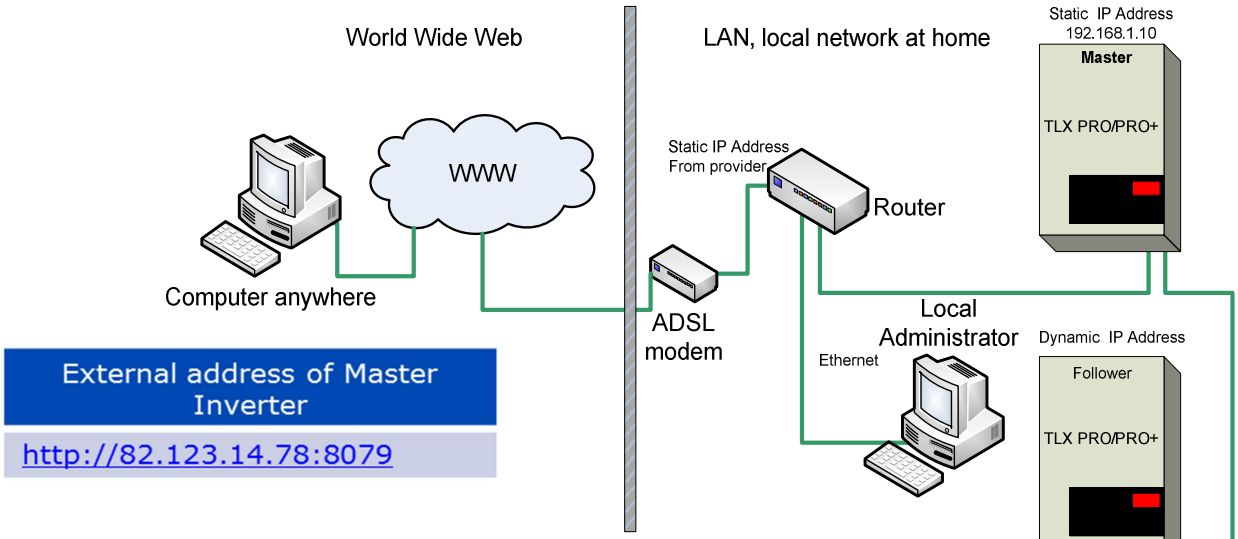
Danfoss Solar Inverters
Session 5 TLX Pro communication

5.4 TLX Pro Internet connection handbook

Port No. (NAT)		Master inverter Static IP Address
8079	=	192.168.1.10



External address of Master Inverter
http://82.123.14.78:8079

Router Static IP address(example)
82.123.14.78

Danfoss LEARNING

Learning is EARNING

PE Global Training

Contents

Preface

If you want to be able to access your TLX Pro or Pro+ inverter anywhere from the Internet there are some prerequisites to be fulfilled before this is possible.

This guide will take you through the process of configuring the TLX Pro and Pro+ and the associated Router. After finishing the guide you will be able to access your Master inverter from anywhere on the internet, and not just from inside you home.

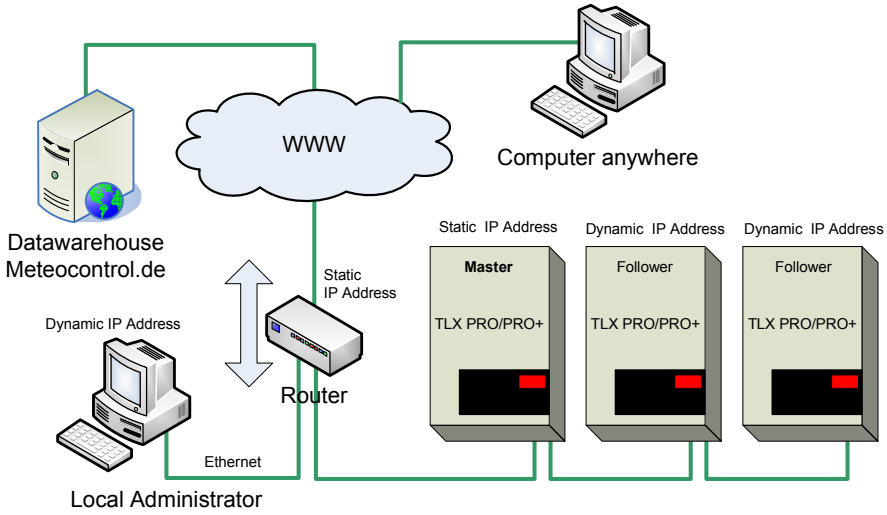
It's based on an example with a Linksys E2000 Router but the tasks to carry out are similar on other Routers for home use.

5.4.4 TLX Pro and Pro+ Internet connection guide

Many households today have already internet access through ADSL and a Router hence what is missing is only the actual configuration of the Router and Inverter to enable access from the outside also called internet access.

Typical Residential set-up

- 1 to three inverters, 5 to 30 kWp
- Standard house hold router (SOHO router)
- Computer with Internet acces
- Upload to Meteocontrol.de



- Requirement to access the Inverters from the Internet
- Monitoring during the day where you are normally at work

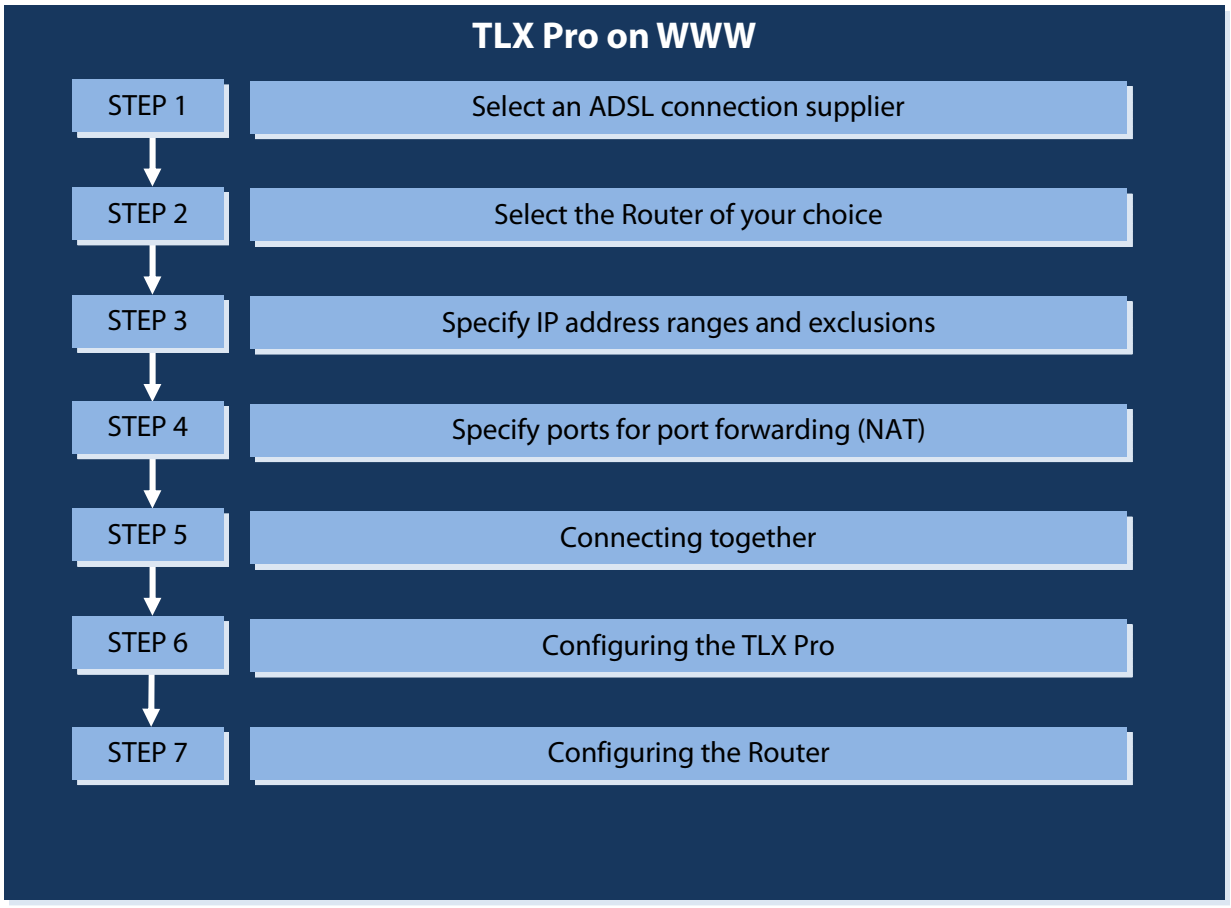
You can omit the Meteocontrol.de account and use the TLX Pro web server interface and monitoring possibilities

What is needed?

1. Internet access / ADSL connection
    a) Dynamic IP address
    b) Static IP address

2. Router
    a) Dynamic IP addressing which is default for most routers and ADSL offerings
        - Router must support dyndns.com feature
    b) Static IP address for the router. Address to be acquired from the ADSL supplier

The necessary steps to execute in order to enable access to the TLX Pro inverter from the internet.



Step 1.1 Select an ADSL connection provider

This shows a list of the most popular ADSL/Internet providers in the mentioned countries.

DK	DE	FR	ES	PT	IT
TDC	Vodafone DSL	France Télécom	Movistar	Jazztel, KPN Quest, Media Capital (IOL),	Telekom
Telenor	Telekom DSL	Orange	Jazztel	Novis/Clix, Oni Telecom,	Vodafone
	1&1 DSL	Free,	Orange	Telepac II/PT Prime	Wind
	Alice,O_2, Arcor	SFR	Ono	Via Net.works	
	Congstar	Bouygues		Vodafone	

Step 1.2 Decide whether to use dynamic or static IP addressing.

This must be agreed on with your selected ADSL provider.

- Dynamic IP addressing is typically the default from your provider (cheapest choice) but requires more configurations.
- Static IP addressing (add-on fee) but a more simple choice regarding configuration

The preferred choice for IP addressing is static as it will require less configuration and involvement from 3rd parties.

Dynamic addressing means that your provider can change your IP address without your knowledge and because you need to know the IP address to be able to access the Inverter this can cause problems.
To overcome this limitation you need to gain access to the Inverter through a service from other companies. These companies or providers are using a feature called DDNS (Dynamic DNS). These service providers are keeping track of the IP address that is assigned to your router all the time. Furthermore your Router must support these providers.

Well-known DDNS providers;
www.dyndns.org
www.tzo.com

Step 2.1 Select the Router of your choice

Select the preferred Router. Either the one that the provider is providing for you or your own choice

A list of the major Router suppliers

DK	DE	FR	ES	PT	IT
Cisco, Linksys	Vodafone Easy Box	Livebox and Livebox Pro (National standard)	Alcatel-Thomson,	DrayTek, D-Link	D-Link
Netgear	AVM Fritzbox, Telekom speedport		Amper (spanish brand)	SpeedTouch	Netgear
D-Link	Netgear, Cisco, D-Link, Linksys, Belkin		Linksys, D-Link, Netgear	Thompson	Linksys
Belkin				Linksys	Digicom

This shows a list of the most popular ADSL/Internet providers in the mentioned countries. Remember, if you are going to use dynamic IP addressing the router must support DDNS, dynamic DNS addressing.

Be aware of, that for France there exists a national standard for which Router you can use.
For further info, see the French Router connection guide presentation "**5.4.4.a IP Addresses and Livebox Orange _FR**" found on the Solar Training Intranet.

Step 3 Specify address ranges and exclusions

You must specify the IP addresses you want to use, but in most circumstances just stick to the default values from the router which normally is in the range of either 192.168.**0**.xxx or 192.168.**1**.xxx

Step 3.1 You must specify the IP address range to use

Use private address range 192.168.(0 or 1).1-255. This is default for most small home office routers.

- If your routers default is 192.168.0.(1-255) then use this
- If it is 192.168.1.(1-255) then use this

Step 3.2 You must specify the IP address range to be used for DHCP

DHCP is automatic IP address assignment to your connected host's

- The dynamic addresses are typically used for your connected computers
- Static address is used for the Master Inverter. It must have a static IP address

	Start	End	Comment
Address range	192.168.1.1	192.168.1.255	Or 192.168.1.xxx
DHCP range	192.168.1.100	192.168.1.254	Used for dynamic addressing in your home network.
Static Address range	192.168.1.2	192.168.1.99	192.168.1.1 is typically used to access the routers config. pages.
Static IP address for the Master inverter	192.168.1.10		This address must be assigned to the Master inverter.

Then change what you need to, **not more**, which is normally only the NAT tables.

DHCP (Dynamic Host Configuration Protocol), a protocol for assigning dynamic IP addresses to devices on a network. With dynamic addressing, a device can have a different IP address every time it connects to the network.

Step 4.1 Specify ports for port forwarding (NAT)

You must specify the port numbers to be used for port forwarding also called Network Address Translation (NAT)

- Port numbers are used to translate the outside IP address to an inside IP address.
- Routers normally block attempts to access anything on the inside of the router from the outside. NAT overcomes this restriction
- You only need to assign port numbers to the IP addresses of the Inverters that you want to access form the Internet hence Master Inverter

	Master inverter	Follower 1	Etc…	Comment
Inverter IP Address	192.168.1.10	192.168.1.11		Any other inverter that needs to be access from the internet must have static IP address
Inverter Port No.	8079	8078		

Routers and NAT tables
NAT devices "hide" an entire, private network behind a single public IP address, permitting the use of private addresses within the private network. Routers typically support this feature.

- LAN side components can access the WAN side trough the automatic readdressing done by the Router.
- WAN side components can NOT access LAN side without the network administrator configuring a NAT table for permanent use

NAT is like the receptionist in an office. Let's say you have left instructions with the receptionist not to forward any calls to you unless you request it. Later on, you call a potential and leave a message for them to call you back. You tell the receptionist that you are expecting a call from this client and to put them through.

The client calls the main number to your office, which is the only number the client knows. When the client tells the receptionist who they are looking for, the receptionist checks a lookup table that matches up the person's name and extension. The receptionist knows that you requested this call; therefore the receptionist forwards the caller to your extension.

Step 5.1 Connect your Router to the ADSL, and the inverter to the Router

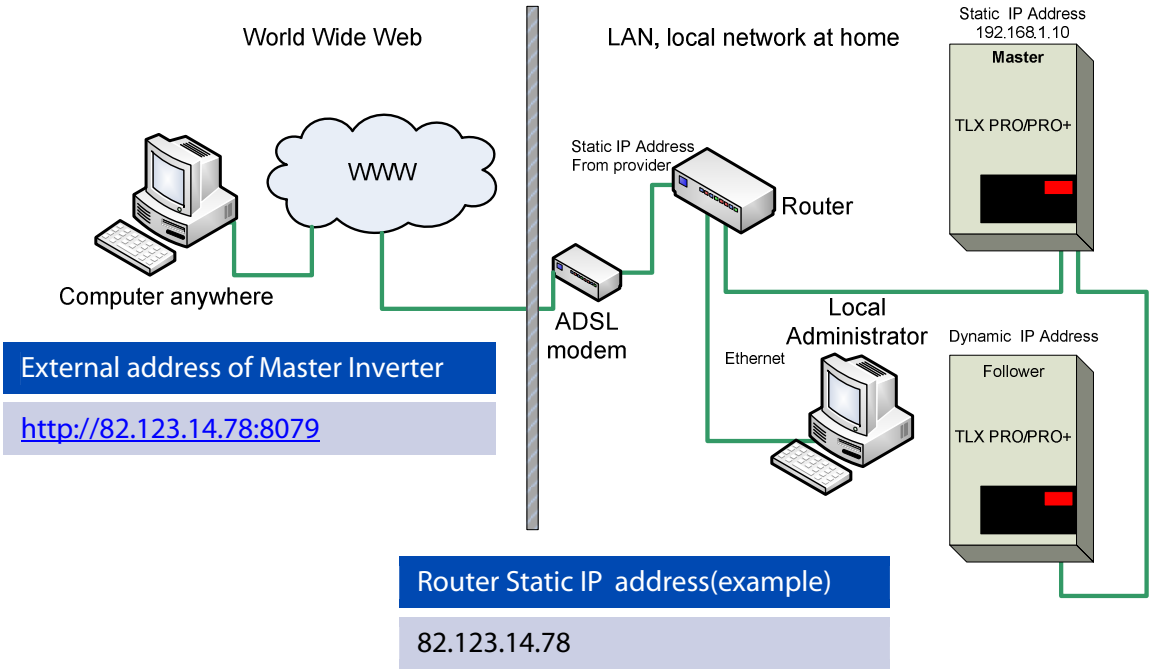
Connect your equipment together using CAT5e shielded (STP) or foiled (FTP) twisted pair cables.

These are standard cables used for Ethernet. Connect your home computer and the first (Master) inverter to the LAN interface of the Router. Connect the next Inverter to the Master Inverters second Ethernet plug.

Connect your Routers WAN Ethernet or the ADSL socket from your Router to the Ethernet socket from your provider or the ADSL socket from your provider depending on your installation.

The Static address shown here is only an example as this is decided by your provider.

Port No. (NAT)		Master inverter Static IP Address
8079	=	192.168.1.10



What you can see here is that you must combine the address of the router with the port. No. The port no. points to the IP address of the inverter. This “link” must be configured inside the router.

Step 6 Configuring the TLX Pro

To change the IP address of the Master Inverter you can log-on to the Webserver and navigate to the IP address configuration of the inverter or just using the display.

Step 6.1 On Windows XP computers

First you must logon to the inverter. You access the WEB server, (if you are on the inside of the network also called LAN side) by either typing serial No or IP address in your WEB Browser.

- You access the WEB server's login page by either typing the Serial No. (Final 10 digits of serial no. found on the product label) or
- Type "masterinverter" if your system is already configured or
- IP address of the Inverter in your WEB browser

Step 6.1 On Windows 7 computers

There is a limitation with windows 7 as you cannot use the inverter serial number or "Masterinverter" in the Internet explorer. To change the IP address of the Master Inverter you can log-on to the Webserver and navigate to the IP address configuration of the inverter or just using the display.

- **Windows 7 has changed the way it resolves names into IP addresses, therefore;**
- **You access the WEB servers login page by typing the IP address, only**

Login (Common to Windows XP and Windows 7)
- User: admin
- Password: admin

Only 1 can be logged in at the same time

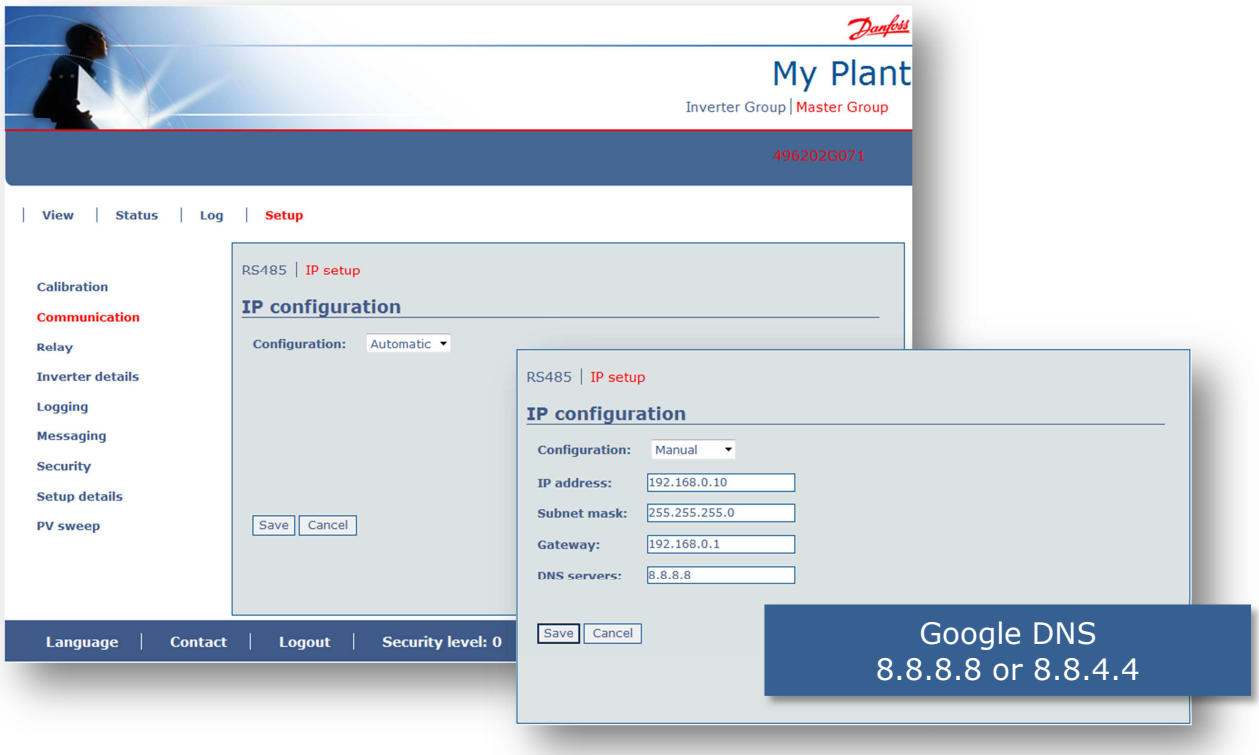
Step 6.2 Change the IP address of the Master inverter to 192.168.0.10

If you don't know the IP address and you have a Windows 7 computer you must know the IP address for the Master inverter in order to access it.
Serial no. or "masterinverter" doesn't work with Windows 7.

How do I find the IP Address for the Inverter you want to access online, if I don't know it?

1. Go to the Inverter you would like to access online
2. In the Display select Setup ↴
   Communication → IP set-up
3. Here you fine the current IP address

Navigate to the IP configuration page of the Master Inverter. You find this under "SETUP" -> "COMMUNICATION" -> "IP setup"



Either use the Web server interface to navigate to the IP configuration or use the Inverters display to change the setting.

- Change the setting from *Automatic* to *Manual* ->
- Change the IP addresses accordingly
  - *Gateway* is the base address of your router
- In the Display select Setup ↴
  Communication → IP set-up
  - And change the settings

After saving the changes you must reconnect to the Master Inverter

Insert the addresses you have selected for your system. If you use manual IP addressing you don't utilize the automatic functions from the DHCP like getting the IP address of your DNS server.

You must insert a DNS server if you are using names for SMTP and FTP settings under the communication configuration otherwise a translation from names to IP address cannot be executed.

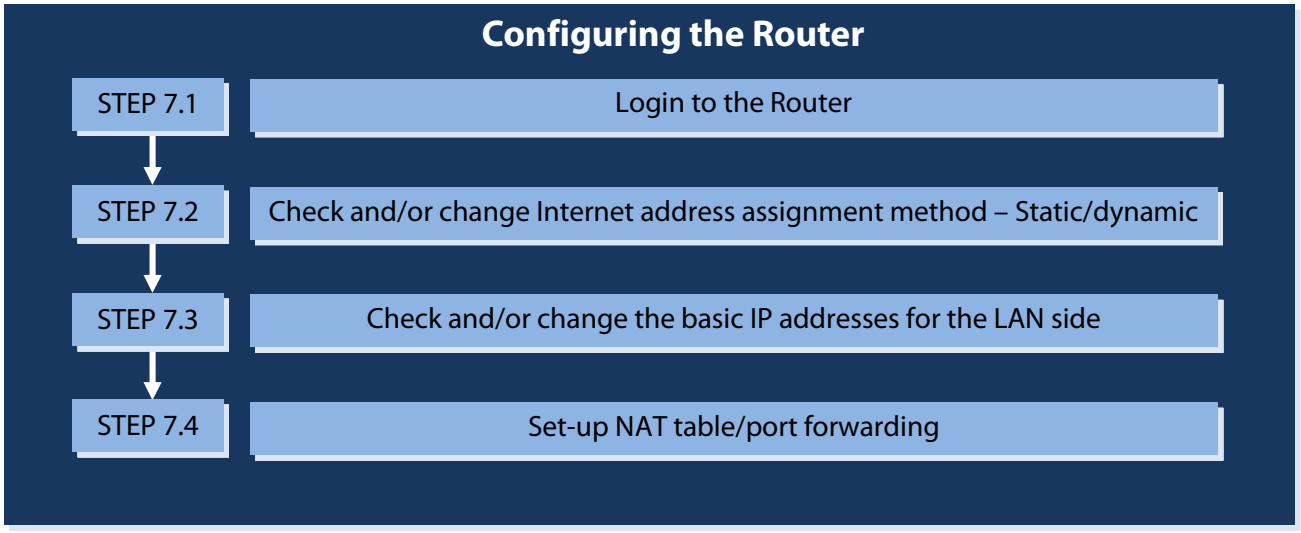
Regarding DNS server (resolves names into IP addresses) if you don't know your DNS server, then you could use Google public DNS servers. There are two, 8.8.8.8 or 8.8.4.4
(See also Google DNS document)

You lose connection once you have changed the settings. You must reconnect to continue working with the Webserver interface if needed.

Step 7 Configuring the Router

In the following example the Cisco/Linksys E2000 router will be used as an illustration of how to configure a router for port forwarding. For other routers, the process is similar.

- On www.portforward.com you can find examples on how to configure most routers



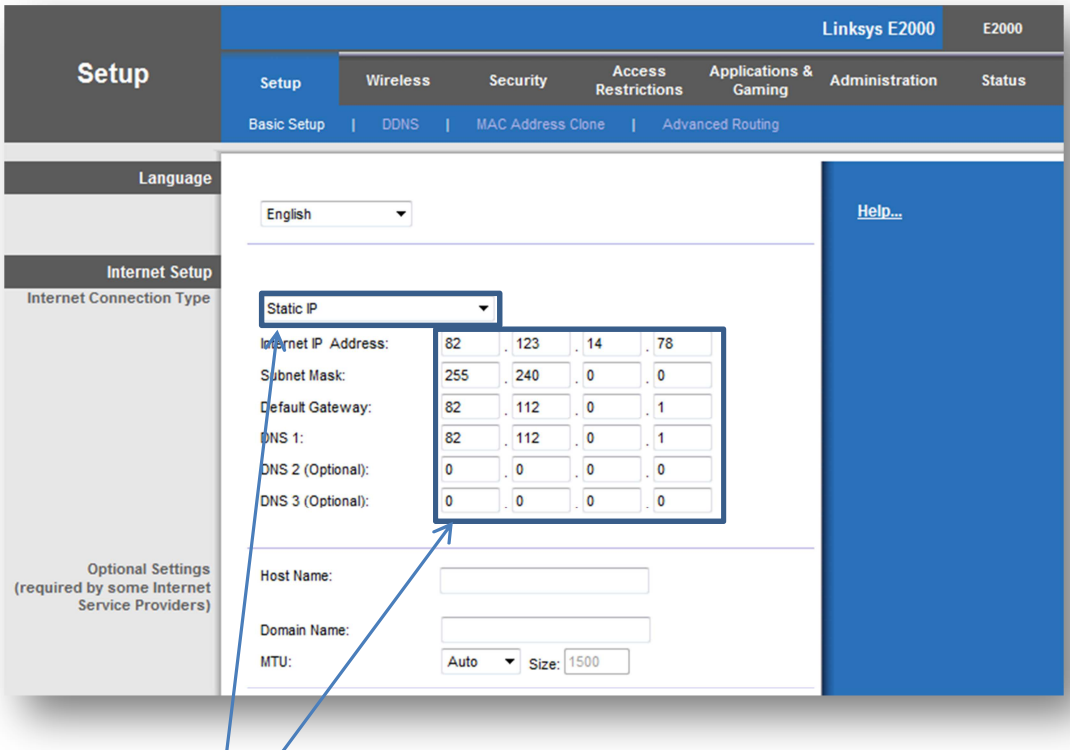
Step 7.1 Login to the Router

First you must log-in to the Router. Most Routers have a default username and password which normally are Username: admin and Password: admin. The Linksys E2000 has no username as default, only Password.

- Type in the address of your Router in your Internet browser; http://192.168.1.1
- You will be asked to log in
  - Default username
    - None
  - Default password
    - admin

Step 7.2 Check and/or change Internet address assignment method – Static IP address

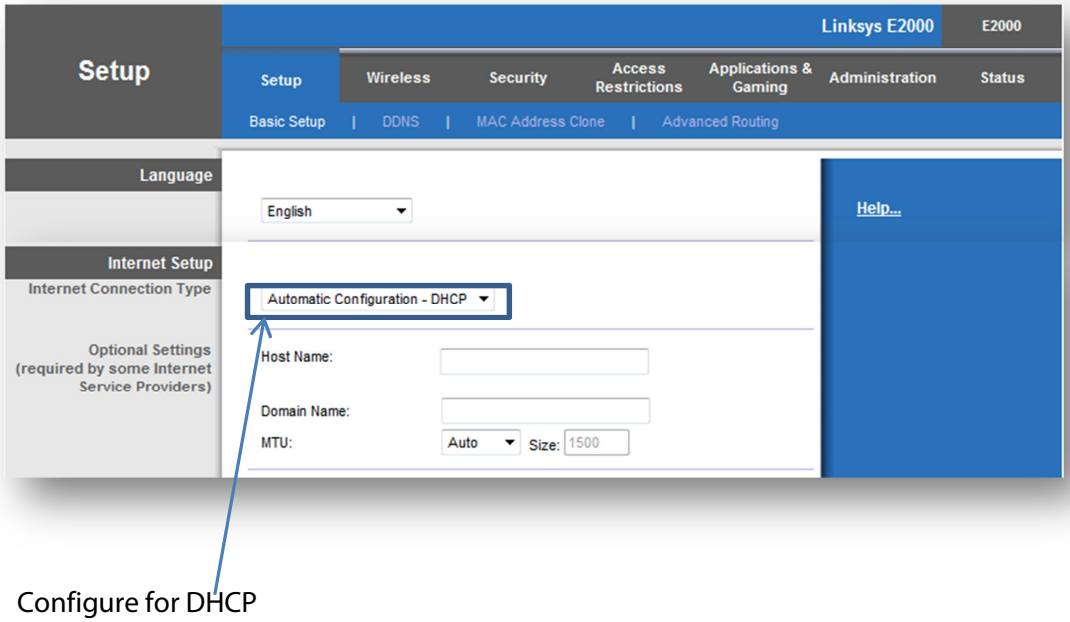
Select the Menu: Setup -> Basic setup
The preferred addressing method is static IP for Internet access. This omits the need for dyndns.org or similar.



- Configure for Static IP
  - This is the preferred selection. It minimizes configuration work
- These settings will supplied to you from your Internet Service Provider
- Settings shown are only an example

Step 7.2 Check and/or change Internet address assignment method – Dynamic IP address

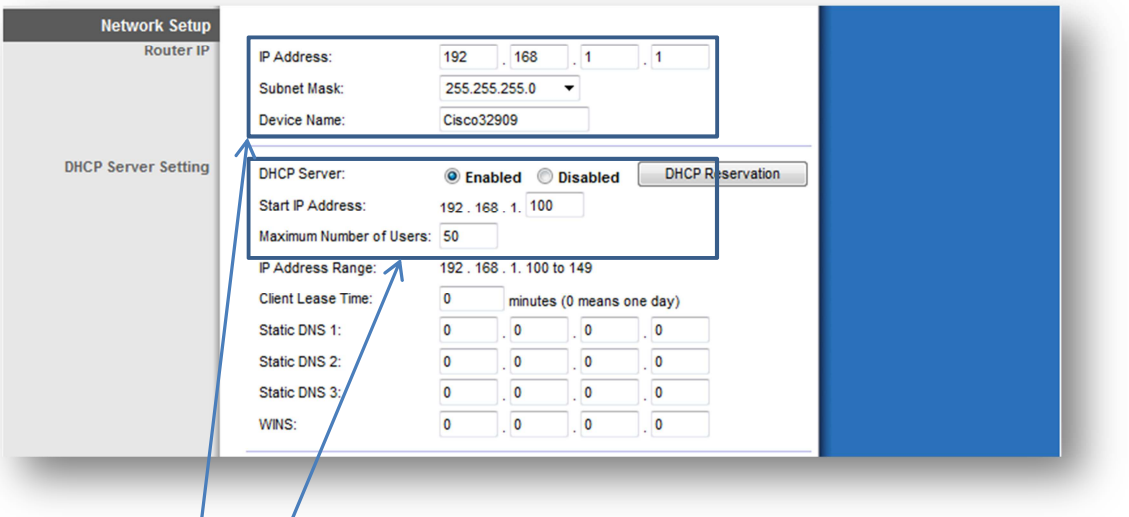
Select the Menu: Setup -> Basic setup
This configuration requires more configurations because you need a service to keep track of the changing IP address. For this you need a service like dyndns.org or similar.



- Configure for DHCP
  - This is the default setting
- This will assign an automatic IP address for the router which is used for the Internet connection
- If you select this option you also need an dyndns.org or, similar, account
- This selection requires more configuration

Step 7.3 Check and/or change the basic IP addresses for the LAN side

The below setting are default for this router and are perfectly ok to use. Previously we selected the IP address 192.168.1.10 as the static IP address for the Master inverter. As you can see it is in the range of the default configuration



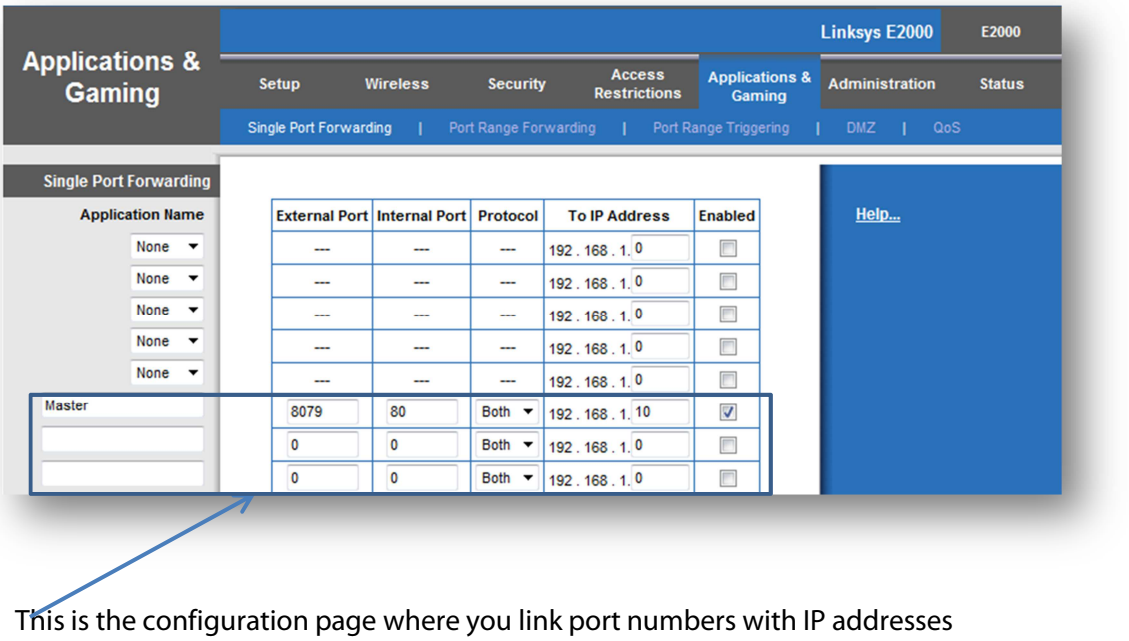
- For this Router this is the default setting
  - This defines the address segment
  - Other Routers may start with 192.168.0.1 instead
- This configures the DHCP to assign addresses in the area of 192.168.1.100 to 149
- 192.168.1.2 to 99 are reserved for static IP addressing
  - In this 192.168.1.1 is reserved for the Router

Step 7.4 Set-up NAT table/port forwarding

This show the NAT table/port forwarding configuration page. Here you assign port number to IP addresses.

This example shows that we have assigned the port no 8079 to the IP address of the Master inverter. Port numbers are just a number in the range of 0 to 65535. Some are predefined some are unused.

The reason for selecting port 8079 in this example is just to give an idea of that my port no. 8079 connects to port 80 on the inside, hence a http page. For more information on port number please see http://www.iana.org/assignments/service-names-port-numbers/service-names-port-numbers.xml

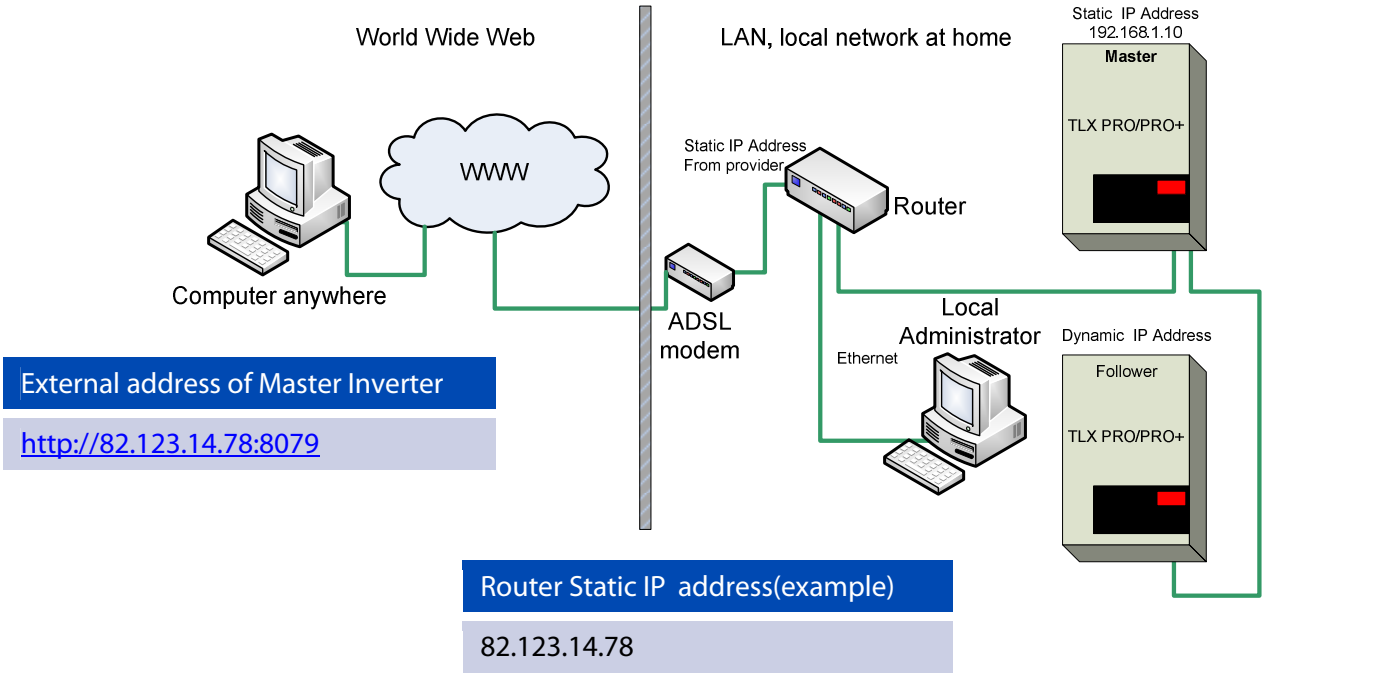


- This is the configuration page where you link port numbers with IP addresses
  - The external port is what is visible on the WAN side of the router
    - Here port 8079 is assigned
  - The internal port is the port no. of the WEB server on the inverter
  - This is always port 80
  - Port 80 means “http”

This concludes the configuration for the Master inverter and Router to enable access from anywhere on the Internet.

- You can now access the Master inverter by typing http://82.123.14.78:8079 in your Internet explorer

Port No. (NAT)		Master inverter Static IP Address
8079	=	192.168.1.10



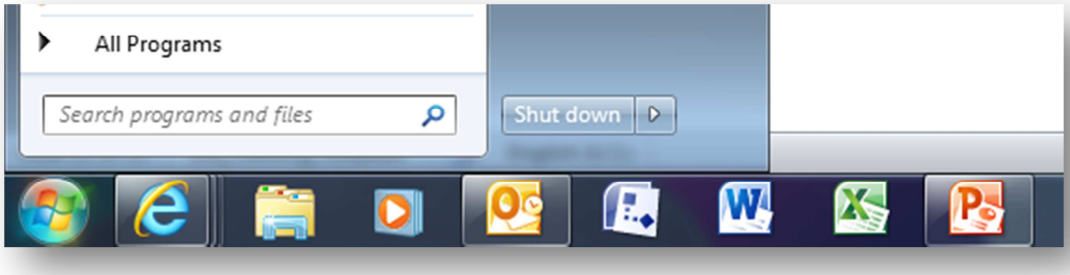
IP address shown here is only an example; use the one you have configured for your system.

IP Address of your computer

Where do i find the IP address of my computer running Windows 7 ?

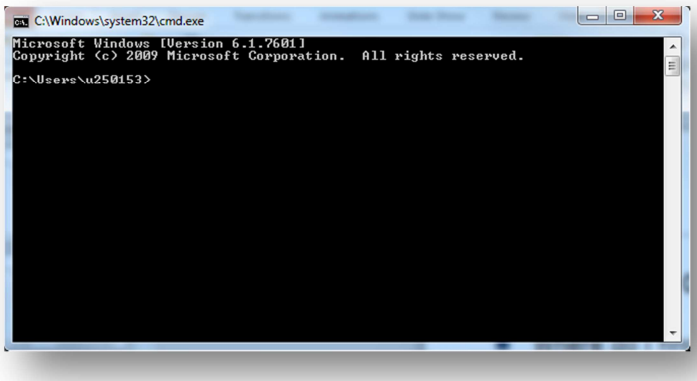
To find the IP address of your computer you can use the command called “ipconfig”. You can execute this command from a command line. This guide will show you how to do.

1. Select *the Start Menu* Windows button

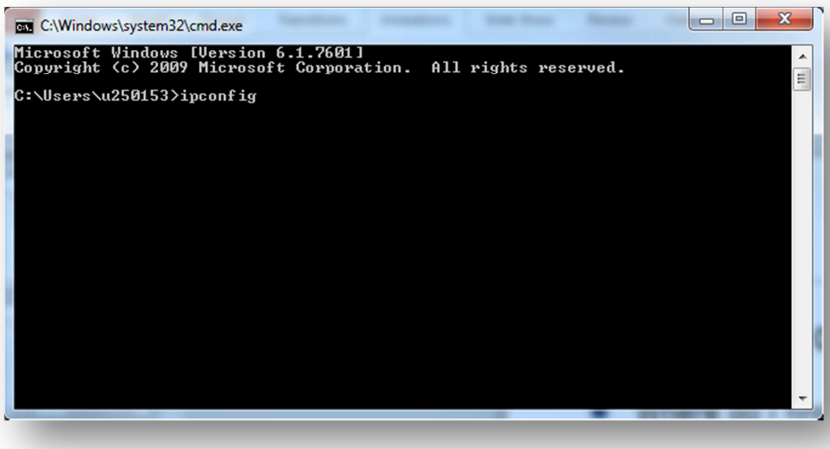


2. The *Command Line* window opens

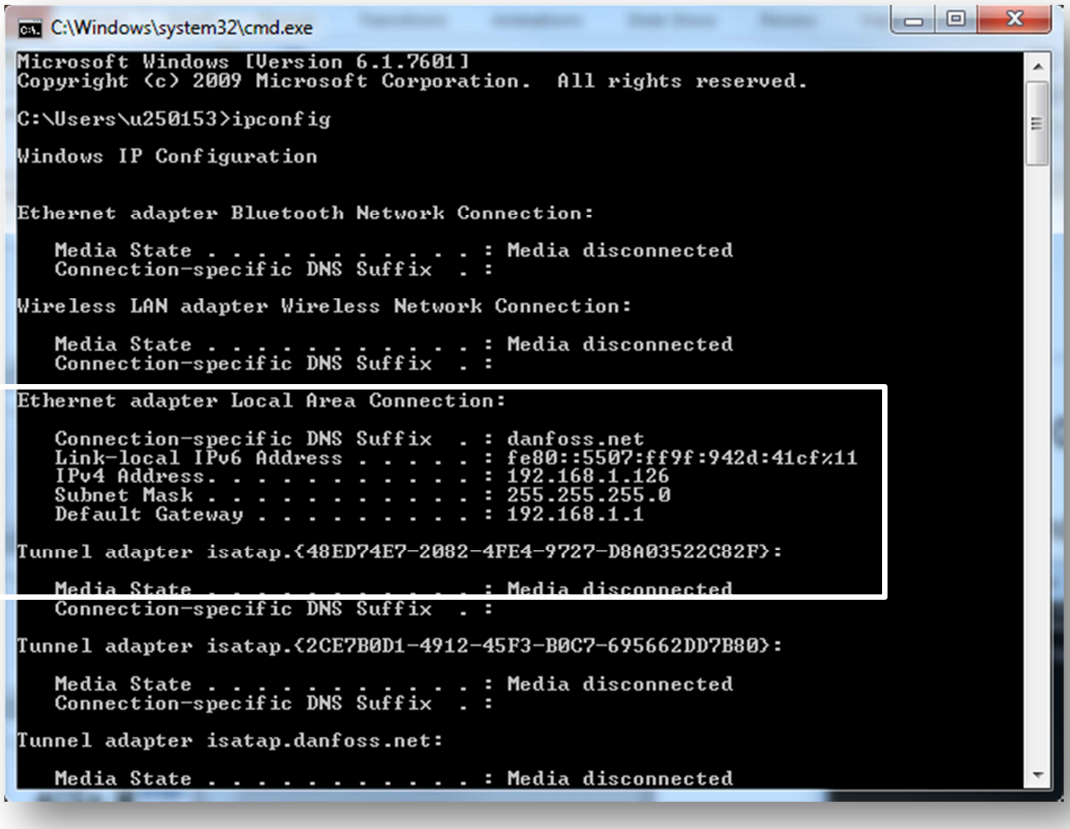
3. The *Command Line* window opens



1. At the command line, write the command *ipconfig* and press Enter



2. This will show you the network configuration of your computer and the IP address of your network card. In this example, the IP address is 192.168.126



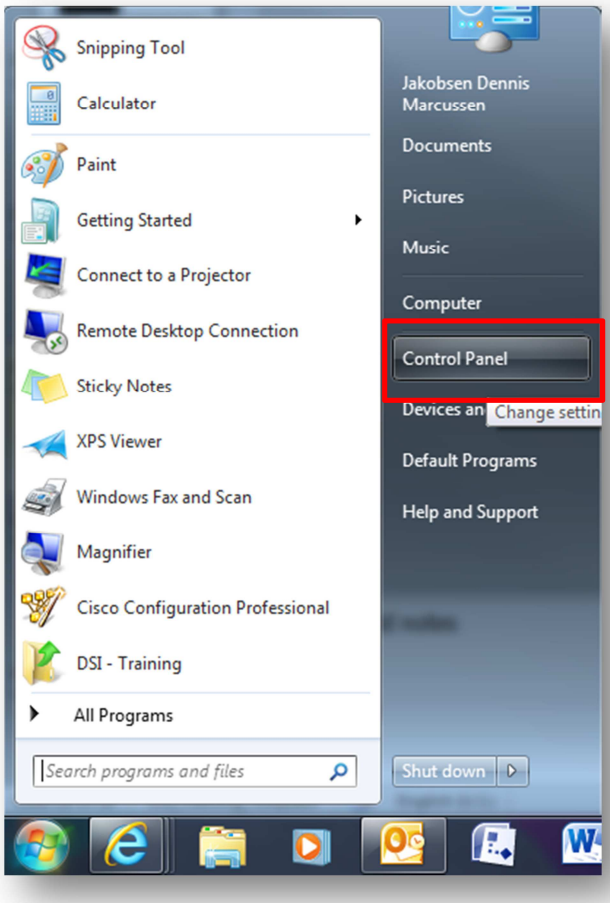
This shows you the configuration or all networks available on your computer. You must find the network card/connection that you use for the Inverter network. Typically it is called like shown in the frame.
A lot of information can be extracted with the ipconfig command. Please consult the windows help for further information.

This is valid for Windows XP also.

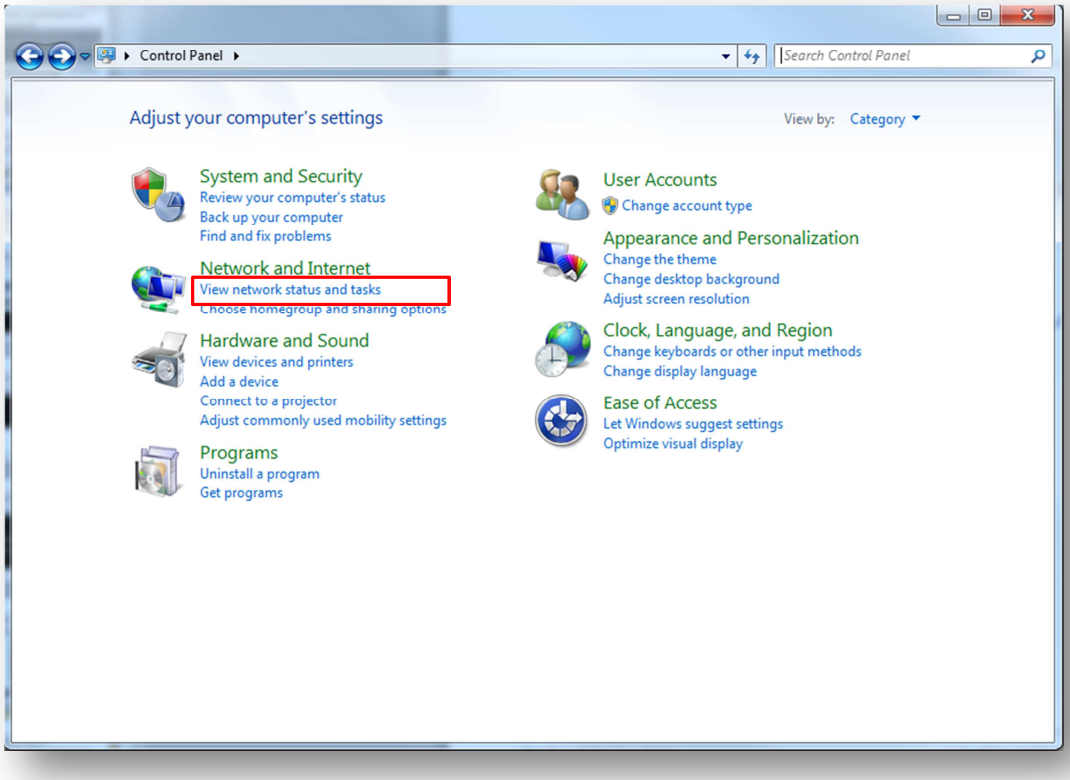
How do i change the IP address of my computer with Windows 7

To change the IP address of your computer you must change the properties of the TCP/IP protocol version 4. This guide will show you how.
Be aware of that, when changing network setting manually it could lead to loss of connection if not done right.

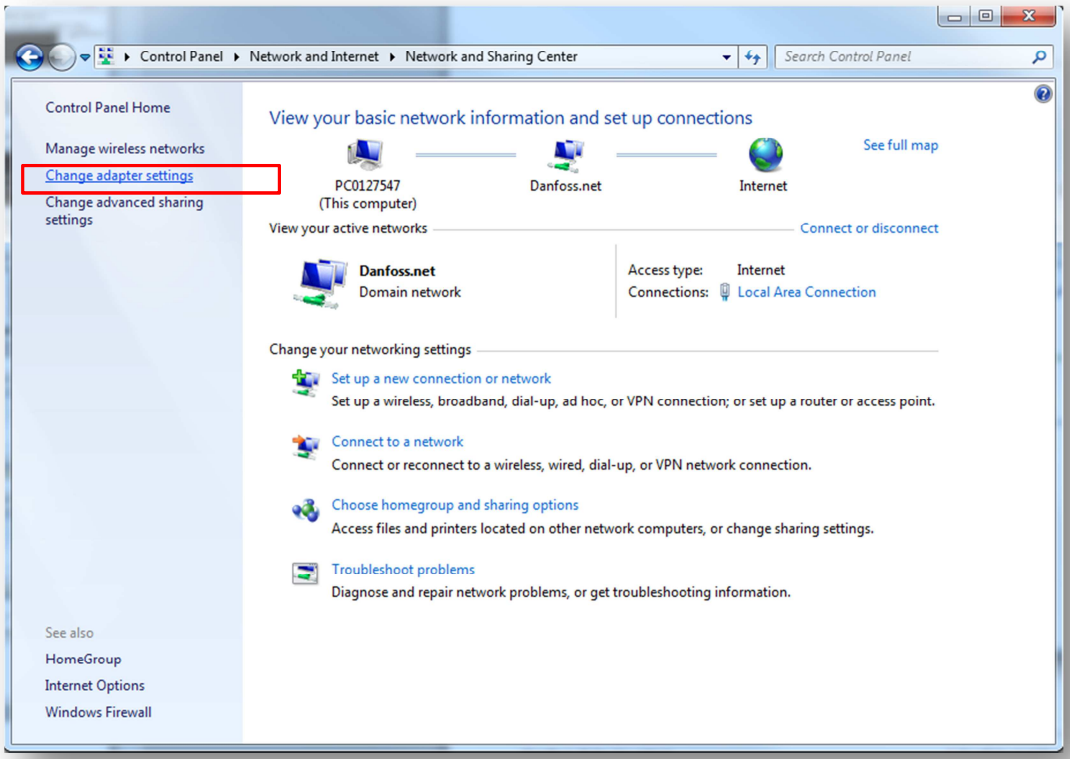
1. Open the control panel from the Windows Start Menu



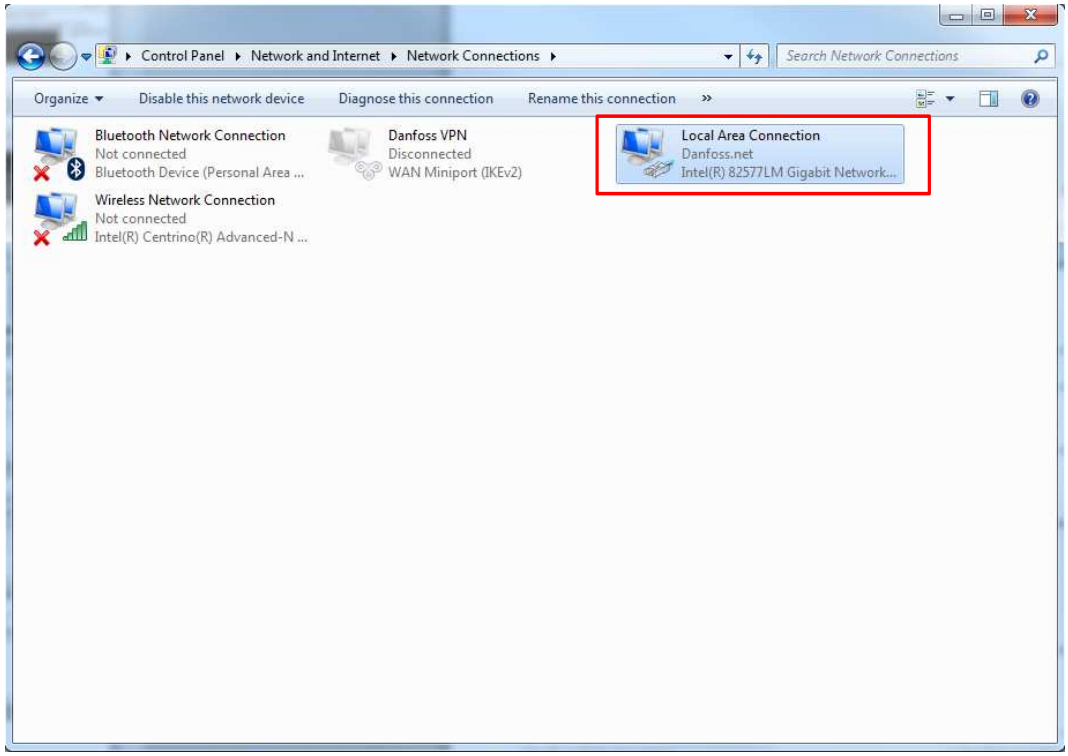
2. Click; *View network status and tasks*



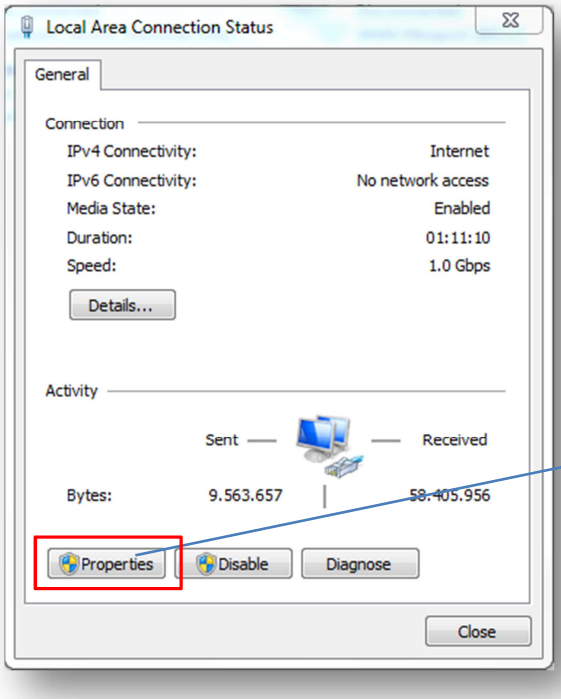
3. Click; *Change adapter settings*



4. Double click on your LAN connection

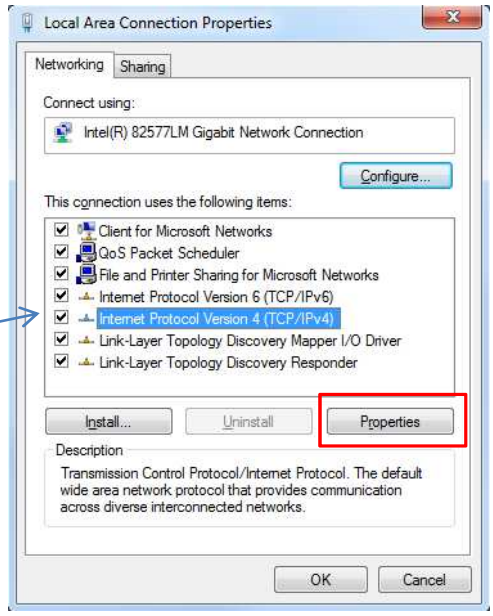


5. Click on; *Properties*

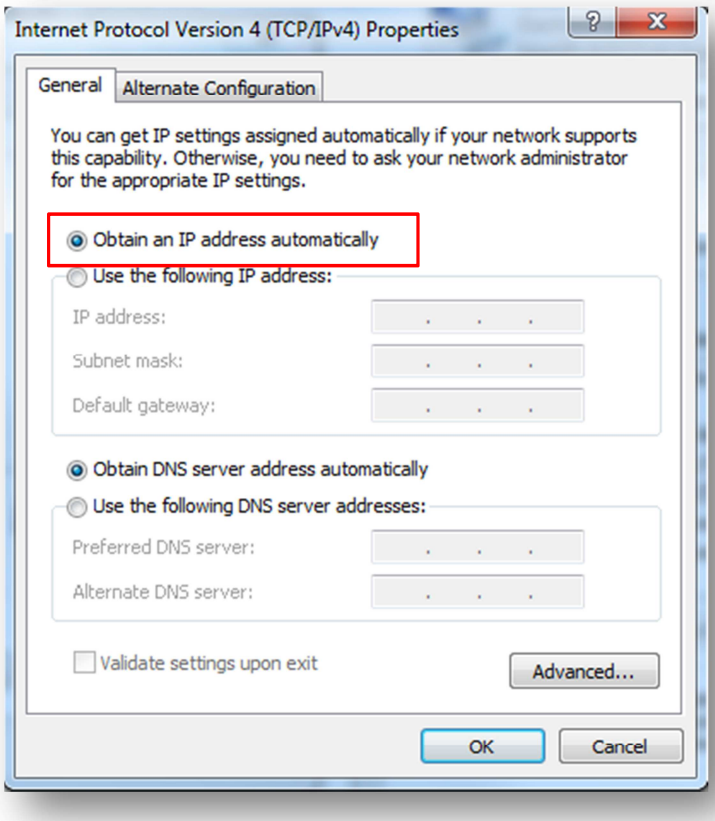


6. Select; *Internet Protocol Version 4*

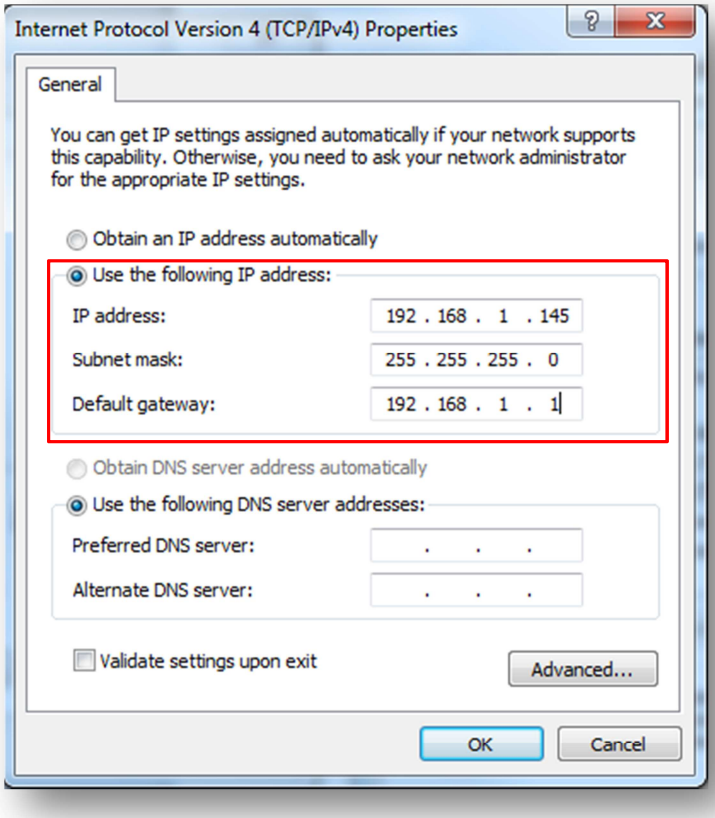
7. Click *Properties*



8. With this setting, IP addresses are obtained automatically from an DHCP server



9. If you want to change to static IP addressing select; *Use the following IP address*



10. Define your IP address and Subnet mask according to your requirements

11. Most often you do not need to define DNS

Note:
When changing to manual IP, it is preferred to have some basic IT skill's.

Wrong settings could led to loss of connection

Summary - TLX Pro Internet connection guide

- You have now learned how to configure the TLX Pro and Pro+ and associated Router to enable Master inverter access from anywhere on the internet, and not just from inside you home
- You have learned where to find your computers IP address
- You have learned how to change the IP address of your computer, running Windows 7

Danfoss Solar Inverters A/S

Danfoss Solar Inverters offers a comprehensive range of advanced grid-connected inverters for residential and commercial solar energy applications. The product range also includes solutions for monitoring the solar system in order to achieve optimal energy output and return on investment.
Energy–saving products and solutions have always been a core competence and now renewable energy generation is added to the Danfoss portfolio of products making modern living possible. Danfoss has 40 years of experience in power electronics technology; solar inverters and frequency converters are technologically closely related.

Contact information

Main web page
www.danfoss.com/solar

Service and hotline information

http://www.danfoss.com/BusinessAreas/Solar+Energy/Service/

Call our Hotline and let us take care of the rest.
We speak five languages – English, German, French, Spanish and Italian – and know exactly how to provide the technical support you need.

High speed inverter Exchange Service
If an exchange inverter is required, we guarantee that it is shipped as soon as possible and within no more than 24 hours.

On-Site Service
If the service issue cannot be solved by our Hotline guidance or Exchange Service, our experienced On-Site service teams are prepared for the task, which is initiated within 24 hours.

Call our Hotline and we will find the easiest and fastest way ensuring that your system is up and running.

Hotline numbers

English:	+ 45 7488 1349
German:	+ 49 (0) 69 8902 454
Italian:	800 29 10 60
French:	0820201043
Spanish:	+34 91 383 0455