User Manual

ADAM-6700 Series

Compact Intelligent Gateway with I/O

ADVANTECH

Enabling an Intelligent Planet

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If you believe your product is defective, follow the steps outlined below.

1. Collect all the information about the problem encountered (for example, CPU speed, Advantech products used, other hardware and software used). Note anything abnormal and list any onscreen messages displayed when the problem occurs.
2. Call your dealer and describe the problem. Please have your manual, product, and any helpful information readily available.
3. If your product is diagnosed as defective, obtain a return merchandize authorization (RMA) number from your dealer. This allows us to process your return more quickly.
4. Carefully pack the defective product, a completed Repair and Replacement Order Card, and a proof of purchase date (such as a photocopy of your sales receipt) into a shippable container. Products returned without a proof of purchase date are not eligible for warranty service.
5. Write the RMA number clearly on the outside of the package and ship the package prepaid to your dealer.

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Technical Support and Assistance

1. Visit the Advantech website at www.advantech.com/support to obtain the latest product information.
2. Contact your distributor, sales representative, or Advantech's customer service center for technical support if you require additional assistance. Please have the following information ready before calling:
   - Product name and serial number
   - Description of your peripheral attachments
   - Description of your software (operating system, version, application software, etc.)
   - A complete description of the problem
   - The exact wording of any error messages

Contents

Chapter 1

Product Overview

1.1 Introduction

The ADAM-6700 series are intelligent compact gateways aimed at edge applications. Equipped with an Arm® Cortex®-A8 32-bit 1 GHz microcontroller unit (MCU) and I/O module, the ADAM-6700 series can serve as edge platforms for data acquisition. Furthermore, the ADAM-6700 series gateways support Node-RED and C-language API programming tools to enable flexible implementation according to application demands.

1. Cloud /database access with data encryption

Every cloud/database has a unique connection mechanism that can cause problems regarding data formatting, encryption, and access. The ADAM-6700 series gateways are capable of transmitting data to the cloud via different nodes. For legacy machines that cannot transmit data to the cloud, the ADAM-6700 series can serve as a data communication gateway to enable IoT applications.

2. Open platform for flexible programming

- Graphical programming environment
  Node-RED is a programming tool developed by IBM for connecting hardware devices together without complex programming. Node-RED allows users to code programs by simply dragging and dropping nodes. Nodes are programmed using JavaScript. For advanced users, the JavaScript code for nodes can be modified according to the project requirements. For more information, visit https://flows.nodered.org/.
- C-language API commands
  For users wanting to program using a high-level language, C-language APIs are provided for easy programming.

3. Data acquisition

The ADAM-6700 series features an I/O module for collecting data from digital or analog sensors. With the inclusion of an Arm® Cortex®-A8 MCU, large amounts of data can be analyzed locally, reducing latency and potential data losses. For example, if a collected data value is outside the predefined threshold, ADAM-6700 platforms can identify this locally and directly trigger an alarm to turn off the machine, while also sending a notification to management..

4. Edge data analysis

Cloud service and storage costs are directly related to the amount of data uploaded to the cloud. Thus, instead of uploading all raw data to the cloud, ADAM-6700 platforms are capable of processing raw data into insightful information, such as average, maximum, and minimum values, before transmission to the cloud. This not only reduces costs by minimizing the amount of data uploaded, but also facilitates data visualization on digital dashboards.

1.2 Hardware Introduction

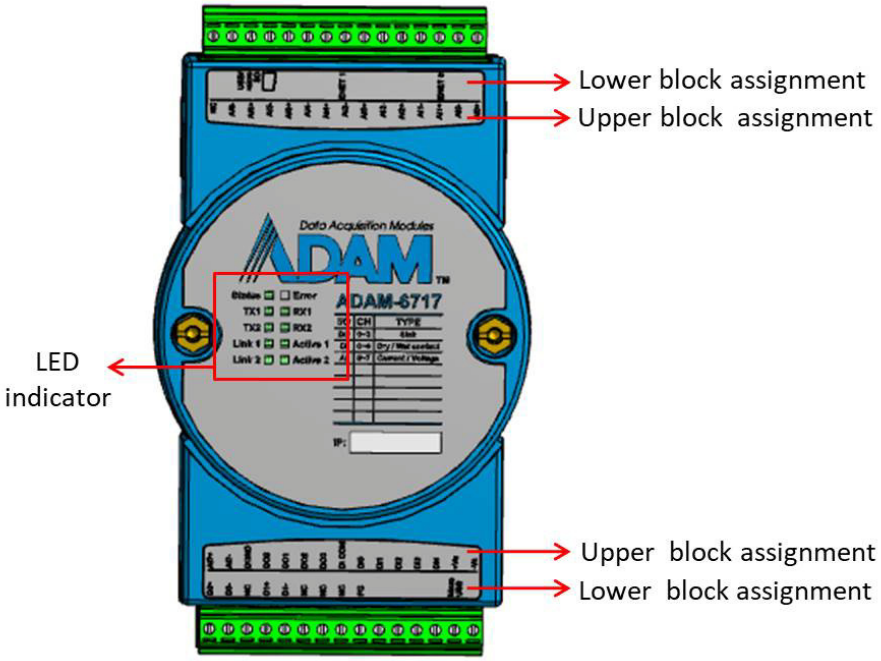

Figure 1.1 ADAM-6700 Series (Front View)

1.2.1 Power Connection

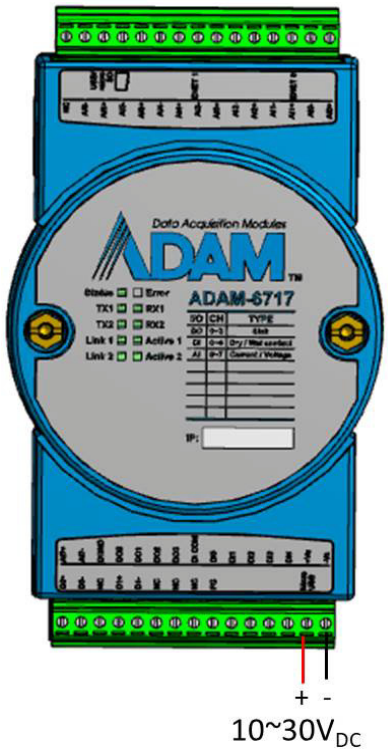

Figure 1.2 ADAM-6700 Series Power Connection

1.2.2 USB Connector

The ADAM-6700 series features a micro USB port that is used as a console port. When connect to the USB port, the device can be powered via USB...

Note! *The ADAM-6700 series can be powered by micro USB for configuration. During operation, the device should be powered with 10 ~ 30V_{DC} via the Vs+ and Vs- terminal pins.*

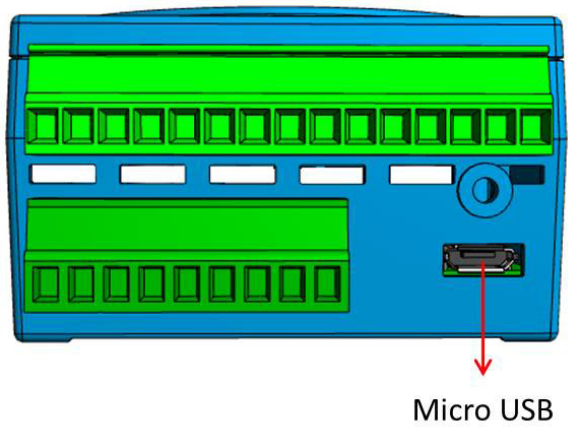

Figure 1.3 ADAM-6700 Series Micro USB

The Type-A USB port is used as a host. Users can connect a USB dongle to the ADAM-6700 device.

Note! *When the Type-A USB port is in use, power must be provided via the Vs+ and Vs- terminal pins.*

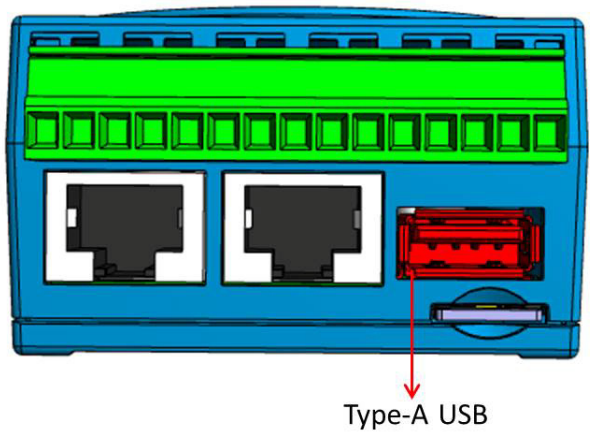

Figure 1.4 ADAM-6700 Series Type-A USB

1.2.3 Micro SD Slot

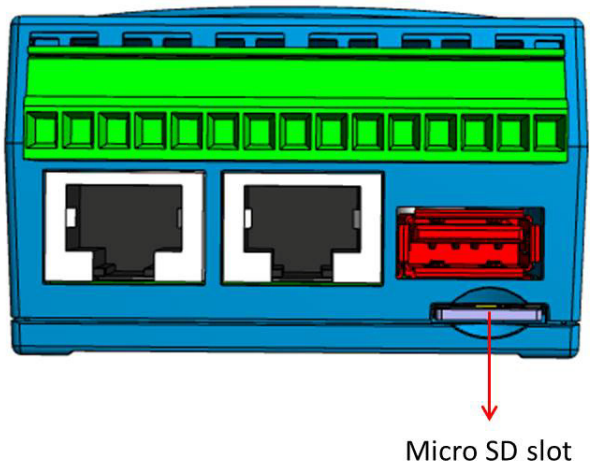

Figure 1.5 ADAM-6700 Series Micro SD

1.2.4 RS-485 Connector

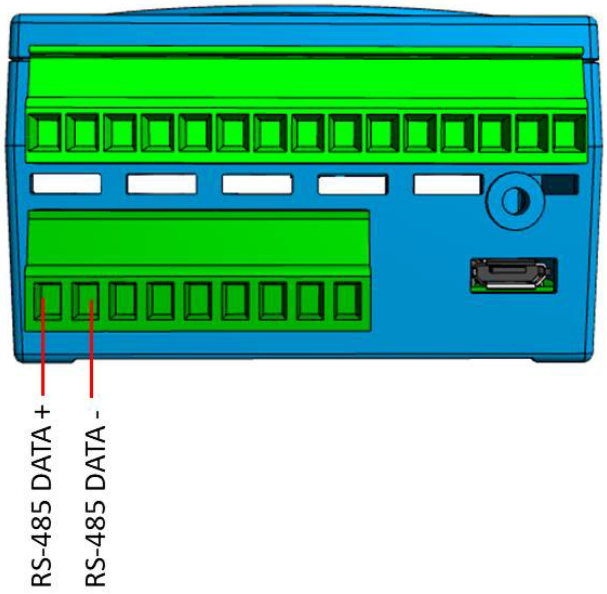

Figure 1.6 ADAM-6700 Series RS-485 Connector

1.2.5 Ethernet Connector

The ADAM-6700 series gateways have two MAC IDs that are listed on a label on the side of the device. The default IP address for these ports is 10.0.0.1 (Eth0) and 11.0.0.1 (Eth1).

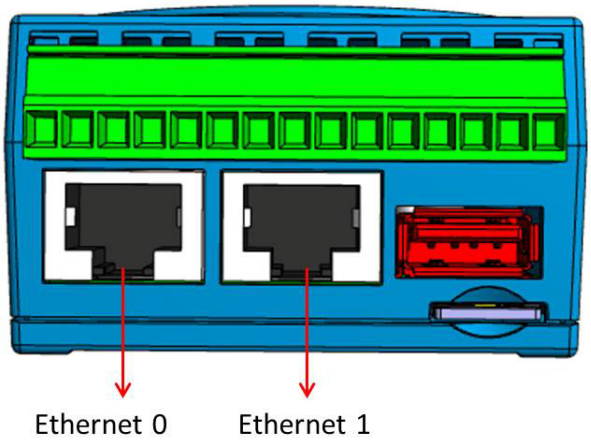

Figure 1.7 ADAM-6700 Series Ethernet Connection

1.2.6 Reset Button

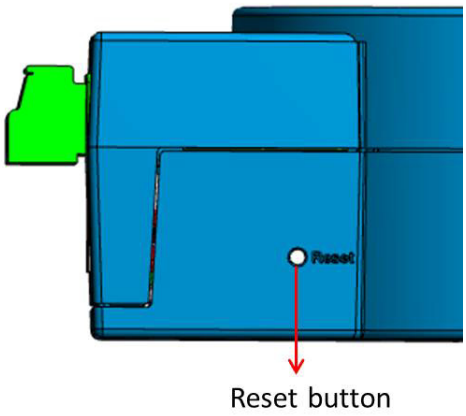

Figure 1.8 ADAM-6700 Series Reset Button

1.3 LED Indicator Definition

The ADAM-6700 series gateways are equipped with LED indicators that show the device status. The LED indicator behaviors are defined below.

The indicator behavior for error events can be configured using Node-RED.

LED	Color	Behavior	Definition
Status	Green	Stay on	Module is booting
		Flash every 1s	Operating system is ready
		Flash every 0.5s	Conducting image recovery processing
Error	Red	User defined	User defined
Tx0	Yellow	Stay on	RS-485 port (D0) is transmitting data
Tx1	Yellow	Stay on	RS-485 port (D1) is transmitting data
Rx0	Green	Stay on	RS-485 port (D0) is receiving data
Rx1	Green	Stay on	RS-485 port (D1) is receiving data
Link0	Yellow	Stay on	Ethernet(Eth0) speed is 100 Mbps
Link1	Yellow	Stay on	Ethernet(Eth1) speed is 100 Mbps
Active0	Green	Flashing	Ethernet(Eth0) is transmitting/receiving data
Active1	Green	Flashing	Ethernet(Eth1) is transmitting/receiving data

1.4 Dimensions

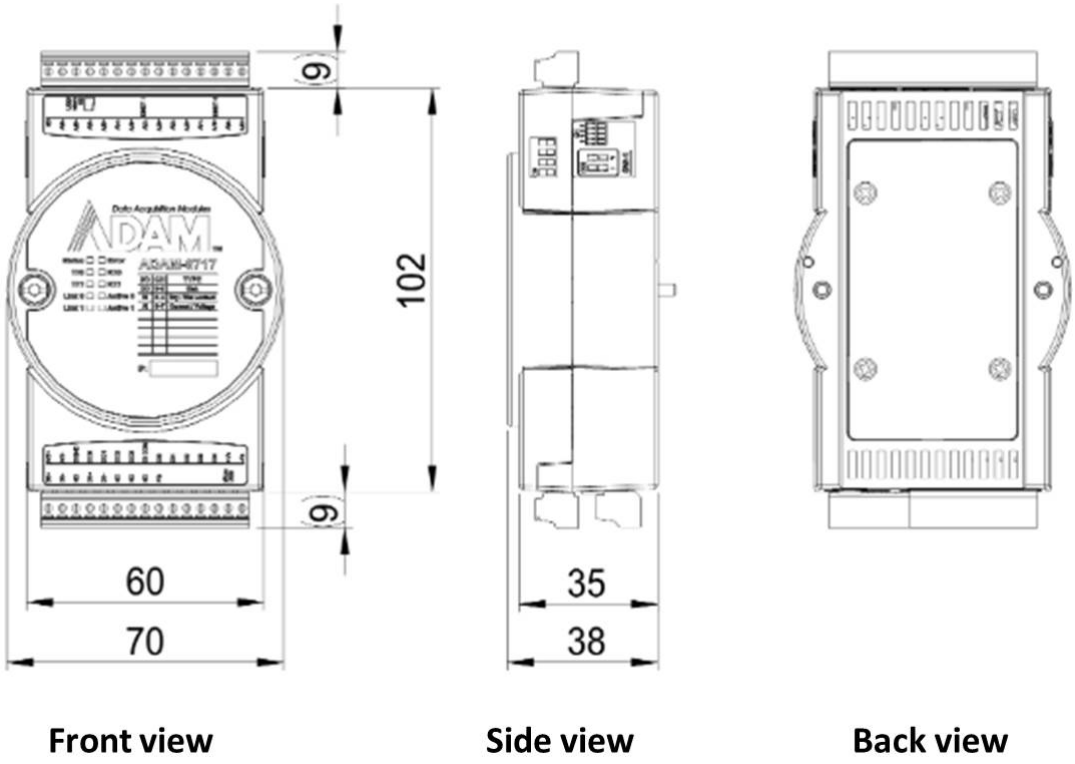

Figure 1.9 ADAM-6700 Series Dimensions

Chapter 2

Wiring and Settings

2.1 ADAM-6717 Gateway with Analog Input

2.1.1 Specifications

Analog Input

- **Channels:** 8 (differential and independent configurable)
- **Current input range:** 0 ~ 20 mA,4 ~ 20 mA, ±20 mA
- **Voltage input range:** 0 ~ 10V, 0 ~ 150mV, 0 ~ 1V, 0 ~ 5V, 0 ~ 10V, ±5V, ±1V, ±500mV, ±150mV, ±10V, 0 ~ 500mV
- **Sampling rate:** 10/100 Hz (total)
- **Accuracy@25 °C:** Voltage 0.1% FSR, current 0.2% FSR
- **Zero drift:** ±6uV /°C
- **Span drift:** ±25 ppm/°C
- **High common mode:** 200 V_{DC}
- **Resolution:** 16 bit

Digital Output

- **Channels:** 4
- **Type:** sink 30 VDC, 0.1A max. per channel
- **Delay time:** Low to high: 100 us; High to low: 150 us

Digital Input

- **Channels:** 5
- **Dry contact:** Logic 0: open; Logic 1: closed to DGND
- **Wet contact:** Logic 0: 0 ~ 3 V_{DC}; Logic 1: 10 ~ 30 V_{DC}

General

- **Power input:** 10 ~ 30 V_{DC}
- **Operating temperature:** -40 ~ 70 °C (-40 ~ 158 °F)
- **Storage temperature:** -40 ~ 85 °C (-40 ~ 185 °F)
- **Operating humidity:** 40 °C @85% RH Non-condensing
- **Storage humidity:** 85 °C @95% RH Non-condensing
- **Power consumption:** 6W @ 24 V_{DC}
- **Real-time clock accuracy:** 2 second delay per day max.
- **LAN port:** 2 x (2 MAC ID) 10/100 Mbps
- **USB port:** 1 x micro USB, 1 x USB Type-A
- **RS-485 port:** 2
- **OS:** RT Linux V3.12
- **Memory:** NAND flash 512 MB
- **RAM:** DDR3L 512 MB
- **Program:** Node-RED, Linux C
- **External storage:** 1 x micro SD slot
- **Screw terminal block:** Accepts wire size #16-28 AWG, stripped length: 6.5 mm
- **Certification:** CE, FCC
- **Isolation:** 2500 V_{DC}

2.1.2 Application Wiring

Analog Input and Digital Output Wiring

The gateway supports the voltage and current input. Before connecting the voltage or current input, ensure that the switch and input range settings of the web utility are set to the correct value.

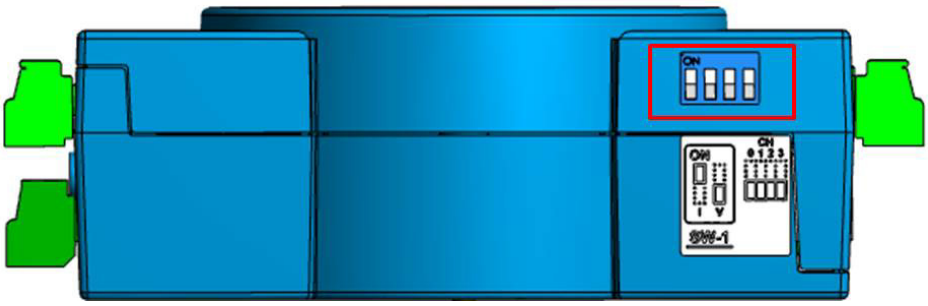

Figure 2.1 Current/Voltage Input Switch Setting

	SW1				SW2			
AI Channel	Ch0	Ch1	Ch2	Ch3	Ch4	Ch5	Ch6	Ch7
ON	Current input mode							
OFF(default)	Voltage input mode							

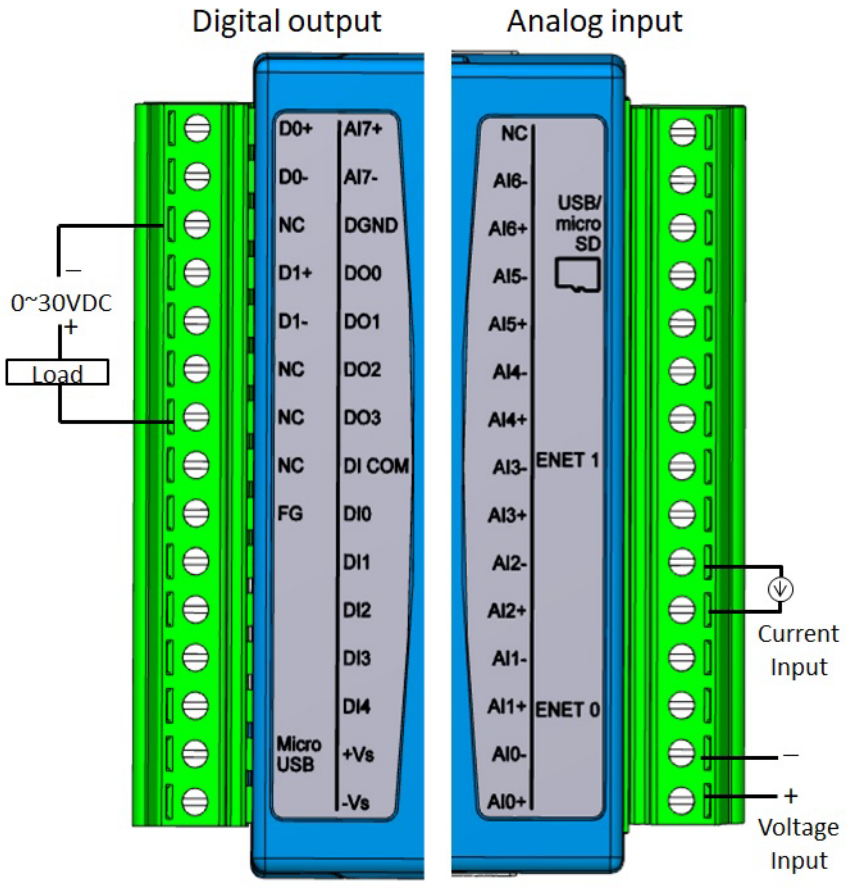

Figure 2.2 Digital Output and Analog Input Wiring

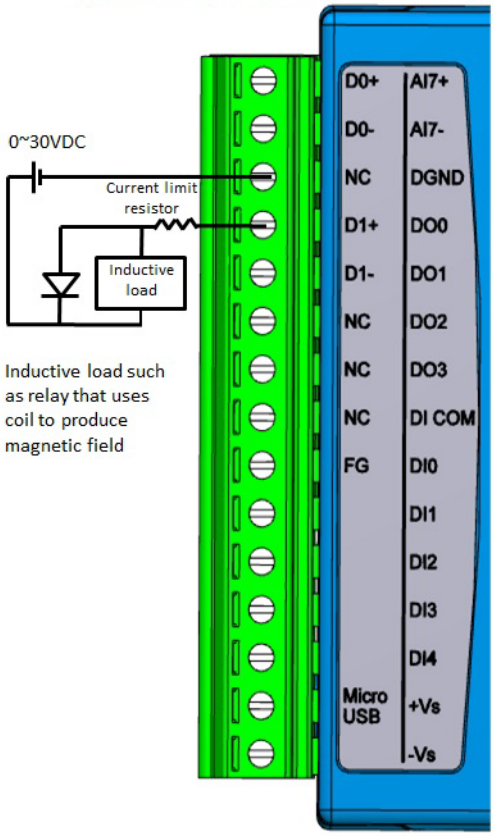

Figure 2.3 Digital Output with Inductive Load

Digital Input Wet/Dry Contact Wiring

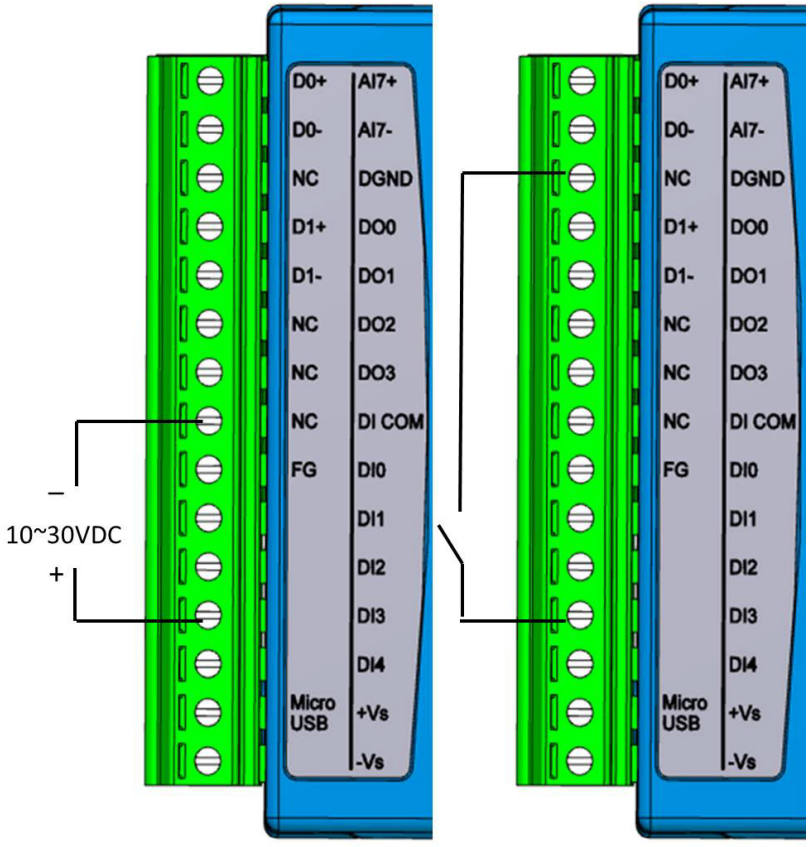

Figure 2.4 Wet and Dry Contact Wiring

2.2 ADAM-6750 Gateway with Digital Input/Output

2.2.1 Specifications

Digital Output

- **Channel:** 12
- **Type:** Sink 30 V_{DC}, 0.1A max. per channel
- **Delay time:** Low to high: 100 us; High to low: 150 us
- **Pulse output:** Up to 3 kHz

Digital Input

- **Channel:** 12
- **Dry contact:** Logic 0: open; Logic 1: closed to DGND
- **Wet contact:** Logic 0: 0 ~ 3 V_{DC}, Logic 1: 10 ~ 30 V_{DC}
- **Counter/frequency:** Up to 3 kHz

General

- **Power input:** 10 ~ 30 V_{DC}
- **Operating temperature: -**40 ~ 70 °C (-40 ~ 158 °F)
- **Storage temperature:** -40 ~ 85 °C (-40 ~ 185 °F)
- **Operating humidity:** 40 °C @85% RH non-condensing
- **Storage humidity:** 85 °C @95% RH non-condensing
- **Power consumption:** 6W @ 24 V_{DC}
- **Real-time clock accuracy:** 2 second delay per day max.
- **LAN port:** 2 x (2 MAC ID) 10/100 Mbps
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- **Certification:** CE,FCC
- **Isolation:** 2500 V_{DC}

2.2.2 Application Wiring

Digital Input and Digital Output Wiring

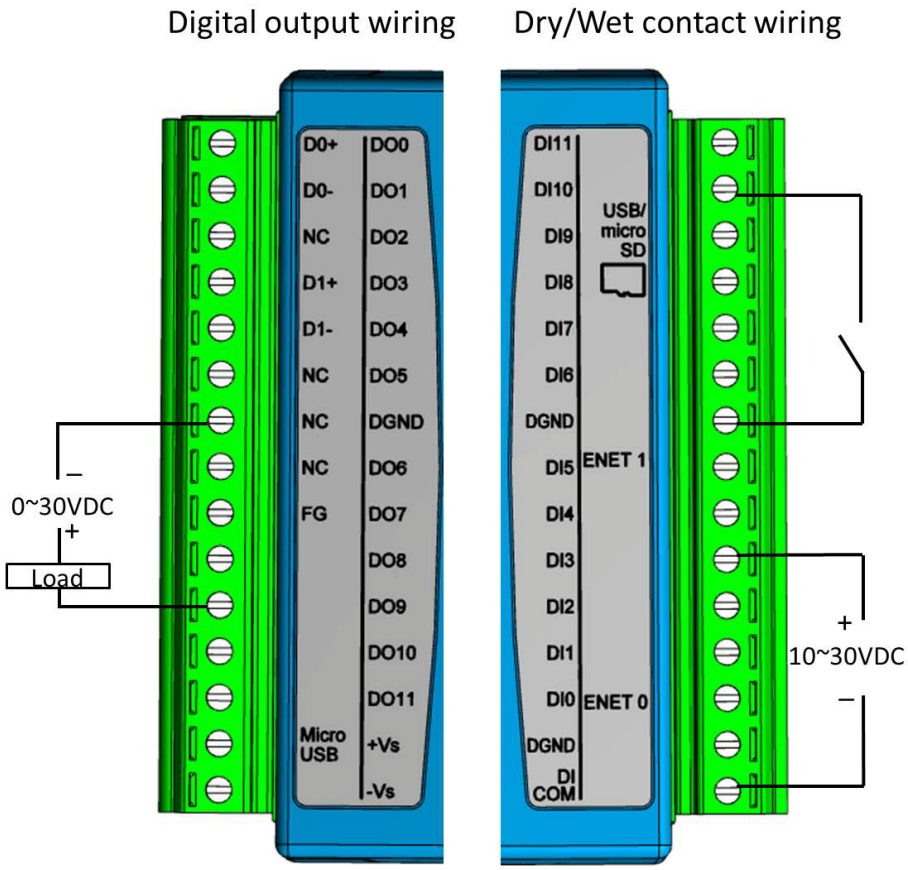

Figure 2.5 Digital Input and Digital Output Wiring

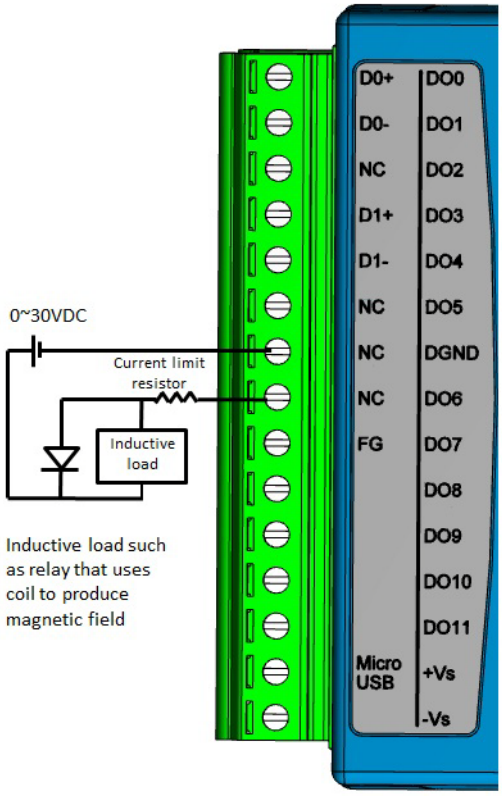

Figure 2.6 Digital Output with Inductive Load

Chapter 3

System Configuration

Advantech has developed a web portal for configuring the

ADAM-6700 series gateways. To access the web portal, users must obtain the IP address of the assigned LAN port. Then open a browser and type the IP address of the LAN port. The default IP setup mode is “DHCP”.

1. If the IP mode is set as “DHCP” and the gateway is connected to the DHCP server, type the IP address of the assigned LAN port.
2. If the IP mode is set as “DHCP”, but the gateway is not connected to the DHCP server, the LAN port will be automatically set to (Eth0)10.0.0.1 and (Eth1) 11.0.0.1
3. If the IP mode is set as “static IP”, input the assigned static IP address.

Figure 3.1 Input the LAN Port IP Address

After inputting the LAN port IP address, the web portal interface should be displayed. Click “Link” to navigate to the web utility configuration page or Node-RED program.

Figure 3.2 Web Portal

Obtain the Gateway IP

To obtain the gateway IP address, connect the LAN port of the ADAM-6700 device to your computer. Then use the ADAM/Apax.NET Utility, version 2.05.11 B19 or later, to obtain the IP address (static or DHCP mode).

Step 1. Enter the ADAM/Apax.NET Utility. Right-click the **Ethernet** icon and click **Search Device**.

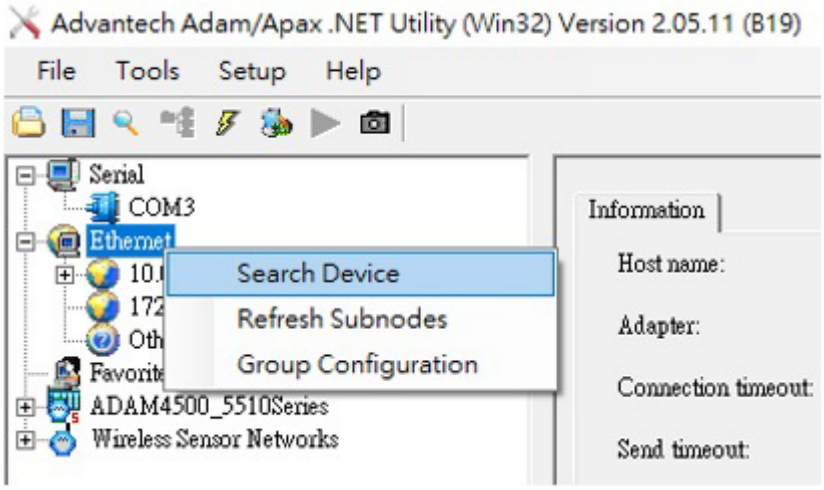

Figure 3.3 Web Utility Searching Devices

Step 2. The ADAM/Apax.NET Utility will list the connected ADAM-6700 gateways and their IP address.

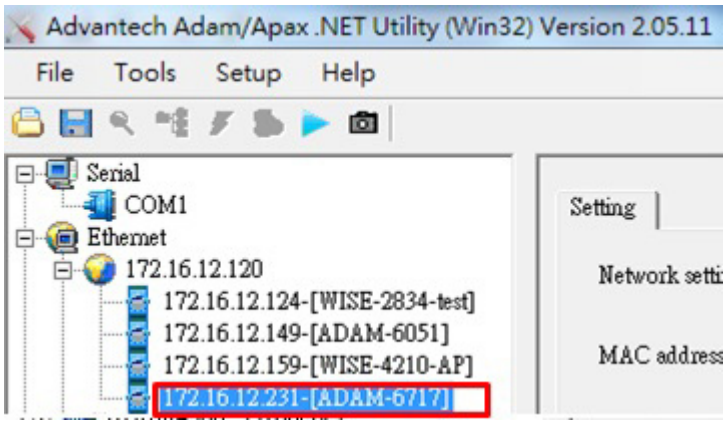

Figure 3.4 Web Utility Obtaining the Gateway IP Address

3.1 Web Utility Configuration

On the Configuration page of the web utility, click “Link”. In the popup window displayed, enter the username and password and click “Sign In”.

Default username: root

Default password: 00000000

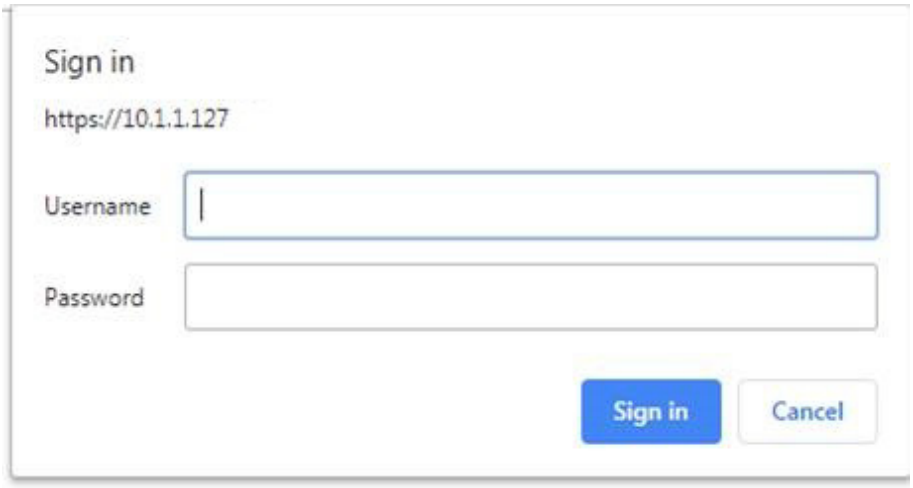

Figure 3.5 Web Utility Login Window

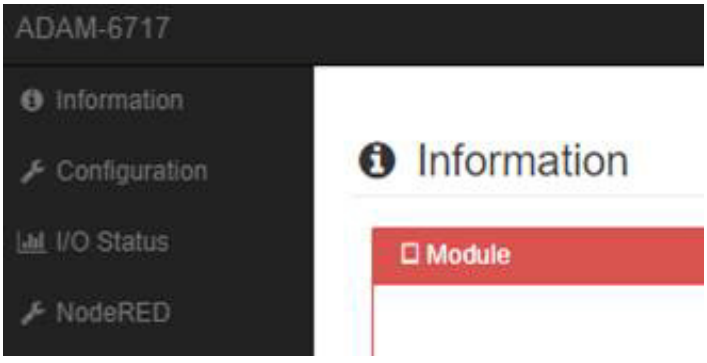

Figure 3.6 Web Utility Configuration Page

3.1.1 Information Settings

The device information, such as the model name and user-defined device name, can be found in the Information tab.

- **Device Information**

Figure 3.7 Device Information

Model Name: Shows the model name

Customized Name: Shows the user-defined device name. The name can be modified in the configuration tab.

- **Network Information**

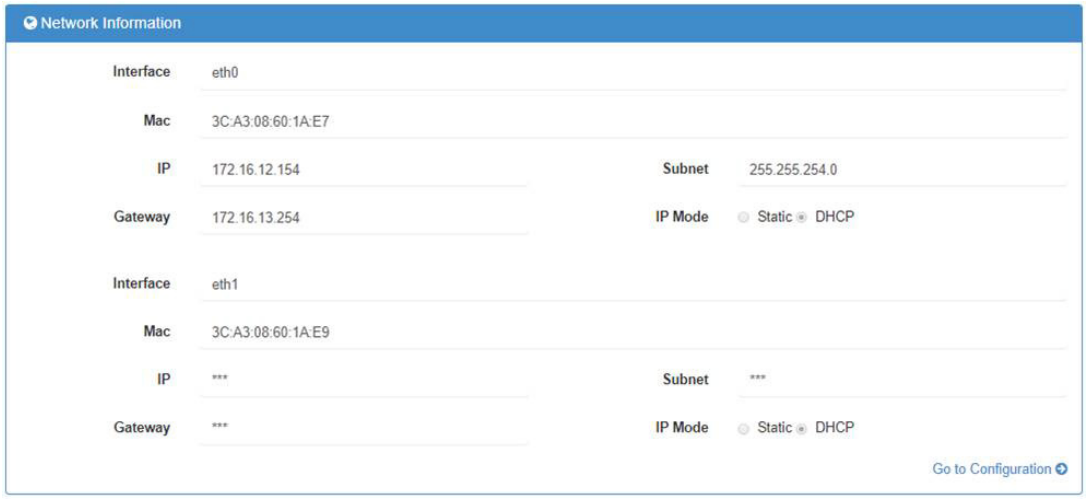

Figure 3.8 Network Information

Interface: Shows the device LAN port

Mac: Shows the Mac ID of the LAN port

Gateway: Shows the gateway IP address

Subnet: Shows the subnet address

IP Mode: This item allows users to set the IP Mode as “Static” or “DHCP”

- **Module Information**

Figure 3.9 Module Information

Module Name: Shows the module name

Module description: Shows the module description

Firmware Description: Shows the firmware version and system information

3.1.2 Configuration

Information

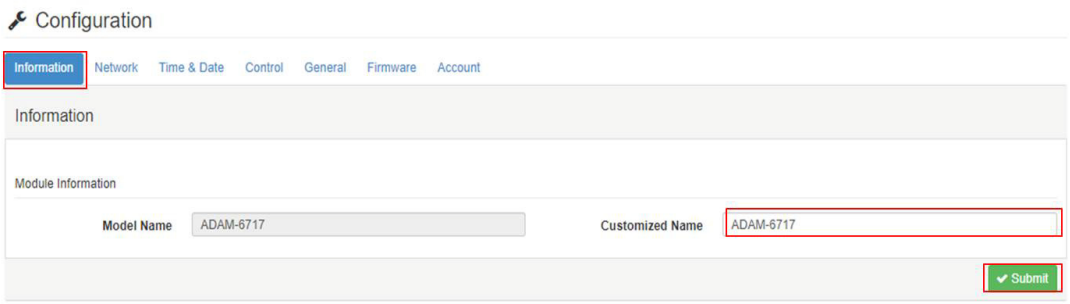

Figure 3.10 Configuration Information

Customized Name: Define the name in the column and click “submit” to implement the change.

Submit: Click for the changes to take effect

Network

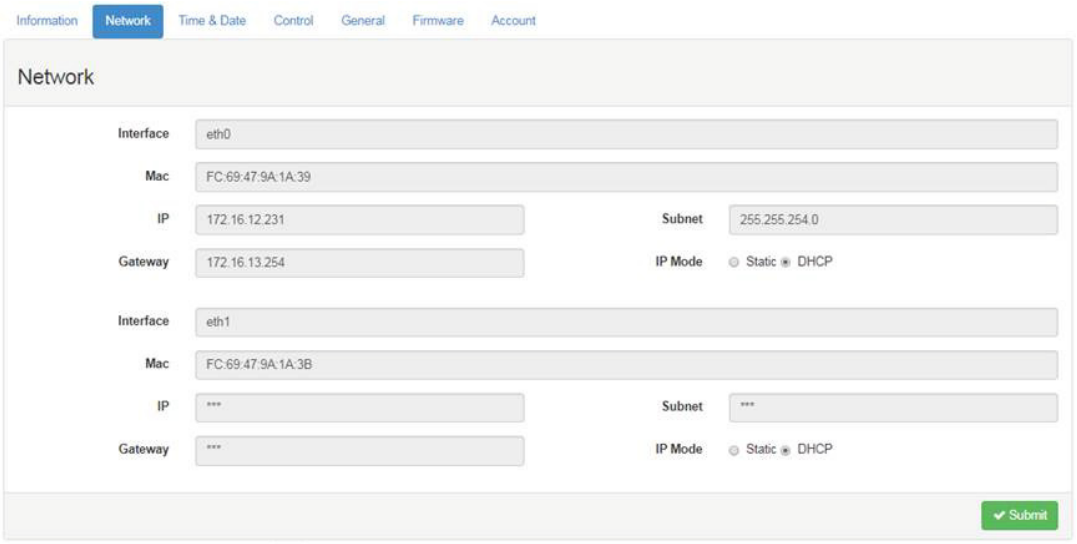

Figure 3.11 Network Information

Interface: Shows the network LAN port

Mac: Shows the Mac ID of the LAN port

IP: Shows the IP address

Gateway: Shows the gateway address

Subnet: Shows the subnet address

IP Mode: This item allows users to set the IP Mode as “Static” or “DHCP”

Time & Date

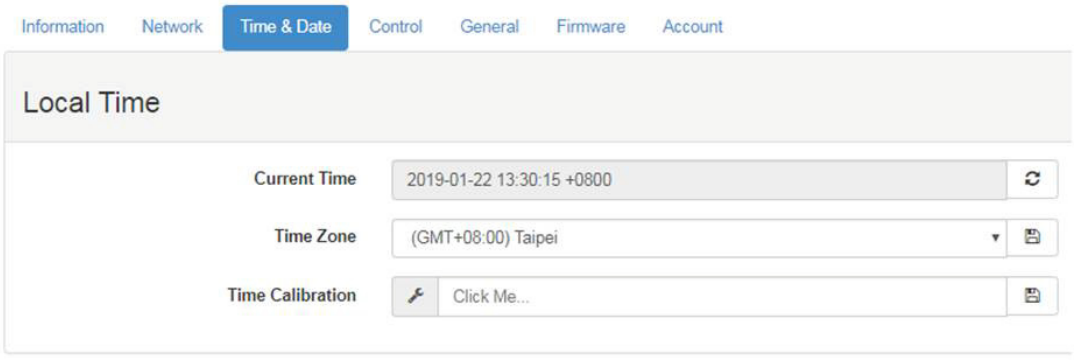

Figure 3.12 Time & Date Configuration

Current Time: Shows the current time
Time Zone: Shows the time zone
Time Calibration: This item allows users to adjust the time and date

Control

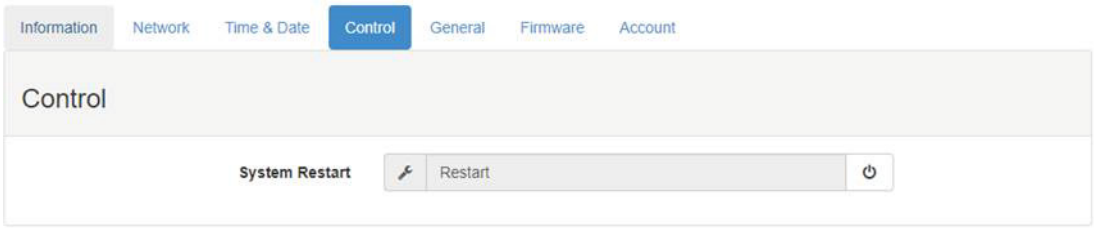

Figure 3.13 Control Tab Page

System Restart: This item allows users to reboot the system

General

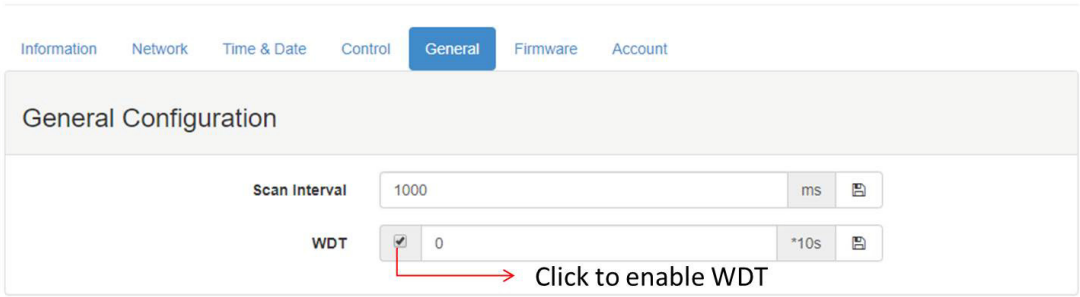

Figure 3.14 General Tab Page

Scan interval: This item allows users to set the time interval for refreshing I/O data

WDT: The system watchdog conducts system checks at regular intervals to ensure normal operation. If the watchdog detects that the system is not running, the device will be automatically rebooted. Click to enable the watchdog (a tick will appear when successfully enabled). Next, set the watchdog timer intervals as multiples of 10 seconds.

Firmware

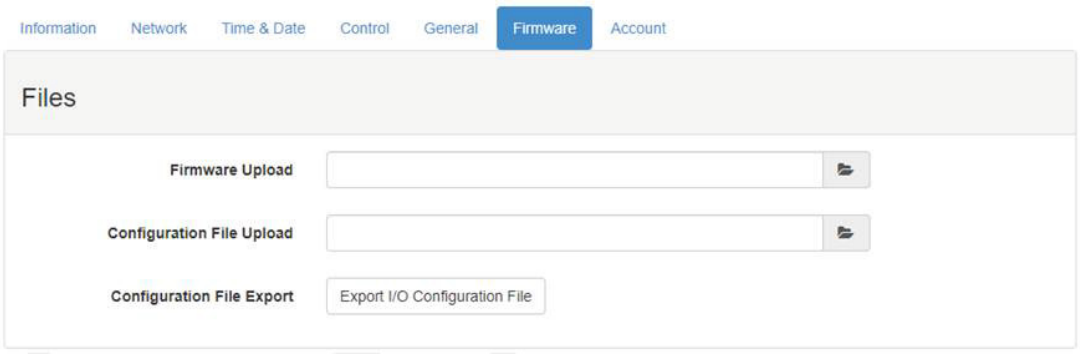

Figure 3.15 Firmware Tab Page

Firmware Upload: Follow the onscreen instructions to update the firmware
Configuration File Upload: Use this item to import the I/O configuration settings
Configuration File Export: Use this item to export the I/O configuration settings

Account

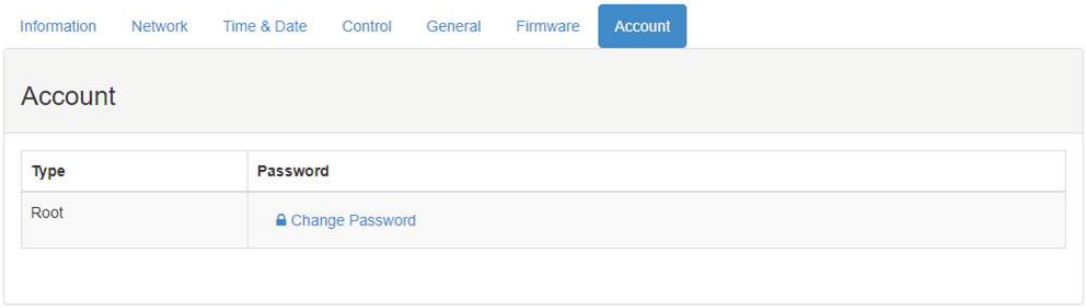

Figure 3.16 Account Tab Page

The default password is “00000000”. To change the password, click “Change Password”. The system will display a popup window.

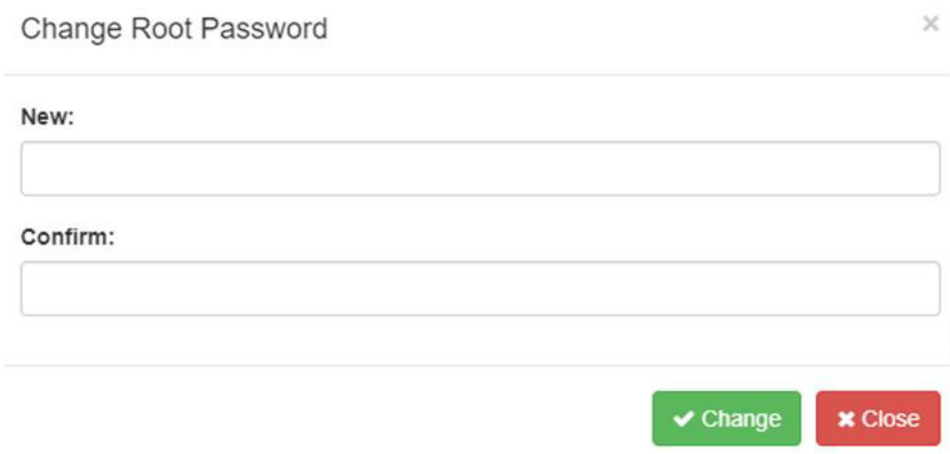

Figure 3.17 Change the Password

Input a new password and click “change”. Wait 30 seconds before logging in again using the new password (the Node-RED program will reboot when the password is changed).

3.1.3 I/O Status Settings

Analog Input Settings

Status

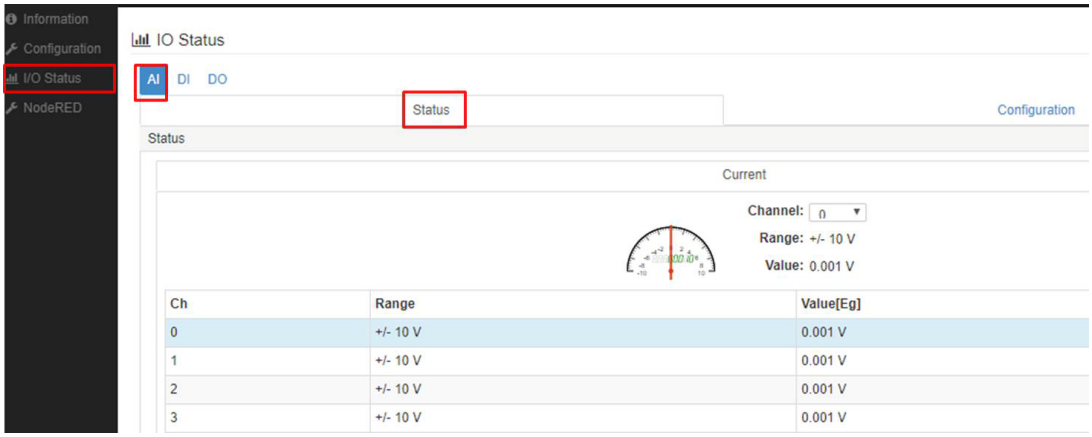

Figure 3.18 Analog Input Status

The Status tab shows the analog input settings, including the input range and values

Note! *Ensure that the current and voltage input range settings are consistent with the switch settings.*

Channel Settings

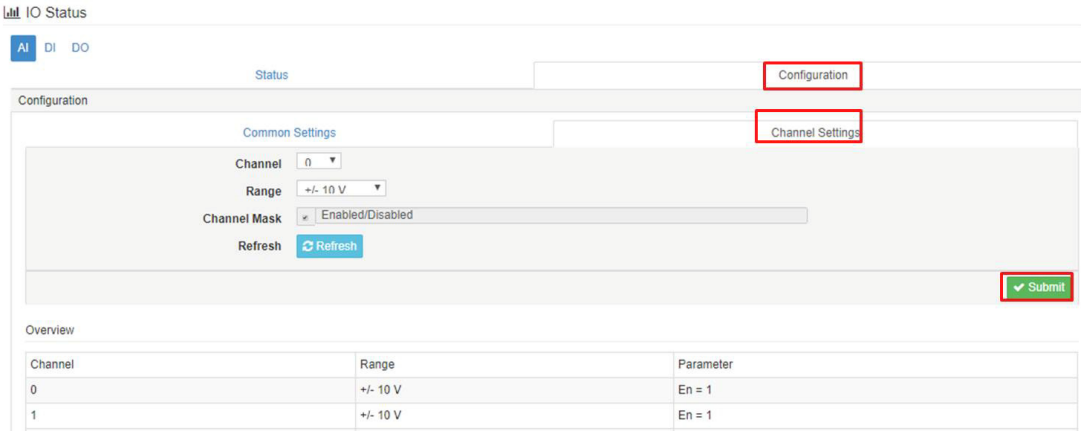

Figure 3.19 Analog Input Channel Settings

Channel: Use this item to select the channel for configuration. The “All” option can be used to configure all channels simultaneously.

Range: Use this item to set the analog input range

Channel Mask: Use this item to enable/disable channel masking (a tick will appear when successfully enabled)

Refresh: Use this item to refresh the channel information

Submit: Click to make the changes take effect

Parameter: When the channel is enabled En = 1 and when the channel is disabled En = 0

Common Settings

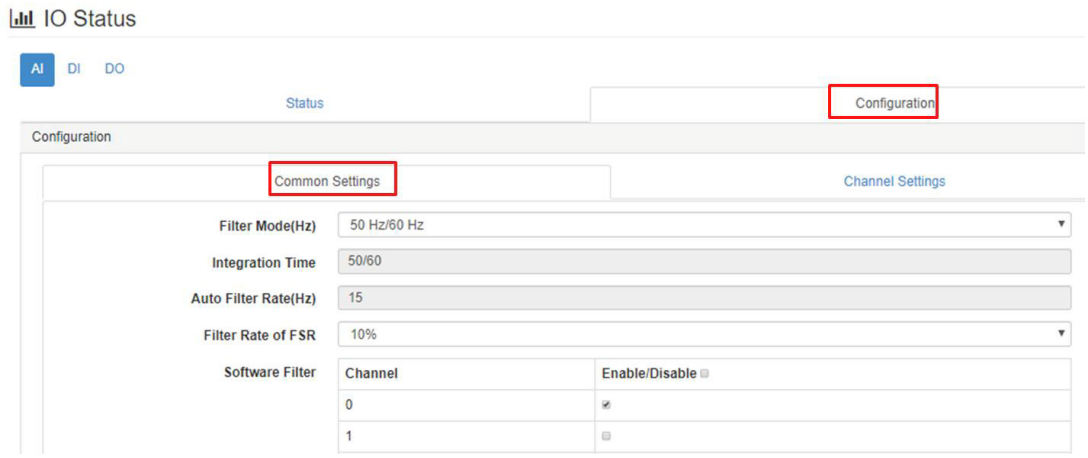

Figure 3.20 Analog Input Common Settings

Filter Mode: Use this item to change the sampling rate. The default mode is 50/60 Hz. Low-speed mode is 10 Hz (total). High speed mode is 100 Hz (total). User-defined mode is not available

Filter Rate of FSR: Use this item to set the noise filter function. If the value is more than the percentage of the input range, the value will be considered noise + filter.

Software Filter: Use this item to enable/disable the noise filter function

■ Digital Input Settings

ADAM-6717

Figure 3.21 ADAM-6717 Digital Input Settings

Status: Shows the status of the digital inputs; green = on, grey = off

ADAM-6750

DI Mode Configuration

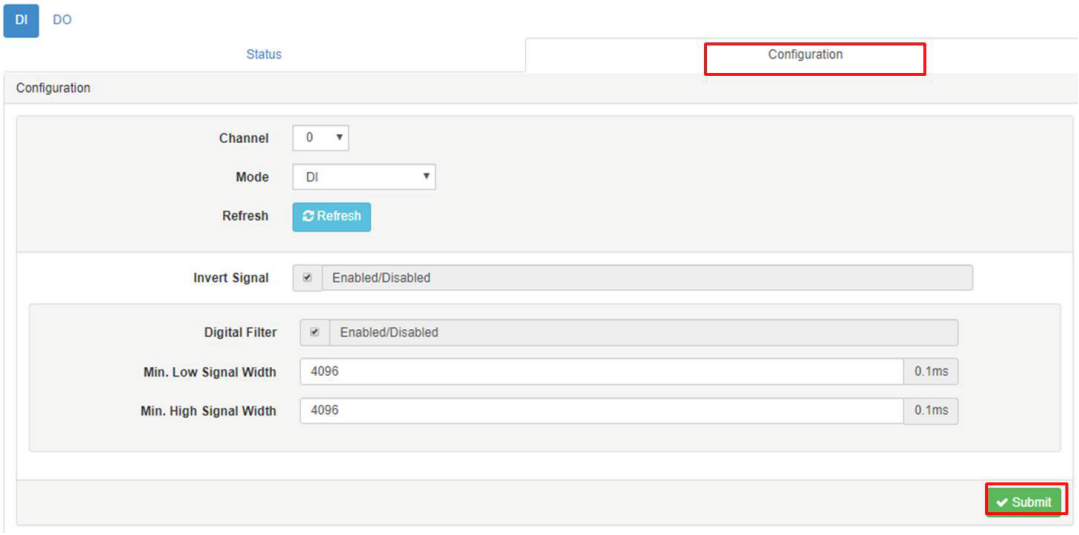

Figure 3.22 ADAM-6750 Digital Input Settings

Channel: Select the channel for configuration

Mode: Use this item to set the digital input mode as “DI”, “counter”, “low-to-high latch”, “high-to-low latch”, or “frequency”

Refresh: Use this item to refresh the current settings

Invert Signal: Use this item to enable/disable inversion of DI signals (a tick will appear when enabled)

Digital Filter: Use this item to enable/disable the digital filter (a tick will appear when enabled)

Min. Low Signal Width: Use this item to set the low signal width of the filter as multiples of 0.1 ms

Min. High Signal Width: Use this item to set the high signal width of the filter as multiples of 0.1ms

Overview

Channel	Mode	Parameter
0	Counter	Inv = 0, Fltr = 0, FtHi = 1, FtLo = 1, CntKp = 0
1	Frequency	Inv = 0
2	DI	Inv = 1, Fltr = 1, FtHi = 4096, FtLo = 4096
3	High to Low Latch	Inv = 0

Figure 3.23 ADAM-6750 Digital Input Information

Parameter: Shows the channel settings: 1 = enable, 0 = disable, Inv = invert signal, Fltr = filter, FtHi = high signal width, FtLo = low signal width, CntKp = keep last value

Counter Mode Configuration

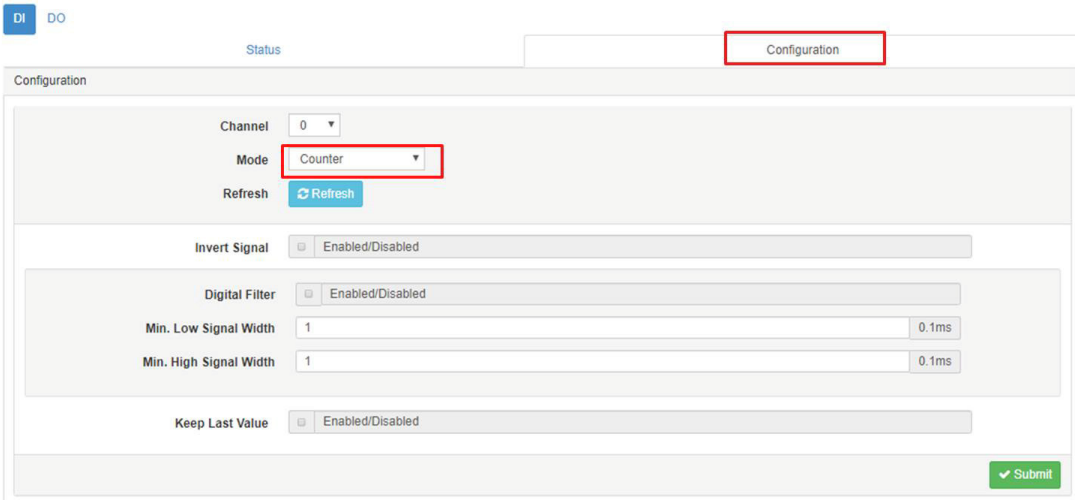

Figure 3.24 Counter Mode Configuration

Channel: Select the channel for configuration

Invert Signal: Use this item to enable/disable inversion of DI signals (a tick will appear when enabled)

Digital Filter: Use this item to enable/disable the digital filter (a tick will appear when enabled)

Min. Low Signal Width: Use this item to set the low signal width of the filter as multiples of 0.1 ms

Min. High Signal Width: Use this item to set the high signal width of the filter as multiples of 0.1 ms

Keep Last Value: Use this item to enable/disable the keep last value function (a tick will appear when enabled)

Submit: Click to make the changes take effect

Low-to-High Delay/High-to-Low Latch Configuration

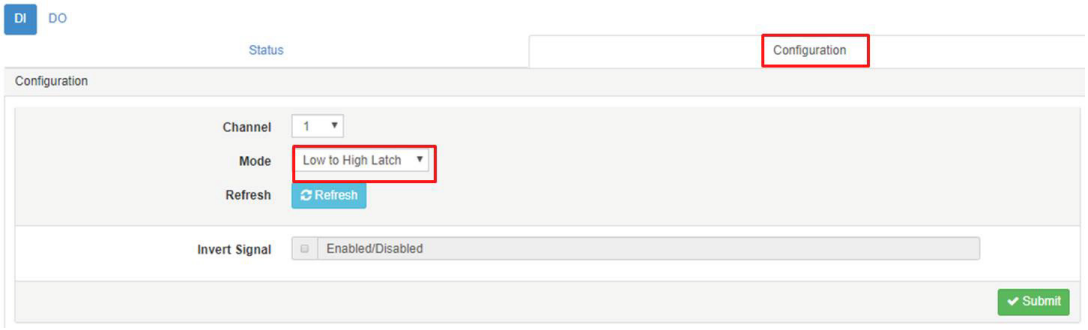

Figure 3.25 Low-to-High Delay/High-to-Low Latch Settings

Invert Signal: Use this item to enable/disable inversion of DI signals (a tick will appear when enabled)

Frequency Mode Configuration

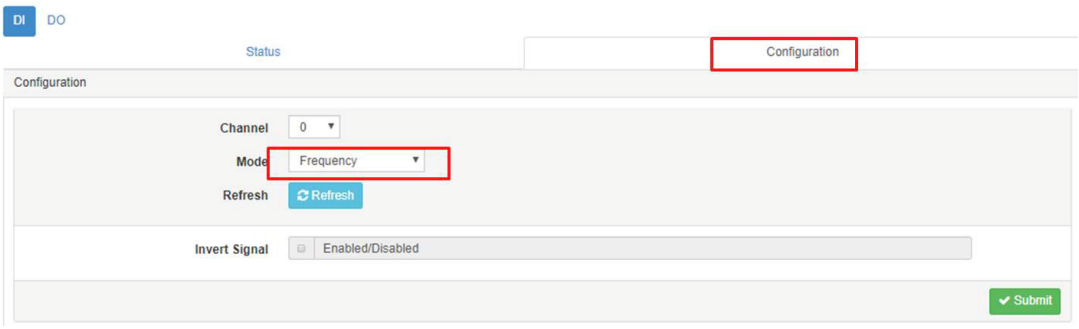

Figure 3.26 Frequency Mode Settings

Invert Signal: Use this item to enable/disable inversion of DI signals (a tick will appear when enabled)

Status

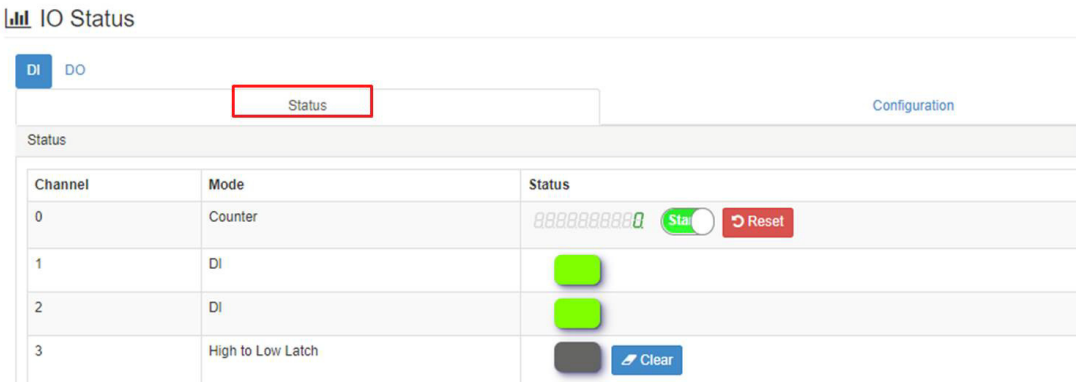

Figure 3.27 ADAM-6750 Digital Input Status

Mode: Use this item to view and change the channel mode

■ Digital Output Settings

ADAM-6717

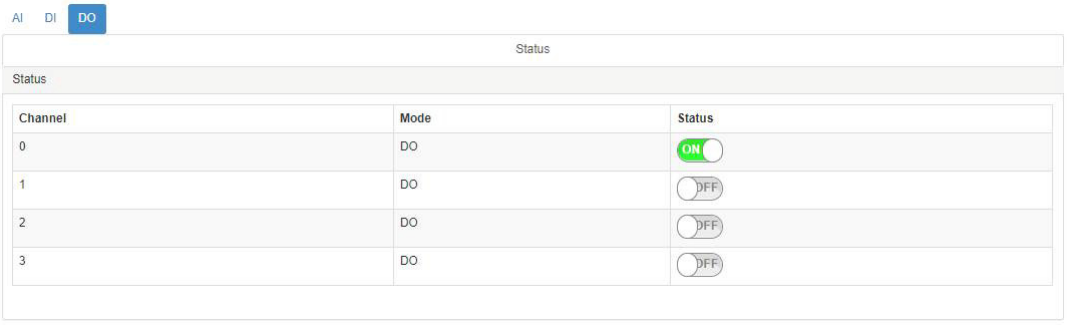

Figure 3.28 ADAM-6717 Digital Output Settings

Status: Shows the status of the digital outputs; green = on, grey = off

ADAM-6750

DO Mode Configuration

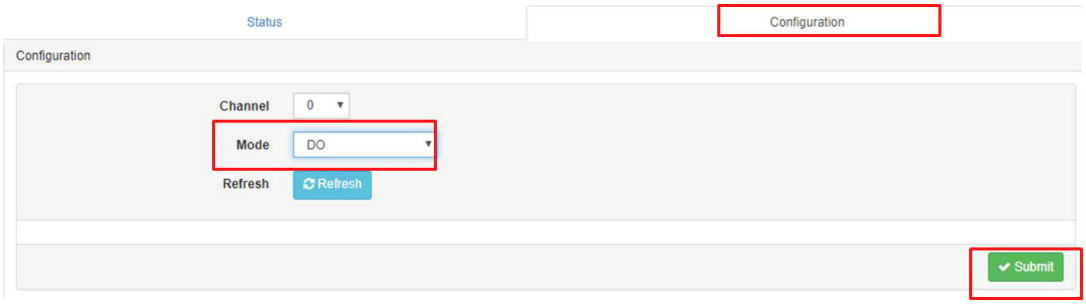

Figure 3.29 ADAM-6750 Digital Output Settings

Channel: Use this item to select the channel for configuration

Submit: Click to make the changes take effect

Pulse Output Mode Configuration

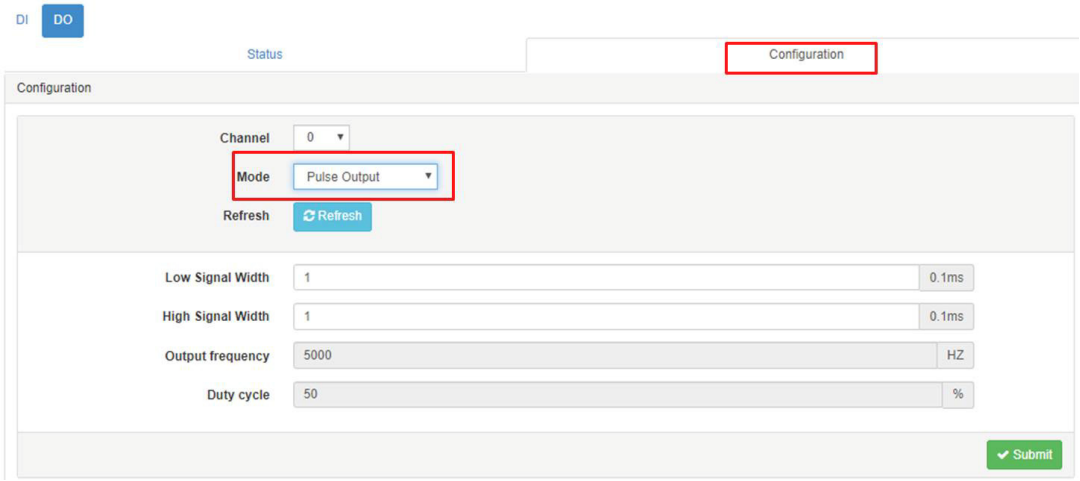

Figure 3.30 Pulse Output Mode Settings

Channel: Use this item to select the channel for configuration

Min. Low Pulse Width: Use this item to set the low pulse width of the filter as multiples of 0.1 ms

Min. High Pulse Width: Use this item to set the high pulse width of the filter as multiples of 0.1 ms

Output Frequency: Use this item to set the pulse output frequency (up to 3 kHz)

Duty Cycle: Use this item to set the duty cycle

Submit: Click to make the changes take effect

I

Low-to-High Delay/High-to-Low Delay Configuration

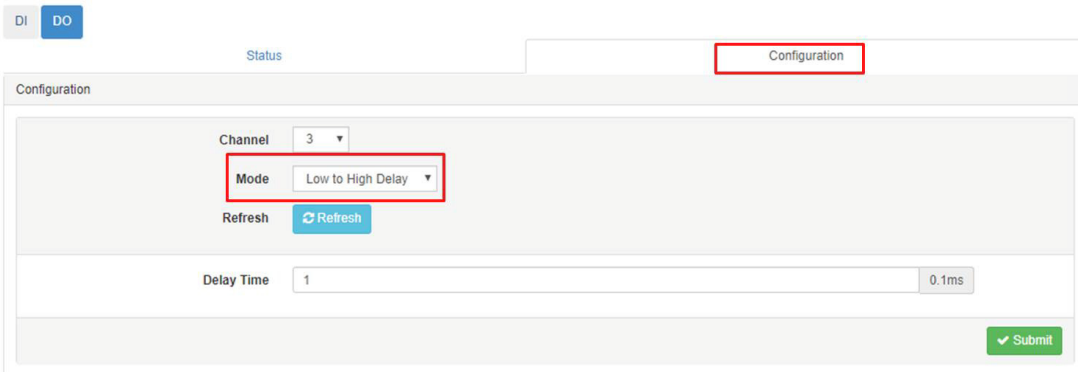

Figure 3.31 Low-to-High Delay/High-to-Low Delay Settings

Channel: Use this item to select the channel for configuration

Delay Time: Use this item to set the delay time as multiples of 0.1 ms

Submit: Click to make the changes take effect

Status

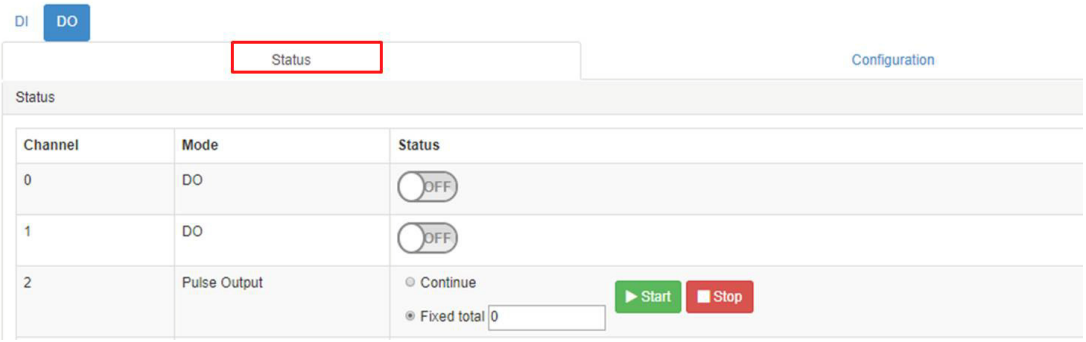

Figure 3.32 ADAM-6750 Digital Output Status

Status: Shows the status of the digital outputs; green = on, grey = off

Pulse Output: Fixed total => Click “start” to output a specific number of pulses

Continue => Click “start” to continue to output pulses until the user clicks “stop”.

3.2 Image Updates

The device image contains the operating system files and should be updated to support new functions. The latest image can be downloaded from www.advantech.com. Follow the steps outlined below to update the image.

1. Ensure that the device is turned off. Copy the image file onto a micro SD card and insert the card into the ADAM-6700 micro SD slot.
2. Turn on the device. The Status LED will flash every 0.5 seconds until the image update is complete. At this point, the status LED will flash every 1 second.
3. Turn off the device and remove the micro SD card. The device is now installed with the new image and ready for use.

Note! *After the image update process is complete, a new update.log file will be created on the micro SD card and the advupdate.txt file will be deleted. This is to prevent the system from updating the image again if the micro SD card is left in the slot. To update the image again, first delete the image file on the micro SD card. Then follow the standard steps to update the image, as outlined in Section 3.2.*

3.3 Firmware Updates

The device firmware can be updated using the web utility.

1. In the Firmware tab, click the Firmware Upload icon and select the firmware file xxxx.bin

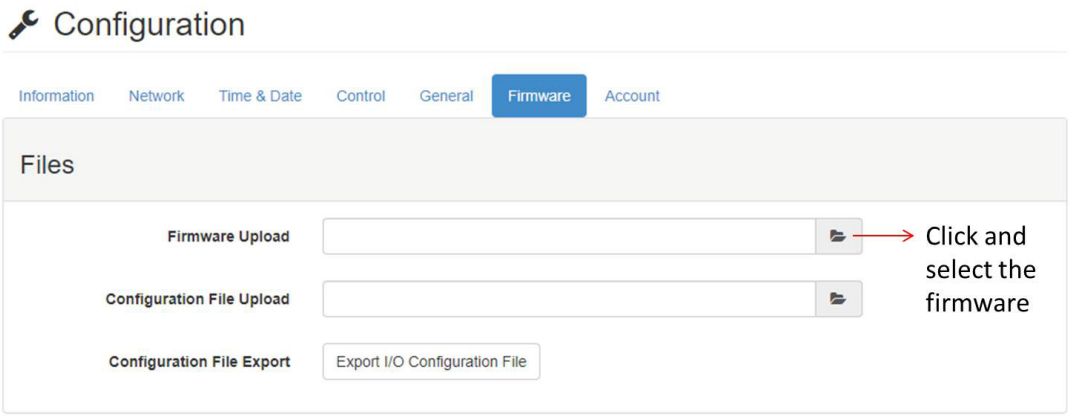

Figure 3.33 Select Firmware File

2. Click the Update icon to start the update, or click the Cancel icon to cancel the process.

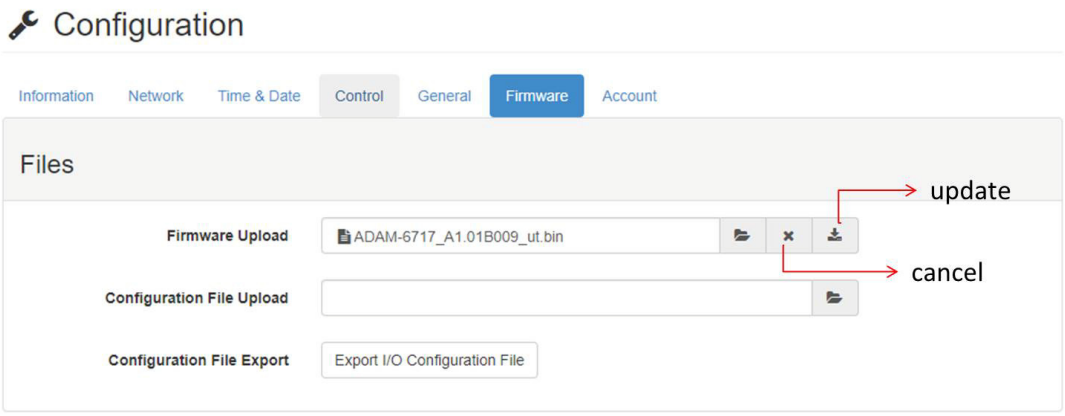

Figure 3.34 Update Firmware

3. Reboot the device to implement the firmware update.

3.4 I/O Configuration Update

To save time when configuring the I/O, the I/O configuration settings can be exported and imported to the device.

1. In the Firmware tab, click the Configuration Upload icon and select the configuration file xxxx.cfg

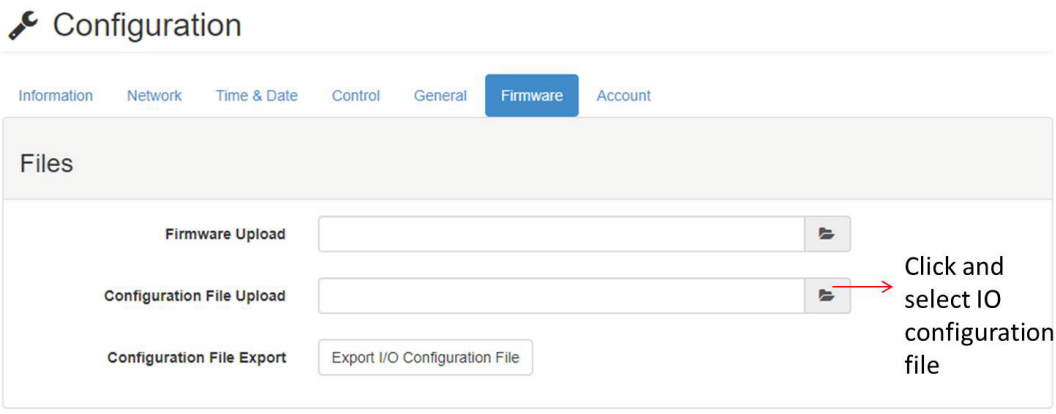

Figure 3.35 Select I/O Configuration File

2. Click the Update icon to start the update, or click the Cancel icon to cancel the process.

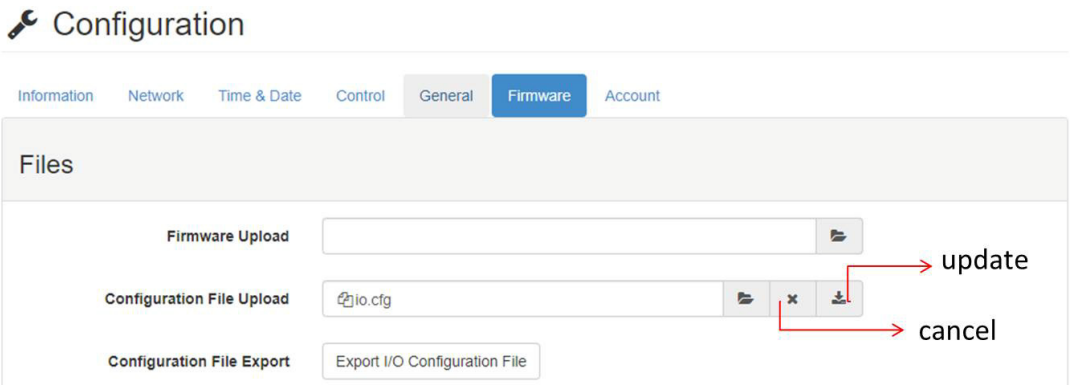

Figure 3.36 Update I/O Configuration

Chapter 4

Node-RED Program

The ADAM-6700 series devices are built in Node-RED, which is a graphical programming environment that allows users to code programs by simply dragging and dropping nodes. User can quickly and easily code programs without needing to know complex high-level programming languages.
Moreover, diverse node resources are available online to suit any application. For more information, visit https://flows.nodered.org/.

Note! *To achieve the optimum performance of the Node-RED program, close the web utility when using Node-RED.*

4.1 Starting the Node-RED Program

Connect the ADAM-6700 series device to your computer. Open a web browser and in the search bar enter the IP address of the LAN port. The web portal interface should be displayed. Click “Link” to navigate to the Node-RED program.

Figure 4.1 Web Portal Utility

Figure 4.2 Click the Node-RED Link

Enter the username and password to login (the username and password will be the same as that for the web portal).

Default username: root

Default password: 00000000

Figure 4.3 Node-RED Login

4.2 Project Creation

After logging into the Node-RED program on the ADAM-6700 series device, users can begin creating projects and coding programs. To connect hardware devices together simply drag nodes from the left-side palette and drop them into the edit area. The node information is shown in the sidebar on the right of the interface. Define the data and flow process by using wires to connect the endpoint of each node. When the flow is finished, click “Deploy” to execute the flow.

Note!

1. *When downloading or updating nodes, confirm whether the nodes support Node.js v6.3.1. If the nodes are not compatible with Node.js v6.3.1, Node-RED may crash when the nodes are in operation.*
2. *If Node-RED crashes due to downloading or updating nodes that are not compatible with Node.js v6.3.1, users will need to clean the flow. Refer to the FAQs on Advantech’s website for instructions on how to clean the flow.*

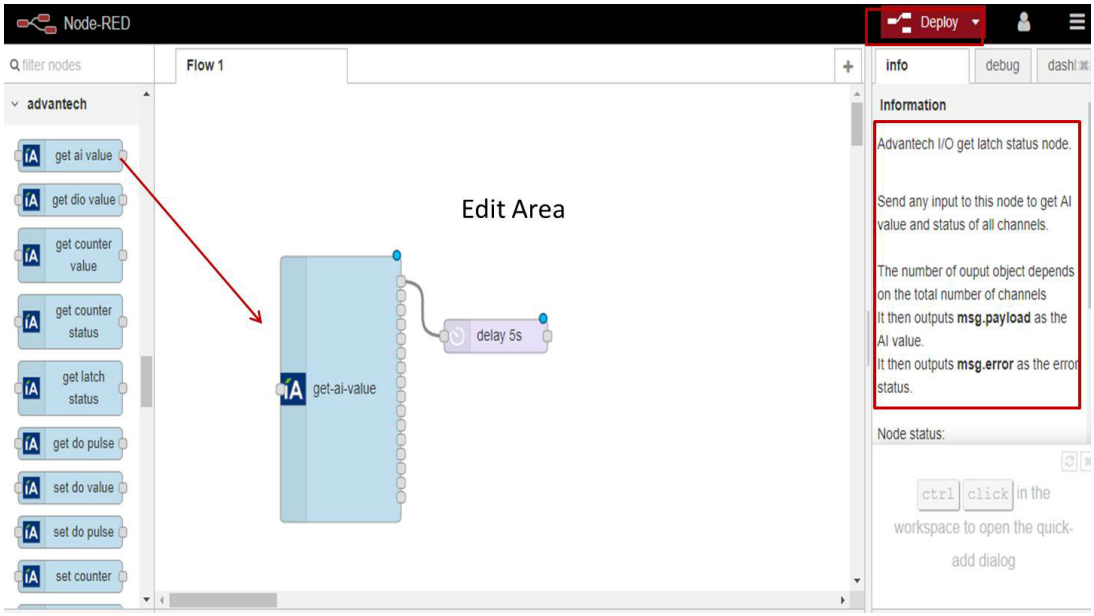

Figure 4.4 Node-RED Project Creation

Users can import sample flows from the library to reduce development time.

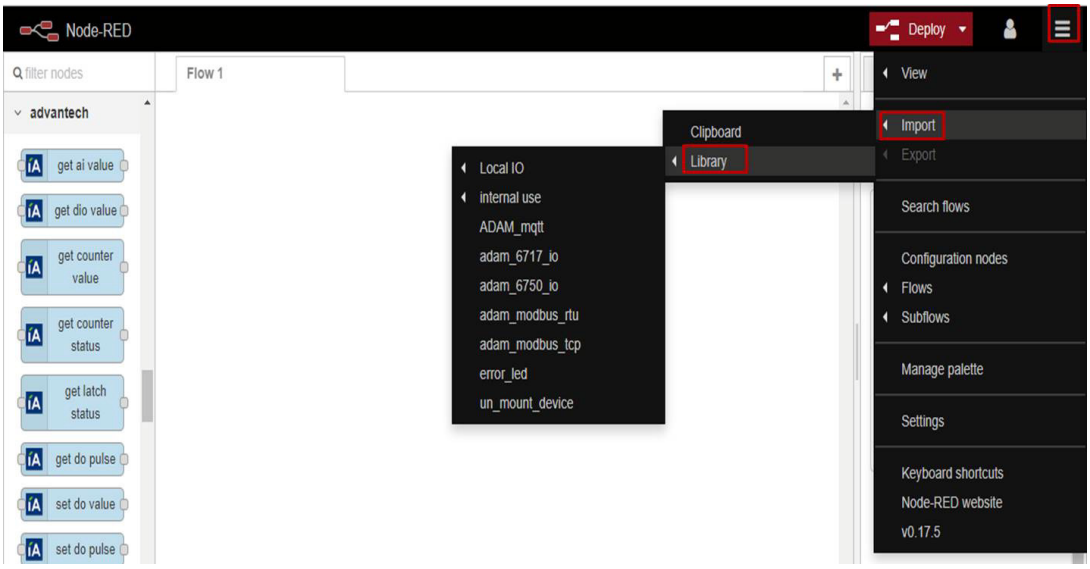

Figure 4.5 Sample Flow Template

Chapter 5

C-Language APIs

5.1 APIs for Development

The ADAM-6700 series gateways offer C-language APIs for easy programming and development. Relevant instructions and software documentation are provided on the Advantech support website at https://support.advantech.com/support.

To find the API instructions, simply visit the above link and in the support portal search bar, input the specific ADAM-6700 model (e.g., ADAM-6717, ADAM-6750).

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Please verify specifications before quoting. This guide is intended for reference purposes only.

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