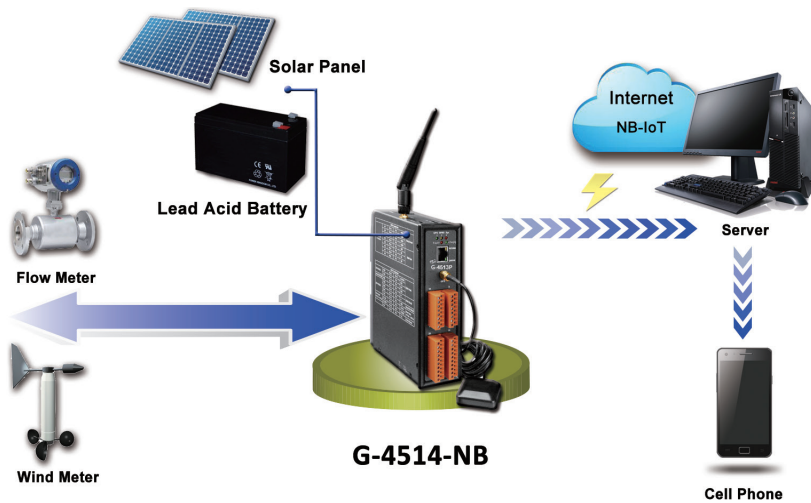


Features:

- Frequency Band: B1 ,B3 ,B5 ,B8 ,B20 ,B28
- Embedded MiniOS7, anti-virus
- NB-IoT automatic and reconnection mechanism
- Support TCP 、 UDP 、 MQTT 、 CoAP protocol, etc.
- Provide Standard AT Commands
- Solar / lead acid battery charger
- 10/100 Base-TX compatible Ethernet controller
- I/O: 3 DI, 3 DO, 8 AI, 1 relay DO
- Support SD card
- Built-in RTC, NVRAM, EEPROM
- High reliability in harsh environments

Introduction:

G-4514-NB is a power saving NB-IoT PAC, built-in solar // lead acid battery charger. G-4514-NB is ideal for applications such as hydrological monitoring, earth-rock flow monitoring, or application which is inconvenient power need to use solar energy. If combined with its GPS function (optional), it can be applied to the field of vehicle and river boat monitoring. G-4514-NB provides solar battery charger, NB-IoT module, Ethernet interface, 3DI, 3DO, 8AI, 1Relay DO.



Specifications:

G-4514-NB	
System	
CPU	Built-in 80 MHz microprocessor
SRAM/Flash	512K/512K, real time clock, watchdog timer
NVRAM	31 bytes, battery backup, data valid up to 10 years
EEPROM	16 KB, data retention >40 years. 1,000,000 erase/write cycles
LED Indicator	5 LEDs
IO	3 DI, 3 DO, 8 AI, 1 relay DO
Device Interface	
COM port	COM1:5-wire RS-232; COM2: RS-485
Ethernet	10/100 Base-TX Ethernet controller
Battery Specification	
Battery Type	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

G-4514-NB	
Power (Solar Input)	
Protection	Reverse Polarity Protection
Frame Ground Protection	ESD, Surge, EFT, Hi-Pot
Power supply	+10 VDC ~ +30 VDC , (Max. Voltage of Solar Panel must less +30V)
Power Consumption	Deep Sleep: < 10 mA@12VDC; Sleep: < 15 mA@12VDC; Idle: 90 mA @ 24 VDC; Data Link: 150 ~ 400 mA (peak) @ 24 VDC
Mechanical	
Casing	Metal
Dimensions	47 mm x 142 mm x 168 mm (W x L x H)
Installation	DIN-Rail or Wall Mounting
Environmental	
Operating Temp.	-20 ~ +70 ° C
Storage Temp.	-40 ~ +80 ° C
Humidity	5~90% RH (Non-condensing)