FactoryCast Gateway
TSX ETG 3021 / 3022 modules

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How to Setup a GPRS Connection ?

# Table of Contents

1- GPRS Overview

Introduction

This technical note describes **How to setup a GPRS connection** with the TSX ETG 302x modules. GPRS Communications are available on TSX ETG 302x modules (V1.1 version)

- TSX ETG 3021 : 900 / 1800 MHz band
- TSX ETG 3022 : 850 / 1900 MHz band

GPRS provides a cost effective solution for wireless permanent remote connections to distributed installations :Remote programming, remote monitoring and maintenance
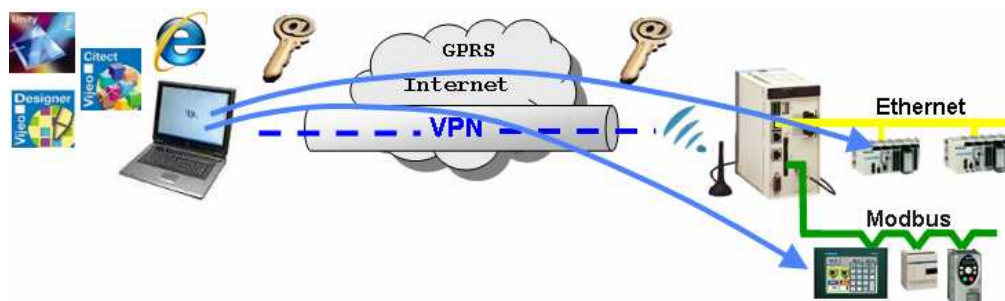
NOTE: This document only explains the main steps to follow to setup and open a GPRS connection with VPN security.

For more detailed information, please refer to the **User Manual documentation** for the related topics

GPRS overview

GPRS (General Packet Radio Service) is a **Packet oriented Data Service** based on **GSM** technology. (Global System for Mobile).

Main advantages over GSM and PSTN:
- Communications cost : Data transfer is typically charged per amount of data exchanged (amount of megabytes per month), while data communication via traditional circuit switching is billed per minute of connection time.
- GPRS allows continuous / permanent remote connections
- Higher Data rates than GSM > Theoretically

GPRS communications

In GPRS, communications are done through the internet and so connections are established differently as GSM or PSTN.

During a GPRS connection,
- ETG302x module connects to the GPRS network via an **Access Point Name (APN)** given by the GPRS service provider
- Access Point Name (APN) realizes the **bridge between the GPRS network and the internet**
- The client PC or application is also connected to the internet.

Therefore to ensure a secure remote access, the ETG302x modules also implements security

services such as
- **VPN (Virtual Private Network)** or IP filtering
- **Data encryption** capabilities

GPRS communications require a **SIM card** and a specific **GPRS subscription / contract** provided by a GPRS service Provider

In GPRS, **connections are always established from modem to GPRS network**, and never from GPRS network to modem. It is not possible for a client application to open a connection by dialing the ETG302x directly as in PSTN.

However the ETG 302x module accepts incoming GSM or PSTN calls and supports Internet Call back function in order to connect itself to the GPRS network from a remote request.

ETG 302x modules provides two modes for connecting to GPRS network :
- **Permanent mode:**
  - Automatically connection at startup or after a boot or after a connection loss
- **On Demand mode:**
  - on a process or application condition. (via internal registers)
  - via Call back function

GPRS connections

The GPRS connections are done to an **Access Point Name (APN)** given by the GPRS service provider.

The ETG302x module then receives an IP address from the provider
- either a **Public IP** or a **PRIvate IP** address
- either a **Static IP** or a **Dynamic IP** address depending on the GPRS subscription.

Note: **We recommend** to choose subscriptions with:
- Public APN with public IP address (visible from internet)
- Static IP address (get rid of DynDNS or IP publication)

ETG302x supports both Static or Dynamic IP addresses.
For Dynamic IP addresses, ETG 302x provides DynDNS support

Notes on GPRS contracts

GSM/GPRS service providers are offering dedicated subscriptions well adapted to industrial applications, also **called M2M (Machine to Machine) subscriptions**.

Various GPRS subscriptions are available with different options:
- various different Data exchange rates (billing on data amount in Megabytes per month)
- option for Static IP or Dynamic IP address
- Incoming TCP ports blocked or not blocked : some providers are offering only subscriptions with TCP ports, blocked for security reasons, for instance ports lower than port 1024 may be blocked

Note: **We recommend** to choose subscriptions with:
- Public APN with public IP address (visible from internet)
- a Static IP address
- and no TCP ports blocked in order to lower remote connection constraints and benefits of the routing services of ETG302x.

GPRS performance

Wireless Generations: **Theoretical Rates**

Generation	Technology	Rate
2G	GSM (CSD)	9,6 kbits/s
2.5G	GPRS	115 kbits/s
2.75G	EDGE	384 kbits/s
3G	UMTS	Rural : 114 kbits/s Urban : 384 kbits/s Building : 2 Mbits/s

GPRS Connection Speed **Typical Rates**

Coding scheme	Speed (kbit/s)
CS-1	8.0
CS-2	12.0
CS-3	14.4
CS-4	20.0

Mini

Maxi

Technology	Download (kbit/s)	Upload (kbit/s)	Configuration	
GSM CSD	9.6	9.6	1+1	
GPRS	32.0	8,0	4+1	Class 8 & 10 and CS-1
GPRS	24.0	16,0	3+2	Class 10 and CS-1
GPRS	80.0	20,0	4+1	Class 8 & 10 and CS-4
GPRS	60.0	40,0	3+2	Class 10 and CS-4
EDGE	236.8	59,2	4+1	Class 8, 10 and MCS-9
EDGE	177.6	118.4	3+2	Class 10 and MCS-9

GPRS is a technology in which speed is a direct function of :
- Connection and signal quality relative to distance to a transceiver station (determines Coding scheme- CS)
- Current network traffic condition from provider: gives how many TDMA (Time division multiple access) time slots are assigned (ie: 3 in download+2 in upload, or 4 in download +1 in upload)
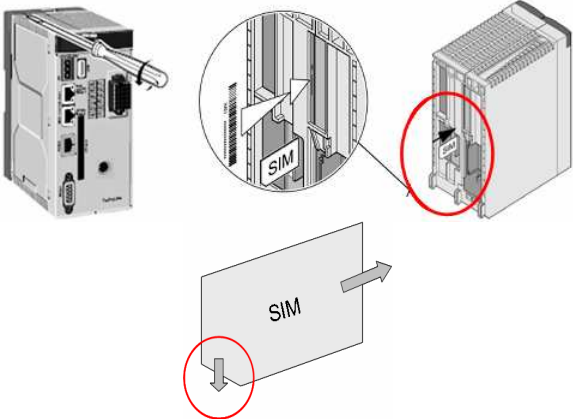
2- Setup Methodology

Setup Methodology   This section describes the main steps to follow to setup GPRS communications and VPN security

Step	Actions
I	**Get a GPRS contract** / subscription from a GPRS service provider with a SIM card and activate the SIM card
II	**Insert the SIM card** inside the back of the ETG302x module and connect the antenna
III	**Connect a PC to the ETG302x module** with an Ethernet cable
IV	**Open an Internet browser** and access ETG302x Web site, enter Setup Web pages
V	**Open Modem Setup page** and configure PIN code via Reboot the module and verify SIM configuration and GSM signal
VI	**Configure GPRS parameters** via Modem Setup page and Reboot module
VII	**Verify GPRS connection status:** Open an Internet browser, and access ETG302x Diagnostic Web pages with the Ethernet cable
VIII	**Connect the PC to the Internet,** after removing the Ethernet cable from the ETG module
IX	**Access to the ETG302x module using GPRS IP address** to open ETG Web site. *(only for contracts with no TCP ports blocked by provider)*
X	**Optional: Configure the VPN service** in Tunnel mode *(For contracts with TCP ports blocked or for accessing Ethernet devices connected to the ETG 302x)*
XI	**On the ETG side , Configure VPN parameters** via VPN security Setup page, and Reboot module *(VPN tunnel mode)*
XII	**On the PC side, Open a VPN client** software or Run a Windows VPN client utility batch file. *(VPN tunnel mode)*
XIII	**Connect to the ETG 302x via the VPN tunnel**

3 - Hardware Setup

SIM card installation

This section describes how to install and setup SIM card in an ETG302x module

Step	Action
1.	**Power off** the ETG 302x module and **connect the GSM antenna**
2.	**Insert the SIM card** inside the back of the ETG302x module after removing the backplane **NOTE:** Pay attention to the sense of the card
3.	**Power on** the ETG 302x module
4.	**Connect a PC** to the Ethernet port of the ETG 302x module **PC installation Pre-requisite:** • Web Designer software installation • A Java Virtual Machine (JVM) must be installed on the PC. o **We recommend** to install **the JVM V1.4.02_14** from SUN provided in the CD ROM delivered with the module

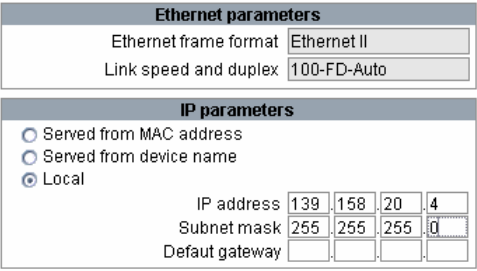|	
5.	**Open an Internet Browser** (Internet Explorer) and enter **IP address** of ETG302x In the "Address" field enter the URL: **http://< ETG_IP_address>,** then Enter. Result: The Home page appears on the screen. **Note:** For the first connection to the module enter the **Factory_default IP address** of the ETG302x module. • The **Factory_default IP address** is derived **from the MAC address** of the module, printed on the front panel • It has the following format : **10.10.xxx.yyy,** where **xxx** and **yyy** represents the last two digits of the MAC address converted to decimal format. • <u>Example:</u> If the MAC address of the module (in hexadecimal format) is: **00 80 F4 01 12 20**., In this case, the default IP address (in decimal format) is: **10.10.18.32**. • Your PC has to be in the same IP address range based upon the subnet mask.
6.	Click on **Setup** in the Menu bar of the Home page
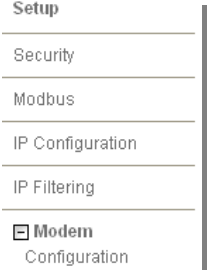
	The configuration menu appears on the left part of the Setup Web page.
	 Setup Security Modbus IP Configuration IP Filtering ⊟ **Modem** Configuration
	NOTE: Hardware module configuration can be done either via **Setup Web pages** embedded in the module or via **Web Designer** software .
7.	If you want to modify the **Factory_default IP address** of the module, Select **IP Configuration** menu Enter the desired **IP address** and **subnet mask** value according to your network configuration. • For instance enter: IP= 139.158.20.4 , Subnet mask= 255.255.255.0 **Ethernet parameters** Ethernet frame format | Ethernet II Link speed and duplex | 100-FD-Auto **IP parameters** ○ Served from MAC address ○ Served from device name ⊙ Local IP address | 139 | .158 | .20 | .4 Subnet mask | 255 | .255 | .255 | .0 Defaut gateway | | . | . | . >> Click on **Apply button** Select **Control menu** and **Reboot** the module to let it get the new IP address configured ! **FactoryCast™ TSX ETG 3021** Home Documentation URL Monitoring Control Diagnostics Maintenance Setup Click on apply and enter Configuration password in Upper case = **USER** (by default)
8.	In the Internet Browser enter now the new IP address you just have configured , **http://<new_ETG_IP_address>**, for instance **139.158.20.4,** then press **Enter**. Click on **Setup** in the Menu bar and Select **Modem configuration** menu **Setup** Security Modbus IP Configuration IP Filtering ⊟ **Modem** Configuration

9.	**Enter carefully** the **PIN code** of your SIM card.
	>> Click on **Apply button** and **Reboot** the module
	Note: Type **the PIN code** of the SIM card **carefully**: if you enter an incorrect PIN code 3 times, the SIM card will be locked. If it happens, call your GPRS service provider to unlock it.
10.	After reboot, you can check if the PIN code is taken into account
	Enter the **Diagnostic** pages by selecting the **Diagnostic** menu and select **Modem Diagnostic**
	Select **Modem Diagnostic** and verify SIM card information, signal level, etc

4 - GPRS Setup

GPRS modem Setup

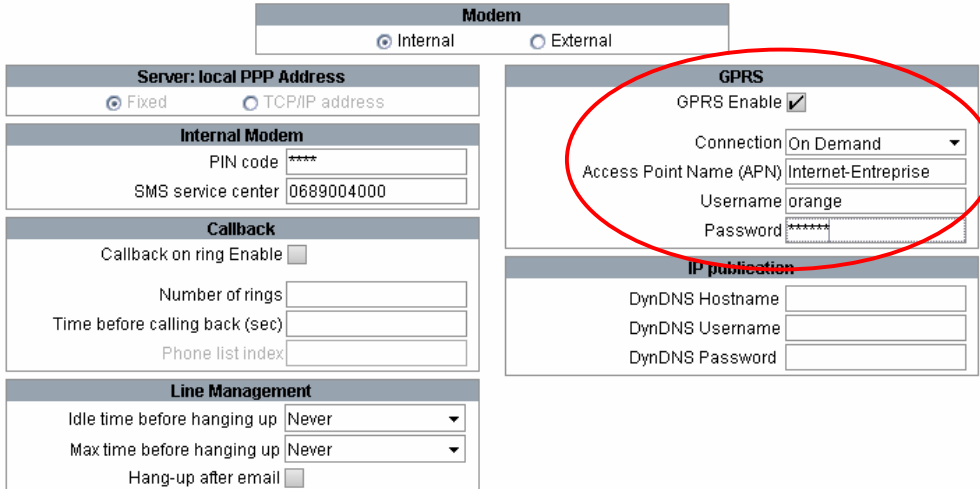This section describes how to setup the GPRS modem configuration

You can configure the GPRS modem connection to be open via the following options:
- **Permanent** mode: Automatically at module startup
- **On Demand** mode:
  - via the **Call back** function
  - by forcing to 1 the **internal register** of the module **%MW1001**

1.	Click on **Setup** in the Menu bar and Select **Modem configuration** menu Select **GPRS enable** check box and enter the GPRS parameters: • **Connection** mode: We recommend to start with **"On Demand"** option • **Access Point Name (APN) :** Enter the **APN** according to you GPRS provider and contract. APN must be Public APN to be accessed from Internet • **Username/Password** of the APN

Modem
○ Internal   ○ External

Server: local PPP Address
○ Fixed   ○ TCP/IP address

Internal Modem
PIN code ****
SMS service center 0689004000

Callback
Callback on ring Enable ☐
Number of rings
Time before calling back (sec)
Phone list index

Line Management
Idle time before hanging up Never
Max time before hanging up Never
Hang-up after email ☐

GPRS
GPRS Enable ✔
Connection On Demand
Access Point Name (APN) Internet-Entreprise
Username orange
Password ******

IP publication
DynDNS Hostname
DynDNS Username
DynDNS Password

>> Click on **Apply button** and **Reboot** the module |

Opening a GPRS connection via internal register

This section describes how to Open GPRS connection by writing to 1 the **internal register 1001** of the module (Command register for open/close modem connection)

This command can be done by a
- **Human action:** via the Data Editor page or a graphic page of the ETG 302x Web site (via a Web browser)
- **Process condition:** via a PLC request to write this register directly in the ETG 302x, in runtime on an event

|	
1.	Enter the **Monitoring** pages by clicking the **Monitoring** menu and select **Data Editor Lite .**

Create a new data table, by clicking the following icon
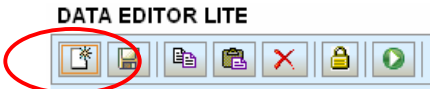
Then double click in the table to create a new line and edit a data access

Fill in the fields: for two registers
- **Unit Id** = 255 , register **Address** = 1001 - Command register for open/close modem connection (open = 1, close = 2)
- **Unit Id** = 255 , register **Address** = 1000 - Status register for modem connection (connection in progress = -1, command OK = 0)
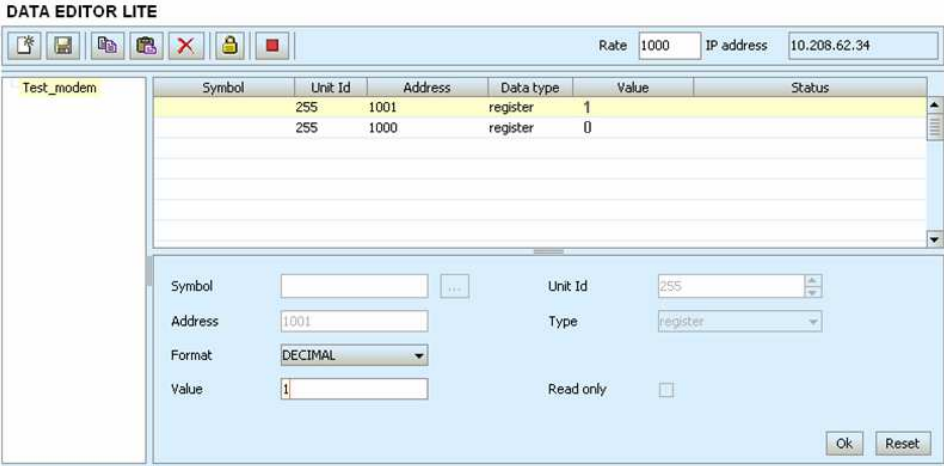

Then click on the start animation icon and enter the value = 1
enter the Write access **password** in Upper case = **USER** (by default)
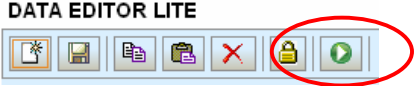
2.	The GPRS connection is now established to the APN of your provider and to the Internet ! You can now check if the GPRS connection is done. Enter the **Diagnostic** pages by selecting the **Diagnostic** menu and select **Modem Statistics** or **Log file .**

Connection status is displayed in the **Modem Diagnostics** screen .
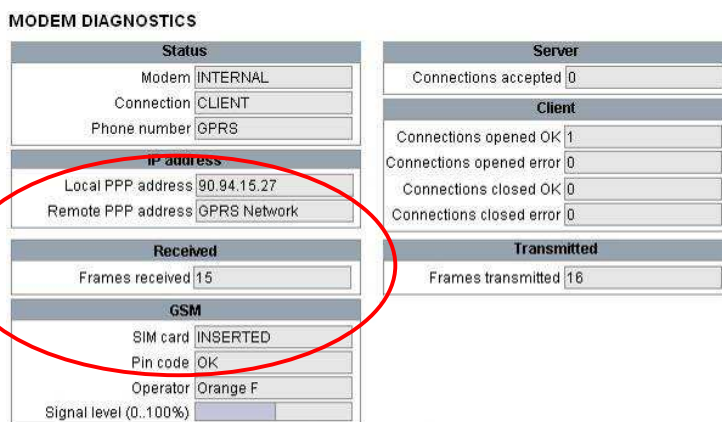
NOTE : If you have a GPRS account with Dynamic IP address, you can read the IP address given by the provider for this connection. (Local PPP address field)

or   **Log file** screen

```
[16 Jun 2008 16:58:28]Dial []
[16 Jun 2008 16:58:28]modem: command = AT
[16 Jun 2008 16:58:38]modem: command = AT+CREG?
[16 Jun 2008 16:58:39]modem: response = AT+CREG?
[16 Jun 2008 16:58:39]modem: response = +CREG: 0,1
[16 Jun 2008 16:58:39]modem: command = AT+CGDCONT=1,"IP","internet-entreprise"
[16 Jun 2008 16:58:39]modem: response = AT+CGDCONT=1,"IP","internet-entreprise"
[16 Jun 2008 16:58:39]modem: response = OK
[16 Jun 2008 16:58:39]modem: command = AT+CGATT=1
[16 Jun 2008 16:58:42]modem: response = AT+CGATT=1
[16 Jun 2008 16:58:42]modem: response = OK
[16 Jun 2008 16:58:42]modem: command = AT+CGACT?
[16 Jun 2008 16:58:42]modem: response = AT+CGACT?
[16 Jun 2008 16:58:42]modem: response = +CGACT: 0,0
[16 Jun 2008 16:58:42]modem: response = +CGACT: 1,0
[16 Jun 2008 16:58:42]modem: response = +CGACT: 1,0
[16 Jun 2008 16:58:42]modem: response = OKGACT: 1,0
[16 Jun 2008 16:58:42]modem: command = AT+CGACT=1,1
[16 Jun 2008 16:58:45]modem: response = AT+CGACT=1,1
[16 Jun 2008 16:58:45]modem: response = OK
[16 Jun 2008 16:58:46]modem: command = ATDT*99***1#
[16 Jun 2008 16:58:46]modem: response = ATDT*99***1#
[16 Jun 2008 16:58:49]modem: response = CONNECT 115200
[16 Jun 2008 16:58:49]Connection Client: IP Remote Address [192.168.111.111]
[16 Jun 2008 16:58:49]Connection Client: IP Local Address [90.94.15.27]
[16 Jun 2008 16:58:55]Connection Client: Established
```

3.

You can now try to access the ETG302x module address via Internet
- by a ping to the IP address of the module
- by opening an internet browser and connect to the module using its IP address.
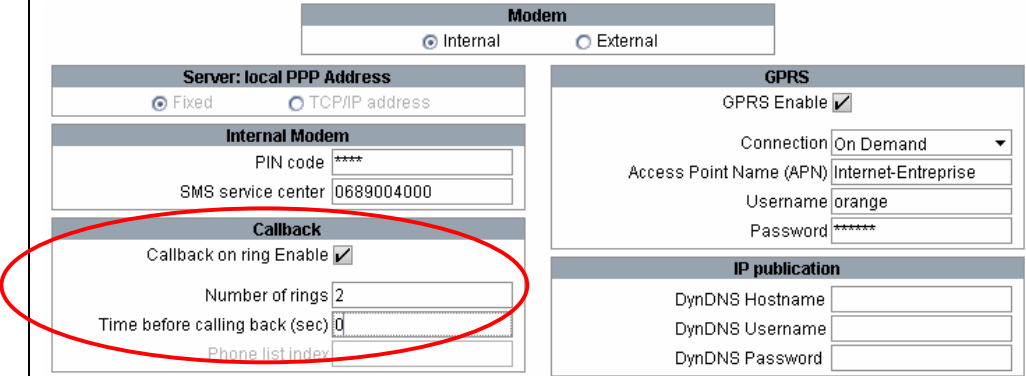
NOTE:
This access via Internet is possible if the conditions described below are fulfilled :
- You have a contract with **no TCP ports blocked *****
- if you are connected to the internet without access restriction (**company firewall**)

***TCP ports blocked: You have a contract with TCP ports blocked, you cannot access to the ETG module HTTP server (port 80).   See VPN section

Opening GPRS connection via Call back

This section describes how to Open GPRS connection by setting up the Call back function:

the **Call back** function allows you to dial the ETG 302x module with its GSM phone number. The ETG302X module will hang-up after a number of ring and connect to the GPRS network.

1.	Click on **Setup** in the Menu bar and Select **Modem configuration** menu Select the **Call back enable** Check box >> Click on **Apply button** and **Reboot** the module
2.	You can now Dial the ETG 302x module via its GSM phone number (from SIM card). The ETG302X module will hang-up after a number of ring and connect to the GPRS network.
3.	After connection verification , You can try to access the ETG302x module address via Internet • by a ping to the IP address of the module • by opening an internet browser and connect to the module using its IP address. **NOTE:** This access via Internet is possible if the conditions described below are fulfilled : • You have a contract with **no TCP ports blocked *** • if you are connected to the internet without access restriction (**company firewall**) *****TCP ports blocked:** You have a contract with TCP ports blocked, you cannot access to the ETG module HTTP server (port 80). In this case, in order to access to the ETG module and devices, you must setup the VPN service, see related section

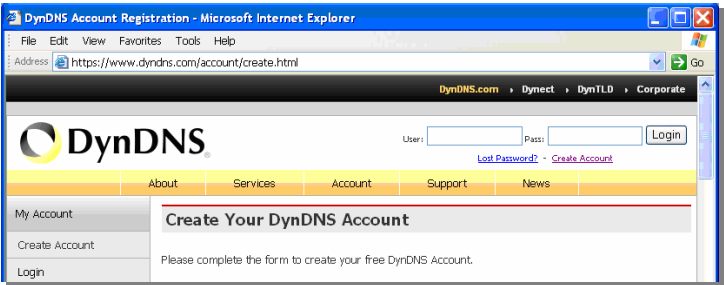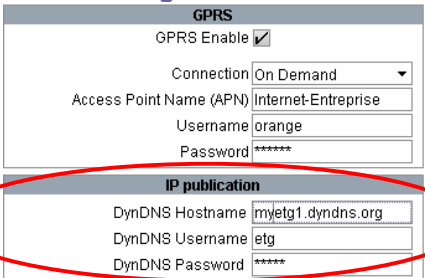# 5 - Working with Dynamic GPRS IP addresses

Dynamic GPRS IP addresses overview

This section describes how to Work with Dynamic GPRS IP addresses .
For more information refer to User manual documentation.

If you have got a **Dynamic GPRS IP address** with your GPRS subscription, it is changed / renewed frequently by your service provider.

ETG 302x provides two solutions to work with Dynamic GPRS IP addresses:

- **DynDNS service for the IP address Publication:**
  o you can configure the **DynDNS IP publication** service in order to access the ETG302x module using a DynDNS name instead of an IP address which is Dynamic and is changed frequently by the provider .

- **Email Publication of the IP address**:
  o **C**onfigure an Email service using Web Designer software to send the new IP address to the end user application.   (refer to the user manual)
  o

1.	We support **DynDNS** name server provided by **DynDNS.com company.** You have first to create an account to the http://www.dyndns.com/ Web site.
2.	To create an account, visit the http://www.dyndns.com/ Web site. (For more information refer to the user manual)
3.	Once you have created your DynDNS account, you will have to register the ETG302x devices and eventually you PC with specific names such as: • myETG1.dyndns.org , myETG2.dyndns.org, • myPC1.dyndns.org
4.	You can now configure the IP publication service Click on **Setup** in the Menu bar and Select **Modem configuration** menu Enter the **IP publication** parameters

5.	**DynDNS behaviour on ETG Side** After connecting to GPRS, the ETG302x module will register to the DynDNS server and maintain the link between the GPRS Dynamic IP address and the DNS name 'myETG1.dyndns.org' for instance. The ETG module will be be accessible via its URL 'myETG1.dyndns.org' instead of its Dynamic IP address. Note: You can ping the URL 'myETG1.dyndns.org' to know the current dynamic IP address given by the provider to the module.

6 - VPN Security Overview

VPN security overview

This section describes how to Set-up **VPN (Virtual Private Network)** service

Using **VPN** security service, ETG302x **can establish secure connections** via private, bi-directional, encrypted tunnels over the Internet between the central sites and your remote equipment.

<u>**Important Note:**</u> **VPN setup (tunnel mode) is mandatory for benefiting of routing capabilities from WAN to LAN** for accessing transparently to devices connected behind an ETG 302x gateway.

VPN security provides:
- **Secured connections between PC connected to Internet and remote ETG302x gateways**, <u>bringing remote devices 'virtually' into your own LAN</u>. Once the tunnel mode is established, your programming software and monitoring tools access the remote device transparently, as if it are in the same local network.

- **Secured Site-to-Site Connections via VPN tunnels between two remote ETG302x gateways**. Any device from one site can access any other device in the remote site. This capability can also be useful for instance as alternative solution for replacing leased lines between sites.

The VPN service is based on
- IPSec protocols*** (Internet Protocol Security) for creating secured tunneled connections.
- IKE (Internet Key Exchange) for session authentication with pre-shared key exchange

VPN services

ETG302x support VPN / IPSec with the following services:

- **Tunnel mode**: In tunnel mode the entire IP packet (data plus the message headers) are encrypted and/or authenticated, Tunnel mode is used for network-to-network communications
- **Transport mode**: In transport mode, only the payload (the data you transfer) of the IP packet is encrypted and/or authenticated. Transport mode is used for host-to-host communications.

- **Data authentication** : different level from SHA to MD5 provided by AH protocol (Authentication header)
- **Data encryption :** different level from 3DES encryption to DES lite encryption provided by ESP protocol (Encapsulating Security Payload)

Notes on VPN client interfaces

When connecting a PC to a remote ETG 302x, the ETG302x acts as a VPN server. It is necessary to run a VPN client interface on the client (PC or other ETG302x) side.


When connecting an ETG302x client to a remote ETG 302x the ETG302x client can act as a VPN client. ETG302x VPN setup includes this client configuration.

Various VPN client can be used:
- **VPN client service provided by Windows** operating systems XP, 2000, Vista (we provide sample batch files to run this service under Windows operating systems)
- "**thegreenbow.com**" **VPN client software** (validated and recommended)
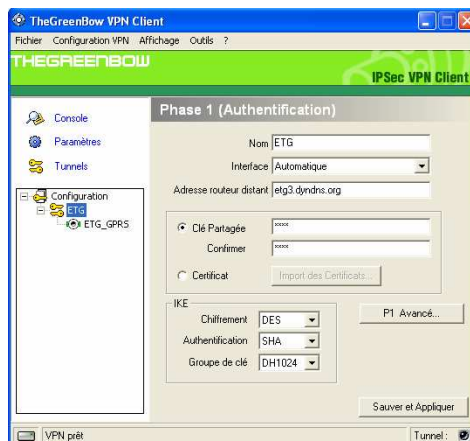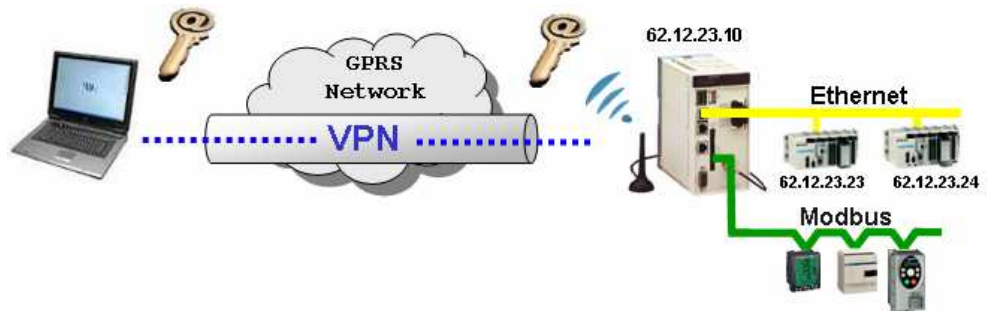
7 - VPN Security Setup

**Setting up
VPN security**

This section describes how to Setup VPN security services

The advantages of using VPN tunnel are:
- Transparent access to all Ethernet devices below the gateway as if they are in the same LAN as your PC
- Use of the local LAN IP addresses (ETG side) . *(Get rid of using GPRS IP addresses)*

11.	Click on **Setup** in the Menu bar and Select **PPP security** menu
	Select the **VPN enable** Check box

	Enter the VPN parameters:
	    • Remote address
	    • Pre shared Key
	    • Mode : Tunnel or Transport (we recommend to use Tunnel mode for transparent routing to Ethernet devices)

☑ VPN enable			

VPN Connections

	Remote address	Pre shared key	Mode	Remote LAN	Subnet mask	ETG client encryption
1	myPC1.dyndns.org	***********	Tunnel ▼	10.10.0.10		▼
2			▼			▼
3			▼			▼
4			▼			▼

Apply   Undo

>> Click on **Apply button** and **Reboot** the module

**Using
Windows VPN
client utility**

This section describes how to use Windows VPN client batch file.

Prerequisite: IPSEC service must be **installed and enabled** on your PC.

If this is not the case, please install **Windows Support tools** that will add IPSEC service

VPN client batch files samples for Windows (XP, 2000, Vista) are provided inside the CD ROM of the ETG 302x.

12.	Customize the provided Batch file to match your application requirements in term of :
	• Network address to access (*eg: 192.168.2.**) • VPN Client & server Addresses (*eg: etg1.dyndns.org, pc1.dyndns.org*) • VPN mode Tunnel or Transport • Encryption level • Preshared key (must match the one configured in the ETG 302x VPN setup page)
	Example of batch command for VPN tunnel from PC to ETG:
	``` ipseccmd -1s 3DES-SHA-2 -n AH[MD5] -f 0=192.168.2.* -t etg1.dyndns.org -a PRESHARE:"etg1presharedkey" -p "ETGTunnel" -r "PCToTarget" -1k 3600s -w reg -x ```
	Example of batch command for VPN tunnel from ETG to PC:
	``` ipseccmd -1s 3DES-SHA-2 -n AH[MD5] -f 192.168.2.*=0 -t pc1.dyndns.org -a PRESHARE:"etg1presharedkey" -p "ETGTunnel" -r "TargetToPC" -1k 3600s -w reg -x ```
	Note: *For more details please read User Manual documentation*

Using Thegreenbow VPN client software

This section describes how to use the **Thegreenbow** VPN client software.
The **Thegreenbow** VPN client software has been validated with ETG 302x modules et we recommend to use it as a VPN client.
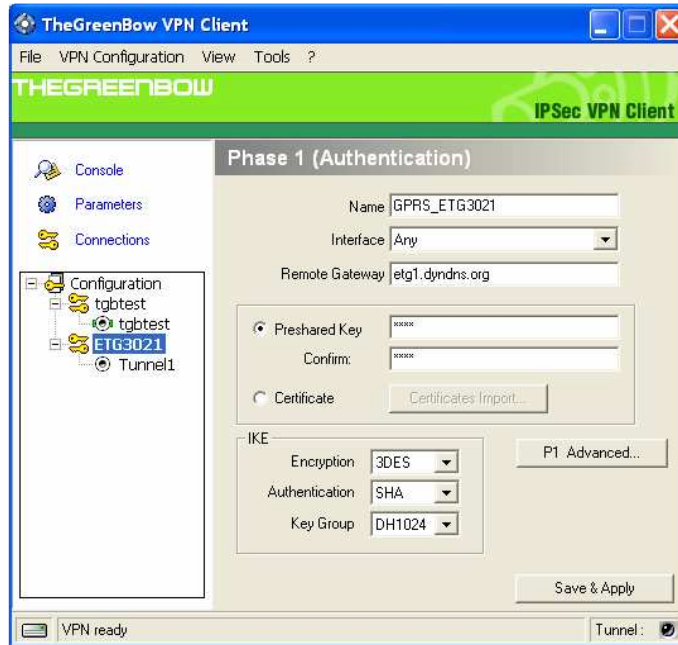
In order to use this VPN client software you have to purchase it on the following Web site
• "**www.thegreenbow.com**" VPN client software.

| 1.	Once installed on you PC, you can use **Thegreenbow** VPN client to launch a **VPN tunnel** between your PC and the remote ETG 302x module.
	Note: *For more details please read User Manual documentation*
	The VPN client software allows you to configure the following parameters: • Remote ETG address (ie. Etg3.dyndns.org) • Pre shared key (must match the one configured in the ETG 302x VPN setup page) • Encryption level

2.	**First panel** • Set Remote ETG address (ie. Etg3.dyndns.org) • Set Pre shared *key (set same in ETG VPN configuration)* • Set IKE encryption
	Second panel • Set Encryption level • Set Tunnel / transport mode • Virtual Client Address: *Use 10.10.0.10 and set same in ETG VPN configuration* • Open Tunnel connection
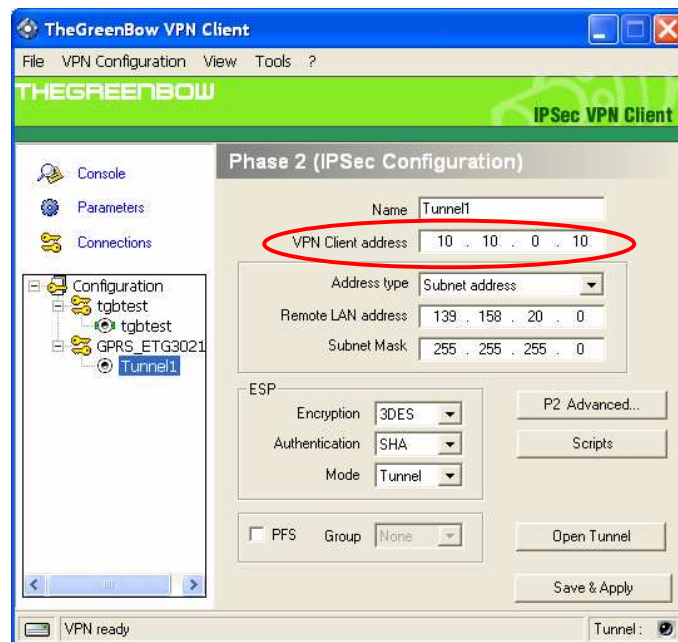
Related VPN configuration in ETG302x setup

- Set Remote PC address
- Set Pre shared *key*   *(set same in ETG VPN configuration)*
- Set Tunnel / transport mode
- Virtual Client Address: *Use 10.10.0.10 same as TheGreenbow VPN client configuration*

☑ VPN enable

	Remote address	Pre shared key	Mode	Remote LAN	Subnet mask	ETG client encryption	
	VPN Connections						
1	myPC1.dyndns.org	***********	Tunnel ▼	10.10.0.10		▼	▲
2			▼			▼	
3			▼			▼	
4			▼			▼	▼

Apply   Undo