DL-1000

PM1/PM2.5/PM10/CO/CO2/HCHO/NH3/H2S/TVOC /Temperature/Humidity/Dew Point Data Logger

User Manual

Version: 1.1.0

Date: Aug. 2020

Warranty

All products manufactured by ICP DAS are warranted against defective materials for a period of one year from the date of delivery to the original purchaser.

Warning

ICP DAS assumes no liability for damages consequent to the use of this product.
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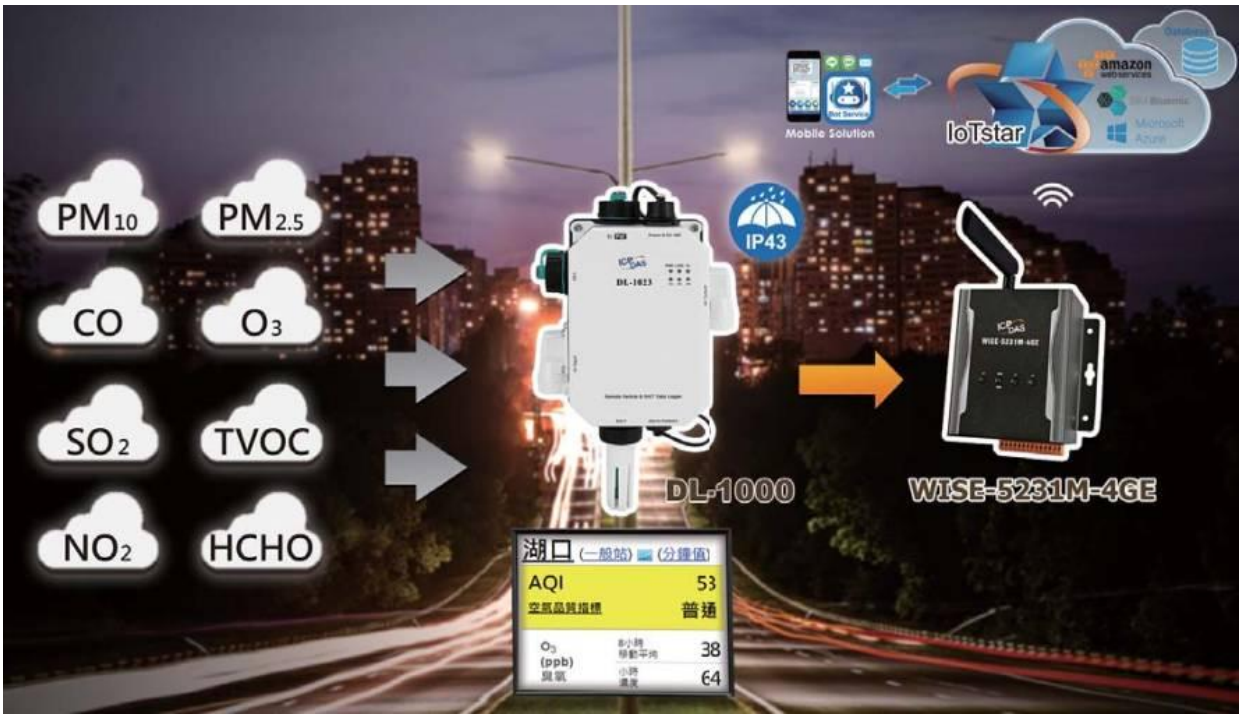
Service@icpdas.com

Contents

1. Introduction

The DL-1000 is a series of particle and gas measurement module that can measure the concentration of aerosols in the air, such as: PM2.5, PM1, PM10 and the number of particles (0.3μm, 0.5μm, 1μm, 2.5μm, 5μm, 10μm). In addition, various fume concentrations related to human health can also be measured. For example: CO/CO2/HCHO/NH3/H2S/TVOC DL-1000 can record data and send alarm when concentration is too high. It can be used to record PM1/2.5/10, CO, CO2, HCHO, TVOC, NH3, H2S, Temperature, Humidity and Dew Point information, including date and time stamps, and are able to store up to 180,000 downloadable records. Real-time data can be accessed from the DL-1000 series Data Logger from anywhere and at any time using the free Windows software, the iOS App or the Android App, as long as they are connected to the same local network as the Data Logger. Support is provided for popular industrial protocols such as DCON, Modbus RTU, and Modbus TCP, as well as the emerging machine-to-machine (M2M)/IoT (Internet of Things) connectivity protocol-MQTT. The DL-1000 series Data Logger can be connected via widely used communication interfaces including RS-485, Ethernet and PoE, meaning that the device can be easily integrated into existing HMI or SCADA systems, and is easy to be maintained in a distributed control system. The DL-1000 series is designed for industrial applications in harsh environments that provides IP43 grade protection approval. The rugged RJ-45 ensures tight, robust connections, and guarantees reliable operation, even for applications that are subject to high vibration and shock.



Characteristics

- Able to record PM1/2.5/10, CO, CO2, HCHC, NH3, H2S, TVOC, Temperature, Humidity, and Dew Point Measurements
- PM1, M2.5, PM10 measurement range: 0 to 1000 ug/m^3
- CO measurement range: 0 to 1000 ppm
- CO_2 measurement range: 0 to 9999 ppm
- TVOC measurement range: 0 to 60000 ppb
- Non-dispersive Infrared (NDIR) sensor with Automatic Baseline Correction algorithm for CO_2 measurement
- TVCO : Metal-Oxide Sensor
- Electrochemical Sensor
- Up to 180,000 records with date and time stamps
- Web-based Configuration Interface
- Simple and Powerful Software Utility, iOS APP and Android App Included
- Supports the DCON, Modbus RTU/TCP, and MQTT Protocols
- Includes RS-485/Ethernet/PoE Communication Interfaces
- Relay Output for Audible/Visual Alarm or IAQ Device Control
- Includes redundant power inputs: PoE (IEEE 802.3af, Class 1) and DC input
- IP 43 Protection Approval

Features

NDIR Sensor

NDIR (Non-Dispersion Infrared) is based on one of the natural properties of CO_2 molecules: CO_2 molecules absorb light at a specific wavelength of 4.26 µm. This wavelength is in the infrared (IR) range. High concentrations of CO_2 molecules absorb more light than low concentrations. NDIR sensor can detect fast and accurately in a wide range of CO_2 concentration.

Built-in Web Server

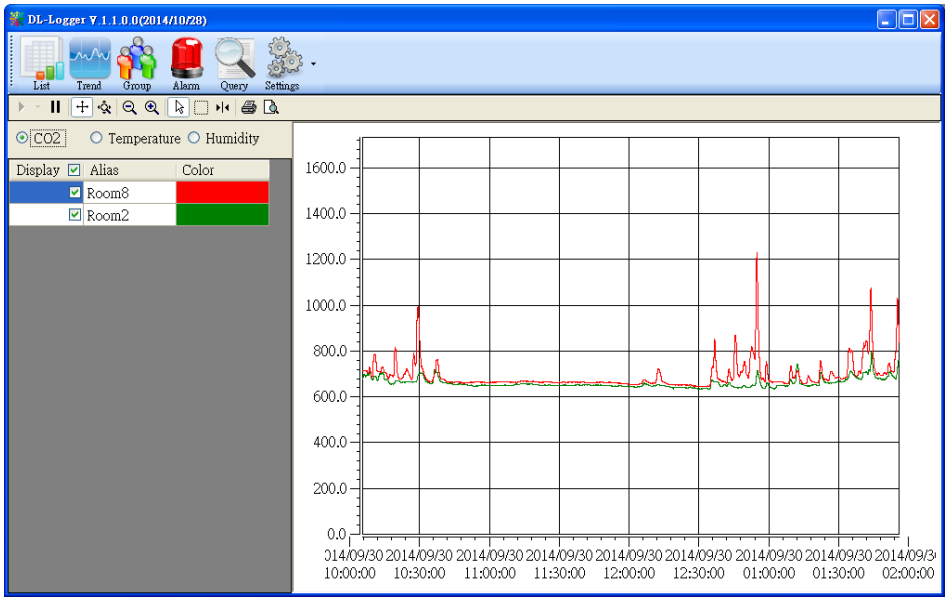
With the built-in Web server, users can easily log in to the DL-1000 module via a standard web browser to monitor the data and configure the settings without install any software in the terminal.

Get Real-time Data Anywhere and Anytime

iAir App for iOS or Android Phones or Tablets is free and easy to install, it can obtain the real-time data from DL-1000 modules over a Wi-Fi network anytime and anywhere. The iAir App can link to the DL-1000 modules by specifying IP addresses or by searching all the modules connected to the same Ethernet segment.

Data Logging Software

The DL300 Utility can be used to configure the modules, monitor real-time data and show the run chart, log alarm events, group DL-1000 modules so that the status of distribution groups can be viewed and managed. The utility also allows the log data to be downloaded and exported to a .CSV file that can then be imported into any industry-standard software or spread sheet for analysis.



- **Easy integration with SCADA software**
  Modbus is one of the most popular protocols used in the industrial world. Supporting traditional serial protocols of RS-485 and Ethernet protocols allow the DL-1000 series well-integrated into the HMI/SCADA systems.

- **Alarm**
  DL-1000 series allows users to set high alarm level for CO/CO_2/TVOC/PM1/PM2.5 /PM10/Temperature/ Humidity/Dew Point and low alarm level for Temperature /Humidity/Dew Point, and to enable/disable the alarm functions. An Alarm LED indicator on the front of the DL-1000 module will flash when an alarm event is activated, and a relay output related to all alarm events can be use to tap an alarm light/sound or control the IAQ devices such as ventilators, air cleaners, and filters. Beep alarm is available when the CO/CO_2/TVOC/PM1/PM2.5/PM10 high level alarm occurs.

- **Screen Lock**
  Users can secure a DL-1000 module by setting a screen lock via the web interface. If the lock is set, users need to enter the correct password when they would like to configure the DL-1000 module.

- **Automatic Baseline Correction**
  The built-in ABC algorithm makes the CO_2 sensor on the DL-1022 and DL-1023 maintenance-free. In most indoor applications, the carbon dioxide level drops to nearly outside air - 400 ppm, and then the ABC algorithm constantly keeps track of the lowest reading and slowly corrects it as the expected fresh air value of 400 ppm. The ABC algorithm can not apply for the places where are no periods that the CO_2 concentration drops to background level such as greenhouses, hospitals, 24-hour operation factories or stories. The ABC function needs be disabled where the spaces the CO_2 concentration may be elevated at all times.

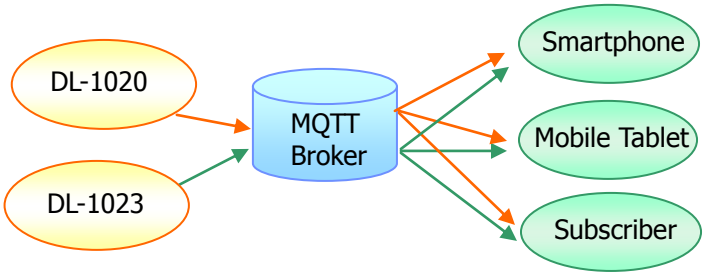
- **Easy Wiring**
  Support for RS-485, Ethernet and Power over Ethernet (PoE) interfaces for users to choose the appropriate one to meet the field requirements.

Power over Ethernet (PoE)

The DL-1000 series features true IEEE802.3af-compliant (classification, Class 1) PoE technology that allows both power and data to be carried over a single Ethernet cable. PoE provides a unified power system, as well as backup provisions for critical building functions, without any additional cables, outlets or connections. It can reduce the power supply wiring and maintenance costs, and improve system scalability.

Support for MQTT protocol

MQTT is a protocol designed for the efficient exchange of real-time data with sensor and mobile devices. It runs over TCP/IP and is in widest use on the "machine-to-machine" (M2M) and "Internet of Things" applications today



Replaceable Filter Patch (FLT-C001)

Generally, the PM2.5 measuring sensor on the market is usually installed in outdoor applications. Because the outdoor air is quite dusty, the measuring channel of PM2.5 sensor is easily clogged by aerosol, resulting in continued alarms for the heavy concentration. Due to the error data from the clogged sensor, this module is returned to the factory for repair. Downtime during the repair period often causes significant cost and losses. In order to solve this problem, ICP DAS design the CL-200 series and DL-1000 series with replaceable patch, FLT-C001, which makes it easy for users to replace them without uninstall the devices. Cost of repair and time can be reduced by this innovated mechanical design.

2. Hardware

2.1 Specifications

Model	DL-1020	DL-1020-WF
PM1 / PM2.5 / PM10 Measurement		
Range	0 to 1,000μg/m3 (Laser Type)	
Resolution	1μg/m3	
Accuracy	± 10% of FSR	
Response Time	1 sec	
Warm-up Time	20 sec	
Life time	5 years, Customer has to replace the filter patch.	
Particle		
Sizes	0.3μm, 0.5μm,,1μm, 2.5μm,,5μm, 10μm	
Life Time	5 years, the filter patch (FLT-C001) by replaceable.	
Temperature Measurement		
Range	-20 to +50°C	
Resolution	0.1°C	
Accuracy	±0.6°C	
Relative Humidity Measurement		
Range	0 to 100% RH, Non-condensing	
Resolution	0.1% RH, Non-condensing	
Accuracy	±5% RH, Non-condensing	
Life time	10 years	
Dew Point		
Range	Calculated using temperature and relative humidity	
Resolution	0.1°C	
System		
CO Alarm	-	
CO_2 Alarm	-	
PM1/ PM 2.5/ PM 10 Alarm	Yes	
Real Time Clock	Yes	
Data Logger	Yes, 180,000 Records	
Alarm Relay Output	PhotoMos Relay × 4, 100 VDC @ 1 A	

Communication			
RS-485 Port		Baud Rate = 1200 ~ 115200 bps	
Ethernet Port		10/100 Base-TX, 8-Pin RJ-45 x1(Auto-negotiating, Auto-MDI/MDIX, LED indicators)	
Security		IP filter (whitelist) and Password (web)	
Protocol		Modbus/RTU(RS-485), Modbus TCP(Ethernet) and MQTT(Ethernet)	
Dual Watchdog		Yes, Module (2.3 sec), Communication (Programmable)	
Wireless Interface		-	Wi-Fi
Standard Supported		-	IEEE 802.11 b/g/n
Wireless Mode		-	Infrastructure/Limited AP
Wireless Security		-	WEP, WPA ,WPA2
Transmission Range		-	50 m (LOS)
LED Indicators			
PWR		Green for normal operation	
Link		Green for the Ethernet-linked	
S1 ~ S4		Red for an alarm condition	
Electrical			
Powered via Terminal Block		+12 to +48 VDC	
Powered via PoE		IEEE 802.3af, Class 1 (require a PoE switch or injector)	
Power Consumption	PoE	3.0 W	3.2 W
	Non-PoE	2.8 W	3.0 W
Mechanical			
Dimensions (L x W x H)		211 mm x 130 mm x 70 mm	
Installation		Ceiling Mounting or Wall Mounting	
Environment			
Operating Temperature		-20 to +50°C	
Storage Temperature		-30 to +75°C	
Humidity		10 to 90% RH, Non-condensing	
Protection Class		IP43	

Model	DL-1021	DL-1021-WF
PM1 / PM2.5 / PM10 Measurement		
Range	0 to 1,000μg/m3 (Laser Type)	
Resolution	1μg/m3	
Accuracy	± 10% of FSR	
Response Time	1 sec	
Warm-up Time	20 sec	
Life time	5 years, Customer has to replace the filter patch.	
Particle		
Sizes	0.3μm, 0.5μm,,1μm, 2.5μm,,5μm, 10μm	
Life Time	5 years, the filter patch (FLT-C001) by replaceable.	
CO Measurement		
Range	0 to 1000 ppm (Electrochemical)	
Resolution	1 ppm	
Accuracy	±5% of measured value	
Response Time	30 sec	
Warm-up Time	60 sec	
Life Time	5 years	
Temperature Measurement		
Range	-20 to +50°C	
Resolution	0.1°C	
Accuracy	±0.6°C	
Relative Humidity Measurement		
Range	0 to 100% RH, Non-condensing	
Resolution	0.1% RH, Non-condensing	
Accuracy	±5% RH, Non-condensing	
Life time	10 years	
Dew Point		
Range	Calculated using temperature and relative humidity	
Resolution	0.1°C	
System		
CO Alarm	Yes	
CO_2 Alarm	-	

PM1/ PM 2.5/ PM 10 Alarm		Yes	
Real Time Clock		Yes	
Data Logger		Yes, 180,000 Records	
Alarm Relay Output		PhotoMos Relay × 4, 100 VDC @ 1 A	
Communication			
RS-485 Port		Baud Rate = 1200 ~ 115200 bps	
Ethernet Port		10/100 Base-TX, 8-Pin RJ-45 x1(Auto-negotiating, Auto-MDI/MDIX, LED indicators)	
Security		IP filter (whitelist) and Password (web)	
Protocol		Modbus/RTU(RS-485), Modbus TCP(Ethernet) and MQTT(Ethernet)	
Dual Watchdog		Yes, Module (2.3 sec), Communication (Programmable)	
Wireless Interface		-	Wi-Fi
Standard Supported		-	IEEE 802.11 b/g/n
Wireless Mode		-	Infrastructure/Limited AP
Wireless Security		-	WEP, WPA ,WPA2
Transmission Range		-	50 m (LOS)
LED Indicators			
PWR		Green for normal operation	
Link		Green for the Ethernet-linked	
S1 ~ S4		Red for an alarm condition	
Electrical			
Powered via Terminal Block		+12 to +48 VDC	
Powered via PoE		IEEE 802.3af, Class 1 (require a PoE switch or injector)	
Power Consumption	PoE	3.1 W	3.3 W
	Non-PoE	2.9 W	3.1 W
Mechanical			
Dimensions (L x W x H)		211 mm x 130 mm x 70 mm	
Installation		Ceiling Mounting or Wall Mounting	
Environment			
Operating Temperature		-20 to +50°C	
Storage Temperature		-30 to +75°C	
Humidity		10 to 90% RH, Non-condensing	
Protection Class		IP43	

Model	DL-1022	DL-1022-WF
PM1 / PM2.5 / PM10 Measurement		
Range	0 to 1,000μg/m3 (Laser Type)	
Resolution	1μg/m3	
Accuracy	± 10% of FSR	
Response Time	1 sec	
Warm-up Time	20 sec	
Life time	5 years, Customer has to replace the filter patch.	
Particle		
Sizes	0.3μm, 0.5μm,,1μm, 2.5μm,,5μm, 10μm	
Life Time	5 years, the filter patch (FLT-C001) by replaceable.	
CO_2 Measurement		
Range	0 ~ 9999 ppm (NDIR)	
Resolution	1 ppm	
Accuracy	±30 ppm ±3% of measured val	
Response Time	120 sec	
Warm-up Time	300 sec	
Life Time	15 years	
Temperature Measurement		
Range	-20 to +50°C	
Resolution	0.1°C	
Accuracy	±0.6°C	
Relative Humidity Measurement		
Range	0 to 100% RH, Non-condensing	
Resolution	0.1% RH, Non-condensing	
Accuracy	±5% RH, Non-condensing	
Life time	10 years	
Dew Point		
Range	Calculated using temperature and relative humidity	
Resolution	0.1°C	
System		
CO Alarm	-	
CO_2 Alarm	Yes	

PM1/ PM 2.5/ PM 10 Alarm		Yes	
Real Time Clock		Yes	
Data Logger		Yes, 180,000 Records	
Alarm Relay Output		PhotoMos Relay × 4, 100 VDC @ 1 A	
Communication			
RS-485 Port		Baud Rate = 1200 ~ 115200 bps	
Ethernet Port		10/100 Base-TX, 8-Pin RJ-45 x1(Auto-negotiating, Auto-MDI/MDIX, LED indicators)	
Security		IP filter (whitelist) and Password (web)	
Protocol		Modbus/RTU(RS-485), Modbus TCP(Ethernet) and MQTT(Ethernet)	
Dual Watchdog		Yes, Module (2.3 sec), Communication (Programmable)	
Wireless Interface		-	Wi-Fi
Standard Supported		-	IEEE 802.11 b/g/n
Wireless Mode		-	Infrastructure/Limited AP
Wireless Security		-	WEP, WPA ,WPA2
Transmission Range		-	50 m (LOS)
LED Indicators			
PWR		Green for normal operation	
Link		Green for the Ethernet-linked	
S1 ~ S4		Red for an alarm condition	
Electrical			
Powered via Terminal Block		+12 to +48 VDC	
Powered via PoE		IEEE 802.3af, Class 1 (require a PoE switch or injector)	
Power Consumption	PoE	3.1 W	3.3 W
	Non-PoE	2.9 W	3.1 W
Mechanical			
Dimensions (L x W x H)		211 mm x 130 mm x 70 mm	
Installation		Ceiling Mounting or Wall Mounting	
Environment			
Operating Temperature		-20 to +50°C	
Storage Temperature		-30 to +75°C	
Humidity		10 to 90% RH, Non-condensing	
Protection Class		IP43	

Model	DL-1023	DL-1023-WF
PM1 / PM2.5 / PM10 Measurement		
Range	0 to 1,000μg/m3 (Laser Type)	
Resolution	1μg/m3	
Accuracy	± 10% of FSR	
Response Time	1 sec	
Warm-up Time	20 sec	
Life time	5 years, Customer has to replace the filter patch.	
Particle		
Sizes	0.3μm, 0.5μm,,1μm, 2.5μm,,5μm, 10μm	
Life Time	5 years, the filter patch (FLT-C001) by replaceable.	
CO Measurement		
Range	0 to 1000 ppm (Electrochemical)	
Resolution	1 ppm	
Accuracy	±5% of measured value	
Response Time	30 sec	
Warm-up Time	60 sec	
Life Time	5 years	
CO_2 Measurement		
Range	0 ~ 9999 ppm (NDIR)	
Resolution	1 ppm	
Accuracy	±30 ppm ±3% of measured value	
Response Time	120 sec	
Warm-up Time	300 sec	
Life Time	15 years	
Temperature Measurement		
Range	-20 to +50°C	
Resolution	0.1°C	
Accuracy	±0.6°C	
Relative Humidity Measurement		
Range	0 to 100% RH, Non-condensing	
Resolution	0.1% RH, Non-condensing	

Accuracy		±5% RH, Non-condensing	
Life time		10 years	
Dew Point			
Range		Calculated using temperature and relative humidity	
Resolution		0.1°C	
System			
CO Alarm		Yes	
CO_2 Alarm		Yes	
PM1/ PM 2.5/ PM 10 Alarm		Yes	
Real Time Clock		Yes	
Data Logger		Yes, 180,000 Records	
Alarm Relay Output		PhotoMos Relay × 4, 100 VDC @ 1 A	
Communication			
RS-485 Port		Baud Rate = 1200 ~ 115200 bps	
Ethernet Port		10/100 Base-TX, 8-Pin RJ-45 x1(Auto-negotiating, Auto-MDI/MDIX, LED indicators)	
Security		IP filter (whitelist) and Password (web)	
Protocol		Modbus/RTU(RS-485), Modbus TCP(Ethernet) and MQTT(Ethernet)	
Dual Watchdog		Yes, Module (2.3 sec), Communication (Programmable)	
Wireless Interface		-	Wi-Fi
Standard Supported		-	IEEE 802.11 b/g/n
Wireless Mode		-	Infrastructure/Limited AP
Wireless Security		-	WEP, WPA ,WPA2
Transmission Range		-	50 m (LOS)
LED Indicators			
PWR		Green for normal operation	
Link		Green for the Ethernet-linked	
S1 ~ S4		Red for an alarm condition	
Electrical			
Powered via Terminal Block		+12 to +48 VDC	
Powered via PoE		IEEE 802.3af, Class 1 (require a PoE switch or injector)	
Power Consumption	PoE	3.2 W	3.4 W
	Non-PoE	3.0 W	3.2 W

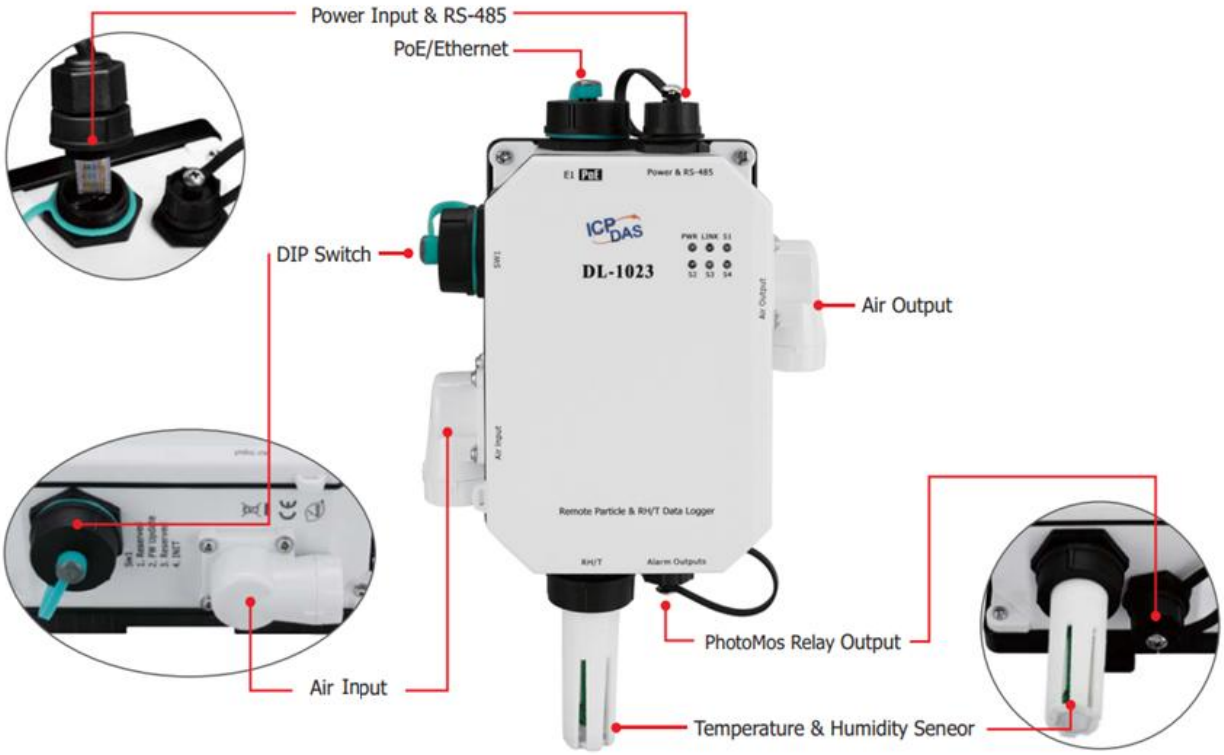
Mechanical	
Dimensions (L x W x H)	211 mm x 130 mm x 70 mm
Installation	Ceiling Mounting or Wall Mounting
Environment	
Operating Temperature	-20 to +50°C
Storage Temperature	-30 to +75°C
Humidity	10 to 90% RH, Non-condensing
Protection Class	IP43

Model	**DL-1038**	**DL-1038-WF**
PM1 / PM2.5 / PM10 Measurement		
Range	0 to 1,000μg/m3 (Laser Type)	
Resolution	1μg/m3	
Accuracy	± 10% of FSR	
Response Time	1 sec	
Warm-up Time	20 sec	
Life time	5 years, Customer has to replace the filter patch.	
Particle		
Sizes	0.3μm, 0.5μm,,1μm, 2.5μm,,5μm, 10μm	
Life Time	5 years, the filter patch (FLT-C001) by replaceable.	
CO Measurement		
Range	0 to 1000 ppm (Electrochemical)	
Resolution	1 ppm	
Accuracy	±5% of measured value	
Response Time	30 sec	
Warm-up Time	60 sec	
Life Time	5 years	
CO_2 Measurement		
Range	0 ~ 9999 ppm (NDIR)	
Resolution	1 ppm	
Accuracy	±30 ppm ±3% of measured value	
Response Time	120 sec	

Warm-up Time	300 sec
Life Time	15 years
TVOC Measurement	
Range	0 to 60000 ppb (MEMS Metal Oxide)
Resolution	1 ppb
Accuracy	±15%
Response Time	60 seconds
Warm-up Time	180 seconds
Life time	5 years
Temperature Measurement	
Range	-20 to +50°C
Resolution	0.1°C
Accuracy	±0.6°C
Relative Humidity Measurement	
Range	0 to 100% RH, Non-condensing
Resolution	0.1% RH, Non-condensing
Accuracy	±5% RH, Non-condensing
Life time	10 years
Dew Point	
Range	Calculated using temperature and relative humidity
Resolution	0.1°C
System	
CO Alarm	Yes
CO_2 Alarm	Yes
TVOC Alarm	Yes
PM1/ PM 2.5/ PM 10 Alarm	Yes
Real Time Clock	Yes
Data Logger	Yes, 180,000 Records
Alarm Relay Output	PhotoMos Relay × 4, 100 VDC @ 1 A
Communication	
RS-485 Port	Baud Rate = 1200 ~ 115200 bps
Ethernet Port	10/100 Base-TX, 8-Pin RJ-45 x1(Auto-negotiating, Auto-MDI/MDIX, LED indicators)
Security	IP filter (whitelist) and Password (web)

Protocol		Modbus/RTU(RS-485), Modbus TCP(Ethernet) and MQTT(Ethernet)	
Dual Watchdog		Yes, Module (2.3 sec), Communication (Programmable)	
Wireless Interface		-	Wi-Fi
Standard Supported		-	IEEE 802.11 b/g/n
Wireless Mode		-	Infrastructure/Limited AP
Wireless Security		-	WEP, WPA ,WPA2
Transmission Range		-	50 m (LOS)
LED Indicators			
PWR		Green for normal operation	
Link		Green for the Ethernet-linked	
S1 ~ S4		Red for an alarm condition	
Electrical			
Powered via Terminal Block		+12 to +48 VDC	
Powered via PoE		IEEE 802.3af, Class 1 (require a PoE switch or injector)	
Power Consumption	PoE	3.2 W	3.4 W
	Non-PoE	3.0 W	3.2 W
Mechanical			
Dimensions (L x W x H)		211 mm x 130 mm x 70 mm	
Installation		Ceiling Mounting or Wall Mounting	
Environment			
Operating Temperature		-20 to +50°C	
Storage Temperature		-30 to +75°C	
Humidity		10 to 90% RH, Non-condensing	
Protection Class		IP43	

2.2 Appearance



The three LED indicators from left to right are:

- PWR: green for normal operation.
- Link: green for the Ethernet linked.
- Alarm: red for alarm condition.

DIP Switch

The functions are printed on the top beside the SW1 DIP switch. All the 4 dip switches need be turned to the off position for normal operation.

1. Reserved
2. FW Update: ON for updating firmware.
3. Reserved
4. INIT: ON for using the factory default settings for communication

Dust Filter Hood

DL-1000 series equip with two filter hoods. In the back side of the hood. ICPDAS provide a customized patch for the hood. This special mechanism design is good for users to replace the patch only.

PoE/ non-PoE Ethernet port

The Ethernet port can be used to connect to a PoE switch or a non-PoE switch.

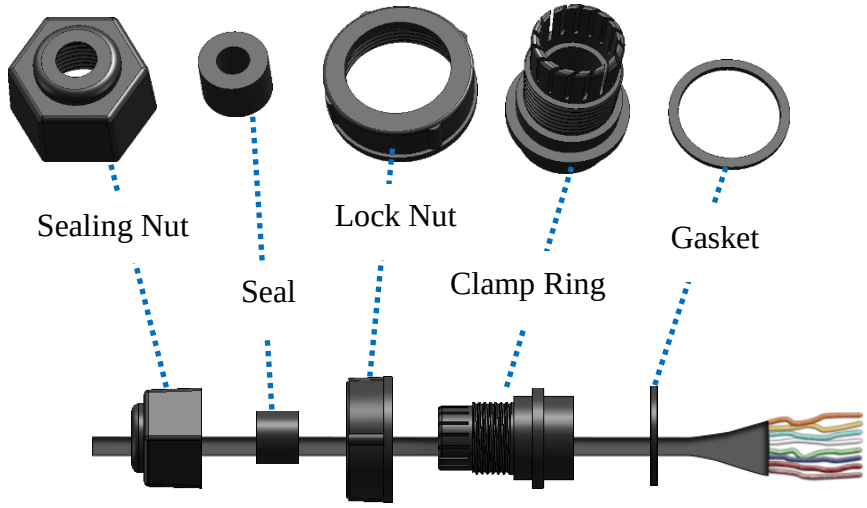
4SASO-0001 **RJ45 Plug Installation IP67 RJ45 Plug**

Installation procedure:

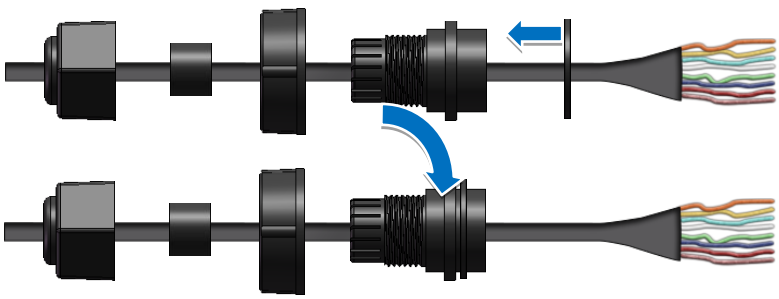
To install the waterproof connector, follow the procedure described below.

Step 1: Remove the **RJ-45 Connector** from the **RJ-45 Cable**

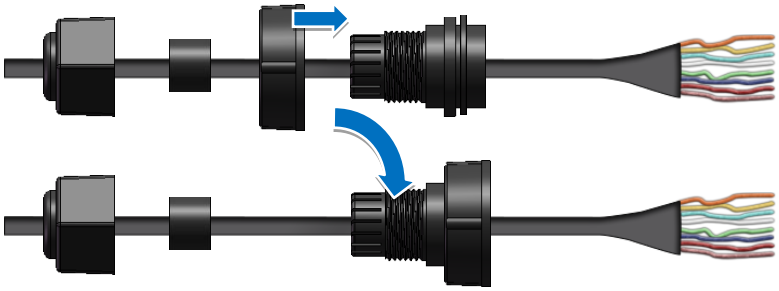
Step 2: Feed the end of the two core power cable through the **Sealing Nut**, **Seal**, **Lock Nut, Clamp Ring** and **Gasket**



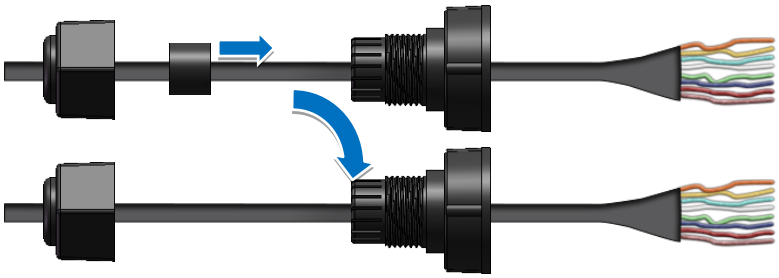
Step 3: Wrap the **Gasket** around the **Clamp Ring**



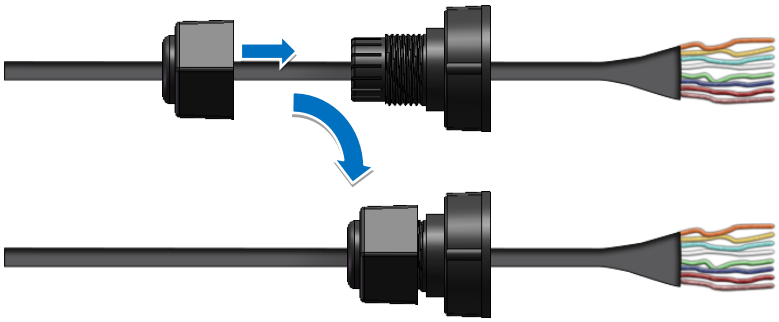
Step 4: Wrap the **Lock Nut** around the **Clamp Ring**



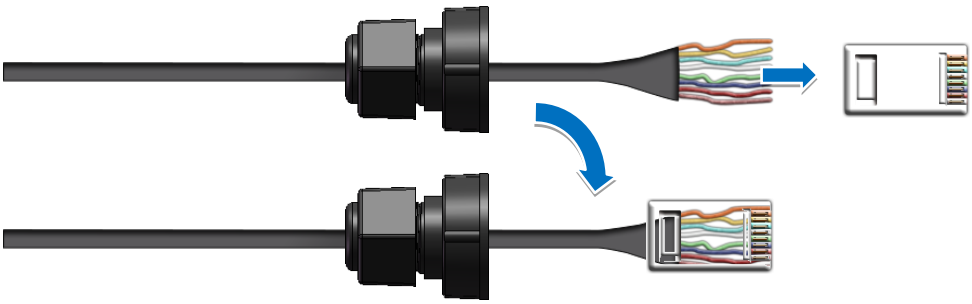
Step 5: Insert the **Seal** around the **Clamp Ring**



Step 6: Push the **Seal Nut** forward and Hand-tighten it to seal the assembly



Step 7: Insert the **RJ-45 Cable** into the **RJ-45 Connector**

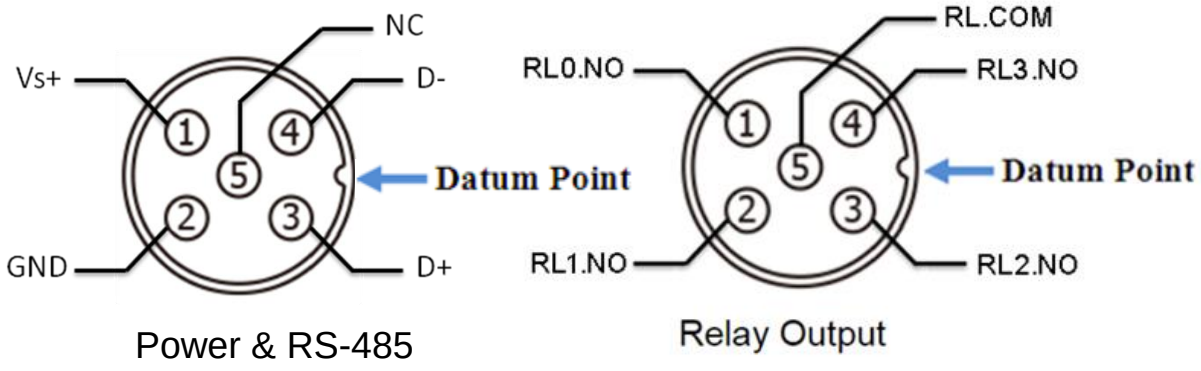


Step 8: Push the RJ-45 waterproof connector assembly forward so that it covers the RJ-45 connector

Step 9: Connect the RJ-45 Cable to the COM Port on the DL-1000-E module

Firmly tighten the connector to the module and ensure that it is completely connected.

Connector for Power/ RS-485/ Alarm Relay Output



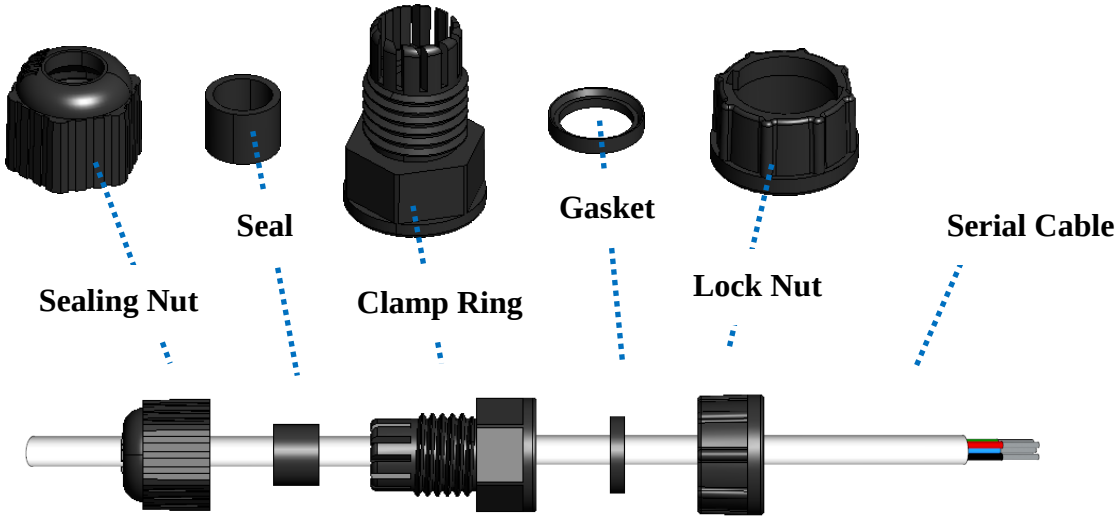
Power & RS-485

Relay Output

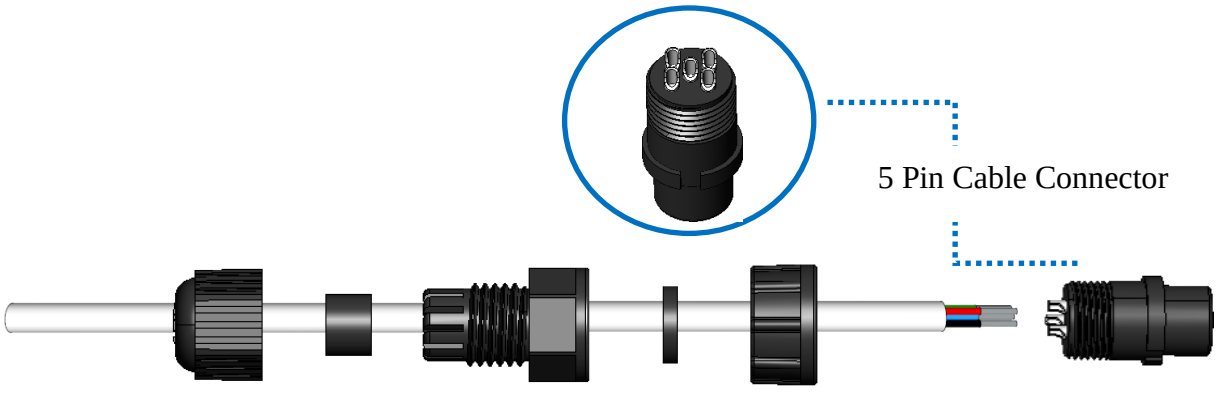
Wire requirement:

- Stripping length: 8 ~ 10 mm
- 0.20 - 1.5 mm² (IEC) / 28 - 16 AWG (UL)

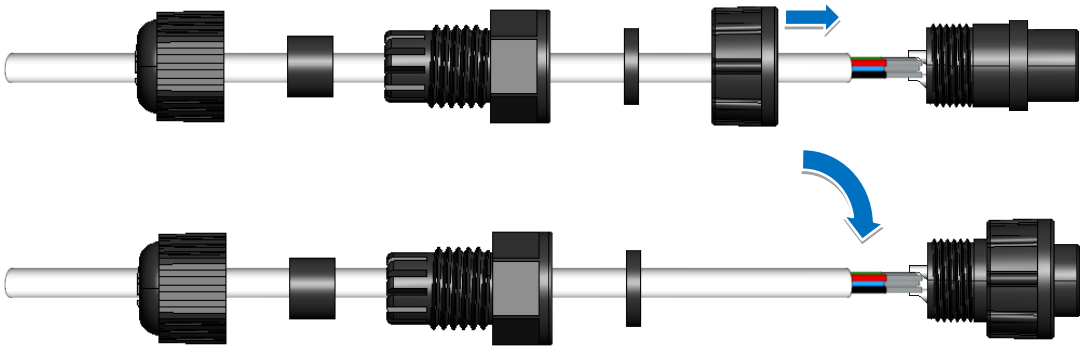
Step 1: Feed the end of the two core power cable through the **Sealing nut**, **Seal**, **Clamp Ring**, **Gasket** and **Lock Nut**



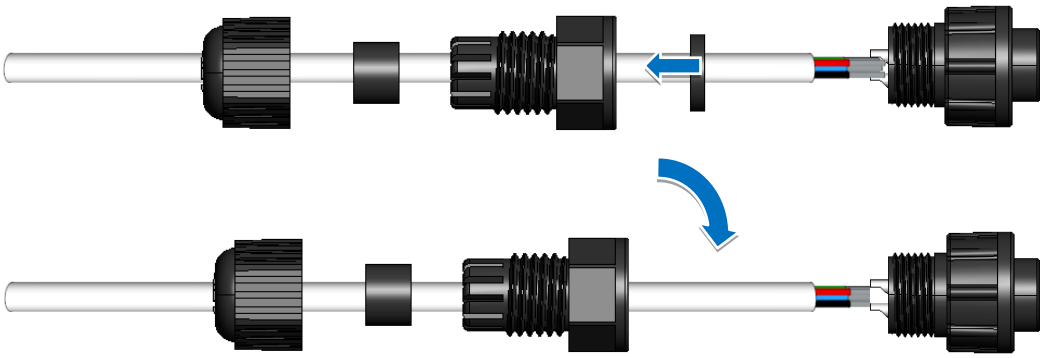
Step 2: Insert the conductors into the holes on the **5 Pin Cable Connector**. See the figure below for the correct pin-out connections



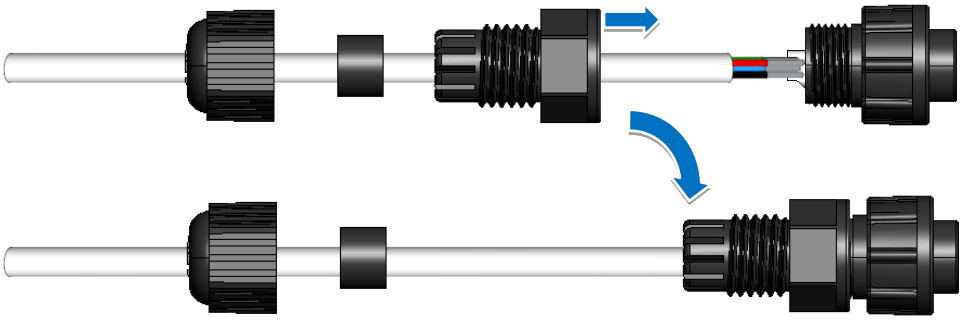
Step 3: Wrap the **Lock Nut** around the **5 Pin Cable Connector**



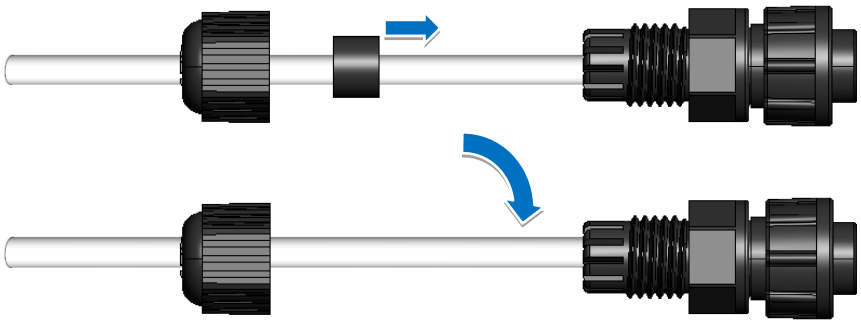
Step 4: Insert the **Gasket** into the **Clamping Ring**



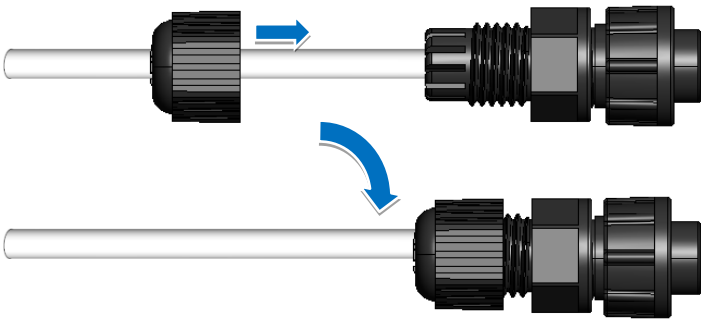
Step 5: Wrap the **Clamp Ring** around the **5 Pin Cable Connector**



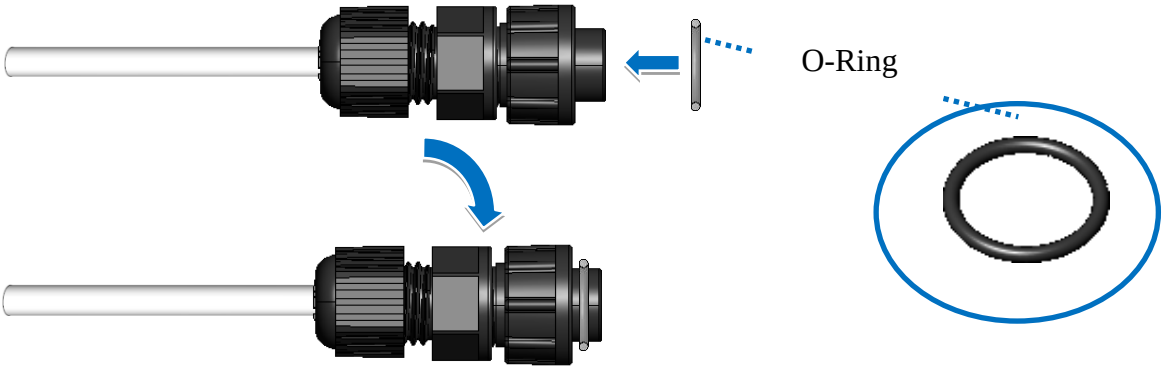
Step 6: Insert the **Seal** into the **Clamp Ring**



Step 7: Push the **Sealing Nut** forward and Hand-tighten it to seal the assembly



Step 8: Wrap the **O-Ring** around the **5 Pin Cable Connector**

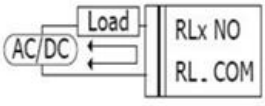
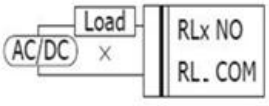


Important: Make sure to tighten firmly.

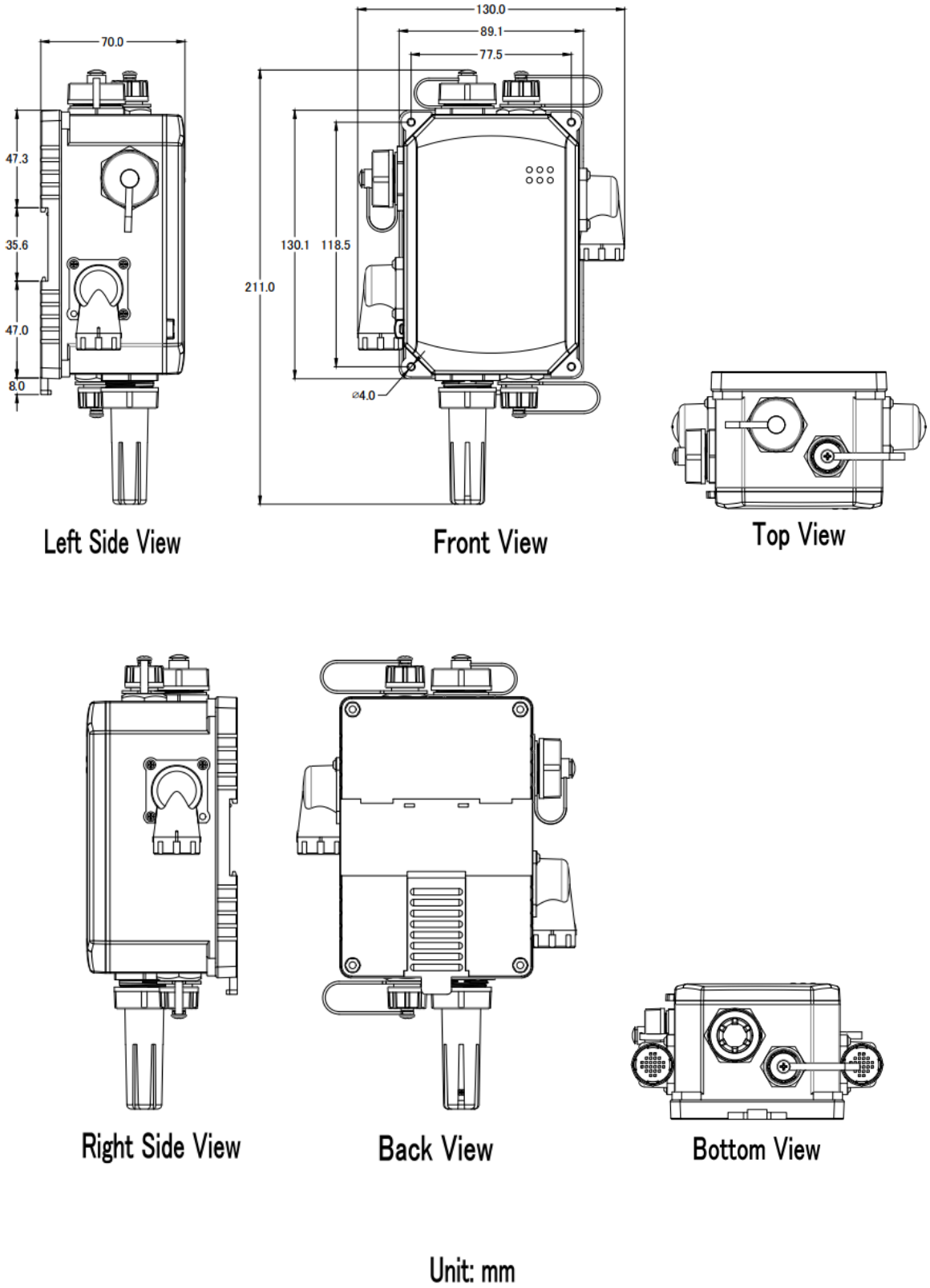
Step 9: Connect the Power cable to the Power socket on the DL-1000 module

The fool-proofing groove (as red circle) is useful for easy connection of power cable and power plug. Please make sure they are located in the same direction when connecting these two items.

Relay Output Wire Connection

Output Type	ON State Readback as 1	OFF State Readback as 0
Relay Output		

2.3 Dimensions (unit: mm)



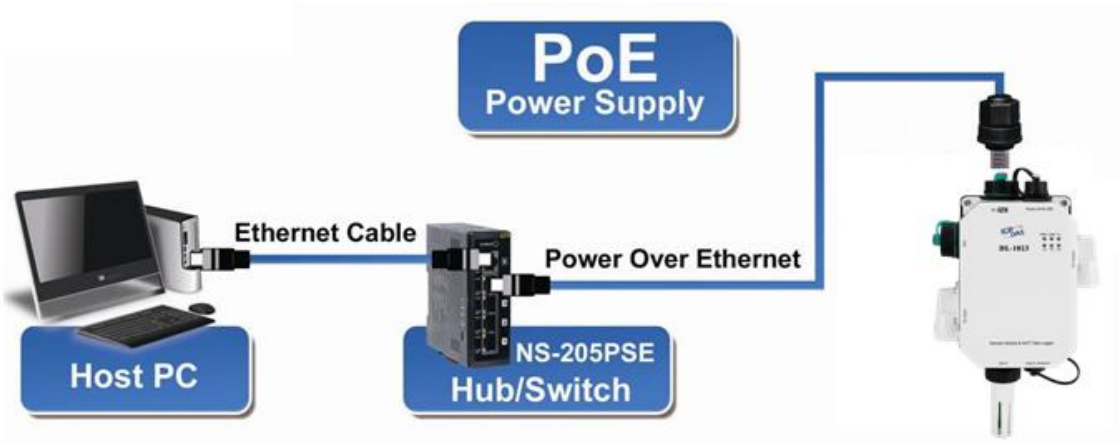
2.4 Cabling for Power and Network

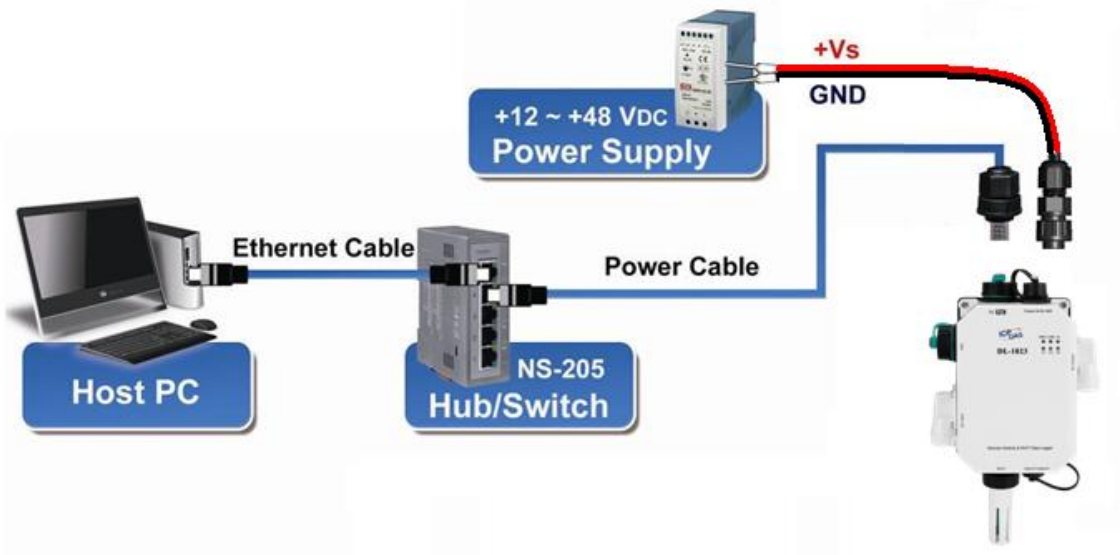
Note

- Do not install the DL-1000 module near a vent, a ventilation fan or a door where the air flows faster. Also avoid putting the module on a desktop below the nose and mouth to prevent incorrect measurement.
- Avoid installing in locations where the temperature is below -20°C or above 80°C.
- Avoid installing in locations near a strong electromagnetic field.

For connecting with a PC or a Android device

The DL-1000 logger can connect to a PoE network without a power source or connect to a non-PoE network. When using the **Search** function in iAir App on Android or iOS mobile devices, mobile devices need to connect to the same subnet that the DL-1000 connected to over Wi-Fi. Similarly to using the Search function in DL-1000 Utility running on Windows, the module and the host PC need to connect on the same subnet, too.



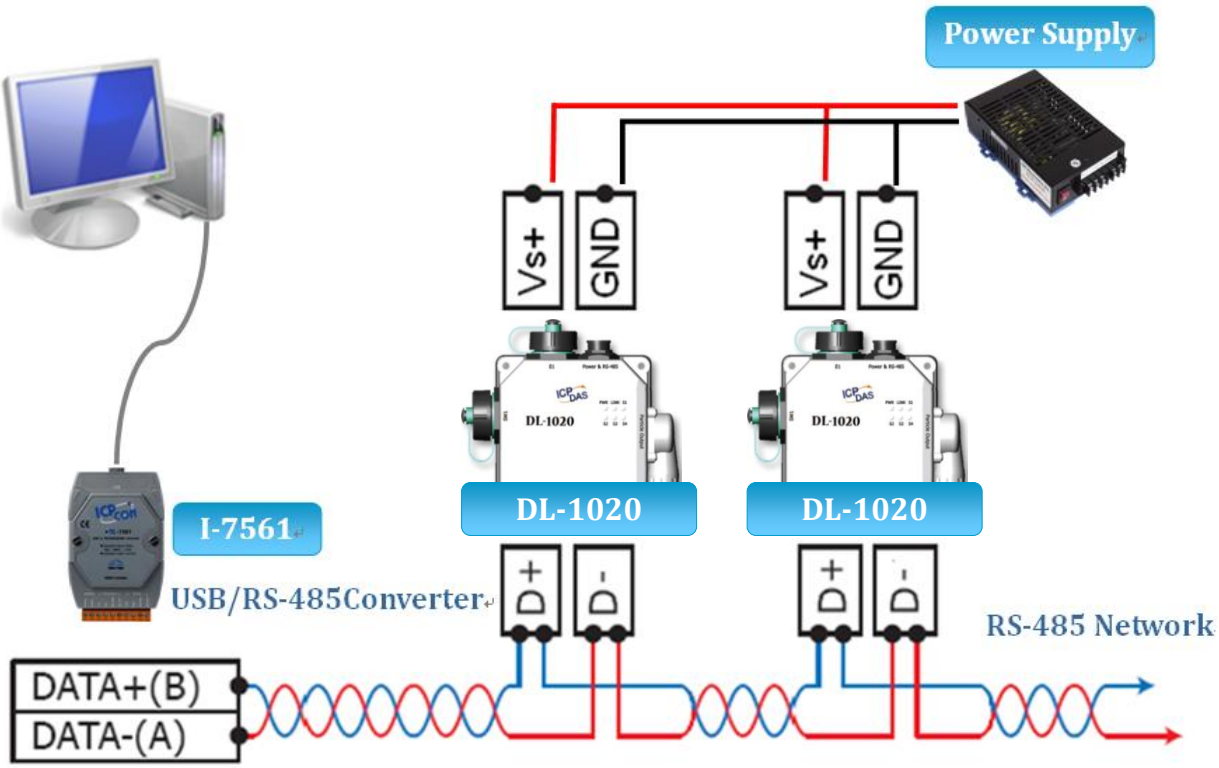


The iAir App and DL-300 Utility search the logger by broadcast, therefore only the devices on the same subnet can be searched out. It means that the host PC, Android devices and the logger must have the same broadcast address. The broadcast address for an IPv4 device can be obtained by performing a bitwise OR operation between the bit complement of the subnet mask and the IP address for a device. In other words, take the device's IP address, and set to '1' any bit positions which hold a '0' in the subnet mask.

For example, in an entire IPv4 subnet, the host PC or the Android device uses the private IP address space 172.16.0.0/12 and subnet mask address 255.240.0.0, the broadcast address is 172.16.0.0 | 0.15.255.255 = 172.31.255.255. Only the loggers which have the same broadcast address could be searched out in the iAir App or DL-300 Utility. Please contact with your network administrator to make sure the DL-1000 logger is connected to the same sub-network that your Android devices or PC is connected to.

For connecting with PC via RS-485 network

The DL-1000 logger can connect to the PC through a RS-485 network with power input requirement of +12 ~ +48 V_{DC}.



3. Configuration via Web Browser

DL-1000 logger has a built-in web server that provides simple web pages for remote monitoring real-time data and configuring the logger with a standard browser. For opening the web page in DL-1000, the factory default IP address (192.168.255.1), Subnet Mask (255.255.0.0) and Gateway (192.168.0.1) need be set to available IP/Subnet Mask/Gateway addresses in your Ethernet environment. The Ethernet configuration can be set by entering the Settings menu from the by web pages.

3.1 Search the DL-1000 logger

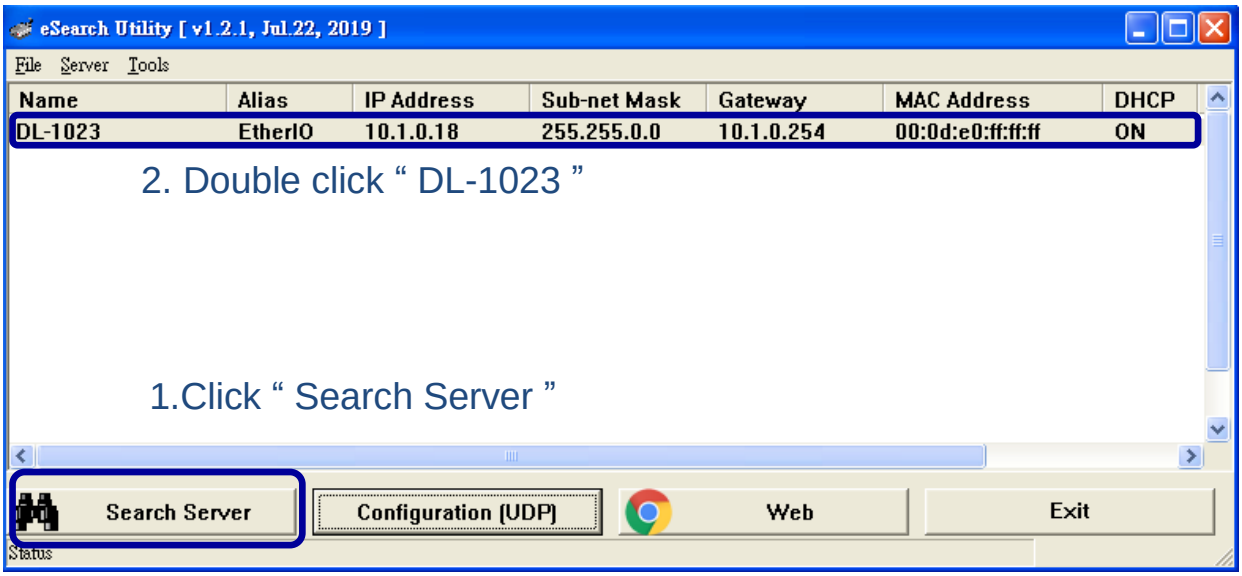
eSearch is designed to search out the DL-1000 logger connected on the same Ethernet network, it supports for Linux and Windows and is needless to install.

The eSearch can be downloaded from
CD:\Napdos\IIoT\utility\esearch
http://ftp.icpdas.com/pub/cd/usbcd/napdos/iiot/utility/esearch/

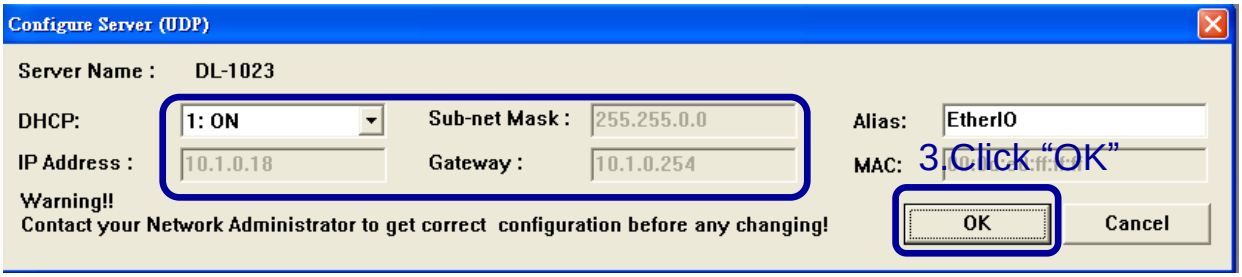
Before running eSearch, turn off firewall on computer, and connect the computer and DL-1000 logger to Ethernet network.

1. Launch eSearch, click the ***Search Servers*** button to search the DL-1000 modules connected to the network, the modules searched out will be listed as below.

2. Double click the module name searched in the list.



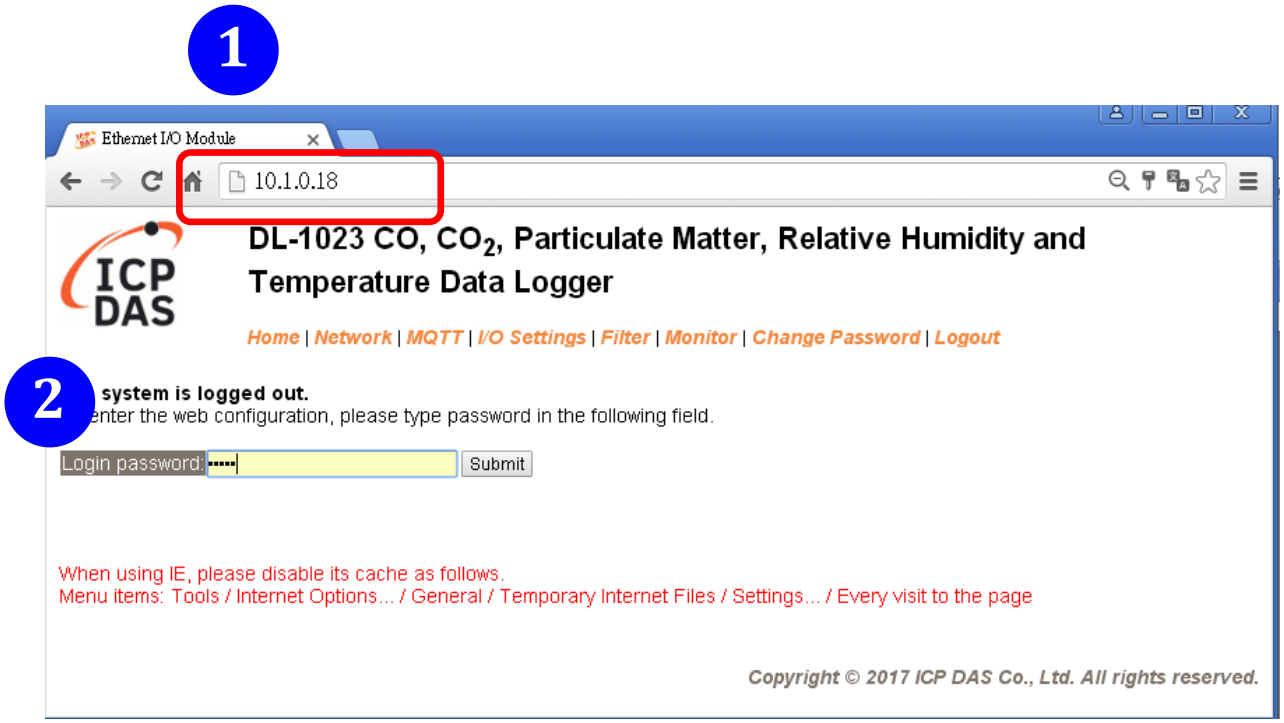
3. Set available IP Address, Sub-net Mask, Gateway (designated by your network administrator) and alias and click the ***OK*** button.



3.2 Logging into the DL-1000

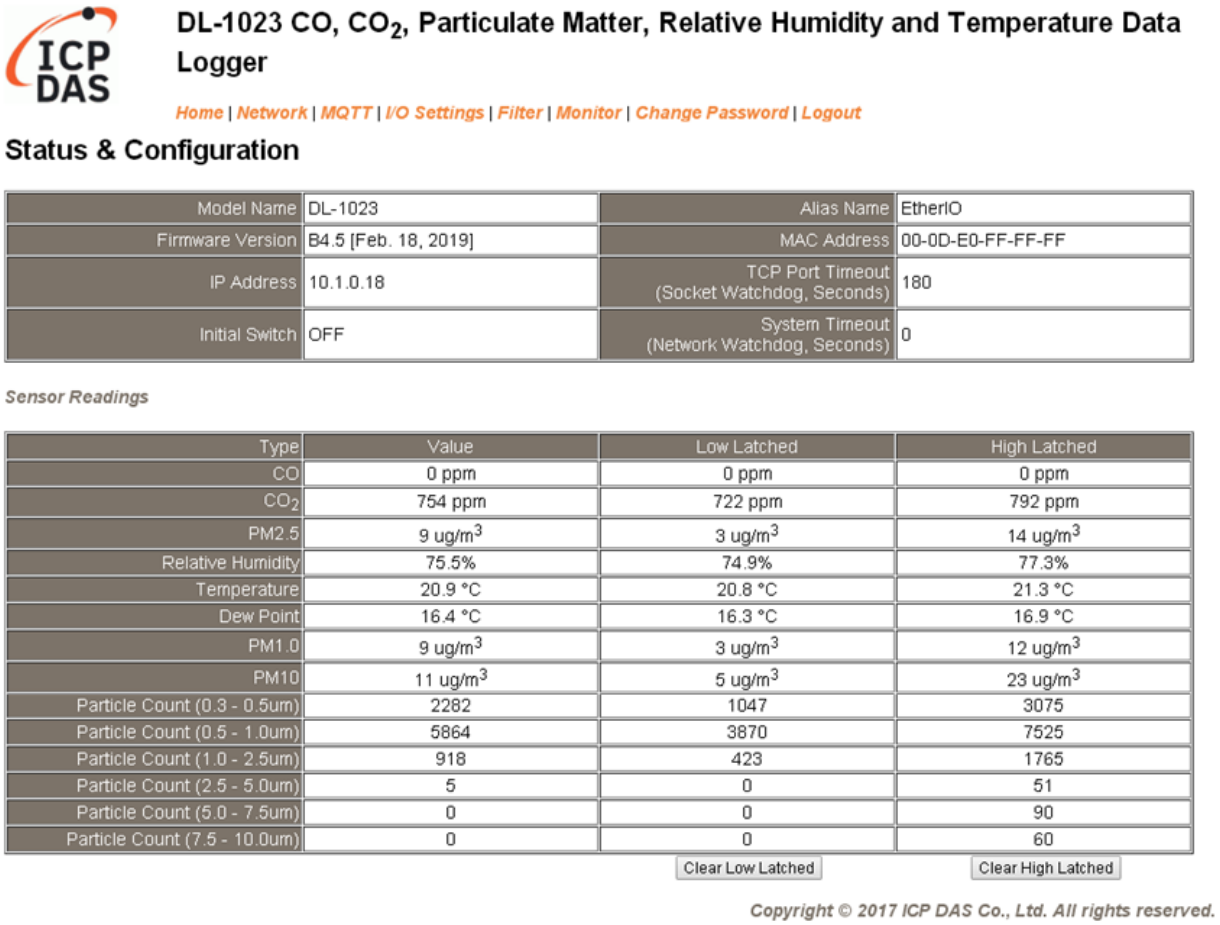
1. Enter the IP address for your DL-1000 in the address bar of a web browser. (sec. 3.1)

2. Type the Login password, and click the **Submit** button.
   (The default Login password is **Admin**, case sensitive.)



3.3 Home

The first page displayed is **Home**, it shows the based configuration of the DL-1000 module and the real-time data as below:



DL-1023 CO, CO_2, Particulate Matter, Relative Humidity and Temperature Data Logger

Home | Network | MQTT | I/O Settings | Filter | Monitor | Change Password | Logout

Status & Configuration

Model Name	DL-1023	Alias Name	EtherIO
Firmware Version	B4.5 [Feb. 18, 2019]	MAC Address	00-0D-E0-FF-FF-FF
IP Address	10.1.0.18	TCP Port Timeout (Socket Watchdog, Seconds)	180
Initial Switch	OFF	System Timeout (Network Watchdog, Seconds)	0

Sensor Readings

Type	Value	Low Latched	High Latched
CO	0 ppm	0 ppm	0 ppm
CO_2	754 ppm	722 ppm	792 ppm
PM2.5	9 ug/m^3	3 ug/m^3	14 ug/m^3
Relative Humidity	75.5%	74.9%	77.3%
Temperature	20.9 °C	20.8 °C	21.3 °C
Dew Point	16.4 °C	16.3 °C	16.9 °C
PM1.0	9 ug/m^3	3 ug/m^3	12 ug/m^3
PM10	11 ug/m^3	5 ug/m^3	23 ug/m^3
Particle Count (0.3 - 0.5um)	2282	1047	3075
Particle Count (0.5 - 1.0um)	5864	3870	7525
Particle Count (1.0 - 2.5um)	918	423	1765
Particle Count (2.5 - 5.0um)	5	0	51
Particle Count (5.0 - 7.5um)	0	0	90
Particle Count (7.5 - 10.0um)	0	0	60

Clear Low Latched Clear High Latched

In the **Sensor Readings** field is the real-time data of CO/CO_2 concentration, temperature, humidity and dew point, the minimum value (Low Latched) and maximum value (High Latched) logged. Clicking on the ***Clear Low Latched*** button and the ***Clear High Latched*** button can reset the latched data to current value and latch new minimum or maximum value.

Alarm

Type	Alarm Mode	Low Alarm Limit	High Alarm Limit	Low Alarm Status	High Alarm Status
CO	Disabled		-1 ppm		Off
CO_2	Disabled		-1 ppm		Off
PM2.5	Disabled		-1 ug/m^3		Off
Relative Humidity	Disabled	0.0%	0.0%	Off	Off
Temperature	Disabled	-0.0 °C	-0.0 °C	Off	Off
Dew Point	Disabled	-0.0 °C	-0.0 °C	Off	Off
PM1.0	Disabled		-1 ug/m^3		Off
PM10	Disabled		-1 ug/m^3		Off
Particle Count (0.3 - 0.5um)	Disabled		-1		Off
Particle Count (0.5 - 1.0um)	Disabled		-1		Off
Particle Count (1.0 - 2.5um)	Disabled		-1		Off
Particle Count (2.5 - 5.0um)	Disabled		-1		Off
Particle Count (5.0 - 7.5um)	Disabled		-1		Off
Particle Count (7.5 - 10.0um)	Disabled		-1		Off

Clear Latched Alarm

The Alarm table displays the settings of alarm mode, high alarm limit for CO/CO_2 concentration, temperature, humidity and dew point, low alarm limit for temperature, humidity and dew point, and the alarm status for each. Clicking on the ***Clear Latched Alarm*** button can clear the activated alarm status.

Digital Output

DO0		
DO1		
DO2		
DO3		

The **Digital Output** table shows the status of the relay output and the control button **Set Digital Output** to change the relay output status. The control function is invalid when any of the alarm modes is not disabled. If one of the alarm modes is enabled, the relay is linked to the alarm status for tapping audible/visual alarm.

At the end of the page are the data, time and device online time since powered on.

RTC

Date	2019-12-24	Time	14:43:58

Device Online Time

Device Online Time	0 Days, 03H:14M:49S

3.4 Network

The networks parameters are set on this page including DHCP enabled/disabled, IP/Subnet Mask/Gateway addresses, the port number and the NetID for Modbus TCP communication. Remember to click on the ***Update Settings*** button to update new parameters.

IP Address Configuration

IP Address	
Address Type	DHCP
Static IP Address	255 . 255 . 255 . 255
Subnet Mask	0 . 0 . 0 . 0
Default Gateway	0 . 0 . 0 . 0
MAC Address	00-0D-E0-FF-FF-FF (Format: FF-FF-FF-FF-FF-FF)
Modbus TCP Slave	
Local Modbus TCP port	502 (Default= 502)
Local Modbus NetID	1 (Default= 1) Enable (Default= Enable)
Update Settings	

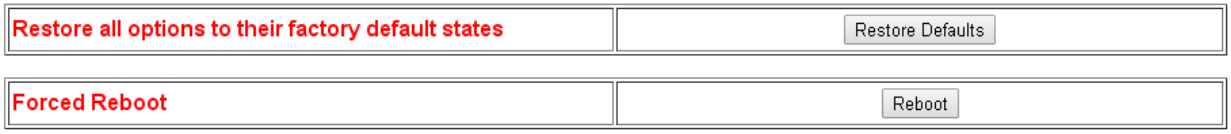
General Settings

Ethernet Speed	Auto (Auto=10/100 Mbps Auto-negotiation)
System Timeout (Network Watchdog)	0 (30 ~ 65535 s, Default= 0, Disable= 0) Action:Reboot
TCP Timeout	180 (5 ~ 65535 s, Default= 180, Disable= 0) Action:Cut-off
UDP Configuration	Enable (Enable/Disable the UDP Configuration, Enable=default.)
Web Auto-logout	10 (1 ~ 65535 minutes, Default= 10, Disable= 0)
Alias Name	EtherIO (Max. 30 chars, part of the MQTT topic name)
Update Settings	

Item	Description	Default
System Timeout (Network Watchdog)	Sets the timeout for rebooting a DL-1000 logger when it is abnormal or failure to communicate. Range: 30 ~ 65535 (unit: second) 0 = Disable	0 (Disable)
TCP Timeout	Sets the timeout for disconnecting a TCP connection when a DL-1000 does not receive data coming from the Ethernet port. Range: 5 ~ 65535 (unit: second) 0 = Disable	180

Web Auto-logout	Sets the timeout for logout the web server in a logger when there is no any operation from the web browser interface. Range: 1 ~ 65535 (unit: minute) 0 = Disable	10
Alias Name	Sets an alias name for easy to identify a DL-1000. The maximum length is 18 characters.	EtherIO

Restore Factory Defaults

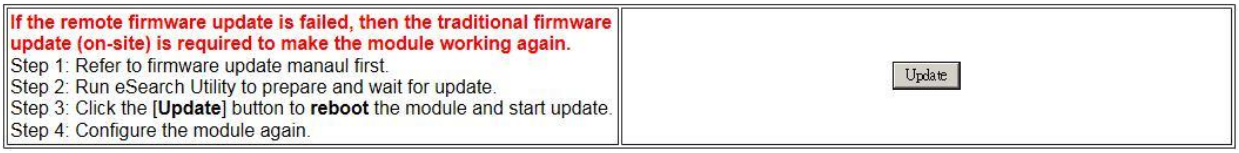


The ***Reboot*** button is used to reboot the DL-1000. After pressing the button, a user needs to login the DL-1000 logger again to using the web interface.

The ***Restore Defaults*** button can be used to restore the following settings to factory default values.

Item	Factory Default
IP address type	Static IP
Static IP	192.168.255.1
Default gateway	192.168.0.1
Subnet Mask	255.255.0.0
MAC address	Factory MAC address
Modbus TCP port	502
Modbus TCP NetID	1
Modbus TCP NetID	Enabled
System Timeout	0 (disabled)
TCP Timeout	180 seconds
Web auto logout	10 minutes
Alias name	EtherIO
Accessible IP	Disabled

Firmware Update



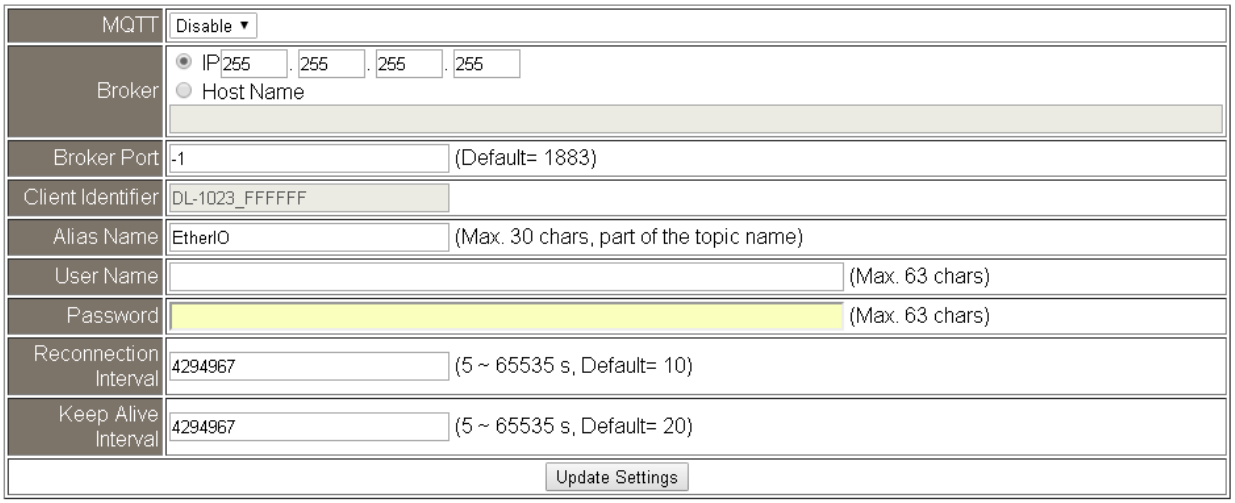
The Update button is used to update firmware for DL-1000 version. For details regarding firmware update, please refer to the section 8. FAQ Q11.

3.5 MQTT

MQTT stands for MQ Telemetry Transport, it is a publish/subscribe, extremely simple and lightweight messaging protocol, designed for constrained devices and low-bandwidth, high-latency or unreliable networks.

The Publish-Subscribe messaging pattern requires a message broker. The broker is responsible for distributing messages to interested clients based on the topic of a message. Now the MQTT Version 3.1.1 becomes an OASIS standard, it is an ideal protocol for communicating with connected devices in the emerging "machine-to-machine" (M2M) and "Internet of Things" applications, and for mobile applications where bandwidth and battery power are at a premium.

Connectivity Settings



Input the IP address and port number for the MQTT broker and click on the ***Update Settings*** button to save the parameters. For RevB version or firmware version B3.9 and later, the MQTT function can be disabled and there are more settings for user name, password, reconnection interval and keep alive interval.

Last Will Settings

Last Will and Testament	☐
Topic	(Max. 30 chars)
Message	(Max. 30 chars)
QoS	0 - At most once
Retained	☐
Update Settings	

The last will settings are only available to the RevB version or firmware version B3.9 and later. The MQTT Last Will and Testament (LWT) feature is used to notify other clients about an ungracefully disconnected client. A DL-1000 module can register an offline message (LWT) to the broker. The LWT message will be delivered to all clients who subscribe to the offline topic if the DL-1000 module disconnects unexpectedly.

- Last Will and Testament: Tick the option to enable the last will and testament function.
- Topic: The topic name of the last will.
- Message: The message of the last will.
- QoS: TheQoS of the last will message.
- Retained: Tick the option such that the will message is to be retained when it is published.

Publication Settings

Cycle	-10	(400 ~ 65500 ms, in 10 ms step, Default= 1000)	
Module Topic Name	N/A	(Max. 255 chars)	
CO Sub Topic Name	N/A	(Max. 63 chars)	Enable
CO_2 Sub Topic Name	N/A	(Max. 63 chars)	Enable
PM2.5 Sub Topic Name	N/A	(Max. 63 chars)	Enable
Relative Humidity Sub Topic Name	N/A	(Max. 63 chars)	Enable
Temperature (°C) Sub Topic Name	N/A	(Max. 63 chars)	Enable
Temperature (°F) Sub Topic Name	N/A	(Max. 63 chars)	Enable
Dew Point (°C) Sub Topic Name	N/A	(Max. 63 chars)	Enable
Dew Point (°F) Sub Topic Name	N/A	(Max. 63 chars)	Enable
PM1.0 Sub Topic Name	N/A	(Max. 63 chars)	Enable
PM10 Sub Topic Name	N/A	(Max. 63 chars)	Enable
Particle Count (0.3 - 0.5um) Sub Topic Name	N/A	(Max. 63 chars)	Enable
Particle Count (0.5 - 1.0um) Sub Topic Name	N/A	(Max. 63 chars)	Enable
Particle Count (1.0 - 2.5um) Sub Topic Name	N/A	(Max. 63 chars)	Enable
Particle Count (2.5 - 5.0um) Sub Topic Name	N/A	(Max. 63 chars)	Enable
Particle Count (5.0 - 7.5um) Sub Topic Name	N/A	(Max. 63 chars)	Enable
Particle Count (7.5 - 10.0um) Sub Topic Name	N/A	(Max. 63 chars)	Enable
All Information Sub Topic Name	N/A	(Max. 63 chars)	Enable
Update Settings			

- Cycle: sets the time period for update the publish messages in millisecond.
- Publication Topic Format: **This is only available to the RevB version or firmware version B3.9 and later.** The format of the publication topic can be either (Module Topic Name)(Sub Topic Name) or (Alias Name)/GetValue/(Sub Topic Name). The default format is (Module Topic Name)(Sub Topic Name).
- Module Topic Name: sets the module topic name.
- CO/ CO2/ PM2.5/ Relative Humidity/ Temperature (°C)/ Temperature (°F)/ Dew Point (°C)/ Dew Point (°F) PM1/ PM10/ Particle Count (0.3 – 10.0um) Sub Topic Name: sets the sub topic name for each item.
- All Information Sub Topic Name: **This is only available to the RevB version or firmware version B3.9 and later.** The sub-topic name of the publication topic of all information. Following is a sample all information topic:


```
{
"ModuleName":"DL-1022",
"MacAddress":"000DE0FFFFFD",
"CO2":"700",
"Humidity":"59.2",
" TemperatureC ":"17.1"
" TemperatureF":"62.8",
"DewPointC":"11.9",
" DewPointF ":"53.4",
"AlarmStatus":"Off"
}
```


A MQTT client subscribes the messages form a MQTT broker by specifying the topic name as

Module Topic Name + Sub Topic Name

For example, to subscribe the CO_2 level in this case, a MQTT client subscribes the topic name from a MQTT broker as

EtherIO/CO2

Besides, for RevB version or firmware version B3.9 and later, the publication topic name can be

Alias Name/GetValue/Sub Topic Name

For example, to subscribe the CO_2 level in this case, a MQTT client subscribes the topic name from a MQTT broker as

EtherIO/GetValue/CO2

Subscription Settings

DO0 Sub Topic Name	N/A	(Max. 63 chars)
DO1 Sub Topic Name	N/A	(Max. 63 chars)
DO2 Sub Topic Name	N/A	(Max. 63 chars)
DO3 Sub Topic Name	N/A	(Max. 63 chars)
Update Settings		

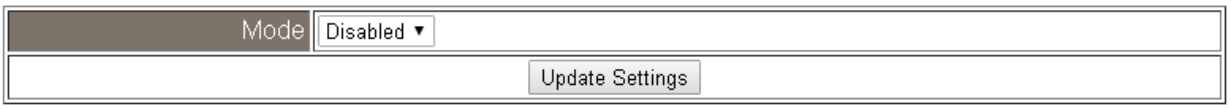
Input the Message Attribute Sub Topic Name and Message Sub Topic Name, and then click on the **Update Settings** button to save the parameters. Users can remotely display message or set the message attribute by publishing MQTT messages to the topic name of [Module Topic Name + Message Sub Topic Name] or [Module Topic Name + Message Attribute Sub Topic Name]

3.6 I/O Settings

Temperature

Users can change the temperature unit to Fahrenheit or Celsius in this field.

CO_2 Automatic Baseline Correction



To Enable/Disable the CO_2 Automatic Baseline Correction function. It is supported on the DL-1022 and DL-1023 only.

Q & A

Q: What is ABC (Automatic Baseline Correction)?

A: ABC stands for the Automatic Baseline Correction which is used to adjust a shifted baseline to the carbon dioxide level in fresh air. In case of normal indoor application, the carbon dioxide level drops to nearly outside air where there are no human, green plants or anything to elevate the carbon dioxide levels on weekday evenings or weekends, the ABC algorithm constantly keeps track of the lowest reading and slowly corrects it as the expected value in fresh air typically around 400 ppm.

Q: Why I need to enable the ABC?

A: When the CO_2 concentration detected in a period time of unoccupied space is greater than the base value of 400ppm, enable the ABC function to adjust the baseline. Be careful that the ABC will not work if a space is constantly occupied such as a hospital, 24-hr factory, 24-hr store, green house or other applications where CO_2 levels may be elevated at all times.

Offset

CO (ppm)	-1
CO_2 (ppm)	-1
TVOC (ppb)	-1
PM2.5 (ug/m^3)	-1
Relative Humidity (%)	0.0
Temperature (°C)	0.0
PM1.0 (ug/m^3)	-1
PM10 (ug/m^3)	-1
Update Settings	

Adjust the CO/CO2/PM2.5/PM1.0/PM10/humidity/temperature offset.
All the settings take effect after clicking the *Update Settings* button.
Besides, for RevB version or firmware version B4.8 and later, the publication topic name can be

Alarm Configuration

Type	Alarm Mode	Low Alarm Limit	High Alarm Limit	Beep On Alarm
CO	Disabled		-1	Enabled
CO_2	Disabled		-1	Enabled
PM2.5	Disabled		-1	Enabled
Relative Humidity	Disabled	0.0	0.0	Enabled
Temperature	Disabled	0.0	0.0	Enabled
Dew Point	Disabled	0.0	0.0	Enabled
PM1.0	Disabled		-1	Enabled
PM10	Disabled		-1	Enabled
Particle Count (0.3 - 0.5um)	Disabled		-1	Enabled
Particle Count (0.5 - 1.0um)	Disabled		-1	Enabled
Particle Count (1.0 - 2.5um)	Disabled		-1	Enabled
Particle Count (2.5 - 5.0um)	Disabled		-1	Enabled
Particle Count (5.0 - 7.5um)	Disabled		-1	Enabled
Particle Count (7.5 - 10.0um)	Disabled		-1	Enabled
Beep On Alarm Time	-1 (0: beep off, 1 to 250: beep on alarm time in seconds, 251: beep on alarm continuously)			
Update Settings				

All the settings take effect after clicking the *Update Settings* button.

Item	Description	Default
Alarm Mode	- **Disabled**: Disables alarm function. **- Momentary**: If a measurement value higher than the High Alarm Limit or lower than the Low Alarm Limit, the alarm occurs until the measurement value is within a range from Low Alarm Limit to High Alarm Limit. (For CO/CO_2 level, until the measurement value is lower than the High Alarm Limit.) The Alarm LED turns red, and the relay turns to on for every alarm event, and a sound alarm beeps as the setting in *Beep on Alarm Time* for CO/CO_2 high limit alarm events during the alarm stage. **- Latched**: If a measurement value higher than the High Alarm Limit or lower than the Low Alarm Limit, the alarm occurs. The Alarm LED turns red, the relay turns to on for every alarm event, and a sound alarm beeps as the setting in *Beep on Alarm Time* for CO/CO_2 high limit alarm events. Even though the alarm event is not presented, the alarm status is latched; the Alarm LED keeps red, and the relay keeps on and the sound alarm keeps beeping if it is set to beeping continuously.	Disabled
Low Alarm Limit	Sets the Low alarm limit conditions for Relative Humidity/ Temperature/ Dew Point.	
High Alarm Limit	Sets the High alarm limit conditions for CO/CO_2/Relative Humidity/ Temperature/ Dew Point.	
Beep On CO And CO_2 Alarm Time	Sets the time for beeping alarm. It is valid when the high limit alarm for CO/CO_2 occurs. Range: 1 ~ 250 (unit: second) 0 = disable the beeping alarm 251 = continue the beeping alarm without stop	251

Digital Output

Channel	Power On Value	Safe Value
DO0	On	Off
DO1	On	Off
DO2	On	Off
DO3	On	Off
Host Watchdog Timeout (seconds)	0 (5 to 65535 Seconds, Default= 0, Disable= 0)	
Update Settings		

Set the *Power On Value* and *Safe Value* for the relay output, and the *Host Watchdog Timeout* timer for RS-485 communication; if a host does not send a command over the setting time, the Host Watchdog timeout occurs and the relay outputs the status set for Safe value. The settings for Power On Value and Safe Value are unavailable when any one setting in the *Alarm Mode* is enabled.

RTC

Year	2019 (2000 to 2159)
Month	12 (1 to 12)
Date	24 (1 to 31)
Hour	15 (0 to 23)
Minute	20 (0 to 59)
Second	58 (0 to 59)
Update Settings	

All the settings take effect after clicking the *Update Settings* button.

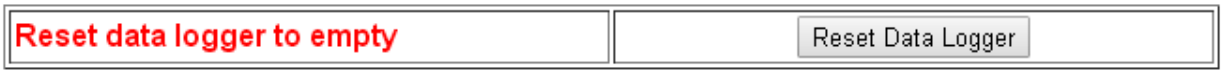
Data Logger

Status	Error
Change Logging	Stop
Overwrite on Full	No
Sampling Interval - Hour	0 (0 to 24)
Sampling Interval - Minute	0 (0 to 59)
Sampling Interval - Second	10 (0 to 59)
Period Start - Year	2019 (2000 to 2159)
Period Start - Month	6 (1 to 12)
Period Start - Date	1 (1 to 31)
Period Start - Hour	0 (0 to 23)
Period Start - Minute	0 (0 to 59)
Period Start - Second	0 (0 to 59)
Period End - Year	2019 (2000 to 2159)
Period End - Month	6 (1 to 12)
Period End - Date	2 (1 to 31)
Period End - Hour	0 (0 to 23)
Period End - Minute	0 (0 to 59)
Period End - Second	0 (0 to 59)
Update Settings	

In this table it shows the settings for data logger.

All the settings take effect after clicking the *Update Settings* button.

Item	Description	Default
Status	- Running: the data logger is running - Stopped: the data logger is stopped	
Change Logging	Sets the mode for data logger - Stop: stops the data logger - Run: continues logging data - Period: logs data in the specified period time	Stop
Overwrite on Full	Sets whether to overwrite old data by new ones when the memory for data storage is full. (Over the upper limit of 450,000.) - No: discards the new data (default) - Yes: overwrites the old data by new ones	No
Sampling Interval	Sets the time interval for logging data. It is valid for both Run mode and Period mode. - Sampling Interval – Hour: sets the hour for log interval - Sampling Interval – Minute: set the minute for log interval - Sampling Interval – Second: sets the second for log interval	10 (s)
Period Start	Sets the start time for Period mode.	
Period End	Sets the stop time for Period mode	



Click the *Reset Data Logger* button to clear the data in data storage memory.

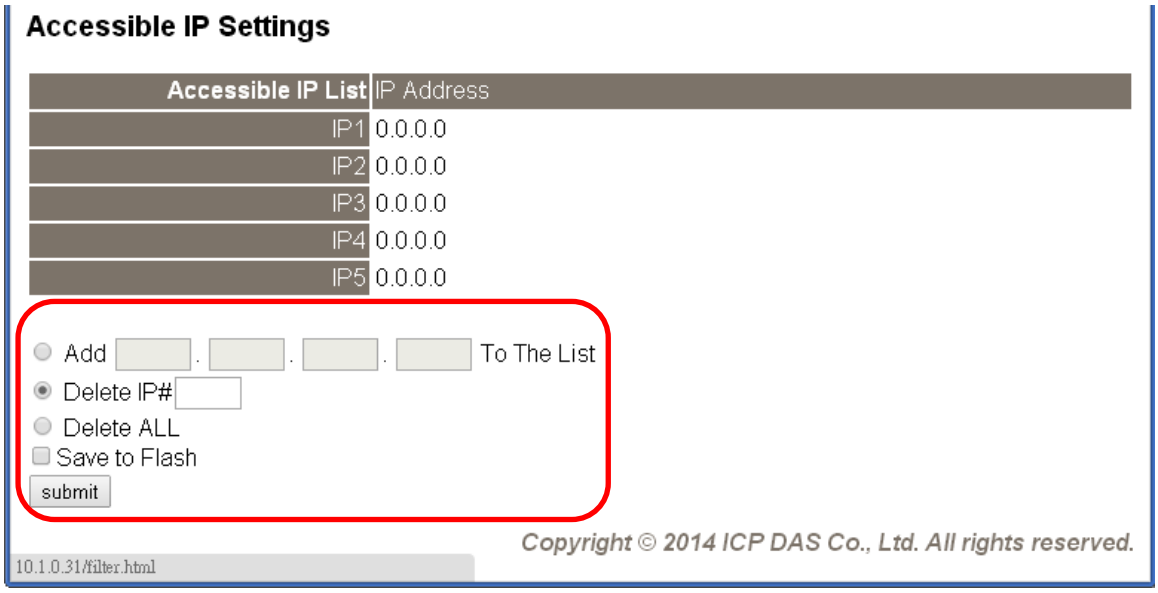
3.7 Accessible IP

For limiting the devices to access the DL-1000 logger, users can specifies particular devices by setting their IP addresses on this page. When the addresses are 0.0.0.0 from IP1 to IP5, all the devices can access the logger. Once any of the 5 IP address columns is set, only the device with which IP is saved in the list can assess the logger.

- **Set accessible IP**

  1. Select the radio button for *Add* ___.___.___.___ *To The List* and type the IP address for the accessible device in the following text box.
  2. Click on the *Submit* button to the setting effect without restarting.

  If the IP setting needs be saved for using after repowered, check the checkbox for Save to Flash before clicking the Submit button.

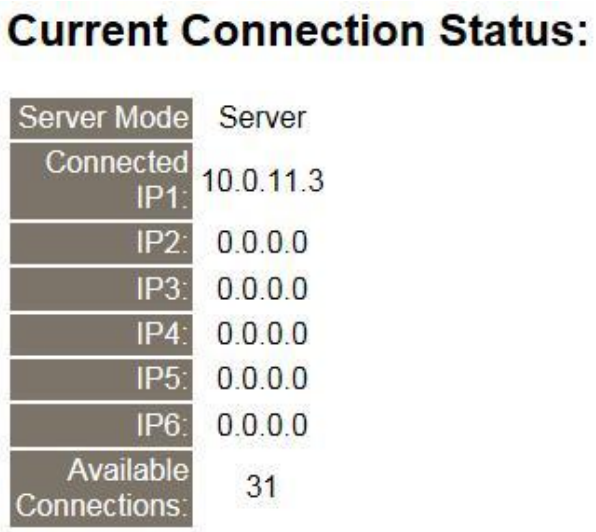


- **Delete IP setting**

  Select the radio button for *Delete IP#* to delete a specified IP or the radio button for *Delete All* to delete all the IP, check the checkbox for *Save to Flash* and then click the *Submit* button to take the delete operation effect.

3.8 Monitor

This is only available to the RevB version or firmware version B3.9 and later. It lists the IP of the devices which are connected to the DL-1000 module.



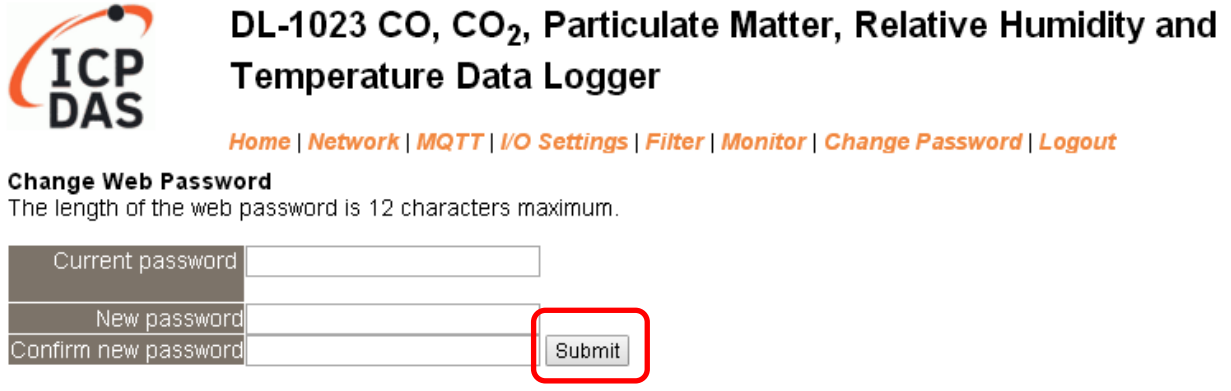
3.9 Change Password

On this page users can change the passwords for login the logger.

- **Change Web Password**

  The password for logging into the web page is **Admin** and can be changed in the *Change Web Password* field. The password can be alphabetic characters or numbers and up to 12 characters (case sensitive).

  To change the password, uses need enter the *Current password*, *New password*, and *Confirm new password* columns and click the Submit button for Change Web Password to take the setting effect.



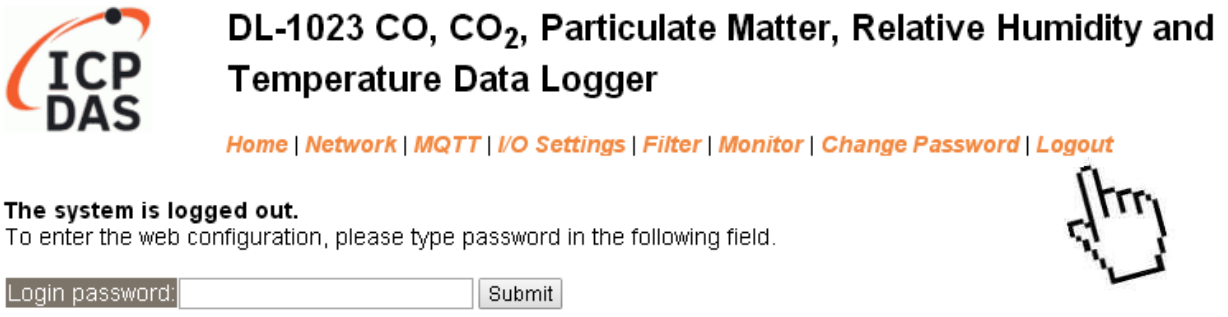
➢ **Change Password**

It is recommended to set the Touch Password to protect the logger from unexpected operation. Once the password is set, the password will be requested when entering the setting menu from the touch screen.

The Touch password is numbers from 0 to 9 and up to 8 digits. Enter your password in *New password* and *Confirm new password* and then click the Submit button for changing touch password to take the setting effect. If the password contains non-number characters, the Parameter Error will be displayed as below.

3.10 Logout

Click the Logout on any page to logout the DL-1000.



4. Configuration via RS-485

➢ The factory default settings for RS-485 communication
- Address: 1
- Protocol: Modbus/RTU
- Baudrate: 9600
- Parity: N,8,1
- Response Delay (ms): 0

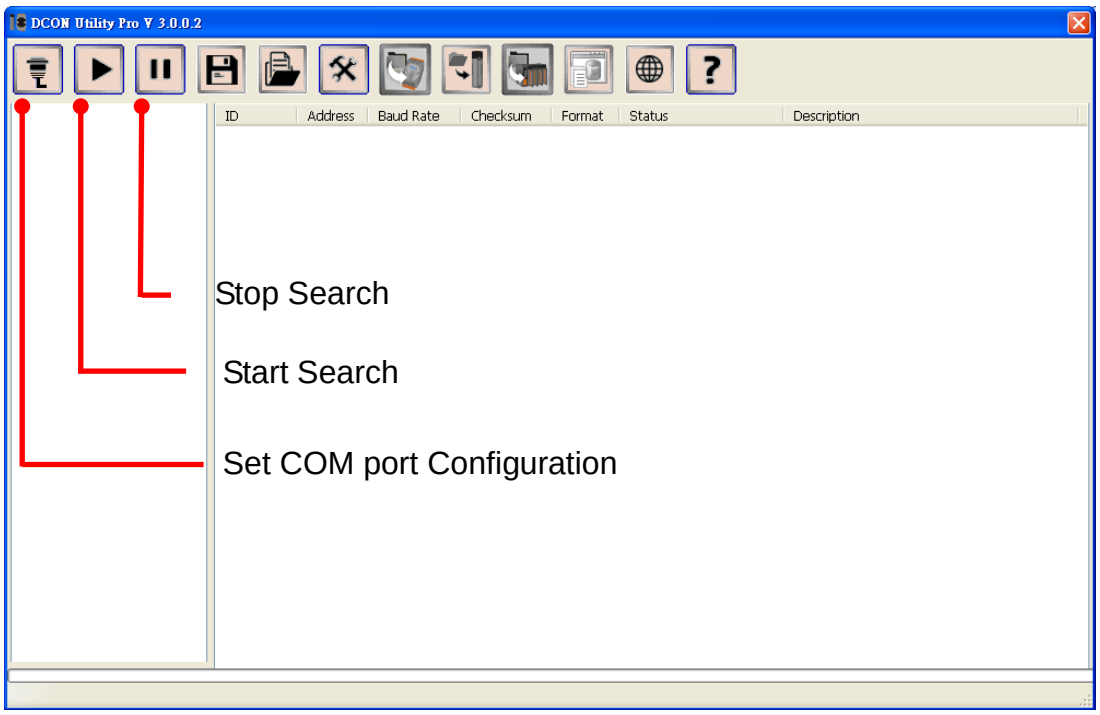
Note

If there are multiple DL-1000 loggers connected to the same RS-485 network, each logger needs be set with a unique RS-485 address. More than one module having the same address will cause communication failure

➢ Testing RS-485 Communication

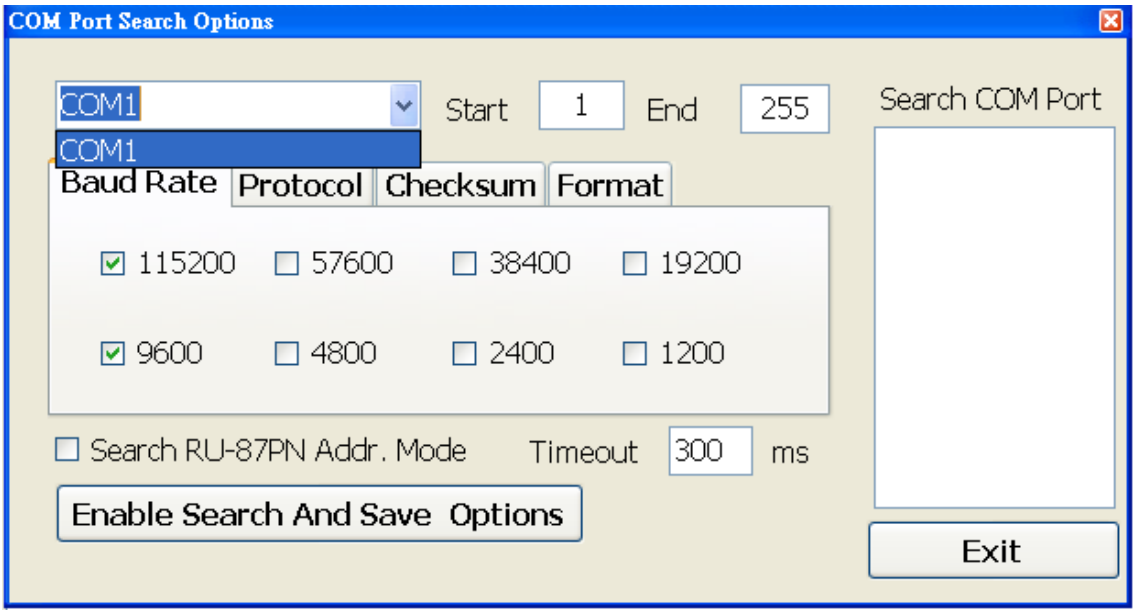
1. Download the DCON Utility Pro from
CD:\Napdos\IIoT\utility\DCON_utility_pro
http://ftp.icpdas.com/pub/cd/usbcd/napdos/iiot/utility/dcon_utility_pro/

2. Launch the DCON_Utility_Pro.exe.

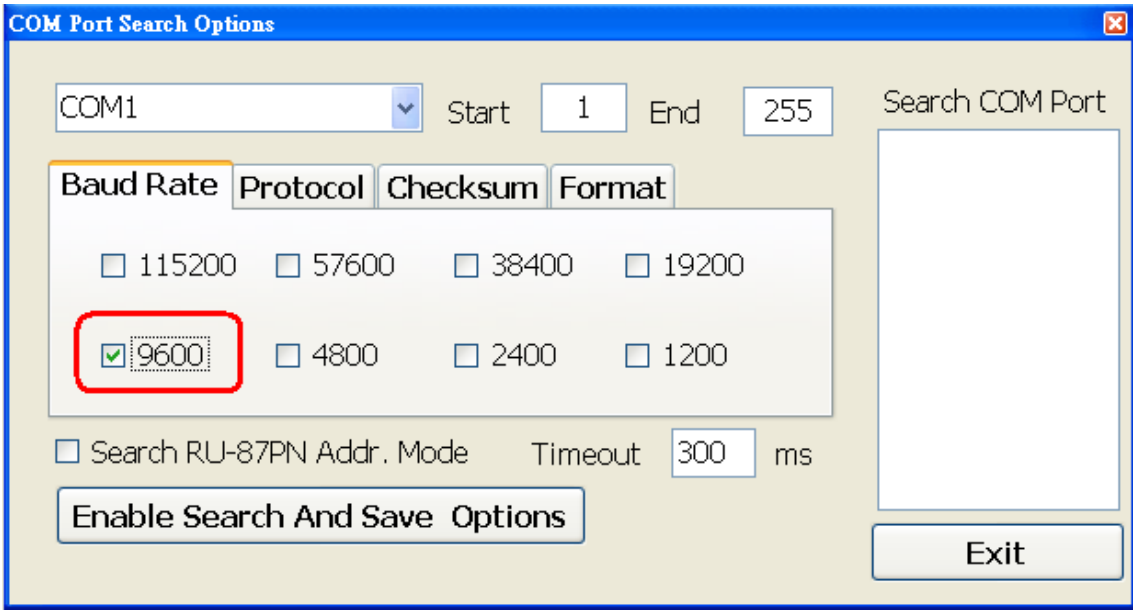


3. Click the icon  to configure the COM port.

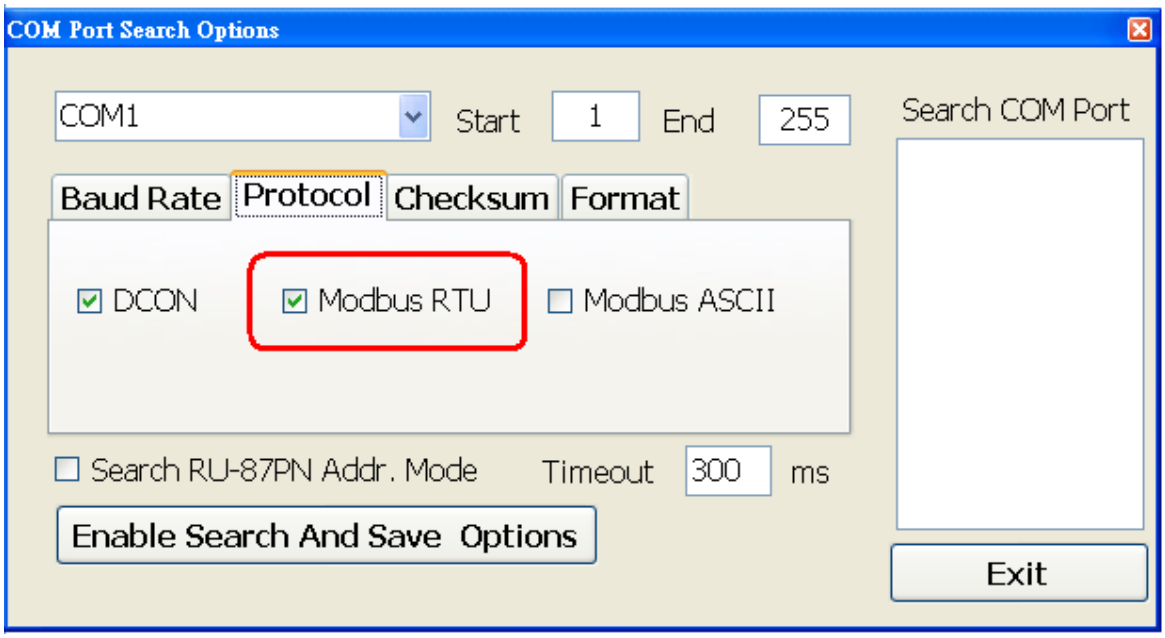
4. Select the COM Port number used to connect the DL-1000 logger.



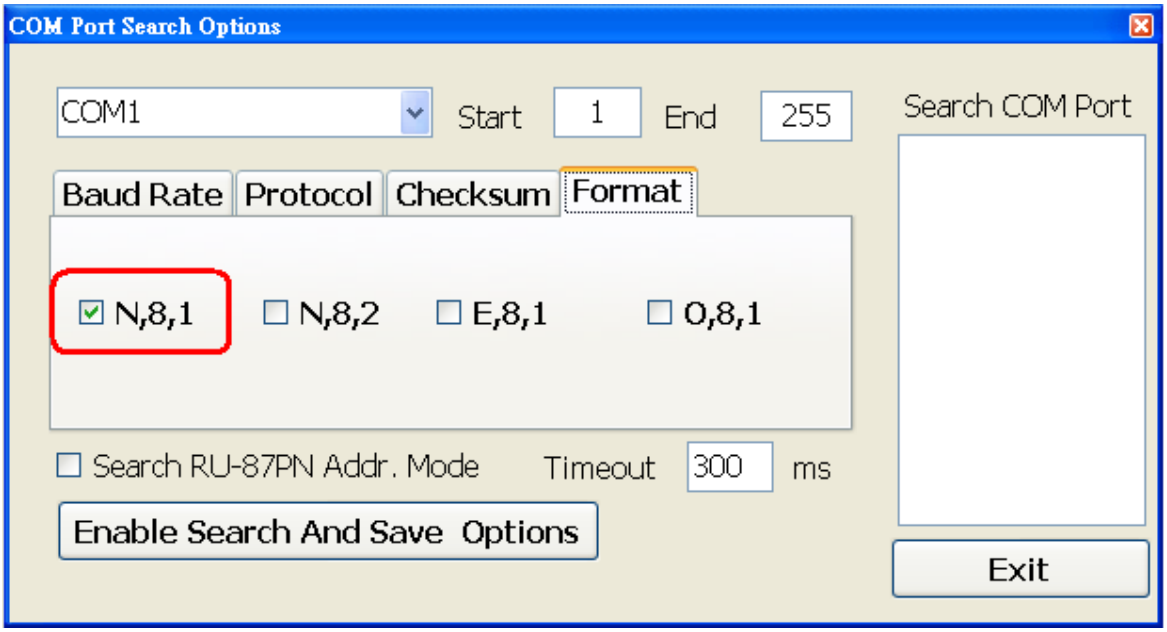
5. The Baud Rate is factory default to 9600 bps, make sure the baud rate setting in the logger is checked in the Comport Option dialog box.



6. Select the Protocol tab and check the protocol that set in the logger.

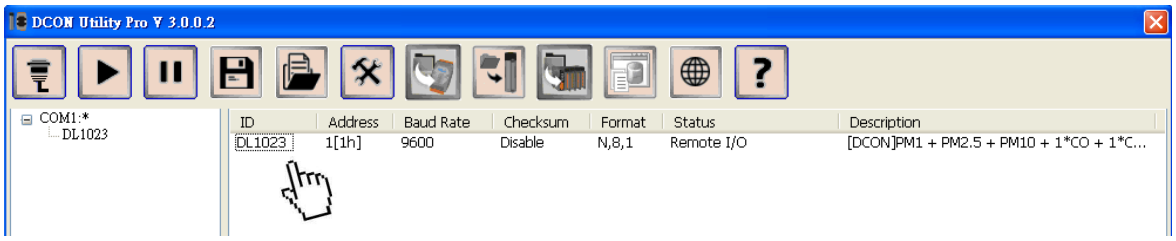


7. Select the Format tab and check the parity that set in the logger.

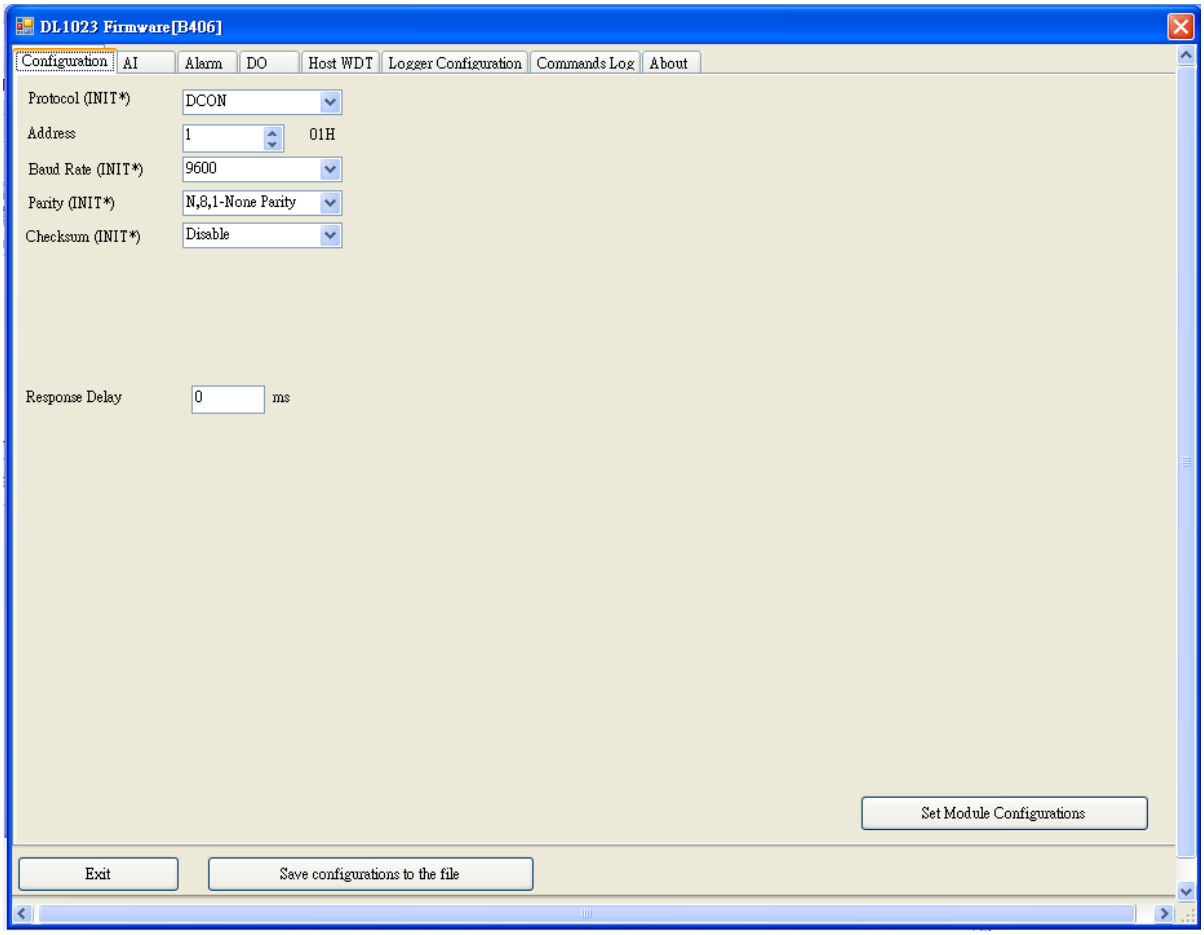


8. Click the Start Search icon. 

9. The DL-1000 logger searched out will be listed as below.



10. Click the module name to configure the logger.

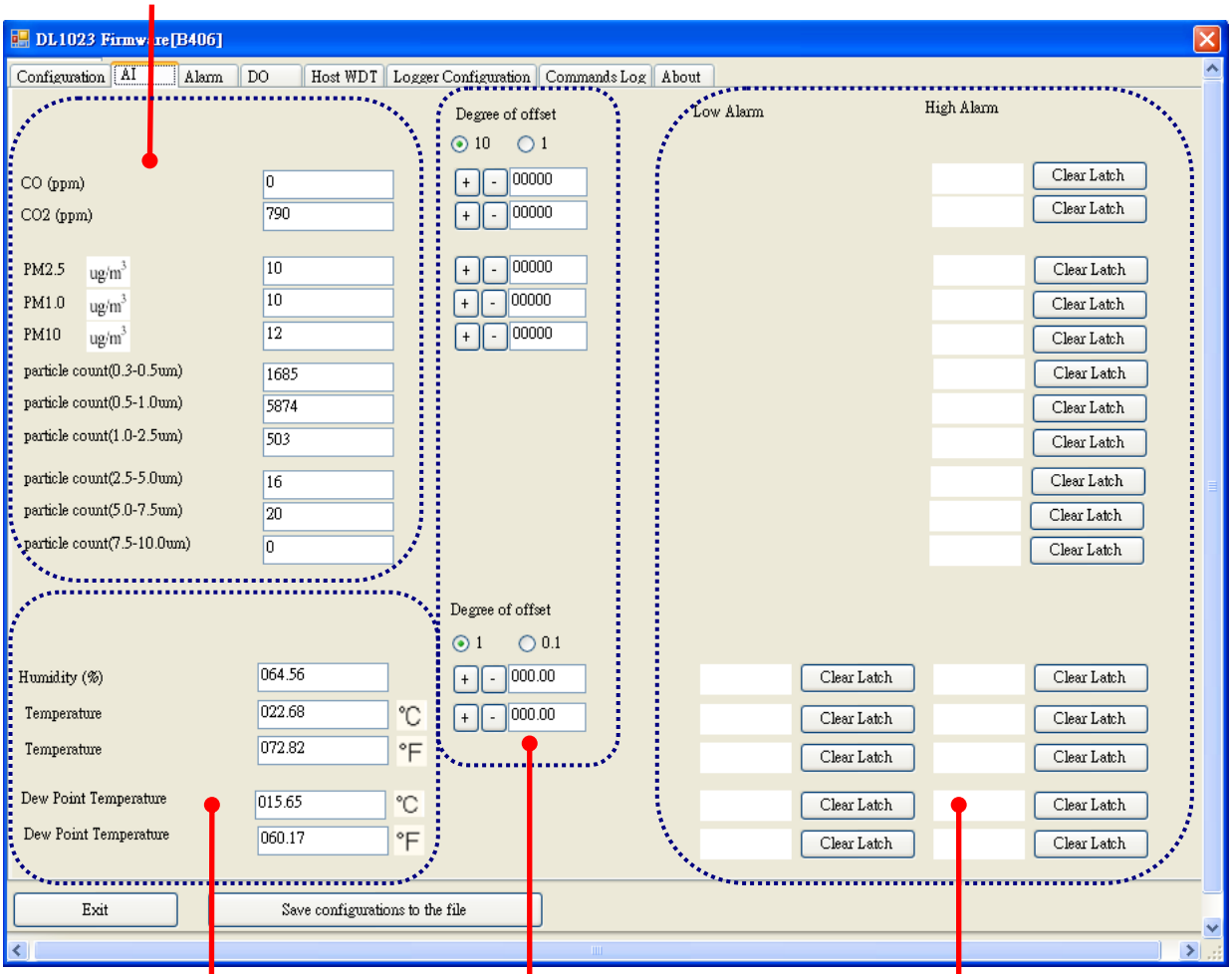


Note

The Protocol/Baud Rate/Parity/Checksum items marked with ”(INIT*)” means that when any of those items needs be modified, the pin 4.INIT needs to be set in ON position and power cycle the logger, then the item can be modified. After complete setting, set the pin 4.INIT back to OFF position and power cycle the logger again to take the setting effect.

➢ **AI tab**

CO/CO_2 /PM2.5/PM1.0/PM10 level

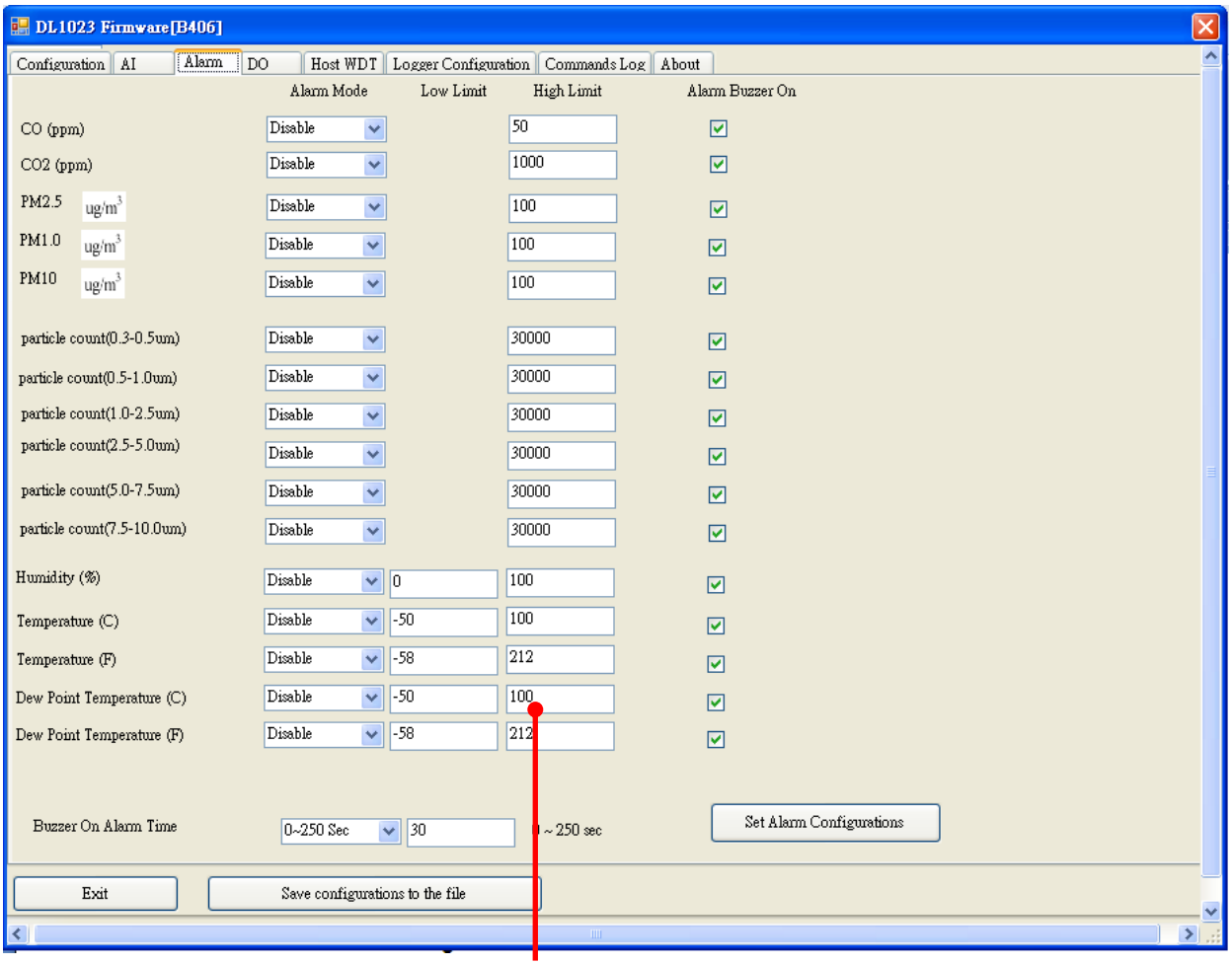


Humidity Temperature and Dew point temperature

Adjust the CO/CO2/PM2.5/PM1.0 /PM10/humidity/temperature offset

Alarm Status

➢ Alarm tab

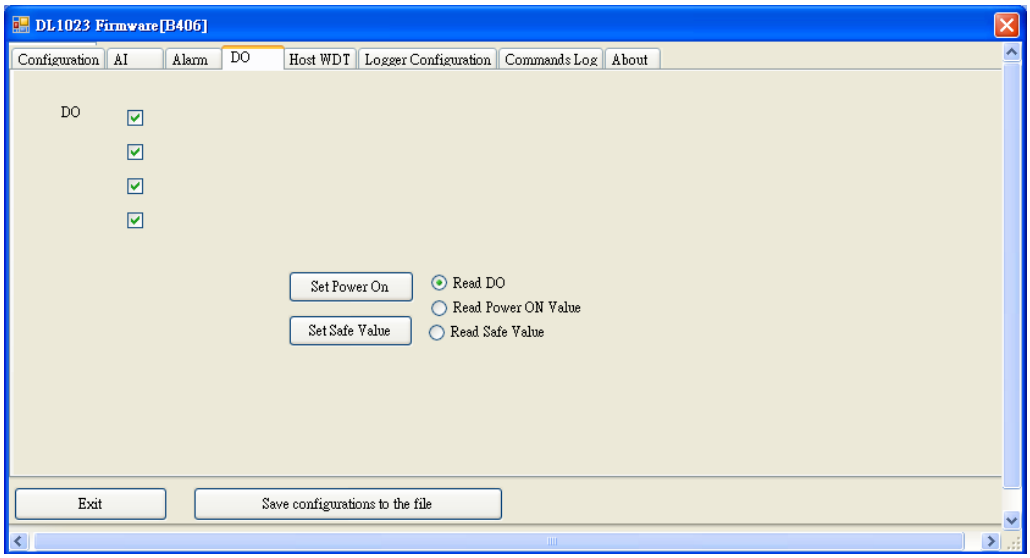


Set alarm mode/Low alarm limit/High alarm limit

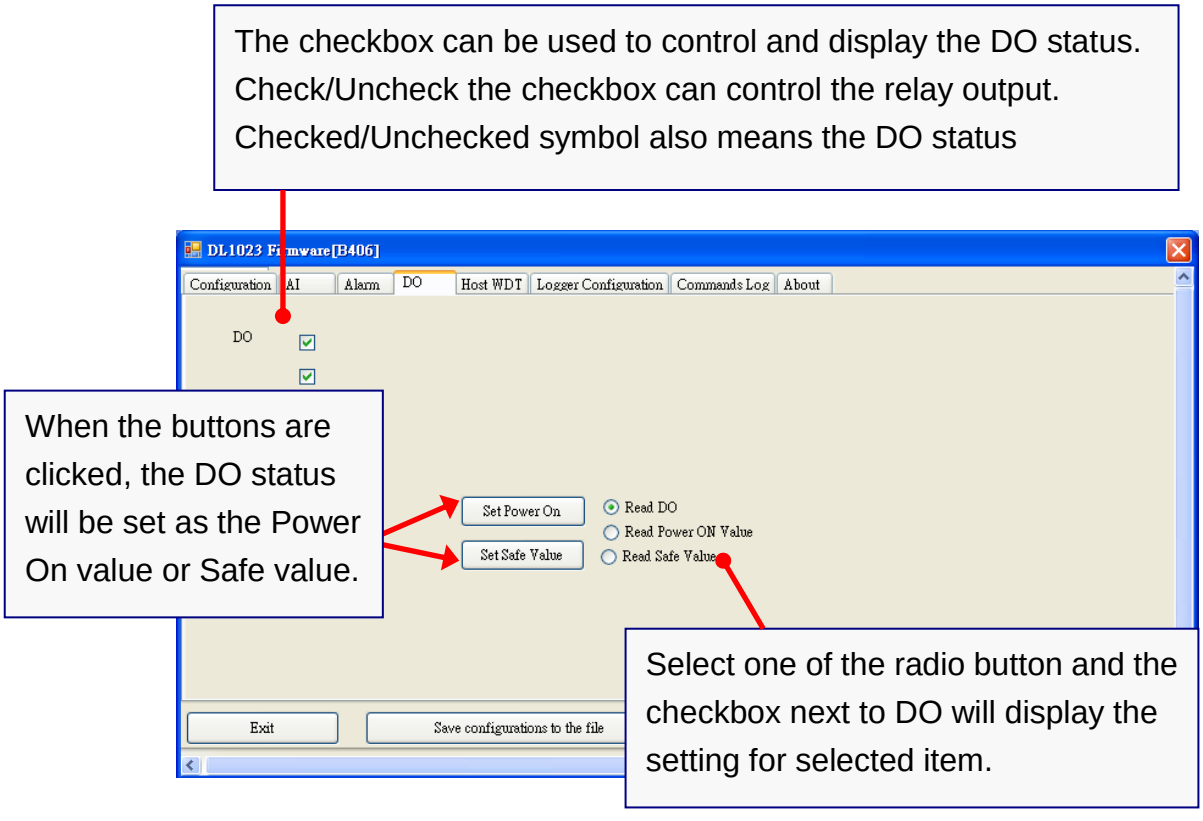
➢ **DO tab**

On this DO0~DO3 tab, users can control the relay to output ON or OFF status, and set the power on value and safe value for the relay output.

When any one of the high/low limit alarm for CO/CO_2/ concentration, PM2.5, PM1.0/PM10, temperature, humidity and dew point is enabled, the functions on this tab are all disabled as below.



If all the alarm events are disabled, the functions are available as below:



➢ Host Watchdog

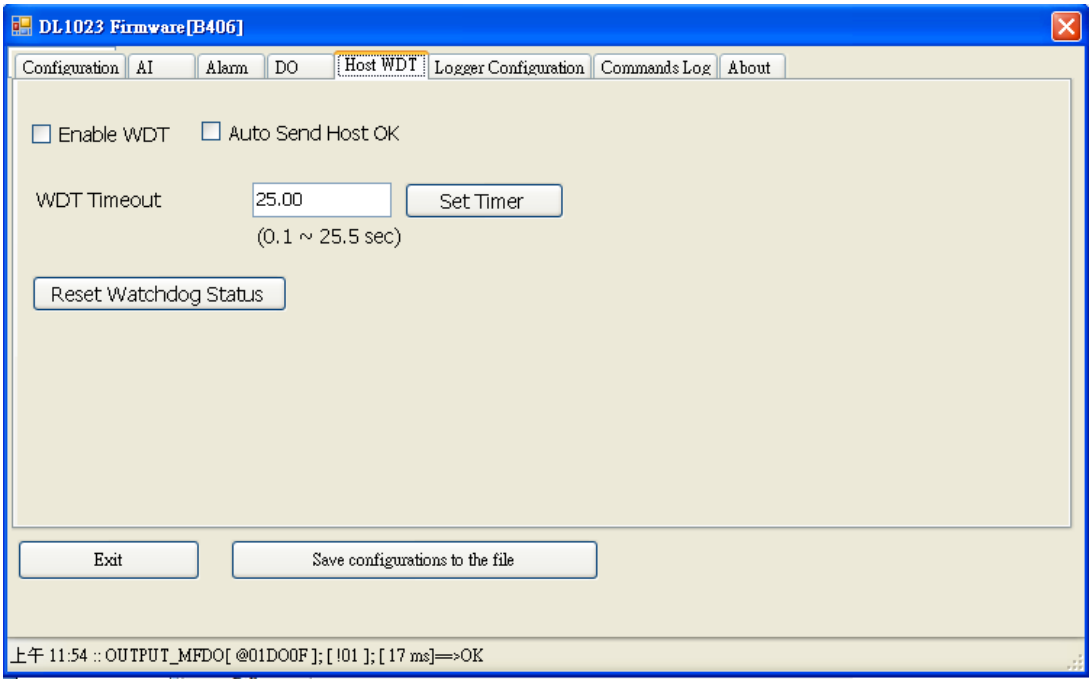
Host Watchdog is used to monitor the RS-485 communication status; if the host (PC) does not send command “~**” in the time period of WDT Timeout setting, the enabled Host Watchdog will announce the timeout error and turn the relay output to Safe value to avoid an unsafe act. Users can not control the relay until the command “~AA1” is sent to clear the WDT timeout status.

On this tab:

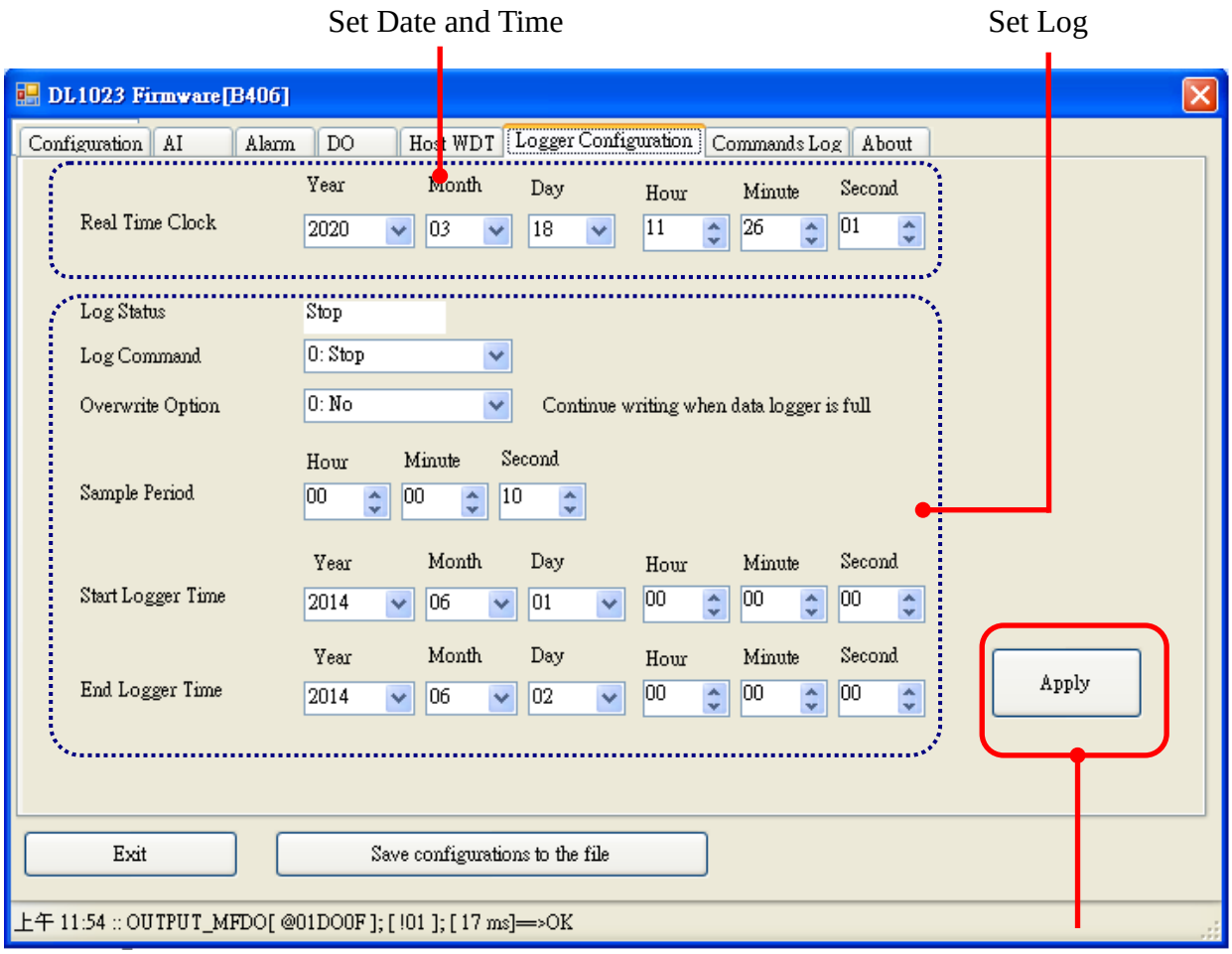
1. Set the time period for WDT timeout, check the checkbox next to Enable WDT and click the Set WDT button to enable the Host watchdog.
2. Check the checkbox next to Send Host OK to send the “~**” command.
3. Uncheck the checkbox next to Send Host OK to stop sending ~** command, the Host watchdog timeout will occur and relay will turn to Safe value.
4. Click the Reset WDT button to clear the Host watchdog timeout status.
5. Uncheck the checkbox next to Enable WDT and click the Set WDT button to disable the Host watchdog.

Note

The relay will not turn to Safe value when any one of the alarm for CO/CO_2 concentration, PM2.5, PM1.0, PM10, temperature, humidity and dew point is enabled. If any one alarm is enabled, the relay will be linked to the Alarm status. In case an Alarm occurs, the relay turns ON, it can be used to turn on the user’s alarm light or beeping alarm or other device.



➢ Data Logger Tab

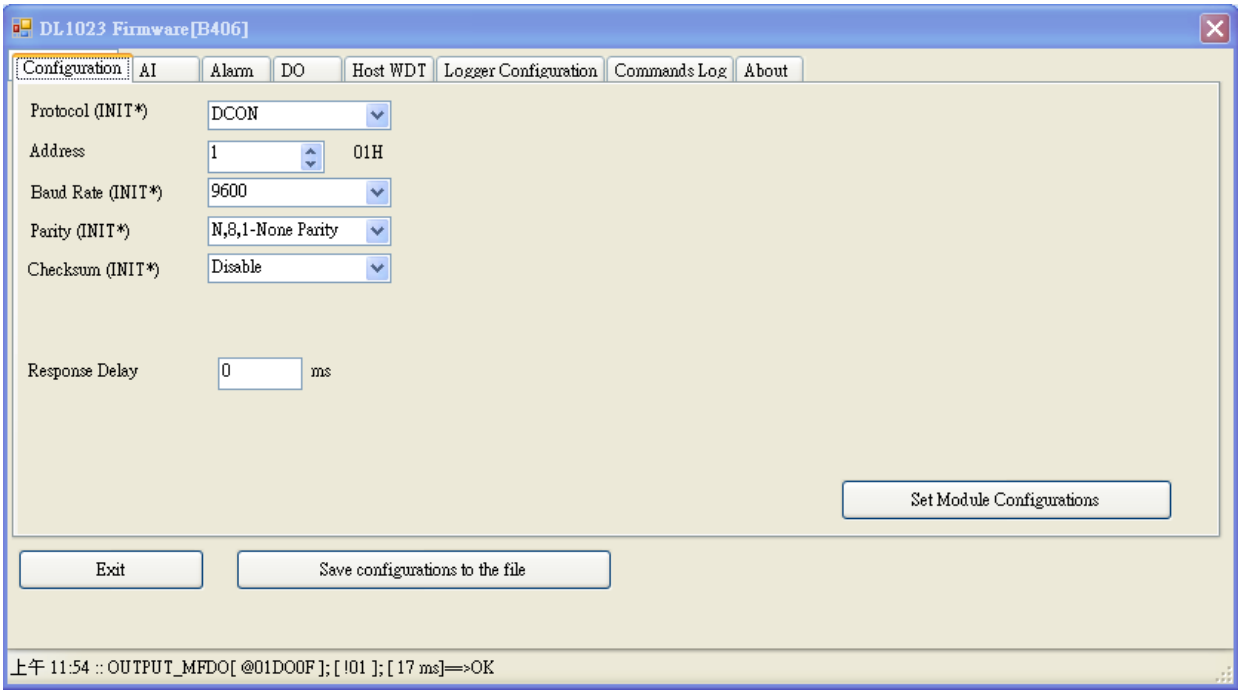


Click the Apply button to save settings.

- INIT

In case of the following situations, users have to set the pin 4.INIT on SW1 in the ON position and power-cycle the DL-1000 module:

- Change protocol from PC
- Change DCON configuration such as baud rate, parity and checksum
- Communication failure with a DL-1000 module.



When a DL-1000 module is powered-on with the pin 4.INIT in ON position, the protocol is DCON, address is 0, Baud Rate is 9600 bps, Parity is set to N/8/1 and Checksum is disabled.

After configuring the communication parameters, click the *Set Module Configurations* button, set the INIT to OFF position and power-cycle the DL-1000 to take the settings effect.

Note

The INIT switch does not need to be set in the ON position when changing the address, baudrate and parity for ModbusRTU communication; users only have to power-cycle the module after complete configuration.

5. Monitoring via Mobile Devices

The iAir App can be used to monitor real-time data of CO/CO_2 level, temperature and humidity anywhere and anytime without any complicated configuration. The DL-1000 modules and your mobile devices such as smart phones or tablets need be addressed on the same network, and then you can get the real-time data from DL-1000 loggers by entering a specific IP address, or by performing an automatic search for available devices.

If a DL-1000 cannot be searched in the iAir App, please contact with the network administrator to make sure the module and your mobile devices are addressed on the same sub-network. It means that they have the same broadcast address.

The iAir app is available to free download in Google Play and App Store. Search “iAir” in or search “iAir”, “ICPDAS” in App Store and tap on install.

The iAir user manual can be obtained from
http://ftp.icpdas.com/pub/cd/usbcd/napdos/iiot/dl-1000/document/

6. Utility to Get/Manage Data Log

DL300 Utility is a convenient, easy-to-use management utility running on Windows platform that allows users to monitor the real-time data and trend chart from DL-1000 modules on the Ethernet, it can group the DL-1000 modules for group view management, log alarm events with timestamp, download the logged data from a DL-1000 logger and export the data to *.csv files for performing statistical analysis in Excel.

The DL-300 Utility can be obtained from:

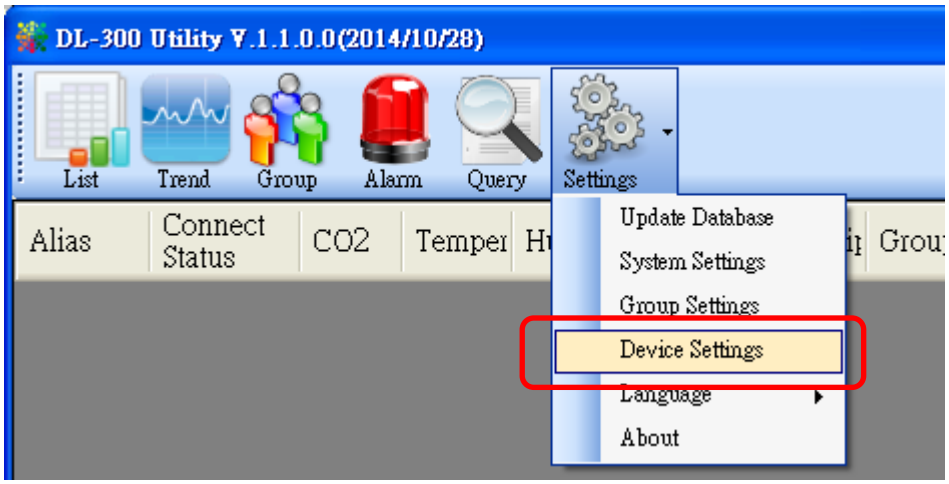
CD: \Napdos\IIoT\utility\DL300_utility
http://ftp.icpdas.com/pub/cd/usbcd/napdos/iiot/utility/dl300_utility/

1. Run the DL300_utility_setup_yyyymmdd.exe, the default install location is C:\ICPDAS\DL300_Utility\DL-300 Utility

2. Open the DL-300 Utility by double clicking on the DL-300 Utility shortcut on desktop.

3. Search out a DL-1000 module on the Ethernet and set the configuration.

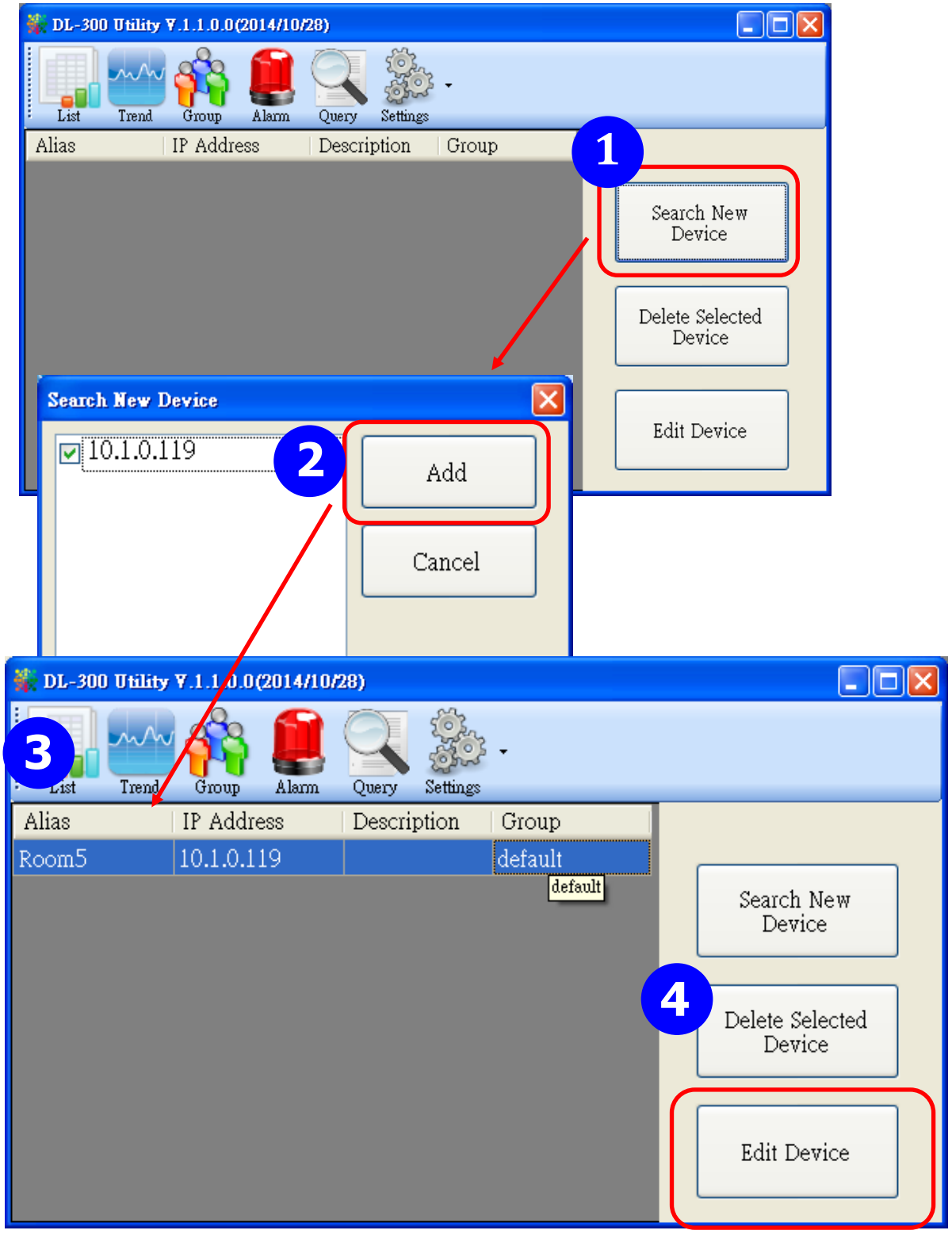
3-1. Select the ***Device Settings*** on the *Settings* menu.



3-2. Click the ***Search New Device*** button to search the DL-1000 modules connected on the same Ethernet network.

3-3. Check the checkbox next to a module and click the ***Add*** button to add the module in the utility.

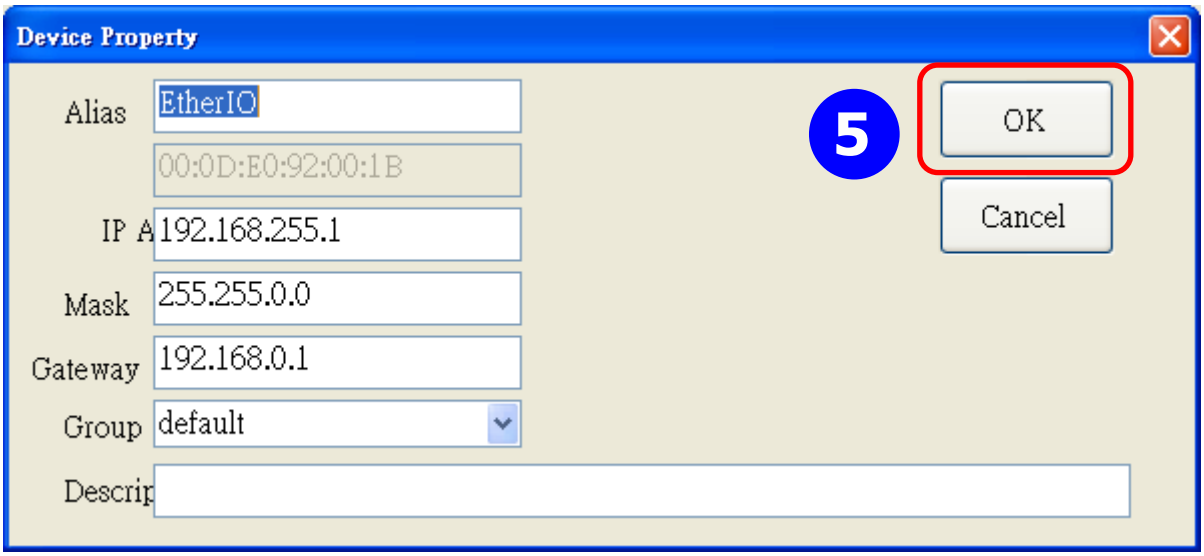
3-4. Highlight a module and click the ***Edit Device*** button to configure the module.



3-5. Set the configuration, and click on the ***OK*** button.

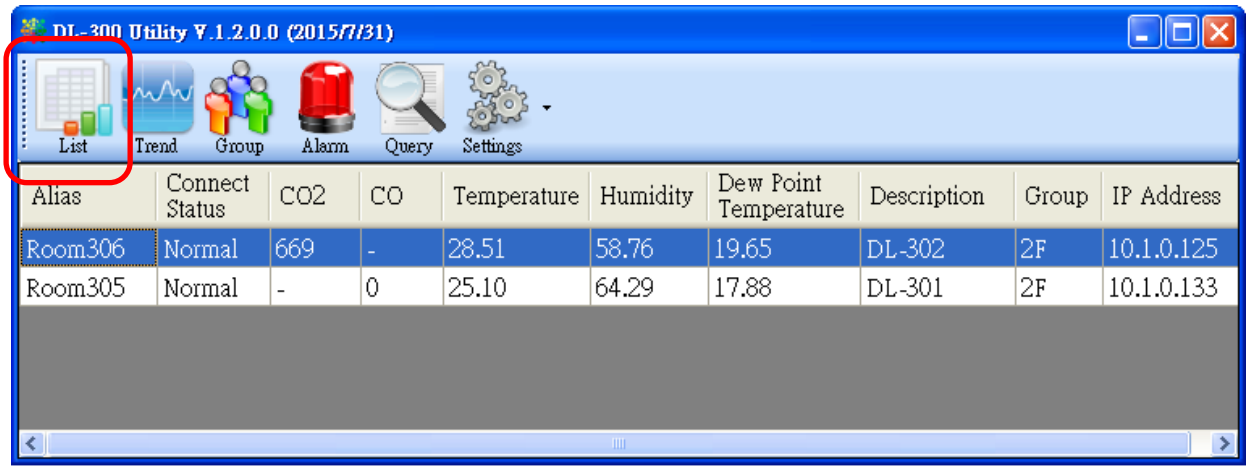
Note

Consult your network administrator before making changes to IP Address/ Mask Address/ Gateway

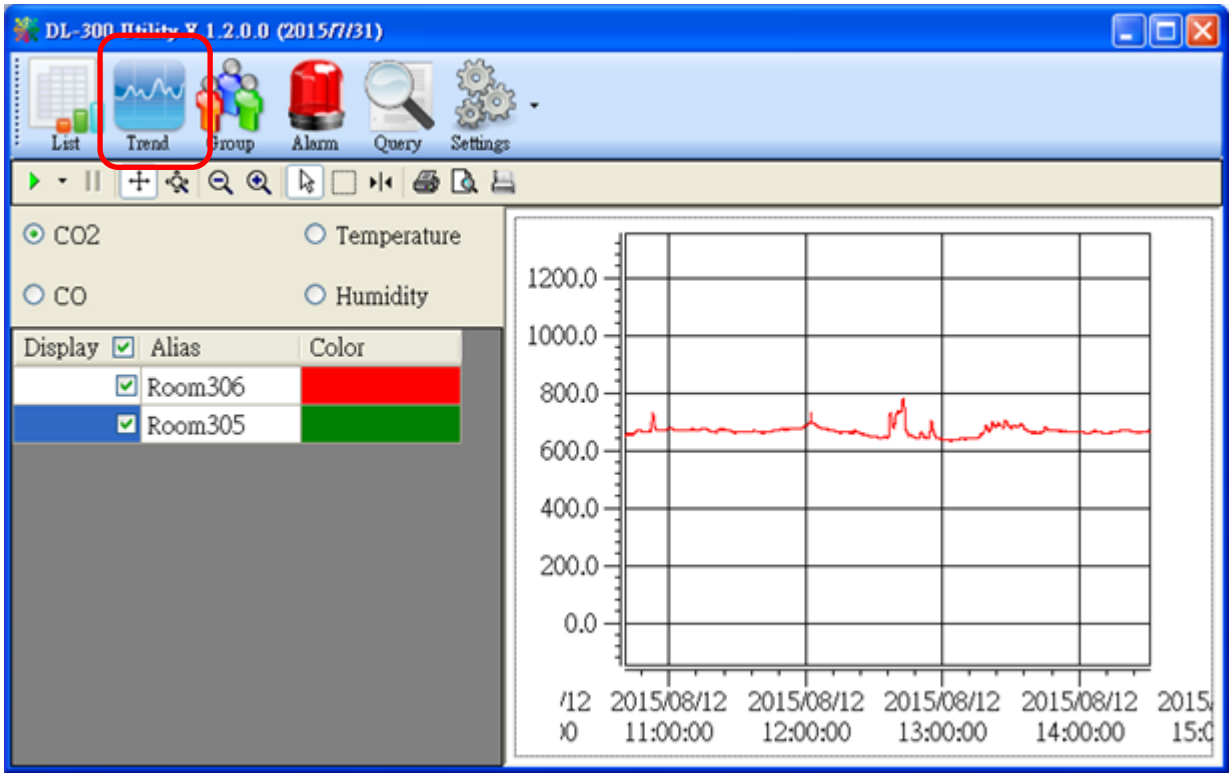


4. Get real-time data, trend chart and alarm event.

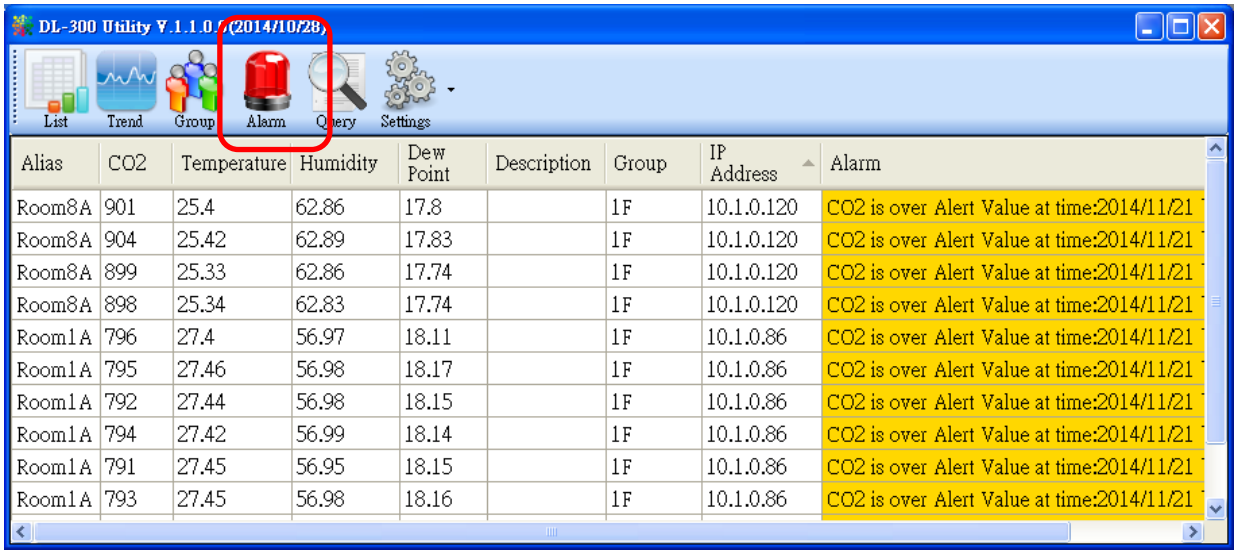
4-1. Click the ***List*** icon to obtain the real-time data. It also lists the connect status, group information and IP address for every DL-1000 logger.



4-2. Click the ***Trend*** icon to display the trend chart. Users can select the radio button for CO/CO_2 level, Temperature or Humidity to access the trend chart for those real-time data, check the checkbox next to each DL-1000 logger to display its trend chart or uncheck it to cancel display. Drag and drop the trend chart can move it to see the data not be displayed in the chart.



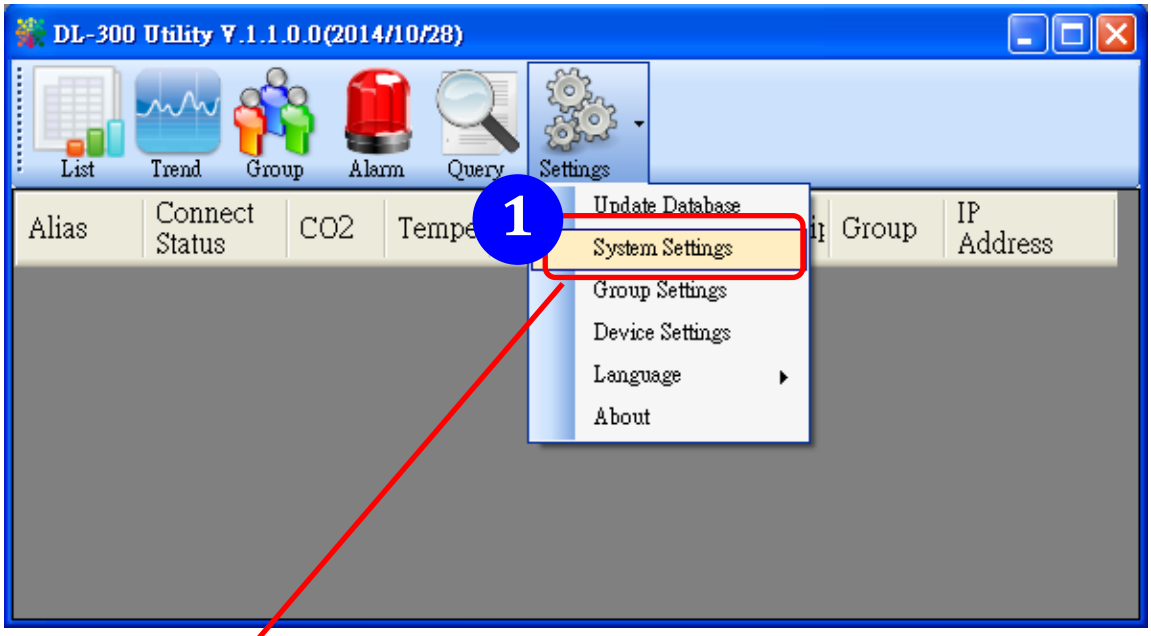
4-3. Click the ***Alarm*** icon to review the alarm events.

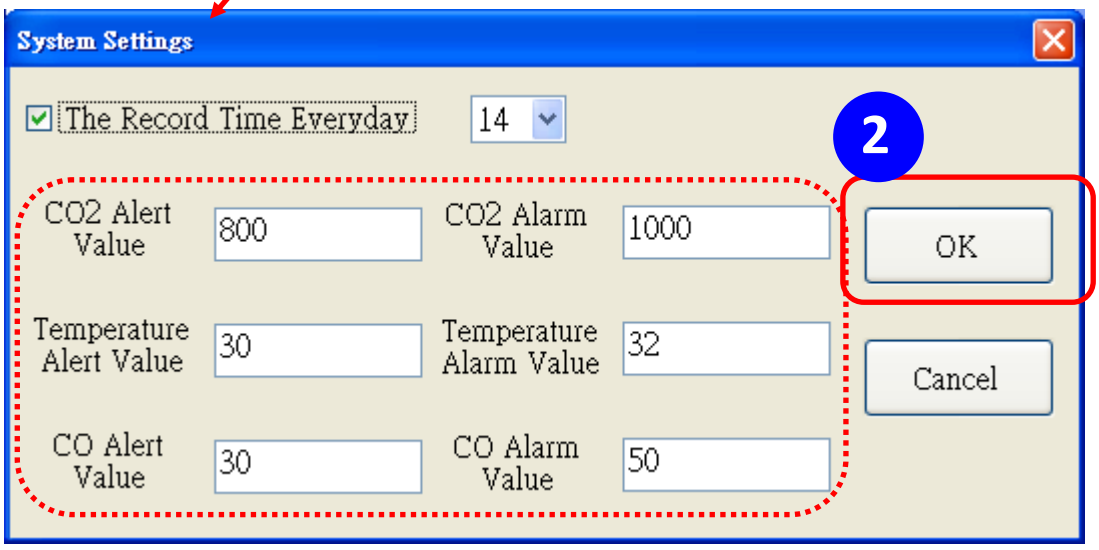


Alias	CO2	Temperature	Humidity	Dew Point	Description	Group	IP Address	Alarm
Room8A	901	25.4	62.86	17.8		1F	10.1.0.120	CO2 is over Alert Value at time:2014/11/21
Room8A	904	25.42	62.89	17.83		1F	10.1.0.120	CO2 is over Alert Value at time:2014/11/21
Room8A	899	25.33	62.86	17.74		1F	10.1.0.120	CO2 is over Alert Value at time:2014/11/21
Room8A	898	25.34	62.83	17.74		1F	10.1.0.120	CO2 is over Alert Value at time:2014/11/21
Room1A	796	27.4	56.97	18.11		1F	10.1.0.86	CO2 is over Alert Value at time:2014/11/21
Room1A	795	27.46	56.98	18.17		1F	10.1.0.86	CO2 is over Alert Value at time:2014/11/21
Room1A	792	27.44	56.98	18.15		1F	10.1.0.86	CO2 is over Alert Value at time:2014/11/21
Room1A	794	27.42	56.99	18.14		1F	10.1.0.86	CO2 is over Alert Value at time:2014/11/21
Room1A	791	27.45	56.95	18.15		1F	10.1.0.86	CO2 is over Alert Value at time:2014/11/21
Room1A	793	27.45	56.98	18.16		1F	10.1.0.86	CO2 is over Alert Value at time:2014/11/21

4-4. Modify the event condition.

Select the ***System Settings*** on the *Settings* menu.





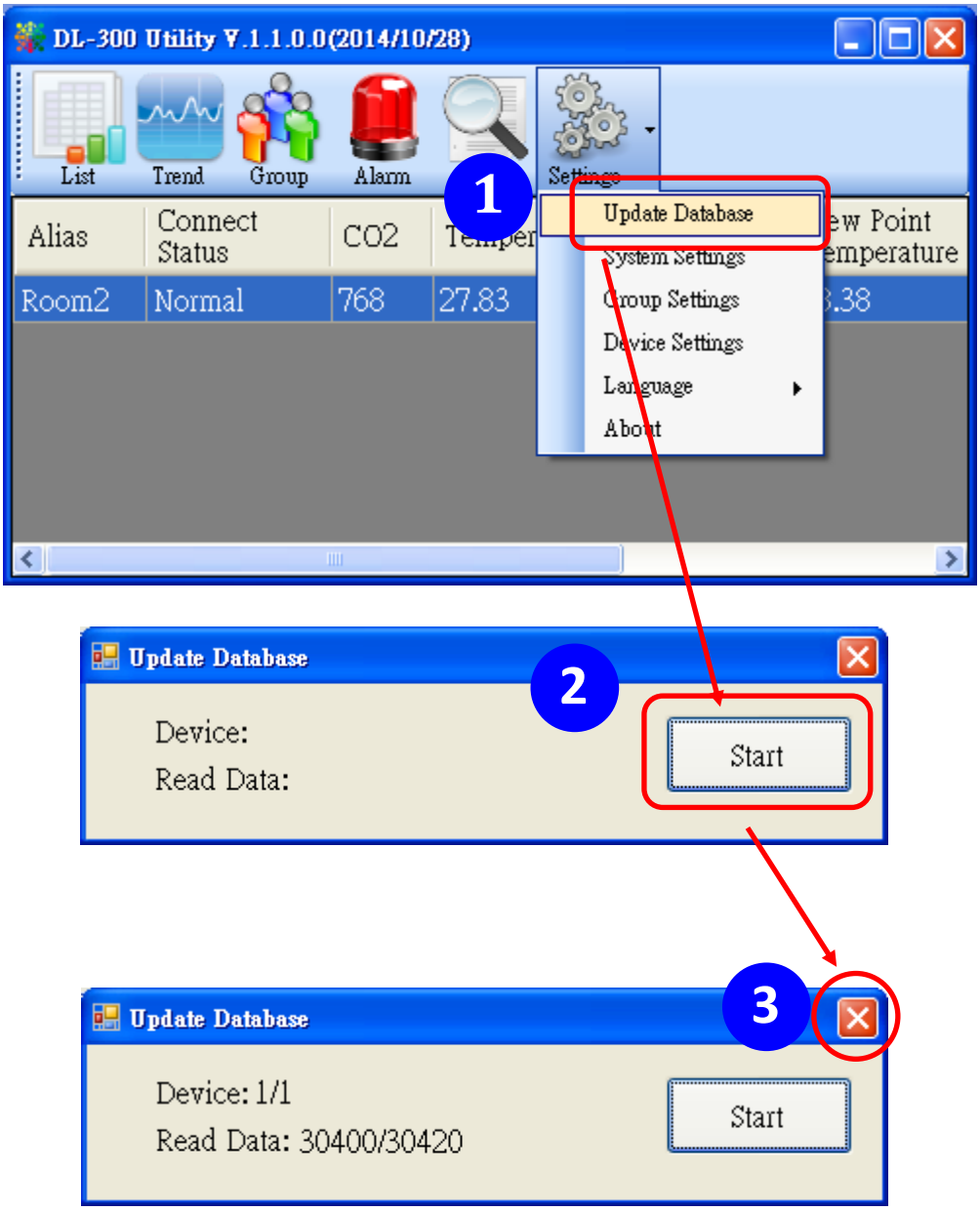
Set the *CO/CO2 Alert Value*, CO/*CO2 Alarm Value* (If it is supported in the logger), *Temperature Alert Value* and *Temperature Alarm Value* for trigger events. Check the checkbox next to *The Record Time Everyday* can schedule auto generate report everyday at the time set in the dropdown menu. Click on the ***OK*** button to complete the settings.

5. Download data in a DL-1000 logger and export the data

5.1. Select ***Update Database*** on the Settings menu

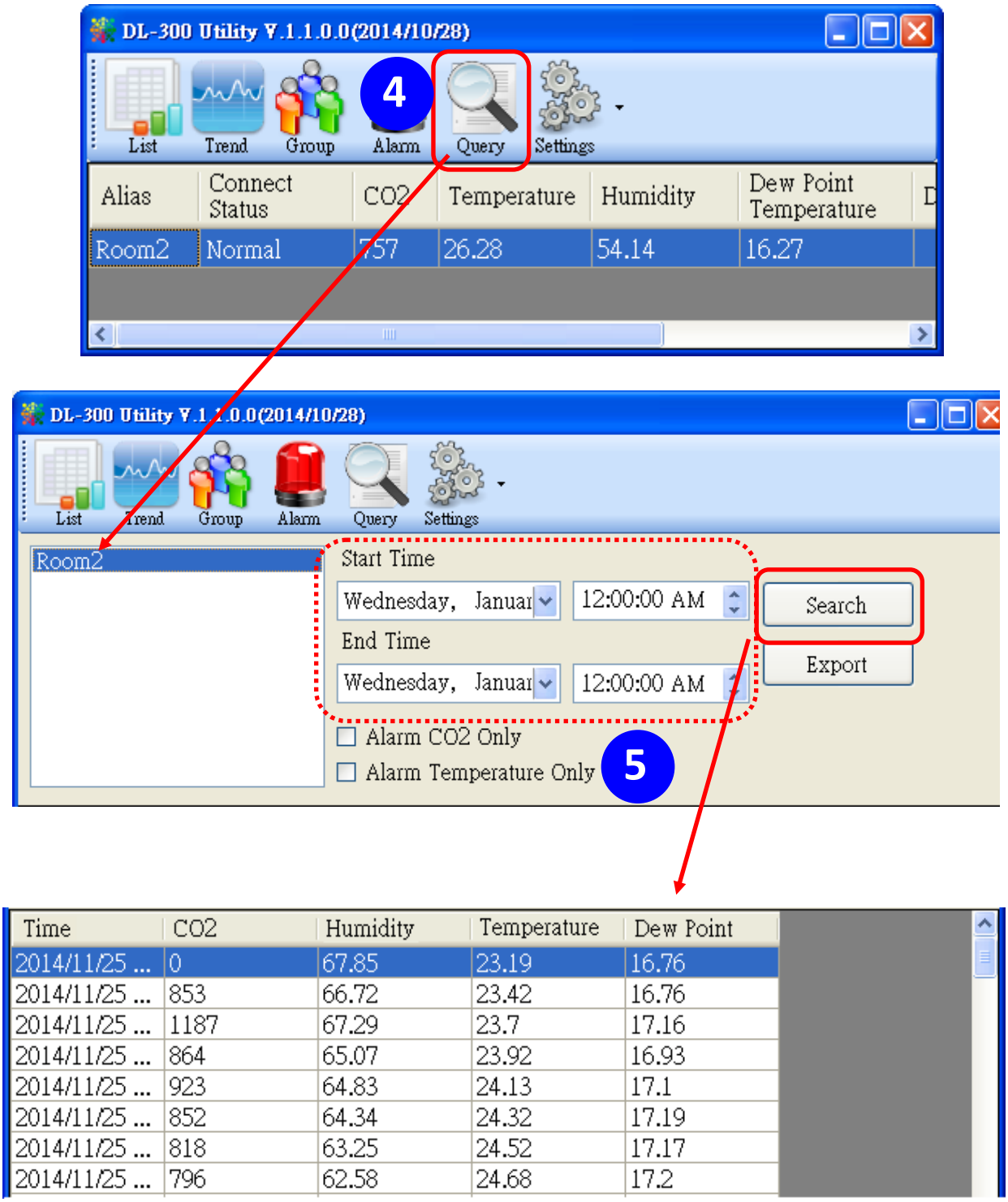
5.2. Click the ***Start*** button to download the data in DL-1000 modules.

5.3. Click the close icon to exit the download procedure when all data are downloaded.

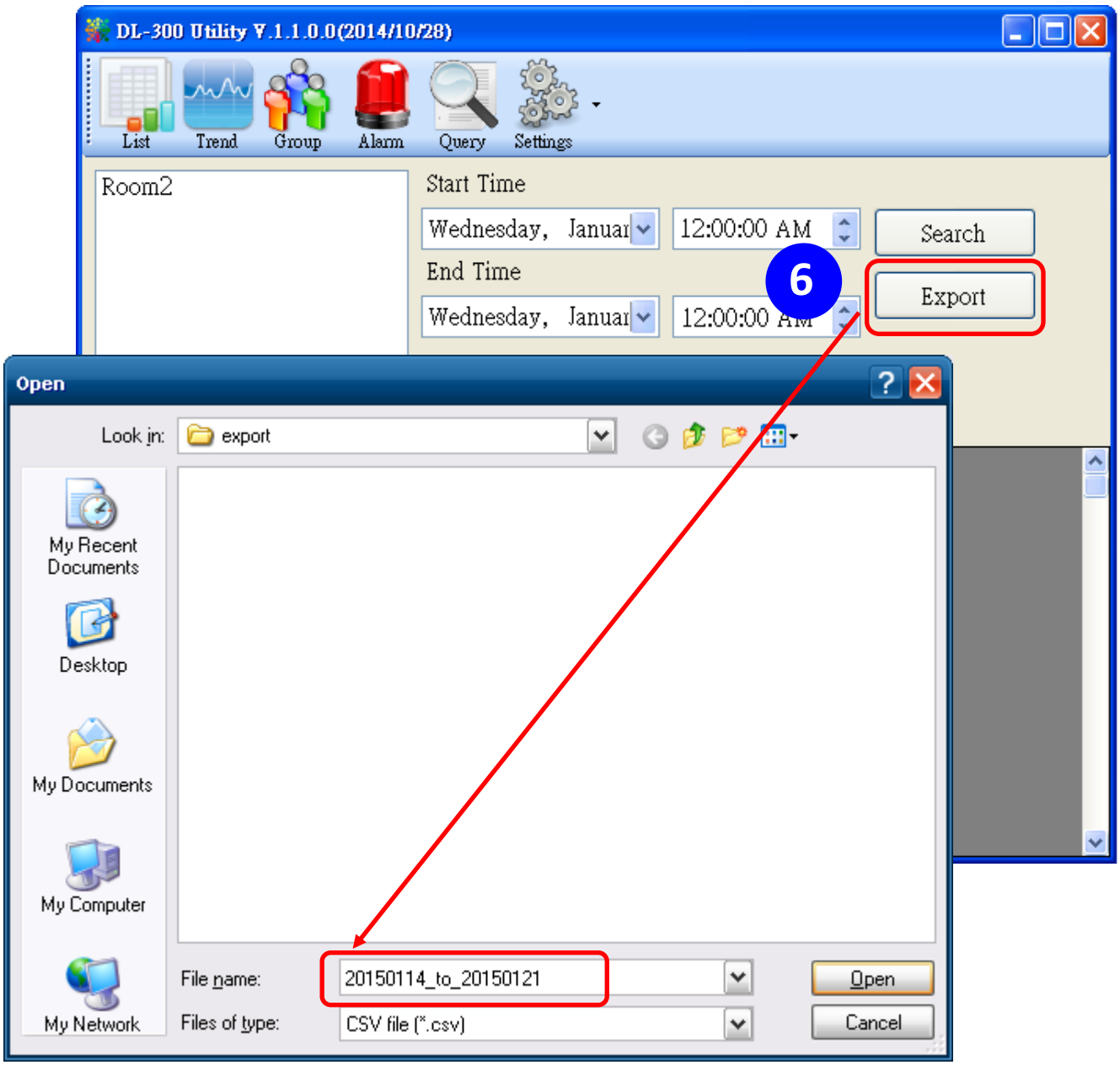


5.4. Click the ***Query*** icon.

5.5. Highlight the desired module, set the *Start Time* and *End Time*, and then click the ***Search*** button. The data in the time period will be listed as below.

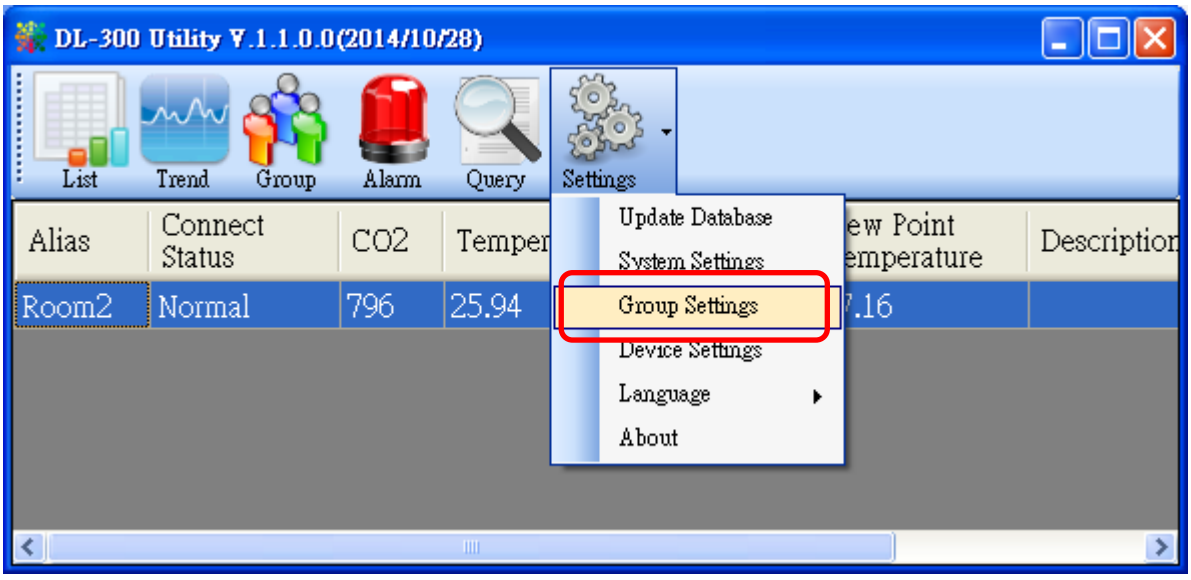


5.6. Click the ***Export*** button to export the searched data in *.csv files for performing statistical analysis in Excel.

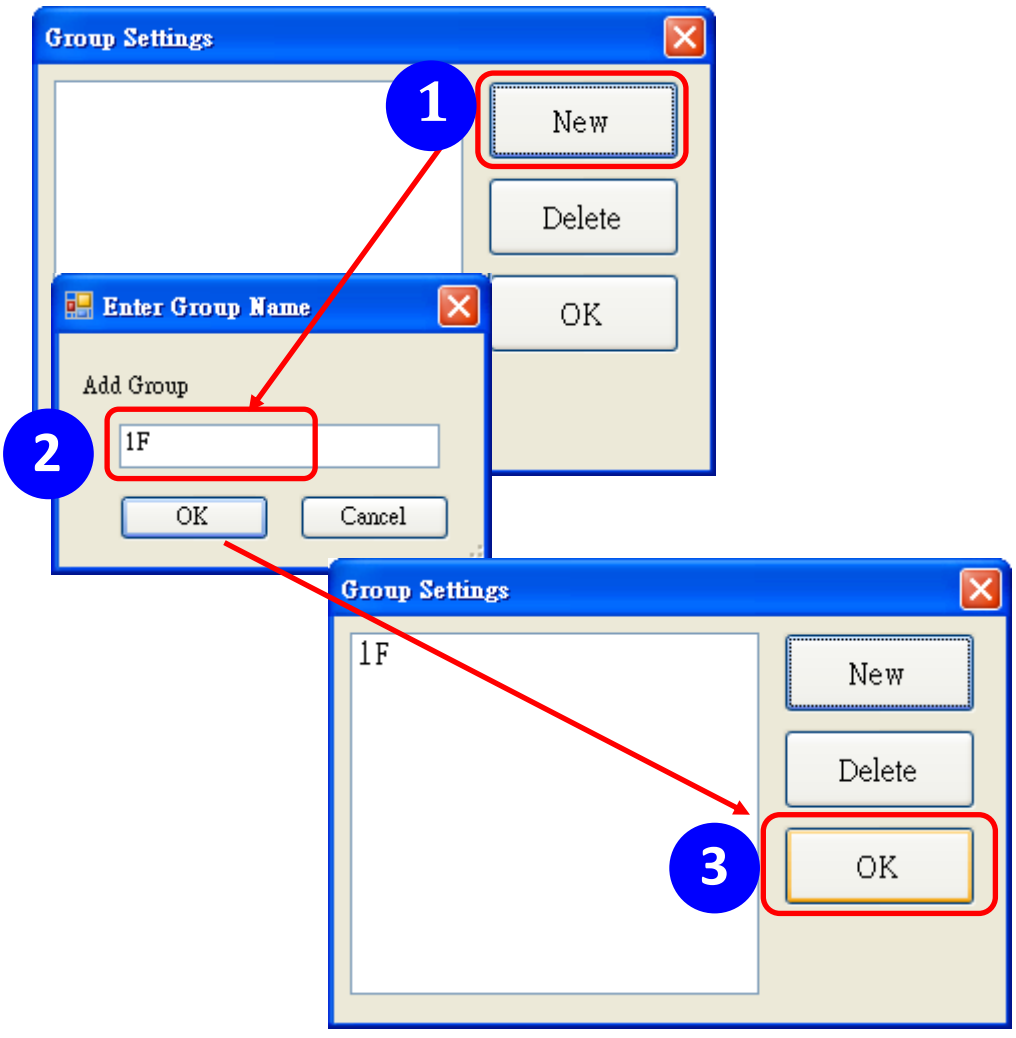


6. Group the devices by location or users

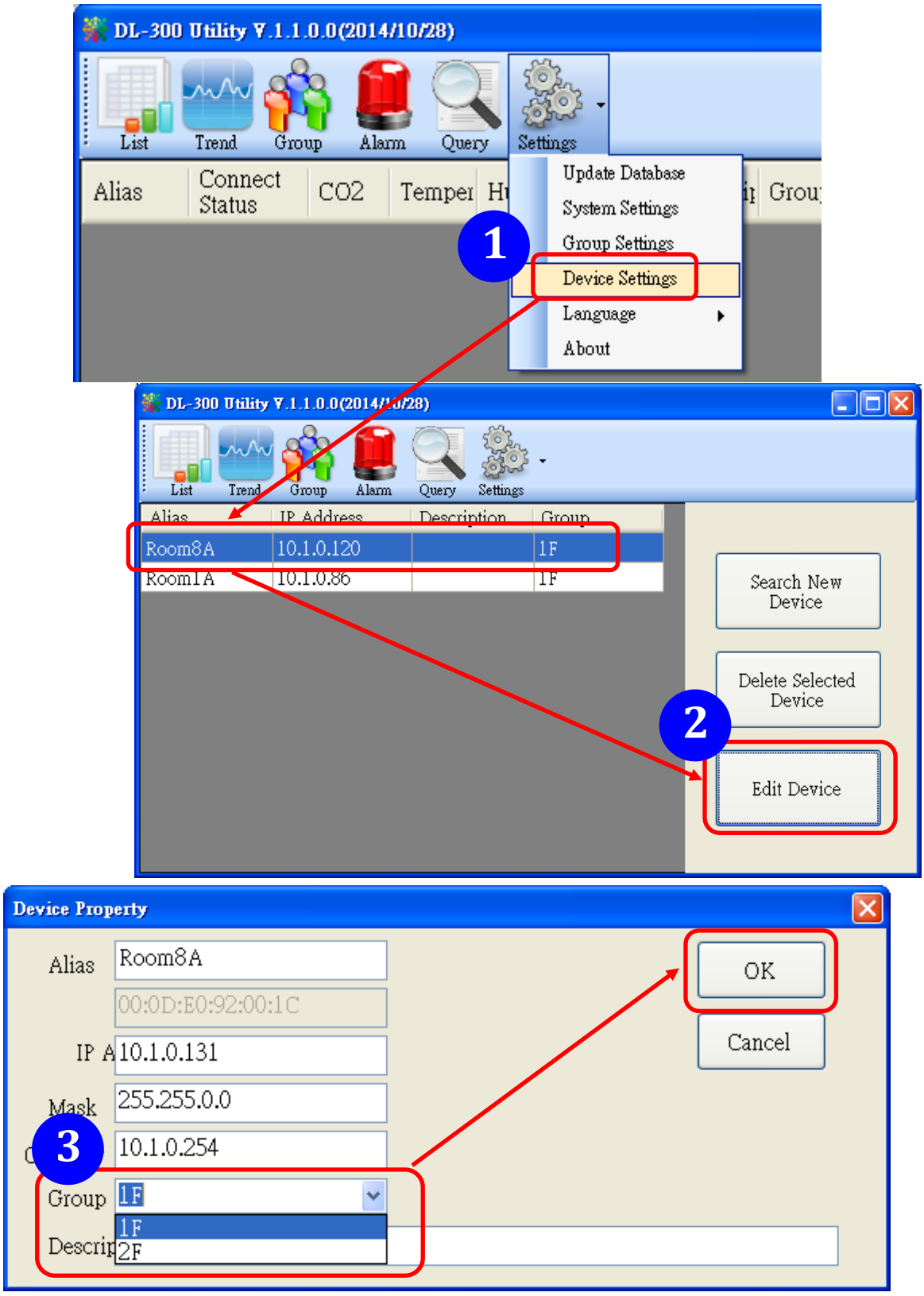
6.1. Select ***Group Settings*** on the Settings menu.



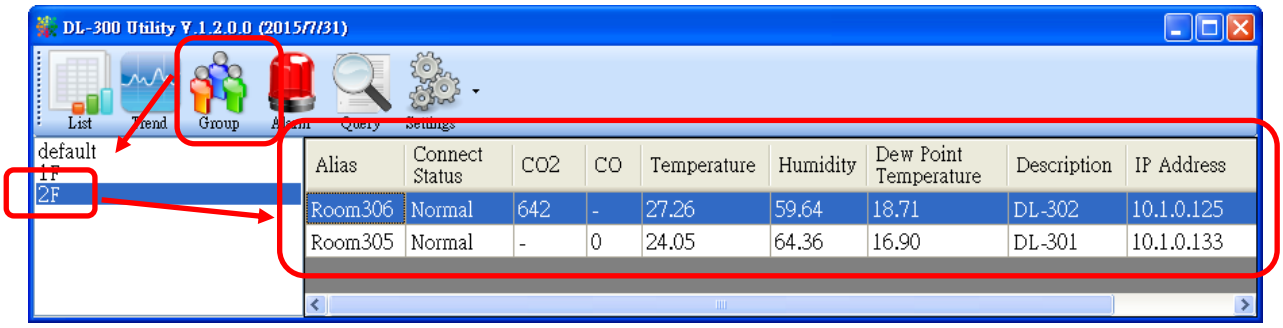
6.2 Click the ***New*** button, enter the group name and click the ***OK*** button in the pop-up box, and then click the ***OK*** button in the Group Settings box.



6-3. Select ***Device Settings*** on the *Settings* menu; highlight the desired device and click the ***Edit Device*** button, select the group name for the module and click the ***OK*** button in the pop-up *Device Property* box to complete the setting.



6-4. Monitor the group data by clicking the ***Group*** icon and then highlighting the group name.



7. FAQ

Q1: What is ABC (Automatic Baseline Correction)?

A: ABC stands for the Automatic Baseline Correction which is used to adjust a shifted baseline to the carbon dioxide level in fresh air. In case of normal indoor application, the carbon dioxide level drops to nearly outside air where there are no human, green plants or anything to elevate the carbon dioxide levels on weekday evenings or weekends, the ABC algorithm constantly keeps track of the lowest reading and slowly corrects it as the expected value in fresh air typically around 400 ppm.

Q2: Why I need to enable the ABC?

A: When the CO_2 concentration detected in a period time of unoccupied space is greater than the base value of 400ppm, enable the ABC function to adjust the baseline. Be careful that the ABC will not work if a space is constantly occupied such as a hospital, 24-hr factory, 24-hr store, green house or other applications where CO_2 levels may be elevated at all times.

Q3: Does the DL-1022/DL-1023 enable the ABC as the factory default setting?

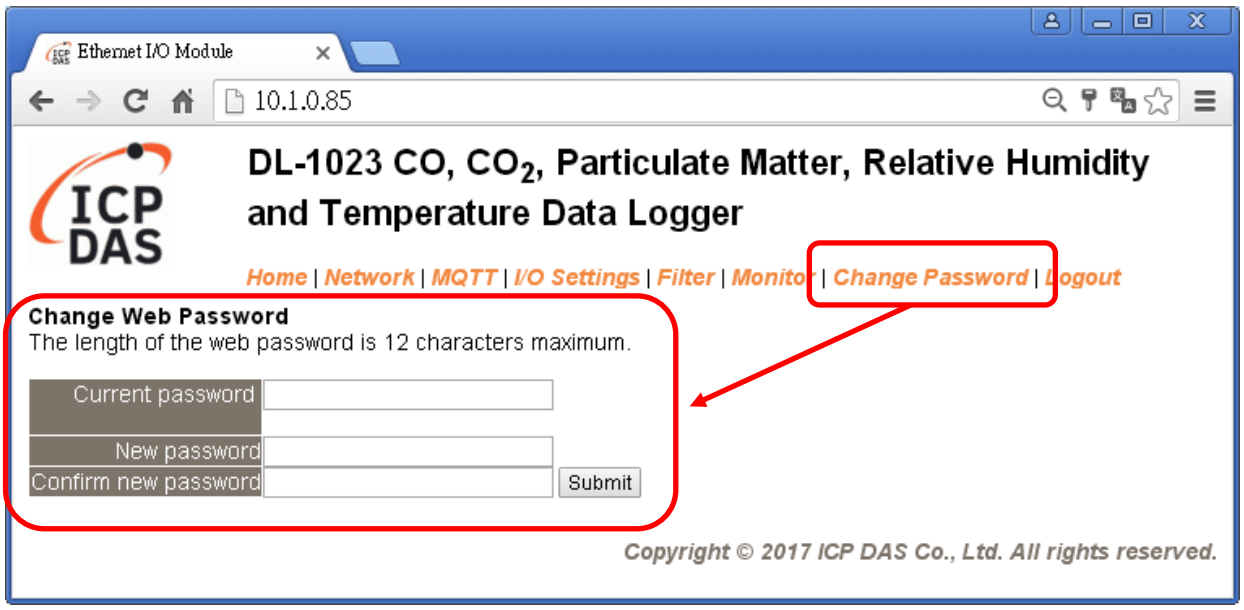
A3: No, the ABC is default disabled in a DL-1022/DL-1023 logger to prevent the baseline from being adjusted to an incorrect value in case of using in a constantly occupied space.

Q4: What to do when the ABC is no work?

A4: When the ABC is no work regarding baseline correction, the DL-1022/DL-1023 needs be returned to ICP DAS.

Q5: How to set the password?

A5: Enter the IP address for your DL-1000 logger in the address bar of a web browser and go to the Change Password page, enter the password in the New password and Confirm new password in the Change Touch Password field and then press the Submit button for change password. The password is numbers from 0 to 9 and up to 8 digits.



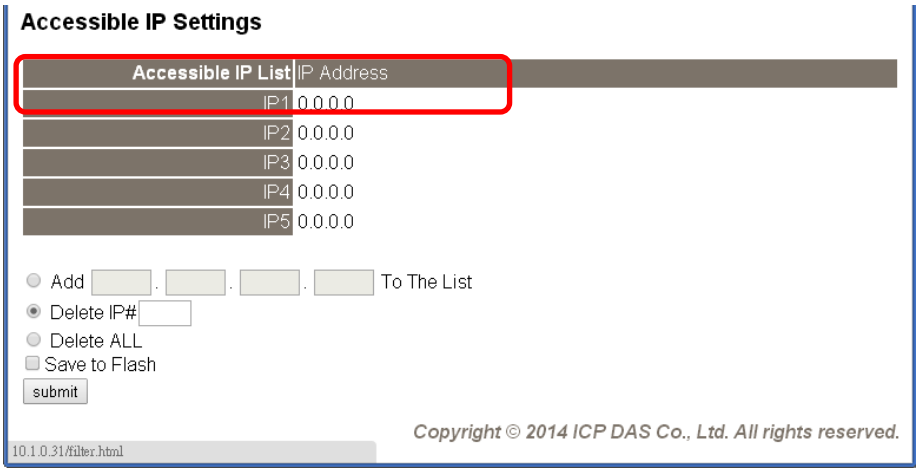
Q6: How to cancel the password?

A6: Enter the IP address for your logger in the address bar of a web browser and keep the New password and Confirm new password in field empty and then press the Submit button for change password.

Q7: How to set the Accessible IP?

A7: Enter the IP address for your logger in the address bar of a web browser and go to the *Accessible IP Settings* page, select the radio button next to *Add ___.___.___.___ To The List* and key in the IP for a device which is allowed to access the DL-1000, and then click the submit button.

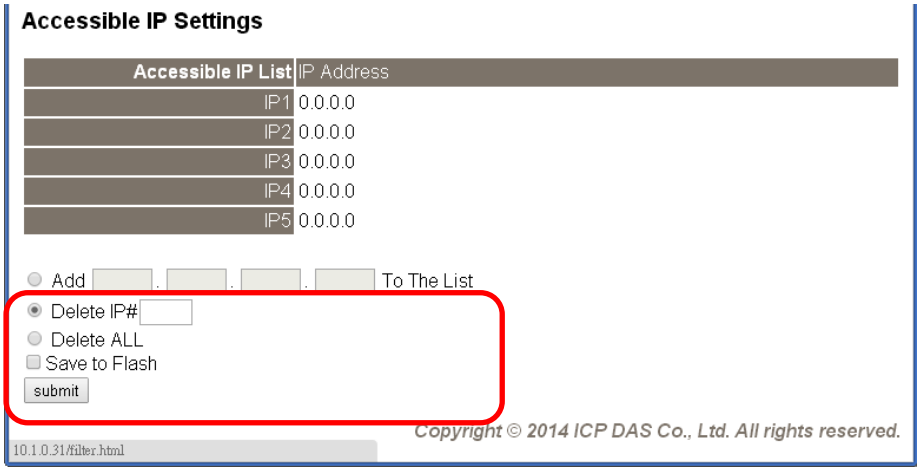
Check the checkbox next to the *Save to Flash* before clicking the *submit* button to save the IP setting and use after repowering. Once any of those in the list is set, only the device for which the IP address is saved in the list can assess the DL-1000.



Q8: How to delete the Accessible IP settings?

A8: Enter the IP address for your logger in the address bar of a web browser and go to the *Accessible IP Settings* page, select the radio button next to Delete IP# to delete a IP by the IP number or select the radio button next tot Delete All and then click the submit button.

Check the checkbox next to the *Save to Flash* before clicking the *submit* button to save the IP setting and use after repowering.



Q9: How to clear the data logged in a DL-1000 module?

A9: Enter the IP address for the module in the address bar of a web browser and go to the *I/O Settings* page, click the Reset Data Logger button at the bottom of the page.

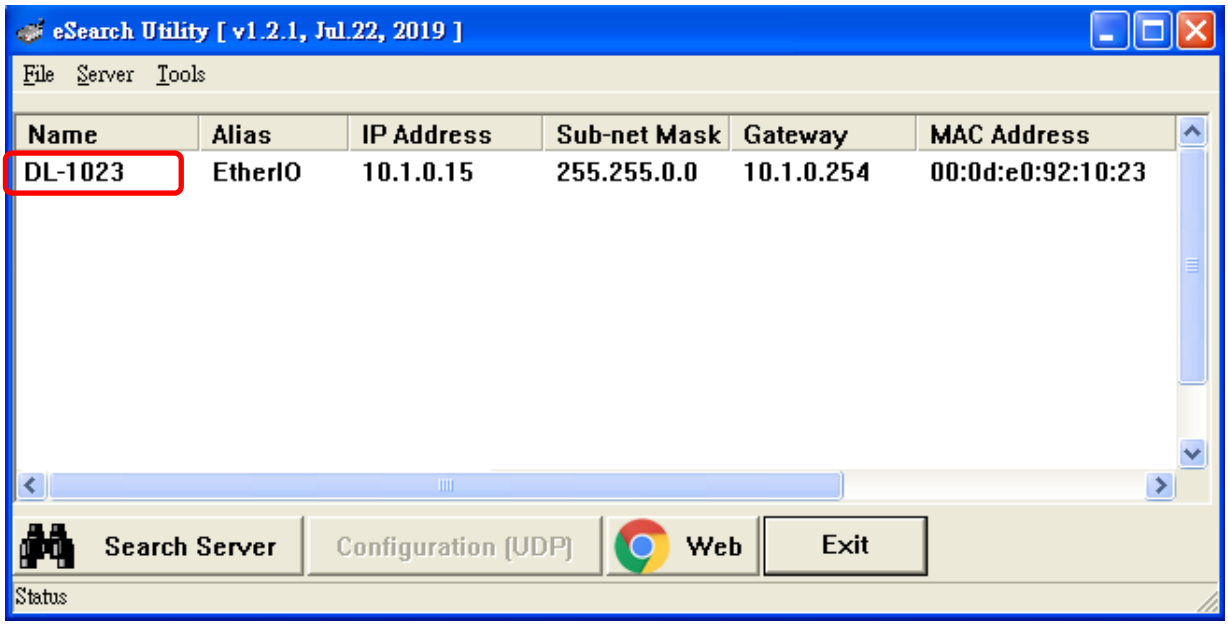
Reset data logger to empty	Reset Data Logger

Q10 How to download firmware into a DL-1000 module?

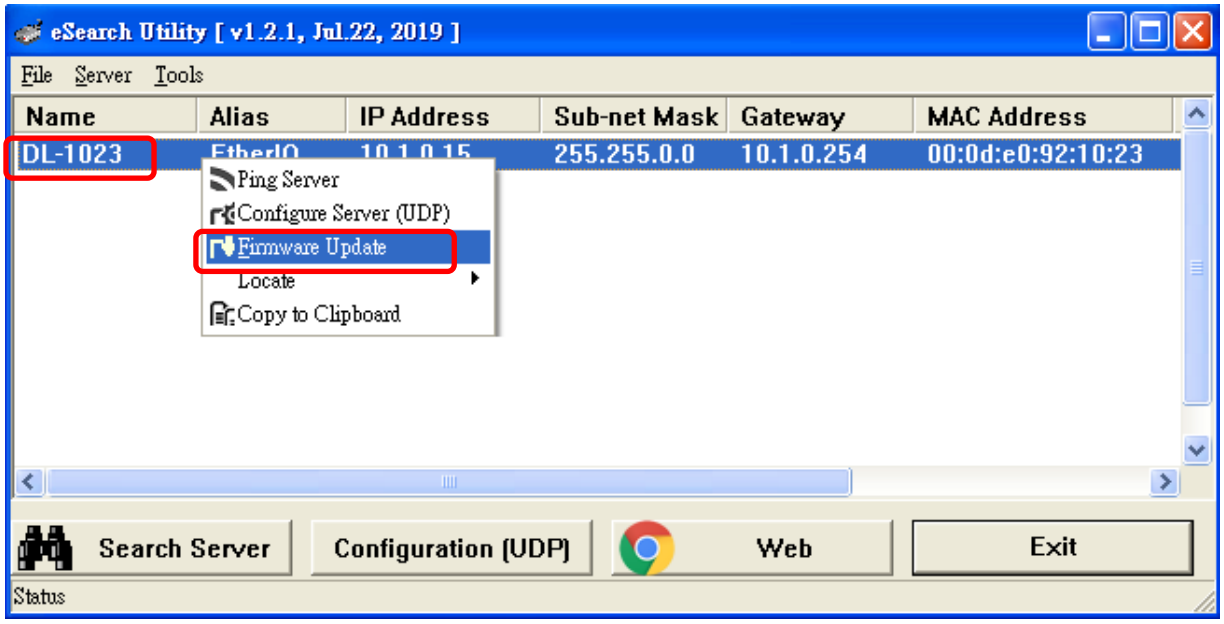
To update the Firmware for yourDL-1000 module, connect DL-1000 module and PC in the same sub-network. Please note that there should be only one network card in the PC.

Download and install the eSearch utility.
http://ftp.icpdas.com/pub/cd/usbcd/napdos/iiot/utility/esearch/

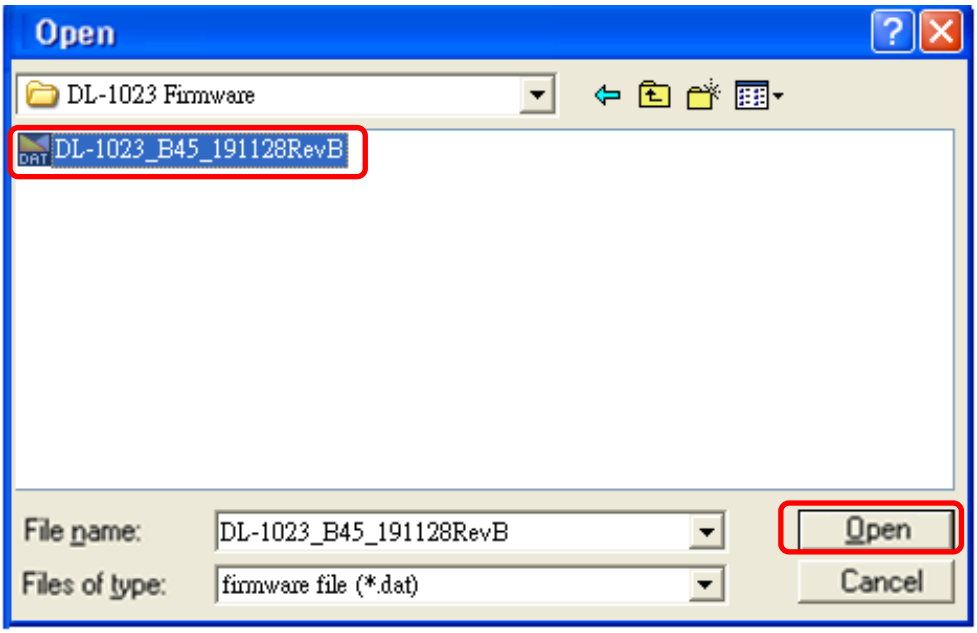
Run the eSearch utility. Click on the Search Server button and it should find the DL-1000 module.



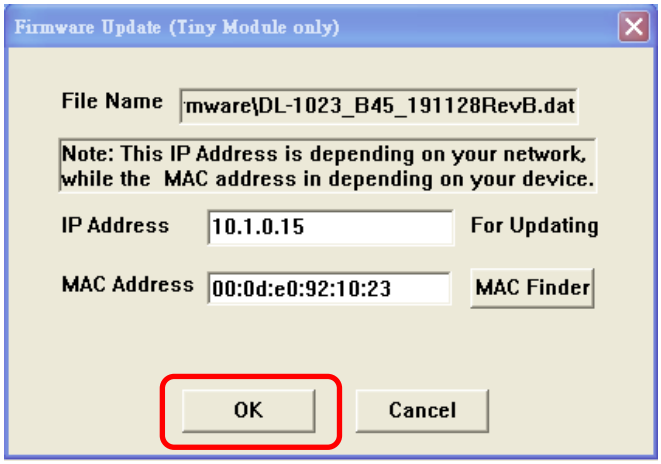
Right click on the DL-1000 module name then select Firmware Update.



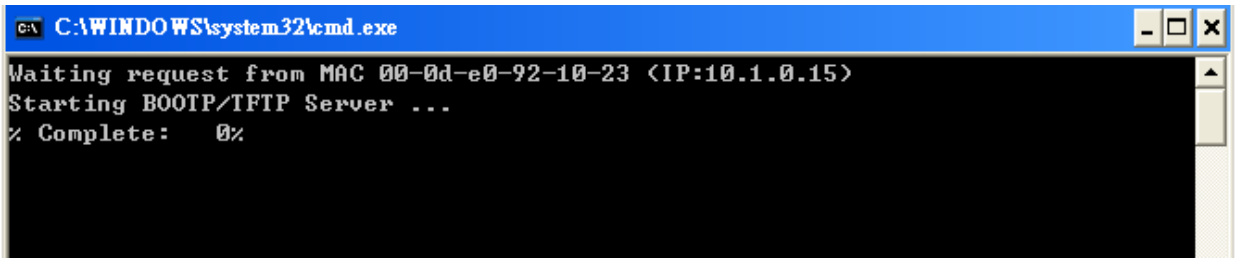
Select the firmware file and click on the Open button.



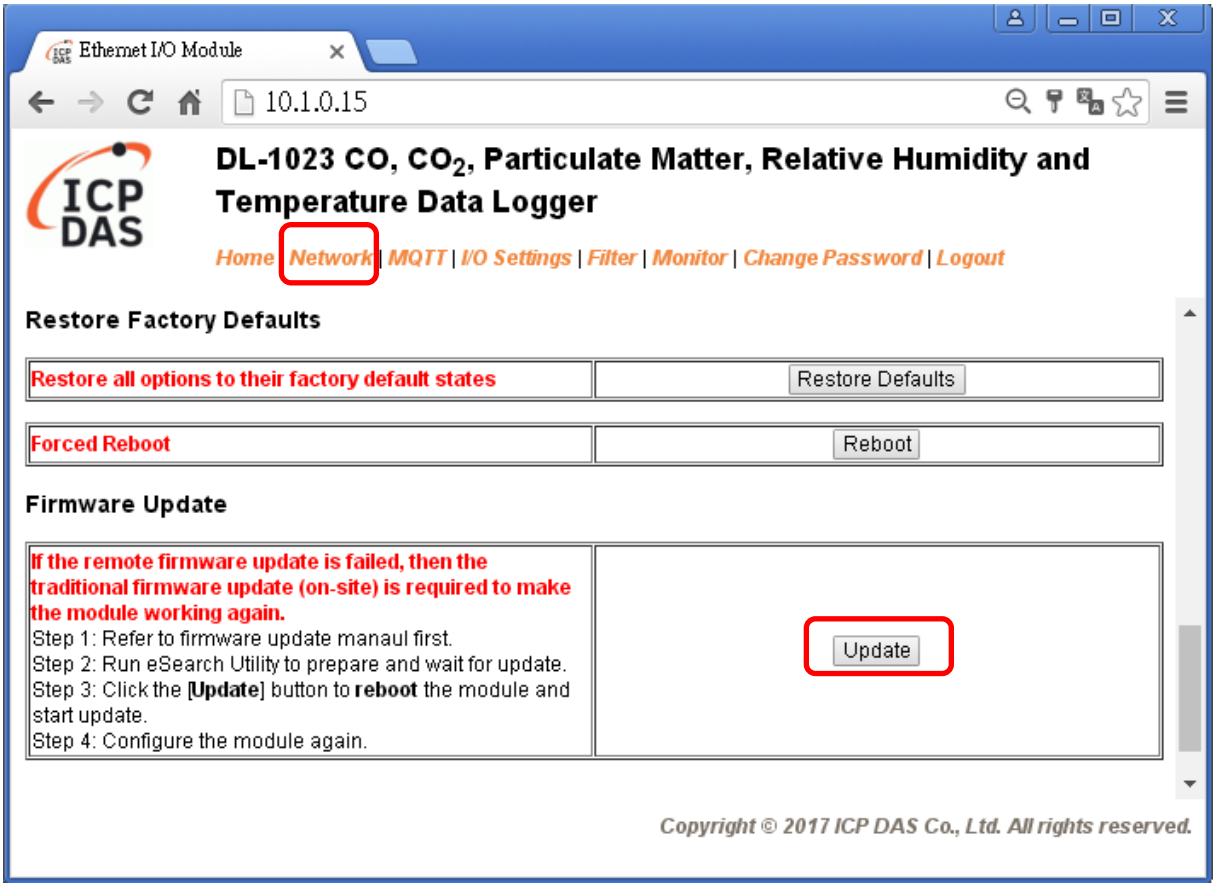
Make sure the IP address and MAC address are correct. Click on the OK button.



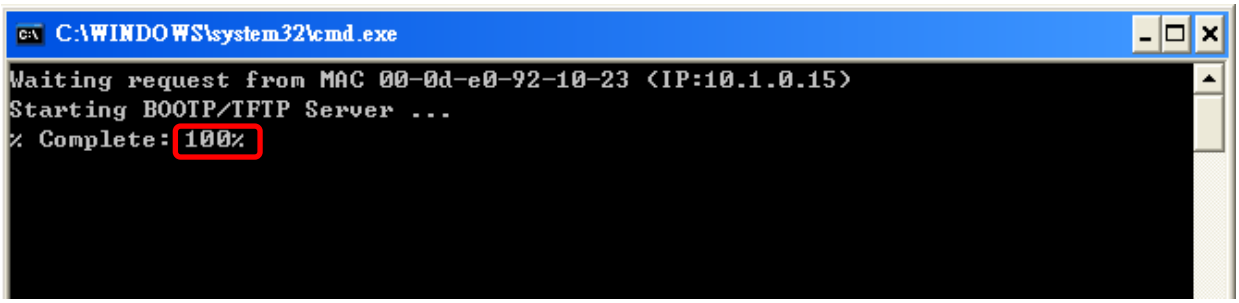
A command prompt window will be displayed to show the progress.



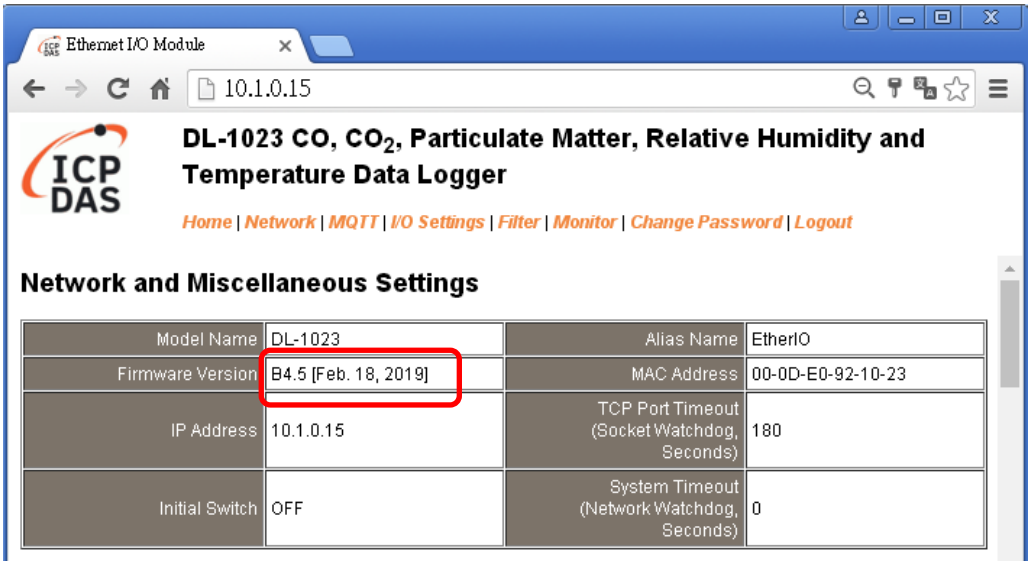
Log in the DL-1000 web page. Click on the Network tab then click on the Update button.



When it shows “% Complete: 100%”, the update is finished. You can close the command prompt window.



Re-log in the DL-1000 web page and check the firmware version.



Appendix A: DCON Command Sets

A-1. DL-1020 DCON Command Sets

Command	Description
$AAF	read firmware version
$AAI	read INIT status response: !AA0 -> INIT short to GND !AA1 -> else
$AAM	read module name
$AAP	Read Modbus RTU/DCON protocol response: !AA0 -> DCON !AA1 -> Modbus RTU
$AAPN	Set Modbus RTU/DCON protocol N-> 0: DCON, 1: Modbus RTU
$AA2	read configuration
$AA5	read reset status !AA1 first after power on, !AA0 others
#AA	Read All Analog Inputs response > (PM2.5 in 1 ug/m^3) (relative humidity in 0.01%)(temperature in 0.01˚C)(temperature in 0.01˚F) (dew point temperature in 0.01˚C)(dew point temperature in 0.01˚F) (PM1.0 in 1 ug/m^3) (PM10 in 1 ug/m^3) (particle count 0.3 - 0.5um) (particle count 0.5 - 1.0um) (particle count 1.0 - 2.5um) (particle count 2.5 - 5.0um) (particle count 5.0 - 7.5um) (particle count 7.5 - 10um)
#AAN	Read Channel Analog Input N = 0 for PM2.5 in 1 ug/m^3, 1 for relative humidity in 0.01%, 2 for temperature in 0.01˚C, 3 for temperature in 0.01˚F, 4 for dew point temperature in 0.01˚C, 5 for dew point temperature in 0.01˚F, 6 for PM1.0 in 1 ug/m^3, 7 for PM10 in 1 ug/m^3, 8 for particle count 0.3 - 0.5um, 9 for particle count 0.5 - 1.0um, A for particle count 1.0 - 2.5um, B for particle count 2.5 - 5.0um, C for particle count 5.0 - 7.5um, D for particle count 7.5 - 10um
%AANNTTCCFF	set configuration, NN: new address, TT = 00, CC: new baud rate FF: data format
@AABA	Read beep on alarm time response !AAHH, HH in hex, 0: disabled, 1 ~ 250: beep on alarm time in seconds, 251: beep on alarm continuously

Command	Description
@AABAHH	Set beep on alarm HH in hex, 0: disabled, 1 ~ 250: beep on alarm time in seconds, 251: beep on alarm continuously
@AABE	Read enable/disable beep on alarm response !AAHHHH, HHHH in hex, bit 0 for channel 0, bit 1 for channel 1, etc, for each bit, 0: disabled, 1: enabled
@AABEHHHH	Enable/disable beep on alarm HHHH in hex, , bit 0 for channel 0, bit 1 for channel 1, etc, for each bit, 0: disabled, 1: enabled
@AACH	Clear all high latched analog inputs to the current values
@AACHN	Clear channel high latched analog input to the current value, N = 0 for PM2.5, 1 for relative humidity in 0.01%, 2 for temperature in 0.01˚C, 3 for temperature in 0.01˚F, 4 for dew point temperature in 0.01˚C, 5 for dew point temperature in 0.01˚F, 6 for PM1.0, 7 for PM10, 8 for particle count 0.3 - 0.5um, 9 for particle count 0.5 - 1.0um, A for particle count 1.0 - 2.5um, B for particle count 2.5 - 5.0um, C for particle count 5.0 - 7um, D for particle count 7.5 - 10um
@AACHCN	Clear high latched alarm of a channel, N = 0 for PM2.5, 1 for relative humidity in 0.01%, 2 for temperature in 0.01˚C, 3 for temperature in 0.01˚F, 4 for dew point temperature in 0.01˚C, 5 for dew point temperature in 0.01˚F, 6 for PM1.0, 7 for PM10, 8 for particle count 0.3 - 0.5um, 9 for particle count 0.5 - 1.0um, A for particle count 1.0 - 2.5um, B for particle count 2.5 - 5.0um, C for particle count 5.0 - 7.5um, D for particle count 7.5 - 10um
@AACL	Clear all low latched analog inputs to the current values
@AACLN	Clear channel low latched analog input to the current value, N = 0 for PM2.5, 1 for relative humidity in 0.01%, 2 for temperature in 0.01˚C, 3 for temperature in 0.01˚F, 4 for dew point temperature in 0.01˚C, 5 for dew point temperature in 0.01˚F, 6 for PM1.0, 7 for PM10, 8 for particle count 0.3 - 0.5um, 9 for particle count 0.5 - 1.0um, A for particle count 1.0 - 2.5um, B for particle count 2.5 - 5.0um, C for particle count 5.0 - 7.5um, D for particle count 7.5 - 10um
@AACLCN	Clear low latched alarm of a channel, N = 1 for relative humidity, 2 for temperature in 0.01˚C, 3 for temperature in 0.01˚F, 4 for dew point temperature in 0.01˚C, 5 for dew point temperature in 0.01˚F
@AADACN	Disable AI alarm of a channel, N = 0 for PM2.5, 1 for relative humidity in 0.01%, 2 for temperature in 0.01˚C, 3 for temperature in 0.01˚F, 4 for dew point temperature in 0.01˚C, 5 for dew point temperature in 0.01˚F, 6 for PM1.0, 7 for PM10, 8 for particle count 0.3 - 0.5um, 9 for particle count 0.5 - 1.0um, A for particle count 1.0 - 2.5um, B for particle count 2.5 - 5.0um, C for particle count 5.0 - 7.5um, D for particle count 7.5 - 10um
@AADI	read DO response !AA00O00, O: 0 ~ F, DO value in hex format

Command	Description
@AADLB	Read the beginning of the period setting of the data logger for period logging mode response !AAyyyymmddhhmmss,
@AADLByyyymmddhhmmss	Set the beginning of the period setting of the data logger for period logging mode yyyy: year, 2000 to 2199, mm: month, 01 to 12, dd: date, 01 to 31, hh: hour, 0 to 24, mm: minute, 0 to 59, ss: second, 0 to 59
@AADLC	Read the data logger command response !AAh, 0: stop, 1: run, 2: run in period mode
@AADLCh	Set the data logger command, h->0: stop, 1: run, 2: run in period mode
@AADLE	Read the ending of the period setting of the data logger for period logging mode response !AAyyyymmddhhmmss
@AADLEyyyymmddhhmmss	Set the ending of the period setting of the data logger for period logging mode yyyy: year, 2000 to 2199, mm: month, 01 to 12, dd: date, 01 to 31, hh: hour, 0 to 24, mm: minute, 0 to 59, ss: second, 0 to 59
@AADLN	Read number of log records in the data logger response !AAhhhhhhhh, hhhhhhhh in hex format
@AADLO	Read the overwriting mode when data logger is full response !AAh, 0: stop logging when full, 1: overwrite
@AADLOh	Set the overwriting mode when data logger is full h->0: stop logging when full, 1: overwrite
@AADLP	Read the samplig period setting of the data logger response !AAhhmmss, hh: hour, 0 to 24, mm: minute, 0 to 59, ss: second, 0 to 59
@AADLPhhmmss	Set the samplig period setting of the data logger
@AADLS	Read logging status of the data logger response !AAhh, hh in hex format, 00: stopped, 01: running, others: error
@AADO0V	set DO, V-> 0 ~ F DO value in hex format, bit 0 for DO0, bit 1 for DO1, etc
@AAEATCN	Enable AI alarm of a channel, N = 0 for PM2.5, 1 for relative humidity in 0.01%, 2 for temperature in 0.01˚C, 3 for temperature in 0.01˚F, 4 for dew point temperature in 0.01˚C, 5 for dew point temperature in 0.01˚F, 6 for PM1.0, 7 for PM10, 8 for particle count 0.3 - 0.5um, 9 for particle count 0.5 - 1.0um, A for particle count 1.0 - 2.5um, B for particle count 2.5 - 5.0um, C for particle count 5.0 - 7.5um, D for particle count 7.5 - 10um T->M: momentary alarm, L: latched alarm
@AAFN	Read fan status Response !AAE, E=0: fan off, 1: fan on,

Command	Description
@AAFNE	Turn fan on or off E=0: fan off, 1: fan on
@AAFNPi	Read the ith fan off period in a day, i = 0 to 5 response !AAbhbmehem, bh: beginning hour, bm: beginning minute, eh: ending hour, em: ending minute.
@AAFNPibhbmehem	Set the ith fan off period in a day, i = 0 to 5, bh: beginning hour, 0 to 23, bm: beginning minute, 0 to 59, eh: ending hour, 0 to 23, em: ending minute, 0 to 59. The beginning hour/minute should be earlier than the ending hour/minute. Otherwise, the setting is ignored. If all of the six period settings are invalid, then the fan is controlled by the @AAFNE command.
@AAHI(data)CN	Set high alarm limit of an AI channel, N = 0 for PM2.5, 1 for relative humidity in 0.01%, 2 for temperature in 0.01˚C, 3 for temperature in 0.01˚F, 4 for dew point temperature in 0.01˚C, 5 for dew point temperature in 0.01˚F, 6 for PM1.0, 7 for PM10, 8 for particle count 0.3 - 0.5um, 9 for particle count 0.5 - 1.0um, A for particle count 1.0 - 2.5um, B for particle count 2.5 - 5.0um, C for particle count 5.0 - 7.5um, D for particle count 7.5 - 10um
@AAHO	Read humidity offset
@AAHO(data)	Set humidity offset, data in format of -100.00 ~ +100.00
@AALO(data)CN	Set low alarm limit of an AI channel, N = 1 for relative humidity in 0.01%, 2 for temperature in 0.01˚C, 3 for temperature in 0.01˚F, 4 for dew point temperature in 0.01˚C, 5 for dew point temperature in 0.01˚F
@AAPO	Read PM2.5 offset
@AAPO(data)	Set PM2.5 offset, data in format of -00100. ~ +00100.
@AAP1O	Read PM1.0 offset
@AAP1O(data)	Set PM1.0 offset, data in format of -00100. ~ +00100.
@AAP10O	Read PM10 offset
@AAP10O(data)	Set PM10 offset, data in format of -00100. ~ +00100.
@AARACN	Read AI alarm enabled/disabled status of a channel response !AAN, N->0: disabled, 1: momentary, 2: latched
@AARAO	Read AI alarm status response !AAHHHHLLLL
@AARHN	Read channel high latched value of analog input
@AARHCN	Read high alarm limit of an AI channel
@AARL	Read all low latched values of analog input channels
@AARLN	Read channel low latched value of analog input
@AARLCN	Read low alarm limit of an AI channel
@AART	Read RTC data
@AARTYYMMDDHHMMSS	Set RTC data
@AATO	Read temperature offset in 0.01˚C

Command	Description
@AATO(data)	Set temperature offset in 0.01˚C, -100.00 ~ +100.00
~**	clear host watchdog timeout counter
~AA0	read host watchdog status
~AA1	clear host watchdog timeout status
~AA2	read host watchdog enable/disable status and timeout value
~AA3ETT	enable/disable host watchdog and set timeout value E-> 0: disable host watchdog, 1: enable host watchdog TT: host watchdog timeout in 0.1s in hex format
~AA4	read DO power on and safe value
~AA50P0S	set DO power on and safe value P-> 0 ~ F: power on value in hex format S-> 0 ~ F: safe value in hex format
~AARD	read response delay time in ms in hex format
~AARDVV	set response delay time in ms, VV in hex format, 00 - 1E

Baud Rate Setting (CC)

Bits 5:0

Baud rate, 0x03 ~ 0x0A

Code	0x03	0x04	0x05	0x06
Baud	1200	2400	4800	9600
Code	0x07	0x08	0x09	0x0A
Baud	19200	38400	57600	115200

Bits 7:6

00: no parity, 1 stop bit
01: no parity, 2 stop bits
10: even parity, 1 stop bit
11: odd parity, 1 stop bit

Data Format Setting (FF)

Bit 6

0: checksum disabled
1: checksum enabled

A-2. DL-1021 DCON Command Sets

Command	Description
$AAF	read firmware version
$AAI	read INIT status response: !AA0 -> INIT short to GND !AA1 -> else
$AAM	read module name
$AAP	Read Modbus RTU/DCON protocol response: !AA0 -> DCON !AA1 -> Modbus RTU
$AAPN	Set Modbus RTU/DCON protocol N-> 0: DCON, 1: Modbus RTU
$AA2	read configuration
$AA5	read reset status !AA1 first after power on, !AA0 others
#AA	Read All Analog Inputs response > (CO in 1 ppm) (PM2.5 in 1 ug/m^3) (relative humidity in 0.01%)(temperature in 0.01˚C)(temperature in 0.01˚F) (dew point temperature in 0.01˚C)(dew point temperature in 0.01˚F) (PM1.0 in 1 ug/m^3) (PM10 in 1 ug/m^3) (particle count 0.3 - 0.5um) (particle count 0.5 - 1.0um) (particle count 1.0 - 2.5um) (particle count 2.5 - 5.0um) (particle count 5.0 - 7.5um) (particle count 7.5 - 10um)
#AAN	Read Channel Analog Input N = 0 for CO in 1 ppm, 1 for PM2.5 in 1 ug/m^3, 2 for relative humidity in 0.01%, 3 for temperature in 0.01˚C, 4 for temperature in 0.01˚F, 5 for dew point temperature in 0.01˚C, 6 for dew point temperature in 0.01˚F, 7 for PM1.0 in 1 ug/m^3, 8 for PM10 in 1 ug/m^3, 9 for particle count 0.3 - 0.5um, A for particle count 0.5 - 1.0um, B for particle count 1.0 - 2.5um, C for particle count 2.5 - 5.0um, D for particle count 5.0 - 7.5um, E for particle count 7.5 - 10um
%AANNTTCCFF	set configuration, NN: new address, TT = 00, CC: new baud rate FF: data format
@AABA	Read beep on alarm time response !AAHH, HH in hex, 0: disabled, 1 ~ 250: beep on alarm time in seconds, 251: beep on alarm continuously
@AABAHH	Set beep on alarm HH in hex, 0: disabled, 1 ~ 250: beep on alarm time in seconds, 251: beep on alarm continuously
@AABE	Read enable/disable beep on alarm response !AAHHHH, HHHH in hex, bit 0 for channel 0, bit 1 for channel 1, etc, for each bit, 0: disabled, 1: enabled
@AABEHHHH	Enable/disable beep on alarm HHHH in hex, , bit 0 for channel 0, bit 1 for channel 1, etc, for each bit, 0: disabled, 1: enabled

Command	Description
@AACH	Clear all high latched analog inputs to the current values
@AACHN	Clear channel high latched analog input to the current value, N = 0 for CO, 1 for PM2.5, 2 for relative humidity in 0.01%, 3 for temperature in 0.01˚C, 4 for temperature in 0.01˚F, 5 for dew point temperature in 0.01˚C, 6 for dew point temperature in 0.01˚F, 7 for PM1.0, 8 for PM10, 9 for particle count 0.3 - 0.5um, A for particle count 0.5 - 1.0um, B for particle count 1.0 - 2.5um, C for particle count 2.5 - 5.0um, D for particle count 5.0 - 7.5um, E for particle count 7.5 - 10um
@AACHCN	Clear high latched alarm of a channel, N = 0 for CO, 1 for PM2.5, 2 for relative humidity in 0.01%, 3 for temperature in 0.01˚C, 4 for temperature in 0.01˚F, 5 for dew point temperature in 0.01˚C, 6 for dew point temperature in 0.01˚F, 7 for PM1.0, 8 for PM10, 9 for particle count 0.3 - 0.5um, A for particle count 0.5 - 1.0um, B for particle count 1.0 - 2.5um, C for particle count 2.5 - 5.0um, D for particle count 5.0 - 7.5um, E for particle count 7.5 - 10um
@AACL	Clear all low latched analog inputs to the current values
@AACLN	Clear channel low latched analog input to the current value, N = 0 for CO, 1 for PM2.5, 2 for relative humidity in 0.01%, 3 for temperature in 0.01˚C, 4 for temperature in 0.01˚F, 5 for dew point temperature in 0.01˚C, 6 for dew point temperature in 0.01˚F, 7 for PM1.0, 8 for PM10, 9 for particle count 0.3 - 0.5um, A for particle count 0.5 - 1.0um, B for particle count 1.0 - 2.5um, C for particle count 2.5 - 5.0um, D for particle count 5.0 - 7.5um, E for particle count 7.5 - 10um
@AACLCN	Clear low latched alarm of a channel, N = 2 for relative humidity, 3 for temperature in 0.01˚C, 4 for temperature in 0.01˚F, 5 for dew point temperature in 0.01˚C, 6 for dew point temperature in 0.01˚F
@AADACN	Disable AI alarm of a channel, N = 0 for CO, 1 for PM2.5, 2 for relative humidity in 0.01%, 3 for temperature in 0.01˚C, 4 for temperature in 0.01˚F, 5 for dew point temperature in 0.01˚C, 6 for dew point temperature in 0.01˚F, 7 for PM1.0, 8 for PM10, 9 for particle count 0.3 - 0.5um, A for particle count 0.5 - 1.0um, B for particle count 1.0 - 2.5um, C for particle count 2.5 - 5.0um, D for particle count 5.0 - 7.5um, E for particle count 7.5 - 10um
@AADI	read DO response !AA00O00, O: 0 ~ F, DO value in hex format
@AADLB	Read the beginning of the period setting of the data logger for period logging mode response !AAyyyymmddhhmmss,
@AADLByyyymmddhhmmss	Set the beginning of the period setting of the data logger for period logging mode yyyy: year, 2000 to 2199, mm: month, 01 to 12, dd: date, 01 to 31, hh: hour, 0 to 24, mm: minute, 0 to 59, ss: second, 0 to 59

Command	Description
@AADLC	Read the data logger command response !AAh, 0: stop, 1: run, 2: run in period mode
@AADLCh	Set the data logger command, h->0: stop, 1: run, 2: run in period mode
@AADLE	Read the ending of the period setting of the data logger for period logging mode response !AAyyyymmddhhmmss
@AADLEyyyymmddhhmmss	Set the ending of the period setting of the data logger for period logging mode yyyy: year, 2000 to 2199, mm: month, 01 to 12, dd: date, 01 to 31, hh: hour, 0 to 24, mm: minute, 0 to 59, ss: second, 0 to 59
@AADLN	Read number of log records in the data logger response !AAhhhhhhhh, hhhhhhhh in hex format
@AADLO	Read the overwriting mode when data logger is full response !AAh, 0: stop logging when full, 1: overwrite
@AADLOh	Set the overwriting mode when data logger is full h->0: stop logging when full, 1: overwrite
@AADLP	Read the samplig period setting of the data logger response !AAhhmmss, hh: hour, 0 to 24, mm: minute, 0 to 59, ss: second, 0 to 59
@AADLPhhmmss	Set the samplig period setting of the data logger
@AADLS	Read logging status of the data logger response !AAhh, hh in hex format, 00: stopped, 01: running, others: error
@AADO0V	set DO, V-> 0 ~ F DO value in hex format, bit 0 for DO0, bit 1 for DO1, etc
@AAEATCN	Enable AI alarm of a channel, N = 0 for CO, 1 for PM2.5, 2 for relative humidity in 0.01%, 3 for temperature in 0.01˚C, 4 for temperature in 0.01˚F, 5 for dew point temperature in 0.01˚C, 6 for dew point temperature in 0.01˚F, 7 for PM1.0, 8 for PM10, 9 for particle count 0.3 - 0.5um, A for particle count 0.5 - 1.0um, B for particle count 1.0 - 2.5um, C for particle count 2.5 - 5.0um, D for particle count 5.0 - 7.5um, E for particle count 7.5 - 10um T->M: momentary alarm, L: latched alarm
@AAFN	Read fan status Response !AAE, E=0: fan off, 1: fan on,
@AAFNE	Turn fan on or off E=0: fan off, 1: fan on
@AAFNPi	Read the ith fan off period in a day, i = 0 to 5 response !AAbhbmehem, bh: beginning hour, bm: beginning minute, eh: ending hour, em: ending minute.

Command	Description
@AAFNPibhbmeheem	Set the ith fan off period in a day, i = 0 to 5, bh: beginning hour, 0 to 23, bm: beginning minute, 0 to 59, eh: ending hour, 0 to 23, em: ending minute, 0 to 59. The beginning hour/minute should be earlier than the ending hour/minute. Otherwise, the setting is ignored. If all of the six period settings are invalid, then the fan is controlled by the @AAFNE command.
@AAHI(data)CN	Set high alarm limit of an AI channel, N = 0 for CO, 1 for PM2.5, 2 for relative humidity in 0.01%, 3 for temperature in 0.01˚C, 4 for temperature in 0.01˚F, 5 for dew point temperature in 0.01˚C, 6 for dew point temperature in 0.01˚F, 7 for PM1.0, 8 for PM10, 9 for particle count 0.3 - 0.5um, A for particle count 0.5 - 1.0um, B for particle count 1.0 - 2.5um, C for particle count 2.5 - 5.0um, D for particle count 5.0 - 7.5um, E for particle count 7.5 - 10um
@AAHO	Read humidity offset
@AAHO(data)	Set humidity offset, data in format of -100.00 ~ +100.00
@AALO(data)CN	Set low alarm limit of an AI channel, N = 2 for relative humidity in 0.01%, 3 for temperature in 0.01˚C, 4 for temperature in 0.01˚F, 5 for dew point temperature in 0.01˚C, 6 for dew point temperature in 0.01˚F
@AAPO	Read PM2.5 offset
@AAPO(data)	Set PM2.5 offset, data in format of -00100. ~ +00100.
@AAP1O	Read PM1.0 offset
@AAP1O(data)	Set PM1.0 offset, data in format of -00100. ~ +00100.
@AAP10O	Read PM10 offset
@AAP10O(data)	Set PM10 offset, data in format of -00100. ~ +00100.
@AARACN	Read AI alarm enabled/disabled status of a channel response !AAN, N->0: disabled, 1: momentary, 2: latched
@AARAO	Read AI alarm status response !AAHHHHLLLL
@AARH	Read all high latched values of analog input channels
@AARHN	Read channel high latched value of analog input
@AARHCN	Read high alarm limit of an AI channel
@AARL	Read all low latched values of analog input channels
@AARLN	Read channel low latched value of analog input
@AARLCN	Read low alarm limit of an AI channel
@AART	Read RTC data
@AARTYYMMDDHHMMSS	Set RTC data
@AATO	Read temperature offset in 0.01˚C
@AATO(data)	Set temperature offset in 0.01˚C, -100.00 ~ +100.00
~**	clear host watchdog timeout counter
~AA0	read host watchdog status
~AA1	clear host watchdog timeout status
~AA2	read host watchdog enable/disable status and timeout value

Command	Description
~AA3ETT	enable/disable host watchdog and set timeout value E-> 0: disable host watchdog, 1: enable host watchdog TT: host watchdog timeout in 0.1s in hex format
~AA4	read DO power on and safe value
~AA50P0S	set DO power on and safe value P-> 0 ~ F: power on value in hex format S-> 0 ~ F: safe value in hex format
~AARD	read response delay time in ms in hex format
~AARDVV	set response delay time in ms, VV in hex format, 00 - 1E

Baud Rate Setting (CC)

Bits 5:0

Baud rate, 0x03 ~ 0x0A

Code	0x03	0x04	0x05	0x06
Baud	1200	2400	4800	9600
Code	0x07	0x08	0x09	0x0A
Baud	19200	38400	57600	115200

Bits 7:6

00: no parity, 1 stop bit
01: no parity, 2 stop bits
10: even parity, 1 stop bit
11: odd parity, 1 stop bit

Data Format Setting (FF)

Bit 6

0: checksum disabled
1: checksum enabled

A-3. DL-1022 DCON Command Sets

Command	Description
$AAF	read firmware version
$AAI	read INIT status response: !AA0 -> INIT short to GND !AA1 -> else
$AAM	read module name
$AAP	Read Modbus RTU/DCON protocol response: !AA0 -> DCON !AA1 -> Modbus RTU
$AAPN	Set Modbus RTU/DCON protocol N-> 0: DCON, 1: Modbus RTU
$AA2	read configuration
$AA5	read reset status !AA1 first after power on, !AA0 others
#AA	Read All Analog Inputs response > (CO_2 in 1 ppm) (PM2.5 in 1 ug/m^3) (relative humidity in 0.01%)(temperature in 0.01˚C)(temperature in 0.01˚F) (dew point temperature in 0.01˚C)(dew point temperature in 0.01˚F) (PM1.0 in 1 ug/m^3) (PM10 in 1 ug/m^3) (particle count 0.3 - 0.5um) (particle count 0.5 - 1.0um) (particle count 1.0 - 2.5um) (particle count 2.5 - 5.0um) (particle count 5.0 - 7.5um) (particle count 7.5 - 10um)
#AAN	Read Channel Analog Input N = 0 for CO_2 in 1 ppm, 1 for PM2.5 in 1 ug/m^3, 2 for relative humidity in 0.01%, 3 for temperature in 0.01˚C, 4 for temperature in 0.01˚F, 5 for dew point temperature in 0.01˚C, 6 for dew point temperature in 0.01˚F, 7 for PM1.0 in 1 ug/m^3, 8 for PM10 in 1 ug/m^3, 9 for particle count 0.3 - 0.5um, A for particle count 0.5 - 1.0um, B for particle count 1.0 - 2.5um, C for particle count 2.5 - 5.0um, D for particle count 5.0 - 7.5um, E for particle count 7.5 - 10um
%AANNTTCCFF	set configuration, NN: new address, TT = 00, CC: new baud rate FF: data format
@AAABC	Read status of the automatic baseline correction response !AAN, N=0: disabled, 1: enabled
@AAABCN	Set the automatic baseline correction N->0: disabled, 1: enabled
@AABA	Read beep on alarm time response !AAHH, HH in hex, 0: disabled, 1 ~ 250: beep on alarm time in seconds, 251: beep on alarm continuously
@AABAHH	Set beep on alarm HH in hex, 0: disabled, 1 ~ 250: beep on alarm time in seconds, 251: beep on alarm continuously

Command	Description
@AABE	Read enable/disable beep on alarm response !AAHHHH, HHHH in hex, bit 0 for channel 0, bit 1 for channel 1, etc, for each bit, 0: disabled, 1: enabled
@AABEHHHH	Enable/disable beep on alarm HHHH in hex, , bit 0 for channel 0, bit 1 for channel 1, etc, for each bit, 0: disabled, 1: enabled
@AACH	Clear all high latched analog inputs to the current values
@AACHN	Clear channel high latched analog input to the current value, N = 0 for CO_2, 1 for PM2.5, 2 for relative humidity in 0.01%, 3 for temperature in 0.01˚C, 4 for temperature in 0.01˚F, 5 for dew point temperature in 0.01˚C, 6 for dew point temperature in 0.01˚F, 7 for PM1.0, 8 for PM10, 9 for particle count 0.3 - 0.5um, A for particle count 0.5 - 1.0um, B for particle count 1.0 - 2.5um, C for particle count 2.5 - 5.0um, D for particle count 5.0 - 7.5um, E for particle count 7.5 - 10um
@AACHCN	Clear high latched alarm of a channel, N = 0 for CO_2, 1 for PM2.5, 2 for relative humidity in 0.01%, 3 for temperature in 0.01˚C, 4 for temperature in 0.01˚F, 5 for dew point temperature in 0.01˚C, 6 for dew point temperature in 0.01˚F, 7 for PM1.0, 8 for PM10, 9 for particle count 0.3 - 0.5um, A for particle count 0.5 - 1.0um, B for particle count 1.0 - 2.5um, C for particle count 2.5 - 5.0um, D for particle count 5.0 - 7.5um, E for particle count 7.5 - 10um
@AACL	Clear all low latched analog inputs to the current values
@AACLN	Clear channel low latched analog input to the current value, N = 0 for CO_2, 1 for PM2.5, 2 for relative humidity in 0.01%, 3 for temperature in 0.01˚C, 4 for temperature in 0.01˚F, 5 for dew point temperature in 0.01˚C, 6 for dew point temperature in 0.01˚F, 7 for PM1.0, 8 for PM10, 9 for particle count 0.3 - 0.5um, A for particle count 0.5 - 1.0um, B for particle count 1.0 - 2.5um, C for particle count 2.5 - 5.0um, D for particle count 5.0 - 7.5um, E for particle count 7.5 - 10um
@AACLCN	Clear low latched alarm of a channel, N = 2 for relative humidity, 3 for temperature in 0.01˚C, 4 for temperature in 0.01˚F, 5 for dew point temperature in 0.01˚C, 6 for dew point temperature in 0.01˚F
@AADACN	Disable AI alarm of a channel, N = 0 for CO_2, 1 for PM2.5, 2 for relative humidity in 0.01%, 3 for temperature in 0.01˚C, 4 for temperature in 0.01˚F, 5 for dew point temperature in 0.01˚C, 6 for dew point temperature in 0.01˚F, 7 for PM1.0, 8 for PM10, 9 for particle count 0.3 - 0.5um, A for particle count 0.5 - 1.0um, B for particle count 1.0 - 2.5um, C for particle count 2.5 - 5.0um, D for particle count 5.0 - 7.5um, E for particle count 7.5 - 10um
@AADI	read DO response !AA00O00, O: 0 ~ F, DO value in hex format
@AADLB	Read the beginning of the period setting of the data logger for period logging mode response !AAyyyymmddhhmmss,

Command	Description
@AADLByyyymmddhhmmss	Set the beginning of the period setting of the data logger for period logging mode yyyy: year, 2000 to 2199, mm: month, 01 to 12, dd: date, 01 to 31, hh: hour, 0 to 24, mm: minute, 0 to 59, ss: second, 0 to 59
@AADLC	Read the data logger command response !AAh, 0: stop, 1: run, 2: run in period mode
@AADLCh	Set the data logger command, h->0: stop, 1: run, 2: run in period mode
@AADLE	Read the ending of the period setting of the data logger for period logging mode response !AAyyyymmddhhmmss
@AADLEyyyymmddhhmmss	Set the ending of the period setting of the data logger for period logging mode yyyy: year, 2000 to 2199, mm: month, 01 to 12, dd: date, 01 to 31, hh: hour, 0 to 24, mm: minute, 0 to 59, ss: second, 0 to 59
@AADLN	Read number of log records in the data logger response !AAhhhhhhhh, hhhhhhhh in hex format
@AADLO	Read the overwriting mode when data logger is full response !AAh, 0: stop logging when full, 1: overwrite
@AADLOh	Set the overwriting mode when data logger is full h->0: stop logging when full, 1: overwrite
@AADLP	Read the samplig period setting of the data logger response !AAhhmmss, hh: hour, 0 to 24, mm: minute, 0 to 59, ss: second, 0 to 59
@AADLPhhmmss	Set the samplig period setting of the data logger
@AADLS	Read logging status of the data logger response !AAhh, hh in hex format, 00: stopped, 01: running, others: error
@AADO0V	set DO, V-> 0 ~ F DO value in hex format, bit 0 for DO0, bit 1 for DO1, etc
@AAEATCN	Enable AI alarm of a channel, N = 0 for CO_2, 1 for PM2.5, 2 for relative humidity in 0.01%, 3 for temperature in 0.01˚C, 4 for temperature in 0.01˚F, 5 for dew point temperature in 0.01˚C, 6 for dew point temperature in 0.01˚F, 7 for PM1.0, 8 for PM10, 9 for particle count 0.3 - 0.5um, A for particle count 0.5 - 1.0um, B for particle count 1.0 - 2.5um, C for particle count 2.5 - 5.0um, D for particle count 5.0 - 7.5um, E for particle count 7.5 - 10um T->M: momentary alarm, L: latched alarm
@AAFN	Read fan status Response !AAE, E=0: fan off, 1: fan on,
@AAFNE	Turn fan on or off E=0: fan off, 1: fan on

Command	Description
@AAFNPi	Read the ith fan off period in a day, i = 0 to 5 response !AAbhbmehem, bh: beginning hour, bm: beginning minute, eh: ending hour, em: ending minute.
@AAFNPibhbmeh em	Set the ith fan off period in a day, i = 0 to 5, bh: beginning hour, 0 to 23, bm: beginning minute, 0 to 59, eh: ending hour, 0 to 23, em: ending minute, 0 to 59. The beginning hour/minute should be earlier than the ending hour/minute. Otherwise, the setting is ignored. If all of the six period settings are invalid, then the fan is controlled by the @AAFNE command.
@AAHI(data)CN	Set high alarm limit of an AI channel, N = 0 for CO_2, 1 for PM2.5, 2 for relative humidity in 0.01%, 3 for temperature in 0.01˚C, 4 for temperature in 0.01˚F, 5 for dew point temperature in 0.01˚C, 6 for dew point temperature in 0.01˚F, 7 for PM1.0, 8 for PM10, 9 for particle count 0.3 - 0.5um, A for particle count 0.5 - 1.0um, B for particle count 1.0 - 2.5um, C for particle count 2.5 - 5.0um, D for particle count 5.0 - 7.5um, E for particle count 7.5 - 10um
@AAHO	Read humidity offset
@AAHO(data)	Set humidity offset, data in format of -100.00 ~ +100.00
@AALO(data)CN	Set low alarm limit of an AI channel, N = 2 for relative humidity in 0.01%, 3 for temperature in 0.01˚C, 4 for temperature in 0.01˚F, 5 for dew point temperature in 0.01˚C, 6 for dew point temperature in 0.01˚F
@AAPO	Read PM2.5 offset
@AAPO(data)	Set PM2.5 offset, data in format of -00100. ~ +00100.
@AAP1O	Read PM1.0 offset
@AAP1O(data)	Set PM1.0 offset, data in format of -00100. ~ +00100.
@AAP10O	Read PM10 offset
@AAP10O(data)	Set PM10 offset, data in format of -00100. ~ +00100.
@AARACN	Read AI alarm enabled/disabled status of a channel response !AAN, N->0: disabled, 1: momentary, 2: latched
@AARAO	Read AI alarm status response !AAHHHHLLLL
@AARH	Read all high latched values of analog input channels
@AARHN	Read channel high latched value of analog input
@AARHCN	Read high alarm limit of an AI channel
@AARL	Read all low latched values of analog input channels
@AARLN	Read channel low latched value of analog input
@AARLCN	Read low alarm limit of an AI channel
@AART	Read RTC data
@AARTYYMMD DHHMMSS	Set RTC data
@AATO	Read temperature offset in 0.01˚C
@AATO(data)	Set temperature offset in 0.01˚C, -100.00 ~ +100.00

Command	Description
~**	clear host watchdog timeout counter
~AA0	read host watchdog status
~AA1	clear host watchdog timeout status
~AA2	read host watchdog enable/disable status and timeout value
~AA3ETT	enable/disable host watchdog and set timeout value E-> 0: disable host watchdog, 1: enable host watchdog TT: host watchdog timeout in 0.1s in hex format
~AA4	read DO power on and safe value
~AA50P0S	set DO power on and safe value P-> 0 ~ F: power on value in hex format S-> 0 ~ F: safe value in hex format
~AARD	read response delay time in ms in hex format
~AARDVV	set response delay time in ms, VV in hex format, 00 - 1E

Baud Rate Setting (CC)

Bits 5:0

Baud rate, 0x03 ~ 0x0A

Code	0x03	0x04	0x05	0x06
Baud	1200	2400	4800	9600
Code	0x07	0x08	0x09	0x0A
Baud	19200	38400	57600	115200

Bits 7:6

00: no parity, 1 stop bit
01: no parity, 2 stop bits
10: even parity, 1 stop bit
11: odd parity, 1 stop bit

Data Format Setting (FF)

Bit 6

0: checksum disabled
1: checksum enabled

A-4. DL-1023 DCON Command Sets

Command	Description
$AAF	read firmware version
$AAI	read INIT status response: !AA0 -> INIT short to GND !AA1 -> else
$AAM	read module name
$AAP	Read Modbus RTU/DCON protocol response: !AA0 -> DCON !AA1 -> Modbus RTU
$AAPN	Set Modbus RTU/DCON protocol N-> 0: DCON, 1: Modbus RTU
$AA2	read configuration
$AA5	read reset status !AA1 first after power on, !AA0 others
#AA	Read All Analog Inputs response > (CO in 1 ppm) (CO_2 in 1 ppm) (PM2.5 in 1 ug/m^3) (relative humidity in 0.01%)(temperature in 0.01˚C)(temperature in 0.01˚F) (dew point temperature in 0.01˚C)(dew point temperature in 0.01˚F) (PM1.0 in 1 ug/m^3) (PM10 in 1 ug/m^3) (particle count 0.3 - 0.5um) (particle count 0.5 - 1.0um) (particle count 1.0 - 2.5um) (particle count 2.5 - 5.0um) (particle count 5.0 - 7.5um) (particle count 7.5 - 10um)
#AAN	Read Channel Analog Input N = 0 for CO in 1 ppm, 1 for CO_2 in 1 ppm, 2 for PM2.5 in 1 ug/m^3, 3 for relative humidity in 0.01%, 4 for temperature in 0.01˚C, 5 for temperature in 0.01˚F, 6 for dew point temperature in 0.01˚C, 7 for dew point temperature in 0.01˚F, 8 for PM1.0 in 1 ug/m^3, 9 for PM10 in 1 ug/m^3, A for particle count 0.3 - 0.5um, B for particle count 0.5 - 1.0um, C for particle count 1.0 - 2.5um, D for particle count 2.5 - 5.0um, E for particle count 5.0 - 7.5um, F for particle count 7.5 - 10um
%AANNTTCCFF	set configuration, NN: new address, TT = 00, CC: new baud rate FF: data format
@AAABC	Read status of the automatic baseline correction response !AAN, N=0: disabled, 1: enabled
@AAABCN	Set the automatic baseline correction N->0: disabled, 1: enabled
@AABA	Read beep on alarm time response !AAHH, HH in hex, 0: disabled, 1 ~ 250: beep on alarm time in seconds, 251: beep on alarm continuously
@AABAHH	Set beep on alarm HH in hex, 0: disabled, 1 ~ 250: beep on alarm time in seconds, 251: beep on alarm continuously

Command	Description
@AABE	Read enable/disable beep on alarm response !AAHHHH, HHHH in hex, bit 0 for channel 0, bit 1 for channel 1, etc, for each bit, 0: disabled, 1: enabled
@AABEHHHH	Enable/disable beep on alarm HHHH in hex, , bit 0 for channel 0, bit 1 for channel 1, etc, for each bit, 0: disabled, 1: enabled
@AACH	Clear all high latched analog inputs to the current values
@AACHN	Clear channel high latched analog input to the current value, N = 0 for CO1, 1 for CO_2, 2 for PM2.5, 3 for relative humidity in 0.01%, 4 for temperature in 0.01˚C, 5 for temperature in 0.01˚F, 6 for dew point temperature in 0.01˚C, 7 for dew point temperature in 0.01˚F, 8 for PM1.0, 9 for PM10, A for particle count 0.3 - 0.5um, B for particle count 0.5 - 1.0um, C for particle count 1.0 - 2.5um, D for particle count 2.5 - 5.0um, E for particle count 5.0 - 7.5um, F for particle count 7.5 - 10um
@AACHCN	Clear high latched alarm of a channel, N = 0 for CO, 1 for CO_2, 2 for PM2.5, 3 for relative humidity in 0.01%, 4 for temperature in 0.01˚C, 5 for temperature in 0.01˚F, 6 for dew point temperature in 0.01˚C, 7 for dew point temperature in 0.01˚F, 8 for PM1.0, 9 for PM10, A for particle count 0.3 - 0.5um, B for particle count 0.5 - 1.0um, C for particle count 1.0 - 2.5um, D for particle count 2.5 - 5.0um, E for particle count 5.0 - 7.5um, F for particle count 7.5 - 10um
@AACL	Clear all low latched analog inputs to the current values
@AACLN	Clear channel low latched analog input to the current value, N = 0 for CO, 1 for CO_2, 2 for PM2.5, 3 for relative humidity in 0.01%, 4 for temperature in 0.01˚C, 5 for temperature in 0.01˚F, 6 for dew point temperature in 0.01˚C, 7 for dew point temperature in 0.01˚F, 8 for PM1.0, 9 for PM10, A for particle count 0.3 - 0.5um, B for particle count 0.5 - 1.0um, C for particle count 1.0 - 2.5um, D for particle count 2.5 - 5.0um, E for particle count 5.0 - 7.5um, F for particle count 7.5 - 10um
@AACLCN	Clear low latched alarm of a channel, N = 3 for relative humidity, 4 for temperature in 0.01˚C, 5 for temperature in 0.01˚F, 6 for dew point temperature in 0.01˚C, 7 for dew point temperature in 0.01˚F
@AADACN	Disable AI alarm of a channel, N = 0 for CO, 1 for CO_2, 2 for PM2.5, 3 for relative humidity in 0.01%, 4 for temperature in 0.01˚C, 5 for temperature in 0.01˚F, 6 for dew point temperature in 0.01˚C, 7 for dew point temperature in 0.01˚F, 8 for PM1.0, 9 for PM10, A for particle count 0.3 - 0.5um, B for particle count 0.5 - 1.0um, C for particle count 1.0 - 2.5um, D for particle count 2.5 - 5.0um, E for particle count 5.0 - 7.5um, F for particle count 7.5 - 10um
@AADI	read DO response !AA00O00, O: 0 ~ F, DO value in hex format
@AADLB	Read the beginning of the period setting of the data logger for period logging mode response !AAyyyymmddhhmmss,

Command	Description
@AADLByyyymmddhhmmss	Set the beginning of the period setting of the data logger for period logging mode yyyy: year, 2000 to 2199, mm: month, 01 to 12, dd: date, 01 to 31, hh: hour, 0 to 24, mm: minute, 0 to 59, ss: second, 0 to 59
@AADLC	Read the data logger command response !AAh, 0: stop, 1: run, 2: run in period mode
@AADLCh	Set the data logger command, h->0: stop, 1: run, 2: run in period mode
@AADLE	Read the ending of the period setting of the data logger for period logging mode response !AAyyyymmddhhmmss
@AADLEyyyymmddhhmmss	Set the ending of the period setting of the data logger for period logging mode yyyy: year, 2000 to 2199, mm: month, 01 to 12, dd: date, 01 to 31, hh: hour, 0 to 24, mm: minute, 0 to 59, ss: second, 0 to 59
@AADLN	Read number of log records in the data logger response !AAhhhhhhhh, hhhhhhhh in hex format
@AADLO	Read the overwriting mode when data logger is full response !AAh, 0: stop logging when full, 1: overwrite
@AADLOh	Set the overwriting mode when data logger is full h->0: stop logging when full, 1: overwrite
@AADLP	Read the samplig period setting of the data logger response !AAhhmmss, hh: hour, 0 to 24, mm: minute, 0 to 59, ss: second, 0 to 59
@AADLPhhmmss	Set the samplig period setting of the data logger
@AADLS	Read logging status of the data logger response !AAhh, hh in hex format, 00: stopped, 01: running, others: error
@AADO0V	set DO, V-> 0 ~ F DO value in hex format, bit 0 for DO0, bit 1 for DO1, etc
@AAEATCN	Enable AI alarm of a channel, N = 0 for CO, 1 for CO_2, 2 for PM2.5, 3 for relative humidity in 0.01%, 4 for temperature in 0.01˚C, 5 for temperature in 0.01˚F, 6 for dew point temperature in 0.01˚C, 7 for dew point temperature in 0.01˚F, 8 for PM1.0, 9 for PM10, A for particle count 0.3 - 0.5um, B for particle count 0.5 - 1.0um, C for particle count 1.0 - 2.5um, D for particle count 2.5 - 5.0um, E for particle count 5.0 - 7.5um, F for particle count 7.5 - 10um T->M: momentary alarm, L: latched alarm
@AAFN	Read fan status Response !AAE, E=0: fan off, 1: fan on,
@AAFNE	Turn fan on or off E=0: fan off, 1: fan on

Command	Description
@AAFNPi	Read the ith fan off period in a day, i = 0 to 5 response !AAbhbmehem, bh: beginning hour, bm: beginning minute, eh: ending hour, em: ending minute.
@AAFNPibhbmehem	Set the ith fan off period in a day, i = 0 to 5, bh: beginning hour, 0 to 23, bm: beginning minute, 0 to 59, eh: ending hour, 0 to 23, em: ending minute, 0 to 59. The beginning hour/minute should be earlier than the ending hour/minute. Otherwise, the setting is ignored. If all of the six period settings are invalid, then the fan is controlled by the @AAFNE command.
@AAHI(data)CN	Set high alarm limit of an AI channel, N = 0 for CO, 1 for CO_2, 2 for PM2.5, 3 for relative humidity in 0.01%, 4 for temperature in 0.01˚C, 5 for temperature in 0.01˚F, 6 for dew point temperature in 0.01˚C, 7 for dew point temperature in 0.01˚F, 8 for PM1.0, 9 for PM10, A for particle count 0.3 - 0.5um, B for particle count 0.5 - 1.0um, C for particle count 1.0 - 2.5um, D for particle count 2.5 - 5.0um, E for particle count 5.0 - 7.5um, F for particle count 7.5 - 10um
@AAHO	Read humidity offset
@AAHO(data)	Set humidity offset, data in format of -100.00 ~ +100.00
@AALO(data)CN	Set low alarm limit of an AI channel, N = 3 for relative humidity in 0.01%, 4 for temperature in 0.01˚C, 5 for temperature in 0.01˚F, 6 for dew point temperature in 0.01˚C, 7 for dew point temperature in 0.01˚F
@AAPO	Read PM2.5 offset
@AAPO(data)	Set PM2.5 offset, data in format of -00100. ~ +00100.
@AAP1O	Read PM1.0 offset
@AAP1O(data)	Set PM1.0 offset, data in format of -00100. ~ +00100.
@AAP10O	Read PM10 offset
@AAP10O(data)	Set PM10 offset, data in format of -00100. ~ +00100.
@AARACN	Read AI alarm enabled/disabled status of a channel response !AAN, N->0: disabled, 1: momentary, 2: latched
@AARAO	Read AI alarm status response !AAHHHHLLLL
@AARH	Read all high latched values of analog input channels
@AARHN	Read channel high latched value of analog input
@AARHCN	Read high alarm limit of an AI channel
@AARL	Read all low latched values of analog input channels
@AARLN	Read channel low latched value of analog input
@AARLCN	Read low alarm limit of an AI channel
@AART	Read RTC data
@AARTYYMMDDHHMMSS	Set RTC data
@AATO	Read temperature offset in 0.01˚C
@AATO(data)	Set temperature offset in 0.01˚C, -100.00 ~ +100.00

Command	Description
~**	clear host watchdog timeout counter
~AA0	read host watchdog status
~AA1	clear host watchdog timeout status
~AA2	read host watchdog enable/disable status and timeout value
~AA3ETT	enable/disable host watchdog and set timeout value E-> 0: disable host watchdog, 1: enable host watchdog TT: host watchdog timeout in 0.1s in hex format
~AA4	read DO power on and safe value
~AA50P0S	set DO power on and safe value P-> 0 ~ F: power on value in hex format S-> 0 ~ F: safe value in hex format
~AARD	read response delay time in ms in hex format
~AARDVV	set response delay time in ms, VV in hex format, 00 - 1E

Baud Rate Setting (CC)

Bits 5:0

Baud rate, 0x03 ~ 0x0A

Code	0x03	0x04	0x05	0x06
Baud	1200	2400	4800	9600
Code	0x07	0x08	0x09	0x0A
Baud	19200	38400	57600	115200

Bits 7:6

00: no parity, 1 stop bit
01: no parity, 2 stop bits
10: even parity, 1 stop bit
11: odd parity, 1 stop bit

Data Format Setting (FF)

Bit 6

0: checksum disabled
1: checksum enabled

A-5. DL-1038 DCON Command Sets

Command	Description
$AAF	read firmware version
$AAI	read INIT status response: !AA0 -> INIT short to GND !AA1 -> else
$AAM	read module name
$AAP	Read Modbus RTU/DCON protocol response: !AA0 -> DCON !AA1 -> Modbus RTU
$AAPN	Set Modbus RTU/DCON protocol N-> 0: DCON, 1: Modbus RTU
$AA2	read configuration
$AA5	read reset status !AA1 first after power on, !AA0 others
#AA	Read All Analog Inputs response > (CO in 1 ppm) (CO_2 in 1 ppm) (TVOC in 1 ppb) (PM2.5 in 1 ug/m^3) (relative humidity in 0.01%)(temperature in 0.01˚C)(temperature in 0.01˚F) (dew point temperature in 0.01˚C)(dew point temperature in 0.01˚F) (PM1.0 in 1 ug/m^3) (PM10 in 1 ug/m^3) (particle count 0.3 - 0.5um) (particle count 0.5 - 1.0um) (particle count 1.0 - 2.5um) (particle count 2.5 - 5.0um) (particle count 5.0 - 7.5um) (particle count 7.5 - 10um)
#AANN	Read Channel Analog Input N = 00 for CO in 1 ppm, 01 for CO_2 in 1 ppm, 02 for TVOC in 1 ppb, 03for PM2.5 in 1 ug/m^3, 04 for relative humidity in 0.01%, 05 for temperature in 0.01˚C, 06 for temperature in 0.01˚F, 07 for dew point temperature in 0.01˚C, 08 for dew point temperature in 0.01˚F, 09 for PM1.0 in 1 ug/m^3, 0A for PM10 in 1 ug/m^3, 0B for particle count 0.3 - 0.5um, 0C for particle count 0.5 - 1.0um, 0D for particle count 1.0 - 2.5um, 0E for particle count 2.5 - 5.0um, 0F for particle count 5.0 - 7.5um, 10 for particle count 7.5 - 10um
%AANNTTCCFF	set configuration, NN: new address, TT = 00, CC: new baud rate FF: data format
@AAABC	Read status of the automatic baseline correction response !AAN, N=0: disabled, 1: enabled
@AAABCN	Set the automatic baseline correction N->0: disabled, 1: enabled
@AABA	Read beep on alarm time response !AAHH, HH in hex, 0: disabled, 1 ~ 250: beep on alarm time in seconds, 251: beep on alarm continuously

Command	Description
@AABAHH	Set beep on alarm HH in hex, 0: disabled, 1 ~ 250: beep on alarm time in seconds, 251: beep on alarm continuously
@AABE	Read enable/disable beep on alarm response !AAHHHHHH, HHHHHH in hex, bit 0 for channel 0, bit 1 for channel 1, etc, for each bit, 0: disabled, 1: enabled
@AABEHHHHHH	Enable/disable beep on alarm HHHHHH in hex, , bit 0 for channel 0, bit 1 for channel 1, etc, for each bit, 0: disabled, 1: enabled
@AACH	Clear all high latched analog inputs to the current values
@AACHNN	Clear channel high latched analog input to the current value, N = 00 for CO1, 01 for CO_2, 02 for TVOC, 03 for PM2.5, 04 for relative humidity in 0.01%, 05 for temperature in 0.01˚C, 06 for temperature in 0.01˚F, 07 for dew point temperature in 0.01˚C, 08 for dew point temperature in 0.01˚F, 09 for PM1.0, 0A for PM10, 0B for particle count 0.3 - 0.5um, 0C for particle count 0.5 - 1.0um, 0D for particle count 1.0 - 2.5um, 0E for particle count 2.5 - 5.0um, 0F for particle count 5.0 - 7.5um, 10 for particle count 7.5 - 10um
@AACHCNN	Clear high latched alarm of a channel, N = 00 for CO, 01 for CO_2, 02 for TVOC, 03 for PM2.5, 04 for relative humidity in 0.01%, 05 for temperature in 0.01˚C, 06 for temperature in 0.01˚F, 07 for dew point temperature in 0.01˚C, 08 for dew point temperature in 0.01˚F, 09 for PM1.0, 0A for PM10, 0B for particle count 0.3 - 0.5um, 0C for particle count 0.5 - 1.0um, 0D for particle count 1.0 - 2.5um, 0E for particle count 2.5 - 5.0um, 0F for particle count 5.0 - 7.5um, 10 for particle count 7.5 - 10um
@AACL	Clear all low latched analog inputs to the current values
@AACLNN	Clear channel low latched analog input to the current value, N = 00 for CO, 01 for CO_2, 02 for TVOC, 03 for PM2.5, 04 for relative humidity in 0.01%, 05 for temperature in 0.01˚C, 06 for temperature in 0.01˚F, 07 for dew point temperature in 0.01˚C, 08 for dew point temperature in 0.01˚F, 09 for PM1.0, 0A for PM10, 0B for particle count 0.3 - 0.5um, 0C for particle count 0.5 - 1.0um, 0D for particle count 1.0 - 2.5um, 0E for particle count 2.5 - 5.0um, 0F for particle count 5.0 - 7.5um, 10 for particle count 7.5 - 10um
@AACLCNN	Clear low latched alarm of a channel, N = 04 for relative humidity, 05 for temperature in 0.01˚C, 06 for temperature in 0.01˚F, 07 for dew point temperature in 0.01˚C, 08 for dew point temperature in 0.01˚F
@AADACNN	Disable AI alarm of a channel, N = 00 for CO, 01 for CO_2, 02 for TVOC, 03 for PM2.5, 04 for relative humidity in 0.01%, 05 for temperature in 0.01˚C, 06 for temperature in 0.01˚F, 07 for dew point temperature in 0.01˚C, 08 for dew point temperature in 0.01˚F, 09 for PM1.0, 0A for PM10, 0B for particle count 0.3 - 0.5um, 0C for particle count 0.5 - 1.0um, 0D for particle count 1.0 - 2.5um, 0E for particle count 2.5 - 5.0um, 0F for particle count 5.0 - 7.5um, 10 for particle count 7.5 - 10um

Command	Description
@AADI	read DO response !AA00O00, O: 0 ~ F, DO value in hex format
@AADLB	Read the beginning of the period setting of the data logger for period logging mode response !AAyyyymmddhhmmss,
@AADLByyyymmddhhmmss	Set the beginning of the period setting of the data logger for period logging mode yyyy: year, 2000 to 2199, mm: month, 01 to 12, dd: date, 01 to 31, hh: hour, 0 to 24, mm: minute, 0 to 59, ss: second, 0 to 59
@AADLC	Read the data logger command response !AAh, 0: stop, 1: run, 2: run in period mode
@AADLCh	Set the data logger command, h->0: stop, 1: run, 2: run in period mode
@AADLE	Read the ending of the period setting of the data logger for period logging mode response !AAyyyymmddhhmmss
@AADLEyyyymmddhhmmss	Set the ending of the period setting of the data logger for period logging mode yyyy: year, 2000 to 2199, mm: month, 01 to 12, dd: date, 01 to 31, hh: hour, 0 to 24, mm: minute, 0 to 59, ss: second, 0 to 59
@AADLN	Read number of log records in the data logger response !AAhhhhhhhh, hhhhhhhh in hex format
@AADLO	Read the overwriting mode when data logger is full response !AAh, 0: stop logging when full, 1: overwrite
@AADLOh	Set the overwriting mode when data logger is full h->0: stop logging when full, 1: overwrite
@AADLP	Read the samplig period setting of the data logger response !AAhhmmss, hh: hour, 0 to 24, mm: minute, 0 to 59, ss: second, 0 to 59
@AADLPhhmmss	Set the samplig period setting of the data logger
@AADLS	Read logging status of the data logger response !AAhh, hh in hex format, 00: stopped, 01: running, others: error
@AADO0V	set DO, V-> 0 ~ F DO value in hex format, bit 0 for DO0, bit 1 for DO1, etc

Command	Description
@AAEATCNN	Enable AI alarm of a channel, N = 00 for CO, 01 for CO_2, 02 for TVOC, 03for PM2.5, 04 for relative humidity in 0.01%, 05 for temperature in 0.01 ˚C, 06 for temperature in 0.01˚F, 07 for dew point temperature in 0.01˚C, 08 for dew point temperature in 0.01˚F, 09 for PM1.0, 0A for PM10, 0B for particle count 0.3 - 0.5um, 0C for particle count 0.5 - 1.0um, 0D for particle count 1.0 - 2.5um, 0E for particle count 2.5 - 5.0um, 0F for particle count 5.0 - 7.5um, 10 for particle count 7.5 - 10um T->M: momentary alarm, L: latched alarm
@AAFN	Read fan status Response !AAE, E=0: fan off, 1: fan on,
@AAFNE	Turn fan on or off E=0: fan off, 1: fan on
@AAFNPi	Read the ith fan off period in a day, i = 0 to 5 response !AAbhbmehem, bh: beginning hour, bm: beginning minute, eh: ending hour, em: ending minute.
@AAFNPibhbmeh em	Set the ith fan off period in a day, i = 0 to 5, bh: beginning hour, 0 to 23, bm: beginning minute, 0 to 59, eh: ending hour, 0 to 23, em: ending minute, 0 to 59. The beginning hour/minute should be earlier than the ending hour/minute. Otherwise, the setting is ignored. If all of the six period settings are invalid, then the fan is controlled by the @AAFNE command.
@AAHI(data)CNN	Set high alarm limit of an AI channel, N = 00 for CO, 01 for CO_2, 02 for TVOC, 03 for PM2.5, 04 for relative humidity in 0.01%, 05 for temperature in 0.01˚C, 06 for temperature in 0.01˚F, 07 for dew point temperature in 0.01˚C, 08 for dew point temperature in 0.01˚F, 09 for PM1.0, 0A for PM10, 0B for particle count 0.3 - 0.5um, 0C for particle count 0.5 - 1.0um, 0D for particle count 1.0 - 2.5um, 0E for particle count 2.5 - 5.0um, 0F for particle count 5.0 - 7.5um, 10 for particle count 7.5 - 10um
@AAHO	Read humidity offset
@AAHO(data)	Set humidity offset, data in format of -100.00 ~ +100.00
@AALO(data)CN N	Set low alarm limit of an AI channel, N = 04 for relative humidity in 0.01%, 05 for temperature in 0.01˚C, 06 for temperature in 0.01˚F, 07 for dew point temperature in 0.01˚C, 08 for dew point temperature in 0.01˚F
@AAPO	Read PM2.5 offset
@AAPO(data)	Set PM2.5 offset, data in format of -00100. ~ +00100.
@AAP1O	Read PM1.0 offset
@AAP1O(data)	Set PM1.0 offset, data in format of -00100. ~ +00100.
@AAP10O	Read PM10 offset
@AAP10O(data)	Set PM10 offset, data in format of -00100. ~ +00100.
@AARACNN	Read AI alarm enabled/disabled status of a channel response !AAN, N->0: disabled, 1: momentary, 2: latched
@AARAO	Read AI alarm status response !AAHHHHHHLLLLLL

Command	Description
@AARH	Read all high latched values of analog input channels
@AARHNN	Read channel high latched value of analog input
@AARHCNN	Read high alarm limit of an AI channel
@AARL	Read all low latched values of analog input channels
@AARLNN	Read channel low latched value of analog input
@AARLCNN	Read low alarm limit of an AI channel
@AART	Read RTC data
@AARTYYMMDDHHMMSS	Set RTC data
@AATO	Read temperature offset in 0.01˚C
@AATO(data)	Set temperature offset in 0.01˚C, -100.00 ~ +100.00
@AAVO	Read TVOC offset
@AAVO(data)	Set TVOC offset, data in format of -00100. ~ +00100.
~**	clear host watchdog timeout counter
~AA0	read host watchdog status
~AA1	clear host watchdog timeout status
~AA2	read host watchdog enable/disable status and timeout value
~AA3ETT	enable/disable host watchdog and set timeout value E-> 0: disable host watchdog, 1: enable host watchdog TT: host watchdog timeout in 0.1s in hex format
~AA4	read DO power on and safe value
~AA50P0S	set DO power on and safe value P-> 0 ~ F: power on value in hex format S-> 0 ~ F: safe value in hex format
~AARD	read response delay time in ms in hex format
~AARDVV	set response delay time in ms, VV in hex format, 00 - 1E

Baud Rate Setting (CC)

Bits 5:0

Baud rate, 0x03 ~ 0x0A

Code	0x03	0x04	0x05	0x06
Baud	1200	2400	4800	9600
Code	0x07	0x08	0x09	0x0A
Baud	19200	38400	57600	115200

Bits 7:6

00: no parity, 1 stop bit

01: no parity, 2 stop bits

10: even parity, 1 stop bit

11: odd parity, 1 stop bit

Data Format Setting (FF)

Bit 6

0: checksum disabled

1: checksum enabled

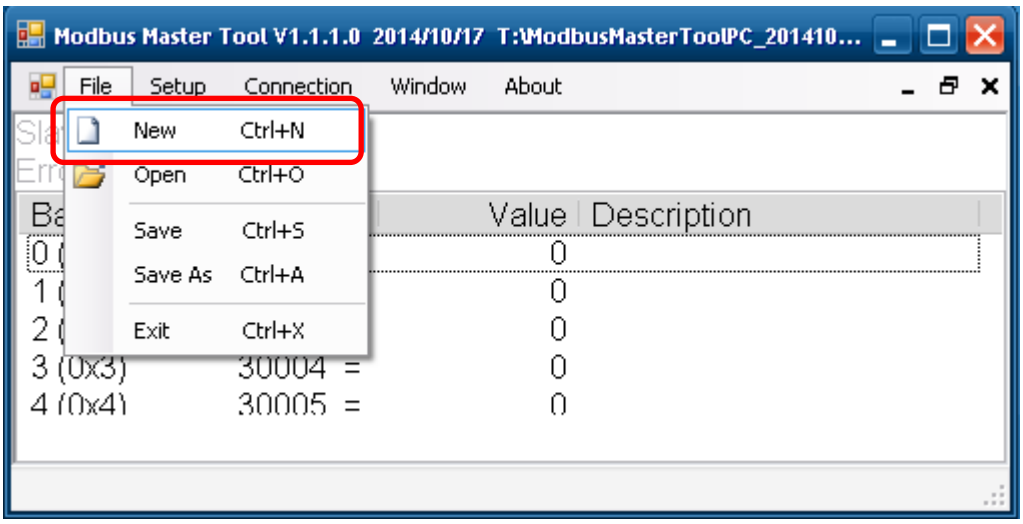
Appendix B: ModbusMasterToolPC

ModbusMasterToolPC is a free, easy-to-use tool for Modbus communication and diagnosing the wiring.
Download and install the ModbusMasterToolPC

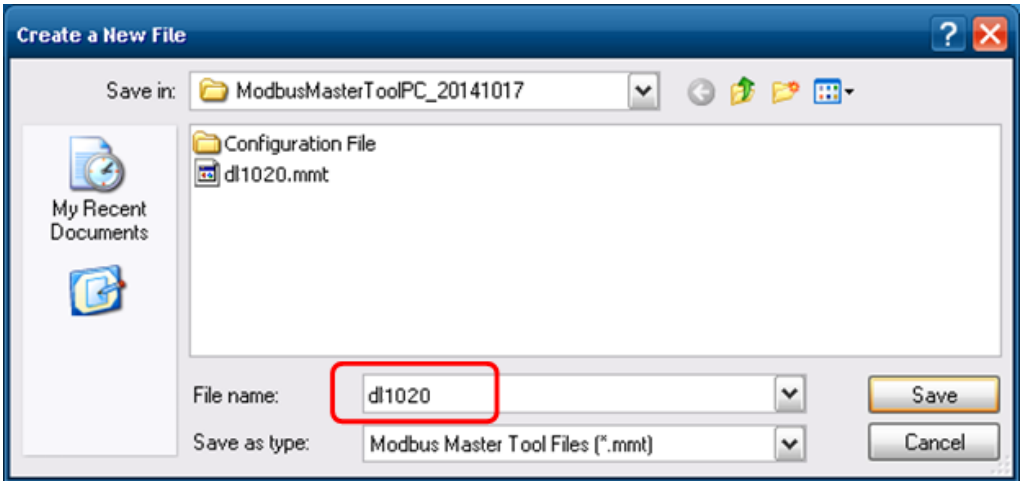
http://ftp.icpdas.com/pub/cd/usbcd/napdos/iiot/utility/modbusmastertoolpc/

This section intends to guide the steps for creating the Modbus communication with DL-1000 logger.

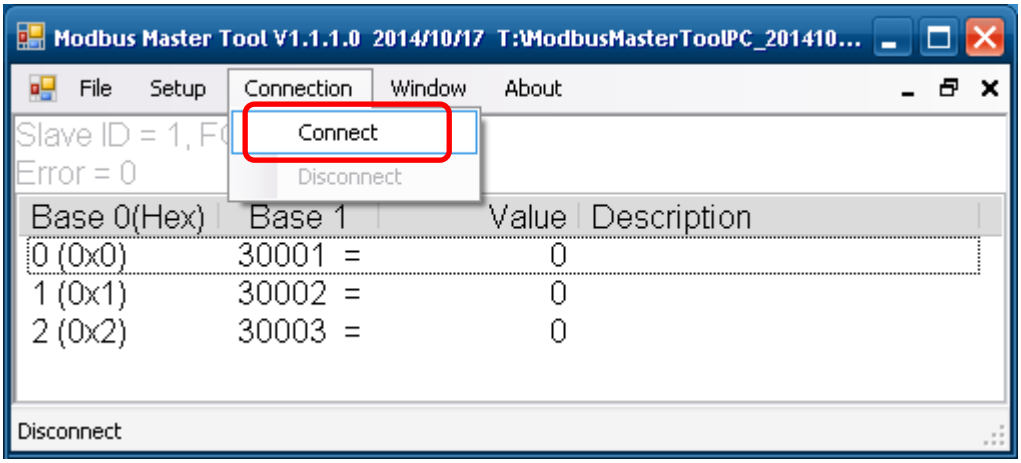
1. Launch the ModbusMasterToolPC.exe.
2. Select ***New*** in the File menu.



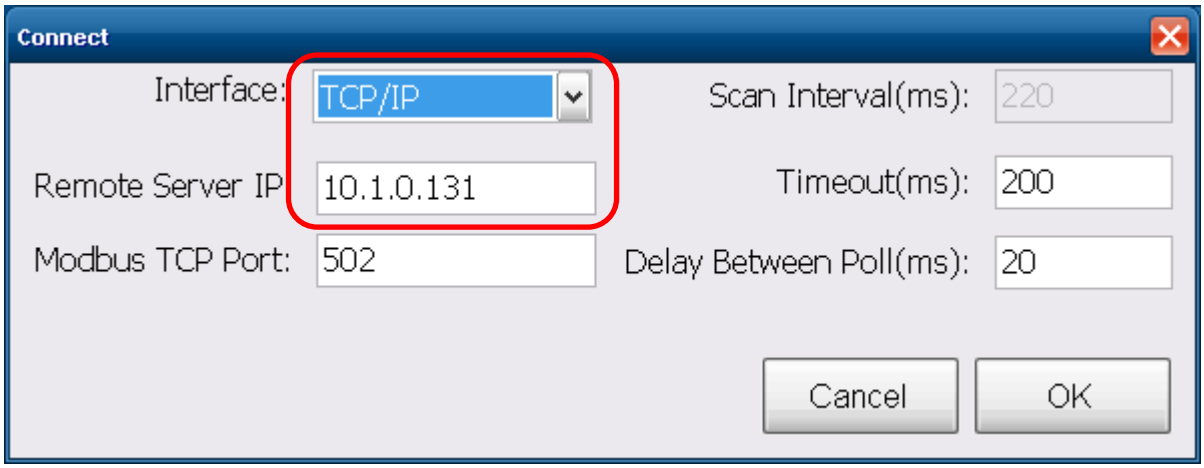
3. Input the file name and click on the ***Save*** button.



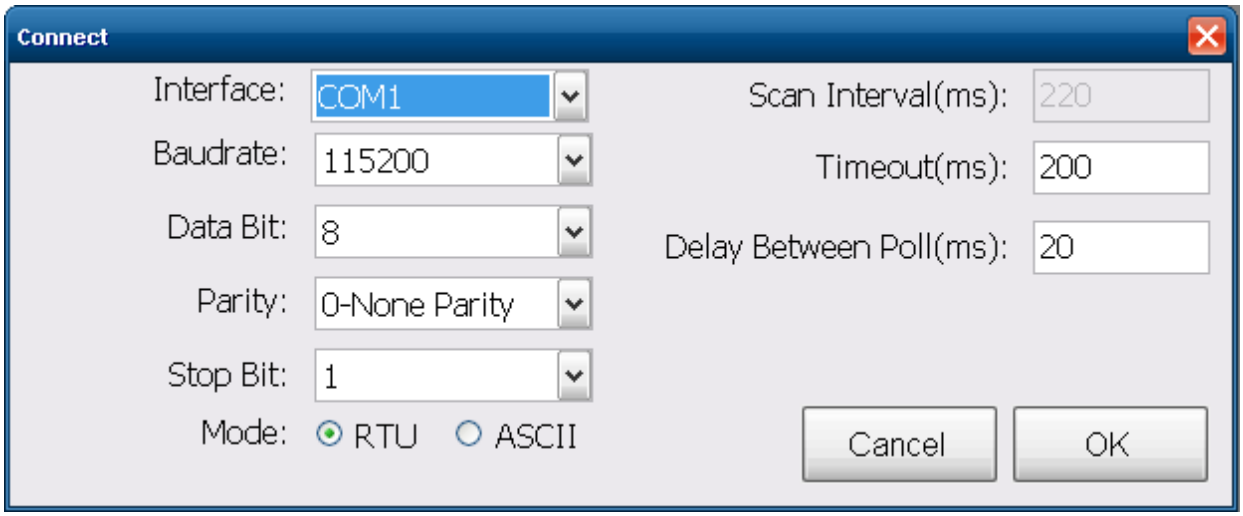
4. Select ***Connect*** in the *Connection* menu.



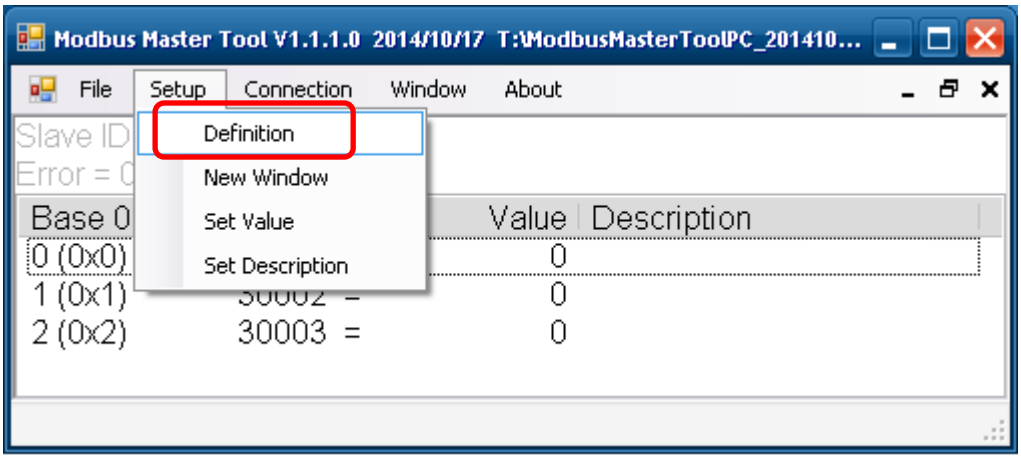
5. Select the communication interface. When using ***TCP/IP*** as the interface, input the IP for your logger and click on the ***OK*** button.



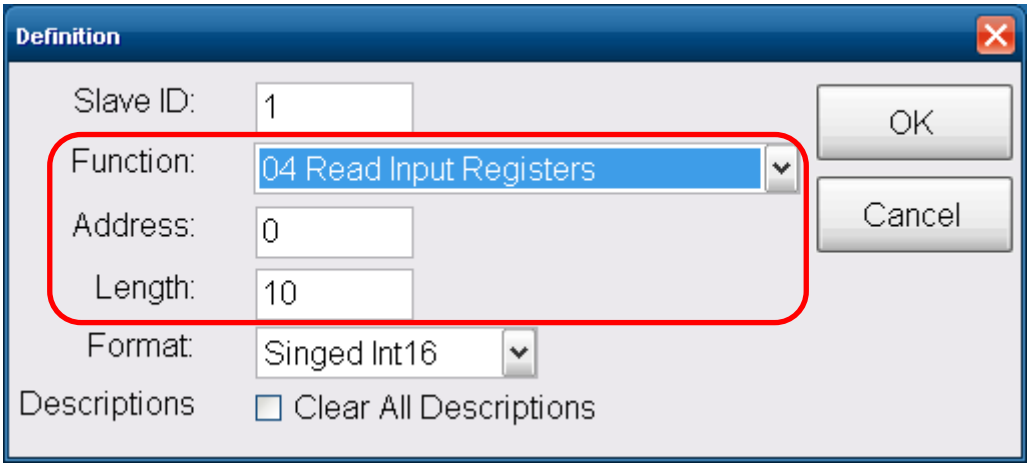
When using RS-485 as the interface, select the COM port, check the RTU mode and click on the ***OK*** button.



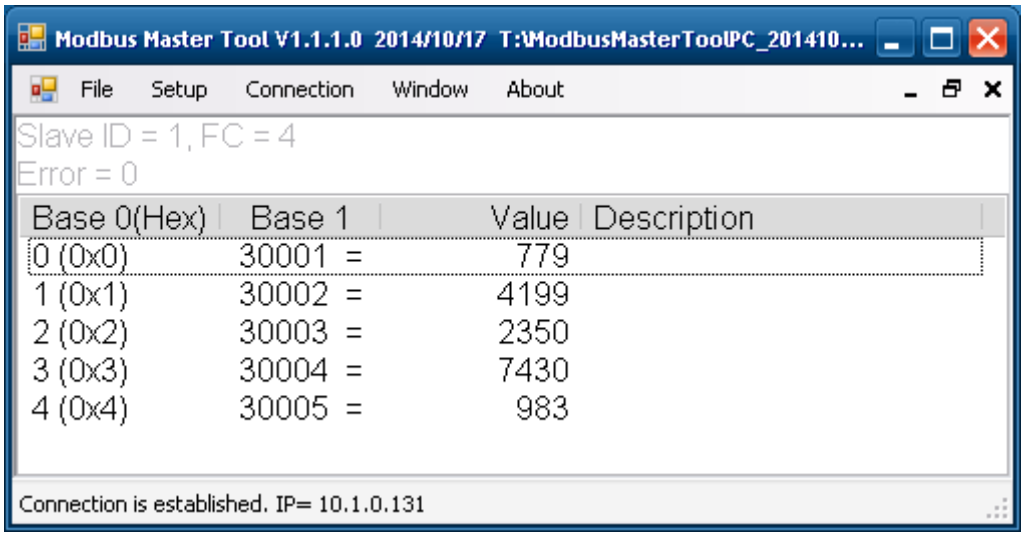
6. Select ***Definition*** in the *Setup* menu.



7. Select the Modbus function code, input the start address and length, and click on the ***OK*** button.

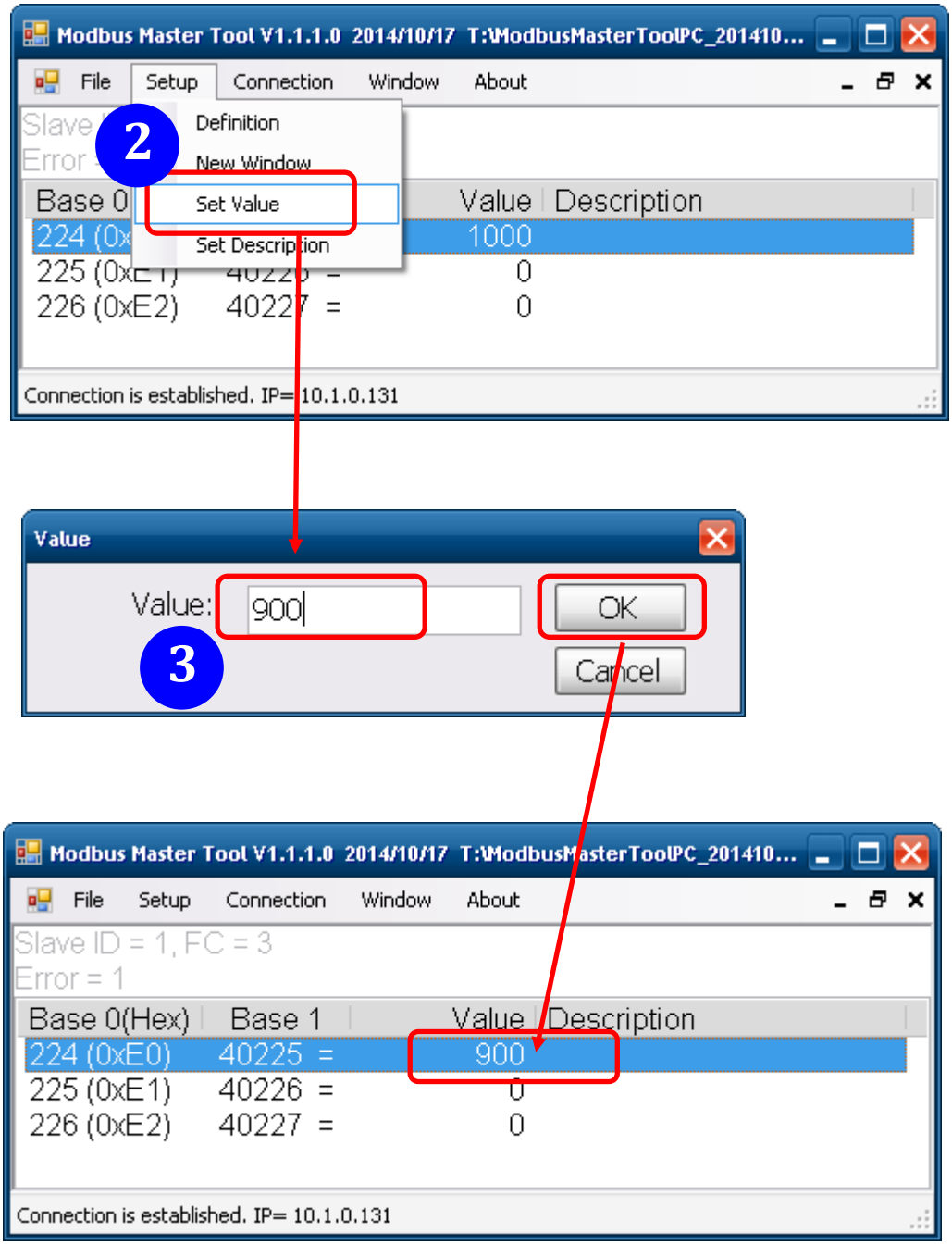


8. Read data.



9. Write data to Holding Register or Coil Status

1. Highlight the Modbus address in the Holding Register or Coil Status list
2. Select ***Set Value*** in the *Setup* menu.
3. Input the data in the Value box and click on the ***OK*** button



Appendix C: Modbus Address Table

C-1. DL-1020 Modbus Address Mappings (Base 1)

Address	Description	Attribute
30001 ~ 30014 40001 ~ 40014	Analog input value of channel 0 to 13. channel 0: PM2.5 in 1ug/m^3, channel 1: relative humidity in 0.01%, channel 2: temperature in 0.01˚C, channel 3:temperature in 0.01˚F, channel 4: dew point temperature in 0.01˚C, channel 5: dew point temperature in 0.01˚F, channel 6: PM1.0 in 1ug/m^3, channel 7: PM10 in 1ug/m^3, channel 8: particle count (0.3 - 0.5um), channel 9: particle count (0.5 - 1.0um), channel 10: particle count (1.0 - 2.5um), channel 11: particle count (2.5 - 5.0um), channel 12: particle count (5.0 - 7.5um), channel 13: particle count (7.5 - 10.0um)	R
40225 ~ 40238	High alarm limit of channel 0 to 13, channel 0: PM2.5 in 1ug/m^3, channel 1: relative humidity in 0.01%, channel 2: temperature in 0.01˚C, channel 3:temperature in 0.01˚F, channel 4: dew point temperature in 0.01˚C, channel 5: dew point temperature in 0.01˚F, channel 6: PM1.0 in 1ug/m^3, channel 7: PM10 in 1ug/m^3, channel 8: particle count (0.3 - 0.5um), channel 9: particle count (0.5 - 1. (2.5 - 5.0um), channel 12: particle count (5.0 - 7.5um), channel 13: particle count (7.5 - 10.0um)0um), channel 10: particle count (1.0 - 2.5um), channel 11: particle count	R/W
40242 ~ 40246	Low alarm limit of channel 1 to 5, channel 1: relative humidity in 0.01%, channel 2: temperature in 0.01˚C, channel 3:temperature in 0.01˚F, channel 4: dew point temperature in 0.01˚C, channel 5: dew point temperature in 0.01˚F	R/W

Address	Description	Attribute
40272	Modbus NetID Only for Modbus TCP protocol	R/W
30301 40301	Number of the digital input channels Only for Modbus TCP protocol	R
30311 40311	Number of the digital output channels Only for Modbus TCP protocol	R
30321 40321	Number of the analog input channels Only for Modbus TCP protocol	R
30331 40331	Number of the analog output channels Only for Modbus TCP protocol	R
30352 40352	Firmware version in hex format Only for Modbus TCP protocol	R
40449	PM2.5 offset in 1 ug/m^3	R/W
40450	Relative humidity offset in 0.01%	R/W
40451	Temperature offset in 0.01˚C	R/W
40455	PM1.0 offset in 1 ug/m^3	R/W
40456	PM10 offset in 1 ug/m^3	R/W
40481	Firmware version (low word)	R
40482	Firmware version (high word)	R
40483	Module name (low word), 0x1020	R
40484	Module name (high word), 0x444C	R
40485	RS-485 module address, 1 to 247 Only for Modbus RTU protocol	R/W
40486	RS-485 baud rate and parity settings Bits 5:0 Baud rate, valid range: 3 ~ 10 Bits 7:6 00: no parity, 1 stop bit 01: no parity, 2 stop bit 10: even parity, 1 stop bit 11: odd parity , 1 stop bit Only for Modbus RTU protocol	R/W
40488	RS-485 response delay time in ms, valid range, 0 ~ 30 Only for Modbus RTU protocol	R/W

Address	Description	Attribute
40489	RS-485 host watchdog timeout value, 0 ~ 255, in 0.1s Only for Modbus RTU protocol	R/W
40492	RS-485 host watchdog timeout count, write 0 to clear Only for Modbus RTU protocol	R/W
40497	Beep on alarm, 0: disable, 1 to 250: beep on alarm time in seconds, 251: beep on alarm continuously	R/W
30513 ~ 30526 40513 ~ 40526	High latched analog input value of channel 0 to 13	R
30545 ~ 30558 40545 ~ 40558	Low latched analog input value of channel 0 to 13	R
30566 40566	Module reset status, 1: power-on, 2: watchdog, 3: software reset command Only for Modbus TCP protocol	R
40568	Ethernet host watchdog timeout value, 5 to 65535, in second, 0 to disable. Only for Modbus TCP protocol	R/W
30569 40569	Ethernet host watchdog timeout count. Only for Modbus TCP protocol	R
30570 40570	Module name, 0x1020 Only for Modbus TCP protocol	R
40564	TCP disconnection timeout value, 5 to 65535, in second, 0 to disable. Only for Modbus TCP protocol	R/W
40565	Module reset timeout value, 30 to 65535, in second, 0 to disable. Only for Modbus TCP protocol	R/W

Address	Description	Attribute
40865	RTC year, 2000 to 2159	R/W
40866	RTC month, 1 to 12	R/W
40867	RTC date, 1 to 31	R/W
40868	RTC hour, 0 to 23	R/W
40869	RTC minute, 0 to 59	R/W
40870	RTC second, 0 to 59	R/W
40871	Total number of log records, low word	R
40872	Total number of log records, high word	R
40873	The starting record to read log data, low word	R/W
40874	The starting record to read log data, high word	R/W
40875	The status of the data logging, 0: stopped, 1: running	R
40876	The data logger command, 0: stop, 1: run, 2: run in period mode	R/W
40877	Continue writing when data logger is full, 0: no, 1: yes	R/W
40878	Hour of the data logger sampling period, 0 ~ 24	R/W
40879	Minute of the data logger sampling period, 0 ~ 59	R/W
40880	Second of the data logger sampling period, 0 ~ 59	R/W
40881	Starting year when logging in period mode, 2000 ~ 2159	R/W
40882	Starting month when logging in period mode, 1 ~ 12	R/W
40883	Starting date when logging in period mode, 1 ~ 31	R/W
40884	Starting hour when logging in period mode, 0 ~ 23	R/W
40885	Starting minute when logging in period mode, 0 ~ 59	R/W
40886	Starting second when logging in period mode, 0 ~ 59	R/W
40887	Ending year when logging in period mode, 2000 ~ 2159	R/W
40888	Ending month when logging in period mode, 1 ~ 12	R/W
40889	Ending date when logging in period mode, 1 ~ 31	R/W
40890	Ending hour when logging in period mode, 0 ~ 23	R/W

Address	Description	Attribute
40891	Ending minute when logging in period mode, 0 ~ 59	R/W
40892	Ending second when logging in period mode, 0 ~ 59	R/W
40929	The first fan off period in a day, beginning hour, 0 ~ 23	R/W
40930	The first fan off period in a day, beginning minute, 0 ~ 59	R/W
40931	The first fan off period in a day, ending hour, 0 ~ 23	R/W
40932	The first fan off period in a day, ending minute, 0 ~ 59	R/W
40933 ~ 40936	The second fan off period in a day	R/W
40937 ~ 40940	The third fan off period in a day	R/W
40941 ~ 40944	The fourth fan off period in a day	R/W
40945 ~ 40948	The fifth fan off period in a day	R/W
40949 ~ 40952	The sixth fan off period in a day	R/W
00001 ~ 00004	Digital output value of channel 0 to 3	R/W
00129 ~ 00132	Safe value of digital output channel 0 to 3	R/W
00161 ~ 00164	Power on value of digital output channel 0 to 3	R/W
00227	Write 1 to reload default TCP settings Only for Modbus TCP protocol	W
00234	Write 1 to reboot module Only for Modbus TCP protocol	W
00257	RS-485 Protocol, 0: DCON, 1: Modbus RTU Only for Modbus RTU protocol	R/W

Address	Description	Attribute
00260	Modbus RTU host watchdog mode 0: same as I-7000 1: can use AO and DO command to clear host watchdog timeout status Only for Modbus RTU protocol	R/W
00261	RS-485 host watchdog mode, 1: enable, 0: disable. Only for Modbus RTU protocol	R/W
00262	Write 1 to play notification sound	W
00270	Host watch dog timeout status, write 1 to clear host watch dog timeout status Only for Modbus RTU protocol	R/W
00273	Reset status, 1: first read after powered on, 0: not the first read after powered on Only for Modbus RTU protocol	R
00279	Fan control, 0: off, 1: on	R/W
00280	Write 1 to clear all high latched analog input values	W
00281	Write 1 to clear all low latched analog input values	W
00290 ~ 00294	Low alarm status of channel 1 to 5. Write 1 to clear low latched alarm.	R/W
00305 ~ 00318	High alarm status of channel 0 to 13. Write 1 to clear high latched alarm.	R/W
00321 ~ 00334	Enable/disable alarm of channel 0 to 13	R/W
00337 ~ 00350	Alarm type, momentary or latched, of channel 0 to 13	R/W
00385 ~ 00398	Write 1 to clear high latched analog input value of channel 0 to 13	W
00417 ~ 00430	Write 1 to clear low latched analog input value of channel 0 to 13	W
00449 ~ 00462	Enable/disable beep on alarm for channel 0 to 13	R/W

C-2. DL-1021 Modbus Address Mappings (Base 1)

Address	Description	Attribute
30001 ~ 30015 40001 ~ 40015	Analog input value of channel 0 to 14. channel 0: CO in 1ppm, channel 1: PM2.5 in 1ug/m^3, channel 2: relative humidity in 0.01%, channel 3: temperature in 0.01˚C, channel 4:temperature in 0.01˚F, channel 5: dew point temperature in 0.01˚C, channel 6: dew point temperature in 0.01˚F, channel 7: PM1.0 in 1ug/m^3, channel 8: PM10 in 1ug/m^3, channel 9: particle count (0.3 - 0.5um), channel 10: particle count (0.5 - 1.0um), channel 11: particle count (1.0 - 2.5um), channel 12: particle count (2.5 - 5.0um), channel 13: particle count (5.0 - 7.5um), channel 14: particle count (7.5 - 10.0um)	R
40225 ~ 40239	High alarm limit of channel 0 to 14, channel 0: CO in 1ppm, channel 1: PM2.5 in 1ug/m^3, channel 2: relative humidity in 0.01%, channel 3: temperature in 0.01˚C, channel 4:temperature in 0.01˚F, channel 5: dew point temperature in 0.01˚C, channel 6: dew point temperature in 0.01˚F, channel 7: PM1.0 in 1ug/m^3, channel 8: PM10 in 1ug/m^3, channel 9: particle count (0.3 - 0.5um), channel 10: particle count (0.5 - 1.0um), channel 11: particle count (1.0 - 2.5um), channel 12: particle count (2.5 - 5.0um), channel 13: particle count (5.0 - 7.5um), channel 14: particle count (7.5 - 10.0um)	R/W
40243 ~ 40247	Low alarm limit of channel 2 to 6, channel 2: relative humidity in 0.01%, channel 3: temperature in 0.01˚C, channel 4:temperature in 0.01˚F, channel 5: dew point temperature in 0.01˚C, channel 6: dew point temperature in 0.01˚F	R/W

Address	Description	Attribute
40272	Modbus NetID Only for Modbus TCP protocol	R/W
30301 40301	Number of the digital input channels Only for Modbus TCP protocol	R
30311 40311	Number of the digital output channels Only for Modbus TCP protocol	R
30321 40321	Number of the analog input channels Only for Modbus TCP protocol	R
30331 40331	Number of the analog output channels Only for Modbus TCP protocol	R
30352 40352	Firmware version in hex format Only for Modbus TCP protocol	R
40449	CO offset in 1ppm	R/W
40450	PM2.5 offset in 1 ug/m^3	R/W
40451	Relative humidity offset in 0.01%	R/W
40452	Temperature offset in 0.01˚C	R/W
40456	PM1.0 offset in 1 ug/m^3	R/W
40457	PM10 offset in 1 ug/m^3	R/W
40481	Firmware version (low word)	R
40482	Firmware version (high word)	R
40483	Module name (low word), 0x1021	R
40484	Module name (high word), 0x444C	R
40485	RS-485 module address, 1 to 247 Only for Modbus RTU protocol	R/W
40486	RS-485 baud rate and parity settings Bits 5:0 Baud rate, valid range: 3 ~ 10 Bits 7:6 00: no parity, 1 stop bit 01: no parity, 2 stop bit 10: even parity, 1 stop bit 11: odd parity , 1 stop bit Only for Modbus RTU protocol	R/W
40488	RS-485 response delay time in ms, valid range, 0 ~ 30 Only for Modbus RTU protocol	R/W

Address	Description	Attribute
40489	RS-485 host watchdog timeout value, 0 ~ 255, in 0.1s Only for Modbus RTU protocol	R/W
40492	RS-485 host watchdog timeout count, write 0 to clear Only for Modbus RTU protocol	R/W
40497	Beep on alarm, 0: disable, 1 to 250: beep on alarm time in seconds, 251: beep on alarm continuously	R/W
30513 ~ 30527 40513 ~ 40527	High latched analog input value of channel 0 to 14	R
30545 ~ 30559 40545 ~ 40559	Low latched analog input value of channel 0 to 14	R
30566 40566	Module reset status, 1: power-on, 2: watchdog, 3: software reset command Only for Modbus TCP protocol	R
40568	Ethernet host watchdog timeout value, 5 to 65535, in second, 0 to disable. Only for Modbus TCP protocol	R/W
30569 40569	Ethernet host watchdog timeout count. Only for Modbus TCP protocol	R
30570 40570	Module name, 0x1021 Only for Modbus TCP protocol	R
40564	TCP disconnection timeout value, 5 to 65535, in second, 0 to disable. Only for Modbus TCP protocol	R/W
40565	Module reset timeout value, 30 to 65535, in second, 0 to disable. Only for Modbus TCP protocol	R/W

Address	Description	Attribute
40865	RTC year, 2000 to 2159	R/W
40866	RTC month, 1 to 12	R/W
40867	RTC date, 1 to 31	R/W
40868	RTC hour, 0 to 23	R/W
40869	RTC minute, 0 to 59	R/W
40870	RTC second, 0 to 59	R/W
40871	Total number of log records, low word	R
40872	Total number of log records, high word	R
40873	The starting record to read log data, low word	R/W
40874	The starting record to read log data, high word	R/W
40875	The status of the data logging, 0: stopped, 1: running	R
40876	The data logger command, 0: stop, 1: run, 2: run in period mode	R/W
40877	Continue writing when data logger is full, 0: no, 1: yes	R/W
40878	Hour of the data logger sampling period, 0 ~ 24	R/W
40879	Minute of the data logger sampling period, 0 ~ 59	R/W
40880	Second of the data logger sampling period, 0 ~ 59	R/W
40881	Starting year when logging in period mode, 2000 ~ 2159	R/W
40882	Starting month when logging in period mode, 1 ~ 12	R/W
40883	Starting date when logging in period mode, 1 ~ 31	R/W
40884	Starting hour when logging in period mode, 0 ~ 23	R/W
40885	Starting minute when logging in period mode, 0 ~ 59	R/W
40886	Starting second when logging in period mode, 0 ~ 59	R/W
40887	Ending year when logging in period mode, 2000 ~ 2159	R/W
40888	Ending month when logging in period mode, 1 ~ 12	R/W
40889	Ending date when logging in period mode, 1 ~ 31	R/W
40890	Ending hour when logging in period mode, 0 ~ 23	R/W

Address	Description	Attribute
40891	Ending minute when logging in period mode, 0 ~ 59	R/W
40892	Ending second when logging in period mode, 0 ~ 59	R/W
40929	The first fan off period in a day, beginning hour, 0 ~ 23	R/W
40930	The first fan off period in a day, beginning minute, 0 ~ 59	R/W
40931	The first fan off period in a day, ending hour, 0 ~ 23	R/W
40932	The first fan off period in a day, ending minute, 0 ~ 59	R/W
40933 ~ 40936	The second fan off period in a day	R/W
40937 ~ 40940	The third fan off period in a day	R/W
40941 ~ 40944	The fourth fan off period in a day	R/W
40945 ~ 40948	The fifth fan off period in a day	R/W
40949 ~ 40952	The sixth fan off period in a day	R/W
00001 ~ 00004	Digital output value of channel 0 to 3	R/W
00129 ~ 00132	Safe value of digital output channel 0 to 3	R/W
00161 ~ 00164	Power on value of digital output channel 0 to 3	R/W
00227	Write 1 to reload default TCP settings Only for Modbus TCP protocol	W
00234	Write 1 to reboot module Only for Modbus TCP protocol	W
00257	RS-485 Protocol, 0: DCON, 1: Modbus RTU Only for Modbus RTU protocol	R/W

Address	Description	Attribute
00260	Modbus RTU host watchdog mode 0: same as I-7000 1: can use AO and DO command to clear host watchdog timeout status Only for Modbus RTU protocol	R/W
00261	RS-485 host watchdog mode, 1: enable, 0: disable. Only for Modbus RTU protocol	R/W
00262	Write 1 to play notification sound	W
00270	Host watch dog timeout status, write 1 to clear host watch dog timeout status Only for Modbus RTU protocol	R/W
00273	Reset status, 1: first read after powered on, 0: not the first read after powered on Only for Modbus RTU protocol	R
00279	Fan control, 0: off, 1: on	R/W
00280	Write 1 to clear all high latched analog input values	W
00281	Write 1 to clear all low latched analog input values	W
00291 ~ 00295	Low alarm status of channel 2 to 6. Write 1 to clear low latched alarm.	R/W
00305 ~ 00319	High alarm status of channel 0 to 14. Write 1 to clear high latched alarm.	R/W
00321 ~ 00335	Enable/disable alarm of channel 0 to 14	R/W
00337 ~ 00351	Alarm type, momentary or latched, of channel 0 to 14	R/W
00385 ~ 00399	Write 1 to clear high latched analog input value of channel 0 to 14	W
00417 ~ 00431	Write 1 to clear low latched analog input value of channel 0 to 14	W
00449 ~ 00463	Enable/disable beep on alarm for channel 0 to 14	R/W

C-3. DL-1022 Modbus Address Mappings (Base 1)

Address	Description	Attribute
30001 ~ 30015 40001 ~ 40015	Analog input value of channel 0 to 14. channel 0: CO_2 in 1ppm, channel 1: PM2.5 in 1ug/m^3, channel 2: relative humidity in 0.01%, channel 3: temperature in 0.01˚C, channel 4:temperature in 0.01˚F, channel 5: dew point temperature in 0.01˚C, channel 6: dew point temperature in 0.01˚F, channel 7: PM1.0 in 1ug/m^3, channel 8: PM10 in 1ug/m^3, channel 9: particle count (0.3 - 0.5um), channel 10: particle count (0.5 - 1.0um), channel 11: particle count (1.0 - 2.5um), channel 12: particle count (2.5 - 5.0um), channel 13: particle count (5.0 - 7.5um), channel 14: particle count (7.5 - 10.0um)	R
40225 ~ 40239	High alarm limit of channel 0 to 14, channel 0: CO_2 in 1ppm, channel 1: PM2.5 in 1ug/m^3, channel 2: relative humidity in 0.01%, channel 3: temperature in 0.01˚C, channel 4:temperature in 0.01˚F, channel 5: dew point temperature in 0.01˚C, channel 6: dew point temperature in 0.01˚F, channel 7: PM1.0 in 1ug/m^3, channel 8: PM10 in 1ug/m^3, channel 9: particle count (0.3 - 0.5um), channel 10: particle count (0.5 - 1.0um), channel 11: particle count (1.0 - 2.5um), channel 12: particle count (2.5 - 5.0um), channel 13: particle count (5.0 - 7.5um), channel 14: particle count (7.5 - 10.0um)	R/W
40243 ~ 40247	Low alarm limit of channel 2 to 6, channel 2: relative humidity in 0.01%, channel 3: temperature in 0.01˚C, channel 4:temperature in 0.01˚F, channel 5: dew point temperature in 0.01˚C, channel 6: dew point temperature in 0.01˚F	R/W
40272	Modbus NetID Only for Modbus TCP protocol	R/W

Address	Description	Attribute
30301 40301	Number of the digital input channels Only for Modbus TCP protocol	R
30311 40311	Number of the digital output channels Only for Modbus TCP protocol	R
30321 40321	Number of the analog input channels Only for Modbus TCP protocol	R
30331 40331	Number of the analog output channels Only for Modbus TCP protocol	R
30352 40352	Firmware version in hex format Only for Modbus TCP protocol	R
40449	CO_2 offset in 1ppm	R/W
40450	PM2.5 offset in 1 ug/m^3	R/W
40451	Relative humidity offset in 0.01%	R/W
40452	Temperature offset in 0.01˚C	R/W
40456	PM1.0 offset in 1 ug/m^3	R/W
40457	PM10 offset in 1 ug/m^3	R/W
40481	Firmware version (low word)	R
40482	Firmware version (high word)	R
40483	Module name (low word), 0x1022	R
40484	Module name (high word), 0x444C	R
40485	RS-485 module address, 1 to 247 Only for Modbus RTU protocol	R/W
40486	RS-485 baud rate and parity settings Bits 5:0 Baud rate, valid range: 3 ~ 10 Bits 7:6 00: no parity, 1 stop bit 01: no parity, 2 stop bit 10: even parity, 1 stop bit 11: odd parity , 1 stop bit Only for Modbus RTU protocol	R/W
40488	RS-485 response delay time in ms, valid range, 0 ~ 30 Only for Modbus RTU protocol	R/W

Address	Description	Attribute
40489	RS-485 host watchdog timeout value, 0 ~ 255, in 0.1s Only for Modbus RTU protocol	R/W
40492	RS-485 host watchdog timeout count, write 0 to clear Only for Modbus RTU protocol	R/W
40496	Automatic baseline correction for CO_2 measurement, 0: disable, 1:enable	R/W
40497	Beep on alarm, 0: disable, 1 to 250: beep on alarm time in seconds, 251: beep on alarm continuously	R/W
30513 ~ 30527 40513 ~ 40527	High latched analog input value of channel 0 to 14	R
30545 ~ 30559 40545 ~ 40559	Low latched analog input value of channel 0 to 14	R
30566 40566	Module reset status, 1: power-on, 2: watchdog, 3: software reset command Only for Modbus TCP protocol	R
40568	Ethernet host watchdog timeout value, 5 to 65535, in second, 0 to disable. Only for Modbus TCP protocol	R/W
30569 40569	Ethernet host watchdog timeout count. Only for Modbus TCP protocol	R
30570 40570	Module name, 0x1022 Only for Modbus TCP protocol	R
40564	TCP disconnection timeout value, 5 to 65535, in second, 0 to disable. Only for Modbus TCP protocol	R/W
40565	Module reset timeout value, 30 to 65535, in second, 0 to disable. Only for Modbus TCP protocol	R/W

Address	Description	Attribute
40865	RTC year, 2000 to 2159	R/W
40866	RTC month, 1 to 12	R/W
40867	RTC date, 1 to 31	R/W
40868	RTC hour, 0 to 23	R/W
40869	RTC minute, 0 to 59	R/W
40870	RTC second, 0 to 59	R/W
40871	Total number of log records, low word	R
40872	Total number of log records, high word	R
40873	The starting record to read log data, low word	R/W
40874	The starting record to read log data, high word	R/W
40875	The status of the data logging, 0: stopped, 1: running	R
40876	The data logger command, 0: stop, 1: run, 2: run in period mode	R/W
40877	Continue writing when data logger is full, 0: no, 1: yes	R/W
40878	Hour of the data logger sampling period, 0 ~ 24	R/W
40879	Minute of the data logger sampling period, 0 ~ 59	R/W
40880	Second of the data logger sampling period, 0 ~ 59	R/W
40881	Starting year when logging in period mode, 2000 ~ 2159	R/W
40882	Starting month when logging in period mode, 1 ~ 12	R/W
40883	Starting date when logging in period mode, 1 ~ 31	R/W
40884	Starting hour when logging in period mode, 0 ~ 23	R/W
40885	Starting minute when logging in period mode, 0 ~ 59	R/W
40886	Starting second when logging in period mode, 0 ~ 59	R/W
40887	Ending year when logging in period mode, 2000 ~ 2159	R/W
40888	Ending month when logging in period mode, 1 ~ 12	R/W
40889	Ending date when logging in period mode, 1 ~ 31	R/W
40890	Ending hour when logging in period mode, 0 ~ 23	R/W

Address	Description	Attribute
40891	Ending minute when logging in period mode, 0 ~ 59	R/W
40892	Ending second when logging in period mode, 0 ~ 59	R/W
40929	The first fan off period in a day, beginning hour, 0 ~ 23	R/W
40930	The first fan off period in a day, beginning minute, 0 ~ 59	R/W
40931	The first fan off period in a day, ending hour, 0 ~ 23	R/W
40932	The first fan off period in a day, ending minute, 0 ~ 59	R/W
40933 ~ 40936	The second fan off period in a day	R/W
40937 ~ 40940	The third fan off period in a day	R/W
40941 ~ 40944	The fourth fan off period in a day	R/W
40945 ~ 40948	The fifth fan off period in a day	R/W
40949 ~ 40952	The sixth fan off period in a day	R/W
00001 ~ 00004	Digital output value of channel 0 to 3	R/W
00129 ~ 00132	Safe value of digital output channel 0 to 3	R/W
00161 ~ 00164	Power on value of digital output channel 0 to 3	R/W
00227	Write 1 to reload default TCP settings Only for Modbus TCP protocol	W
00234	Write 1 to reboot module Only for Modbus TCP protocol	W
00257	RS-485 Protocol, 0: DCON, 1: Modbus RTU Only for Modbus RTU protocol	R/W

Address	Description	Attribute
00260	Modbus RTU host watchdog mode 0: same as I-7000 1: can use AO and DO command to clear host watchdog timeout status Only for Modbus RTU protocol	R/W
00261	RS-485 host watchdog mode, 1: enable, 0: disable. Only for Modbus RTU protocol	R/W
00262	Write 1 to play notification sound	W
00270	Host watch dog timeout status, write 1 to clear host watch dog timeout status Only for Modbus RTU protocol	R/W
00273	Reset status, 1: first read after powered on, 0: not the first read after powered on Only for Modbus RTU protocol	R
00279	Fan control, 0: off, 1: on	R/W
00280	Write 1 to clear all high latched analog input values	W
00281	Write 1 to clear all low latched analog input values	W
00291 ~ 00295	Low alarm status of channel 2 to 6. Write 1 to clear low latched alarm.	R/W
00305 ~ 00319	High alarm status of channel 0 to 14. Write 1 to clear high latched alarm.	R/W
00321 ~ 00335	Enable/disable alarm of channel 0 to 14	R/W
00337 ~ 00351	Alarm type, momentary or latched, of channel 0 to 14	R/W
00385 ~ 00399	Write 1 to clear high latched analog input value of channel 0 to 14	W
00417 ~ 00431	Write 1 to clear low latched analog input value of channel 0 to 14	W
00449 ~ 00463	Enable/disable beep on alarm for channel 0 to 14	R/W

C-4. DL-1023 Modbus Address Mappings (Base 1)

Address	Description	Attribute
30001 ~ 30016 40001 ~ 40016	Analog input value of channel 0 to 15. channel 0: CO in 1ppm, channel 1: CO_2 in 1ppm, channel 2: PM2.5 in 1ug/m^3, channel 3: relative humidity in 0.01%, channel 4: temperature in 0.01˚C, channel 5:temperature in 0.01˚F, channel 6: dew point temperature in 0.01˚C, channel 7: dew point temperature in 0.01˚F, channel 8: PM1.0 in 1ug/m^3, channel 9: PM10 in 1ug/m^3, channel 10: particle count (0.3 - 0.5um), channel 11: particle count (0.5 - 1.0um), channel 12: particle count (1.0 - 2.5um), channel 13: particle count (2.5 - 5.0um), channel 14: particle count (5.0 - 7.5um), channel 15: particle count (7.5 - 10.0um)	R
40225 ~ 40240	High alarm limit of channel 0 to 15, channel 0: CO in 1ppm, channel 1: CO_2 in 1ppm, channel 2: PM2.5 in 1ug/m^3, channel 3: relative humidity in 0.01%, channel 4: temperature in 0.01˚C, channel 5:temperature in 0.01˚F, channel 6: dew point temperature in 0.01˚C, channel 7: dew point temperature in 0.01˚F, channel 8: PM1.0 in 1ug/m^3, channel 9: PM10 in 1ug/m^3, channel 10: particle count (0.3 - 0.5um), channel 11: particle count (0.5 - 1.0um), channel 12: particle count (1.0 - 2.5um), channel 13: particle count (2.5 - 5.0um), channel 14: particle count (5.0 - 7.5um), channel 15: particle count (7.5 - 10.0um)	R/W
40244 ~ 40248	Low alarm limit of channel 3 to 7, channel 3: relative humidity in 0.01%, channel 4: temperature in 0.01˚C, channel 5:temperature in 0.01˚F, channel 6: dew point temperature in 0.01˚C, channel 7: dew point temperature in 0.01˚F	R/W

Address	Description	Attribute
40272	Modbus NetID Only for Modbus TCP protocol	R/W
30301 40301	Number of the digital input channels Only for Modbus TCP protocol	R
30311 40311	Number of the digital output channels Only for Modbus TCP protocol	R
30321 40321	Number of the analog input channels Only for Modbus TCP protocol	R
30331 40331	Number of the analog output channels Only for Modbus TCP protocol	R
30352 40352	Firmware version in hex format Only for Modbus TCP protocol	R
40449	CO offset in 1ppm	R/W
40450	CO_2 offset in 1ppm	R/W
40451	PM2.5 offset in 1 ug/m^3	R/W
40452	Relative humidity offset in 0.01%	R/W
40453	Temperature offset in 0.01˚C	R/W
40457	PM1.0 offset in 1 ug/m^3	R/W
40458	PM10 offset in 1 ug/m^3	R/W
40481	Firmware version (low word)	R
40482	Firmware version (high word)	R
40483	Module name (low word), 0x1023	R
40484	Module name (high word), 0x444C	R
40485	RS-485 module address, 1 to 247 Only for Modbus RTU protocol	R/W
40486	RS-485 baud rate and parity settings Bits 5:0 Baud rate, valid range: 3 ~ 10 Bits 7:6 00: no parity, 1 stop bit 01: no parity, 2 stop bit 10: even parity, 1 stop bit 11: odd parity , 1 stop bit Only for Modbus RTU protocol	R/W

Address	Description	Attribute
40488	RS-485 response delay time in ms, valid range, 0 ~ 30 Only for Modbus RTU protocol	R/W
40489	RS-485 host watchdog timeout value, 0 ~ 255, in 0.1s Only for Modbus RTU protocol	R/W
40492	RS-485 host watchdog timeout count, write 0 to clear Only for Modbus RTU protocol	R/W
40496	Automatic baseline correction for CO_2 measurement, 0: disable, 1:enable	R/W
40497	Beep on alarm, 0: disable, 1 to 250: beep on alarm time in seconds, 251: beep on alarm continuously	R/W
30513 ~ 30528 40513 ~ 40528	High latched analog input value of channel 0 to 15	R
30545 ~ 30560 40545 ~ 40560	Low latched analog input value of channel 0 to 15	R
30566 40566	Module reset status, 1: power-on, 2: watchdog, 3: software reset command Only for Modbus TCP protocol	R
40568	Ethernet host watchdog timeout value, 5 to 65535, in second, 0 to disable. Only for Modbus TCP protocol	R/W
30569 40569	Ethernet host watchdog timeout count. Only for Modbus TCP protocol	R
30570 40570	Module name, 0x1023 Only for Modbus TCP protocol	R
40564	TCP disconnection timeout value, 5 to 65535, in second, 0 to disable. Only for Modbus TCP protocol	R/W

Address	Description	Attribute
40565	Module reset timeout value, 30 to 65535, in second, 0 to disable. Only for Modbus TCP protocol	R/W
40865	RTC year, 2000 to 2159	R/W
40866	RTC month, 1 to 12	R/W
40867	RTC date, 1 to 31	R/W
40868	RTC hour, 0 to 23	R/W
40869	RTC minute, 0 to 59	R/W
40870	RTC second, 0 to 59	R/W
40871	Total number of log records, low word	R
40872	Total number of log records, high word	R
40873	The starting record to read log data, low word	R/W
40874	The starting record to read log data, high word	R/W
40875	The status of the data logging, 0: stopped, 1: running	R
40876	The data logger command, 0: stop, 1: run, 2: run in period mode	R/W
40877	Continue writing when data logger is full, 0: no, 1: yes	R/W
40878	Hour of the data logger sampling period, 0 ~ 24	R/W
40879	Minute of the data logger sampling period, 0 ~ 59	R/W
40880	Second of the data logger sampling period, 0 ~ 59	R/W
40881	Starting year when logging in period mode, 2000 ~ 2159	R/W
40882	Starting month when logging in period mode, 1 ~ 12	R/W
40883	Starting date when logging in period mode, 1 ~ 31	R/W
40884	Starting hour when logging in period mode, 0 ~ 23	R/W
40885	Starting minute when logging in period mode, 0 ~ 59	R/W
40886	Starting second when logging in period mode, 0 ~ 59	R/W
40887	Ending year when logging in period mode, 2000 ~ 2159	R/W
40888	Ending month when logging in period mode, 1 ~ 12	R/W

Address	Description	Attribute
40889	Ending date when logging in period mode, 1 ~ 31	R/W
40890	Ending hour when logging in period mode, 0 ~ 23	R/W
40891	Ending minute when logging in period mode, 0 ~ 59	R/W
40892	Ending second when logging in period mode, 0 ~ 59	R/W
40929	The first fan off period in a day, beginning hour, 0 ~ 23	R/W
40930	The first fan off period in a day, beginning minute, 0 ~ 59	R/W
40931	The first fan off period in a day, ending hour, 0 ~ 23	R/W
40932	The first fan off period in a day, ending minute, 0 ~ 59	R/W
40933 ~ 40936	The second fan off period in a day	R/W
40937 ~ 40940	The third fan off period in a day	R/W
40941 ~ 40944	The fourth fan off period in a day	R/W
40945 ~ 40948	The fifth fan off period in a day	R/W
40949 ~ 40952	The sixth fan off period in a day	R/W
00001 ~ 00004	Digital output value of channel 0 to 3	R/W
00129 ~ 00132	Safe value of digital output channel 0 to 3	R/W
00161 ~ 00164	Power on value of digital output channel 0 to 3	R/W
00227	Write 1 to reload default TCP settings Only for Modbus TCP protocol	W
00234	Write 1 to reboot module Only for Modbus TCP protocol	W

Address	Description	Attribute
00257	RS-485 Protocol, 0: DCON, 1: Modbus RTU Only for Modbus RTU protocol	R/W
00260	Modbus RTU host watchdog mode 0: same as I-7000 1: can use AO and DO command to clear host watchdog timeout status Only for Modbus RTU protocol	R/W
00261	RS-485 host watchdog mode, 1: enable, 0: disable. Only for Modbus RTU protocol	R/W
00262	Write 1 to play notification sound	W
00270	Host watch dog timeout status, write 1 to clear host watch dog timeout status Only for Modbus RTU protocol	R/W
00273	Reset status, 1: first read after powered on, 0: not the first read after powered on Only for Modbus RTU protocol	R
00279	Fan control, 0: off, 1: on	R/W
00280	Write 1 to clear all high latched analog input values	W
00281	Write 1 to clear all low latched analog input values	W
00292 ~ 00296	Low alarm status of channel 3 to 7. Write 1 to clear low latched alarm.	R/W
00305 ~ 00320	High alarm status of channel 0 to 15. Write 1 to clear high latched alarm.	R/W
00321 ~ 00336	Enable/disable alarm of channel 0 to 15	R/W
00337 ~ 00352	Alarm type, momentary or latched, of channel 0 to 15	R/W
00385 ~ 00400	Write 1 to clear high latched analog input value of channel 0 to 15	W
00417 ~ 00432	Write 1 to clear low latched analog input value of channel 0 to 15	W
00449 ~ 00464	Enable/disable beep on alarm for channel 0 to 15	R/W

C-5. DL-1038 Modbus Address Mappings (Base 1)

Address	Description	Attribute
30001 ~ 30017 40001 ~ 40017	Analog input value of channel 0 to 16. channel 0: CO in 1ppm, channel 1: CO_2 in 1ppm, channel 2: TVOC in 1ppb, channel 3: PM2.5 in 1ug/m^3, channel 4: relative humidity in 0.01%, channel 5: temperature in 0.01℃, channel 6:temperature in 0.01℉, channel 7: dew point temperature in 0.01℃, channel 8: dew point temperature in 0.01℉, channel 9: PM1.0 in 1ug/m^3, channel 10: PM10 in 1ug/m^3, channel 11: particle count (0.3 - 0.5um), channel 12: particle count (0.5 - 1.0um), channel 13: particle count (1.0 - 2.5um), channel 14: particle count (2.5 - 5.0um), channel 15: particle count (5.0 - 7.5um), channel 16: particle count (7.5 - 10.0um)	R
40225 ~ 40241	High alarm limit of channel 0 to 16, channel 0: CO in 1ppm, channel 1: CO_2 in 1ppm, channel 2: TVOC in 1ppb, channel 3: PM2.5 in 1ug/m^3, channel 4: relative humidity in 0.01%, channel 5: temperature in 0.01°C, channel 6:temperature in 0.01°F, channel 7: dew point temperature in 0.01°C, channel 8: dew point temperature in 0.01°F, channel 9: PM1.0 in 1ug/m^3, channel 10: PM10 in 1ug/m^3, channel 11: particle count (0.3 - 0.5um), channel 12: particle count (0.5 - 1.0um), channel 13: particle count (1.0 - 2.5um), channel 14: particle count (2.5 - 5.0um), channel 15: particle count (5.0 - 7.5um), channel 16: particle count (7.5 - 10.0um)	R/W
40261 ~ 40265	Low alarm limit of channel 4 to 8, channel 4: relative humidity in 0.01%, channel 5: temperature in 0.01℃, channel 6:temperature in 0.01℉, channel 7: dew point temperature in 0.01℃, channel 8: dew point temperature in 0.01℉	R/W

Address	Description	Attribute
30301 40301	Number of the digital input channels Only for Modbus TCP protocol	R
30311 40311	Number of the digital output channels Only for Modbus TCP protocol	R
30321 40321	Number of the analog input channels Only for Modbus TCP protocol	R
30331 40331	Number of the analog output channels Only for Modbus TCP protocol	R
30352 40352	Firmware version in hex format Only for Modbus TCP protocol	R
40372	Modbus NetID Only for Modbus TCP protocol	R/W
40449	CO offset in 1ppm	R/W
40450	CO_2 offset in 1ppm	R/W
40451	TVOC offset in 1ppb	R/W
40452	PM2.5 offset in 1 ug/m^3	R/W
40453	Relative humidity offset in 0.01%	R/W
40454	Temperature offset in 0.01˚C	R/W
40458	PM1.0 offset in 1 ug/m^3	R/W
40459	PM10 offset in 1 ug/m^3	R/W
40481	Firmware version (low word)	R
40482	Firmware version (high word)	R
40483	Module name (low word), 0x1038	R
40484	Module name (high word), 0x444C	R
40485	RS-485 module address, 1 to 247 Only for Modbus RTU protocol	R/W
40486	RS-485 baud rate and parity settings Bits 5:0 Baud rate, valid range: 3 ~ 10 Bits 7:6 00: no parity, 1 stop bit 01: no parity, 2 stop bit 10: even parity, 1 stop bit 11: odd parity , 1 stop bit Only for Modbus RTU protocol	R/W

Address	Description	Attribute
40488	RS-485 response delay time in ms, valid range, 0 ~ 30 Only for Modbus RTU protocol	R/W
40489	RS-485 host watchdog timeout value, 0 ~ 255, in 0.1s Only for Modbus RTU protocol	R/W
40492	RS-485 host watchdog timeout count, write 0 to clear Only for Modbus RTU protocol	R/W
40496	Automatic baseline correction for CO_2 measurement, 0: disable, 1:enable	R/W
40497	Beep on alarm, 0: disable, 1 to 250: beep on alarm time in seconds, 251: beep on alarm continuously	R/W
30513 ~ 30529 40513 ~ 40529	High latched analog input value of channel 0 to 16	R
30545 ~ 30561 40545 ~ 40561	Low latched analog input value of channel 0 to 16	R
40564	TCP disconnection timeout value, 5 to 65535, in second, 0 to disable. Only for Modbus TCP protocol	R/W
40565	Module reset timeout value, 30 to 65535, in second, 0 to disable. Only for Modbus TCP protocol	R/W
30566 40566	Module reset status, 1: power-on, 2: watchdog, 3: software reset command Only for Modbus TCP protocol	R
40568	Ethernet host watchdog timeout value, 5 to 65535, in second, 0 to disable. Only for Modbus TCP protocol	R/W
30569 40569	Ethernet host watchdog timeout count. Only for Modbus TCP protocol	R

Address	Description	Attribute
30570 40570	Module name, 0x1038 Only for Modbus TCP protocol	R
40865	RTC year, 2000 to 2159	R/W
40866	RTC month, 1 to 12	R/W
40867	RTC date, 1 to 31	R/W
40868	RTC hour, 0 to 23	R/W
40869	RTC minute, 0 to 59	R/W
40870	RTC second, 0 to 59	R/W
40871	Total number of log records, low word	R
40872	Total number of log records, high word	R
40873	The starting record to read log data, low word	R/W
40874	The starting record to read log data, high word	R/W
40875	The status of the data logging, 0: stopped, 1: running	R
40876	The data logger command, 0: stop, 1: run, 2: run in period mode	R/W
40877	Continue writing when data logger is full, 0: no, 1: yes	R/W
40878	Hour of the data logger sampling period, 0 ~ 24	R/W
40879	Minute of the data logger sampling period, 0 ~ 59	R/W
40880	Second of the data logger sampling period, 0 ~ 59	R/W
40881	Starting year when logging in period mode, 2000 ~ 2159	R/W
40882	Starting month when logging in period mode, 1 ~ 12	R/W
40883	Starting date when logging in period mode, 1 ~ 31	R/W
40884	Starting hour when logging in period mode, 0 ~ 23	R/W
40885	Starting minute when logging in period mode, 0 ~ 59	R/W
40886	Starting second when logging in period mode, 0 ~ 59	R/W
40887	Ending year when logging in period mode, 2000 ~ 2159	R/W
40888	Ending month when logging in period mode, 1 ~ 12	R/W

Address	Description	Attribute
40889	Ending date when logging in period mode, 1 ~ 31	R/W
40890	Ending hour when logging in period mode, 0 ~ 23	R/W
40891	Ending minute when logging in period mode, 0 ~ 59	R/W
40892	Ending second when logging in period mode, 0 ~ 59	R/W
40929	The first fan off period in a day, beginning hour, 0 ~ 23	R/W
40930	The first fan off period in a day, beginning minute, 0 ~ 59	R/W
40931	The first fan off period in a day, ending hour, 0 ~ 23	R/W
40932	The first fan off period in a day, ending minute, 0 ~ 59	R/W
40933 ~ 40936	The second fan off period in a day	R/W
40937 ~ 40940	The third fan off period in a day	R/W
40941 ~ 40944	The fourth fan off period in a day	R/W
40945 ~ 40948	The fifth fan off period in a day	R/W
40949 ~ 40952	The sixth fan off period in a day	R/W

Revision History

Revision	Date	Description
1.0.0	2020/ 05	First released
1.1.0	2020/ 08	-Added DL-1038 information