EL-641M-4

USER MANUAL

Version 1.1 – Nov 2024

ELPRO Technologies

641M-2 & 641M-4

Industrial Cellular 4G-LTE Router

REVISION HISTORY

Revision	Date	Firmware version	Revision Details
1	Jan 2021	V1.1.7 (22a7514)	Initial release.
1.1	Dec 2024	V1.1.7 (22a7514)	New Format

Trademarks and copyright

ELPRO Technologies and the following logos, are the trademarks or registered trademarks in Australia.

Disclaimers

Information in this document is subject to change without notice and does not represent a commitment on the part of Elpro Technologies.

Elpro Technologies provides this document as is, without warranty of any kind, either expressed or implied, including, but not limited to, its particular purpose. Elpro Technologies may make improvements and/or changes in this manual, or in the product(s) and/or the program(s) described in this manual at any time.

Information provided in this manual is intended to be accurate and reliable. However, Elpro Technologies assumes no responsibility for its use, or for any infringements on the rights of third parties that may result from its use.

Technical Support

E-mail: support@elprotech.com
Sale: sales@elprotech.com
Web: https://www.elprotech.com

Interference Issues

Avoid possible radio frequency (RF) interference by following these guidelines:

The use of cellular telephones or devices in aircraft is illegal. Use in aircraft may endanger operation and disrupt the cellular network. Failure to observe this restriction may result in suspension or denial of cellular services to the offender, legal action, or both.

Do not operate in the vicinity of gasoline or diesel fuel pumps unless use has been approved or authorized.

Do not operate in locations where medical equipment that the device could interfere with may be in use.

Do not operate in fuel depots, chemical plants, or blasting areas unless use has been approved and authorized.

Use care if operating in the vicinity of protected personal medical devices, i.e., hearing aids and pacemakers.

Operation in the presence of other electronic equipment may cause interference if equipment is incorrectly protected.

Follow recommendations for installation from equipment manufacturers.

Declaration of Conformity

EL-641M-4 are in conformity with the essential requirements and other relevant provisions of the CE and RoHS.

Notes

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:
This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

The distance between user and products should be no less than 20cm.

Warning: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Contents

1 Product Overview

1.0. Overview

EL-641M-4 router offers a single, flexible platform to address a variety of wireless communications needs with over-the-air configuration and system monitoring for optimal connectivity. This router enables wireless data connectivity over public and private LTE cellular networks at 4G speeds.

EL-641M-4 router has dual SIM backup, 4 LAN ports, 1 port could be changed to Ethernet WAN connection (for fixed internet fail over to cellular). An optional 802.11 b/g/n Wi-Fi interface access point and client operations supports connectivity to IP applications in a variety of different connection scenarios. RS232 and RS485 interfaces are provided to support Serial to IP communication. EL-641M-4 router also support 2 x digital input and 2 x Digital output for alarm applications.

EL-641M-4 router supports 9 to 48 VDC wide range power inputs, designed with reverse-voltage protection mechanism for greater reliability. It is an advanced choice for universal wireless M2M applications with reliable features for data transmission.

1.1. Features and Benefits

1.1.1 Industrial internet access

- Wireless Mobile Broadband 3G / 4G Connection
- Remote access to SCADA System for Industrial Automation
- Reduce high costs for on-site maintenance

1.1.1 Designed for industrial usage

- Power Input Range 9 to 48 VDC
- Industrial designed for harsh environment
- Compact metal casing for easy mounting

1.1.2 Secure and reliable remote connection

- Connection manager ensure seamless communication
- Support Multiple VPN tunnels for data encryption
- Firewall prevents unsafe and unauthorized access

1.1.3 Easy to use and easy maintenance

User-friendly web interface for human interaction

1.2. General Specifications

Cellular Interface

- Standards: FDD-LTE/TDD-LTE, WCDMA/UMTS/HSPA/HSPA+/EDGE/GPRS,
- 2× SMA female antenna connector
- x SIM (3.0V & 1.8V)

Wi-Fi Interface

- Standards: 802.11b/g/n, 300Mbps
- SMA Female antenna connector
- Support Wi-Fi AP and Client modes
- Security: WEP, WPA and WPA2 encryption
- Encryption: TKIP, CCMP

Ethernet Interface

- Standard: IEEE 802.3, IEEE 802.3u
- Number of Ports: 4 x 10/100 Mbps, RJ45 connector
- 1 x WAN interface (configurable on Web GUI)
- 1.5KV magnetic isolation protection

Serial Interface

- 1×RS232 (3 PIN): TX, RX, GND
- 1 x RS485 (2 PIN): Data+(A), Data-(B)
- Baud rate: 300 bps to 115200 bps
- Connector: terminal block
- 15KV ESD protection

DI/DO Interface

- Type: 2 x DI + 2 x DO
- Connector: terminal block
- Isolation: 3KVDC or 2KVrms
- Absolute maximum VDC: 36VDC
- Absolute maximum ADC: 100mA

Other Interfaces

- 1× RST button
- LED instruction: 1 x SYS, 1 x NET, 1 x USR, 3 x RSSI

Software

- Network protocols: DHCP, ICMP, PPPoE, HTTP, HTTPS, DNS, VRRP, NTP…
- VPN: IPSec, GRE, OpenVPN, DMVPN
- Policy: RIPv1/RIPv2/OSPF/BGP dynamic route (optional)
- Firewall & Filter: Port forwarding, DMZ, anti-DoS, ACL
- Serial port: TCP server and client, UDP
- Management: Web

Power Supply and Consumption

- Connector: 3-pin 3.5 mm female socket with lock
- Input voltage range: 9~48VDC
- Power consumption:

- Idle: 100 mA@12V
- Data link: 400 mA (peak) @12V

Physical Specification

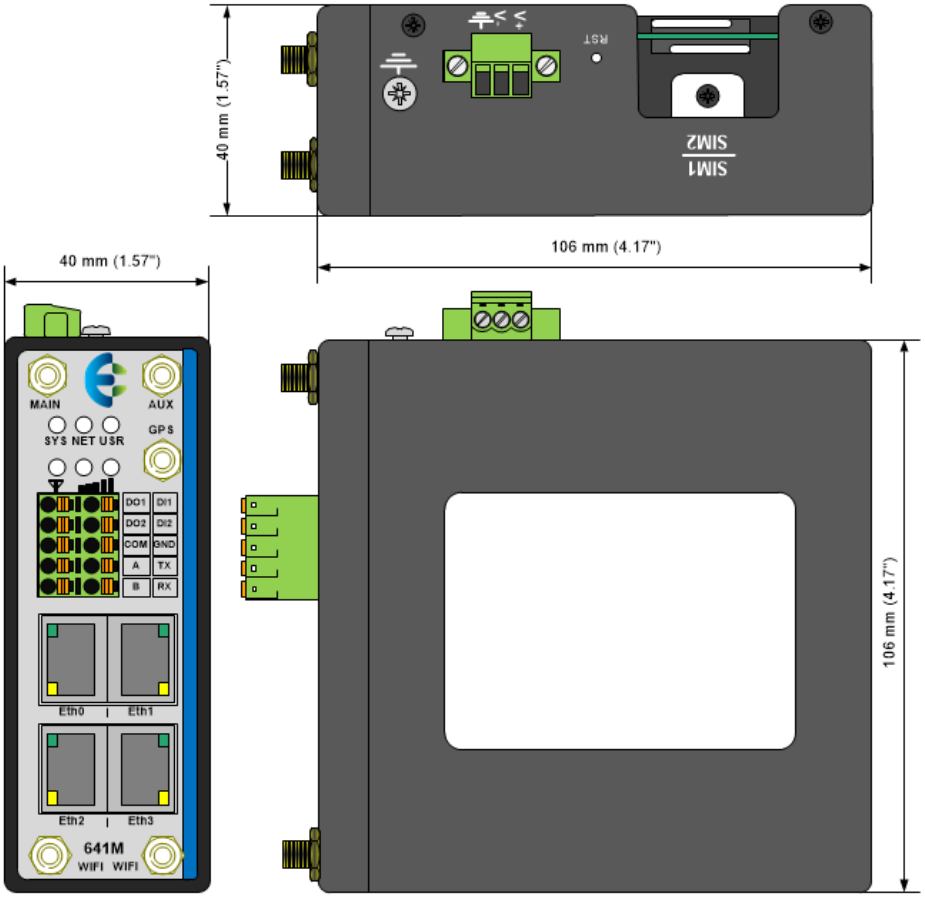
- Ingress Protection: IP30
- Housing & Weight: Metal, 300g
- Dimension: 104mm x 104mm x 38mm (excluding antenna)
- Installations: Din-rail mounting

Environmental

- Operation temperature: -40~+75℃
- Store temperature: -40~+85℃
- Operation humidity: 5% to 95% non-condensing

1.3. Mechanical Specifications

Dimension: 106mm x 106mm x 40mm (excluding antenna)



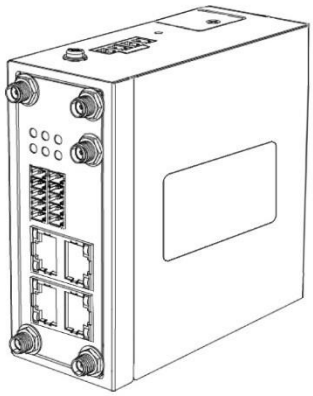
1.4. Package Checklist

EL-641M-4 router includes the parts shown in below, please verify your components.
NOTE: if any of the below items is missing or damaged, please contact your sales representative.

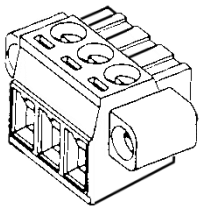
Included equipment

- 1 x Industrial Cellular 4G-LTE Router EL-641M-4 Router

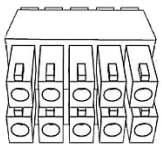
EL-641M-4 router



- 1 x 3-pin 3.5 mm male terminal block with lock for power supply



- 1 x 10-pin 3.5 mm male terminal block for RS232/RS485/DI/DO



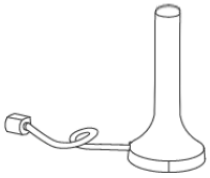
1 x Ethernet cable

Optional Accessories (sold separately)

3G/4G cellular antenna

Stubby antenna

Magnet antenna

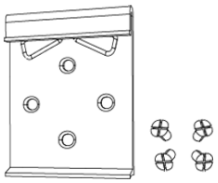


SMA Female Wi-Fi antenna

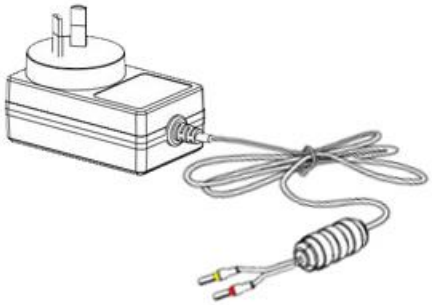
Stubby antenna

Magnet antenna

35mm Din-rail mounting kit



AC/DC power adapter (12VDC, 1.5A; AU plug)



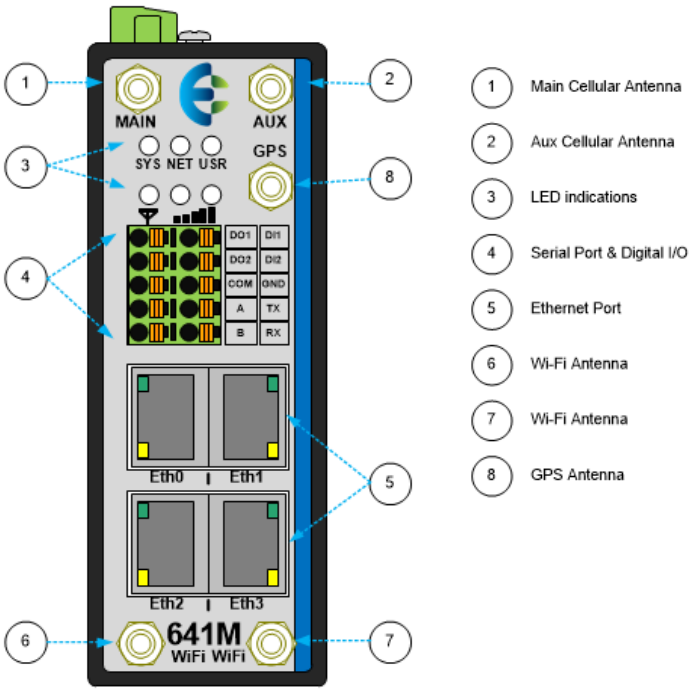
1.5. Order Information

Model	Part Number	Description
EL-641M-2	EL-641M-2-W	4G LTE, Dual SIMs,2 x Eth, 1 x RS232 (3 PIN), 1 x RS485, 2 x DI, 2 x DO, 9 - 48VDC,
EL-641M-4	EL-641M-4-W	4G LTE, Dual SIMs,4 x Eth, 1 x RS232 (3 PIN), 1 x RS485, 2 x DI, 2 x DO, 9 - 48VDC, 2.4GHz Wi-Fi, GPS

2 Installation

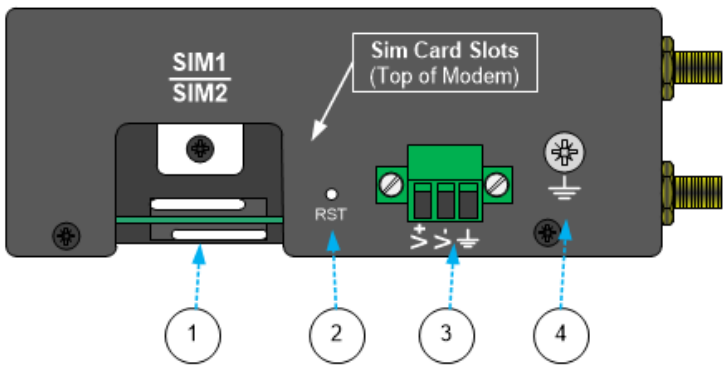
2.1. Product Overview

2.1.1 Front Panel



1. Main Cellular Antenna
2. Aux Cellular Antenna
3. LED indications
4. Serial Port & Digital I/O
5. Ethernet Port
6. Wi-Fi Antenna
7. Wi-Fi Antenna
8. GPS Antenna

2.1.2 Left Side Panel



1. Dual SIM card slot
2. Reset Button
3. Power Connector
4. Ground Stud

2.2. LED Indicators

Name	Color	Status	Description
SYS	Green	Slow Blinking (500ms duration)	Operating normally
		Fast Blinking	System initialing
		Off	Power is off
NET	Green	On	Register to Highest priority network service (depend on Radio, e.g. Radio support LTE as Highest priority network).
		Fast Blinking (500ms duration)	Register to Non-Highest priority network service (depend on Radio, e.g. Radio support LTE as Highest priority network, then WCDMA and GPRS is non-highest priority network).
		Off	Register failed
USR: SIM	Green	On	Router is trying cellular connection with SIM1
		Fast Blinking (250ms duration)	Router is trying cellular connection with SIM2
		Off	No SIM detected
USR: Wi-Fi	Green	On	Wi-Fi is enable but without data transmission
		Blinking	Wi-Fi is enabled and data transmission
		Off	Wi-Fi is disable or initialize failed
Signal Strength Indicator 	Green	On, 3 LED light up	Signal strength (21-31) is high
		On, 2 LED light up	Signal strength (11-20) is medium
		On, 1 LED light up	Signal strength (1-10) is low
		Off	No signal

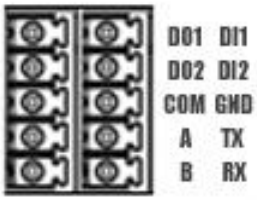
2.3. Ethernet Port Indicator

Name	Status	Description
Link indicator	On	Connection is established
	Blinking	Data is being transmitted
	Off	Connection is not established

NOTE：There are two LED indicators for each Ethernet port. Due to the chipset design EL-641M-4 router would only light up the green one(Link indicator) on left side, the right LED is Off without meaning.

2.4. PIN Definition of Terminal block

2.4.3 Serial Port & DIDO



PIN	RS232	RS485	DI	DO	Direction
1	--	--	--	DO1	Router-->Device
2	--	--	--	DO2	Router-->Device
3	--	--	--	COM	--
4	--	A	--	--	Router<-->Device
5	--	B	--	--	Router<-->Device
6	--	--	DI1	--	Router<--Device
7	--	--	DI2	--	Router<--Device
8	GND	--	--	--	--
9	TX	--	--	--	Router-->Device
10	RX	--	--	--	Router<--Device

2.4.4 Power Input

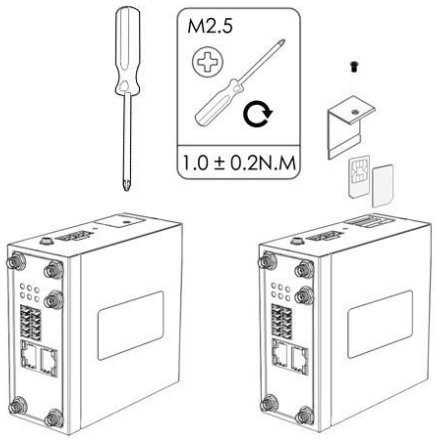
PIN	Description
V+ (Red line)	Positive
V- (Yellow line)	Negative
PGND	GND

2.5. Reset Button

Function	Action
Reboot	Press the RST button within 3s under operation status
Factory Reset	Press the RST button between 3s to 10s, all LEDs blink few times then reboot the router manually.
Run Normally	Press the RST button more than 10s, router will run normally without reboot or factory reset.

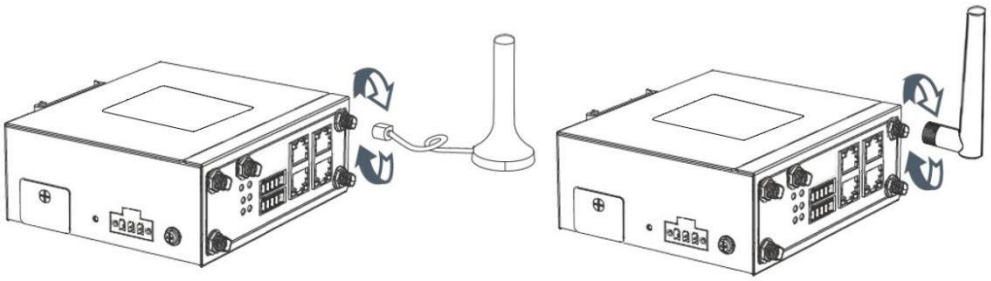
2.6. Insert SIM card

Insert / Remove SIM card
Make sure the power is disconnected.
Use a Phillips-head screwdriver to remove SIM slot cover.
Insert the SIM card(s) in to the SIM sockets.
Replace the SIM slot cover.



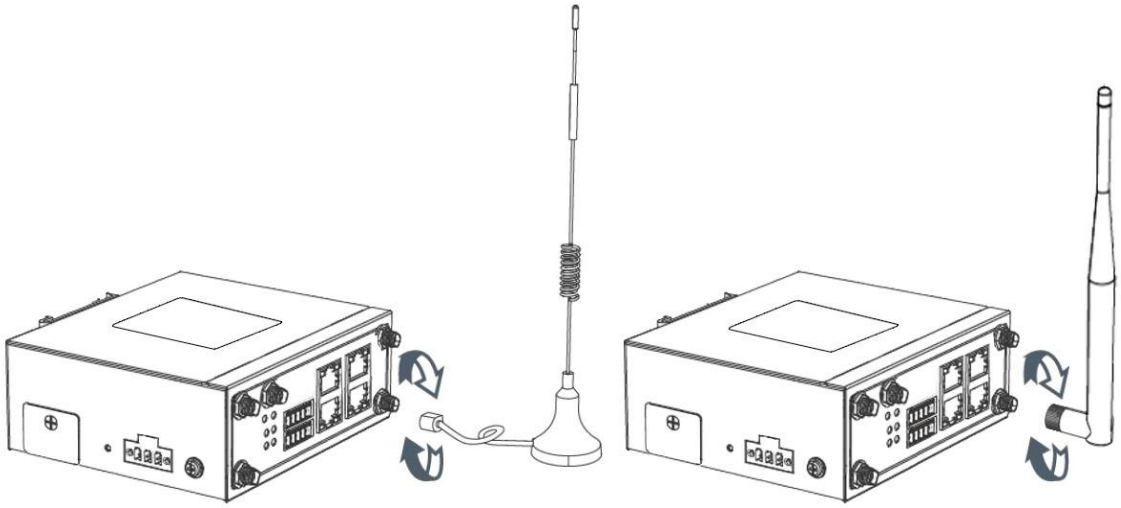
2.7. Install Antenna

- Connect the cellular antenna to the MAIN and AUX connector on the unit.



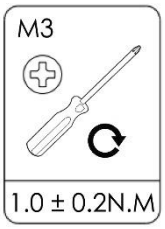
NOTE: EL-641M-4 router supports dual antennas with MAIN and AUX connectors. MAIN connector is for data receiving and transmission. AUX connector is for enhancing signal strength, which cannot be used separately.

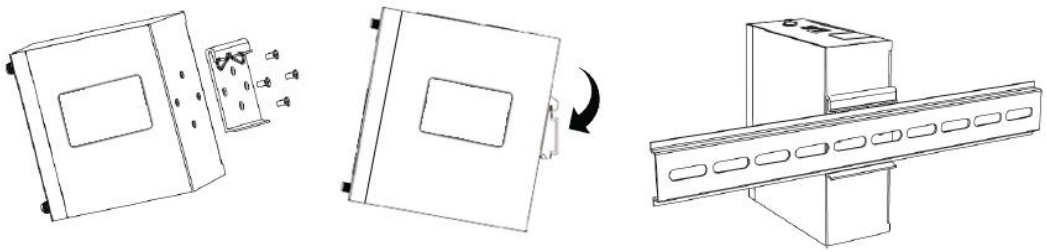
- Connect the Wi-Fi antenna to the Wi-Fi connector on the unit.



2.8. DIN-rail Mounting

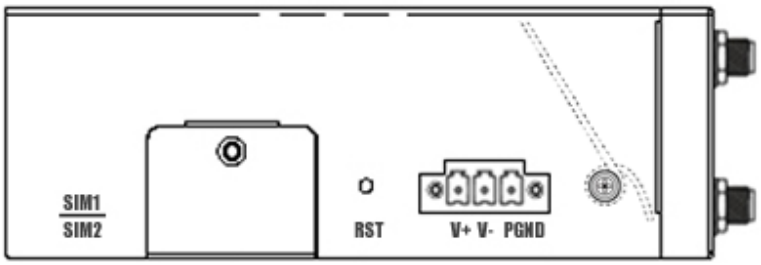
- Use 4 pcs of M3x6 flat head phillips screws to fix the DIN-rail to the router.
- Insert the upper lip of the DIN-rail into the DIN-rail mounting kit.
- Press the router towards the DIN-rail until it snaps into place.





2.9. Protective Grounding Installation

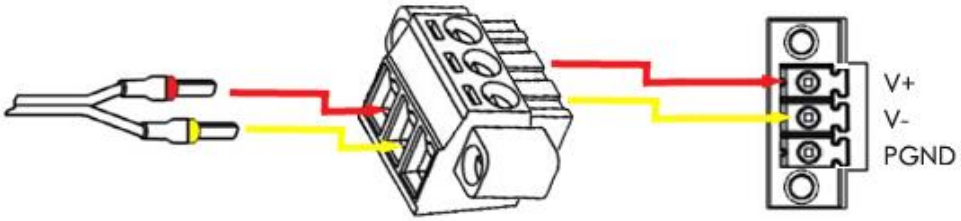
- Remove the grounding nut.
- Connect the grounding ring of the cabinet's grounding wire onto the grounding stud and screw up the grounding nut.



NOTE: Strongly recommended the router to be grounded when deployed.

2.10. Power Supply Installation

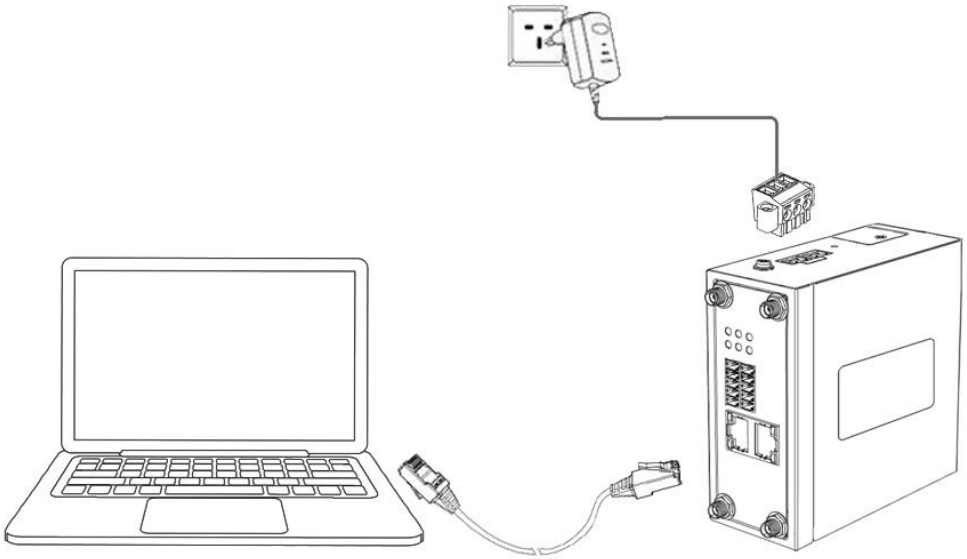
1. Remove the pluggable connector from the unit, then loosen the screws for the locking flanges as needed.
2. Connect the wires of the power supply to the terminals.



COLOR	POLARITY
RED	V+
YELLOW	V-

2.11. Power On The Router

1. Connect one end of the Ethernet cable to the LAN port on the unit and the other end to a LAN port on a PC.
2. Connect the AC power to a power source.
3. Router is ready when SYS LED is blinking.



3 Access to Web page

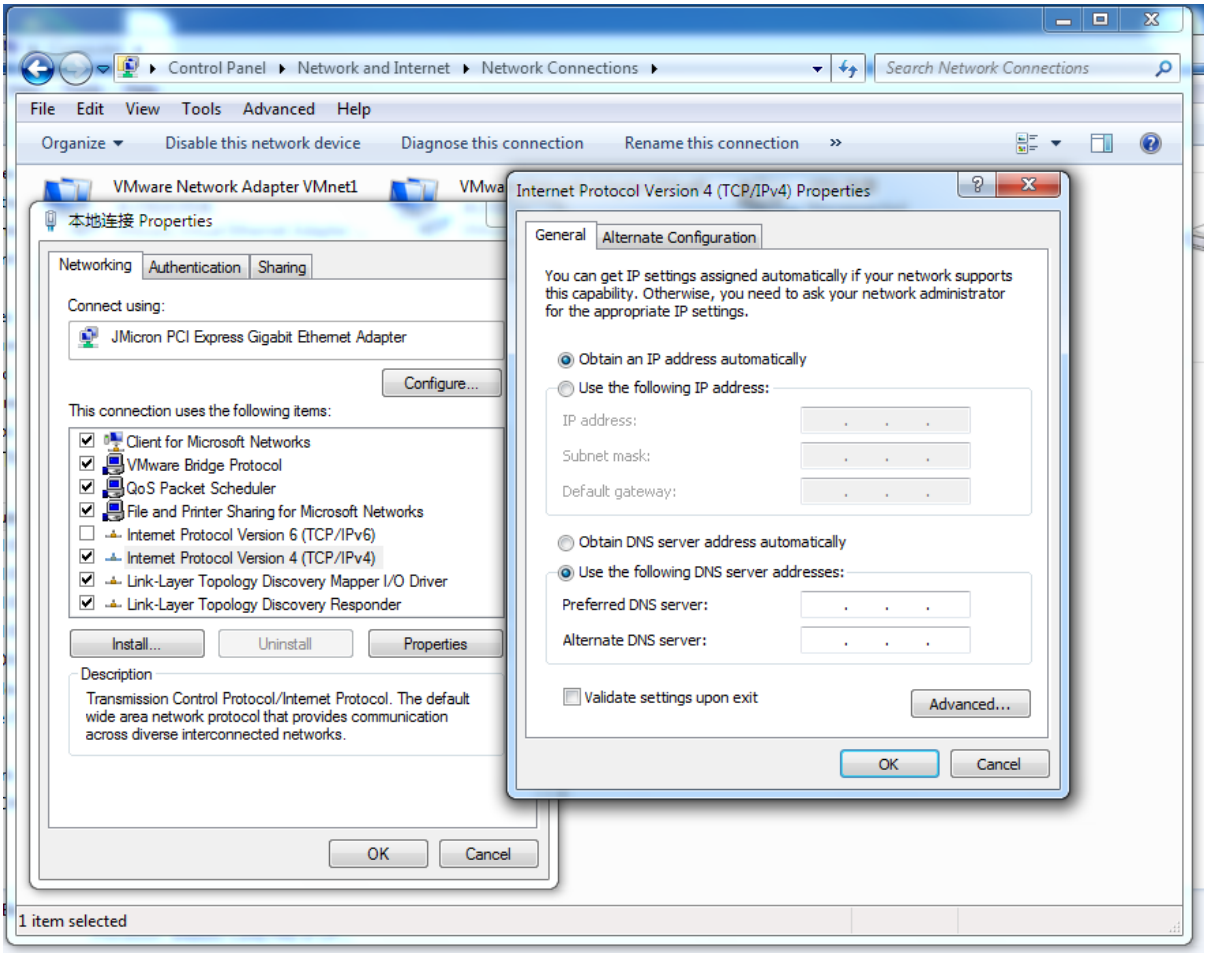
3.1. PC Configuration

EL-641M-4 router contains a DHCP server which will automatically assign an IP address to your PC, however in some cases the user may need to change the network settings on their PC to accept the IP address from the EL-641M-4. or you can configure a static IP address manually.

- Obtain an IP address automatically

The process required to do this differs depending on the version of Windows you are using.

NOTE: The following steps are based on Windows 7.



Select Start » Control Panel » Network Connections. Right click Local Area Connection and select Properties to open the configuration dialog box for Local Area Connection. Select Internet Protocol (TCP/IP) and click Properties to open the TCP/IP configuration window. On the General tab, select Obtain an IP address automatically and Obtain DNS server address automatically. Click OK to complete TCP/IP configuration.

3.2. Factory Default Settings

EL-641M-4 router supports Web-based configuration interface for management. If this is the first time for you to configure the router, please refer to below default settings.
Username: admin
Password: admin
LAN IP Address: 192.168.1.1 (Eth0~Eth3 bridge as LAN mode)
DHCP Server: Enabled

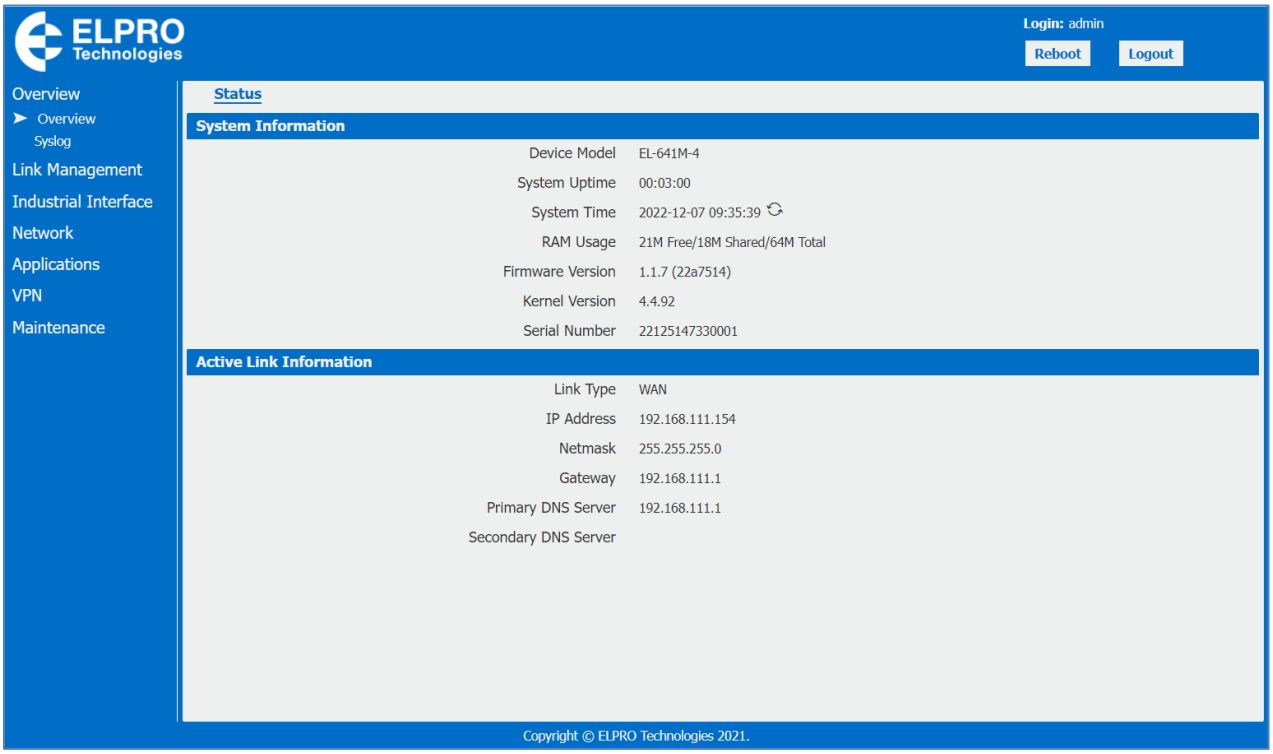
3.3. Login to Web Page

1. Start a Web browser on your PC (Chrome and IE are recommended), enter 192.168.1.1 into the address bar of the web browser.
2. Then use the default username and password(admin/admin), to log in to the router.

4 Web Configuration

4.1. Web Interface

EL-641M-4 router Web interface is divided into two sections. In the left pane is the main navigation menu. On the right is the content area for each page.



NOTE: The navigation menu may contain fewer sections than shown here depending on which options are installed in your unit.

- Reboot: reset the router within power disconnect.
- Logout: logout to web authorization page.

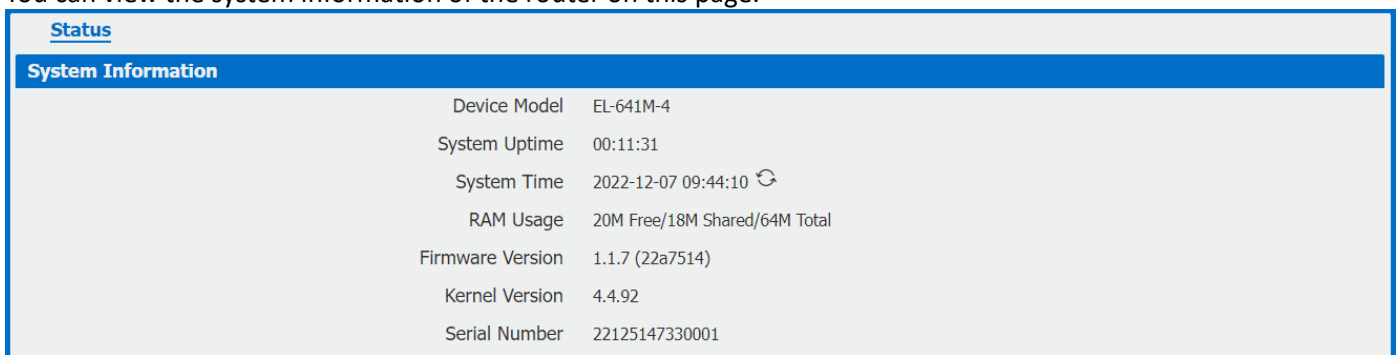
- Save: save the configuration on current page.
- Apply: apply the changes on current page immediately.

- Close: exit without changing the configuration on current page.

4.2. Overview

4.2.1 Status

You can view the system information of the router on this page.



System Information

Device Module
Displays the model name of router

System Uptime
Displays the duration the system has been up in hours, minutes and seconds.

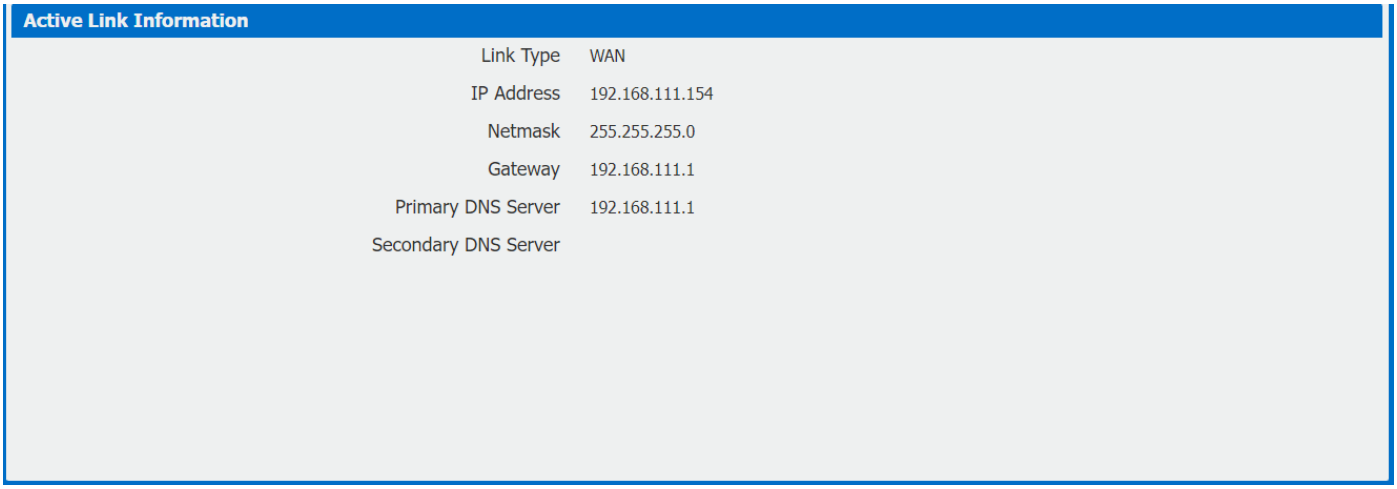
System Time
Displays the current date and time.

RAM Usage
Displays the RAM capacity and the available RAM memory.

Firmware Version
Displays the current firmware version of router.

Kernel Version
Displays the current kernel version of router.

Serial Number
Display the serial number of router.



Active Link Information

Link Type
Current interface for internet access.

IP Address
Displays the IP address assigned to this interface.

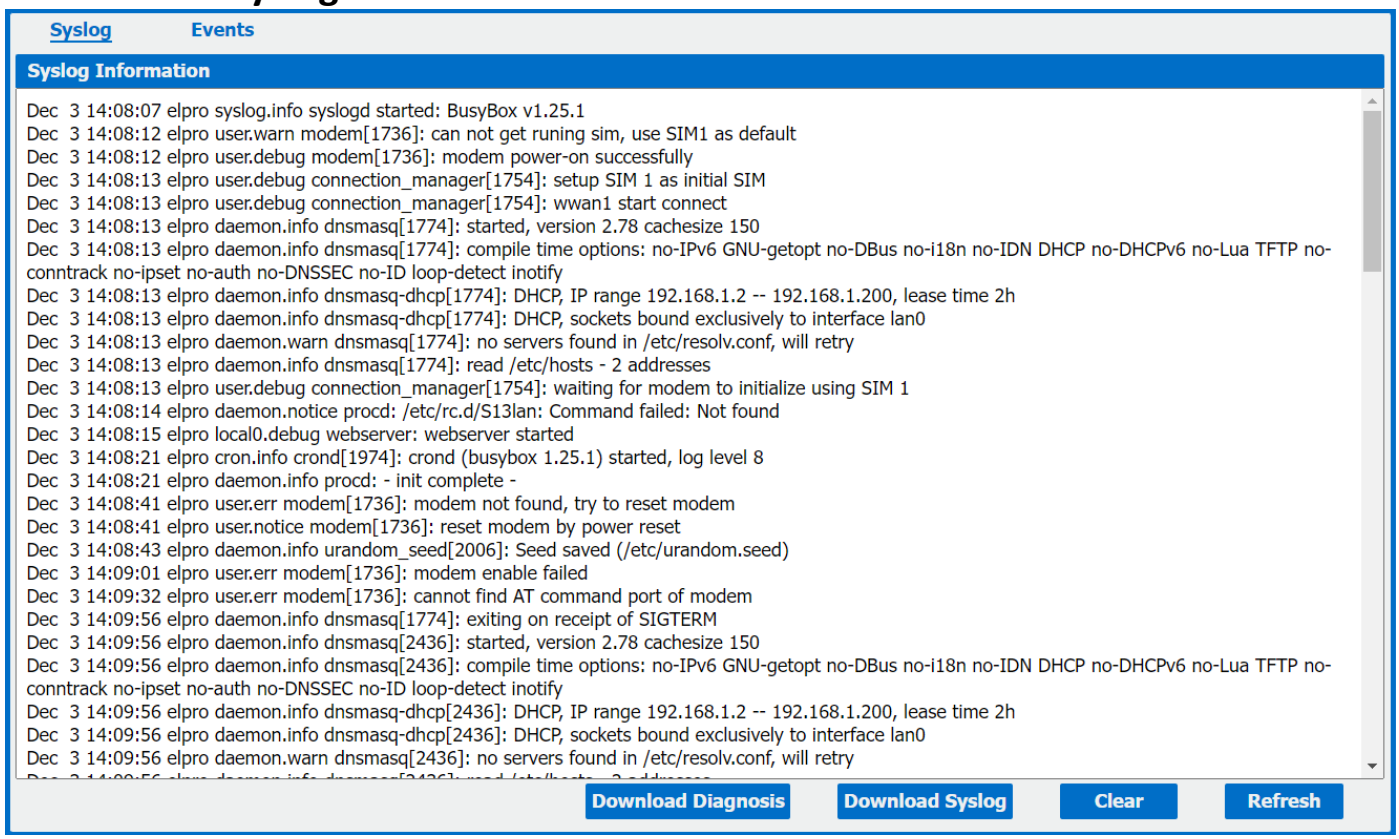
Netmask
Displays the subnet mask of this interface.

Gateway
Displays the gateway of this interface. This is used for routing packets to remote networks.

Primary DNS Server
Displays the primary DNS server of this interface.

Secondary DNS Server
Displays the secondary DNS server of this interface.

4.2.2 Syslog



Syslog Information

Download Diagnosis
Download the Diagnosis file for analysis.

Download Syslog
Download the complete syslog since last reboot.

Clear

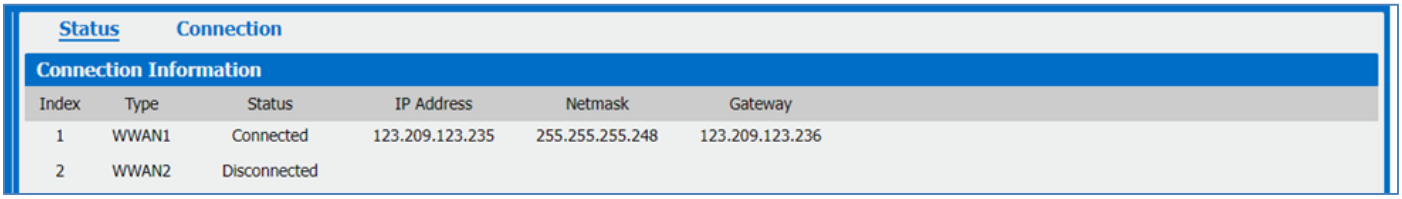
Clear the current page syslog printing.

Refresh
Reload the current page with latest syslog printing.

4.3. Link Management

This section shows you the setup of link management.

4.3.1 Connection Manager



Connection Manager->Status

Type
Displays the connection interface

Status
Displays the connection status of this interface.

IP Address
Displays the IP Address of this interface.

Netmask
Displays the subnet mask of this interface.

Gateway
Displays the gateway of this interface. This is used for routing packets to remote networks.

Click ⊕ to add a new priority interface.

Click ✎ to edit current interface settings.

Click ⊗ to delete current interface.

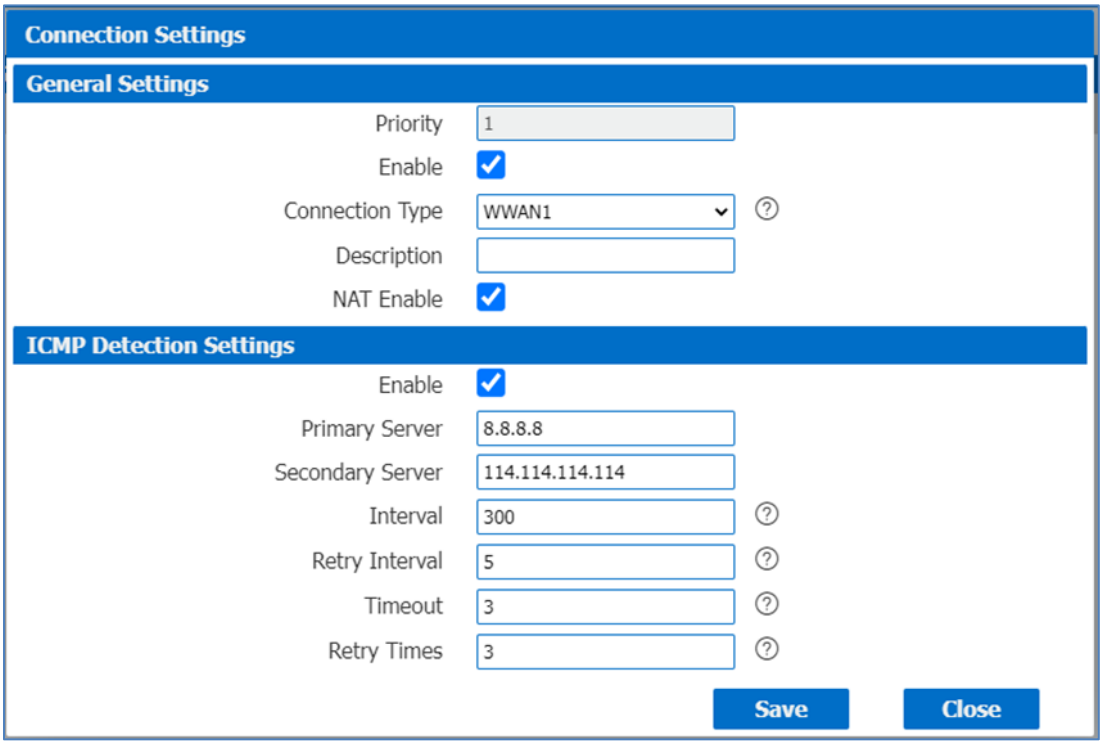
Connection Manager->Connection

Priority
Displays the priority list of default routing selection.

Enable
Displays the connection enable status.

Connection Type
Displays the name of this interface.

Description
Displays the description of this connection.



Connection Settings

Priority
Displays current index on priority list.

Connection Type
Select the available interface as outbound link.
NOTE: specify SIM1 carrier link as WWAN1, SIM2 carrier link as WWAN2.

NAT Enable
Check this box to enable NAT (Network Address Translation) on the current link.

ICMP Detection Settings->Enable
Check this box to detect link connection status based on pings to a specified IP address.

Primary Server
Enter the primary IP address that pings will be sent to, to detect the link state. Recommend entering the IP address of known external reachable server or network (e.g. 8.8.8.8).

Secondary Server
Enter the secondary IP address that pings will be sent to, when the primary server is ping failed, router would try to ping the secondary server.

Interval
The duration of each ICMP detection in seconds.

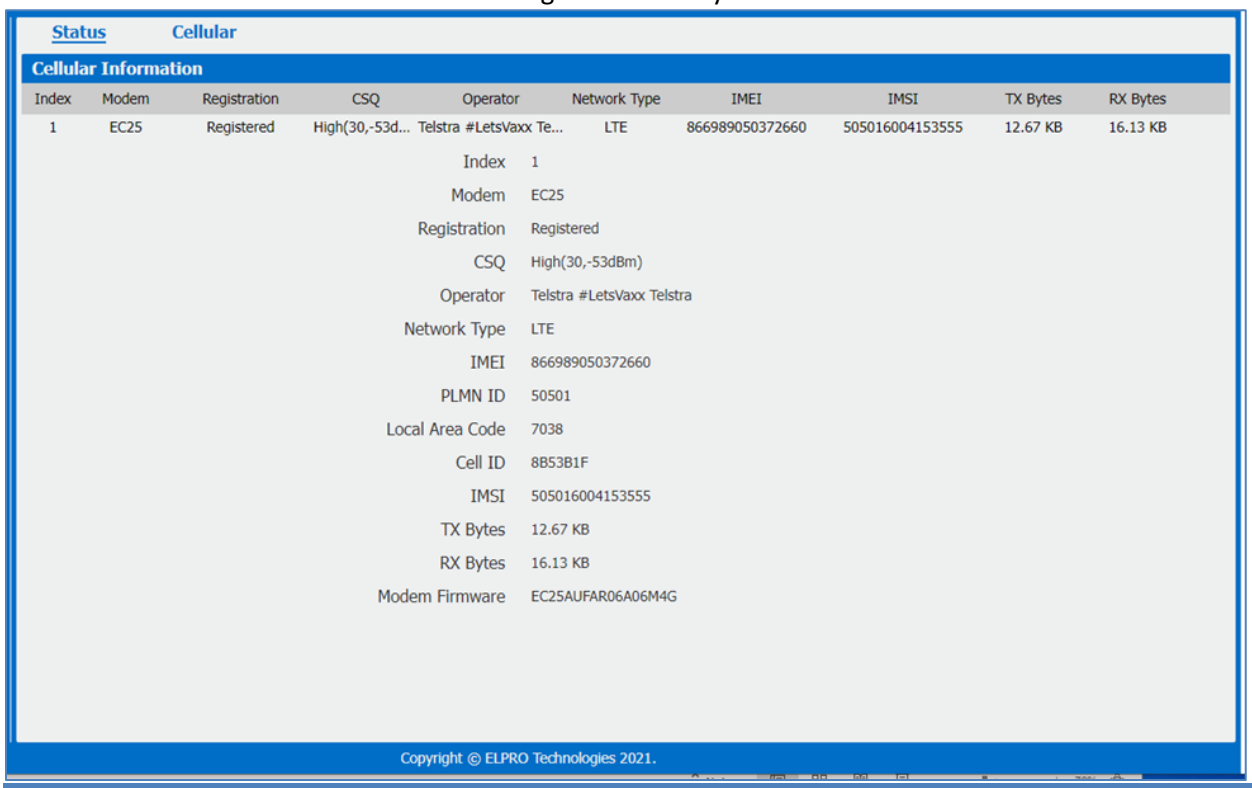
Retry Interval
The interval in seconds between each ping if no packets have been received.

Timeout
Enter timeout for received ping reply to determine the ICMP detection failure.

Retry Times
Specify the retry times for ICMP detection.

4.3.2 Cellular

EL-641M-4 Router main function is connecting to Internet by cellular modem.



Cellular->Status

Modem
Displays the module of the modem used by this WWAN interface.

Registration
Displays the registration status of SIM card.

CSQ
Displays the signal strength of the carrier network.

Operator
Displays the wireless network provider.

Network Type
Displays the RF technology currently active. Example: LTE, UMTS, or CDMA.

IMEI
International Mobile Electronic Identifier. Depending on the carrier and technology used, this may be required for the carrier when activating the data contract. In some cases, this will be blank.

PLMN ID
Displays the current PLMN ID, including MCC, MNC, LAC and Cell ID.

Local Area Code
Displays the location area code of the SIM card.

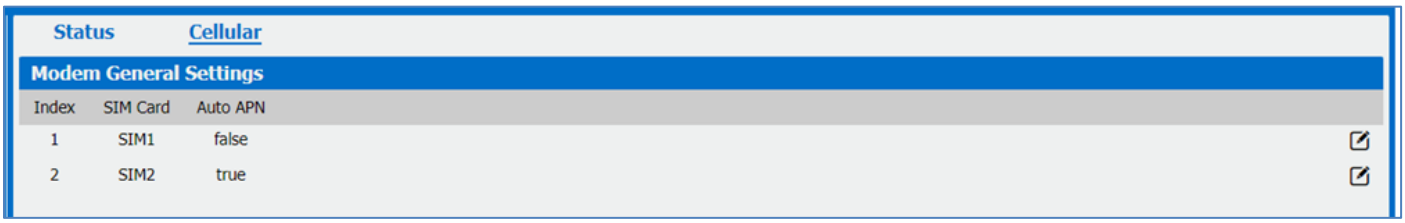
Cell ID
Displays the Cell ID of the SIM card location.

IMSI
International Mobile Subscriber Identity, as read from the SIM. This is the user's network subscription.

TX Bytes
Displays the total bytes transmitted since the time the unit was connected. EL-641M-4 router would record this data with same SIM card, reboot would not erase this data.

RX Bytes
Displays the total bytes received since the time the unit was connected. EL-641M-4 router would record this data with same SIM card, reboot would not erase this data.

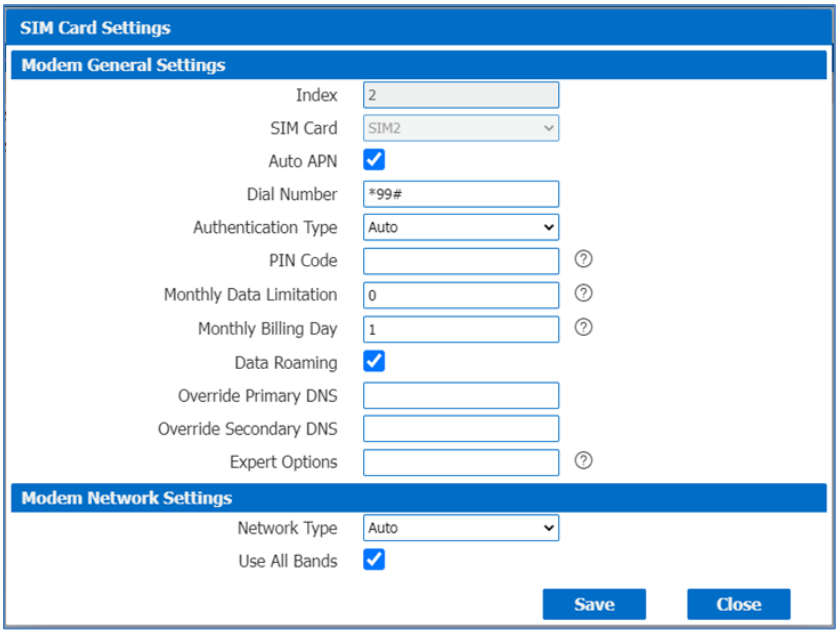
Modem Firmware
Displays firmware version of the module used by the WWAN interface.



Cellular

SIM Card
Displays the SIM card support on this unit.

Auto APN
Displays the Enable status of auto APN function.



SIM Card Settings

SIM Card
Displays the current SIM card settings.

Auto APN
Check this box enable auto checking the Access Point Name provided by the carrier.

Dial Number
Enter the dial number of the carrier.

Authentication Type
Authentication method used by the carrier. Possible selections are Auto, PAP, CHAP.

PIN Code
Enter a 4-8 characters PIN code to unlock the SIM.

Monthly Data Limitation
Enter the data total amount for SIM card, SIM card switchover when data reach limitation.

Monthly Billing Day
Enter the date of renew data amount every month.

Data Roaming
Enable or disable the data roaming function on the router.

Override Primary DNS
Enter the primary DNS server will override the automatically obtained DNS.

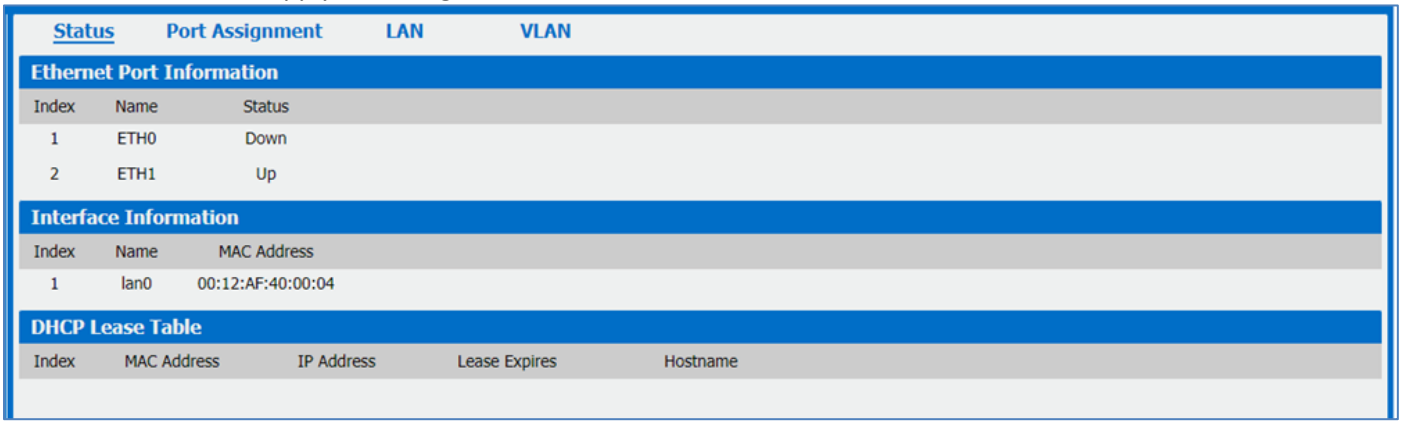
Override Secondary DNS
Enter the secondary DNS server will override the automatically obtained DNS.

Network Type
Select the mode of operation of the cell module (Auto, 4G Firstly, 4G Only, etc.).

Use All Bands
Check this box to enable all bands selection or choose specified bands.

4.3.3 Ethernet

The same instructions apply to settings for all Ethernet interfaces.



Ethernet->Status

Ethernet Port Information
Displays the port physical connected states.

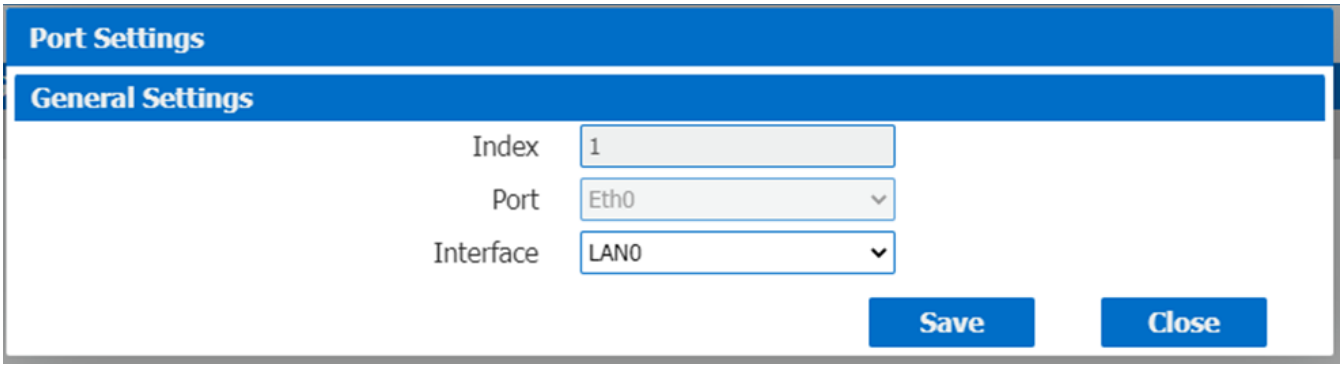
Interface Information
Displays the name and MAC address of Ethernet interface.

DHCP Lease Table
Displays the current IP address assigned to DHCP client.

Ethernet->Port Assignment

Port
Displays the port states and numbers of this unit.

Interface
Displays the port states of belong subnet.

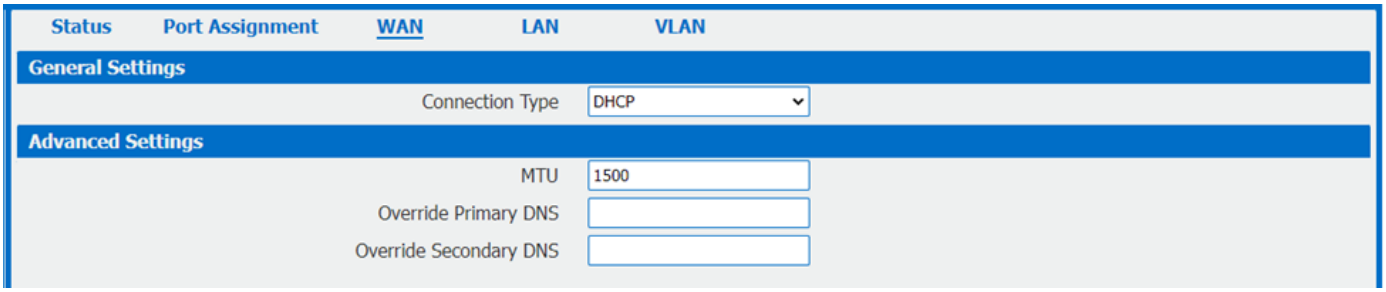


Note: Please make sure LAN0 is assigned and existing.

Ethernet->Port Settings

Port
Indicate the current configurate port.

Interface
Select belong subnet for current configurate port.



Ethernet->WAN

Connection Type
If you select DHCP Client, external DHCP server will assign an IP address to this unit.

MTU
Maximum Transmission Unit, maximum packet size allowed to be transmitted. Should be left as default value of 1500 in most cases.

Override Primary DNS
Enter the primary DNS server will override the automatically obtained DNS.

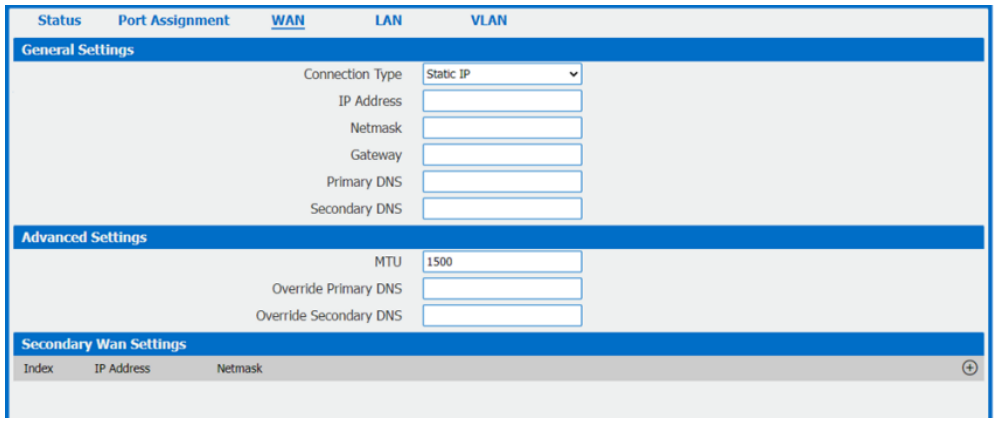
Override Secondary DNS
Enter the secondary DNS server will override the automatically obtained DNS.

Ethernet->WAN->Secondary Wan Settings

IP Address
Enter the IP address of secondary wan interface.

Netmask
Enter the netmask of secondary wan interface.

EL-641M-4 also support WAN connection type set to Static IP and PPPoE mode.



Ethernet->WAN->Static IP or PPPoE

IP Address
Static address for this interface. It must be on the same subnet as the gateway.

Netmask
Will be assigned by the gateway.

Gateway
IP address of the Gateway (DHCP Host). If not known this can be left as all zeros.

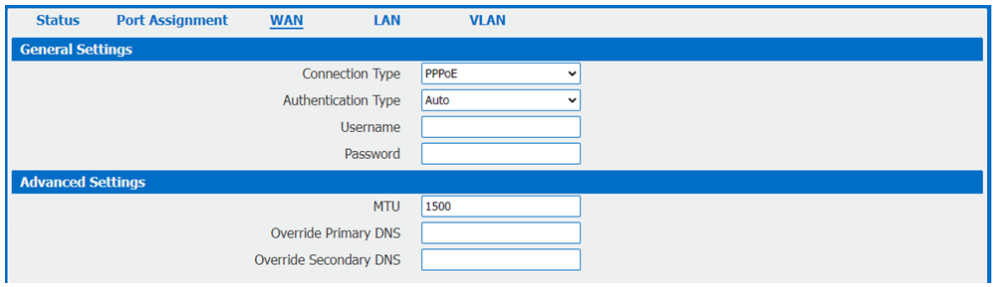
Primary DNS
IP address of the primary DNS server.

Secondary DNS
IP address of the secondary DNS server.

Authentication Type
Authentication method used by the carrier. Possible selections are Auto, PAP, CHAP.

Username
Username to provide when connecting.

Password
Password to provide when connecting.

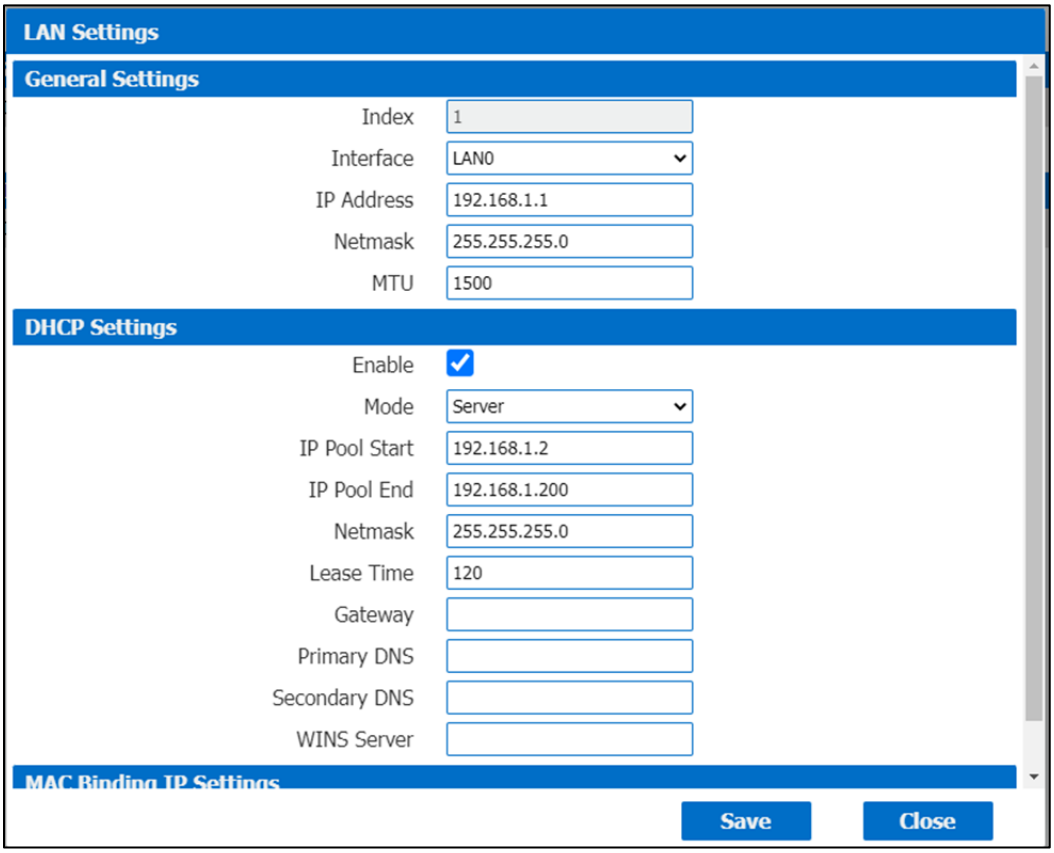


Ethernet->LAN

Interface
Displays current name of LAN subnet.

IP Address
Displays LAN IP address of this subnet.

Netmask
Displays subnet mask for this subnet.



Ethernet->LAN

Interface
Select the configurate LAN port of this subnet.

IP Address
Enter LAN IP address for this interface.

Netmask
Enter subnet mask for this subnet.

MTU
Maximum Transmission Unit, maximum packet size allowed to be transmitted. Should be left as default value of 1500 in most cases.

Enable
Check this box to enable DHCP feature on current LAN port.

Mode
Select the DHCP working mode from “Server” or “Relay”.

Relay Server
Enter the IP address of DHCP relay server.

IP Pool Start

External LAN devices connected to this unit will be assigned IP address in this range when DHCP is enabled. This is the beginning of the pool of IP addresses.

IP Pool End
This is the end of the pool of IP addresses.

Netmask
Subnet mask of the IP address obtained by DHCP clients from DHCP server.

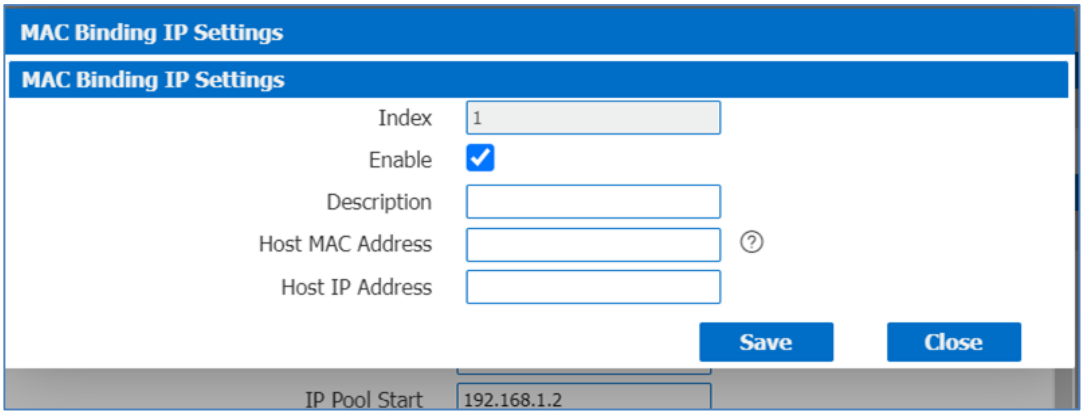
Lease Time
The lease time of the IP address obtained by DHCP clients from DHCP server.

Gateway
The gateway address obtained by DHCP clients from DHCP server.

Primary DNS
Primary DNS server address obtained by DHCP clients from DHCP server.

Secondary DNS
Secondary DNS server address obtained by DHCP clients from DHCP server.

WINS Server
Windows Internet Naming Service obtained by DHCP clients from DHCP server.

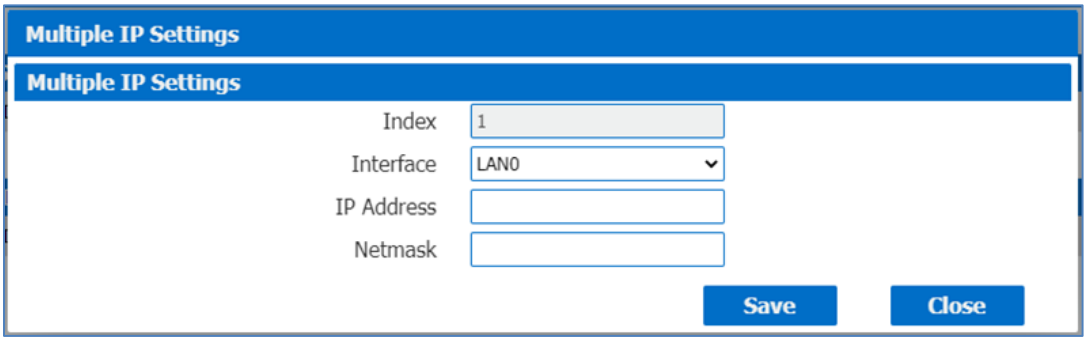


Ethernet->LAN->MAC Binding IP Settings

Enable
Check this box to enable MAC binding IP feature.
Description
Enter the description for MAC binding IP feature.

Host MAC Address
Enter the host MAC address.

Host IP Address
Enter the host IP address.

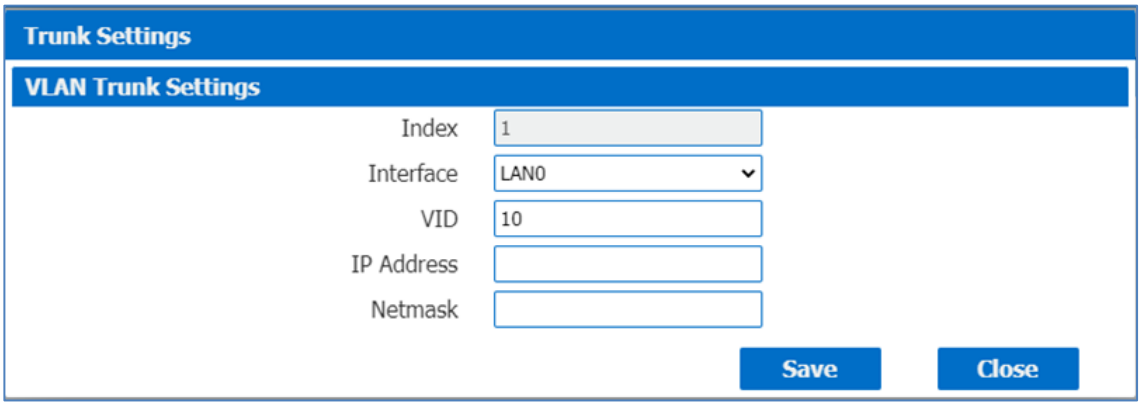


Ethernet->LAN->Multiple IP Settings

Interface
Select the configurate LAN port of this subnet.

IP Address
Enter multiple IP address for this interface.

Netmask
Enter subnet mask for this subnet.



Ethernet->VLAN->VLAN Trunk Settings

Interface
Select the LAN port for VLAN trunk.
VID
Specify the VLAN ID for VLAN trunk.

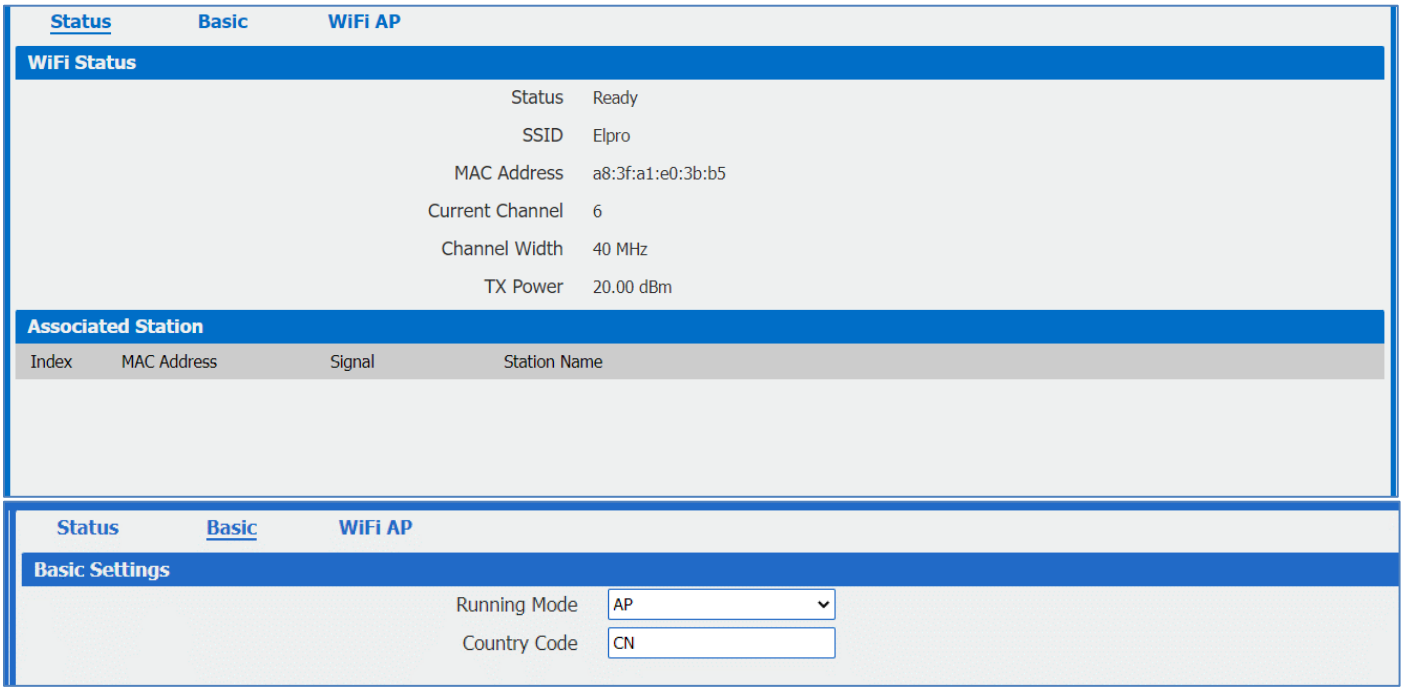
IP Address
Enter IP address for this VLAN trunk.

Netmask
Enter subnet mask for this VLAN trunk.

4.3.4 Wi-Fi

EL-641M-4 router could only be set to function as either a Wi-Fi Client or a Wi-Fi Access Point, but not both simultaneously. Select Wi-Fi (Access Point) from the main navigation menu to Wi-Fi (default as Access Point) page, which contains tabs for configuration of the Wi-Fi Access Point interface.

You could review the Wi-Fi connection status as below.



Wi-Fi->Basic

Running Mode

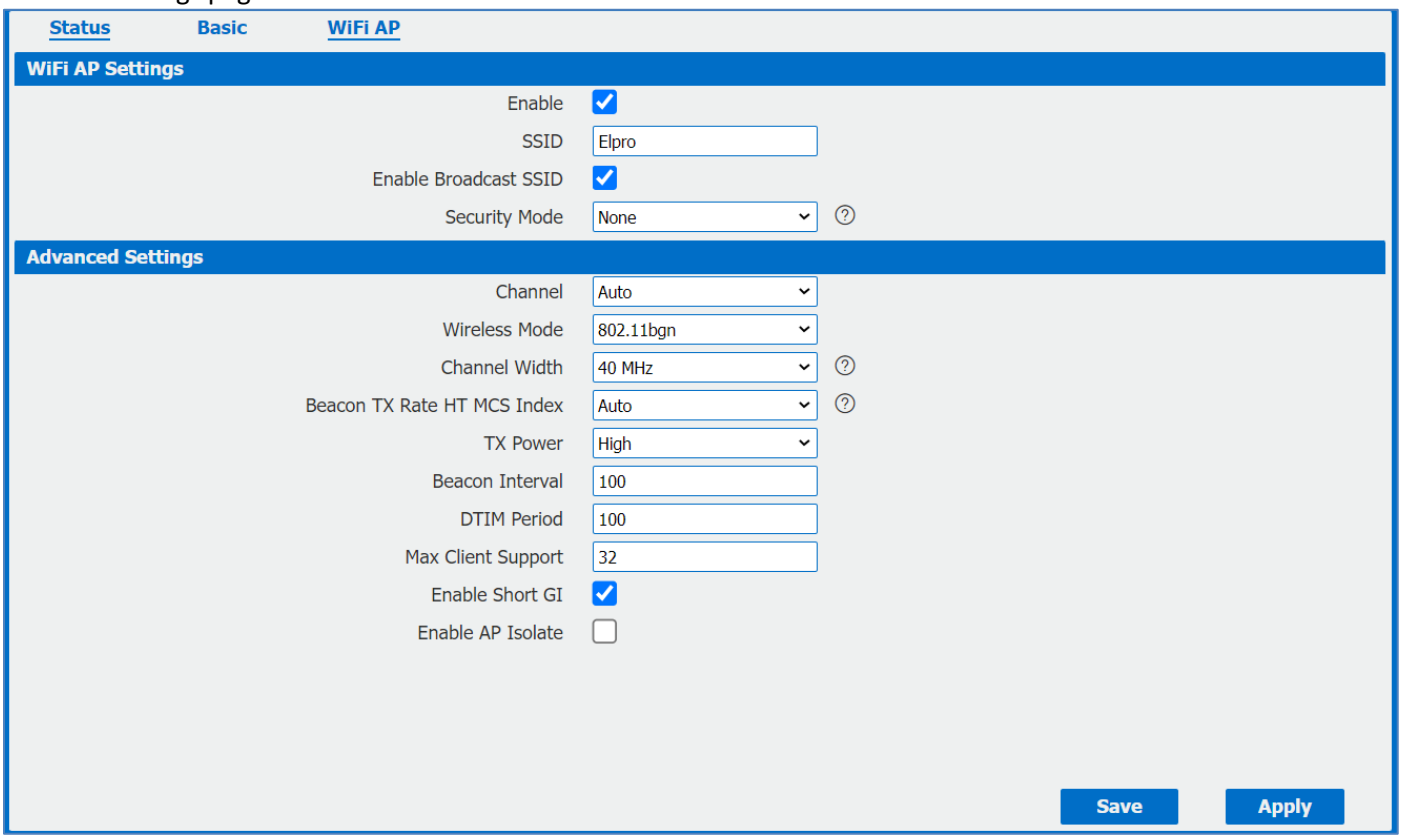
Select the configurate Wi-Fi mode from AP or Client.

Country Code

Enter the country where the AP is located.

Wi-Fi AP

Wi-Fi AP settings page as below.



Wi-Fi->Wi-Fi AP

Enable

Check this box will enable the Wireless interface.

SSID

The SSID is the name of the wireless local network. Devices connecting to the EL-641M-4 router WiFi access will identify the Access Point by this SSID.

Enable Broadcast SSID

When the checkbox is not checked, SSID broadcast is disabled, other wireless devices can't not find the SSID, and users have to enter the SSID manually to access to the wireless network.

Security Mode

Select security mode from “None”, “WEP” or “WPA PSK”.

WPA Type

Select WPA Type from “Auto”, “WPA” and “WPA2”.

Encryption Type

Select the encryption method. Options are “Auto”, “TKIP”, or “CCMP”. Because these options depend on the authentication method selected, some options will not be available.

Channel

Select the Wi-Fi channel the module will transmit on. If there are other Wi-Fi devices in the area the EL-641M-4 router should be set to a different channel than the other access points. Channels available for selection depend on the selected Band.

Wireless Mode

Select the Wi-Fi 802.11 mode: B, G, or N. Available selections depend on selected Band.

Channel Width
Select the width of the Wi-Fi channel. 20 MHz will limit the channel to 20 MHz wide; 20/40 MHz will enable the use of a 40 MHz wide channel when available.

Beacon TX Rate HT MCS Index
Modulation and Coding Scheme, The MCS modulation coding table is a representation proposed by 802.11n to characterize the communication rate of the WLAN. The MCS takes the factors affecting the communication rate as the columns of the table and uses the MCS index as a row to form a rate table.

TX power
Select the transmission power for the AP from “High”, “Medium” and “Low”.

Beacon Interval
Enter the interval of time in which the router AP broadcasts a beacon which is used for wireless network authentication.

DTIM Period
Enter the delivery traffic indication message period and the router AP will multicast the data according to this period.

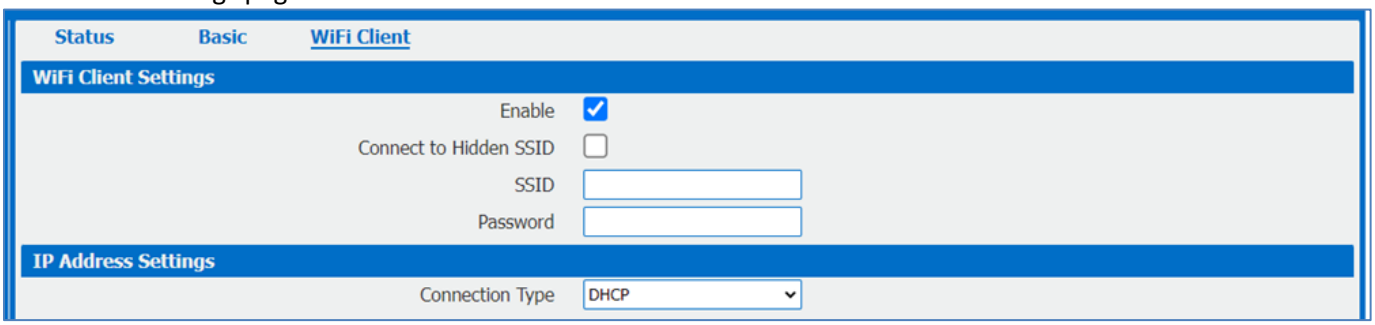
Max Client Support
Enter the maximum number of clients to access when the router is configured as AP.

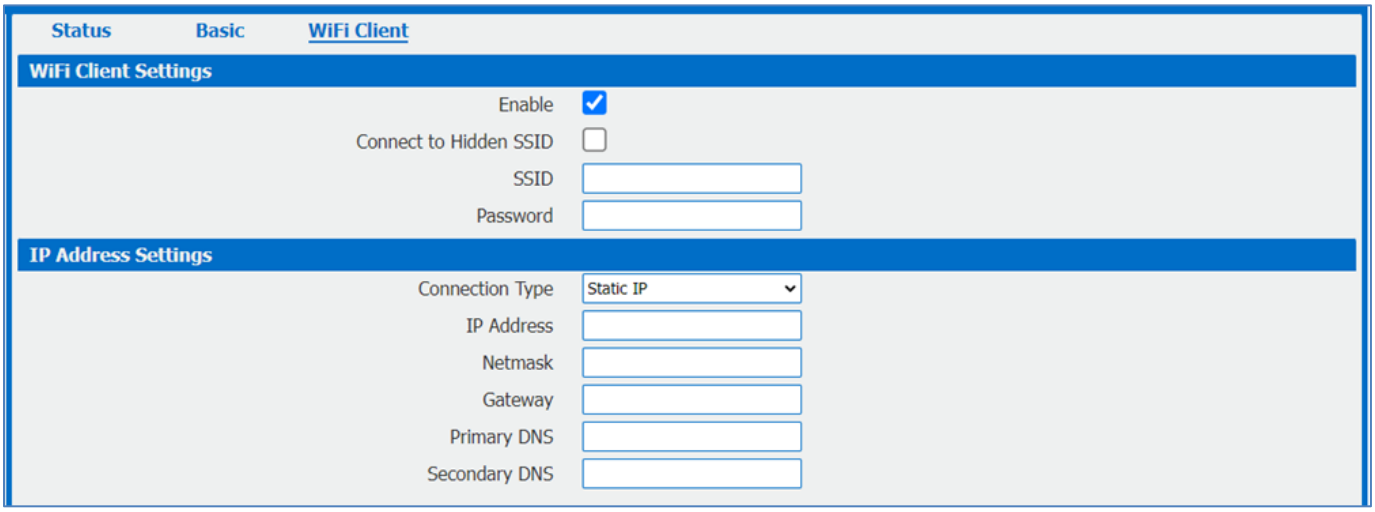
Enable Short GI
Check this box to enable Short GI(guard interval), Short GI is a blank time between two symbols, providing a long buffer time for signal delay.

Enable AP Isolate
Check this box to enable AP isolate, the route will isolate all connected wireless devices.

Wi-Fi Client

Wi-Fi Client settings page as below.





Wi-Fi->Wi-Fi Client

Enable
Check this box will enable the Wireless interface.

Connect to Hidden SSID
Check this box will enable connect to hidden SSID.

SSID
The SSID of external access point.

Password
Enter the password of external access point.

Connection Type
Select from DHCP Client or Static IP address.

IP Address
Static address for this interface. It must be on the same subnet as the gateway.

Netmask
Will be assigned by the gateway.

Gateway
IP address of the Gateway.

Primary DNS
Enter the primary DNS server will override the automatically obtained DNS.

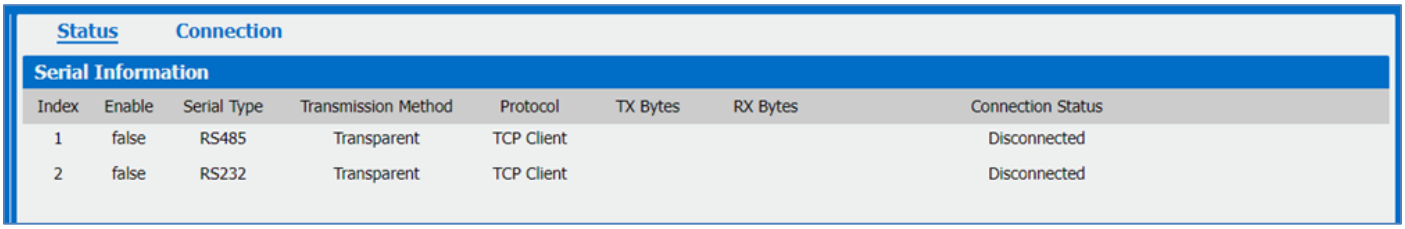
Secondary DNS
Enter the secondary DNS server will override the automatically obtained DNS.

4.4. Industrial Interface

The Industrial page contains tabs for making configuration settings for Serial RS232 and RS485, Digital input and output. Select Serial & Digital IO from the main navigation menu to navigate to this page.

4.4.1 Serial

You could review the status of serial connection.



Serial->Status

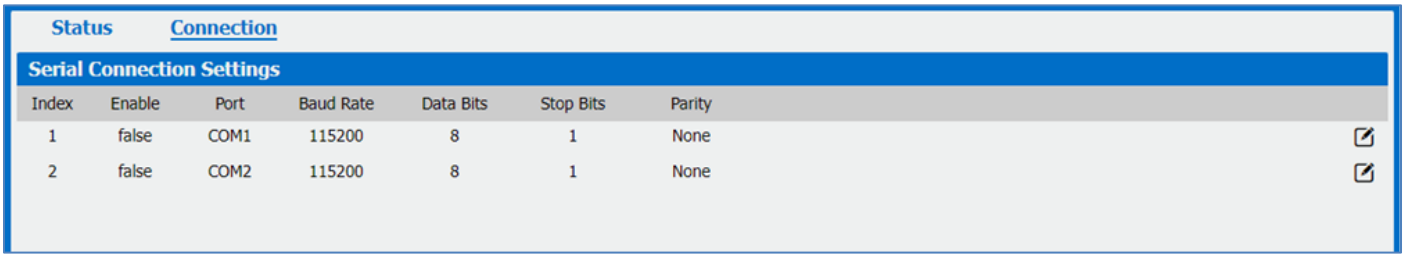
Enable
Displays status of current serial function.

Serial Type
Displays the serial type of COM port.

Transmission Method
Displays the transmission method of this serial port.

Protocol
Displays the protocol used by this serial port.

Connection Status
Displays the connection status of this serial port.



Serial->Connection

Enable
Displays status of current serial function.

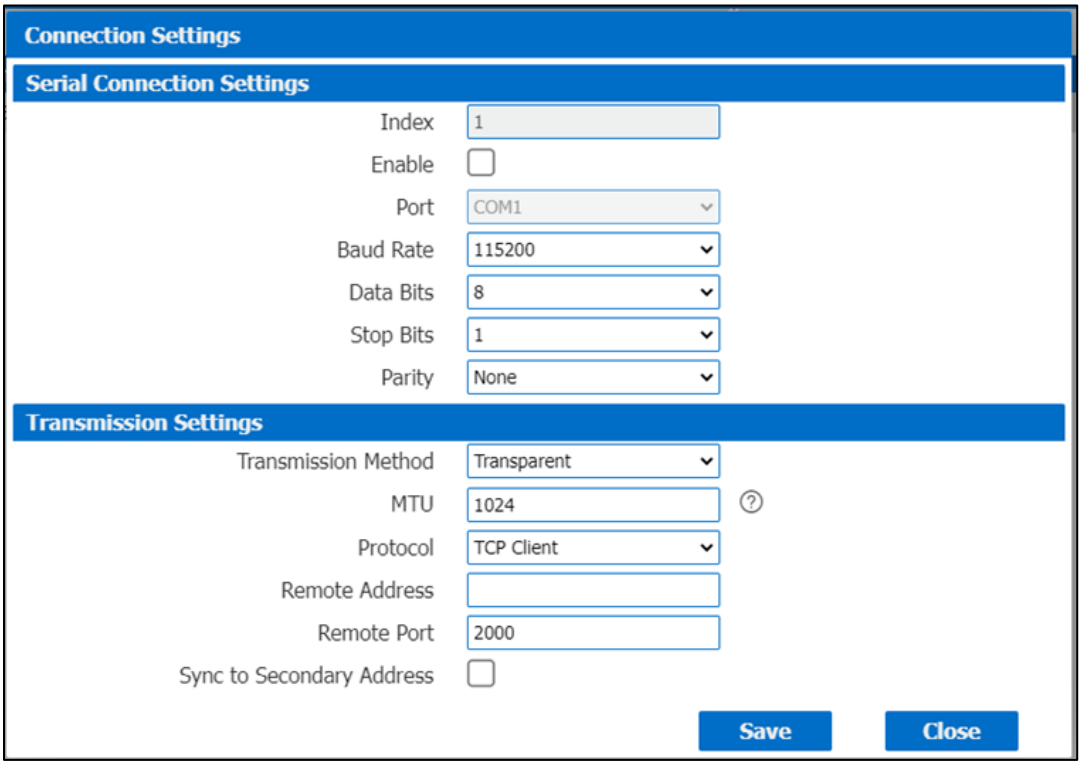
Port
Displays the serial type of COM port.

Baud Rate
Displays the serial port baud rate.

Data Bits
Displays the serial port Data Bits.

Stop Bits
Displays the serial port Stop Bits.

Parity
Displays the serial port parity.



Serial->Connection Settings

Baud Rate
Select the serial port baud rate. Supported values are 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, or 115200.

Data Bits
Select the values from 7 or 8.

Stop Bits
Select the values from 1 or 2.

Parity
Select values from none, even, odd, mark, space.

Transmission Method
Select the transmission method for serial port. Optional for “Transparent”, “Modbus RTU Gateway” and “Modbus ASCII Gateway”.

MTU
Maximum Transmission Unit, maximum packet size allowed to be transmitted. Should be left as default value of 1024 in most cases.

Protocol
Select the mode for Serial IP communication. Supported modes are UDP, TCP Server, or TCP Client.

Remote IP Address
Enter the IP address of the remote server.

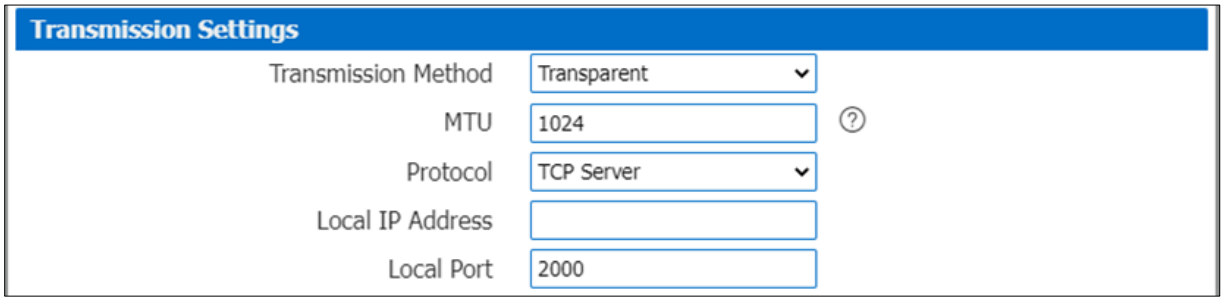
Remote Port
Enter the port number of the remote server.

Sync to Secondary Address
Check this box to enable the data send to secondary remote server for data backup.

Remote Secondary Address
Enter the remote backup server IP address.

Remote Secondary Port
Enter the remote backup server port.

Below window displays different settings when you select TCP Server on Protocol.

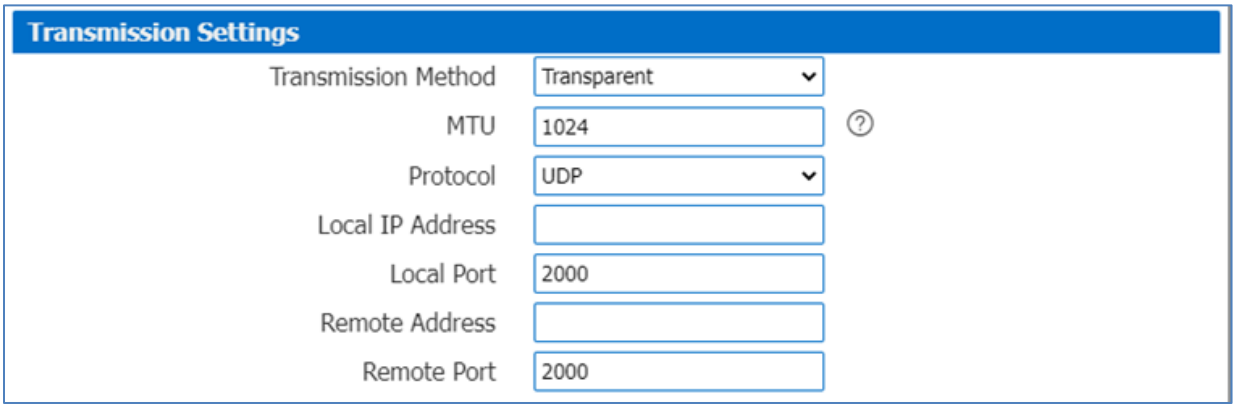


Serial->Connection Settings

Local IP Address
Enter the IP Address of the local endpoint.

Local Port
The port number assigned to the serial IP port on which communications will take place.

Below window displays different settings when you select UDP on Protocol.



Serial->Connection Settings

Local IP Address
Enter the IP Address of the local endpoint.

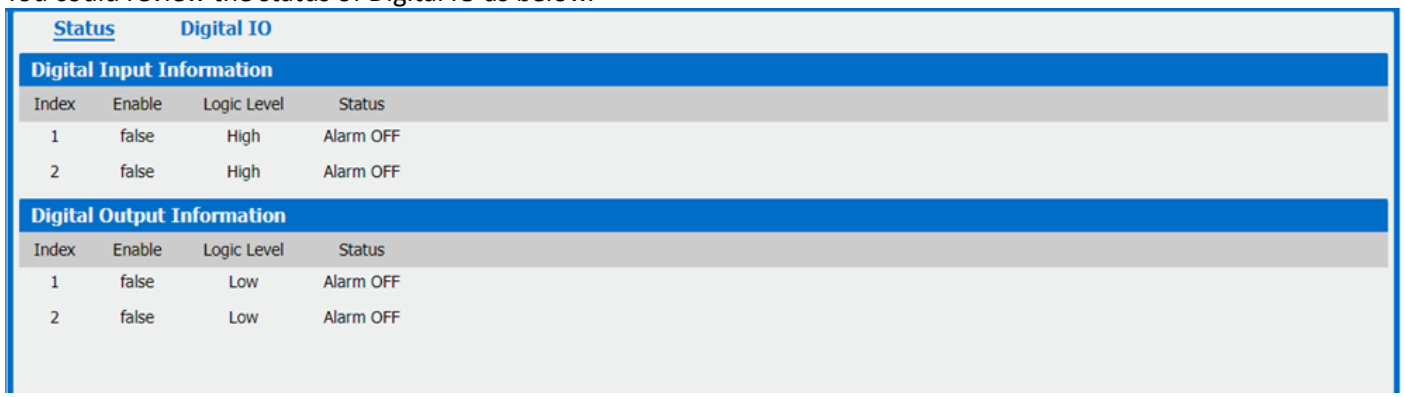
Local Port
The port number assigned to the serial IP port on which communications will take place.

Remote IP Address
Enter the IP address of the remote server.

Remote Port
Enter the port number of the remote server.

4.4.2 Digital IO

This section allows you to set the Digital IO parameters. The Digital input could be used for triggering alarm, and Digital output could be used for controlling the slave device by digital signal.
You could review the status of Digital IO as below.

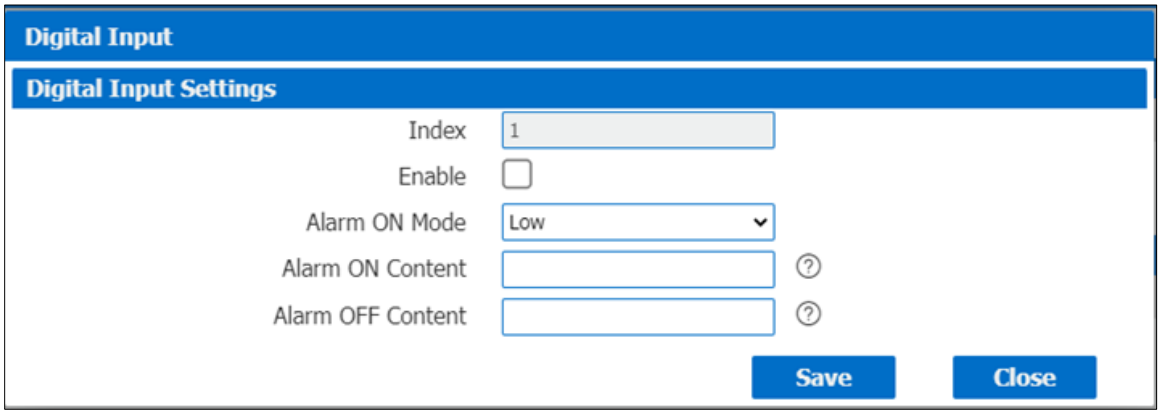


Digital IO->Status

Enable
Displays status of current digital IO function.

Logic Level
Displays the electrical level of digital IO port.

Status
Displays the alarm status of digital IO port.



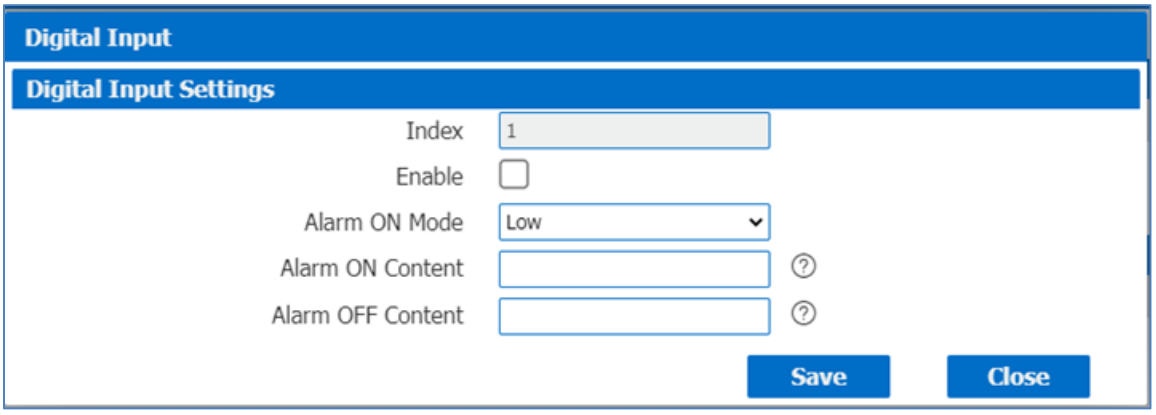
Digital IO->Digital Input

Enable
Check this box to enable digital Input function.

Alarm ON Mode
Select the electrical level to trigger alarm. Option are “Low” and “High”.

Alarm ON Content
Specify the alarm on content to be sent out via SMS message.

Alarm OFF Content
Specify the alarm off content to be sent out via SMS message.
NOTE Alarm Content can also include special parameters: $DI_INDEX, $DATE, $SERIAL_NUMBER, $DEVICE_MODEL, $FIRMWARE_VERSION, $SYSTEM_UPTIME, $LINK_TYPE, $IP_ADDRESS, $MODEM_MODEL, $CSQ, $OPERATOR, $NETWORK_TYPE, $IMEI, $PLMN_ID, $LOCAL_AREA_CODE, $CELL_ID, $IMSI, $MODEM_FIRMWARE



Digital IO->Digital Output

Enable
Check this box to enable digital output function.

Alarm Source
Select from “Digital Input1”, “Digital Input2” or “SMS”, Digital output triggers the related action when there is alarm comes from Digital Input or SMS.

Alarm ON Action
Select from “High”, “Low” or “Pulse”. High means high electrical level output. Low means low electrical level output. Pulse will generate a square wave as specified in the pulse mode parameters when triggered.

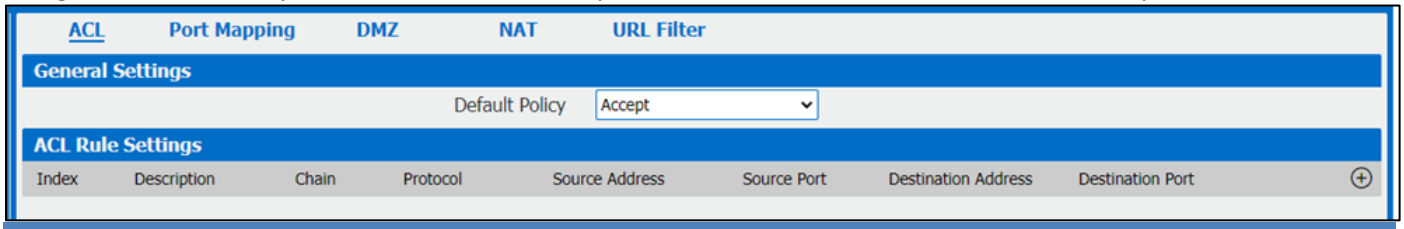
Alarm OFF Action
Initiates when alarm disappeared. Select from “High”, “Low” or “Pulse”. High means high electrical level output. Low means low electrical level output. Pulse will generate a square wave as specified in the pulse mode parameters when triggered.

Pulse Width
This parameter is available when select “Pulse” as “Alarm ON Action/Alarm OFF Action”. The selected digital output channel will generate a square wave as specified in the pulse mode parameters.

4.5. Network

4.5.1 Firewall

Firewall rules are security rule-sets to implement control over users, applications or network objects in an organization. Using the firewall rule, you can create blanket or specialized traffic transit rules based on the requirement.

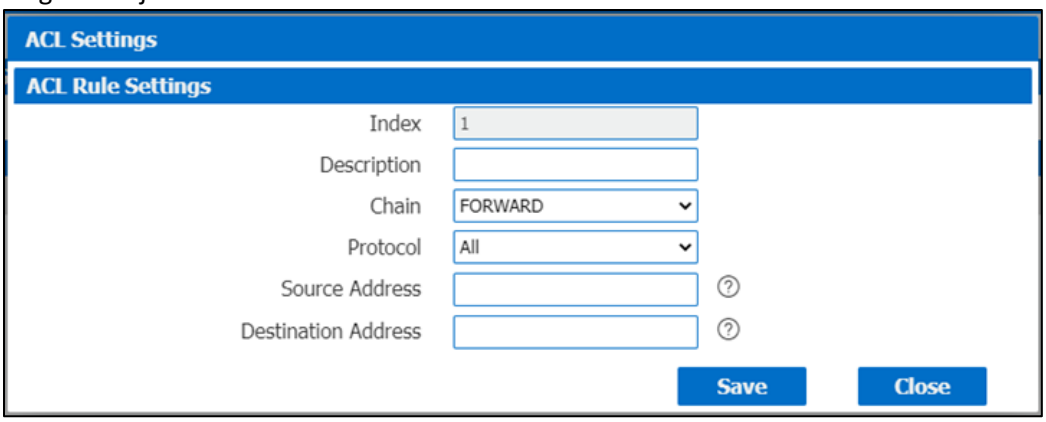


Firewall->ACL

Default Policy

Select the "Accept" or "Drop" from the list, the packets which are not included in the access control list will be processed by the default filter policy.

An access control list (ACL), with respect to a computer file system, is a list of permissions attached to an object. An ACL specifies which users or system processes are granted access to objects, as well as what operations are allowed on given objects.



Firewall->ACL

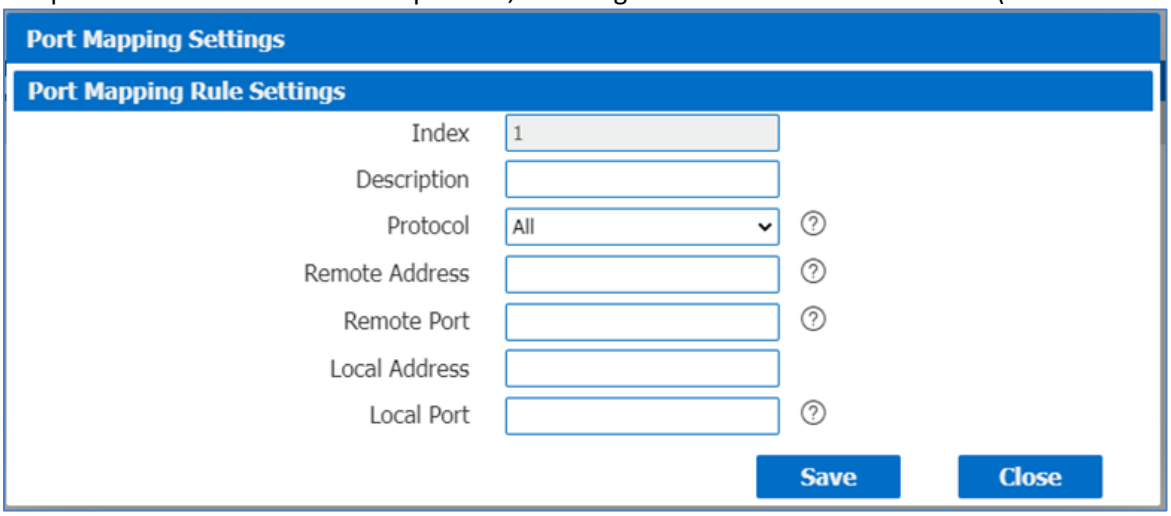
Description
Add a description for this rule.

Chain
Specify the forward rule of ACL, choose from “FORWARD” and “INPUT”.

Protocol
All: Any protocol number.
TCP: The TCP protocol.
UDP: The UDP protocol.
TCP & DUP: both TCP and UDP protocol
ICMP: The ICMP protocol.

Source Address
A specific host IP address can also be specified, or a range of IP addresses via a bitmask (the box following the /).

Destination Address
A specific IP address can also be specified, or a range of IP addresses via a bitmask (the box following the /).



Firewall->Port Mapping

Description
Add a description for this rule.

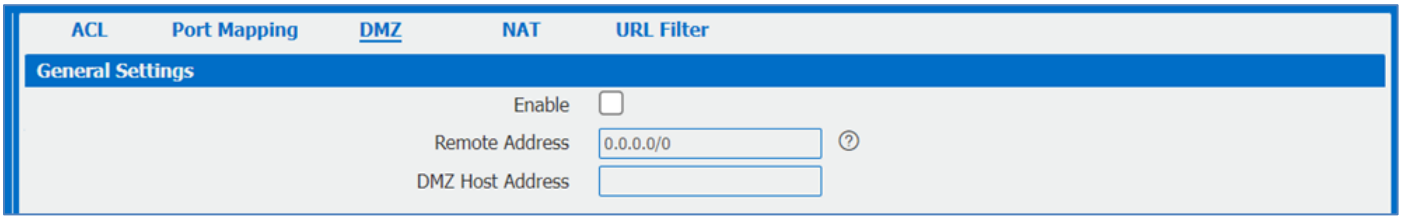
Protocol
All: Any protocol number.
TCP: The TCP protocol.
UDP: The UDP protocol.

Remote Address
Enter a WAN IP address that is allowed to access the unit.

Remote Port
Enter the external port number range for incoming requests.

Local Address
Sets the LAN address of a device connected to one of the Fusion’s LAN interfaces. Inbound requests will be forwarded to this IP address.

Local Port
Sets the LAN port number range used when forwarding to the destination IP address.

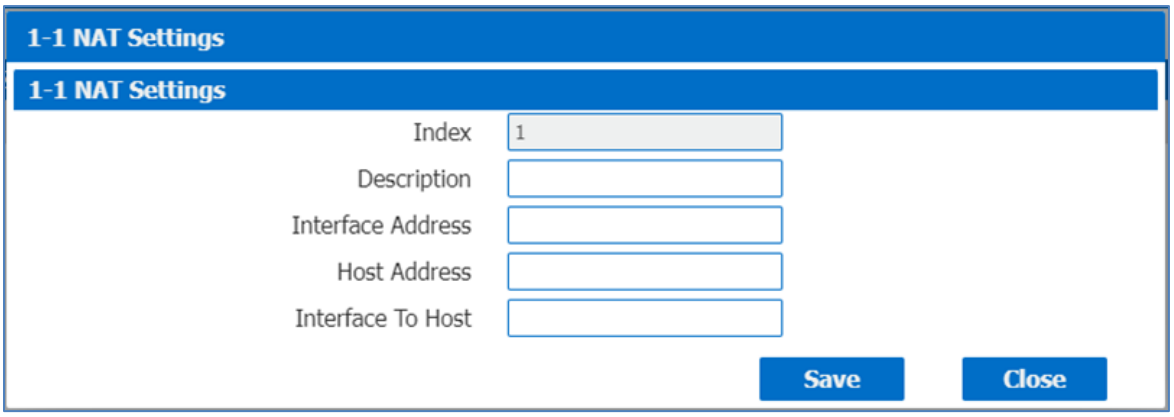


Firewall->DMZ

Enable
Check this box to enable DMZ function.

Remote Address
Optionally restricts DMZ access to only the specified WAN IP address.
NOTE: If set to 0.0.0.0/0, the DMZ is open to all incoming WAN IP addresses.

DMZ Host Address
The WAN IP address which has all ports exposed except ports defined in the Port Forwarding configuration.



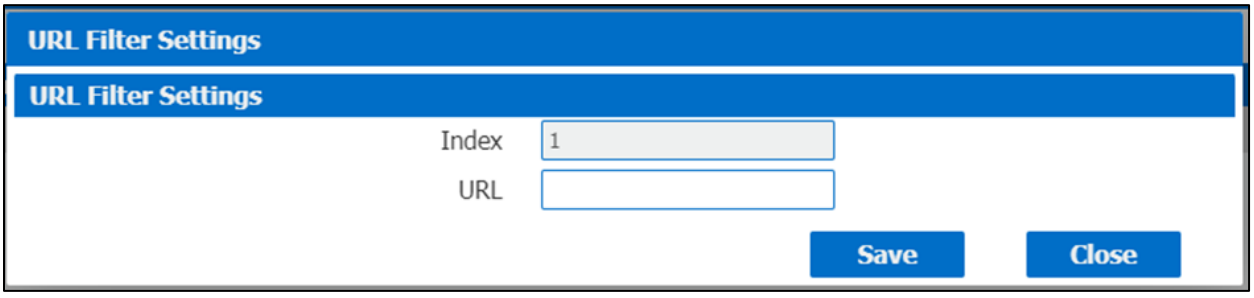
Firewall->NAT

Description
Enter a description of 1-to-1 NAT setting.

Interface Address
Specify the interface address that need to be accessed before NAT.

Host Address
Specify the host address that need to be accessed after NAT.

Interface To Address
Specify the interface that connected to host, like lan0, lan1, lan2, lan3.

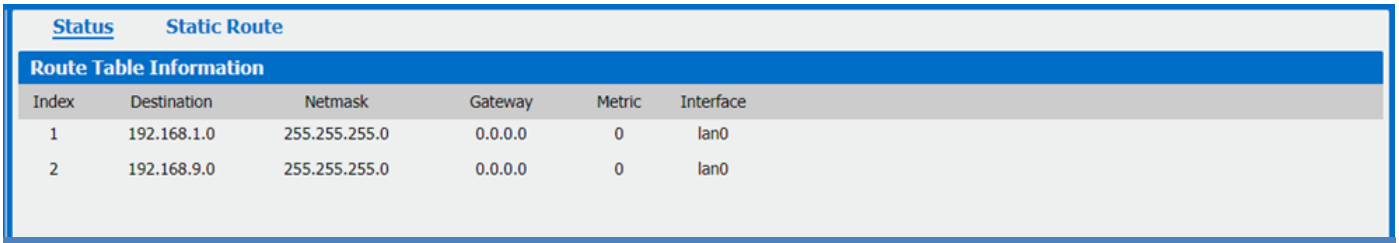


Firewall->URL Filter

URL
Enter the URL to block the data traffic to go to the website. For example, www.google.com

4.5.2 Route

Static Routing refers to a manual method of setting up routing between networks. Select the Static Routing tab to add static routes to the Static Route Table.
Please refer current route table as below.



Route->Route Table Information

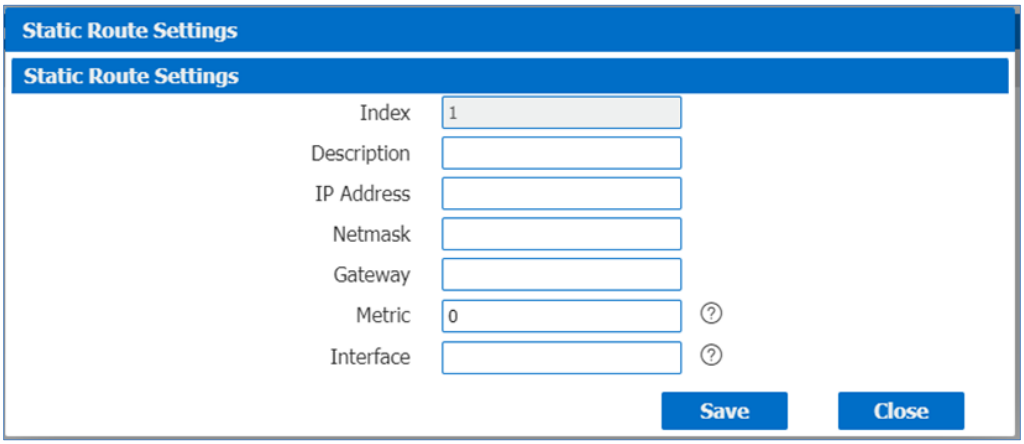
Destination
Displays the destination of routing traffic.

Netmask
Displays the subnet mask of this routing.

Gateway
Displays the gateway of this interface. This is used for routing packets to remote networks.

Metric
Displays the metric value of this interface.

Interface
Displays the outbound interface of this route.



Route->Static Route Settings

Description
Enter the description of current static route rule.

IP Address
Enter the IP address of the destination network.

Netmask
Enter the subnet mask of the destination network.

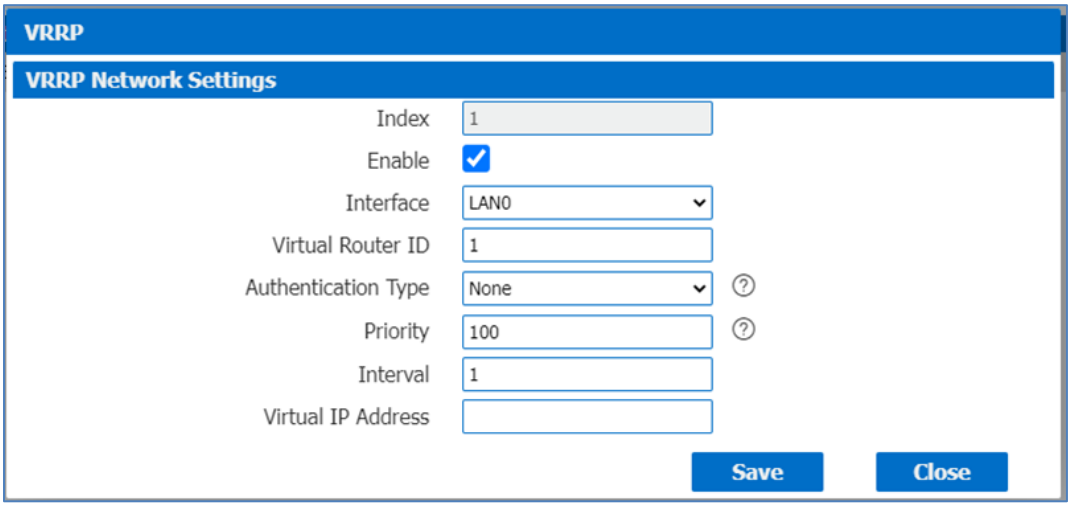
Gateway
Enter the IP address of the local gateway.

Metric
Enter the metric value of current static route rule. The smaller value, the higher priority.

Interface
Please refer to the Network->Route->Status interface.

4.5.3 VRRP

The Virtual Router Redundancy Protocol (VRRP) is a computer networking protocol that provides automatic assignment of available Internet Protocol (IP) routers for participating hosts. The VRRP router who has the highest number will become the virtual master router. The VRRP router number ranges from 1 to 255 and usually we use 255 for the highest priority and 100 for backup. If the current virtual master router receives an announcement from a group member (Router ID) with a higher priority, then the latter will pre-empt and become the virtual master router.



Network->VRRP

Enable
Check this box will enable VRRP.

Interface
Select the interface of Virtual Router.

Virtual Router ID
User-defined Virtual Router ID. Range: 1-255.

Authentication Type
Select the authentication type for VRRP.

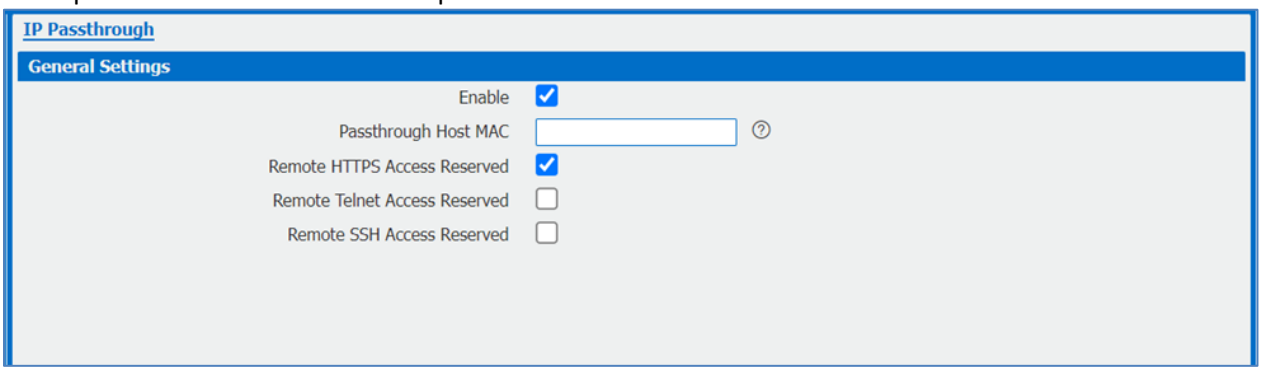
Priority
Enter the VRRP priority range is 1-254 (a bigger number indicates a higher priority).

Interval
Heartbeat package transmission time interval between routers in the virtual IP group. Range: 1-255.

Virtual IP Address
Enter the virtual IP address of virtual gateway.

4.5.4 IP Passthrough

IP Passthrough mode disables NAT and routing and passes the WAN IP address from the WAN interface to the device connected on the local Interface. It is used instead of Network Address Translation (NAT) in order to make the router "transparent" in the communication process.



Network->IP Passthrough

Enable
Check this box will enable IP Passthrough.

Passthrough Host MAC
Enter the MAC of passthrough host to receive the WAN IP address.

Remote HTTPS Access Reserved
Check this box to allow to remote access the router via https while enable IP Passthrough mode.

Remote Telnet Access Reserved
Check this box to allow to remote telnet to the router while enable IP Passthrough mode.

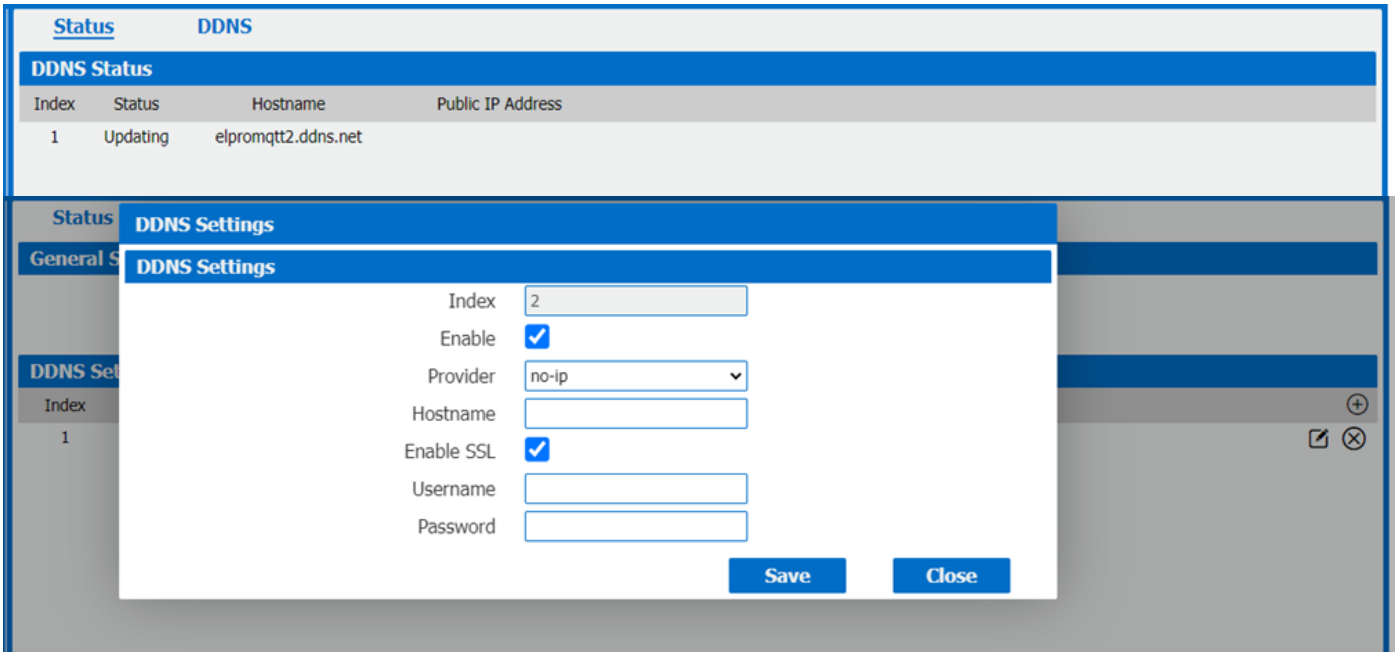
Remote SSH Access Reserved
Check this box to allow to remote SSH to the router while enable IP Passthrough mode.

4.6. Applications

4.6.1 DDNS

DDNS is a system that allows the domain name data of a computer with a varying (dynamic) IP addresses held in a name server to be updated in real time in order to make it possible to establish connections to that machine without the need to track the actual IP addresses at all times. A number of providers offer Dynamic DNS services (DDNS), free or for a charge.

You could review the status of DDNS as below.



DDNS

Status
Display the DDNS status.

Hostname
Display the hostname of DDNS.

Public IP Address
Display the public IP address.

Check IP Interval
Enter the interval, the modem will update the Dynamic DNS server of its carrier assigned IP address.

Log Level
Select the log output level from “none”, “Error”, “Notice”,” Info” and “Debug”.

Enable
Check this box to enable the DDNS service.

Provider
Select the DDNS provider from the list, options from “DynDNS”, “no-ip”,”3322” and custom.

DDNS Server
The internet address to communicate the Dynamic DNS information to. This option is available after you select custom on DDNS Provider.

DDNS Path
DDNS path for custom type.

Check IP Server
Check IP Server for custom type

Check IP Path
Check IP Path for custom type.

Enable SSL
Enable SSL for connection.

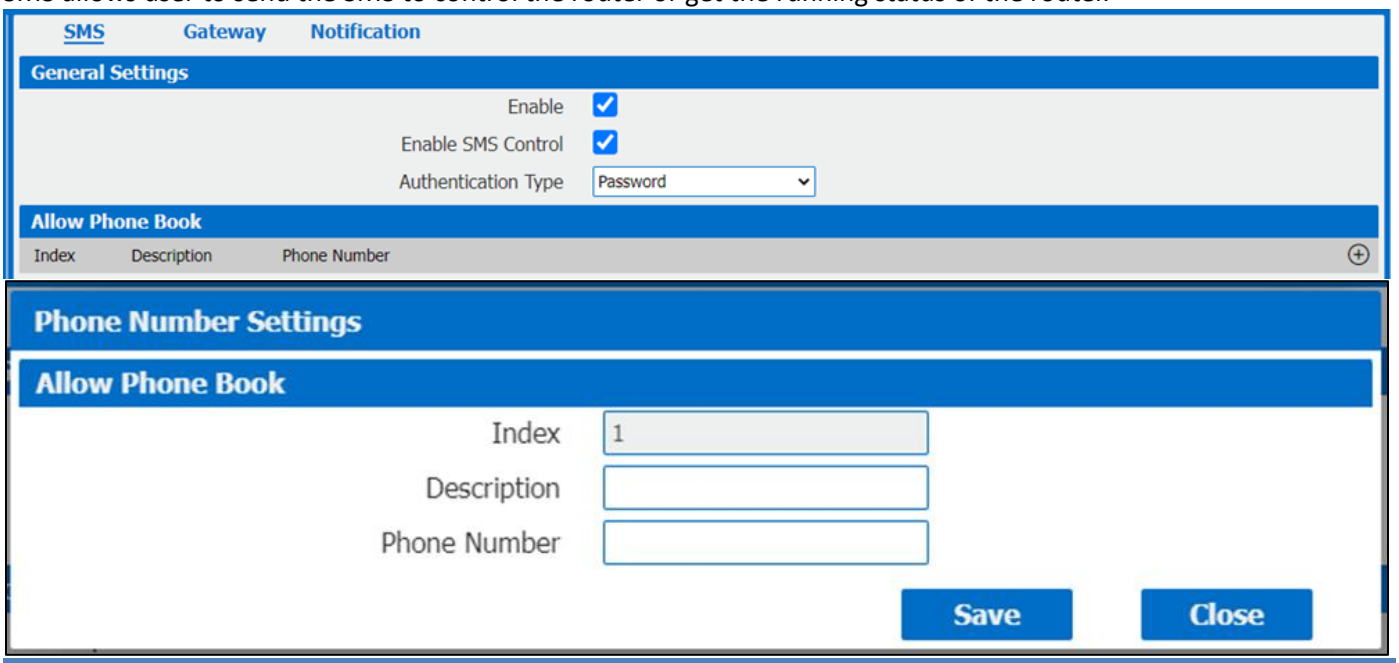
Username
Enter the username used when setting up the account. Used to login to the Dynamic DNS service.

Password
Enter the password associated with the account.

Hostname
Enter the hostname associated with the account.

4.6.2 SMS

SMS allows user to send the SMS to control the router or get the running status of the router.



Application->SMS

Enable
Check this box to enable SMS feature.

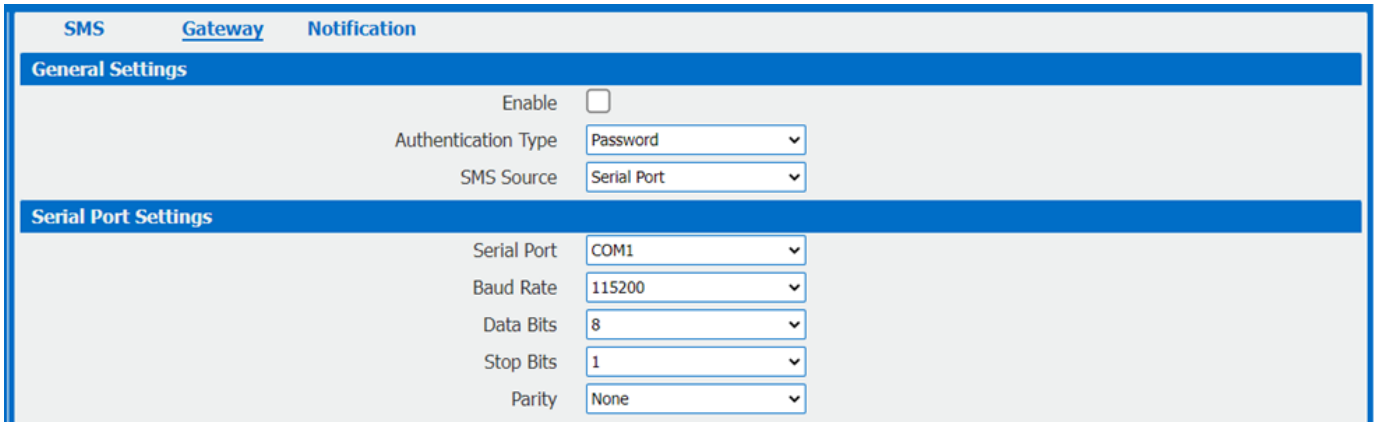
Enable SMS Control
Check this box to enable SMS control feature.

Authentication Type
Specify the authentication mode for SMS, optional for “None” and “Password”.

Description
Enter the description of the Phone Book

Phone Number
Enter the special phone number and only allow this phone number to send SMS to the router

SMS Gateway allow to send SMS messages by using a valid syntax from serial device or ethernet device.



Application->SMS>Gateway

Enable
Check the box will enable SMS gateway.

Authentication Type
Specify the authentication mode for SMS, optional for “None” and “Password”.

SMS Source
Specify SMS source to receive valid syntax, optional for “Serial Port” and “HTTP(S) GET/POST”.

SMS Message Format
Specify the SMS format between “Text” and “PDU” when reading SMS or reading SMS list via “HTTP(S) GET/POST”

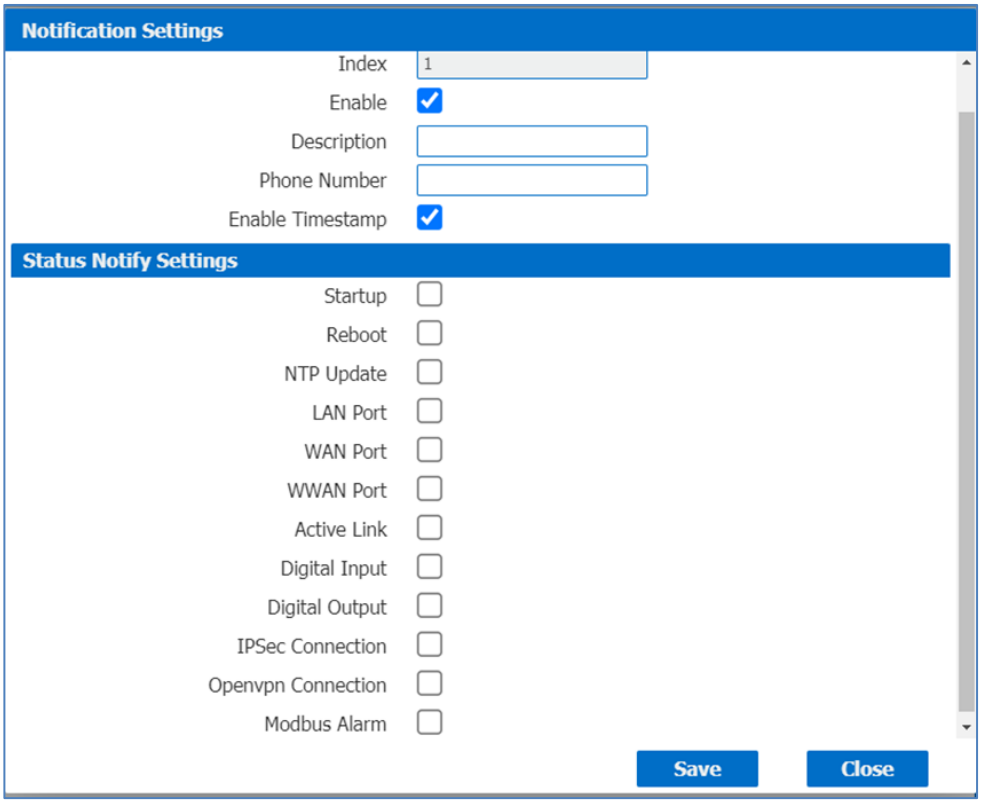
Serial Port
Select the serial port from COM1 or COM2.

Baud Rate
Select the serial port baud rate. Supported values are 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, or 115200.

Data Bits
Select the values from 7 or 8.

Stop Bits
Select the values from 1 or 2.

Parity
Select values from none, even, odd, mark, space.
SMS Notification feature allow to send SMS notification to the pre-setting phone number when some of router status changed.



Application->SMS>Notification

Index
Display the index of the notification channel, maximum is 10.

Description
Add the description for notification channel.

Phone Number
Pre-setting phone number to receive the notification

Timestamp
Check this box to enable timestamp on the SMS notify.

Startup
Send SMS notification to the pre-setting phone number when system startup.

Reboot
Send SMS notification to the pre-setting phone number when system reboot.

NTP Update
Send SMS notification to the pre-setting phone number when NTP update successfully.

LAN Port Status
Send SMS notification to the pre-setting phone number when LAN port status changed.

WAN Port Status
Send SMS notification to the pre-setting phone number when WAN port status changed.

WWAN Port
Send SMS notification to the pre-setting phone number when WWAN port status changed.

Active Link
Send SMS notification to the pre-setting phone number when active link status changed.

Digital Input
Send SMS notification to the pre-setting phone number when DI status changed.

Digital Output
Send SMS notification to the pre-setting phone number when DO status changed.

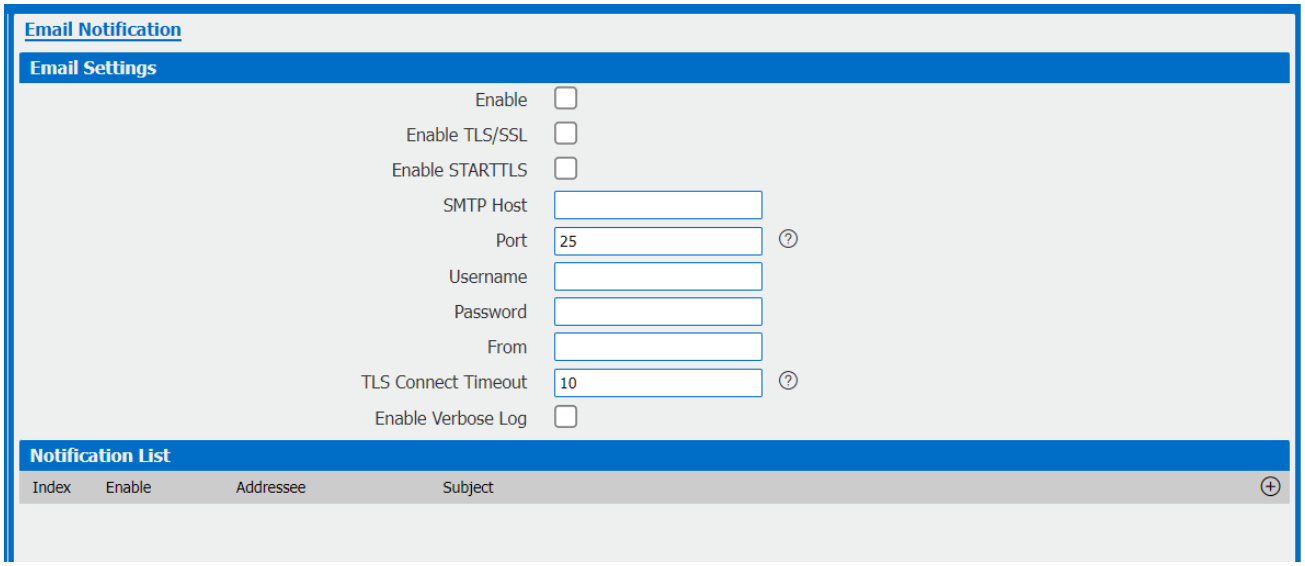
IPSec Connection
Send SMS notification to the pre-setting phone number when IPSec connection status changed.

OpenVPN Connection
Send SMS notification to the pre-setting phone number when OpenVPN Connection Status changed.

Modbus Alarm
Send SMS notification to pre-setting phone number when trigger Modbus alarm.

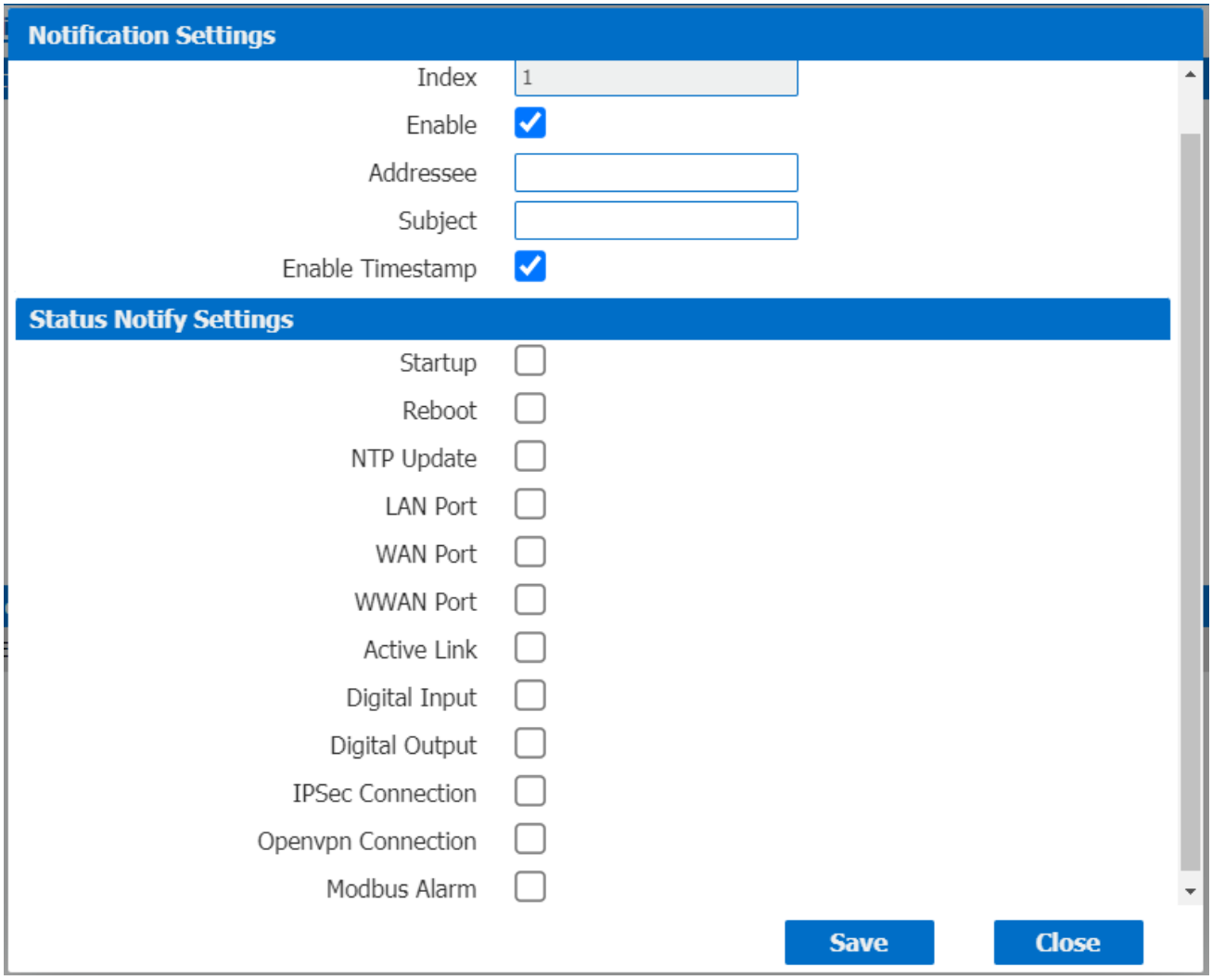
4.6.3 Email Notifications

Email notification application allows the 641M to be able to send email based on configured events in the device such as Startup, Reboot, Digital I/O, VPN status or Modbus Alarm.



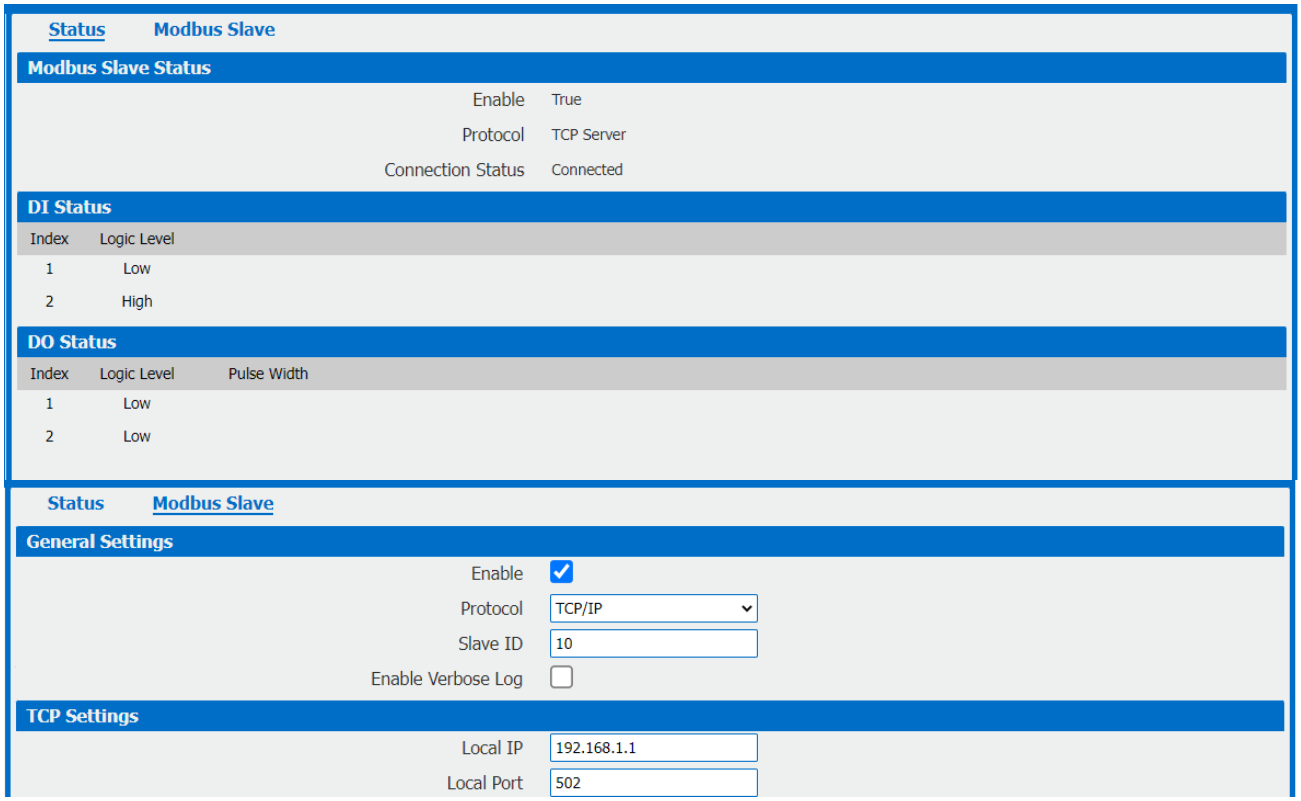
Application->Email Notification

Enable
Check this box to enable Email Notification feature.
Enable TLS/SSL
Check this box to enable TLS/SSL.
Enable STARTTLS
Check this box to enable STARTLS.
SMTP Host
Mail server host address to connect for sending email.
Port
Mail server host port.
Username
Email exchange server login username
Password
Email exchange server login password
From
Sending email address.
TLS Connect Timeout
Connection timeout configuration for TLS/SSL connections.
Enable Verbose Log
Checkbox to enable detailed logging in system log.


Notification Settings
Index
1
Enable
Addressee
Subject
Enable Timestamp
Status Notify Settings
Startup
Reboot
NTP Update
LAN Port
WAN Port
WWAN Port
Active Link
Digital Input
Digital Output
IPSec Connection
Openvpn Connection
Modbus Alarm
Save
Close

4.6.4 Modbus Slave

This application allows the 641M to function as a Modbus TCP/IP or RTU slave device. The Modbus slave can be accessed externally from a Ethernet or serial connected master or using the 641M Modbus master software function.



Application->Modbus Slave

Enable

Check this box to enable Modbus Slave feature.

Protocol

Select either TCP/IP or RTU protocol.

Slave ID

Configuration of the Modbus slave ID of the device.

Enable Verbose Log

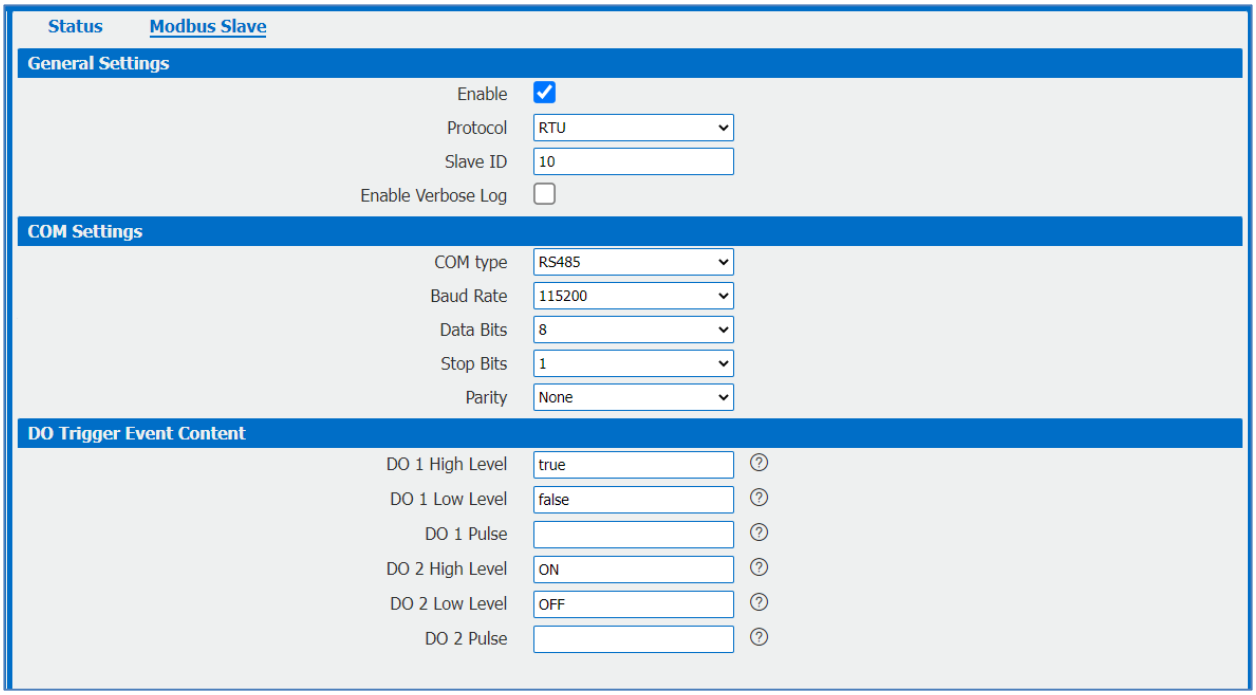
Check to enable detailed function logging in system log file.

Local IP

IP address used for slave device.

Local Port

IP Port used for slave device.



Modbus RTU Settings

COM type

Connected to Modbus master through either RS-485 or RS-232 port.

Baud Rate

Select serial data rate, 300 to 115200 baud.

Data Bits

Number of data bits to transmit, set to 8 only.

Stop Bits

Number of stop bits to transmit, set to 1 or 2.

Parity

Data byte parity, set to None, Odd, Even, Mark, Space

DO 1 High Level

Value to be used for digital output high level. See note below.

DO 1 Low Level

Value to be used for digital output low level. See note below.

DO 1 Pulse

Value to be used for digital output pulse. See note below.

DO 1 High Level

Value to be used for digital output high level. See note below.

DO 1 Low Level

Value to be used for digital output low level. See note below.

DO 1 Pulse

Value to be used for digital output pulse. See note below.

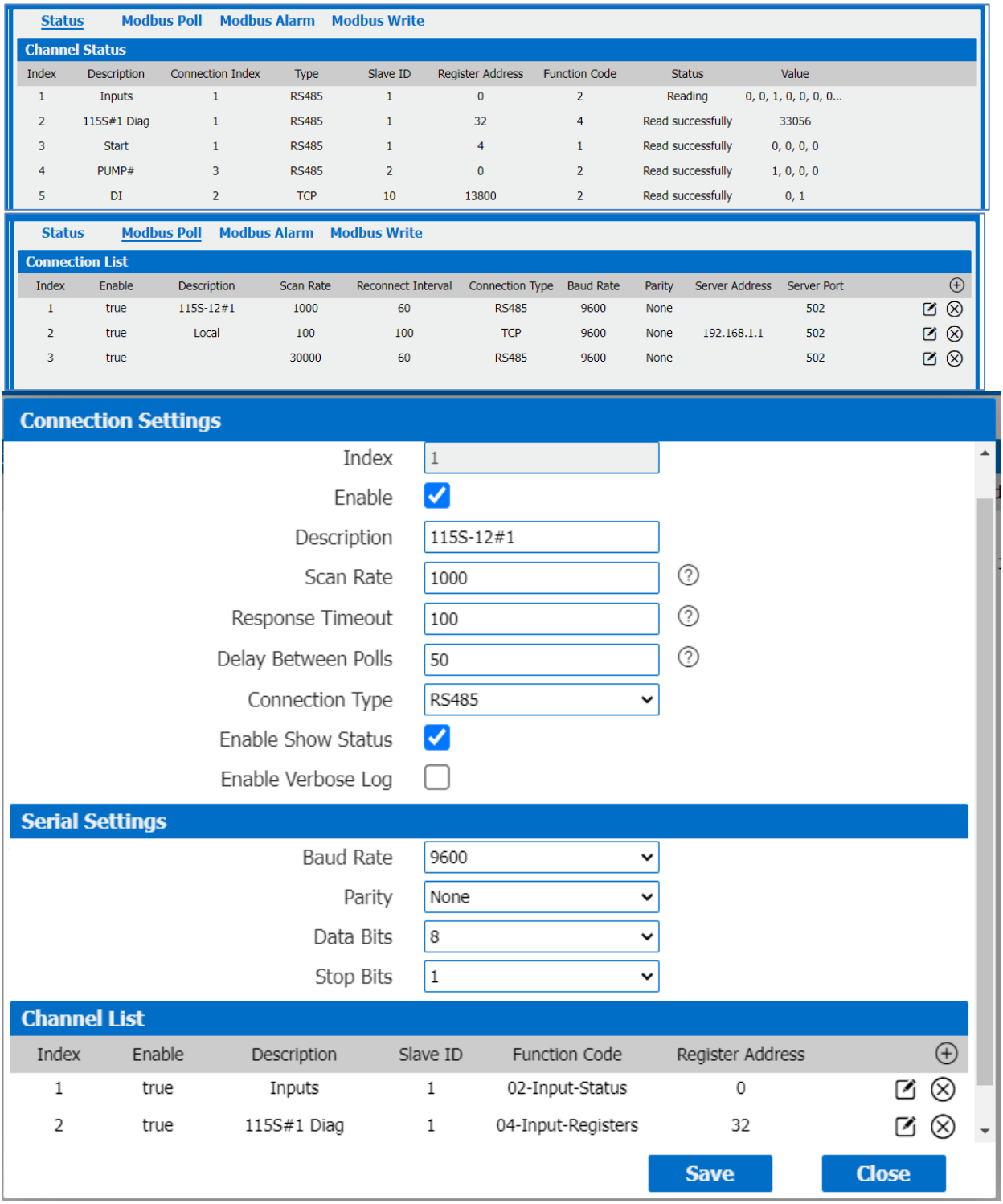
The Trigger Event Content controls the values used for notifications with other applications for each of the configured states of the output. This is a text field that can be used for simple text or expressions. There is several internal field values available to be used to form this text output. Field values can be used singly or combined with other fields or text. These are listed below:

$DI_INDEX, $DATE, $SERIAL_NUMBER, $DEVICE_MODEL, $FIRMWARE_VERSION, $SYSTEM_UPTIME, $LINK_TYPE, $IP_ADDRESS, $MODEM_MODEL, $CSQ, $OPERATOR, $NETWORK_TYPE, $IMEI, $PLMN_ID, $LOCAL_AREA_CODE, $CELL_ID, $IMSI, $MODEM_FIRMWARE

4.6.5 Modbus Master

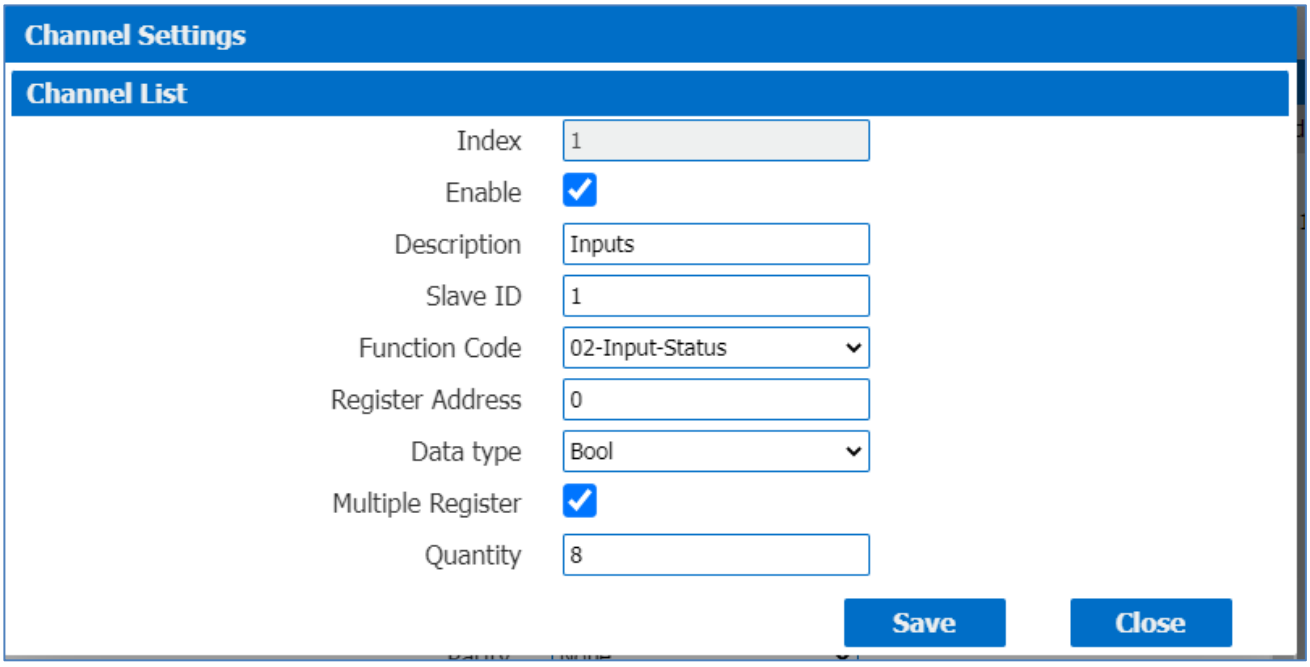
This application provides a Modbus Master feature to poll internal or external slave devices and collecting register values for applications to use when sending or receiving messages.

The Modbus master poll configuration is also used by other applications such as MQTT, Sparkplug and DNP3 as the source of register values. In each of these applications the Connection index is used as the reference.

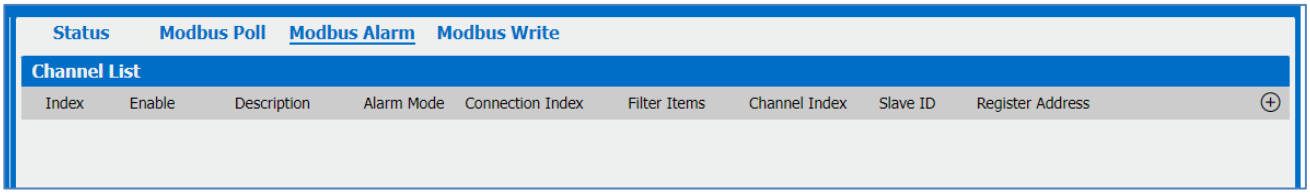


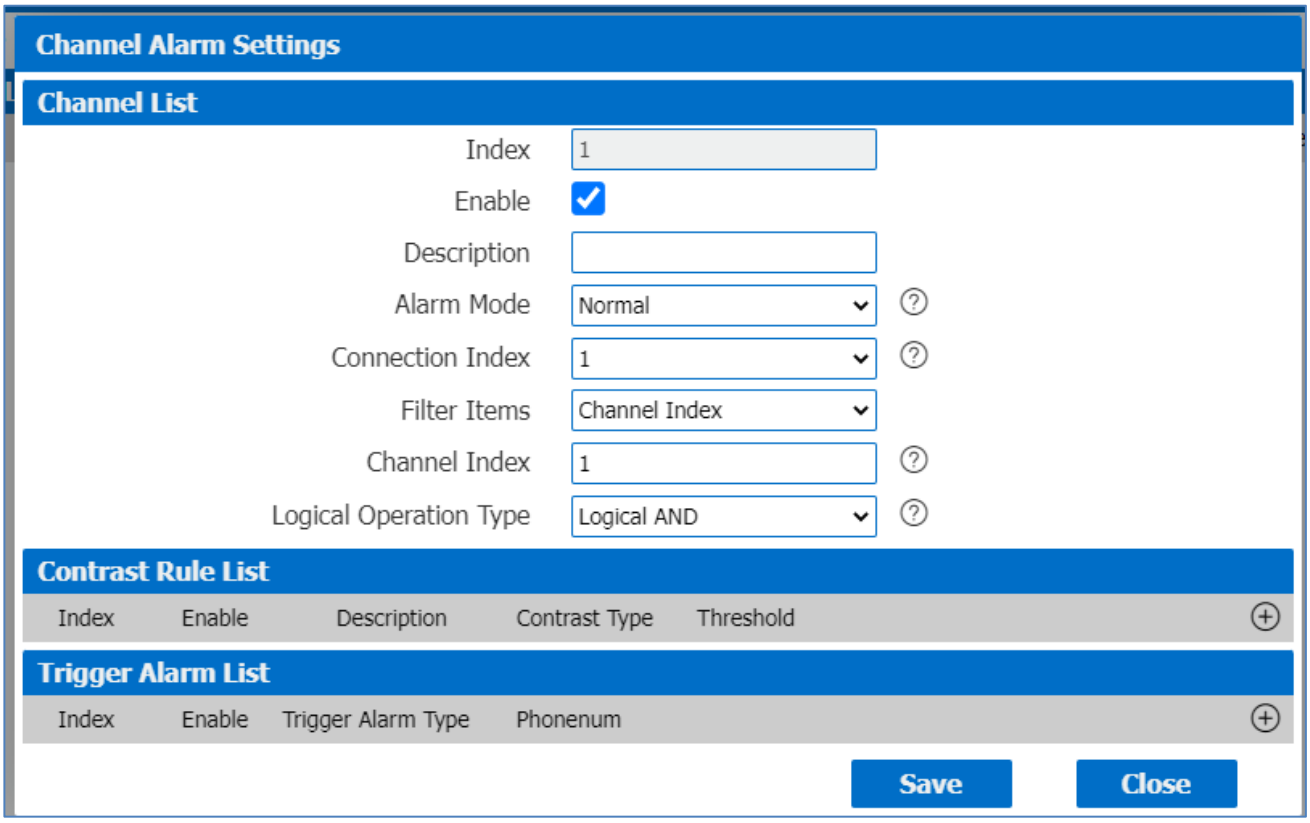
Application->Modbus Slave

Enable
Check this box to enable Modbus master poll.
Description
Descriptive name used as a reference for poll.
Scan Rate
Rate at with scan or poll occurs in milli-seconds.
Response Timeout
Timeout used if there is not a response received from the slave in milliseconds.
Delay Between Polls
Delay time to wait between sending poll messages in milliseconds.
Connection Type
RS-232, RS485 or TCP.
Enable Show Status
Show on status page.
Enable Verbose Log
Check to enable detailed function logging in system log file.
Baud Rate
Select serial data rate, 300 to 115200 baud.
Data Bits
Number of data bits to transmit, set to 8 only.
Stop Bits
Number of stop bits to transmit, set to 1 or 2.
Parity
Data byte parity, set to None, Odd, Even, Mark, Space.



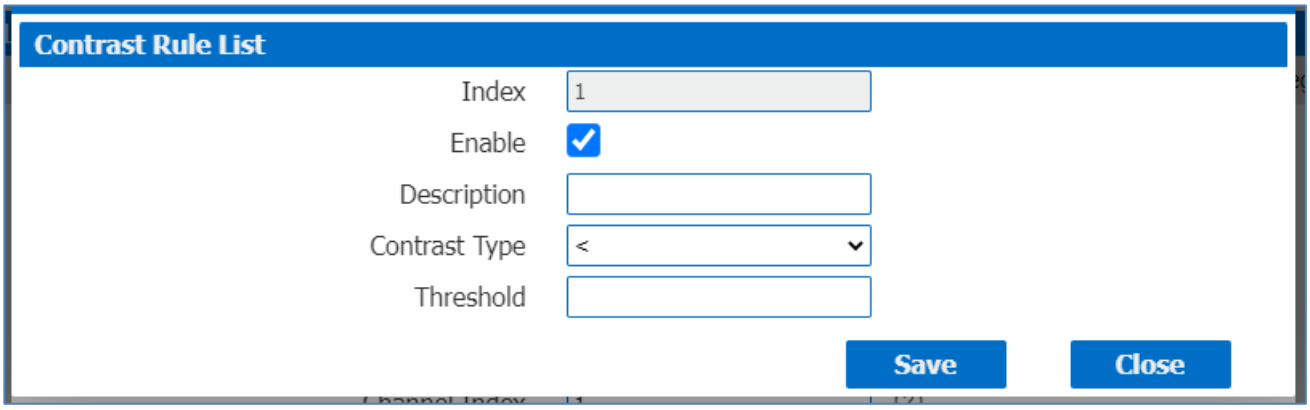
Enable
Check this box to enable this channel.
Description
Enter descriptive text for channel.
Slave ID
Polled slave ID address to be used for poll.
Function Code
Modbus function code to use to reference register.
Register Address
Modbus register to use for poll.
Data type
Data type to use for value. Bool for Coils and Inputs. Uint16, Int16, Uint32, Int32, Float or Double64 other 16 bit and 32 bits register types. Type must match register references to avoid poll error.
Multiple Register
Check if a block of multiple registers to be polled.
Quantity
Number of registers to poll.





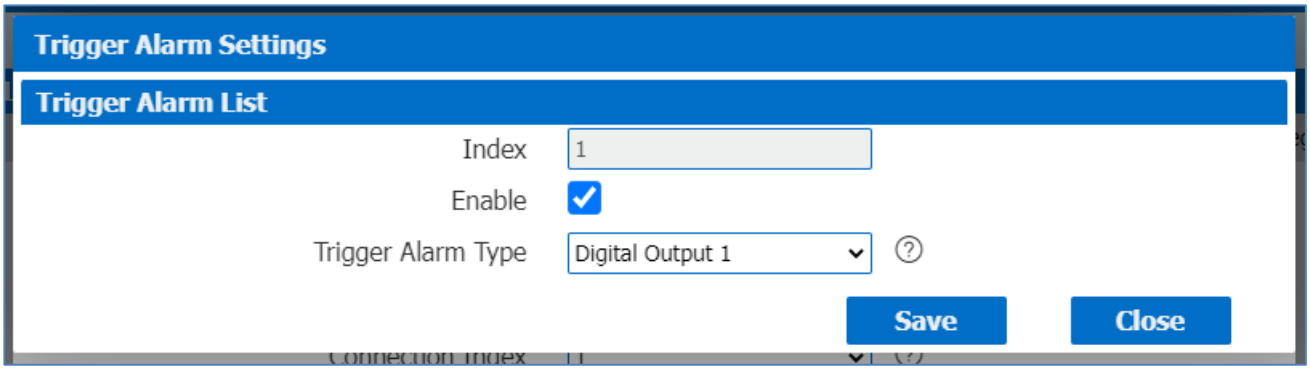
Application->Modbus Master-> Modbus Alarm

Enable
Check this box to enable.
Description
Enter descriptive text for channel.
Alarm Mode
Configure alarm mode for Normal, Continuous or Every operation.
Connection Index
Connection Index to link Alarm
Filter Items
Apply filter to alarm using Channel Index, Slave ID or Register Address.
Channel Index
Channel on configured connection or use or leave empty for all channels.
Logical Operation Type
Apply a logical AND or OR to the rules.



Application->Modbus Slave

Enable
Check this box to enable Rule.
Description
Description text for rule.
Contrast Type
Operand to use for rule: <, >, <=, >=, !=, !, |, &, ^
Threshold
Value to use.



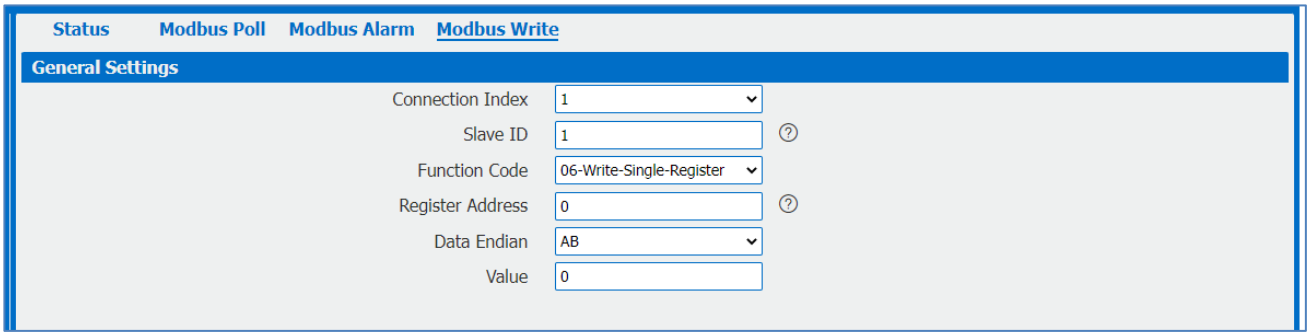
Application->Modbus Master

Enable

Check this box to enable.

Trigger Alarm Type

Select the output type to use for this alarm. Digital Output1, Digital Output2, Event Notification, SMS.



Application->Modbus Master-> Modbus Write

Slave ID

Slave ID to use for write command.

Function Code

Modbus Function Code to use for register.

Register Address

Register Address to use.

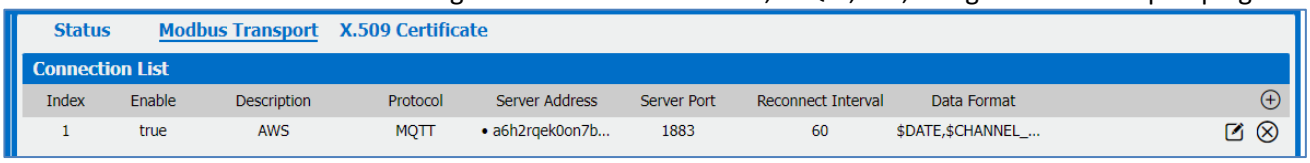
Data Endian

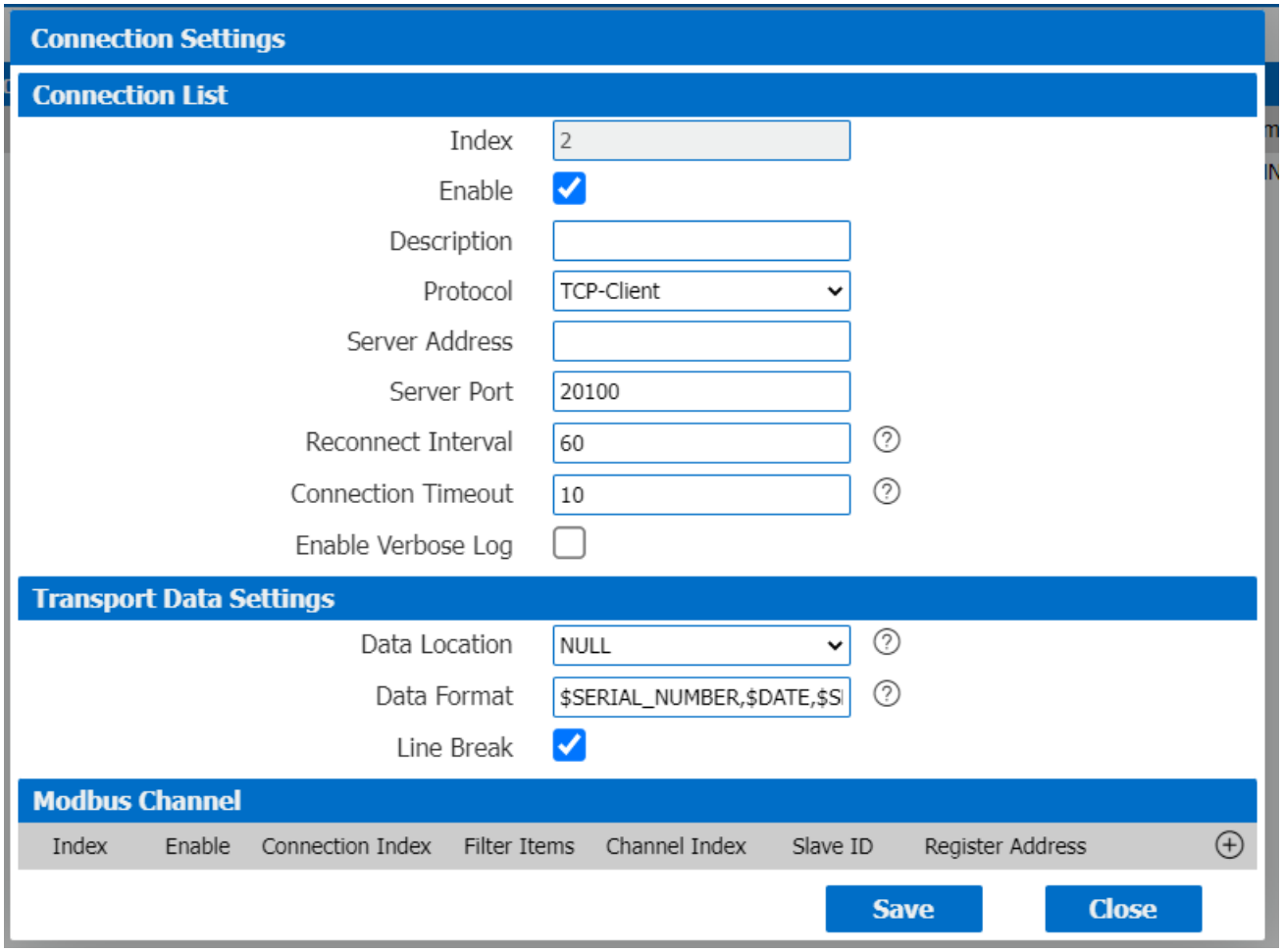
Endian conversion to make byte order correct.

4.6.6 Modbus Transport

Internal Modbus transport that uses connections to the master or slave application applications or protocols. The Modbus Transport application is included when installing the Modbus Master software application.

This can be used to collect Modbus register values for TCP Client, MQTT, FTP, Google Cloud and SparkplugB.





Application->Modbus Transport

Enable

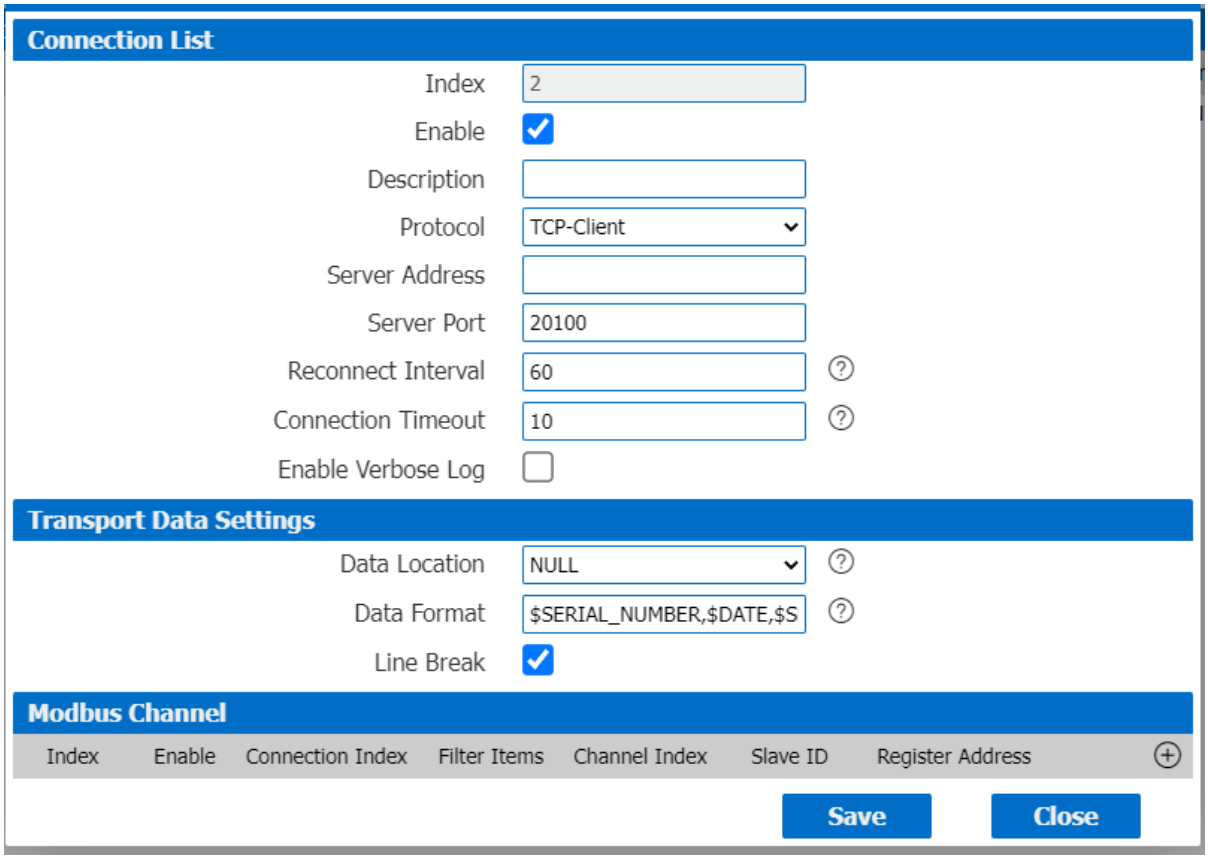
Check this box to enable Modbus Slave feature.

Description

Description text for channel.

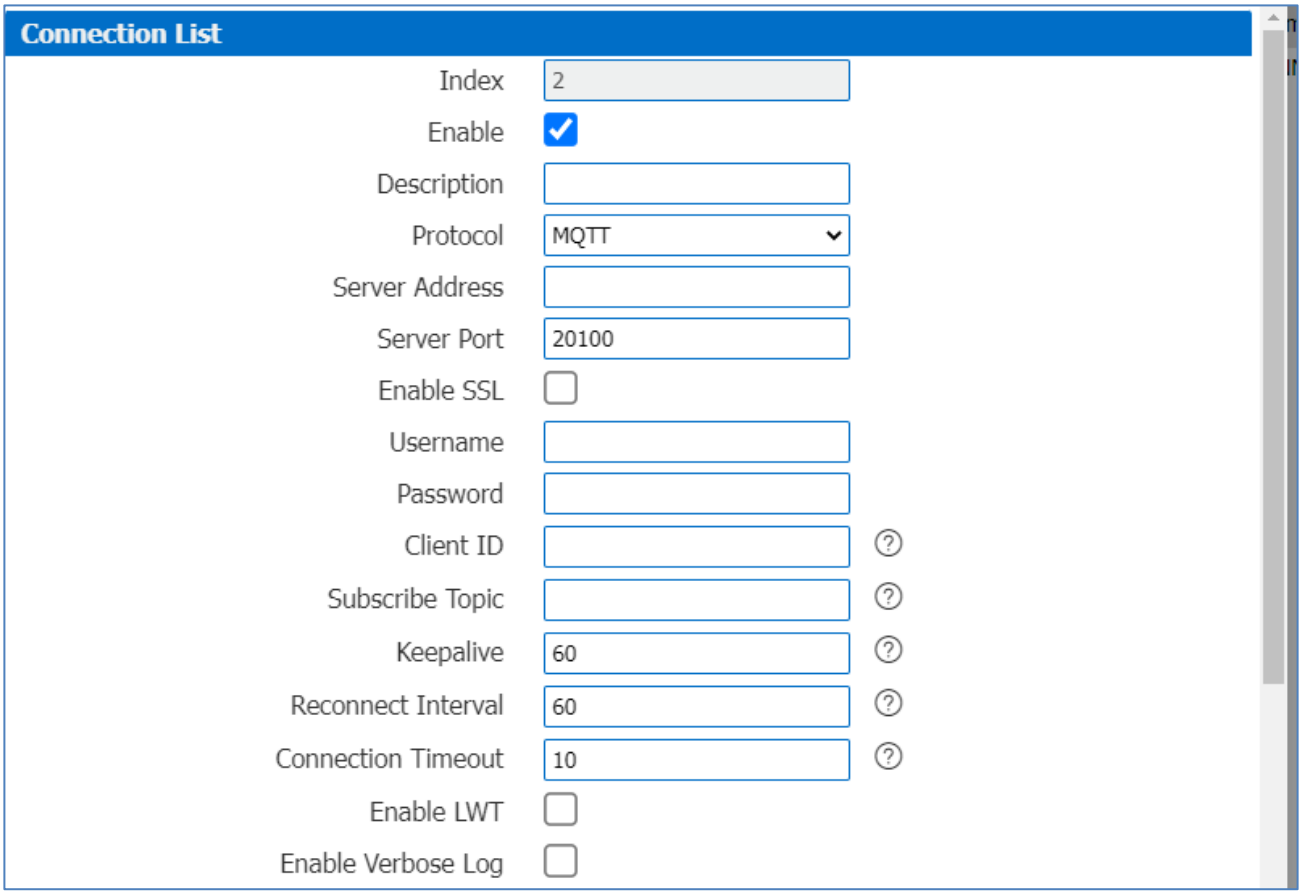
Protocol

Configure for TCP Client, MQTT, FTP or Google Cloud.



Application->Modbus Transport->TCP Client

Server Address
TCP server IP or Domain Name.
Server Port
TCP server port.
Reconnect Interval
FTP reconnect interval in seconds.
Connection Timeout
FTP connection timeout in seconds.
Enable Verbose Log
Enable detailed logging for system log file.
Data Location
NULL, RAM or Flash configurable allows short term storage of data if connection is down.
Data Format
String that configures the data format for transmitted data on this connection.
Line Break
Check to enable line break to be send after data is transmitted.



Application->Modbus Transport->TCP Client

Server Address
TCP server IP or Domain Name.
Server Port
TCP server port.
Enable SSL
Check to enable SSL with TLS. Note that certificate needs parameters will need to be configured.
Username
Broker connection username.
Password
Broker connection password.
Client ID
Client ID to use for broker connection. May be empty.
Subscribe Topic
Subscribe topic to use for writing output data.
Keepalive
TCP or TLS keep alive time for connection to broker.
Reconnect Interval
FTP reconnect interval in seconds.
Connection Timeout
FTP connection timeout in seconds.
Enable LWT
Enable Last Will and Testament. If enabled, then LWT Topic and Payload can be entered.
Enable Verbose Log

Enable detailed logging for system log file.

Data Location

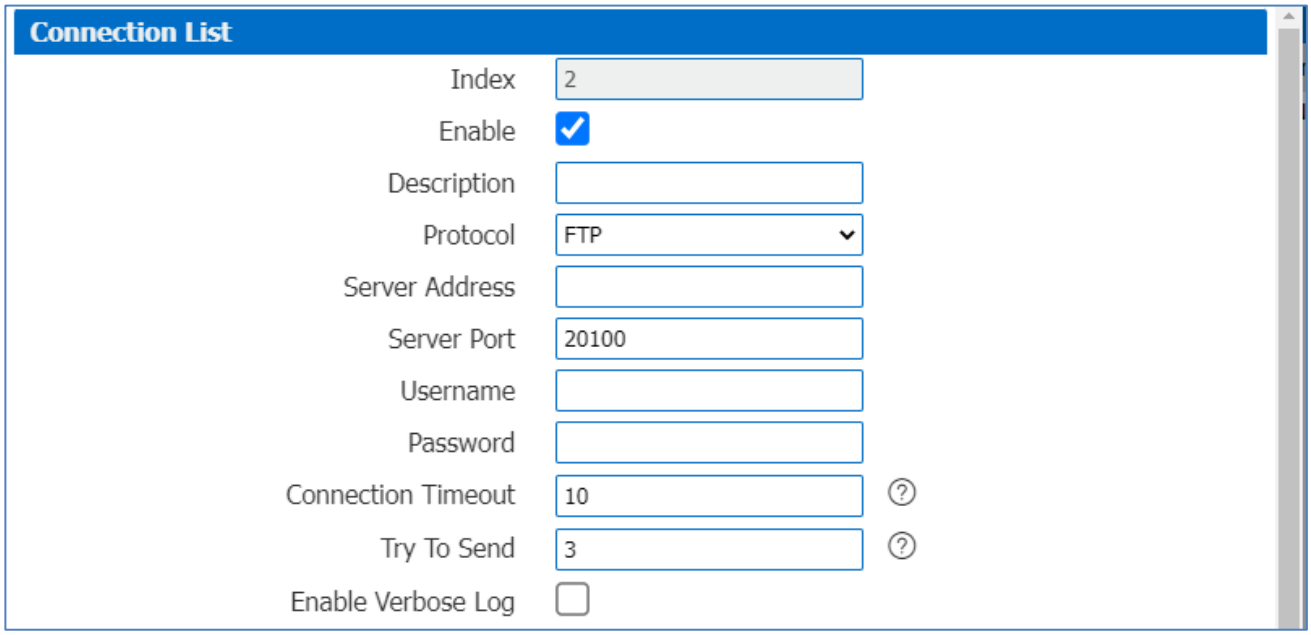
NULL, RAM or Flash configurable allows short term storage of data if connection is down.

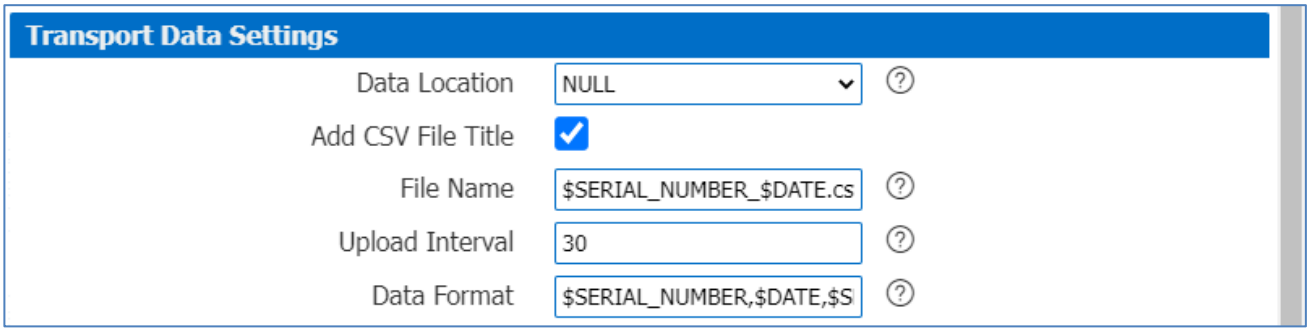
Data Format

String that configures the data format for transmitted data on this connection.

Line Break

Check to enable line break to be send after data is transmitted.





Application->Modbus Transport->FTP

Server Address

FTP server IP or Domain Name.

Server Port

FTP server port.

Username

Server connection username.

Password

Server connection password.

Connection Timeout

FTP connection timeout in seconds.

Try to Send

Number of times to resend connection request on failure to connect.

Enable Verbose Log

Enable detailed logging for system log file.

Data Location

NULL, RAM or Flash configurable allows short term storage of data if connection is down.

Add CSV File Title

Include title in CSV file

File Name

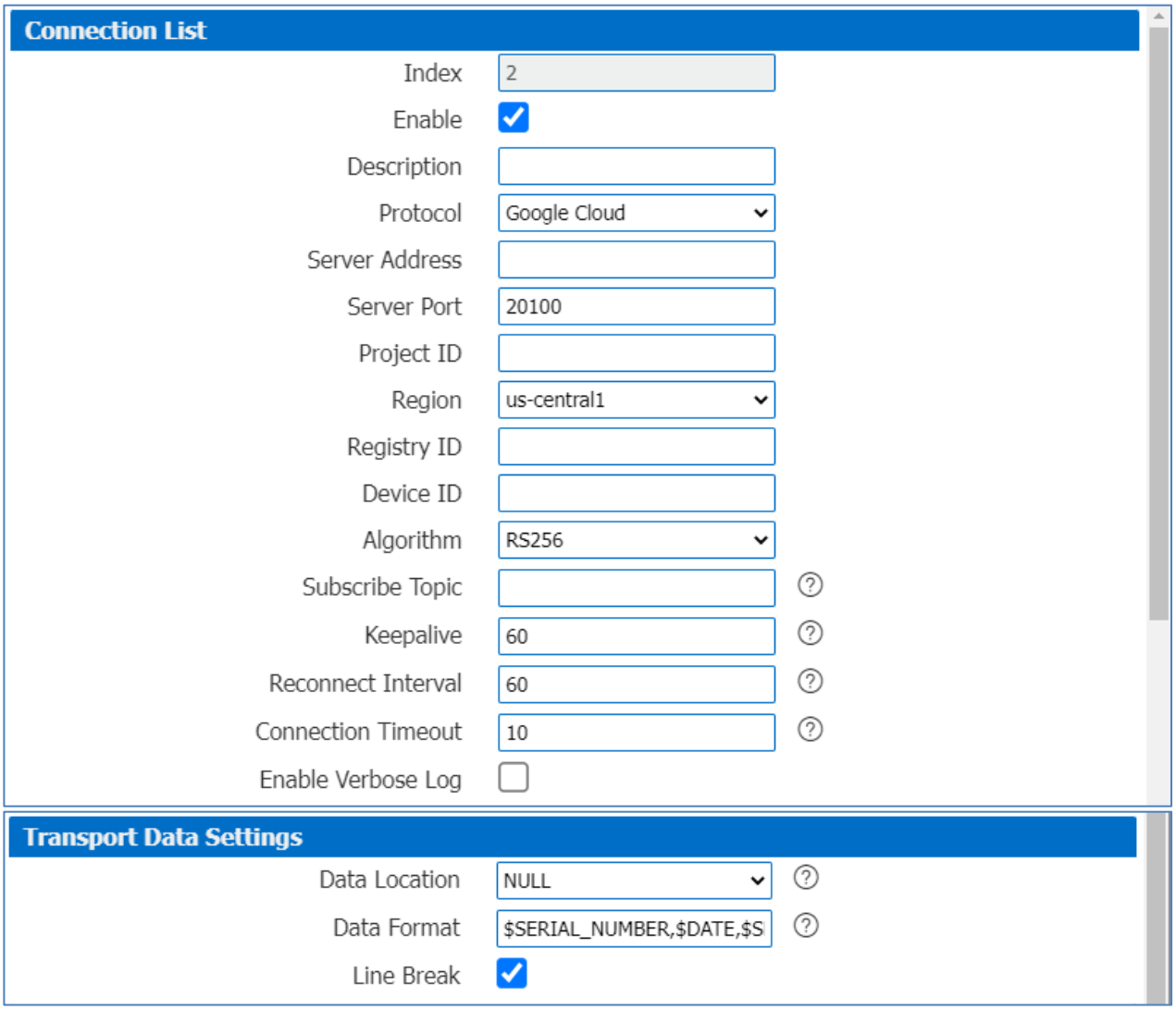
String configuration of file number. $ expressions can be used for internal values.

Upload Interval

Time interval to send the FTP file in seconds. 1- 86400 seconds.

Data Format

Format of data to send in FTP file. $ expressions can be used for internal values.



Application->Modbus Transport->Google Cloud

Server Address

FTP server IP or Domain Name.

Server Port

FTP server port.

Project ID

Google Cloud project ID to connect.

Region

Google Cloud server region to connect.

Registry ID

Device registry ID configuration.

Device ID

Device ID configuration, must be unique.

Algorithm

Signature algorithm to use for token, RS256 or HS256.

Subscribe Topic

Topic to use to send Modbus data.

Keepalive

Google cloud connection keepalive time in seconds, 1- 86400.

Reconnect Interval

Connection reconnect time in seconds, 1-600.

Connection Timeout

Connection timeout in seconds.

Try to Send

Number of times to resend connection request on failure to connect.

Enable Verbose Log

Enable detailed logging for system log file.

Data Location

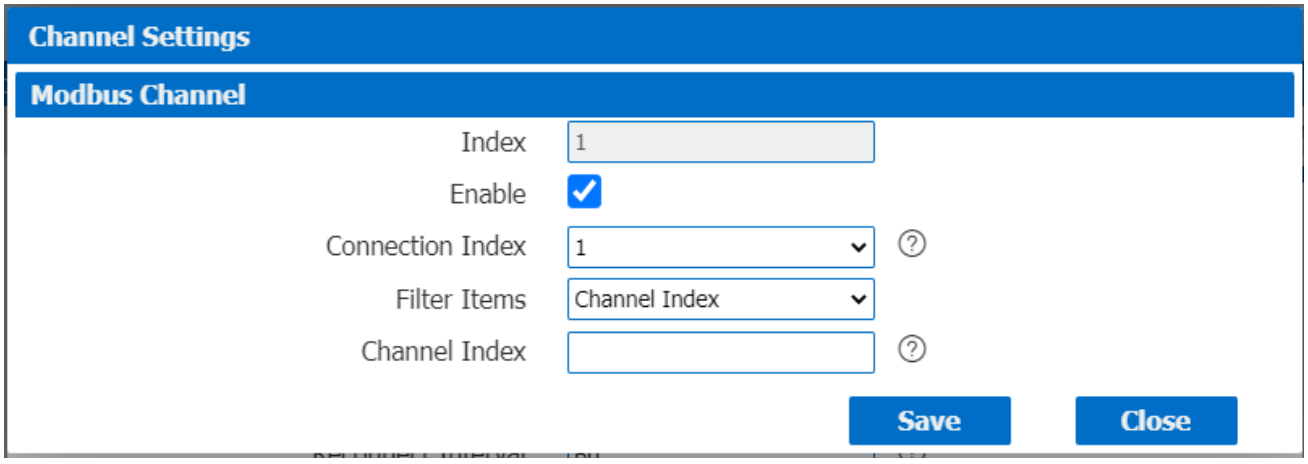
NULL, RAM or Flash configurable allows short term storage of data if connection is down.

Data Format

String that configures the data format for transmitted data on this connection.

Line Break

Check to enable line break to be send after data is transmitted.



Application->Modbus Transport->Channel Settings

Enable

Check this box to enable channel.

Connection Index

Modbus channel connection index to use for this link.

Filter Items

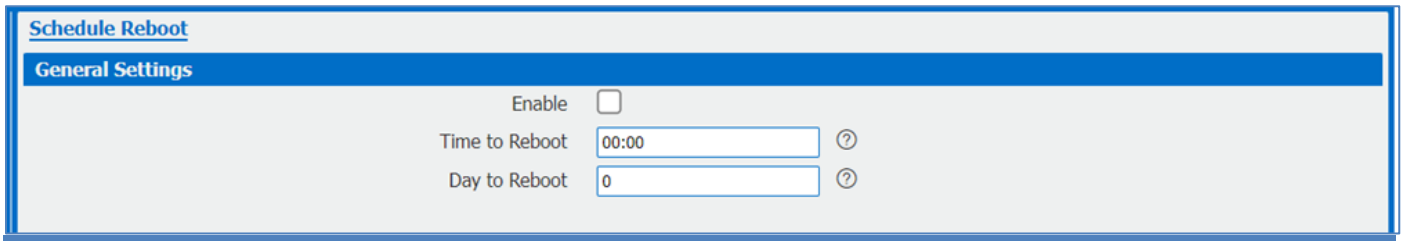
Filter Modbus connection by Channel Index, Slave ID or Register Address.

Channel Index

Channel index to listen on for Modbus data. If empty then listen on all channels.

4.6.7 Schedule Reboot

Schedule reboot allows user to define the time for router reboot itself.



Application->Schedule Reboot

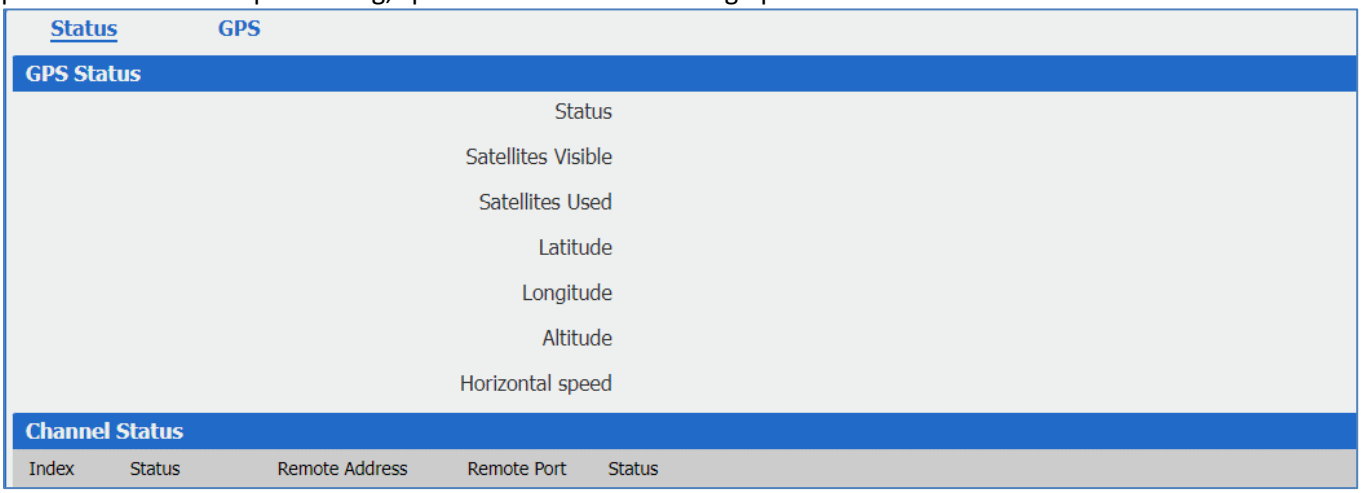
Enable
Check this box to enable schedule reboot feature.

Time to Reboot
Enter the time of each day to reboot device. Format: HH(00-23):MM(00-59).

Day to Reboot
Enter the day of each month to reboot device. 0 means every day.

4.6.8 GPS

GPS (Global Positioning System) is a high-precision radio navigation positioning system based on satellites. It can provide the accurate positioning, speed measurement and high precision standard time.



Application->GPS->Status

Status
Displays current GPS status.

Satellites Visible
Displays the number of the visible satellites.

Satellites Used
Displays the number of the visible satellites in using.

Latitude
Displays the latitude of GPS.

Longitude
Display the longitude of GPS.

Altitude
Display the altitude of GPS.

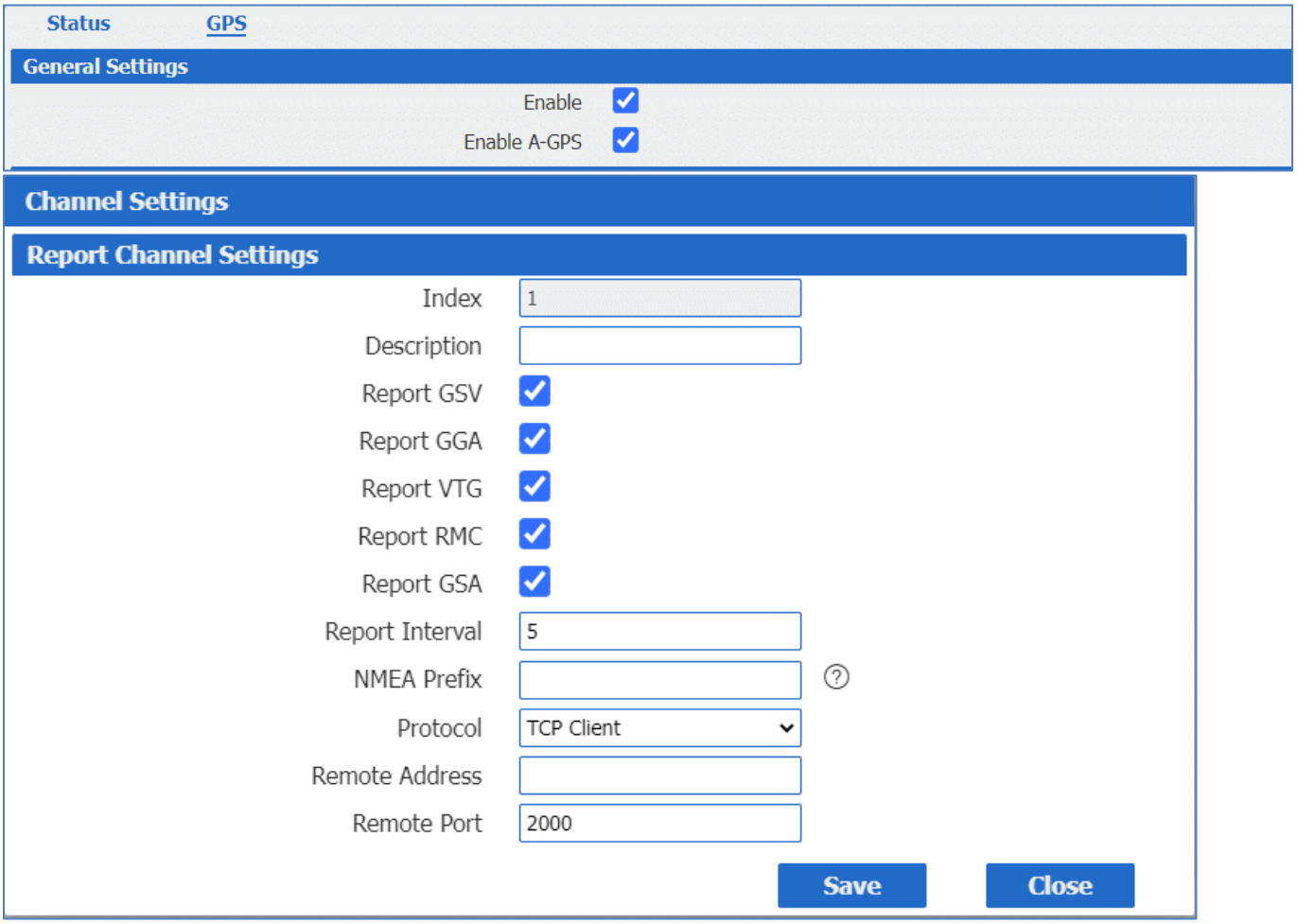
Horizontal speed
Display the horizontal speed of GPS.

Status (Channel)
Display the transmission protocol of the channel.

Remote Address
Display the remote IP address of the channel.

Remote Port
Display the remote port of the channel.

Status (Channel)
Display the status of the channel.



Application->GPS->GPS

Enable
Check this box to enable GPS.

Enable A-GPS
Check this box to enable A-GPS (Assisted Global Positioning).

Description
Specify the description of the GPS transmission channel.

Report GSV
Check this box to enable to send the GPS data with GSV format.

Report GGA
Check this box to enable to send the GPS data with GGA format.

Report VTG
Check this box to enable to send the GPS data with VTG format.

Report RMC
Check this box to enable to send the GPS data with RMC format.

Report GSA
Check this box to enable to send the GPS data with GSA format.

Report Interval
Specify the interval time to send the GPS data to remote server.

NMEA Prefix
Self-defined the GPS data prefix to send to remote server.

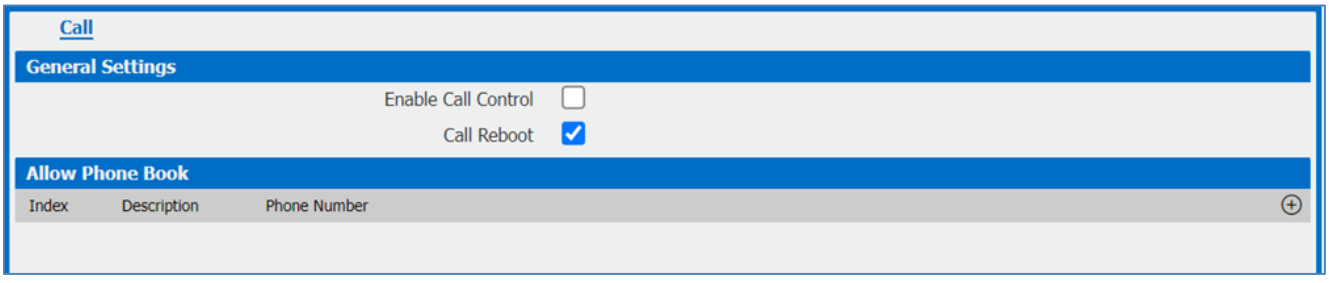
Protocol
Specify the transmission protocol of the channel.

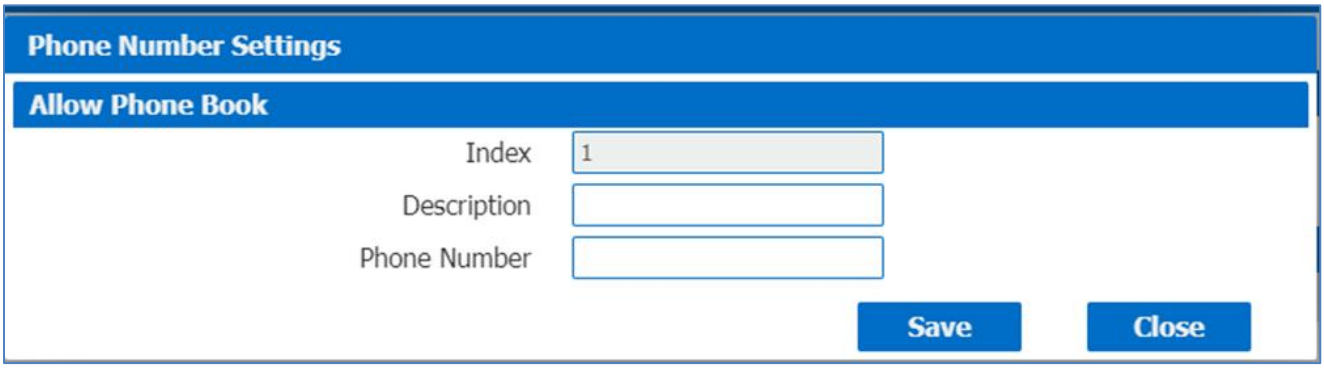
Remote Address
Specify the remote IP address to receive the GPS data.

Remote Port
Specify the remote port to receive the GPS data.

4.6.9 Call

Call reboot allow the user to make a call to the router to control it restart.





Application->Call

Enable Call Control
Check this box to enable call control feature.

Call Reboot
Check this box to enable call reboot feature.

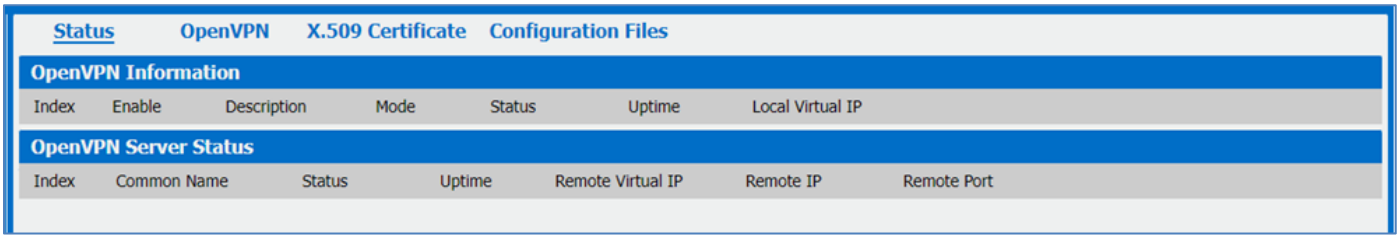
Description
Define the description of the phone book

Phone Number
Specify the phone number that allow to make a call to the router.

4.7. VPN

4.7.1 OpenVPN

OpenVPN is an open source virtual private network (VPN) product that offers a simplified security framework, modular network design, and cross-platform portability.
You could review all OpenVPN connection as below.



VPN->OpenVPN->Status>OpenVPN Information

Enable
Displays current OpenVPN settings is enable or disable.

Mode
Displays current working mode of OpenVPN.

Status
Displays the current VPN connection status.

Uptime
Displays the connection time since VPN is established.

Local Virtual IP

Displays the virtual IP address obtain from remote side.

VPN->OpenVPN->Status>OpenVPN Server Status

Common Name
Displays the common name of OpenVPN client.

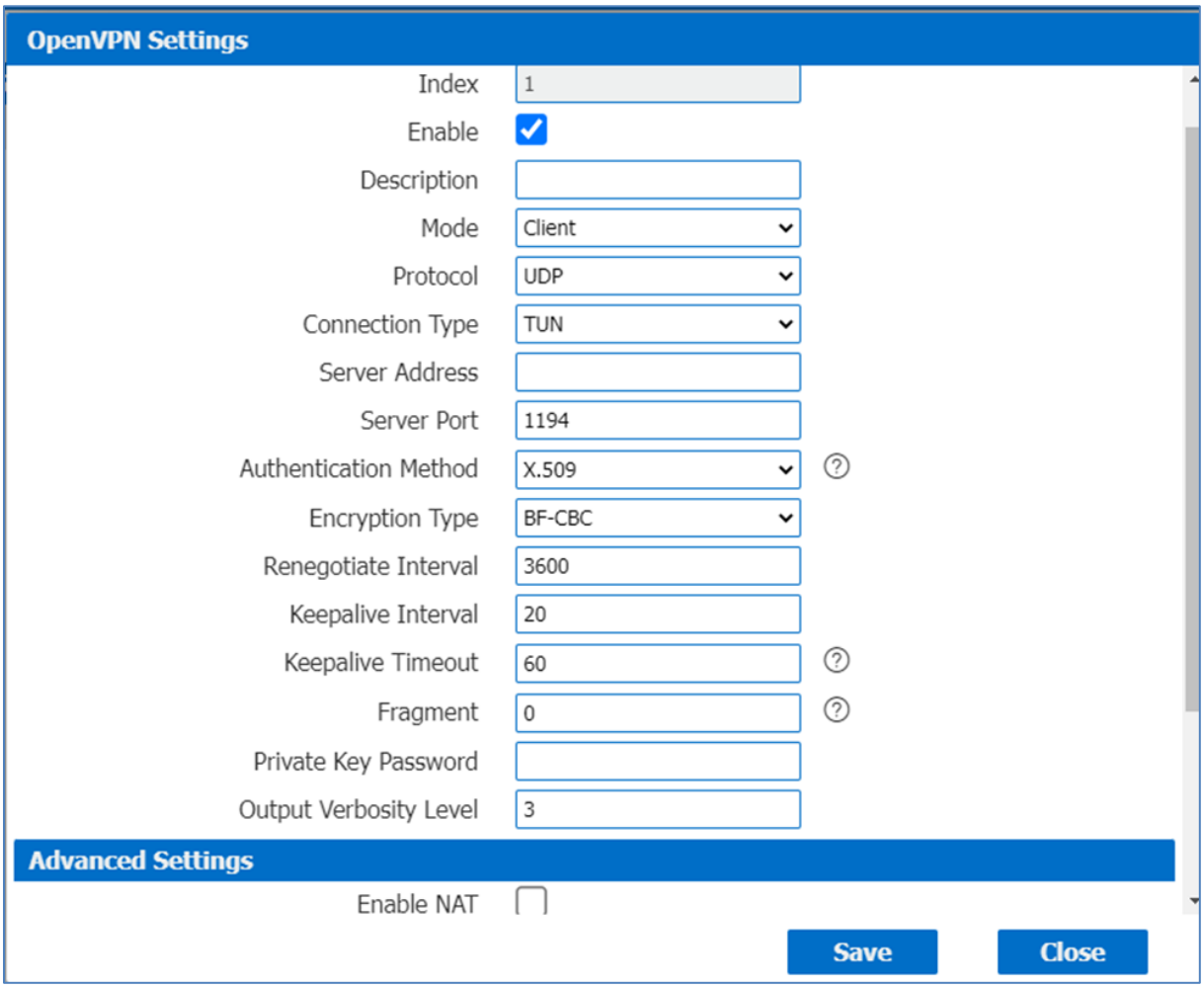
Status
Displays the current VPN connection status.

Uptime
Displays the connection time since VPN is established.

Remote Virtual IP
Displays the virtual IP address of OpenVPN client.

Remote IP
Displays the remote IP address of OpenVPN client.

Remote Port
Displays the remote port obtain of OpenVPN client.



.

VPN->OpenVPN

Enable
Check this box to enable OpenVPN tunnel.

Description
Enter a description for this OpenVPN tunnel.

Mode
Select from “P2P”, “Client” or “Server”.

Protocol
Select from “UDP”, “TCP Client” or “TCP Server”

Connection Type
Select from “TUN”, “TAP” which are two different kinds of device interface for OpenVPN. The difference between TUN and TAP device is that a TUN device is a point-to-point virtual device on network while a TAP device is a virtual device on Ethernet.

Server Address
Enter the IP address or domain of remote server.

Server Port
Enter the negotiate port on OpenVPN server.

Max Client
Allow max OpenVPN client connect to OpenVPN server.

Authentication Method
Select from "X.509", "Pre-shared", "Password", and "X.509 And Password".

Encryption Type
Select from "BF-CBC", "DES-CBC", "DES-EDE-CBC", "DES-EDE3-CBC", "AES-128-CBC", "AES-192-CBC" and "AES-256-CBC".

Username
Enter the username for authentication when selection from “Password” or “X.509 And Password”.

Password
Enter the password for authentication when selection from “Password” or “X.509 And Password”.

Local IP Address
Enter the local virtual IP address when select “P2P” and “OpenVPN Server” mode.

Remote IP Address
Enter the remote virtual IP address when select “P2P” mode.

Local Port
Specify the OpenVPN Server port, default is 1194.

Topology
Select the possible topology from “Subnet” and “Net30”
Subnet: The recommended topology for modern servers. Note that this is not the current default. Addressing is done by IP & netmask.
Net30: This is the old topology for support with Windows clients running 2.0.9 or older clients. This is the default as of OpenVPN 2.3, but not recommended for current use. Each client is allocated a virtual /30, taking 4 IPs per client, plus 4 for the server.

Subnet
Specify the subnet for the OpenVPN client. Default is 10.8.0.0

Subnet Netmask
Specify the subnet netmask for OpenVPN client. Default is 255.255.255.0

TAP Bridge
Select the specified LAN that bridge with OpenVPN tunnel when select “TAP” connection type.

Renegotiate Interval
Enter the renegotiate interval if connection is failed.

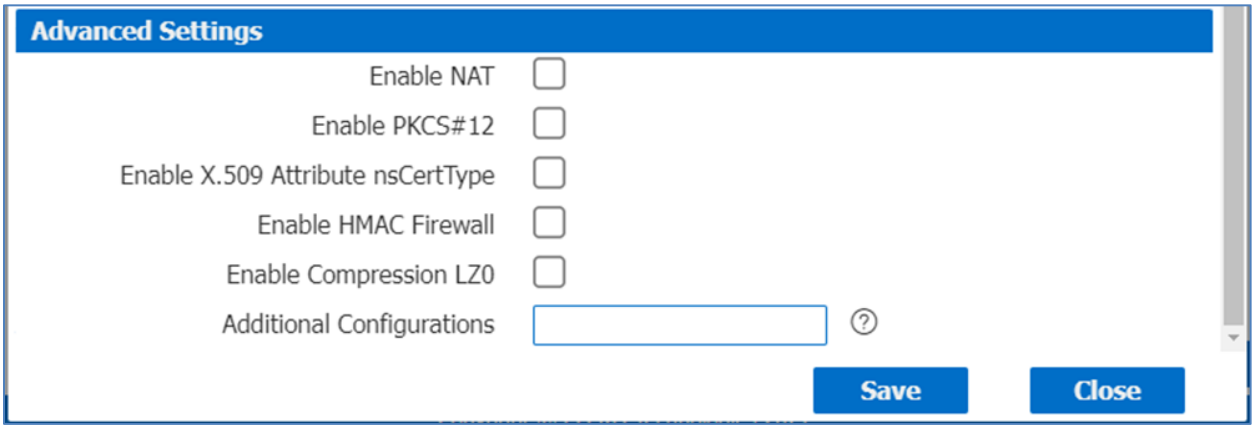
Keepalive Interval
Enter the keepalive interval to check the tunnel is active or not.

Keepalive Timeout
Enter the keepalive timeout, once connection is failed it will trigger the OpenVPN reconnect.

Fragment
Enter the fragment size, 0 means disable.

Private Key Password
Enter the private key password for authentication when selection from “X.509” or “X.509 And Password”.

Output Verbosity Level
Enter the level of the output log and values.



VPN->OpenVPN->Advanced Settings

Enable NAT
Check this box to enable NAT, the source IP of host behind router will be disguised before accessing the remote end.

Enable Default Gateway
Check this box to enable default gateway, all the data traffic will go through the VPN tunnel.

Enable PKCS#12
It is an exchange of digital certificate encryption standard, used to describe personal identity information.

Enable CRL
Check this box to enable CRL(Certificate Revocation List).

Enable Client to Client
Check this box to allow client to communicate with each other.

Enable Duplicate CN
Check this box allow multiple clients connect to the server with the same certificate/key files or common names.

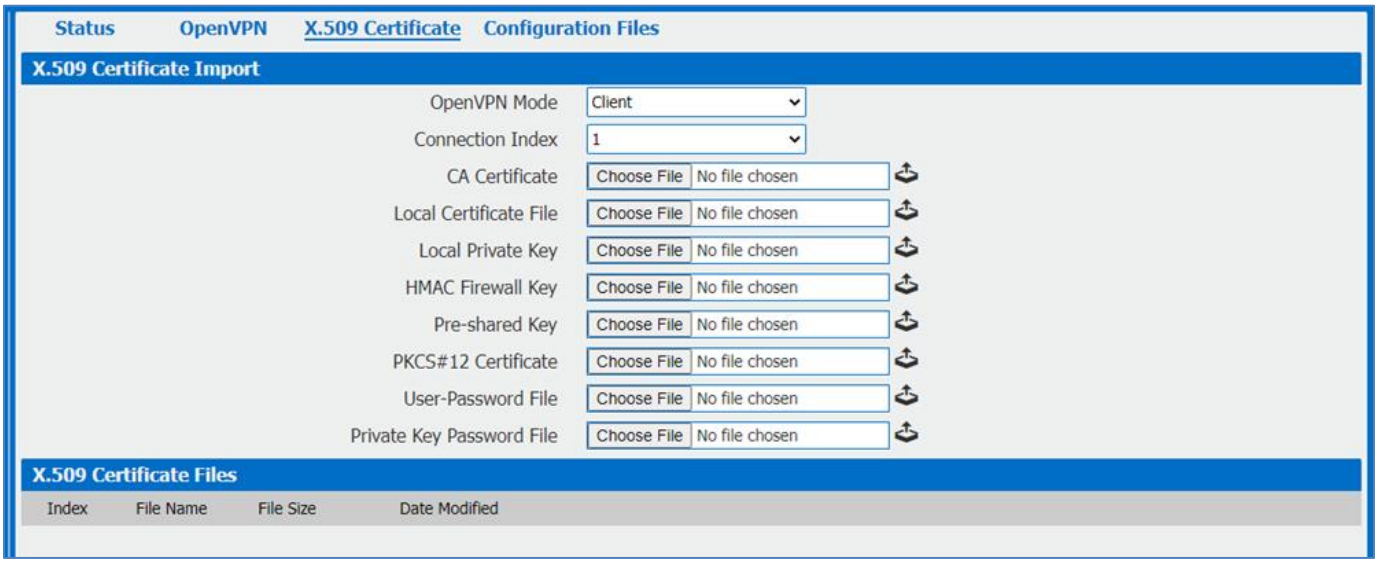
Enable IP Persist
Check this box to keep the IP address unchanged.

Enable X.509 Attribute nsCertType
Require that peer certificate was signed with an explicit nsCertType designation of “server”.

Enable HMAC Firewall
Add additional layer of HMAC authentication on the top of the TLS control channel to protect against DoS attacks.

Enable Compression LZO
Compress the data.

Additional Configurations
Enter some other options of OpenVPN in this field. Each expression can be separated by a ‘,’.



VPN->OpenVPN->X.509 Certificate

OpenVPN Mode
Select OpenVPN working mode between Server and Client.

Connection Index
Displays the current connection index for OpenVPN channel.

CA Certificate
Import CA certificate file.

Local Certificate File
Import Local Certificate file.

Local Private Key
Import Local Private Key file.

DH File
Import DH file when works as OpenVPN server.

HMAC Firewall Key
Import HMAC Firewall Key file.

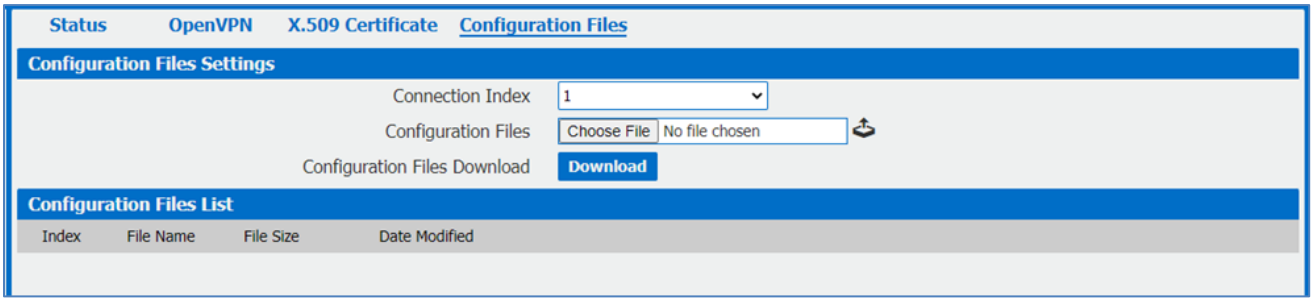
Pre-shared Key
Import the pre-shared key file.

PKCS#12 Certificate
Import PKCS#12 Certificate.

User-Password File
Import the username and password file when import the OpenVPN client file.

Private Key Password File
Import the private key password file when import the OpenVPN client file.

CRL File
Import CRL file.



VPN->OpenVPN->Configuration Files

Connection Index
Select OpenVPN connection index.

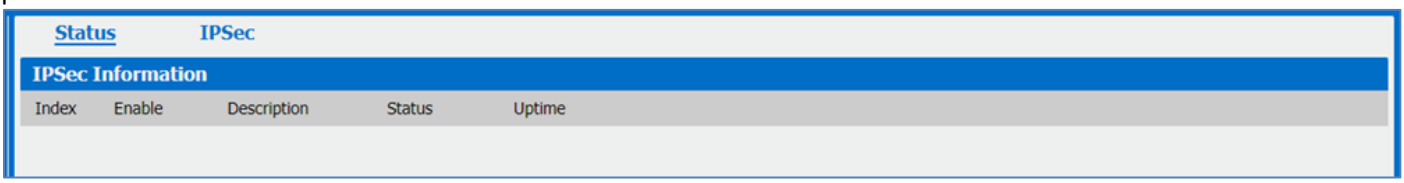
Configuration Files
Import the OpenVPN client file.

Configuration Files Download
Download the OpenVPN client configuration.

Configuration Files List
Display the imported OpenVPN client file.

4.7.2 IPSec

IPSec facilitates configuration of secured communication tunnels. The various tunnel configurations will be displayed in the Tunnel Table at the bottom of the page. All tunnels are create using the ESP (Encapsulating Security Payload) protocol.



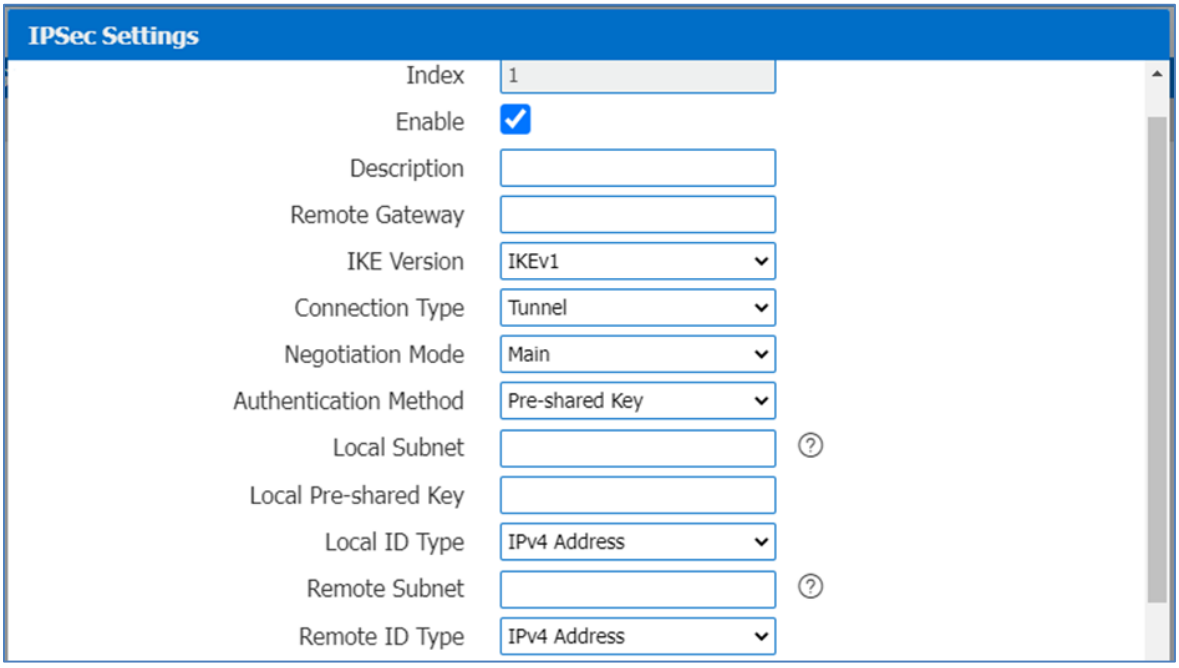
VPN->IPSec->Status

Enable
Displays current IPSec settings is enable or disable.

Description
Displays the description of current VPN channel.

Status
Displays the current VPN connection status.

Uptime
Displays the connection time since VPN is established.



VPN->IPSec

Enable
Select Enable will launch the IPSec process.

Description
Enter a description for this IPSec VPN tunnel.

Remote Gateway
Enter the IP address of the remote endpoint of the tunnel.

IKE Version

Internet Key Exchange, select from “IKEv1” or “IKEv2”.

Connection Type
Select from “Tunnel” or “Transport”.
Tunnel: In tunnel mode, the entire IP packet is encrypted and authenticated. It is then encapsulated into a new IP packet with a new IP header. Tunnel mode is used to create virtual private networks for network-to-network communications.
Transport: In transport mode, only the payload of the IP packet is usually encrypted or authenticated. The routing is intact, since the IP header is neither modified nor encrypted.

Negotiation Mode
Select from “Main” or “Aggressive”.

Authentication Method
Select from “Pre-shared Key” or “Pre-shared Key and Xauth”.

Local Subnet
Ener the IP address with mask if a network beyond the local LAN will be sending packets through the tunnel. Multiple subnets separated by commas.
NOTE: The Remote subnet and Local subnet addresses must not overlap!

Local Pre-shared Key
Enter the pre-shared key which match the remote endpoint.

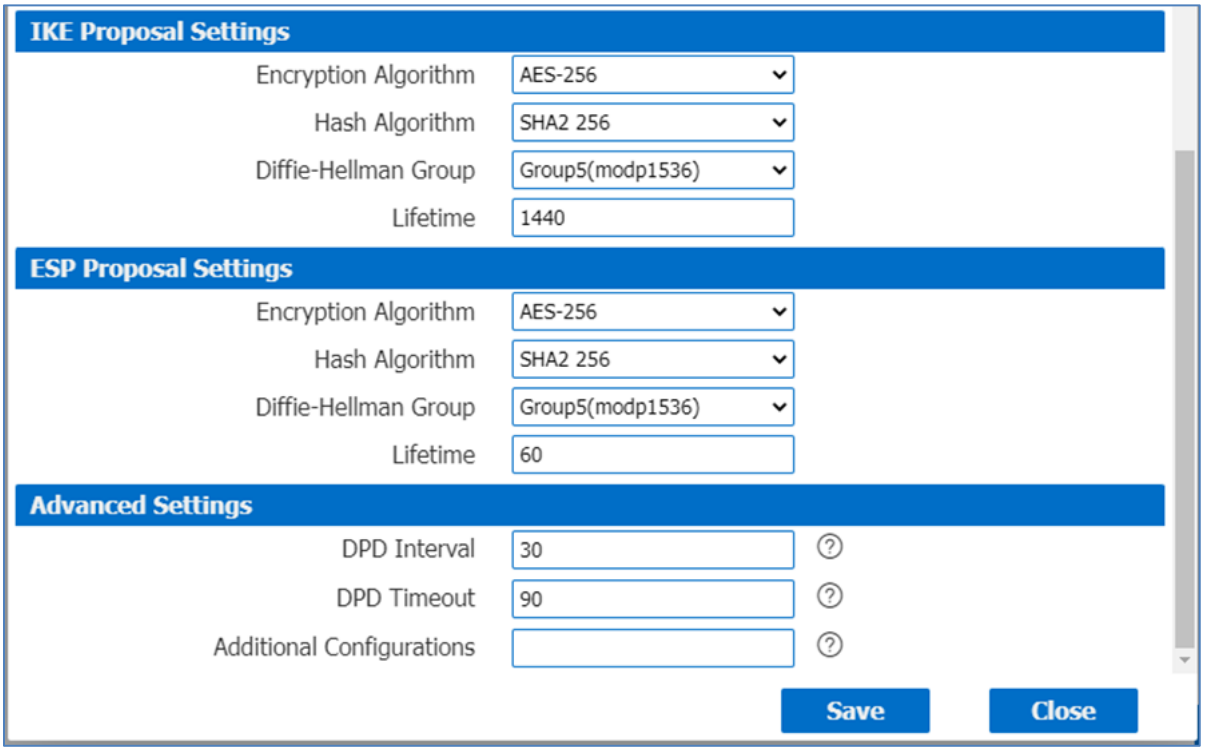
Local ID Type
The local endpoint's identification. The identifier can be a host name or an IP address.

Xauth Identity
Enter Xauth identity after “Pre-shared Key and Xauth” on authentication Method is enabled.

Xauth Password
Enter Xauth password “Pre-shared Key and Xauth” on authentication Method is enabled.

Remote Subnet
Enter an IP address with mask if encrypted packets are also destined for the specified network that is beyond the Remote IP Address. Multiple subnets separated by commas.
NOTE: The Remote subnet and Local subnet addresses must not overlap!

Remote ID Type
The authentication address of the remote endpoint.

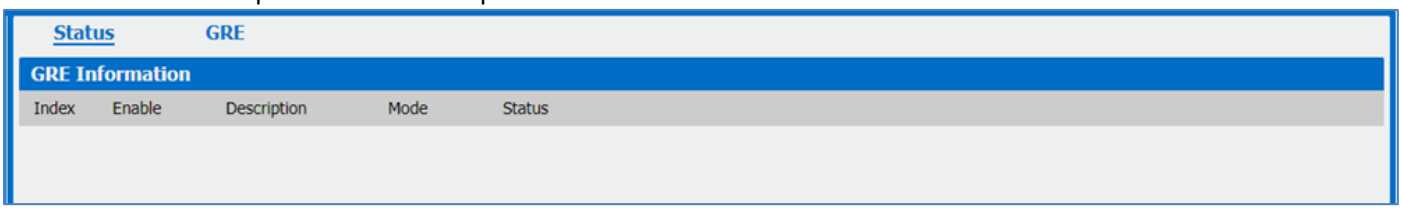


VPN->IPSec

- **Encryption Algorithm (IKE)**
  Select 3DES AES-128, AES-192, or AES-256 encryption.
- **Hash Algorithm (IKE)**
  Select from MD5, SHA1, SHA2 256, SHA2 384 or SHA2 512 hashing.
- **Diffie-Hellman Group (IKE)**
  Negotiate (None) or use 768 (Group 1), 1024 (Group 2), 1536 (Group 5) or 2048 (Group 14) etc.
- **Lifetime (IKE)**
  How long the keying channel of a connection should last before being renegotiated.
- **Encryption Algorithm (ESP)**
  Select 3DES AES-128, AES-192, or AES-256 encryption.
- **Hash Algorithm (ESP)**
  Select from MD5, SHA1, SHA2 256, SHA2 384 or SHA2 512 hashing.
- **Diffie-Hellman Group (ESP)**
  Negotiate (None) or use 768 (Group 1), 1024 (Group 2), 1536 (Group 5) or 2048 (Group 14) etc.
- **Lifetime (ESP)**
  How long a particular instance of a connection should last, from successful negotiation to expiry.
- **DPD Interval**
  Enter the interval after which DPD is triggered if no IPsec protected packets is received from the peer.
- **DPD Timeout**
  Enter the remote peer probe response timer.
- **Additional Configurations**
  Enter some other options of IPSec in this field. Each expression can be separated by a ';'.

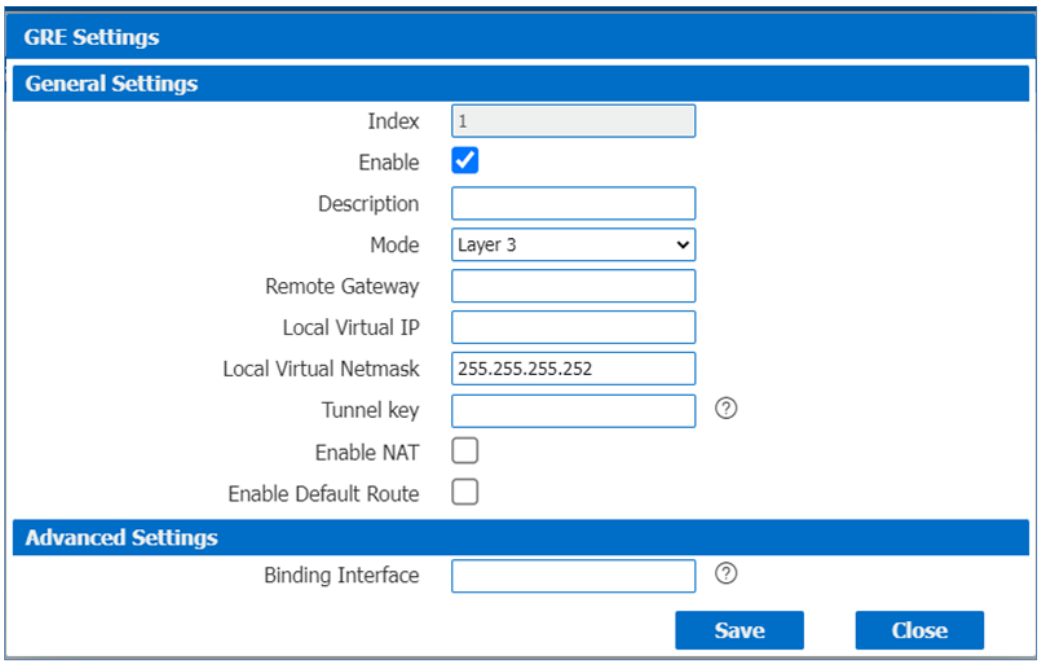
4.7.3 GRE

Generic Routing Encapsulation (GRE) is a protocol that encapsulates packets in order to route other protocols over IP networks. It's a tunneling technology that provides a channel through which encapsulated data message could be transmitted and encapsulation and decapsulation could be realized at both ends.



VPN->GRE->Status

- **Enable**
  Displays current GRE settings is enable or disable.
- **Description**
  Displays the description of current VPN channel.
- **Mode**
  Displays the current VPN mode.
- **Status**
  Displays the current VPN connection status.



VPN->GRE

- **Enable**
  Check this box to enable GRE.
- **Description**
  Enter the description of current VPN channel.
- **Mode**

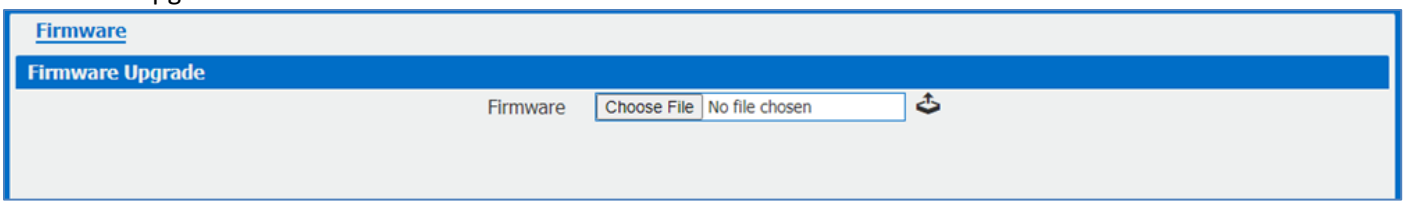
Specify the running mode of GRE, optional are “Layer 2” and “Layer 3”.

- **Remote Gateway**
  Enter the remote IP address of peer GRE tunnel.
- **Local Virtual IP**
  Enter the local tunnel IP address of GRE tunnel.
- **Local Virtual Netmask**
  Enter the local virtual netmask of GRE tunnel.
- **Tunnel Key**
  Enter the authentication key of GRE tunnel.
- **Enable NAT**
  Check this box to enable NAT function.
- **Bridge Interface**
  Specify the bridge interface work with Layer 2 mode.
- **Enable Default Route**
  Check this box to make all the traffic go through VPN tunnel.
- **Binding Interface**
  Only specified interface turn into active WAN will start the VPN tunnel.

4.8. Maintenance

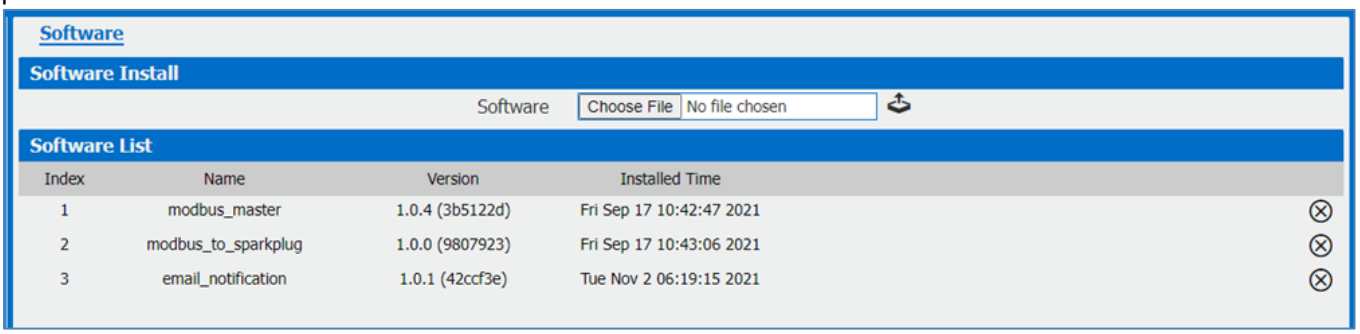
4.8.1 Upgrade

When newer versions of EL-641M-4 firmware become available, the user can manually update the unit by uploading a package to the unit.
NOTE: The unit need manually reboots once the upload completes, thus taking the EL-641M-4 router out of service during approximately 1 minute. Unless otherwise stated, the user is not expected to take any special precautions.
CAUTION: It is important to have a stable power source and ensure that power to the Fusion is not interrupted during a firmware upgrade.



4.8.2 Software

When release a new feature (APP Package) of EL-641M-4 router, the user can manually install to the unit by uploading a package. Or user can uninstall this feature (APP Package) from router.
NOTE: The unit need manually reboots once the upload/uninstall completes, thus taking the EL-641M-4 router out of service during approximately 1 minute. Unless otherwise stated, the user is not expected to take any special precautions.



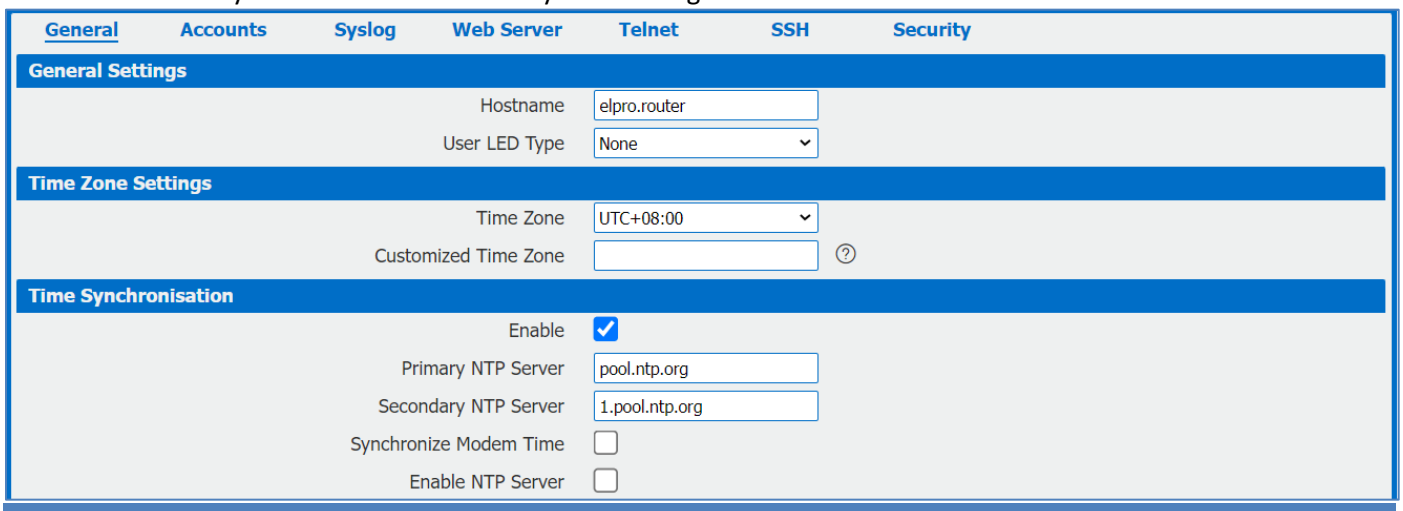
Click  to upload the APP Package.

Click  to delete the APP Package.

Note: We are working different kinds of the APP Packages. Please contact us to get them in case of you would like to test.

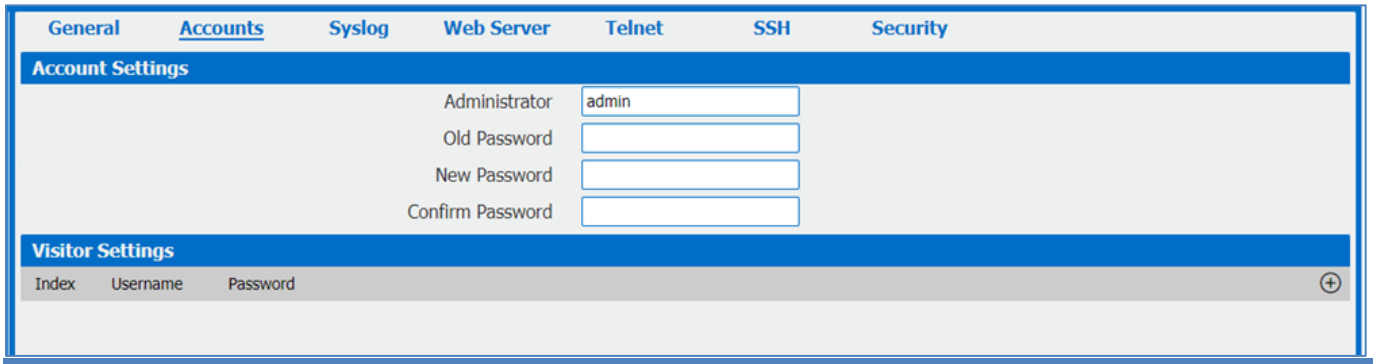
4.8.3 System

This section allows you to review the device system settings.



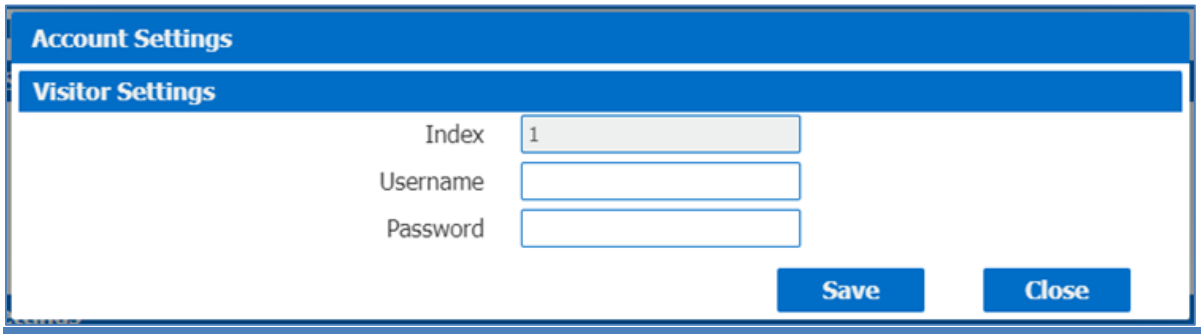
System->General

- **Hostname**
  User-defined router name, which might be use for IPSec local ID identify.
- **User LED Type**
  Defined the User LED behavior.
- **Time Zone**
  Select the zone where the device is in use.
- **Customized Time Zone**
  Customized the zone where the device is in use.
- **Enable (NTP Client)**
  Selected Enabled to utilize the NTP client to synchronize the device clock over the network using a time server (NTP server).
- **Primary NTP Server**
  Enter the IP address (or host name) of the primary time server.
- **Secondary NTP Server**
  Enter the IP address (or host name) of the secondary time server.
- **Synchronize Modem Time**
  Synchronize the time from cellular module.
- **Enable NTP Server**
  Check the box to make the router as a NTP server.



System->Account

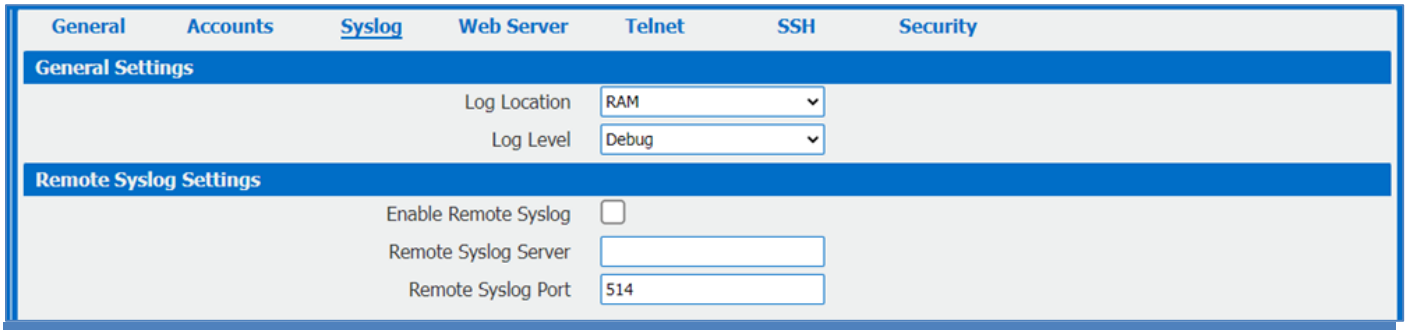
- **Administrator**
  Displays the name of current administrator, default as “admin”.
- **Old Password**
  Enter the old password of administrator.
- **New Password**
  Enter the new password of administrator.
- **Confirm Password**
  Confirm the new password of administrator.



System->Account

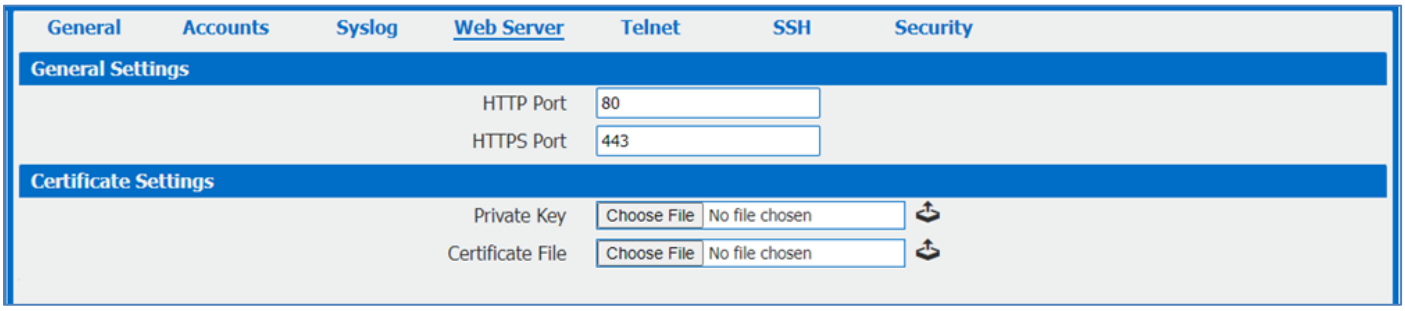
- **Username**
  Enter a username of visitor privilege
- **Password**
  Enter the new password of current visitor account.

Syslog displays system logs that are stored in the log buffers.



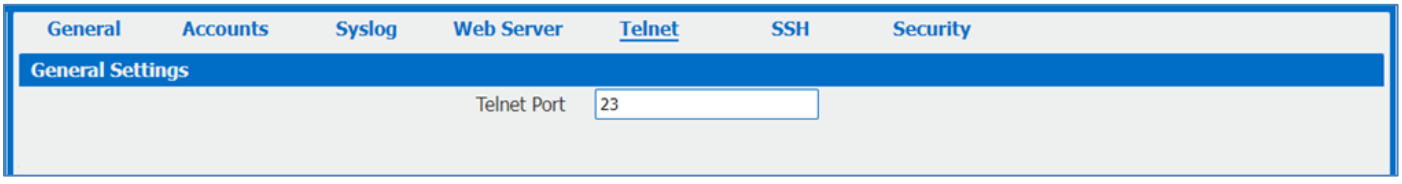
System->Syslog

- **Log Location**
  Select the log store location from “RAM” or “Flash”.
- **Log Level**
  Select the log output level from “Debug”, “Notice”, “Info”, “Warning” or “Error”.
- **Enable Remote Syslog**
  Check this box to enable remote syslog connection.
- **Remote Syslog Server**
  Enter the IP address of remote syslog server.
- **Remote Syslog Port**
  Enter the port for remote syslog server listening.



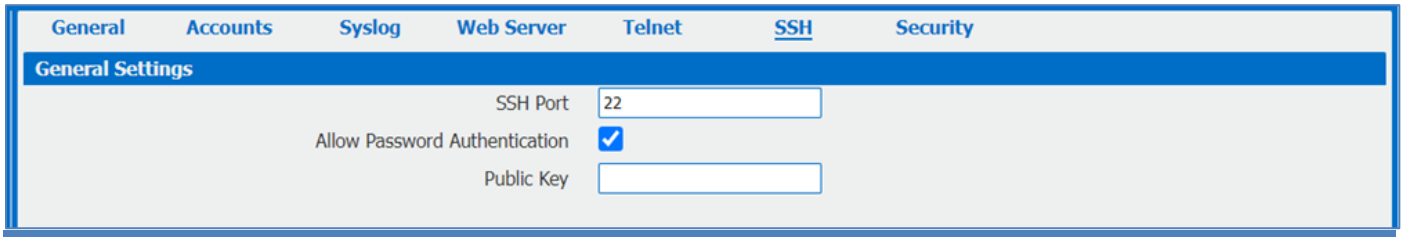
System->Web Server

- **HTTP Port**
  Enter the port for Hypertext Transfer Protocol. A well-known port for HTTP is port 80.
- **HTTPS Port**
  Enter the port for HTTPS Protocol. A well-known port for HTTPS is port 443.
- **Private Key**
  Import private Key file for HTTPS connection.
- **Certificate File**
  Import certificate file for HTTPS connection.



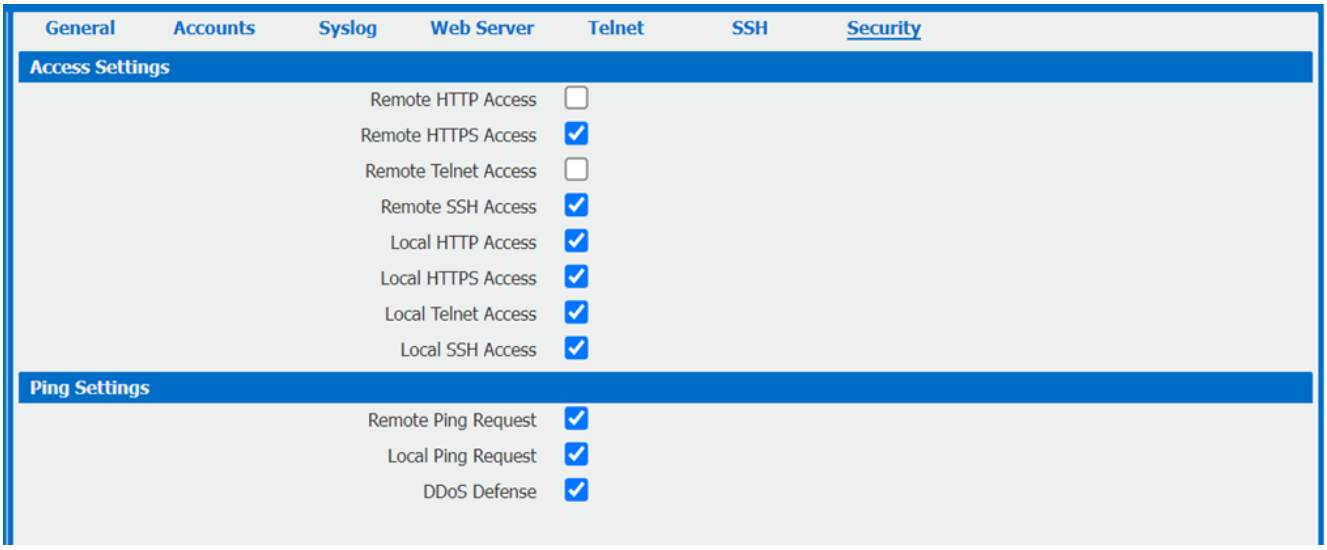
System->Telnet

- **Telnet Port**
  Enter the port for telnet access. A well-known port for HTTP is port 23.



System->SSH

- SSH Port
  Enter the port for SSH access. A well-known port for HTTP is port 22.
- **Allow Password Authentication**
  Check this box to enable SSH authentication.
- **Public Key**
  Enter the public Key SSH authentication.



System->Security

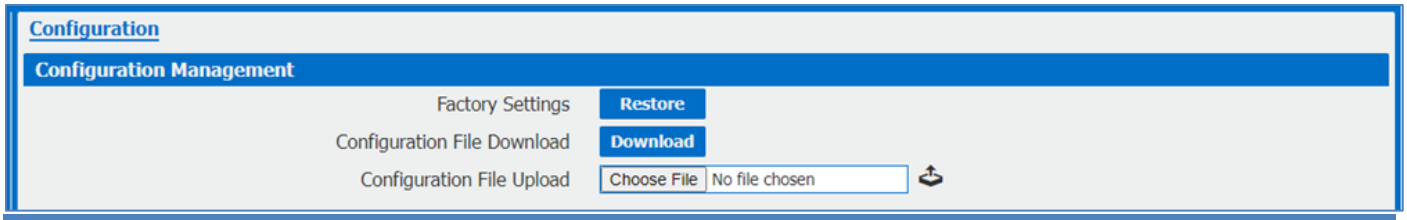
- **Remote HTTP Access**
  Check this box to allow remote HTTP access.
- **Remote HTTPS Access**
  Check this box to allow remote HTTPS access.
- **Remote Telnet Access**
  Check this box to allow remote Telnet access.
- **Remote SSH Access**
  Check this box to allow remote SSH access.
- **Local HTTP Access**
  Check this box to allow local HTTP access.
- **Local HTTPS Access**
  Check this box to allow local HTTPS access.
- **Local Telnet Access**

Check this box to allow local Telnet access.

- **Local SSH Access**
  Check this box to allow local SSH access.
- **Remote Ping Request**
  Check this box to allow remote ping request.
- **Local Ping Request**
  Check this box to allow local ping request.
- **DDoS Defense**
  Check this box to enable DDoS defense.

4.8.4 Configuration

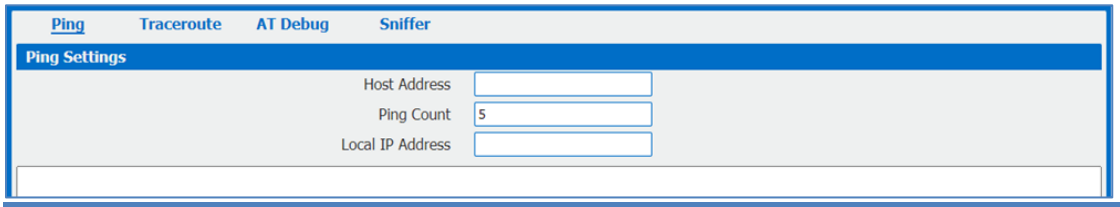
The Unit Configuration tab allows you to save parameters (settings in the Web interface) to a file. Conversely, if you have saved settings from the EL-641M-4 router to a file, you can Import these previously-saved configuration settings to the EL-641M-4 router as well.



System->Configuration

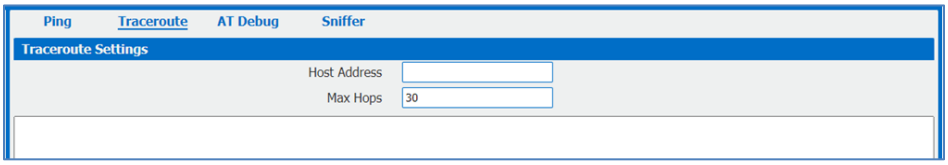
- **Restore**
  Reset the unit to factory default settings.
- **Download**
  Download the configuration file from EL-641M-4 router.
- **Configuration File Upload**
  Import previously saved configuration file.

4.8.5 Debug Tools



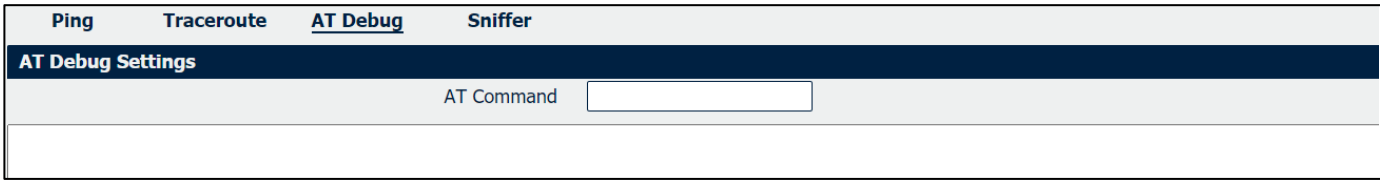
Debug Tools->Ping

- **Host Address**
  Enter a host IP address or domain name for ping.
- **Ping Count**
  Enter the ping times.
- **Local IP Address**
  Enter the ping source IP address or leave it blank.



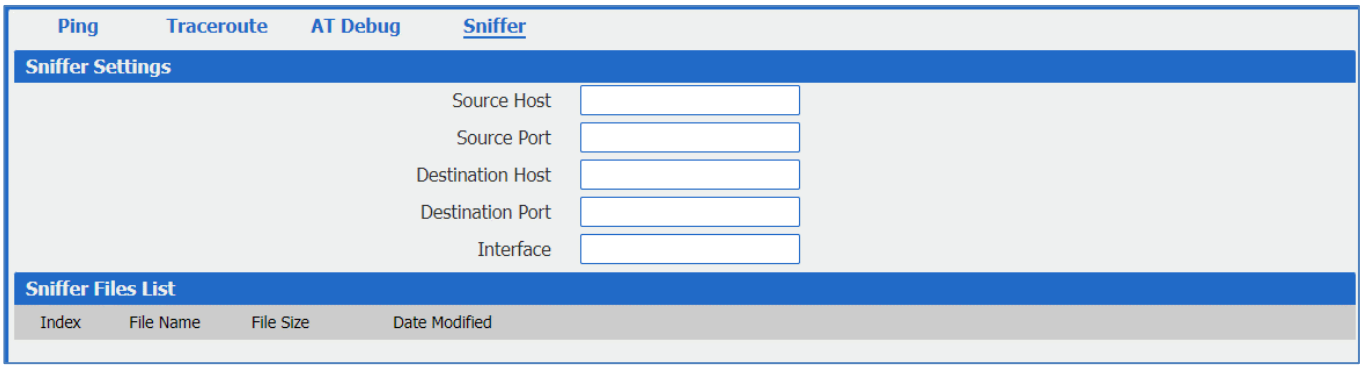
Debug Tools->Traceroute

- **Host Address**
  Enter a host IP address or domain name for traceroute.
- **Max Hops**
  Enter the max hops for traceroute.



Debug Tools->AT Debug

- AT Command
  Enter the AT command of the module.



Debug Tools->Sniffer

- **Source Host**
  Enter the source host IP address.
- **Source Port**
  Enter the source port.
- **Destination Host**
  Enter the destination host IP address.
- **Destination Port**
  Enter the destination port.
- **Interface**
  Enter the interface that the data traffic goes through.
- **File Name**
  Display the file name of the packages.
- **File Size**
  Display the size of the package.
- **Date Modified**
  Display the date of the package.

5 Appendix A -Glossary

APN:	Access Point Name
GPRS:	General Packet Radio Service
HSPA:	High Speed Packet Access
HSDPA:	High-Speed Downlink Packet Access
HSUPA:	High-Speed Uplink Packet Access
LTE:	3GPP Long Term Evolution
IMEI:	International Mobile Equipment Identity
ICCID:	Integrated Circuit Card Identifier
PIN:	Personal Identification Number
PPP:	Point-to-Point Protocol
RSSI:	Received Signal Strength Indication
SIM:	Subscriber Identity Module
SMS:	Short Message Service
DHCP:	Dynamic Host Configuration Protocol
LAN:	Local Area Network
LED:	Light-Emitting Diode
NTP:	Network Time Protocol
SMA:	SubMiniature version A (connector)
SSID:	Service Set Identifier
TCP/IP:	Transmission Control Protocol / Internet Protocol
UDP:	User Datagram Protocol
VPN:	Virtual Private Network
Wi-Fi or WiFi:	Wireless Fidelity
VDC:	Voltage, Direct Current

6 Appendix B -Q&A

No Signal

Phenomenon

EL-641M-4 Router modem status show no signal.

Possible Reason

- Antenna installation is wrong.
- Modem failure.

Solution

- Check the LTE antenna or replace with new one.
- Check the cellular page confirm modem is detected correctly or not.

Cannot detect SIM card

Phenomenon

EL-641M-4 Router cannot detect SIM card, cellular is not failed to connect to base station.

Possible Reason

- SIM card damage.
- SIM bad contact.

Solution

- Replace SIM card.
- Re-install SIM card.

Poor Signal

Phenomenon

EL-641M-4 Router no signal or poor signal.

Possible Reason

- Antenna installation is wrong.
- Area signal weak.

Solution

- Check the antenna and re-connect it.
- Contact Telecom Operator to confirm signal problem.
- Change to high-gain antenna.

IPSec VPN established, but LAN to LAN cannot communicate

Phenomenon

IPSec VPN established, but LAN to LAN cannot communicate

Possible Reason

- Both subnets are not match the interested traffic.
- IPSec second phase (ESP) settings is not match.

Solution

- Check both subnet settings.
- Check IPSec second phase (ESP) setting.

Forget Router Password

Phenomenon

Forget router login password.

Possible Reason

- User has changed the password.

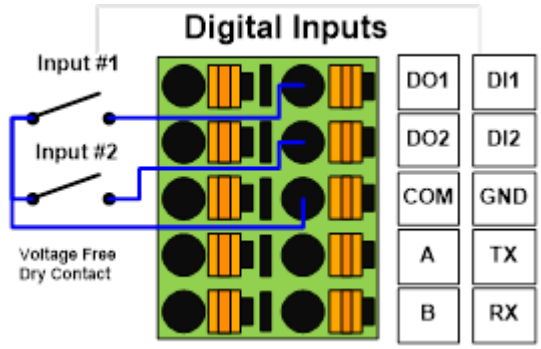
Solution

- After router power on, press RESET button between 3 to 10 seconds then release, router need manually reboot and reset to factory default settings (Username/Password is admin/admin).

7 Appendix C -Digital IO Scenario

Digital Input

Typical Application Diagram



Digital Input Electrical Specifications

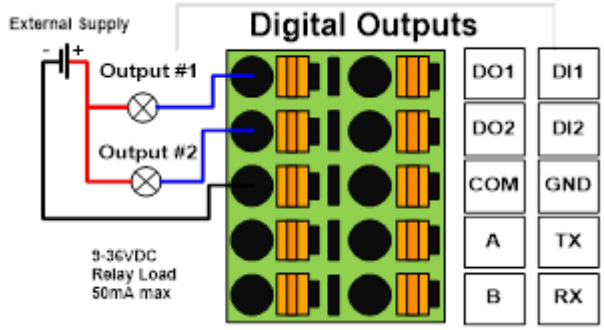
Galvanic Isolation

Over-voltage protection: 36Vdc

Over-current projection: 100mA per channel @25°C

Digital Output

Typical Application Diagram



Digital Output Electrical Specifications

Switch ON: close to V-

Switch OFF: open (high impedance)

DO ELECTRICAL CHARACTERISTICS

1. Galvanic isolation
2. Over-Voltage Protection: 36 VDC
3. Over-Current Protection: 50mA per channel @ 25℃

Wet Contact Typical Application

DO Logic LOW: Switch ON (Led ON)

DO Logic HIGH: Switch OFF (Led OFF)

8 Appendix D - CLI

Command-line interface (CLI) is a software interface that provide another configurable way to set parameters on our router. We could use Telnet or SSH connect to our router for CLI input.

EL-641M-4 CLI Access

Elpro.router login: admin
Password: admin
>

CLI reference commands

>?

config Change to the configuration mode
exit Exit this CLI session
help Display an overview of the CLI syntax
ping Ping
reboot Reboot system
show Show running configuration or running status
telnet Telnet Client
traceroute TraceRoute
upgrade Upgrade firmware
version Show firmware version

e.g.

> version

1.1.7 (22a7514)

> show wifi

```
wifi
{
   "status":"Ready",
   "mac":"a8:3f:a1:e0:ab:81",
   "ssid":"Elpro",
   "channel":"6",
   "width":"40 MHz",
   "txpower":"20.00 dBm"
}
```

> ping www.baidu.com

```
PING www.baidu.com (14.215.177.38): 56 data bytes
64 bytes from 14.215.177.38: seq=0 ttl=54 time=10.826 ms
64 bytes from 14.215.177.38: seq=1 ttl=54 time=10.284 ms
64 bytes from 14.215.177.38: seq=2 ttl=54 time=10.073 ms
64 bytes from 14.215.177.38: seq=3 ttl=54 time=10.031 ms
64 bytes from 14.215.177.38: seq=4 ttl=54 time=10.347 ms
```

--- www.baidu.com ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max = 10.031/10.312/10.826 ms
>

How to Configure the CLI

CONTEXT SENSITIVE HELP

[?] - Display context sensitive help. This is either a list of possible
command completions with summaries, or the full syntax of the
current command. A subsequent repeat of this key, when a command
has been resolved, will display a detailed reference.

AUTO-COMPLETION

The following keys both perform auto-completion for the current command line.
If the command prefix is not unique then the bell will ring and a subsequent
repeat of the key will display possible completions.

[enter] - Auto-completes, syntax-checks then executes a command. If there is
a syntax error then offending part of the command line will be
highlighted and explained.

[space] - Auto-completes, or if the command is already resolved inserts a space.

MOVEMENT KEYS

[CTRL-A] - Move to the start of the line
[CTRL-E] - Move to the end of the line.
[up] - Move to the previous command line held in history.
[down] - Move to the next command line held in history.
[left] - Move the insertion point left one character.
[right] - Move the insertion point right one character.

DELETION KEYS

[CTRL-C] - Delete and abort the current line
[CTRL-D] - Delete the character to the right on the insertion point.
[CTRL-K] - Delete all the characters to the right of the insertion point.
[CTRL-U] - Delete the whole line.
[backspace] - Delete the character to the left of the insertion point.

ESCAPE SEQUENCES

!! - Subsitute the the last command line.
!N - Substitute the Nth command line (absolute as per 'history' command)
!-N - Substitute the command line entered N lines before (relative)