

EMG Ethernet Modbus Gateway User Manual

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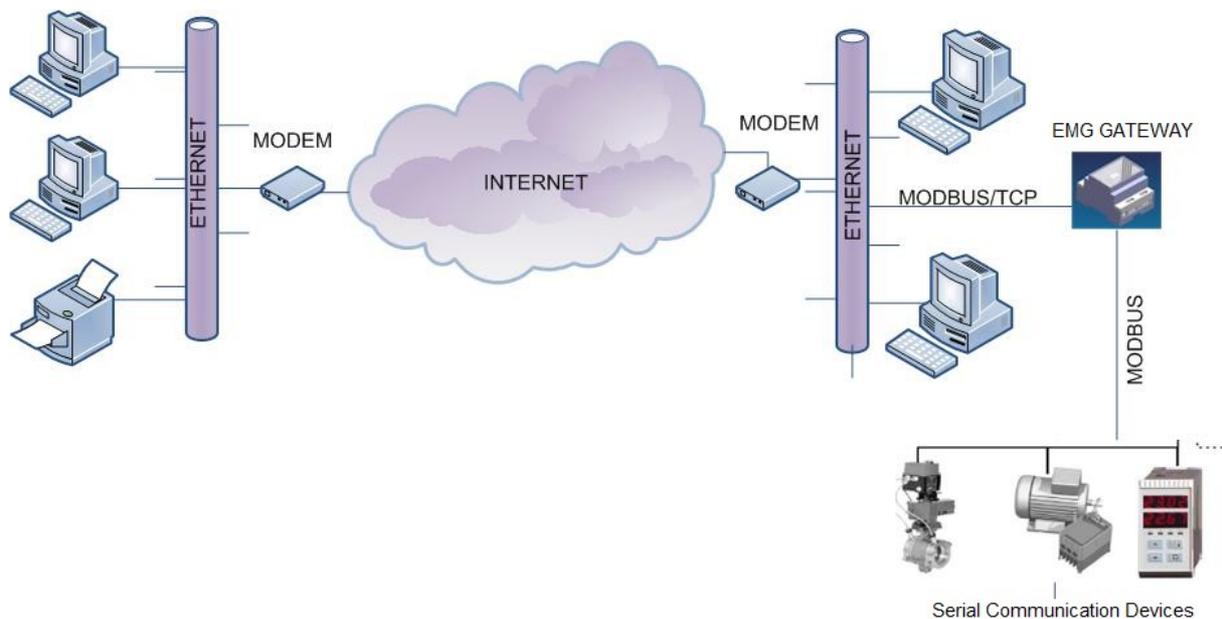
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1.Introduction

1.1 General Features

ENTES EMG family series MODBUS Gateway is a MODBUS/TCP protocol converter that lets the users control their devices remotely through serial connection via the RS-485 protocol using TCP/IP protocol over the existing internet/intranet infrastructure. While it is possible to monitor from one place with EMG-10, it is possible to monitor from 4 different places with EMG-02 and EMG-12.



Technical Data :

Category	Description
Network Protocols	TCP/IP, ARP, ICMP, HTTP, ModbusTCP
Serial Ports	RS485 for Communication, USB Port for Configuration
Operating Modes	ModbusTCP/RTU and Modbus Tunnel
Network Interface	10/100 Mbps auto-negotiation
Serial Communication Formats	Data Bits : 5-6-7-8 data bit Stop Bit: 1-1.5-2 characters Parity: Even-Odd-None
Serial Interface	300-115200 bps
Power Supply	9-24V AC - 9-30V DC or from USB port(~75 mA)
Insulation and Protection	RS485 port: 500V Ethernet port: 1500V 15KV ESD protection on USB port 10/1000 us (600W) transient pulse protection on RS485 port

Table 1. EMG Series Technical Data

1.2 Installing the drivers

Since the EMG series devices communicate through the computer USB port, the drivers which come with the bundled CD must be installed to the computer before using the device.

To install the drivers;

1. Connect the EMG series device to the computers through the USB port of computer. The POWER LED on the device should turn on and the computer will recognize the device automatically.
2. To locate the driver files manually, select “Install from a list or specific location” option and click on “Next”.



3. On the next window, specify the location of the drivers and click on “Next”.



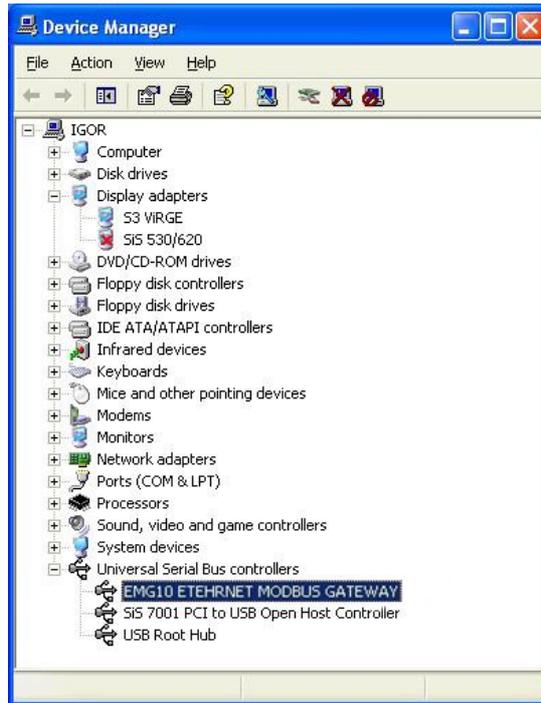
4. Click on “Continue” on the next window
5. The system will copy the necessary files to the computer.



6. Copying progress is finished and the EMG Series device is now ready to use.



7. After the installation is completed, the device can be seen using these steps:
My Computer → **Control Panel** → **System** → **Device Manager** → **Universal Serial Bus Controller**



2. Configuration

2.1 Main Device Parameters

In order for the device to function properly, both the RS-485 serial communication parameters and the network parameters have to be configured correctly. Incorrect or incomplete configuration of these parameters can degrade the system performance and even disrupt the existing network infrastructure.

Network Settings		Serial Port Settings	
Connection Setting	Server	Baud Rate	9600
DHCP	Off	Data Bit	8
WEB Access	Off	Stop Bit	1
Log-in Timeout	120000 ms	Parity	None
Link	Auto	Timeout	2000 ms
IP Address	192.168.2.240	Delay	50 ms
Gateway Address	192.168.2.1		
Subnet Mask	255.255.255.0		
Port	502		
Operating Mode	MODBUS/TC P		

Table 2. EMG Factory Default Values

2.1.1 RS485 Serial Communication Parameters

EMG Series device uses these parameters along with other units to which the device is serially connected. For high performance communication, all the device parameters over an RS-485 network must be configured the same.

2.1.1.1 Baud Rate

Defines the communication speed of the device. Supported rates are: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bps.

2.1.1.2 Data Bit

Defines the data packet size. Supported bit values are: 5, 6, 7, 8.

2.1.1.3 Stop Bit

Stop bits come after the data and parity bits in serial communication protocols and indicate that the data packet has ended. Supported stop bit values are: 1, 1.5, 2.

2.1.1.4 Parity Bit

Parity bits are used to verify the data packets. Supported values are: Even, Odd, None

2.1.1.5 Time-Out

Time-out defines how much time the EMG Series device will wait for a response from the queried unit.

2.1.1.6 Delay (for EMG02 and EMG12)

When monitoring from more than one place is in effect, this value defines the wait time for the response of queries to be sent to each connected device. This time value may differ according to the device attributes.

2.1.2 Network Parameters

The settings in this section are related to the communication of the ENTES EMG Series device over the internet/intranet infrastructure.

2.1.2.1 Connection Settings

EMG Series device can work in both server or client mode. If you want to establish a remote connection to the EMG Series device, select the “*Listens for connection requests*” option. If you want the EMG Series device to connect to the server and operate as a client, select the “*Connects to remote server*” option.

2.1.2.2 DHCP

If you want the device to obtain the IP address from the DHCP server, activate this option. It is recommended to use this option only when the EMG Series device is operating in client mode.

2.1.2.3 WEB Access

If you want the configuration of the device settings from the WEB interface, activate this option.

2.1.2.4 WEB Port

You can configure the port which will be used for WEB access from here.

2.1.2.5 Log-in Time-out

When this set time passes after the WEB interface is closed without clicking on “Exit” button on the interface page, the previous log-in information will be reset and the user will be asked to enter the necessary information again.

2.1.2.6 Server IP

This option is only active when the EMG Series device is configured as client and defines the server IP address to which the device will be connecting. If the device fails to connect to the server, it will try to reconnect to the server in 1 minute intervals. After the device connects to the server, it sends its MAC address to the server to identify itself.

2.1.2.7 IP Address

It is for identifying the EMG Series device on the network. Each device on the LAN must have a different IP address. If the device receives its address from DHCP server, the IP address which is received from the DHCP server will be shown in this area.

2.1.2.8 Subnet Mask

This number defines in which subnet the IP address is. If the device receives its address from DHCP server, the IP address which is received from the DHCP server will be shown in this area.

2.1.2.9 Default Gateway

This address enables the EMG Series device to access to WAN over a modem or a router. If the device receives its address from DHCP server, the IP address which is received from the DHCP server will be shown in this area.

2.1.2.10 MODBUS/TCP Port

Applications which use the TCP/IP protocol while communicating over the internet require a preassigned port number. Some of these port number may already be appointed to other processes. For example, port 80 is reserved for HTTP and port 23 is reserved for TELNET. For MODBUS/TCP protocol, this port number is assigned as 502. It isn't mandatory for the MODBUS/TCP applications to communicate using this port but the software applications must support this port too.

2.1.2.11 Link

Select the link mode according to the network configuration to which the EMG Series device will be connected.

2.1.3 Operating Modes

EMG Software is able to communicate over TCP protocol using two operating modes. The packet structures and communication is explained next.

2.1.3.1 MODBUS/TCP Packet Structure

MODBUS/TCP protocol is a revised version of the existing MODBUS protocol to enable communication over the internet. The MODBUS protocol which is used in serial communication applications has a packet structure as shown in Figure 1.

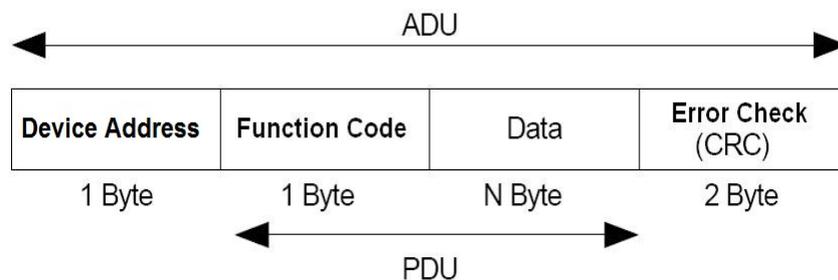


Figure 1. Modbus Packet Structure

“Device Address” defines the address of the device on the network to which the received queries will be sent. This address must be different for each device on the RS-485/232 network. “Function Code” is one of the function codes defined in the MODBUS standard. “Data” is the data block which contains the information requested from the device or sent by the device. “Error Check (CRC)” defines the 16 bit long CRC information which is used to verify the data integrity.

Some additions to the MODBUS protocol have been made according to the network structure in the MODBUS/TCP protocol. An example of a MODBUS/TCP data packet is given in Figure 2. As you can see, there is an MBAP header in the packet structure. The explanations of the data blocks are given in Figure 2.

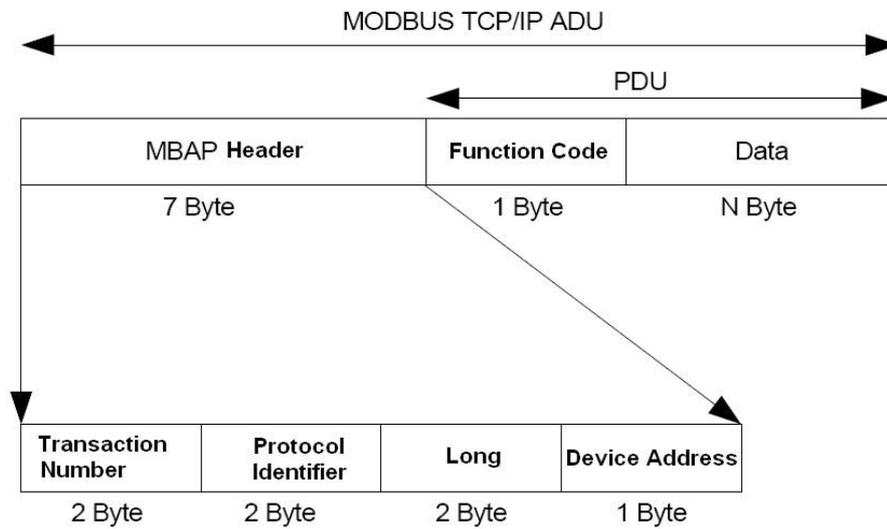
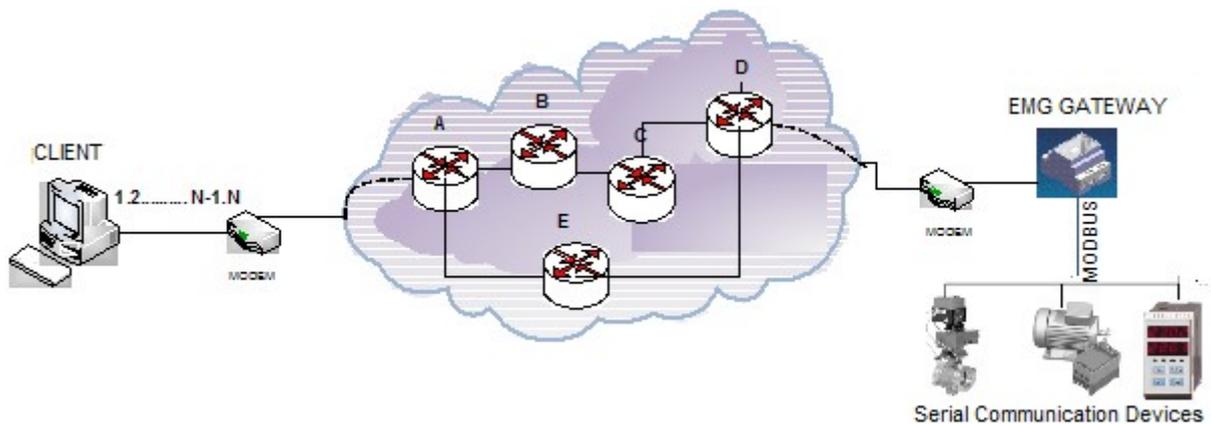


Figure 2. Modbus Packet Structure

Query Number

MODBUS protocol is a request/response based protocol. It means that which response belongs to which request is already defined when the first request is created. The information requested by the client in the Nth packet is sent as the Nth response packet by the server. Let's imagine a scenario like below to comprehend the importance of the query number for the communication over the internet.



In this scenario, let's imagine that the client produced (N-1)th and Nth request packets one after another and sent those to the gateway over the internet. Although the destination IP address of both packets is the same, these packets may follow different paths to their destinations(For example, (N-1)th packet may follow the A-B-C-D path and Nth packet may follow the A-E-D path). As a result, Nth packet may arrive the destination before (N-1)th packet arrives. If there aren't any numbers which indicate the query order, the gateway will relay the requests to the serial channel and relay back the responses back to the client in the order that they arrived in. But the (N-1)th response sent to the client by the gateway is actually the response for the Nth request.

To prevent this kind of confusion while communicating over the internet, a number to define the order of the requests is added into the MODBUS/TCP packet. This number is created by the client and increased for every new request. After the gateway receives and processes the requests in the order that they arrive in, it sends them back in the same order. This way, the client detects which response belongs to which request.

Protocol Identifier

It is the 16 bit long number that defines to which protocol the packet belongs. For MODBUS/TCP, this number is set as “0”.

Packet Length

It is the length of the following data.

Data Address

It is the MODBUS address of the serial connected device to which the request will be sent.

As seen from the packet structures above, MODBUS/TCP packet doesn't have CRC information. The error control occurs within the TCP protocol itself.

2.1.3.2 Tunnel Mode Packet Structure

In Tunnel Mode Operation mode, the MBAP header isn't added to the packet. The request/response packets are transmitted embedded in the TCP packet and the CRC information is transmitted along the data block embedded in the TCP packet.

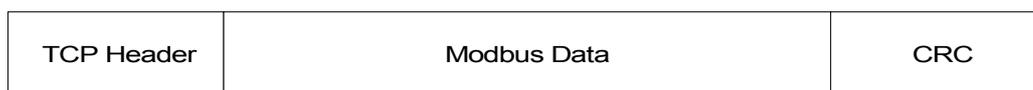
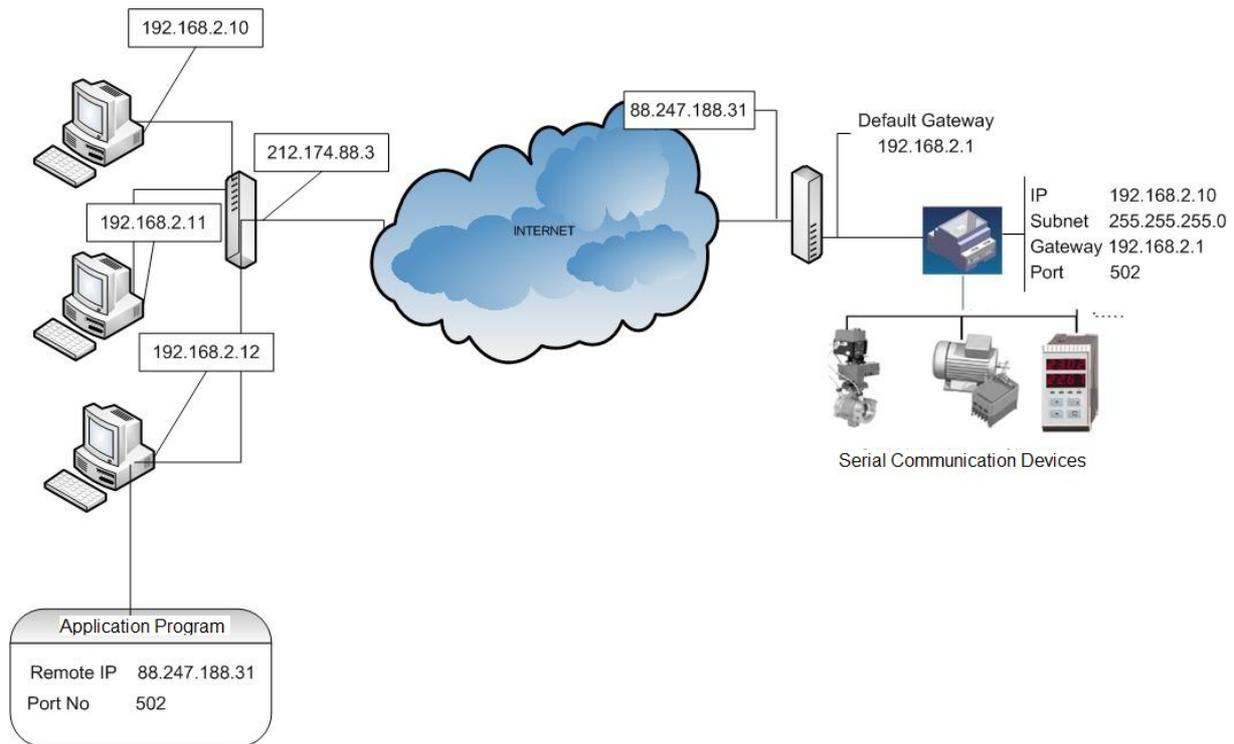


Figure 3. Tunnel Mod Packet Structure

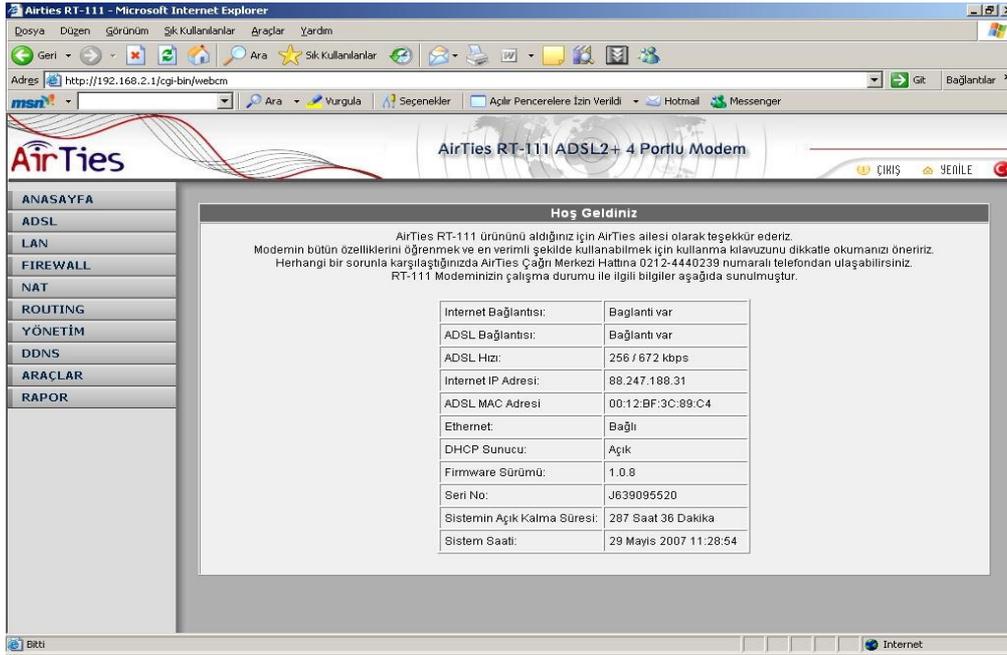
Note: Tunnel mode feature isn't available in the EMG-02 model.

2.1.4 Configuration example for communicating over ADSL modem

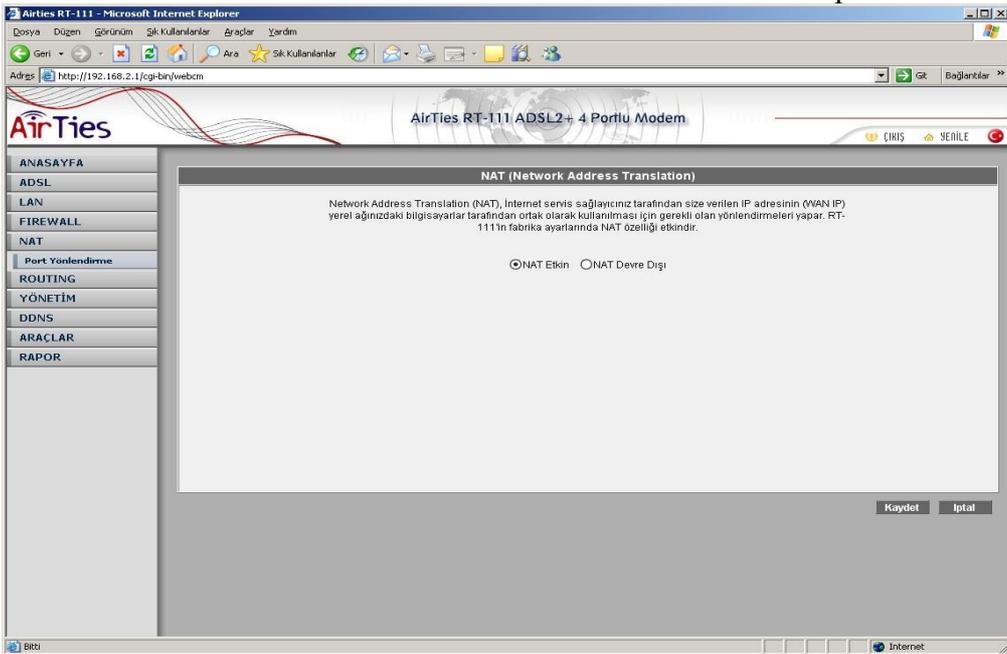
In the example below, an application which shows how you can access your devices which are connected to a remote network using EMG Ethernet-MODBUS Gateway is given. The program in this example runs on a computer with an IP address of *192.168.2.12* and the EMG Series device is placed on the remote network under the sub-net with an IP address of *88.247.188.31*. To enable to access to MODBUS Gateway from the remote network, necessary routing configurations on the modem to which the gateway is connected must be made. Furthermore, the default gateway address on the EMG Series device must be entered as the LAN address of the installed ADSL modem, which is *192.168.2.1*.



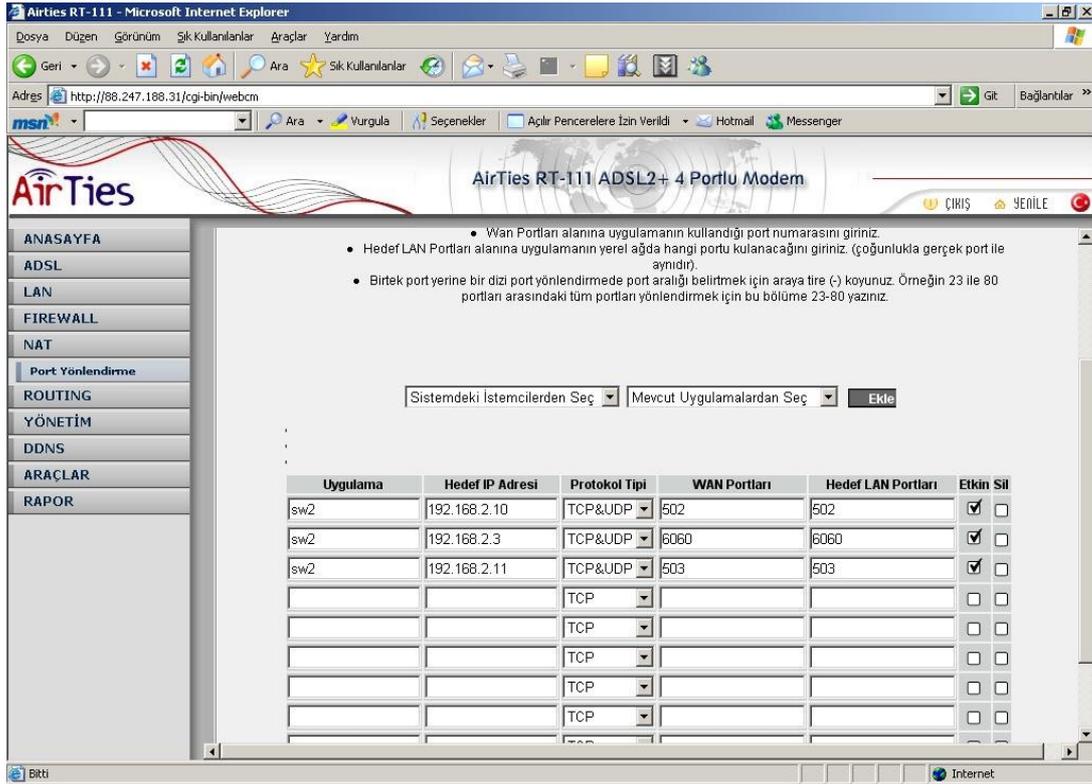
The model of the ADSL modem used in this application is AirTies RT111 ADSL2+4. Many modems available on the market are configured using a WEB interface. To change the configuration of your modem, enter the IP address of your modem (*88.247.188.31* in this example) to the address bar of your preferred browser. You will be greeted with the Main Menu.



Select the NAT Menu from the left side of the screen and activate this option.



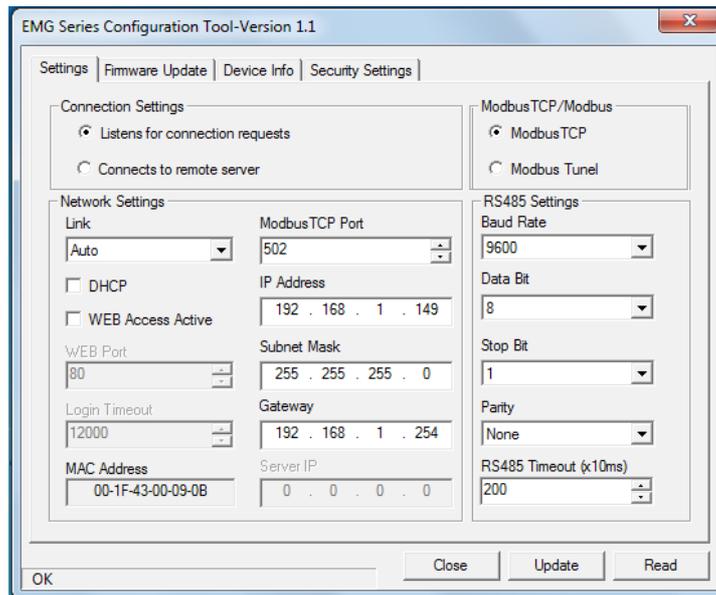
Select Port Forwarding under the NAT Menu and add the EMG Series device to the port forwarding list as shown below. After you save the changes you will be able to monitor the serially connected devices over the internet.



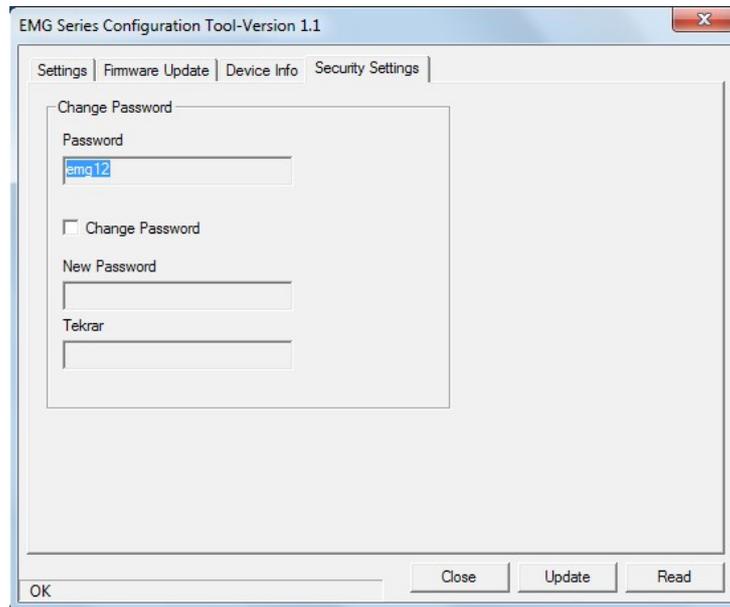
2.1 Reading/Changing the Configuration using the USB interface

You can use the **EMG Configuration Tool** software in the bundled CD to change the settings on the EMG. To do this;

1. Connect your device using the USB port.
2. **POWER LED** will light up.
3. Run the file **EMG Configuration Tool.exe**.
4. After the program starts, the settings of the device will show up automatically.



5. After that, you will be able to see the device settings any time you click on the **Read** button.



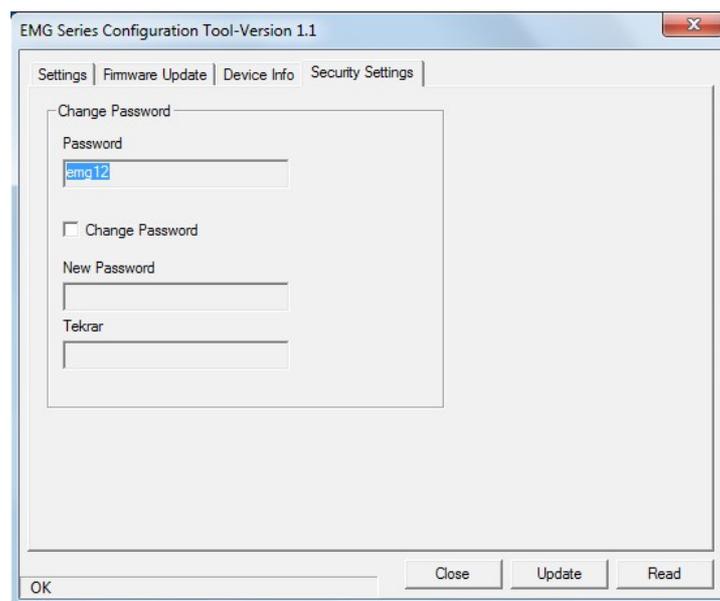
6. To change the settings on your device, click on the **Update** button after you enter the new settings. The new settings will be installed and shown on the program.

Not: For the new settings to be in effect, you must power off and on the device.

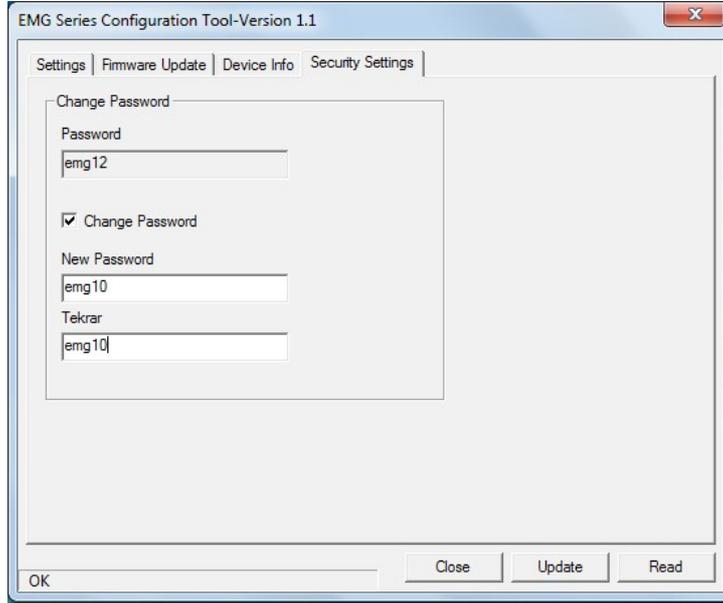
2.1 Security Settings

In this section, you can learn the password which is used to access the device using the WEB interface or change an existing password. To learn your existing password:

1. Click on the **Security Settings** tab on the **EMG Configuration Tool** window.



2. Under the **Password** section, your existing password which is used to access the device using the WEB interface will be shown.
3. To change your password, click on the **Change Password** box.



4. After you enter your new password in the active text fields and click **Update** button, your new password will be shown.

Not: If you committed any changes on the system settings, all of the changes will be installed with the new password.

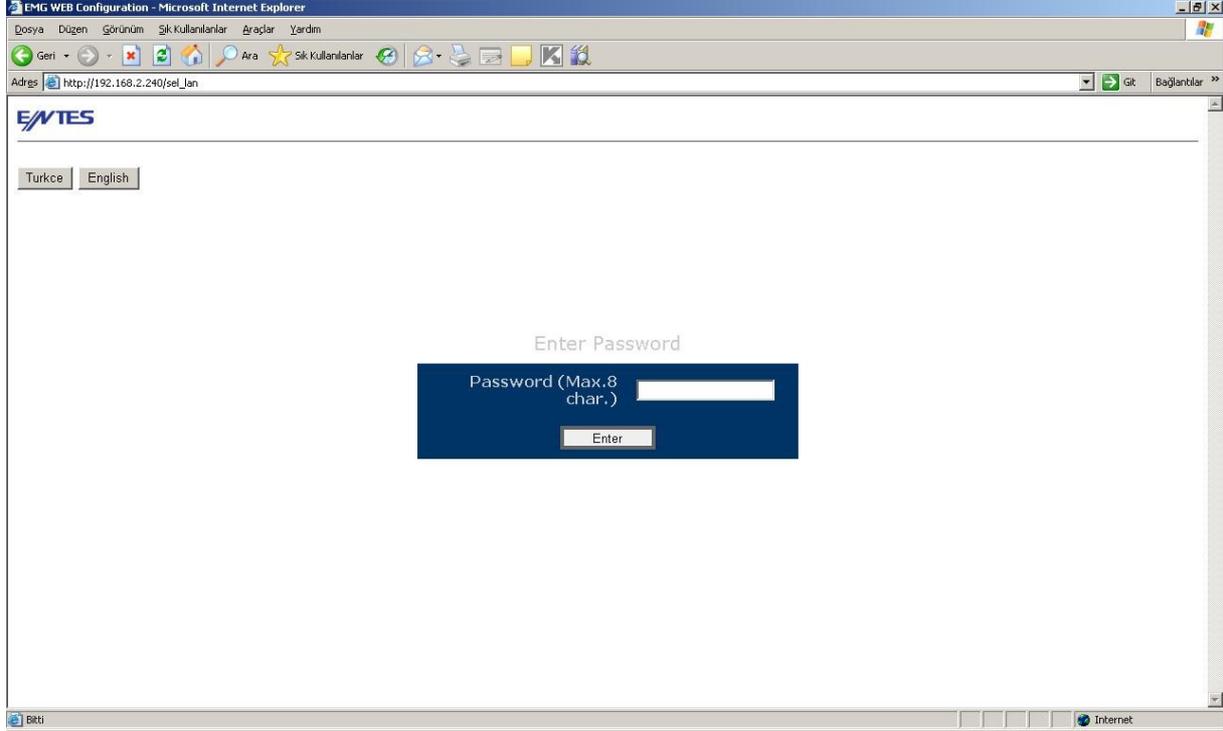
2.3 Reading/Changing the Configuration using the WEB interface

You can also configure the EMG Series device using the WEB interface. Using the port 80 of the HTTP protocol on the gateway, you can access the device settings from a remote computer. The only option you can not change using the WEB interface is the “**Disable WEB Access**” option.

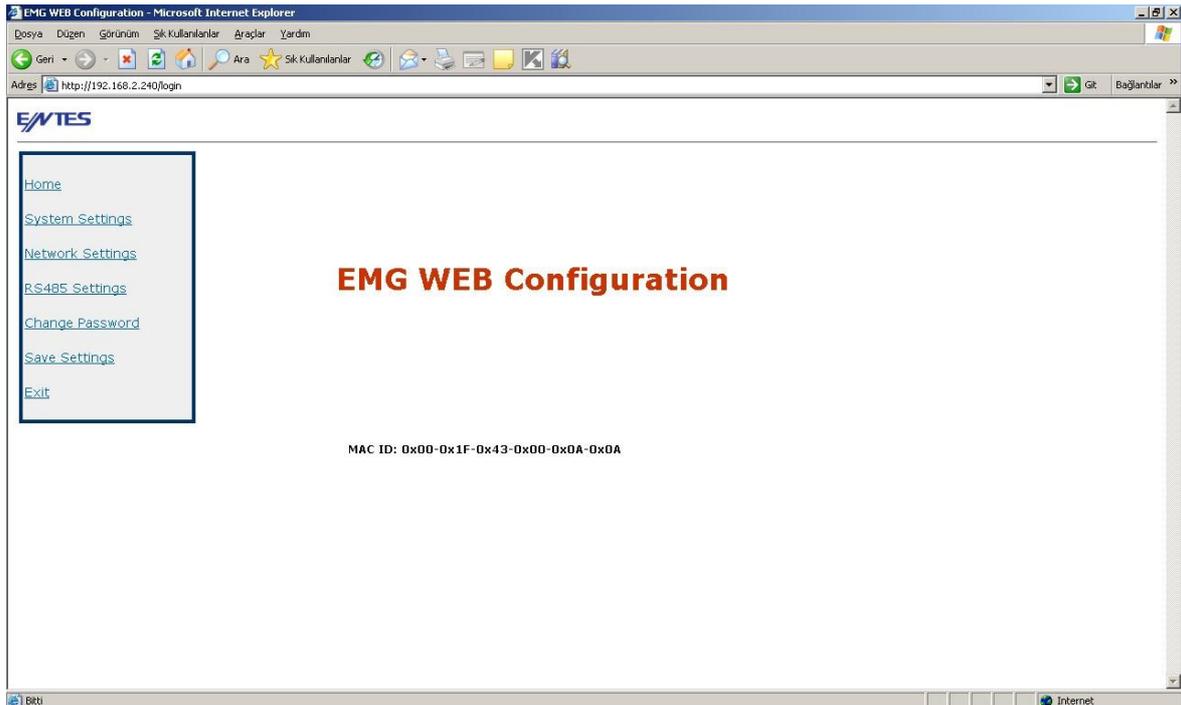
1. enter the IP address of your device to the address bar of your preferred browser. If you are connecting from an outside network, enter the IP address of your modem. In this case, the port 80 on the modem must be forwarded to the IP address of the EMG Series device.



2. You will be asked to enter a password to access the System Settings. When the device first starts to operate, the default password is **emgxx** and it is case sensitive(for EMG12 → ”**emg12**”, for EMG-10 → “**emg10**”, for EMG-02 → “**emg02**”)



3. If you entered the correct password, you will be directed to the settings page. If you enter a wrong password, you will be asked to enter the correct password again(there is no limit).



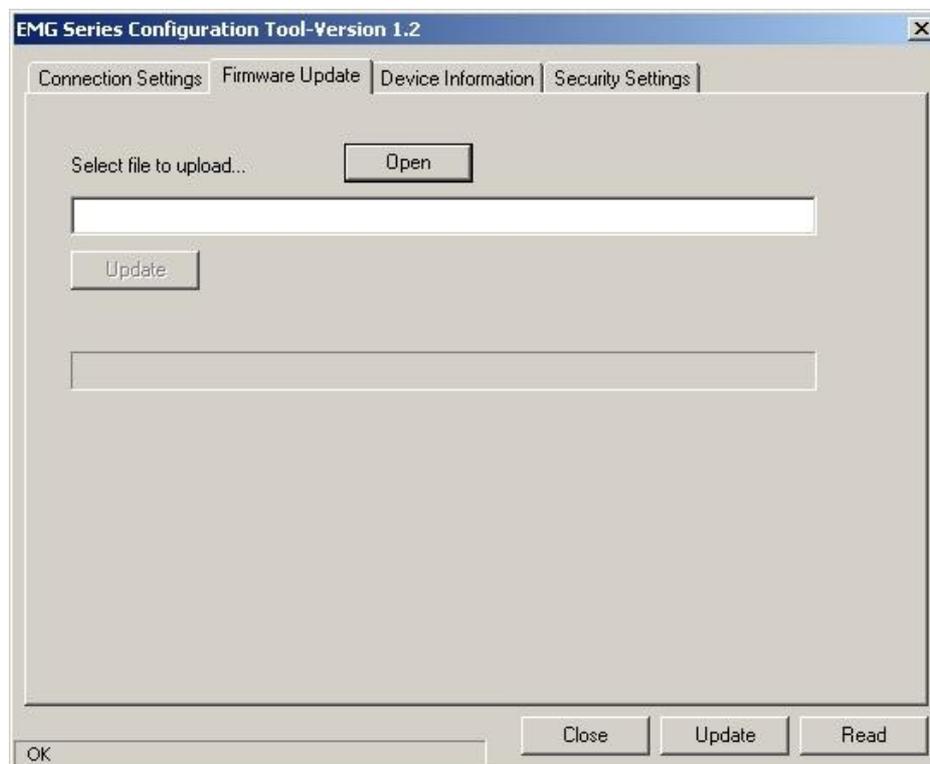
4. After you made the desired setting changes, click on the **UPDATE** button. To install the settings that you made, click on the “**Save Changes**” button. The EMG will reset and your new settings will be activated.

3. Firmware Updates

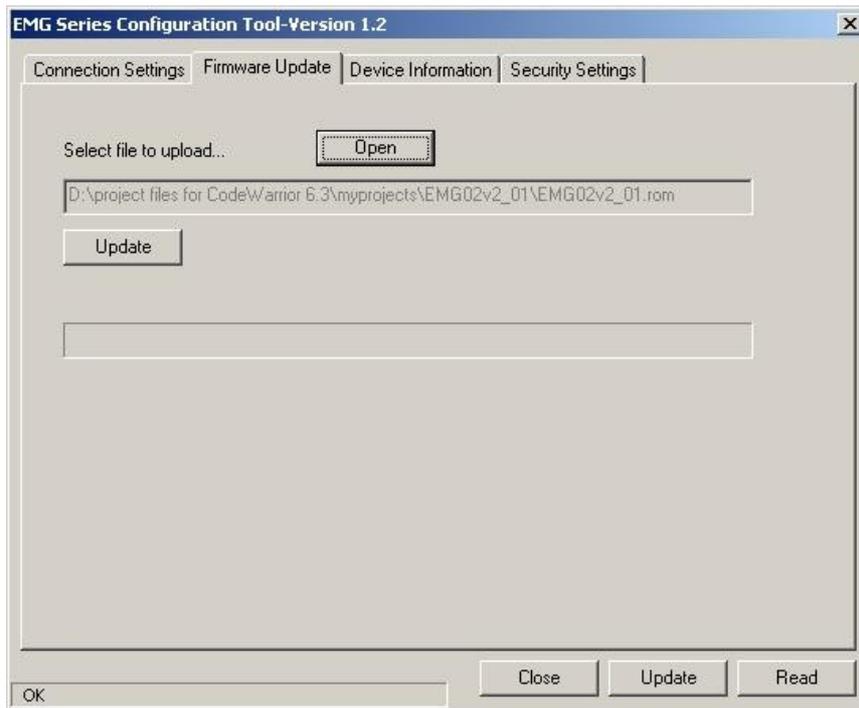
If there are necessary updates or new additions to the EMG firmware, you can install them to the device using the USB port. The latest version of the firmware can be downloaded from <http://www.entec.com.tr>. Because the firmware update deletes the read-only memory(ROM) of the device and the installs the new firmware in this memory, your previous settings will be deleted and replaced with the factory default settings. The file to be installed will be EMG10v.x_x_x.rom or EMG12vx_x_x.rom. v.x_x_x stands for the version information.

For the update to be successful, the firmware version of the device and **EMG Configuration Tool** version must be compatible. Otherwise, a successful firmware update will be out of the question.

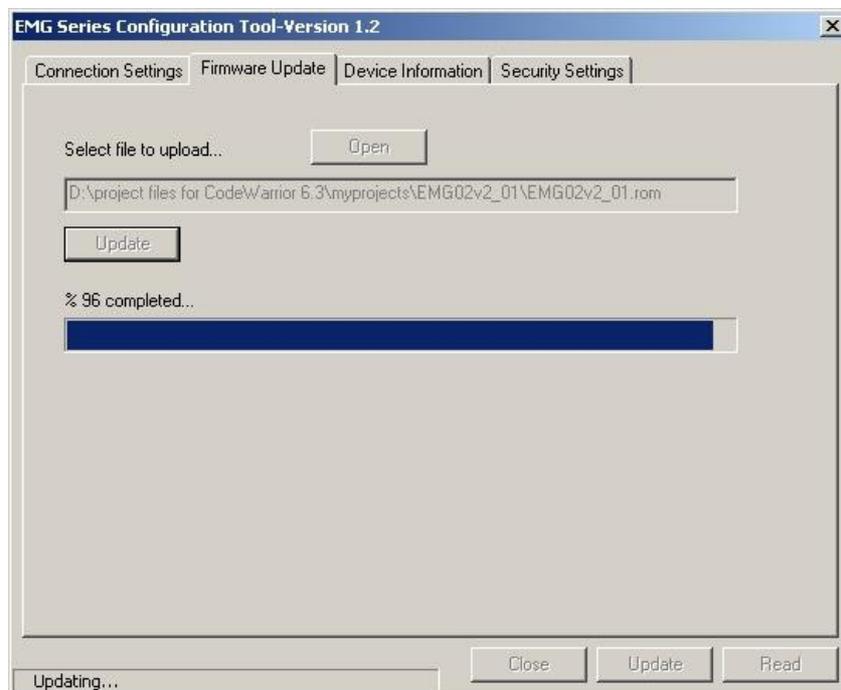
1. To update the device firmware, click on the **Firmware Update** tab on the **EMG Configuration Tool**.



2. Click on the **Open** button and locate the ROM file you want to install.



3. Click on the **Update** button. After the device is reset, the installation of the new firmware will start.



4. After the firmware update is successful, disconnect the power supply of the device and reconnect it.

4. Appendices

Appendix A Differences between EMG model devices

EMG10: Allows only 1 TCP connection.

EMG12 Allows 4 TCP connections at the same time.

EMG02 It is similar to EMG12 but allows request only sent to MODBUS addresses 1 and 2. This model also doesn't support the MODBUS Tunnel Mode.

Appendix B Query Interval and TCP Time-Out

When querying on the Ethernet/MODBUS Gateway devices using the client software, the query interval must not exceed 1.5 minutes. After 1.5 minutes, a counter in the device will be activated and disconnect the network connection. In applications requiring a query interval more than 1.5 minutes, it is recommended to set the client software so that it checks the connection status before every query and reconnect if the connection is down.