Tri-Band GSM/GPRS Modem

TNC-G110
USER'S MANUAL

Rev 1.2
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Contents

TNC-G110 USER'S MANUAL

Safety Precautions

- This modem is intended for use when supplied with power from a DC source between 9 VDC to 36 VDC. Other usage will invalidate any approval given to this modem and may be dangerous.
- The modem generates radio frequency (RF) power. When using the modem care must be taken on safety issues related to RF interference as well as regulations of RF equipment.
- Usage of modem in aircrafts is illegal and it may cause danger to aircraft operation and disrupt cellular network. Offenders may face suspension or revocation of cellular telephone services, or legal action or both.
- Uses of modem are not advisable at explosive environments. Users are to restrain himself from using radio equipments at these areas where blasting actions are taking place. E.g.: fuel depots, chemical plants.
- The use of the Alert device to operate a vehicle's lights or horn on public roads is not permitted.
- It is advised that hand-held microphone or telephone handset should not be used by the driver while the vehicle is moving, except in an emergency. Speak only into a fixed, neck slung or clipped-on microphone when it would not distract your attention from the road.
- Be sure that the modem will not be interfering with nearby equipment. For example: pacemakers or medical equipment. The antenna of the modem should be away from computers, office equipment, home appliance, etc.
- Antenna of the device should be at least 30 cm from the human body.
- Do not put the antenna inside metallic box, containers, etc.
- Check for any regulation or law authorizing the use of GSM in vehicle in your country before installing the modem. Consult your vehicle dealer for any possible interference of electronic parts by the modem. Vehicle installation of modem must be by qualified personnel.
- Non-radiating cable (e.g. coaxial cables) are to be used to connect radio equipment to antenna.
- Antenna should be mounted at placement that considerations are taken that no part of human body can get too close to any part of antenna unless there is an intervening metallic screen (e.g. metallic roof).
- Be careful when the modem is powered by the vehicle's main battery. The battery may be drained after an extended period.

Protecting your modem

To ensure error-free usage, please install and operate your modem with care. Do remember the following:

- Do not expose the modem to extreme conditions such as high humidity/rain, high temperatures, direct sunlight, caustic/harsh chemicals, dust, or water.
- Do not try to disassemble or modify the modem. There is no user serviceable part inside and the warranty would be void.
- Do not drop, hit or shake the modem. Do not use the modem under extreme vibrating condition.
- Do not pull the antenna or power supply cable. Attach/ detach by holding the connector.
- Connect the modem only according to the instruction manual. Failure to do it will void the warranty.
- In case of problem, please contact authorized dealer.

1. INTRODUCTION

TNC-G110 is a ready-to-use GSM modem for voice, data, fax and SMS services. It also supports GPRS (Class 10) for hi-speed data transfer. TNC-G110 can be easily controlled by using AT command for all kinds of operations. With standard 9-pin RS232 port(optional IEEE1394 USB cable for TNC-G110U model) and telephone-RJ22 the TNC-G110 can be set up with minimal effort.

Package
The TNC-G110 package should include the following:
TNC-G110 x 1
Antenna (Duck type, 3mm) (Optional)
Safety note x 1

INTERFACES
SIM holder with eject button
Status indicator
RJ 11 Phone Jack
9 pin Sub-D female connector
DIP switch at back plate to select DTR reset function. (Default: DTR disabled by DIP switch 1 to ON position)
2 pin DC power header

Status indicator
The LED will indicate different status of the modem:

On	Modem switched on
Off	Modem switched off
Flashing rapidly (Start up)	Modem searching for network
Flashing slowly	Modem is in transmission/communication (GSM only)
Flashing rapidly (After network is found)	Modem is in GPRS mode

SMA female antenna connector

Connect this to an external antenna with SMA male connector. Make sure the antenna is for the GSM900/1800/1900 frequency with impedance of 50ohm, and also connector is secured tightly.

9 pin Sub-D Female Connector
The connector provides serial link to the modem.

9-PIN D-SUB Female connector (RS232)

Pin Number	Name	EIA Designation	Type
1	DCD	Data Carrier Detect	Output
2	TX	Transmit Data	Output
3	RX	Receive Data	Input
4	DSR	Data Set Ready	Output
5	GND	Ground	
6	DTR	Data Terminal Ready	Input
7	RTS	Request to Send	Input
8	CTS	Clear to Send	Output
9	RI	Ring Indicator	Output

IEEE1394 USB cable interface for TNC-G110U

If you choose the ***TNC-G110U***, it provides serial link by IEEE1394 USB cable (USB Type A to Type B connector).

Specification of microphone and speaker to be connected :

Parameter	Min	Typical	Max	Remark
Phone current @2V/2kohm		0.5		mA
Phone input level			100	mVpp
Speaker output current 150ohm/1nF		16		mA
Speaker Impedence			32	Ohm

2-PIN connector (Power, Input / Output)

Pin assignment of 2-pin connector
Pin number Name Functions

Pin number	Name	Function
1	POWER –DC	Power negative input
2	POWER +DC	Power positive input

2. INSTALLATION

2.1 Mounting the modem

The modem can only be mounted onto a standard 35mm Din-rail.

2.2 Install the SIM card

Use a flat tip screw driver or paper clip to press the SIM holder eject button. The SIM holder will come out a little. Then take out the SIM holder.

Note: DO NOT pull out the SIM holder without pushing the ejector.
Put the SIM card to the tray; Make sure it sits properly in the tray. Put the tray back into the slot.

2.3 Connect the external antenna (SMA type)

Connect this to an external antenna with SMA male connector. Make sure the antenna is for the GSM900/1800/1900 frequency with impedance of 50ohm, and also connector is secured tightly.

Note : Please use antenna designed for GSM 900/1800/1900 MHz operation. Incorrect antenna will affect communication and even damage the modem.
Antenna of the device should be at least 30 cm from the human body.

2.4 Connect the DC power supply

Connect the open ending of the included power cord to a DC supply. Refer to the following for power supply requirement.

Power Supply Requirement:
Supply voltage: 9V~ 36V

Peak current at 12V supply:	2A
Average current at 12V supply in idle mode	30mA

Connect the power connector to the modem. The modem will turn on automatically. The status indicator will lit on and start to flash very fast. The modem will start to register to the network and after a few seconds the status indicator on the modem will be flashing slowly (registered to the network successfully refer 1.2.1).

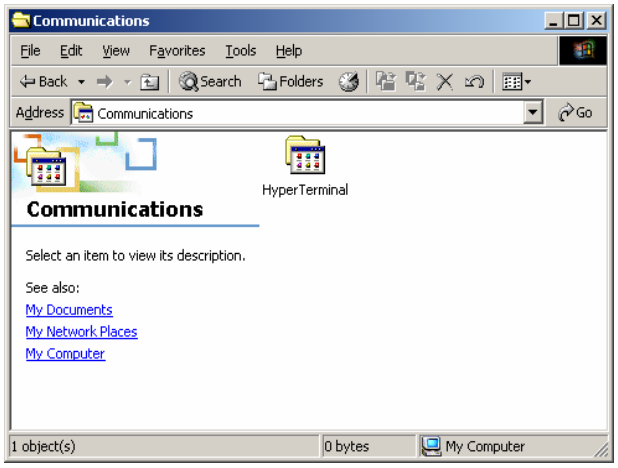
2.5 Connect the modem to external device(Connect the power supply first before this)

You can use the optional RS-232 cable to connect the modem's SUB-D connector (IEEE1394 USB cable for TNC-G110U) to external controller/computer. The following section in the next page describes how to communicate with the modem software in Microsoft Windows environment.

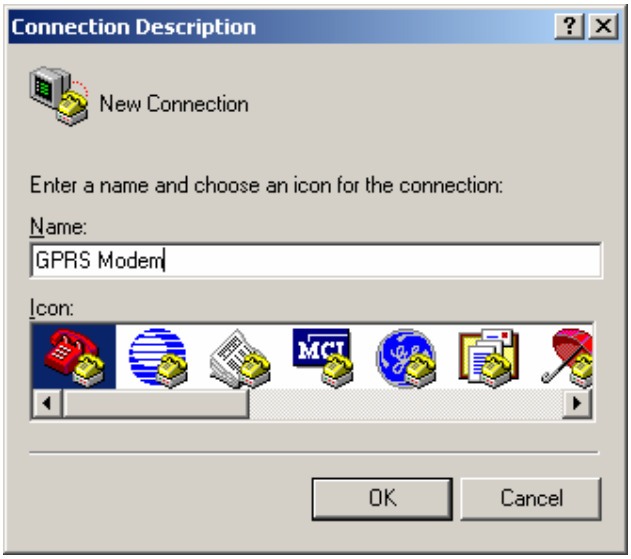
3. WORKING WITH TNC-G110

Checking the modem (using Microsoft WindowsTM HyperTerminal as example)

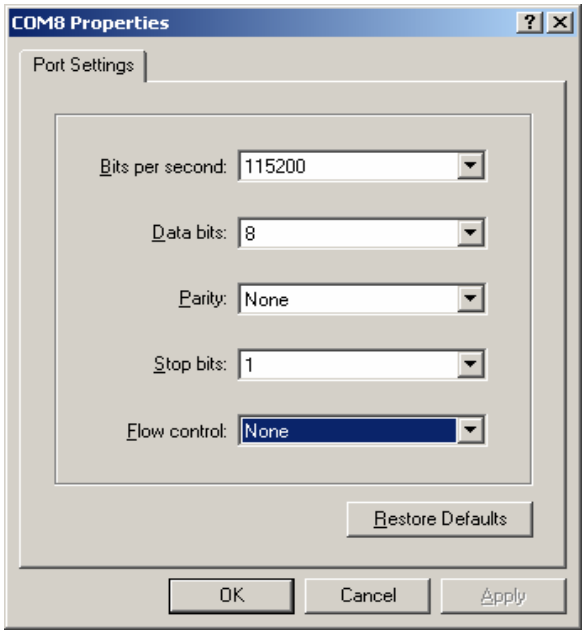
On the first power-up attempt, you can use terminal software to communicate with the modem through an RS-232 serial Port (USB port for TNC-G110U). Following examples are using the HyperTerminal in Windows 2000. ***(Make sure that the DTR reset function is disabled by setting DIP switch 1 at the back plate to ON position before proceeding)***



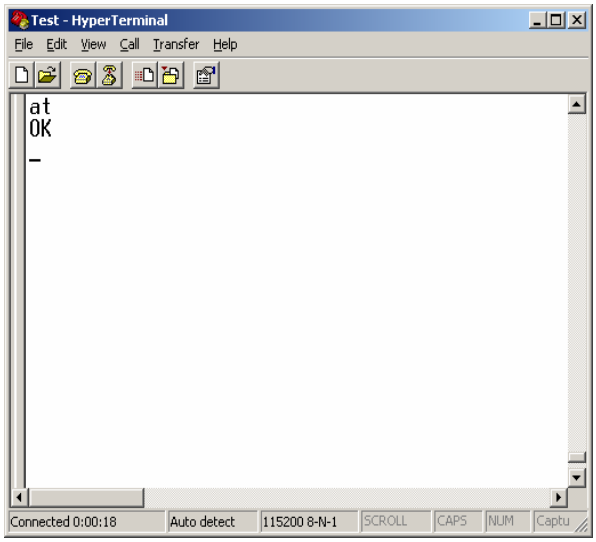
On Windows 2000, start the HyperTerminal program. Assign a name for a new session.



Choose the correct Com port and baud rate settings (115200bps, 8bits, no paritybit, 1 stop bit).



On the terminal screen, type "AT" to check for "OK" response from the modem



Basic Operation :

Followings are examples of some AT commands. Please refer to the AT Command document for a full description.
Note : Issue AT+CMEE=1 to have extended error code (+CME ERROR)

Description	AT commands	Modem response	Comments
Network Registration Checking	AT+CREG?	CREG=<mode>,1	Modem registered to the network
		CREG=<mode>,2	Registration lost, re-registration attempt
		CREG=<mode>,0	Modem not registration on the network, no registration attempt
Receiving signal strength	AT+CSQ	+CSQ: 20,0	The first parameter has to be at least 15 for normal communication
Receiving an incoming call		RING	An incoming call is waiting
	ATA		Answer the call
		OK	
Make a call	ATD1234567;		Don't forget the « ; » at the end for « voice » call
		OK	Communication established
		CME ERROR : 11	PIN code not entered (with + CMEE = 1 mode)
		CME ERROR : 3	AOC credit exceeded or a communication is already established
Make an emergency call	ATD 112;		Don't forget the « ; » at the end for « voice » call
		OK	
Communication loss		NO CARRIER	
Hang up	ATH		
		OK	
Enter PIN code	AT+CPIN=1234		
		OK	PIN Code accepted
		+CME ERROR : 16	Incorrect PIN Code (with +CMEE = 1 mode)
		+CME ERROR : 3	PIN already entered (with +CMEE = 1 mode)

Basic command for sending & receiving SMS

1. Set the Echo ON
   ATE1.

2. Set to text mode.
   AT+CMGF=1

3. Send an SMS. E.g. we want to send to this phone number: 91234123
   AT+CMGS="91234123"(CLICK enter after this)
   >Type your message here (press Ctrl-Z to send a message).

4. To read all message:
   AT+CMGL="ALL"

4. TROUBLESHOOTING

4.1 The modem's LED does not blink

Check if the modem has connected to a 9-36V power supply properly
Check if the power connector is properly inserted
Check the fuse on the power cord
Check that the antenna is connected properly to the SMA connector

4.2 The modem does not response to the terminal program

The default setting of the modem's baud rate is as follow:
AT+IPR=0

This is set for auto-baudrate detection. The modem will lock on to whatever baudrate it detects first until the user power off and on again.

User can still change the baudrate again in runtime by issuing this command:
AT+IPR=(desired baudrate, eg. 9600/19200/...)

5. TNC-G110 WINDOW2000 GPRS SETUP GUIDE

This document describes how to use TNC-G110 and a PC with Windows 2000 to make a GPRS Internet Dial-up.

Setup requirement

The following items are necessary for the setup:

- TNC-G110 with serial cable(IEEE1394 cable for TNC-G110U) and power supply
- PC with Windows 2000 installed, and a free RS-232 port(USB port for TNC-G110U)
- A SIM card with GPRS service subscribed

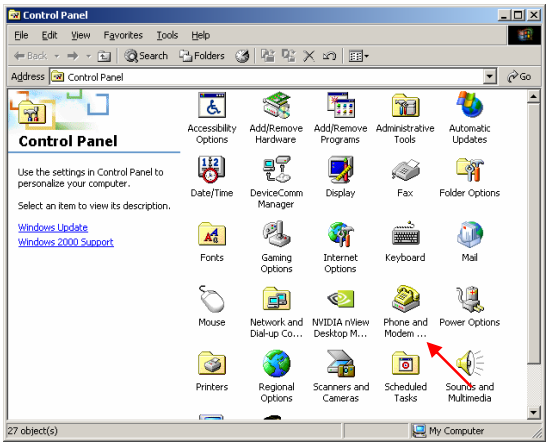
CONFIGURATING TNC-G110

Setting up HyperTerminal

Refer to Chapter 2 and 3 of TNC-G110 USER GUIDE, set up TNC-G110 and HyperTerminal.
(Make sure that the DTR reset function is disabled by setting DIP switch 1 at the back plate to ON position before starting the configuration of TNC-G110)
Setting serial port speed
Open a hyperterminal at baud rate of 115,200bps
Power up the TNC-G110 modem.
a)Type AT&F and enter.
b)Type AT&W and enter
Now you can close the HyperTerminal

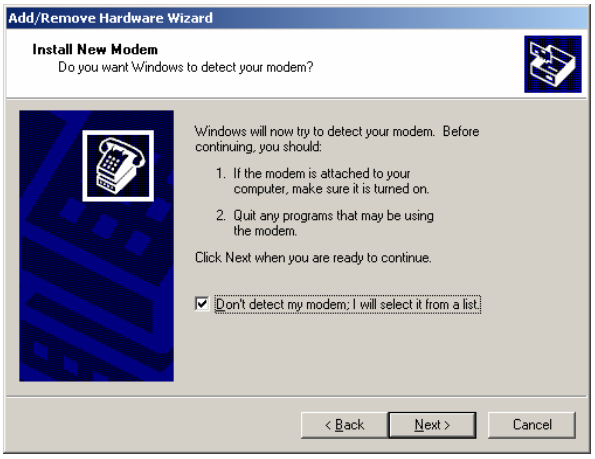
ADDING A MODEM TO WINDOWS 2000

On Windows 2000, Choose "**Start**", then choose "Control Panel folder

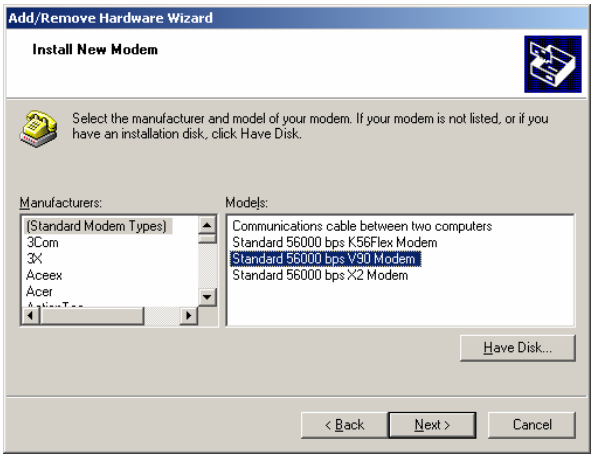


Double click the '**Modem**' icon

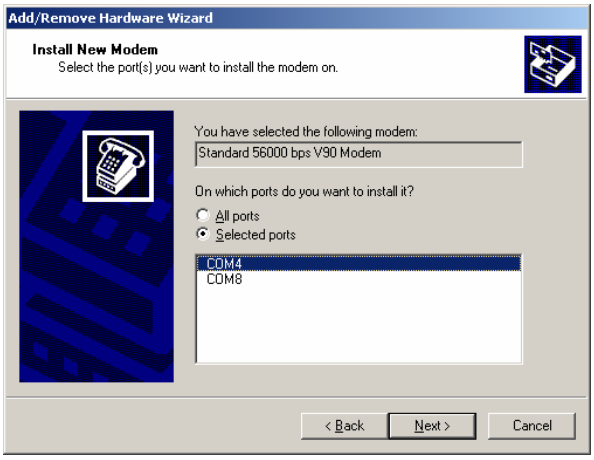
If your system have no modem installed it will show the '**Install New Modem**' dialogue box, otherwise it will show '**Modem Properties**' (see)
You can then press 'Add' button
On '**Install New Modem**' dialogue box, click '**Don't detect my modem**'.
Then press '**Next**'



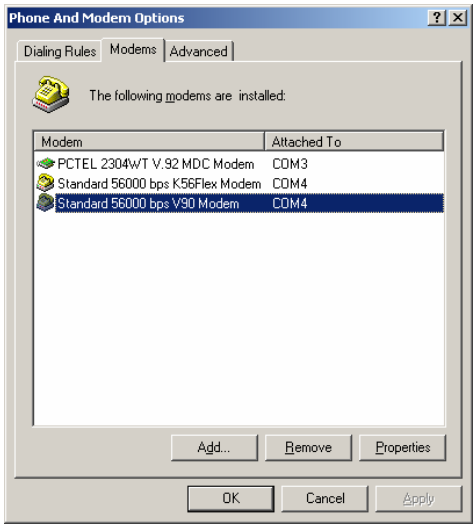
Choose '**Standard 56000bps Modem**', then press '**Next**'



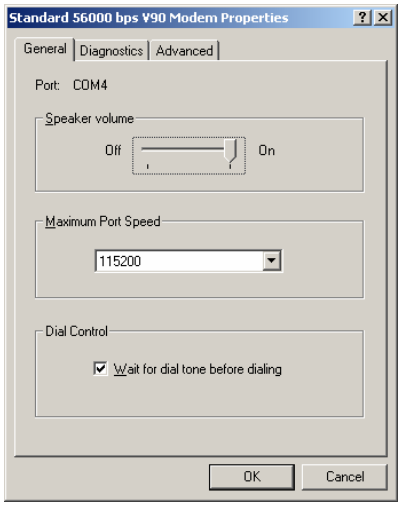
Choose the COM port where the TNC-G110 connected, then press '**Next**'



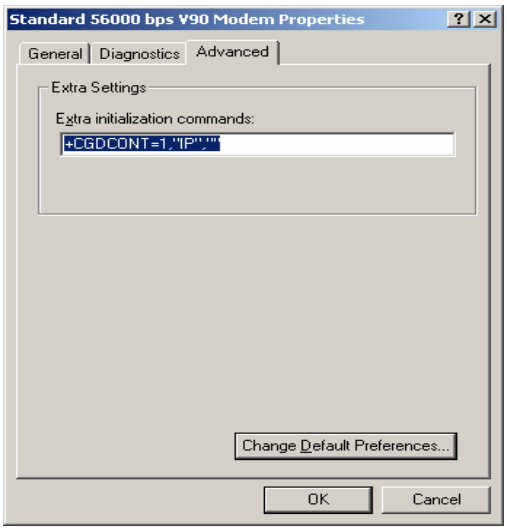
Now the modem has been installed. Select Advanced Tab



Set Maximum Port Speed to 115200



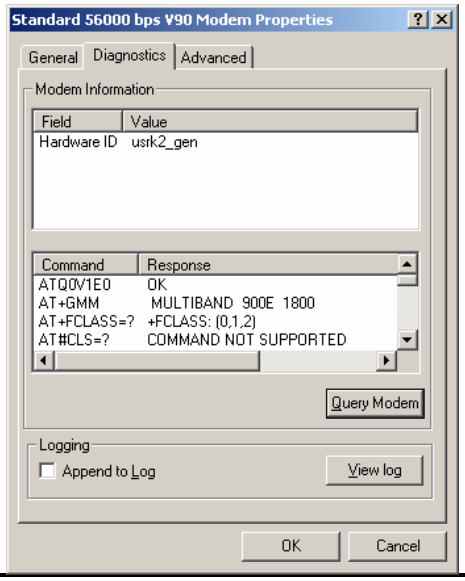
On '**Extra settings**', type the APN information here. (Consult your Network Operator for the correct APN settings)
Common setting is :
+CGDCONT=1,"IP",""



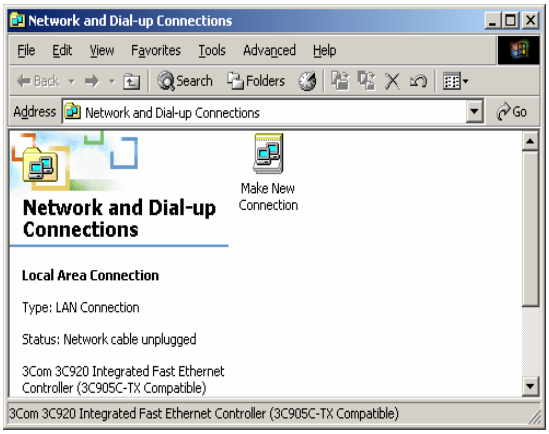
Select the Diagnostics tab and click Quey Modem

You should receive modem response at the window. This will indicate the modem is setup correctly

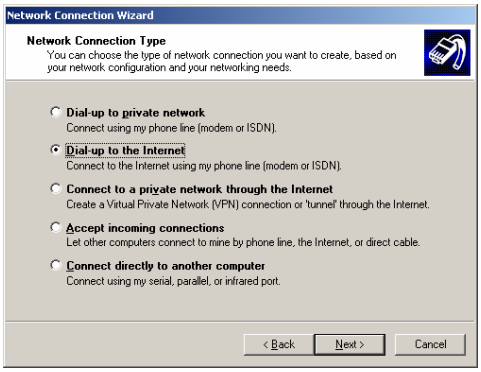
Close all dialog boxes and the modem setup is completed



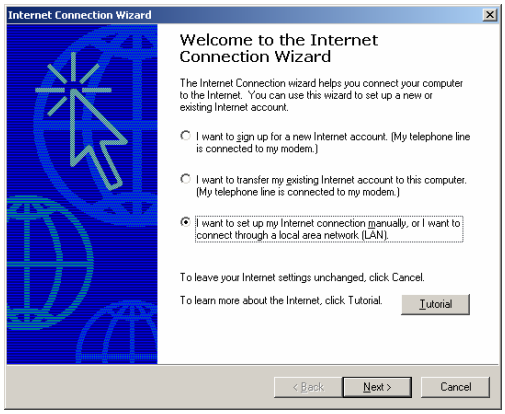
MAKING A DIAL-UP NETOWORKING
On Windows 2000, go to '**Accessories**' _ '**Communication**' _ '**Dial-up Networking**'



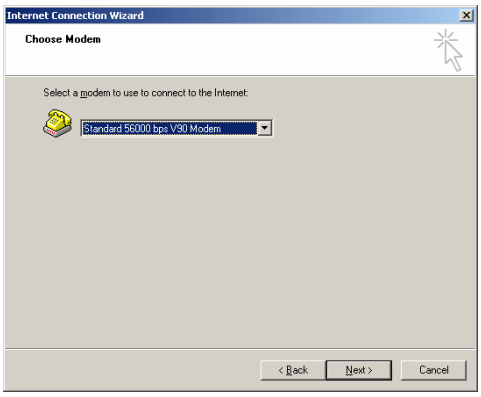
Double click '**Make a New Connection**'



Select Network Connection Type



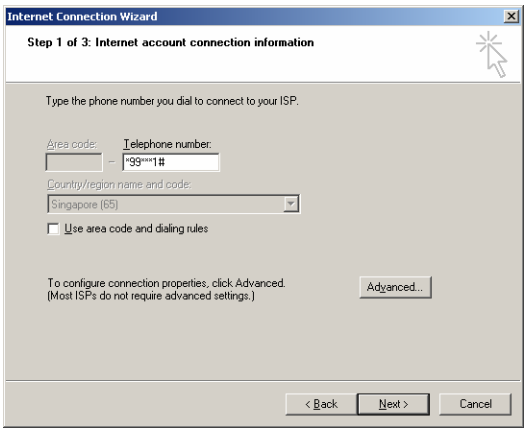
Select setup connection manually



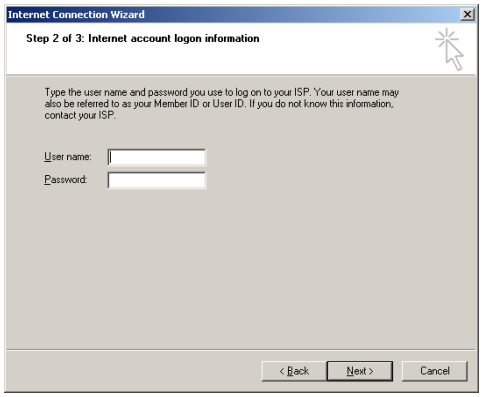
Select the modem that you have configure earlier

Key in the telephone number
*99***1#

And uncheck "Use area code and dialing rules



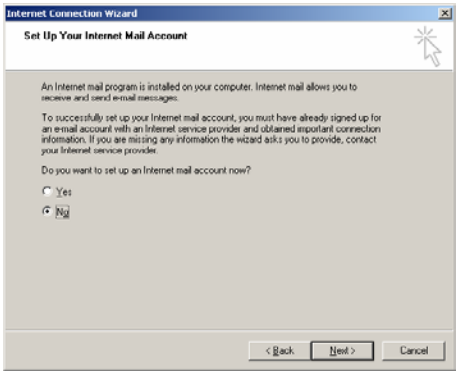
Depending type of ISP which may requires username and password, leave this as blank for now.



Give a connection name

Example : TNC-G110

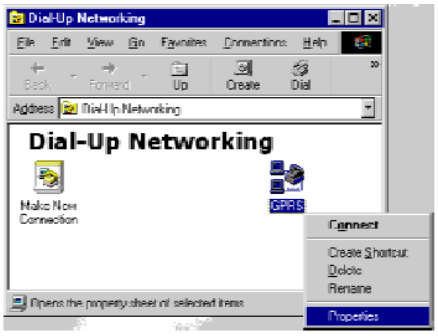
Check "No" to Internet mail account



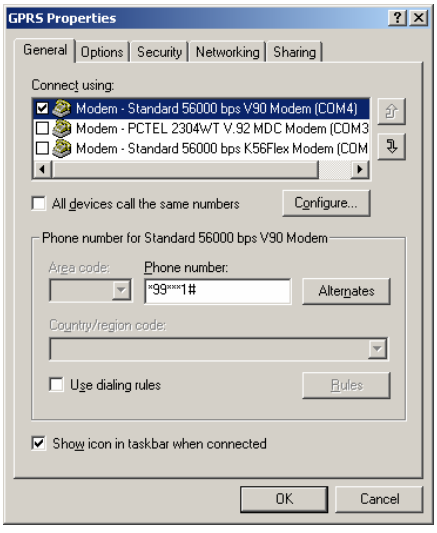
Click "finish" to complete the dialup networking setup

Some more editing is required before the setup is complete.

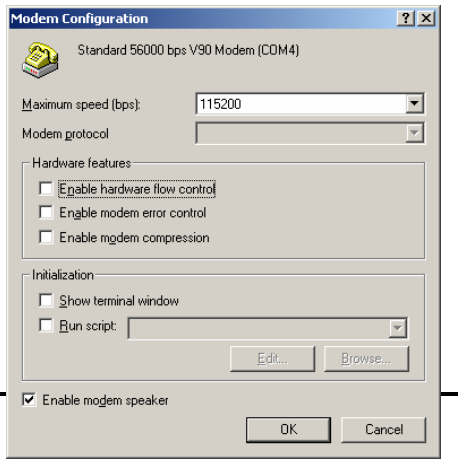
Right-click the just-made GPRS dialup icon. Then choose '**Properties**'



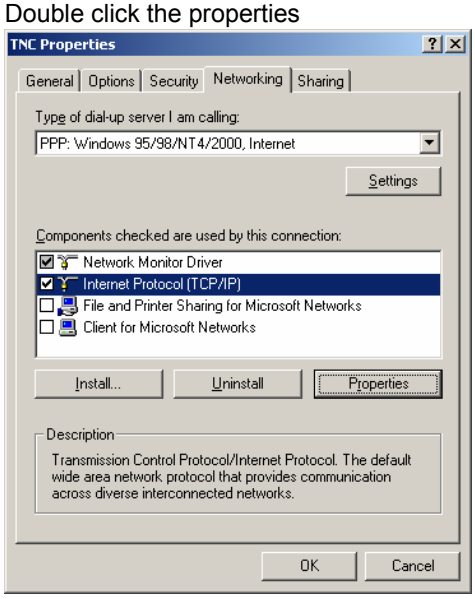
Select the modem and click the Configure button

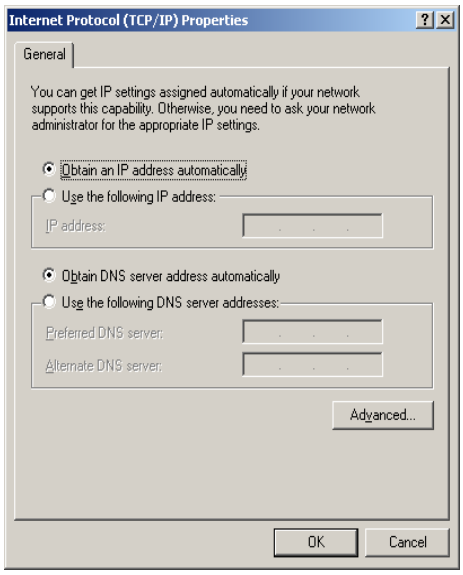


Select Maximum speed to be 115200bps



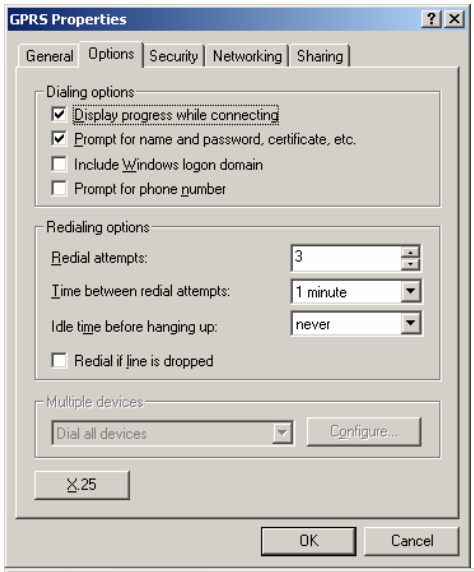
Click the Networking Tab and select Internet Protocol TCP/IP
Double click the properties





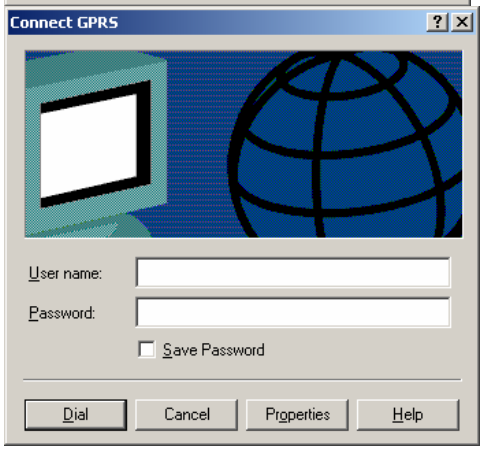
Select Options Tab and check the settings as shown

Then close all dialog boxes by pressing '**OK**'s.



Now you have finished the setup of GPRS

Now you can make a GPRS dial-up by double-click the GPRS icon. Remember to leave User name and password blank on connection (or refer to your network operator's instruction)



6. TROUBLE SHOOTING

Problem	Action
Dial-up Networking reports modem is not responding	Check if the modem is ready, LED is flashing slowly Check the serial port setting of Maestro and Windows modem device Check connection cable Check if the modem is used by another program
Dial-up not successful	Check if GPRS service ready from the network Try entering command: AT+CGQREQ=1,0,0,3,0,0 by using HyperTerminal
Dial-up successful, but disconnect immediately	Check APN setting, consult your network operator
Dial-up successful, but cannot access the Internet	Check your Windows' Internet settings Check signal strength Note : Dial-up Networking will NOT drop even signal is lost; it will try to recover soon

7. TECHNICAL SPECIFICATIONS

TNC-G110

Tri-Band GSM900/DCS1800/PCS1900
GSM/GPRS modem

The TNC-G110 from Taiko is an intelligently designed and powerful tri-band GSM/GPRS class10 modem. The modem is designed for a variety of applications, such as alert device, remote monitoring, car phone, vehicle tracking, vending machines, ATMs, Wireless pay phone and traffic control.

The TNC-G110 is the ideal solution for those seeking to develop wireless applications based on GSM/GPRS technology.

APPLICATION

- Fleet Management
- Traffic control
- Vending machines
- Mobile Trunk
- Car Phone/Telematics
- Wireless Terminal
- Alarm/Securities System
- Remote control

Features

DTR Hard-Reset Feature

To reset the modem, it can be easily done by triggering the DTR signal to the modem. (Set DIP switch 1 at back plate to OFF) The modem will detect any transition in the voltage level of this incoming DTR signal as a signal to perform a power reset instead of powering on & off the modem physically. This feature will be good for modems that are installed at remote locations. The host device (PLC/PC) which is connected to our modem can initial a reset to the modem whenever the modem seemed to "hang" for no apparent reasons by just triggering the DTR signal.

General Characteristics

1) BAND: EGSM 900/DCS 1800/PCS 1900 MHZ

	TX	RX
EGSM	880~915MHz	925~960MHz
DCS	1710~1785MHz	1805~1880MHz
PCS	1850~1910MHz	1930~1990MHz

2) GSM/GPRS: Phase 2/2+ Compliance

i. GPRS Multi Slot Class 10

ii. GPRS Mobile Station Class B:

iii. Coding Scheme: CS-1, CS-2, CS-3, CS-4

iv. GPRS data downlink transfer: max. 85.6 kbps

v. GPRS data uplink transfer: max. 42.8 kbps

3) Support SIM Interface

4) Physical

- Dimension: 95(H) x 35(W) x 74(D) mm
- Weight: 210 g

5) Power Operation Voltage: 9~36Vdc

6) Power Consumption:

Voice Call	
GSM 900	@power level #5 <350mA,Typical 240mA @power level #10,Typical 130mA @power level #19,Typical 86mA
GSM1800/1900	@power level #0 <300mA,Typical 200mA @power level #10,Typical 87mA @power level #15,Typical 80mA
GPRS Data	
DATA mode, GPRS (1 Rx,1 Tx)	
GSM 900	@power level #5 <350mA,Typical 230mA @power level #10,Typical 125mA @power level #19,Typical 84mA

GSM1800/1900	@power level #0 <300mA,Typical 180mA @power level #10,Typical 83mA @power level #15,Typical 76mA
DATA mode, GPRS (3 Rx, 2 Tx)	
GSM 900	@power level #5 <550mA,Typical 450mA @power level #10,Typical 225mA @power level #19,Typical 142mA
GSM1800/1900	@power level #0 <450mA,Typical 340mA @power level #10,Typical 140mA @power level #15,Typical 127mA
DATA mode, GPRS (4 Rx,1 Tx)	
GSM 900	@power level #5 <350mA,Typical 270mA @power level #10,Typical 160mA @power level #19,Typical 120mA
GSM1800/1900	@power level #0 <300mA,Typical 220mA @power level #10,Typical 120mA @power level #15,Typical 113mA

Software Interface

GSM 07.07:	Digital cellular telecommunications (Phase 2+); AT command set for GSM Mobile Equipment (ME)
GSM 07.10:	Support GSM 07.10 multiplexing protocol
GSM 07.05:	Digital cellular telecommunications (Phase 2+); Use of Data Terminal Equipment – Data Circuit terminating Equipment (DTE – DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)
GSM 11.14:	Digital cellular telecommunications system (Phase 2+); Specification of the SIM Application Toolkit for the Subscriber Identity Module – Mobile Equipment (SIM – ME) interface
GSM 11.11:	Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module – Mobile Equipment (SIM – ME) interface
GSM 03.38:	Digital cellular telecommunications system (Phase 2+); Alphabets and language-specific information
GSM 11.10	Digital cellular telecommunications system (Phase 2)； Mobile Station (MS) conformance specification； Part 1: Conformance specification

Note: For software AT commands, please refer to the TNC-G110 AT Command List.

Voice/Data Service

Tele Service

- Speech Service with EFR (Enhance Full Rate)/FR (Full Rate)/HR (Half Rate) Codec.
- Emergency Call
- DTMF Tone Generation

Short Message Service

- SMS with MT (Mobile Terminate)/PP, MO (Mobile Originated)/PP
- Delivery Report
- Cell Broadcast
- Support transmission of SMS alternatively over CSD or GPRS

FAX Service

- Direction: MOC (Mobile originated call) & MTC (Mobile terminated call)
- Fax GSM TS 3.45 fax transparent mode
- TS 61, 62
- TIA/EIA 578, Fax class 1, Interface to PC for GSM & PSTN
- ITU-T V.17 (14400 bps), V29 (9600bps), V27ter (2400/4800 bps)
- Transmission speed rate: 2400, 4800, 7200, 9600bps

Circuit Switch

- Data GSM TS 4.21 transparent mode
- Data GSM TS4.22 transparent mode
- Data transmission mode: asynchronous (normal)
- Radio channel: full rate
- Transmission speed rate: 2400, 4800, 9600 bps with data compression max 14400bps

Packet Switch

- GPRS Class B device
- Multi-Slot Transmission up to Class 10,
- Coding Scheme CS1 – CS4 Supported

Supplementary Service

Number identification

- Calling line identification presentation (CLIP)
- Calling line identification restriction (CLIR)
- Connected line identification presentation (CoLP)

Call Offering

- Call forwarding unconditional (CFU)

- Call forwarding on mobile subscriber busy (CFB)
- Call forwarding on no reply (CFNRy)
- Call forwarding on mobile subscriber not reachable (CFNRc)

Call Completion

- Call waiting (CW)
- Call hold (HOLD)

Multi-Party

- MPTY Supported

Call-barring

- Barring of all outgoing calls (BAOC)
- Barring of outgoing international calls (BOIC)
- Barring of outgoing international calls (BOIC- xHC)
- Barring of all incoming calls (BAIC)
- Barring of incoming calls when roaming (BIC-Roam)

RF functionalities

Maximum TX Power

The performance of the transmitter meets test requirement GSM 11.10 Chapter 13.

Band	Max	Min
EGSM	33 dBm ±2dBm	0dBm ±5dBm
DCS	30 dBm ±2dBm	±5dBm
PCS	30 dBm ±2dBm	±5dBm

Parametric Performance

Tests carried out at -20ºC, 25ºC and 60ºC for each voltage 3.6V, 3.8V and 4.0V. The Measure Peak Phase, RMS Phase, frequency error, power level, and static sensitivity meets GSM 11.10 specifications

Band	Peak Phase Error	RMS Phase Error
EGSM	<20°	<5°
DCS	<20°	<5°
PCS	<20°	<5

Sensitivity

The performance of the receiver meets test requirement GSM 11.10 Chapter 14.

Band	Typical	Min
EGSM	-106 dBm	-104 dBm
DCS	-105 dBm	-103 dBm
PCS	-105 dBm	-103 dBm

Radio Frequency

Radio Frequency (900 MHz EGSM)	
Frequency Range	TX 880-915 MHz; RX 925-960 MHz
Channel Spacing	200 KHz
Number of Channels	124 Carriers x 8 (TDMA)
Modulation	GMSK
Duplex Spacing	45 MHz
Frequency Stability	+/- 0.1 ppm (Uplink TX)
Power Output	33 dBm Class 4 (2 W peak)
Output Impedance	50 Ohm
Spurious Emission	-36 dBm up to 1 GHz (< -30 dBm > 1 GHz)
Radio Frequency (1800 MHz)	
Frequency Range	TX 1710-1785 MHz; RX 1805-1880 MHz
Channel Spacing	200 KHz
Number of Channels	374 Carriers x 8 (TDMA)
Modulation	GMSK
Duplex Spacing	95 MHz
Frequency Stability	+/- 0.1 ppm (Uplink TX)
Power Output	30 dBm – 0 dBm
Output Impedance	50 Ohm
Spurious Emission	-36 dBm up to 1 GHz (< -30 dBm > 1 GHz) Compatible with phase 2 feature
Radio Frequency (1900 MHz)	
Frequency Range	TX: 1850~1910MHz; RX: 1930~1990MHz
Channel Spacing	200KHz
Number of Channels	299 Carriers x 8 (TDMA)
Modulation	GMSK
Duplex Spacing	80 MHz
Frequency Stability	+/- 0.1 ppm (Uplink TX)
Power Output	30 dBm – 0 dBm
Output Impedance	50 Ohm
Spurious Emission	-36 dBm up to 1 GHz (< -30 dBm > 1 GHz) Compatible with phase 2 feature

Hardware Interface

RS232

The RS232 interface includes the following features –
Hardware flow control (DSR, RTS/CTS) –
Auto-baud rate with the possibility of baud rates ranging from 1200 to 115.2K bits.
The pins assignments are shown in the table below:

Pin No.	Description	Direction
1	Carrier Detect (DCD)	Output
2	TransmitData (TX)	Output
3	Receive Data (RX)	Input
4	Data Terminal Ready (DTR)	Output
5	Ground (GND)	
6	Data Set Ready (DRS)	Input
7	Request to Send (RTS)	Output
8	Clear to Send (CTS)	Input
9	Ring Indicator (RI)	Output

LED

LED is dedicated for paging identification. The status is listed as follows:

State	Status
Off	TNC-G110 is not running
64ms On/ 800ms Off	TNC-G110 does not find the network
64ms On/ 3000ms Off	TNC-G110 find the network
64ms On/ 300ms Off	TNC-G110 communication

SIM Function

The SIM Card digital interface in ABB insures the translation of logic levels between DBB and SIM Card for the transmission of 3 different signals: a clock signal, derived from a clock elaborated in DBB, to SIM Card (SIM_CLK); a reset signal, from DBB to the SIM Card (SIM_RST); and serial data from DBB to SIM Card (SIM_IO) and vice-versa.

Audio Function

Audio interface is provided via a handset connector for voice communication.

Antenna

SMA connector Antenna interface (50 Ohm)

Power connector

2way, 3.5mm pitch connector for Vdc power interface. Reverse power connection protection is provided

Environmental

Operational temperature: -20 ~ +60 ℃
Functional temperature: -20 ~ +70 ℃
Storage temperature: -40 ~ +85 ℃

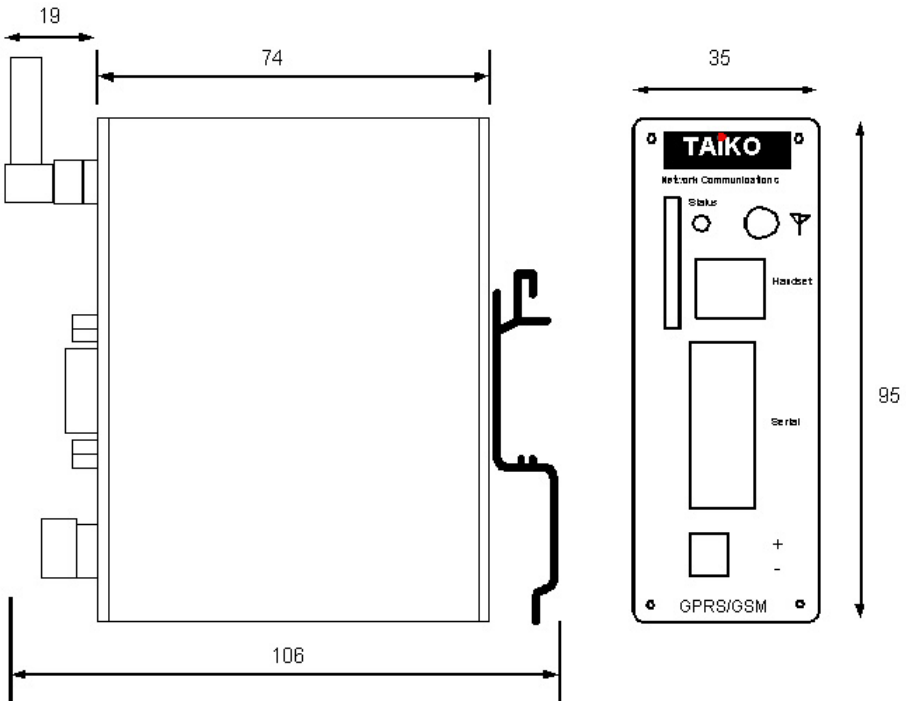
Order information

TNC-G110	900/1800/1900 MHz Tri-band GSM / GPRS Modem

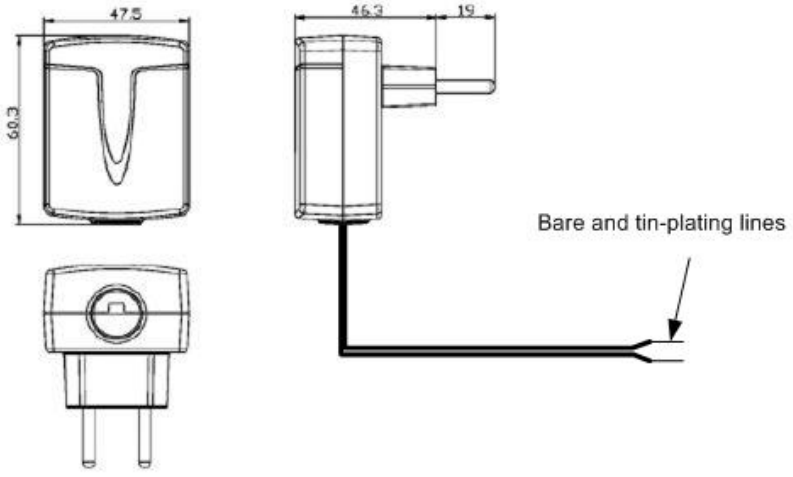
Optional Accessories

GSM-D4-3	GSM Standard antenna
GSM-D4-5	GSM Remote antenna (with 2.5m extension cable)
CAB -232	RS232C cable, 3m
ADP-24012 I	nput 240Vdc, Output12Vdc, 800mA Power adapter

Physical Package



Accessories



Model number: M10120E