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Document Revision

Version	Date	Description of changes
Rev1.0	2022-10-17	First release for ALM-Horn-RGB

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1. Introduction

The ALM-Horn-RGB have a water clear upper cover, RGB 3 color Ultra-Bright LED, 100dbm Piezo Transducer siren, with PoE Ethernet, Modbus TCP protocol and built-in Web Server.

ALM-Horn-RGB includes 1-channel digital input for any dry contact output such as SA, BA, FA ..etc, and 1-channel digital output. Each device have 4 kinds of alarm index can be define by user, including with 4 kinds of tone & 4 kinds of color LED flash light, High Sound Pressure output, adjustment Hi/Low volume, NC/NO input mode select all by Web Server or Modbus command, support wide input power range, with IP43 waterproof.

The ALM-Horn-RGB support Modbus TCP protocol, Which makes perfect integration for monitoring or control in SCADA software, HMI Modbus & Utility.

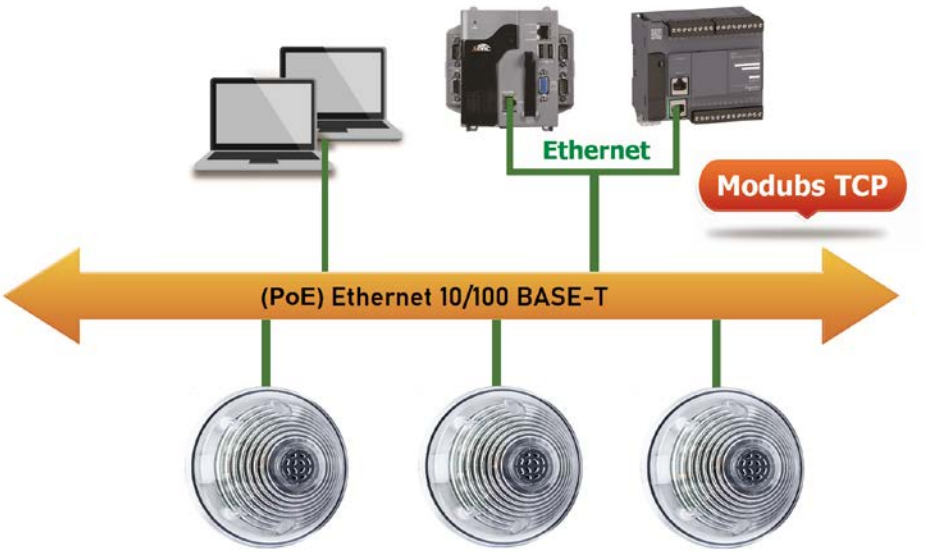


Figure 1-1: Application architecture for the ALM-Horn-RGB

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1.1 Features

- Ethernet 10/100 Base-T, IEEE 802.3 standard interface
- Modbus TCP protocol
- Http Web Server
- Photo couple input, Open Collector output
- PoE & Wide power supply range
- Wide operating temperature range
- Piezo Transducer Output
- Water clear upper cover with 8 Ultra-Bright 3 color RGB LED
- 4 Selectable Alarm Tone
- NC/NO trigger input selectable
- Hi/Low volume selectable

1.1.1 Features Description

The ALM-Horn-RGB accepts any dry contact to trigger DI input, when the alarm been trigger, it will output from Piezo Transducer, LED's & open collector DO.

ALM-Horn-RGB have 4 user define Alarm Index, including with 4 kinds of tone(Tone Index) + 4 kinds of RGB color LED flash light setting(Color Index). The Alarm Index not only can trigger by DI alarm, it also can trigger by Modbus command & Http Web server. All the Alarm Index, RGB Color Index, Tone Index, DI trigger mode NC (Normal Close) or NO (Normal Open), Piezo Transducer volume Hi/Low can be set in both Http Web Server & Modbus Command.

Note: Alarm Index = Tone Index + Color Index(x2).

For Communication, ALM-Horn-RGB accepts Modbus protocol to monitor DI status and remote DO output, trigger Alarm Index (independent with DI trigger mode).

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1.2 Specifications

Table 1-1: System Specifications

Device	ALM-Horn-RGB
Alarm Output	
Piezo Transducer Pressure Level	100 ± 5 dB @10cm/3.0 KHz (Volume Hi, W/O waterproof membrane)
LED	Water clear upper cover with 8 RGB Ultra-Bright 3 color LED
Volume Control	Yes(Hi/Low)
Digital Input	
Channels	1
Input Type	Dry Contact: Sink
Dry Contact Level	NO: Open, NC: Close to GND
Photo-Isolation	3750 VDC
Input Condition	Pulse Width must > 200mSec or more
Digital Output	
Channels	1
Output Type	Open Collector (Sink)
Max Load Current	400 mA
Load Voltage	+3.5 VDC ~ +30 VDC
Switch	
SW1	Restore to default (inside case)
Ethernet	
Ports	RJ-45, 10/100 Base-Tx
PoE	Yes, Class 3
Security	Password and IP Filter
Protocol	Modbus TCP, Modbus UDP
Software	
Built-in Web Server	Yes
CPU Module	
CPU	32-bit ARM
Watchdog	Module, Communication (Programmable)
LED Indicators	
Power/Status	System, Ethernet ACT, Ethernet PoE 3 LED's

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Device	ALM-Horn-RGB
Protection	
Waterproof	IP43 (Panel Mount Upright Position)
ESD (IEC 61000-4-2)	±8 kV Air for Random Point
EFT (IEC 61000-4-4)	±2 kV for Power
Environment	
Operating Temperature	-20 ~ +75°C
Mechanism	
Dimensions(WxLxH)	119mm x 119mm x 48mm
Installation	Panel Mount/Wall Mount
Power Requirements	
Input Voltage Range	12 ~ 48 VDC with Reverse Protection (Vin to GND)
Consumption	6.6W(max.)

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2. Hardware

2.1 Outward Appearance

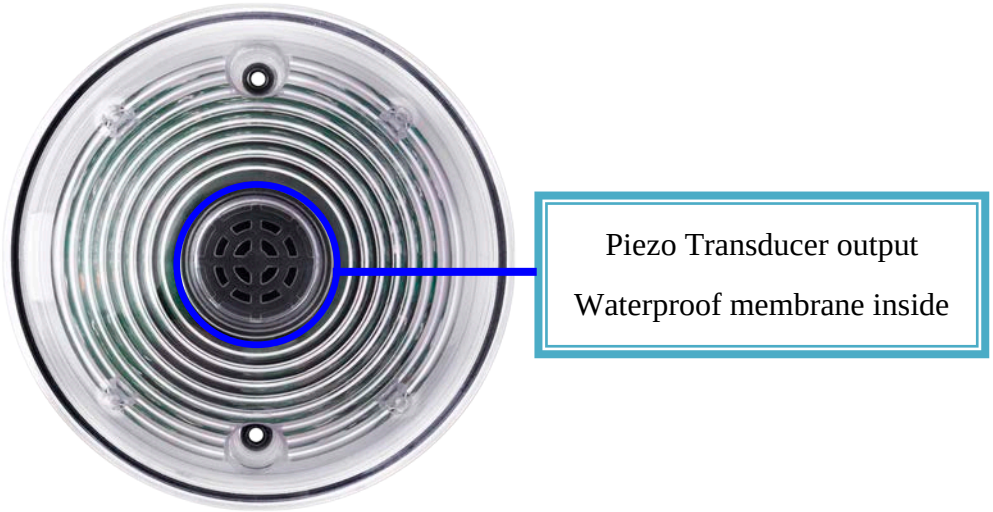


Figure 2-1: Front Panel

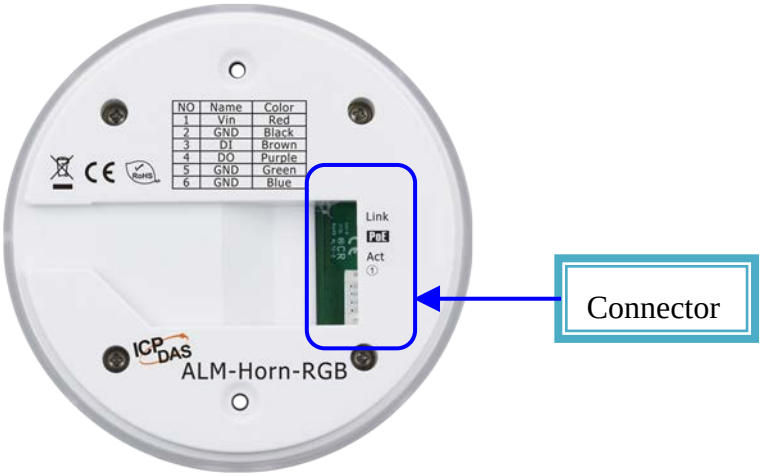


Figure 2-2: Back Panel

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2.1.2 Connector Pin Define

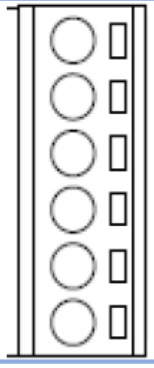
Terminal NO	Pin Name	Wire Color
		
1	Vin	Red
2	GND	Black
3	DI	Brown
4	DO	Purple
5	GND	Green
6	GND	Blue

Figure 2-3: I/O Connector of ALM-Horn-RGB

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2.2 Configuration & Setting

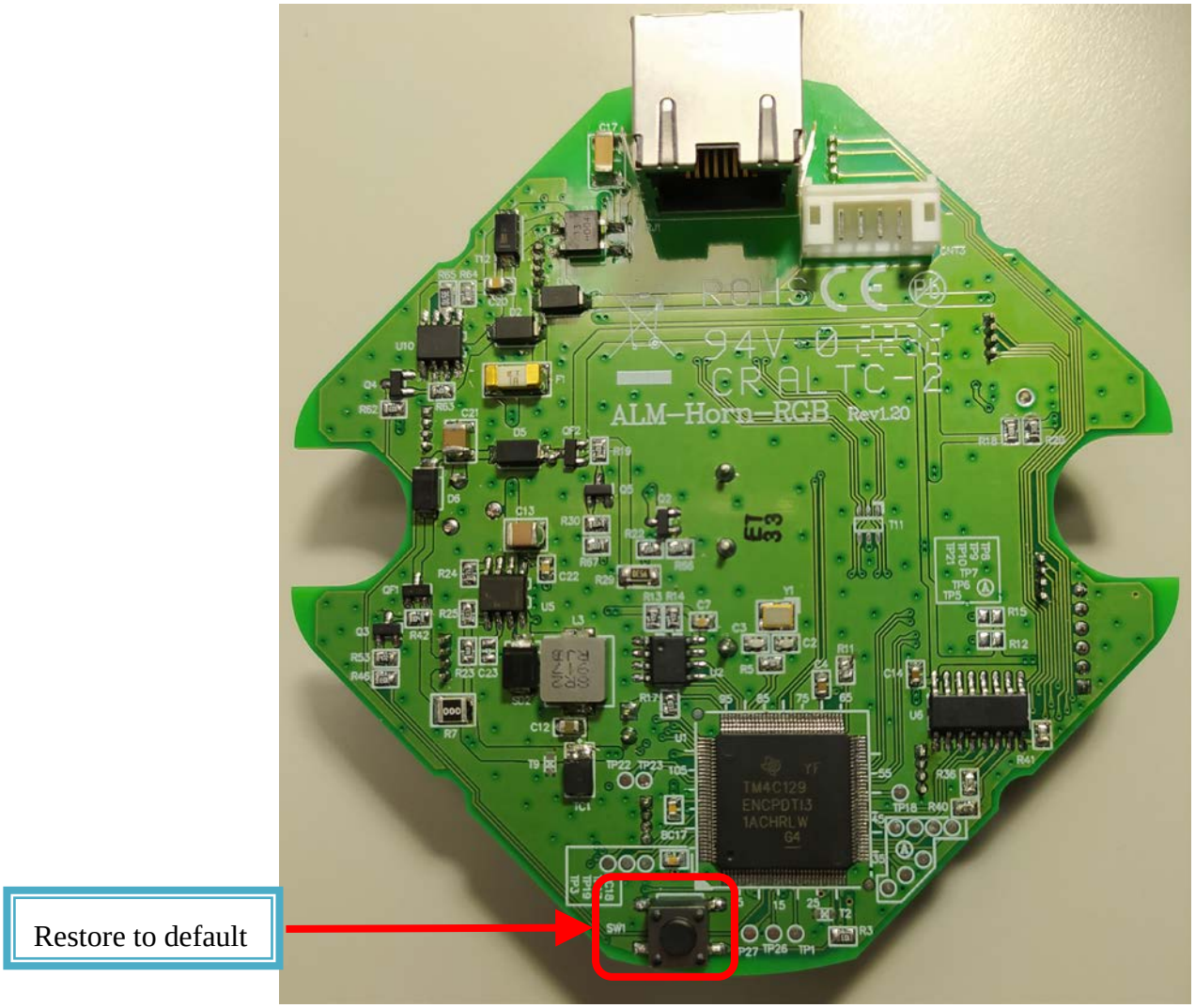


Figure 2-4**:** Switch on the PCB

2.2.1 Restore to default for ALM-Horn-RGB

Use the Web Server > Network > Restore, or Remove the back panel, Press & hold the Restore button(SW1) on the bottom side over 5 Sec until the 8 color LED light up Red color then release the switch to restore device's default setting. (Default is set in Static IP 192.168.77.1, Web Password: Admin)

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2.3 Dimensions

The diagrams below provide the dimensions of the ALM-Horn-RGB to use in defining your enclosure specifications. All dimensions are in millimeters.

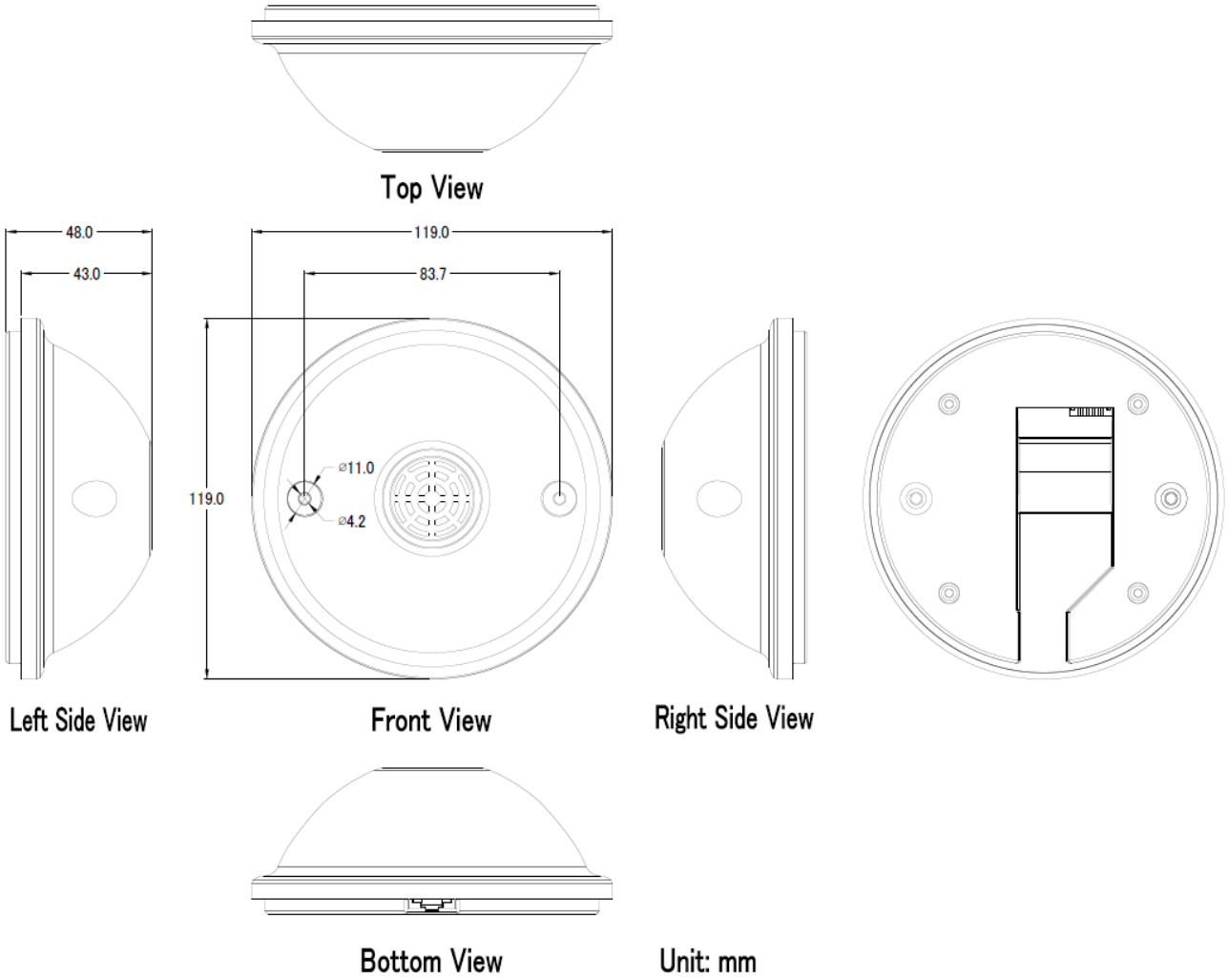


Figure 2-5: Dimension of the ALM-Horn-RGB

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2.4 Wire Connection

2.4.1 Wire connection define

The following describe the wire color

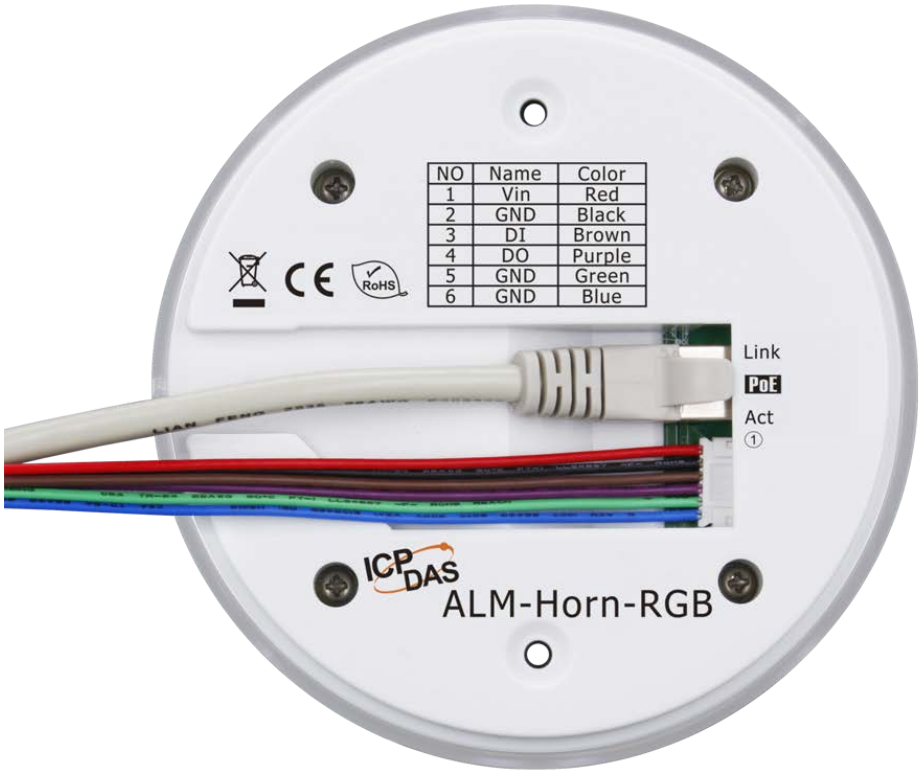


Figure 2-6**:** Color of Wire

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2.4.2 I/O connection

2.4.2.1 Digital Input (DI) wiring

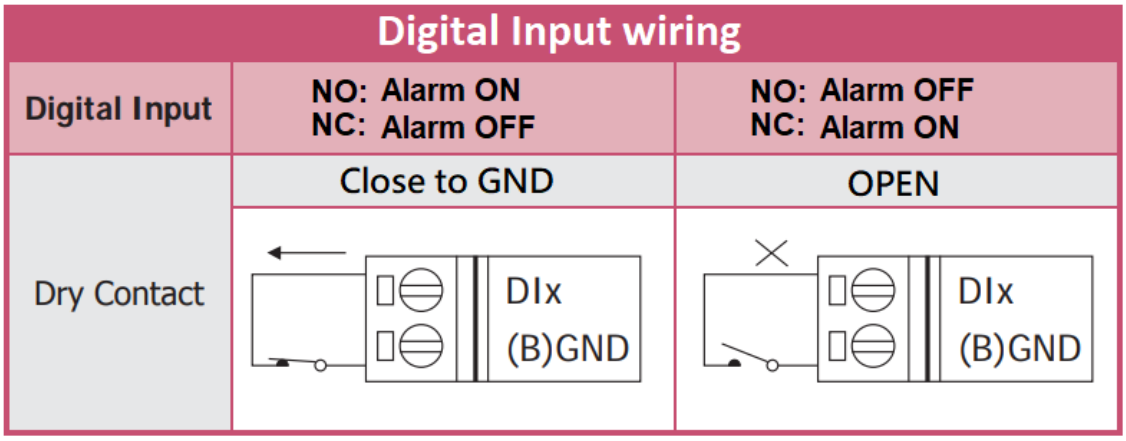


Figure 2-7**:** DI Dry contact wiring

2.4.2.2 Open Collector Digital Output(DO) wiring

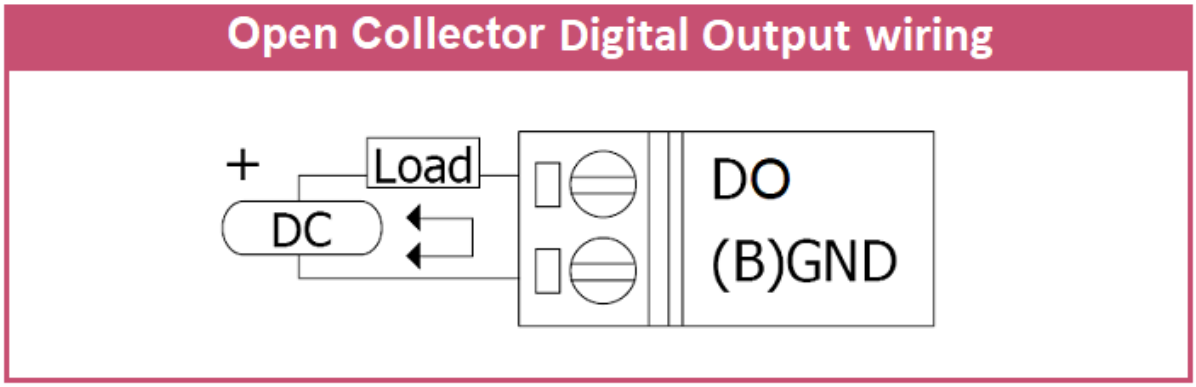


Figure 2-8**:** Open Collector Output wiring

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3. Software

Web Server

The ALM-Horn-RGB support Http Web Server, using browser enter the IP address, the login page will show out, key the correct password (Default: Admin), you will enter the first page "Status page". (Default is set in Static IP 192.168.77.1)

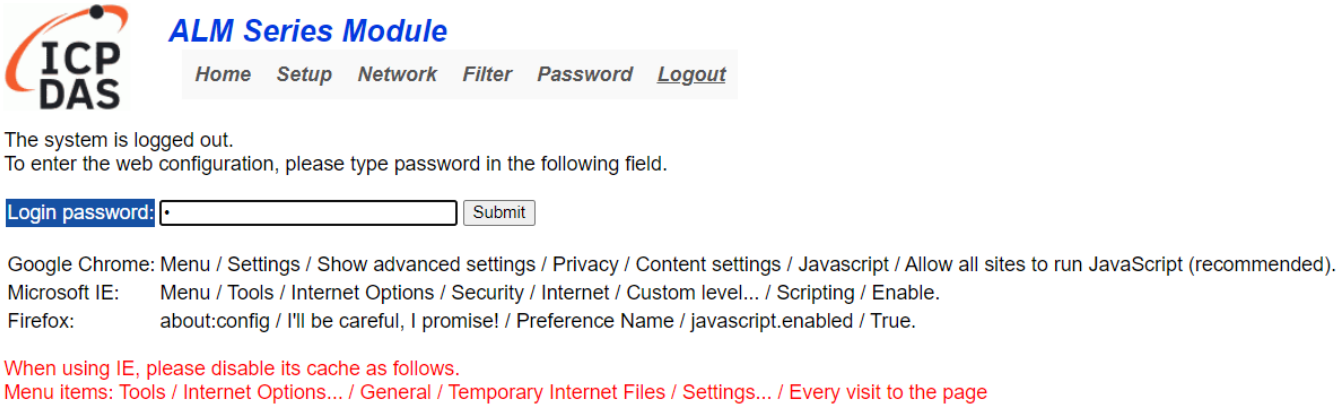


Figure 3-1**:** Login page

3.1.1 Status page

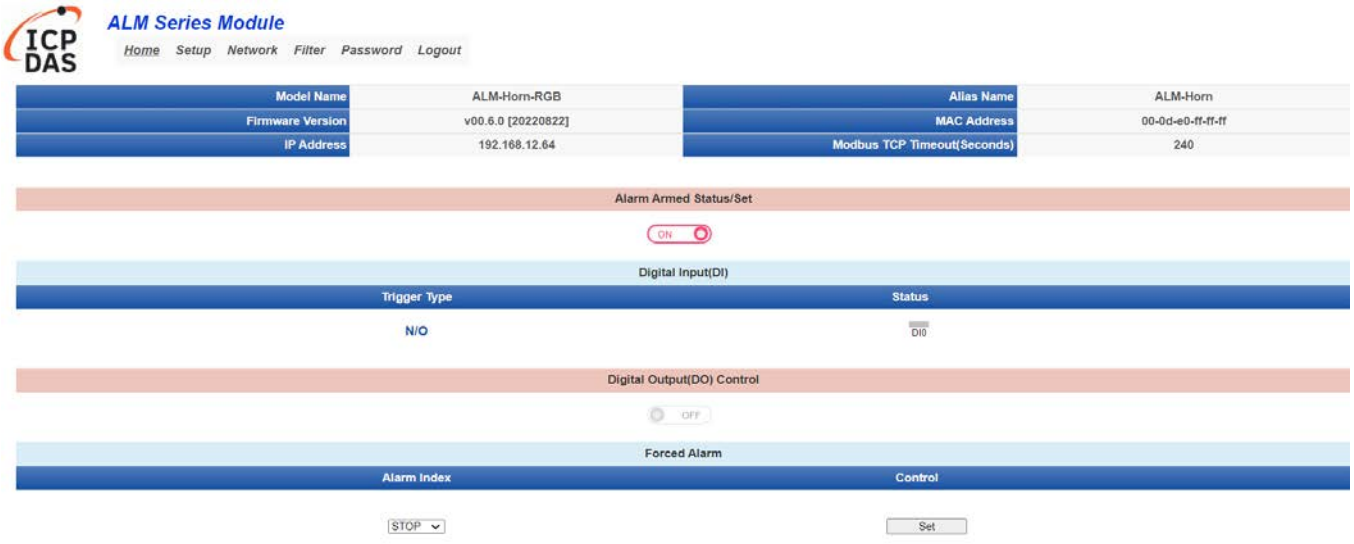


Figure 3-2**:** Status page

Status page show all monitor status and controls,

1. **Alarm Armed**: Control the device global alarm, when it's "ON" all alarm include DI trigger, Forced Alarm will take effect.

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2. **DI Trigger Type**: Show the setting status of the DI trigger type.
   N/O(Normal Open): The DI input dry contact normal is open circuit, short to GND will trigger the DI alarm.
   N/C(Normal Close): The DI input dry contact normal is close to GND, open circuit will trigger the DI alarm.
3. **DI Status**: Show the DI alarm status, turn on when alarm have been triggered, else there will no alarm.
4. **DO output Status/Control**: Show the status of DO output, when it turns ON there will be a DI alarm, it can be change output status by pressing the switch. DO output is automatic control by DI alarm, when DI been trigger DO will turn on automatic.
5. **Forced Alarm**: Select the "Alarm Index", press "Set" button, will forced the alarm trigger.

3.1.2 Setup page

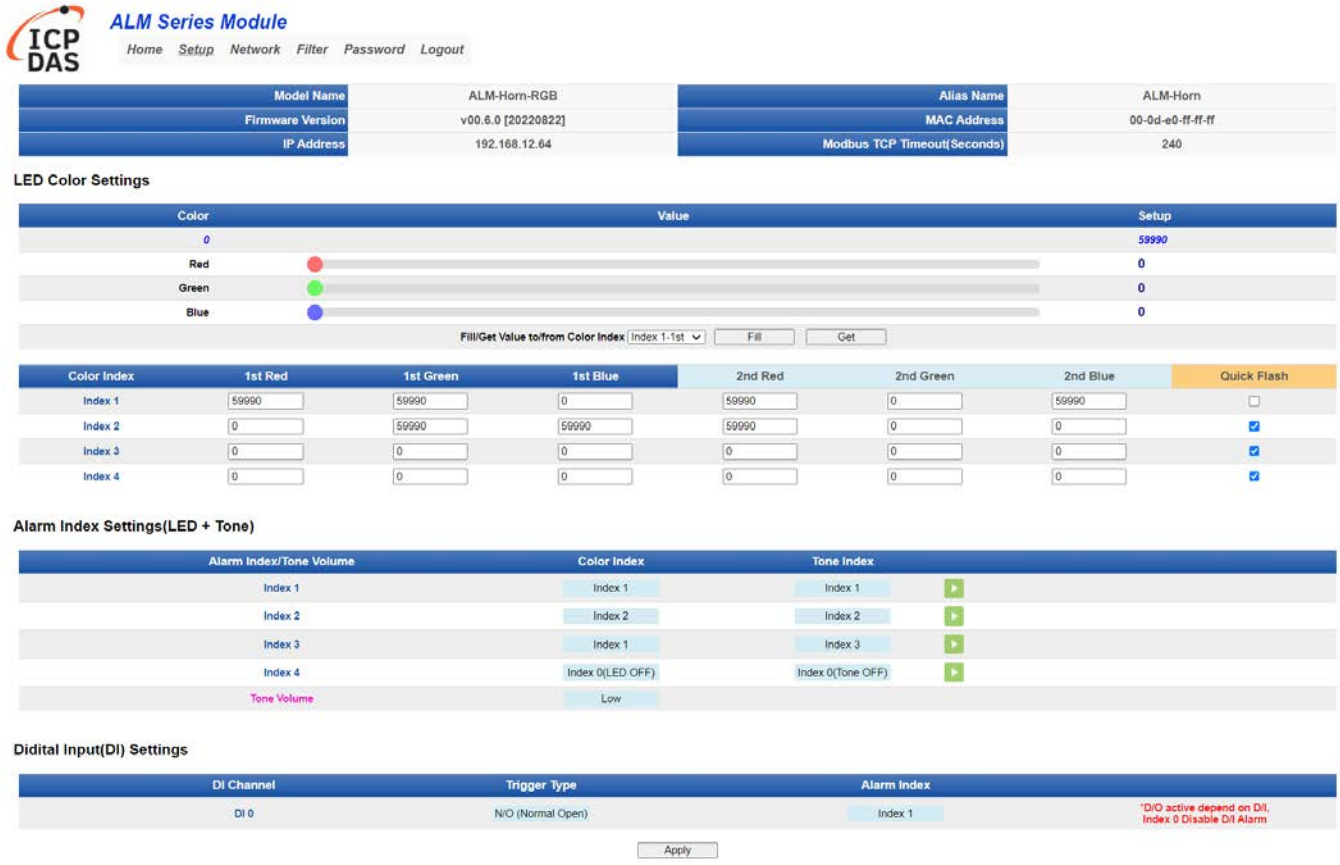
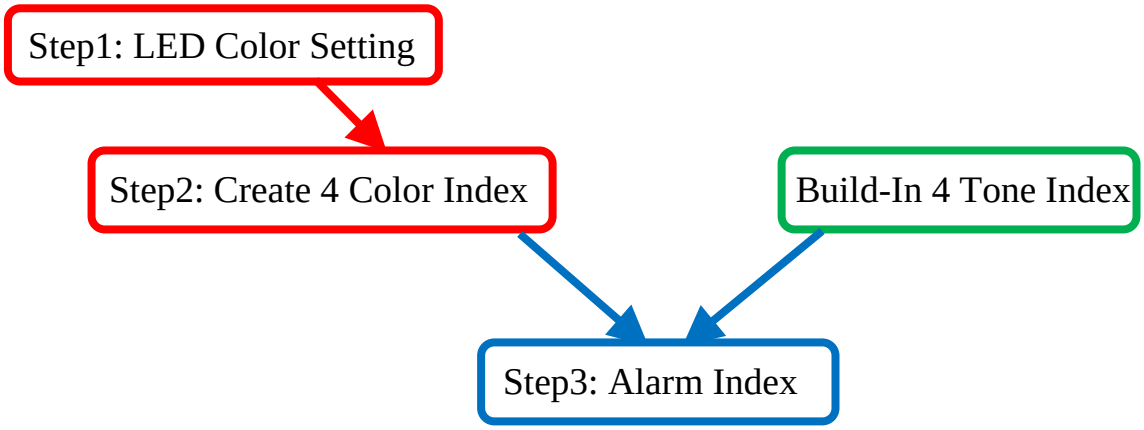


Figure 3-3**:** Setup page

Show & Set all the parameter of alarm setting.

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1. **LED Color Settings**: A Color Index include 2 color space field, to fill the color you desire just pull the Bar R(Red)/G(Green)/B(Blue), it will show the color directly from the device LED, select a Color Index(1st or 2nd) from "Fill/Get Value to/From Color Index", press "Fill" button, it will fill the color value into your select item below, press "Get" button, it will pull the item value back to the BAR. When LED active it will toggle between these 2 color. If the "Quick Flash" been checked, each color will quick flash when show.
   There are 4 Color Index/8 color space field for user define.
2. **Alarm Index Settings**: An Alarm Index include 1 Color Index + 1 Tone Index, Tone Volume have 2 level Hi & Low. After finish selected, each Alarm Item have ▶ playback test button, it can show the LED & Tone playback about 5 second.



3. **Digital Input(DI) Settings**: DI0 Trigger Type setting.
   N/O(Normal Open): The DI input dry contact normal is open circuit, short to GND will trigger the DI alarm.
   N/C(Normal Close): The DI input dry contact normal is close to GND, open circuit will trigger the DI alarm.
   DI0 Alarm Index: Set an Alarm Index to play when alarm been trigger.

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3.1.3 Network page

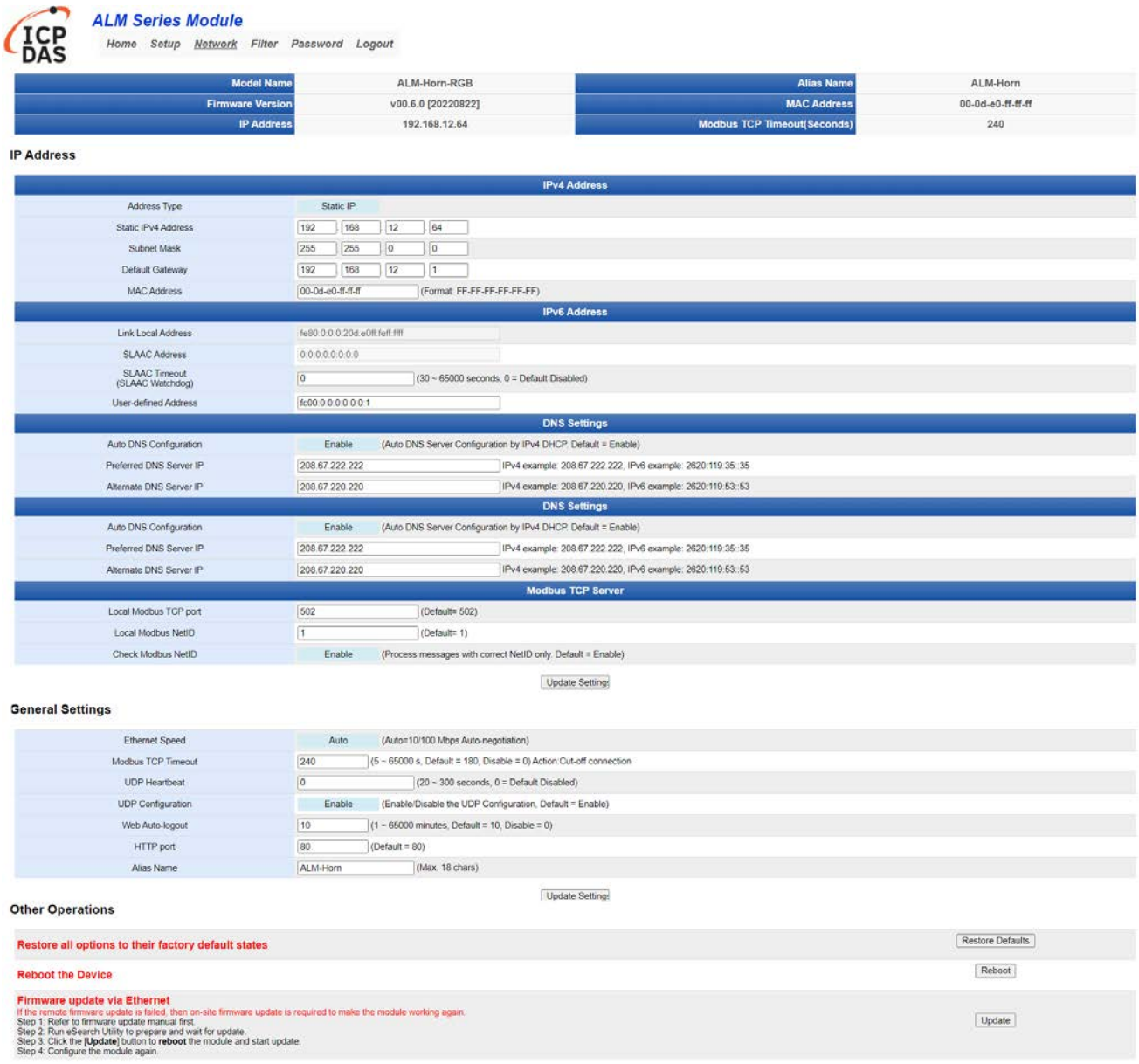


Figure 3-4**:** Network page

Show & Set all the parameter of Network and Modbus.

1. **IP Address**: Setting for IPV4 & IPV6 network parameter, and Modbus at the last. (Default Modbus port: 502)
2. **General Settings**: Include Ethernet Speed, Timeout, HTTP port, Alias Name…Setting.
3. **Other Operations**:

Restore Defaults: Restore all parameter setting back to factory default.

Reboot: Reboot the device.

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Update: (Firmware Update)

1. Download eSearch Utility & Manual,
   http://www.icpdas.com/en/product/guide+Software+Utility_Driver+eSearch__Utility
2. Disconnect/Disable all other network, leave the only one you use.
3. Click the **Update** button in Web Server > Network to wait for eSearch start.
4. Run eSearch Utility & press Search Server button, after found ALM-Horn-RGB, Right click on it, select Firmware Update, select the New F/W file "******.dat", wait for a minutes, after the console run to 100% it will update finish and re-start.

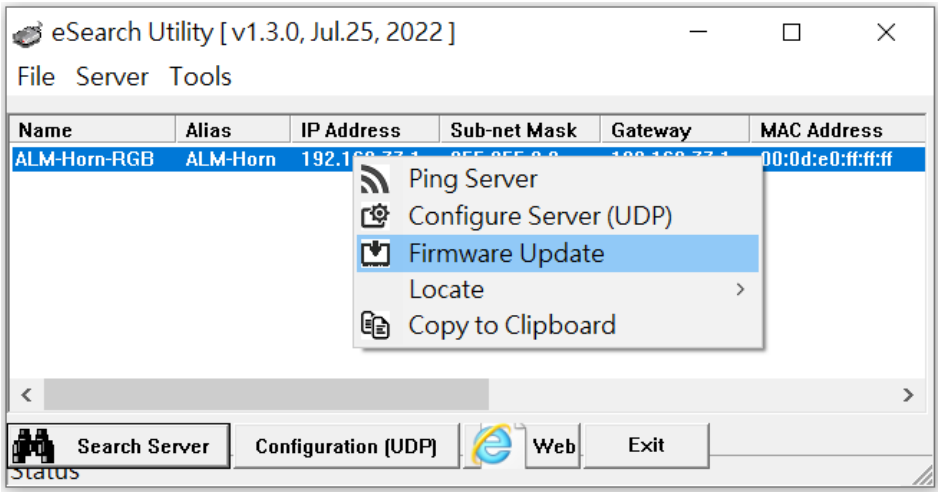


Figure 3-5**:** eSearch Utility

3.1.4 Filter page

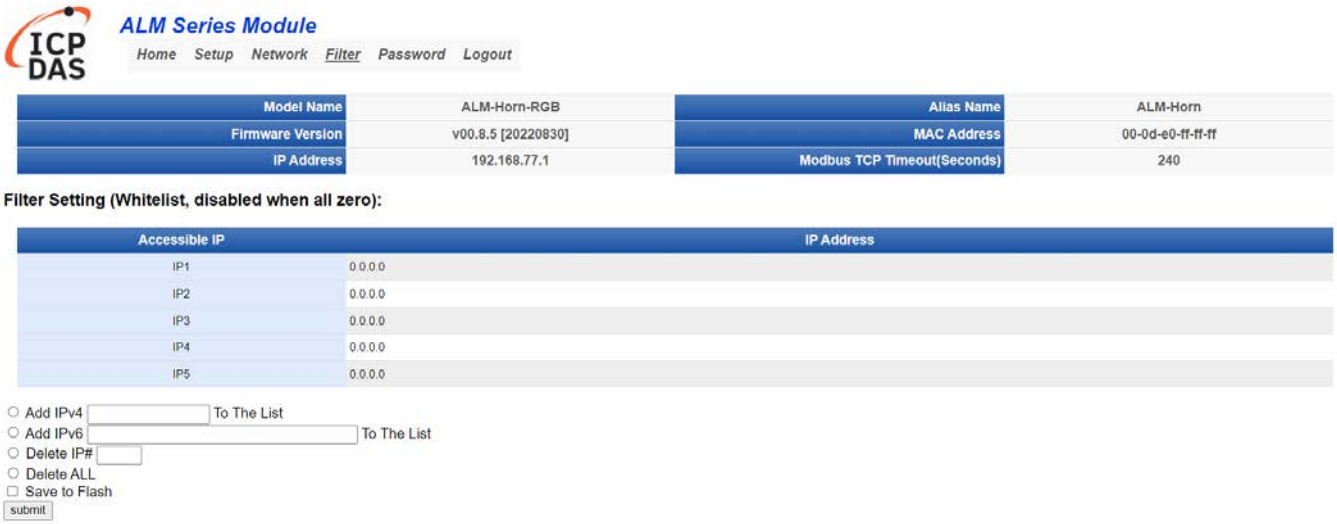


Figure 3-6**:** Filter page

Set/Modify IP address Whitelist(Allow access) for the device.

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3.1.5 Change Password page

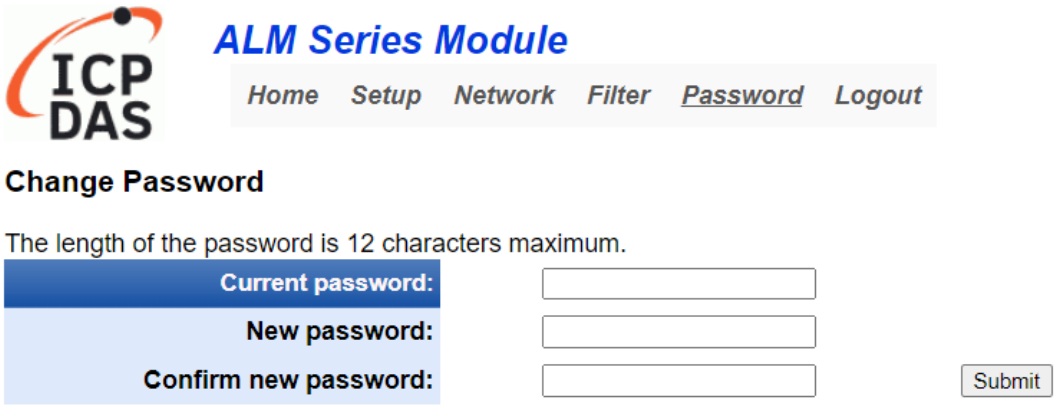


Figure 3-6: Change Password page

For user to change the Web Server password. (Default: Admin)

3.1.6 Forget IP Address

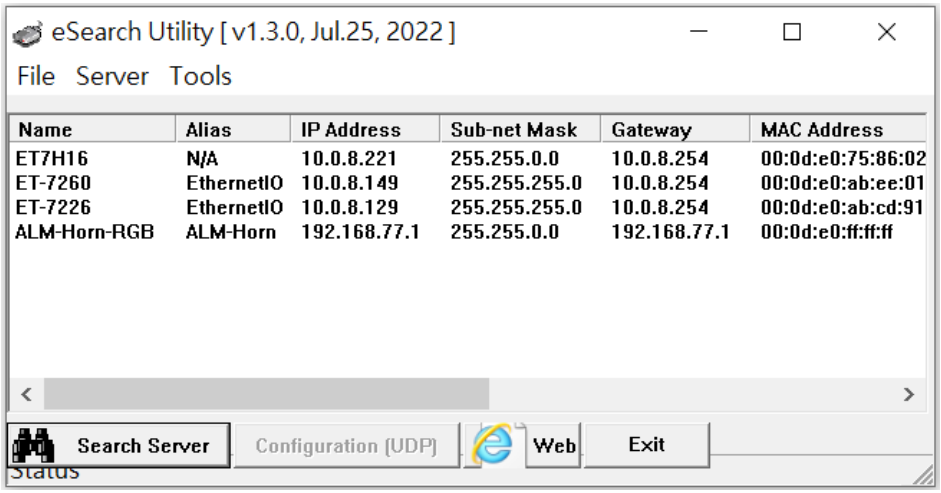


Figure 3-7: eSearch Utility search IP

If you forget the IP address of the device, use eSearch utility press "Search Server" button to search it.
http://www.icpdas.com/en/product/guide+Software+Utility_Driver+eSearch__Utility
Double click on the device item can change the IP of the device.

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4. Modbus Protocol

4.1.1 Function Code

The function code field of a Modbus data unit is coded in one byte. Valid codes are in the range of 1 ... 255 decimal (the range 128 - 255 is reserved and used or exception responses). When a Modbus request is sent from a Modbus Client to a Server device the function code field tells the Server what kind of action to perform.

The Modbus TCP/RTU feature of ALM-Horn-WF/-MRTU supports 5 function codes, which allows the reading and writing of data contents of registers.

Function Code	Descriptions
01 (0x01)	Read Coil Status
02 (0x02)	Read Input Status
03 (0x03)	Read multiple Analog Output registers
04 (0x04)	Read multiple Analog Input registers
05 (0x05)	Force Single Coil
06 (0x06)	Write single Analog Output registers
15 (0x0F)	Write multiple Coil Output
16 (0x10)	Write multiple Analog Output registers

Table 4-1: Supports Function Codes of ALM-Horn-RGB

Any other function code request will be returned with an error response indicating the function code is not supported, as well as a request for too much data or data at a register address that not present.

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4.1.2 Error Response

Byte Index	Field Name	Byte count	Description
00	Address	1 Byte	1 to 247
01	Function code	1 Byte	Function code + 0x80
02	Exception code	1 Byte	01

Table 4-2: Error response of Modbus Protocol

If a CRC mismatch occurs, the module will not respond.

4.2 Data Encoding

Modbus uses a "big-endian" representation for address and data items. This means that when a numerical quantity larger than single byte is transmitted, the most significant byte (MSB, also called the high-order byte) is send first. The following sub-topics describe the different byte of encoding and show how the data is encoded as it is within the Modbus packet.

4.2.1 Binary

A binary item is represented as a single bit within a data word. All binary is packed into 16-bits data words, which are accessed using function code 01 and 02. Therefore, a single register contains 16 bits of binary data, each having a specific meaning.

Value	1st	2nd
0xAA55 (1010101001010101)	0xAA (10101010)	0x55 (01010101)

Table 4-3: A single register contains 16 bits of binary data

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4.2.2 16-bits Word

A 16-bits word item is transmitted with the most significant byte first. Function code 03 and 04 read 16-bits items at a time; therefore, each of these data items will fit within one register that is read.

Value	1st	2nd
0x1234	0x12	0x34

Table 4-4: A 16-bits word item

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4.3 Modbus TCP Protocol Description

The Modbus protocol defines a simple protocol data unit independent of the underlying communication layers. The mapping of Modbus protocol on network can introduce some additional fields on the application data unit.

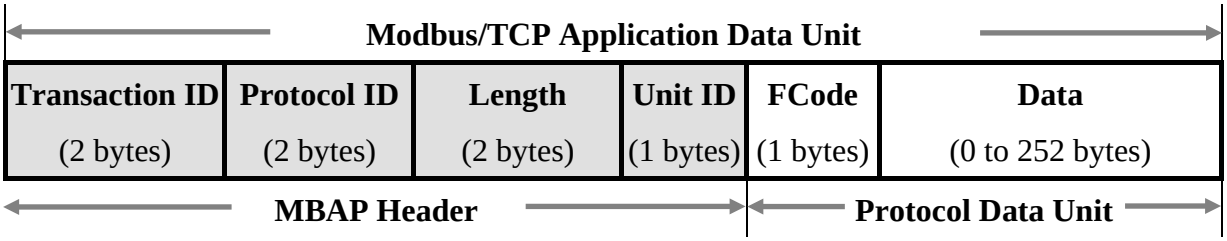


Figure 4-5: Modbus/TCP Application Data Unit

4.3.1 MBAP

The Modbus/TCP extension includes 7 additional bytes to the original Modbus protocol, which allows for transport over the TCP/IP layers.

A dedicated header is used on TCP/IP to identify the Modbus Application Data Unit. It is called the MBAP Header (MODBUS Application Protocol Header). The MBAP Header consists of 7 bytes of information:

Fields	Length	Description
Transaction Identifier	2 bytes	Identification of Request/Response transaction – Copied from request to response
Protocol Identifier	2 bytes	0 = Modbus protocol
Length	2 bytes	Number of following bytes - Includes the Unit Identifier
Unit Identifier	1 byte	Identification of remote slave

Table 4-6: MODBUS/TCP Application Protocol Header

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4.4 ALM-Horn-RGB Address Mapping

Modbus Address Base on 0

Address	Length	Descriptions	Range	Access Type
00000	1	Digital Output	0=OFF, 1=ON	R/W
00016	1	Alarm ARMED	0=OFF, 1=ON	R/W
00024	1	DI Trigger Type	0=N/C, 1=N/O	R/W
00032	1	Alarm Tone Volume	0=Low, 1=Hi	R/W
00064	4	LED Quick-Flash Alarm Index 1~4	0= OFF, 1=ON	R/W
00226	1	Restore all config (Will Reboot)	1 = Action	W
00233	1	Reboot the Module	1 = Action	W

Table 4-7: FC01/FC05/FC15 Read/Write Coil address

Address	Length	Descriptions	Range	Access Type
00000	1	Digital Input	0=OFF, 1=ON	R

Table 4-8: FC02 Read Input Status address

Address	Length	Descriptions	Range/Value	Access Type
00351	1	Firmware Version	0x0102 = V1.02	R

Table 4-9: FC04 Read Input registers address

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Address	Length	Descriptions	Range/Value	Access Type
00000	1	Alarm ARMED	0=OFF, 1=ON	R/W
00001	1	Forced Alarm Index	0=STOP 1/2/3/4 Index	R/W
00008	1	DI Alarm Index	0=OFF 1/2/3/4 Index	R/W
00016	4	LED Color Index1~4 of 1st RED Value	0 ~ 59990	R/W
00020	4	LED Color Index1~4 of 1st Green Value	0 ~ 59990	R/W
00024	4	LED Color Index1~4 of 1st Blue Value	0 ~ 59990	R/W
00032	4	LED Color Index1~4 of 2nd RED Value	0 ~ 59990	R/W
00036	4	LED Color Index1~4 of 2nd Green Value	0 ~ 59990	R/W
00040	4	LED Color Index1~4 of 2nd Blue Value	0 ~ 59990	R/W
00048	4	ALARM Index1~4 of LED Color Index	0=OFF 1/2/3/4 Index	R/W
00052	4	ALARM Index1~4 of Tone Index	0=OFF 1/2/3/4 Index	R/W
00263	1	Modbus TCP timeout(sec)	5 ~ 65000	R/W
00271	1	Modbus Device ID	1 ~ 247	R/W
00555	1	Module Reset Status	WR:0 to Clear	R/W
00556	1	Boot Count of Module, Reset Default to clear	1 ~ 32767	R
00559	1	Model ID (0x3501)	0x3501	R

Table 4-10: FC03/FC6/FC16 Read/Write Output registers address

Technical Support

If you have problems about using the ALM-Horn Series device, please contact ICP DAS Product Support.
Email: service@icpdas.com

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