

User Guide – MODBUS TCP/IP protocol
Firmware Version: 8900

DAT 8019

PRELIMINARY DESCRIPTION

All of the data shared by a device communicating by Modbus TCP/IP protocol are mapped in tables, at each data is associated a proper address. Each data can be of two types:

- "REGISTER", data of 2 bytes size (word of 16 bits) that can be associated to analogue input or output, variables, set-point, etc...
- "COIL", data of 1 single bit that can be associated to digital input or output or to a logic state.

A register could contain the image (mirror) of more coils; in example the 16 digital inputs of a device could be read or written as bit (singularly) addressing the coil related to each input or can be read or written as a single word addressing the associated register wherein each bit corresponds to a coil.

In the Modbus protocol, registers and coils are divided as per the following groups of addresses:

0xxxx and 1xxxx = Coils (bit)

3xxxx and 4xxxx = Registers (word)

When reading functions are performed, use the tables indicated below to address the registers .

It is possible to access to the internal registers of the device by direct command Modbus TCP/IP or by the integrated web server.

REGISTERS TABLE

Position Register	Description	Access
40002	Firmware [0]	RO
40003	Firmware [1]	RO
40004	Name [0]	R/W
40005	Name [1]	R/W
40007	Node ID	R/W
40011	System Flags	R/W
40013	Watchdog timer	R/W
40031	Input type Ch (1-0)	R/W
40032	Input type Ch (3-2)	R/W
40033	Input type Ch (5-4)	R/W
40034	Input type Ch (7-6)	R/W
40036	Break status	RO
40041	Analog Input (0) - Ch0	RO
40042	Analog Input (1) - Ch1	RO
40043	Analog Input (2) - Ch2	RO
40044	Analog Input (3) - Ch3	RO
40045	Analog Input (4) - Ch4	RO
40046	Analog Input (5) - Ch5	RO
40047	Analog Input (6) - Ch6	RO
40048	Analog Input (7) - Ch7	RO

COILS TABLE

(*)Coil (Hex)	(*)Coil (Dec)	Description	Access
0x00A1	00161	Watch-dog Enable	R/W
0x00A2	00162	Watch-dog Event	R/W
0x00A3	00163	Power-Up Event	R/W

SUPPORTED MODBUS FUNCTION CODES

Function	Description
01	Read Coil Status (0xxxx)
02	Read Inputs Status (1xxxx)
03	Read Holding Registers (4xxxx)
04	Read Inputs Registers (3xxxx)
05	Force Single Coil
06	Preset Single Register
15 (0F)	Force Multiple Coil
16 (10)	Preset Multiple Registers

NOTES:

(*) If the software DEV9K is in use subtract 1 to the address position number of the register and/or coil.

Registers and coils marked as RO in the column 'Access' are Read Only registers.

Registers and coils marked as R/W in the column 'Access' are Read and Write registers.

For the devices of DAT8000 series, the group of data 0xxxx is the mirror of the group 1xxxx, the group of data 3xxxx is the mirror of the group 4xxxx, therefore the first register could be addressed either as 30002 (with function 04) or 40002 (with function 03).

The maximum number of coils that can be read through Modbus functions 01 and 02 (see "Supported modbus functions codes") are: **128**

The maximum number of registers that can be read through Modbus functions 03 and 04 (see "Supported modbus functions codes") are: **64**

The maximum number of registers that can be written by Modbus function 16 (see "Supported modbus functions codes") are: **64**

The maximum number of coils that can be written by Modbus function 15 (see "Supported modbus functions codes") are: **64**

DESCRIPTION MODBUS REGISTERS

40002 / 40003 : FIRMWARE

Field of 2 read only registers ; contains the firmware identifier provided by the manufactured.
- Default value: 8900 (hex)

40004 / 40005 : NAME

Field of 2 read/write registers (4 bytes or 4 ASCII characters) available for the user, it can contain the name of the device or an abbreviation that identifies its function inside the plant. Each one of the 4 bytes could be written by values from 0 to 255, ASCII characters included.
The default value of this field contains the identifier of the device expressed in ASCII characters.
- Default value: "8019" (ASCII).

40007 : NODE ID

Contains the MODBUS address of the device; the values allowed are from 1 to 245 decimal.
This data is necessary for the correct addressing of the device into the Modbus net and must follow the IP address.
- Default value: Dec: 1, Hex: 01 INIT: Dec 245, Hex : F5.

40011 : SYSTEM FLAGS

Contains the enable bits and system events of the device. The following parameters are configurable:

Watchdog Event Enable: this bit allows to enable the Watchdog Event (0 = Watchdog disabled, 1 = Watchdog enabled). If this bit is active and the device doesn't receive commands for the time specified in the register 40013 "Watchdog timer", the PWR green led blinks.
If this function is required must be implemented at the power-on of the device; the bit must be reset manually when the Watchdog event is occurred.
Watchdog Event: if this bit is set as 1 indicates that the Watchdog condition has happened (0 = Normal condition; 1 = alarm condition)
PowerUp Event: this bit is forced to 1 at each power on and indicates that the device has been switched off or reset. With the setting of this bit as 0 and checking its state, it is possible to know if a reset of the device has occurred (0 = reset not occurred; 1 = reset occurred).
This bit must be reset manually.

Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Coil	-	-	-	-	-	163	162	161	-	-	-	-	-	-	-	-
Descr.	<div style="display: flex; justify-content: space-between;"> <div style="width: 100px;"></div> <div style="width: 100px;"> <p>└─ Watchdog Event enabling</p> <p>└─ Watchdog Event</p> <p>└─ Power-up Event</p> </div> </div>															

40013 : WATCHDOG TIMER

Contains the value of the WatchDog timer, expressed in step of 1 second. If the WatchDog is enabled and the device doesn't receive commands in a time lower or equal to the value of the one expressed in this register the WatchDog will be activated (see description register "System Flags").
- Default value: 10 (10 sec.)

40031: INPUT TYPE Ch (1-0)

This register shows the input type that is configured in relation to the type of sensor connected. The table beside shows the types of sensors that can be connected to the input with the corresponding value to write on the low part of register for the configuration of the input type.

- Default manufacturer : PT100 (0D0D Hex)

Attention: both input types set in this register must belong to the same typology according to the table "input type divided by typology (gain)" beside.

Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Descr.	Input type #1								Input type #0							

40032: INPUT TYPE Ch (3-2)

This register shows the input type that is configured in relation to the type of sensor connected. The table beside shows the types of sensors that can be connected to the input with the corresponding value to write on the low part of register for the configuration of the input type.

- Default manufacturer : PT100 (0D0D Hex)

Attention: both input types set in this register must belong to the same typology according to the table "input type divided by typology (gain)" beside.

Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Descr.	Input type #3								Input type #2							

40033: INPUT TYPE Ch (5-4)

This register shows the input type that is configured in relation to the type of sensor connected. The table beside shows the types of sensors that can be connected to the input with the corresponding value to write on the low part of register for the configuration of the input type.

- Default manufacturer : PT100 (0D0D Hex)

Attention: both input types set in this register must belong to the same typology according to the table "input type divided by typology (gain)" beside.

Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Descr.	Input type #5								Input type #4							

40034: INPUT TYPE Ch (7-6)

This register shows the input type that is configured in relation to the type of sensor connected. The table beside shows the types of sensors that can be connected to the input with the corresponding value to write on the low part of register for the configuration of the input type.

- Default manufacturer : PT100 (0D0D Hex)

Attention: both input types set in this register must belong to the same typology according to the table "input type divided by typology (gain)" beside.

Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Descr.	Input type #7								Input type #6							

TABLE INPUT TYPE

Input	Value (Hex)	Value (Dec)
Disabled	00h	0
Res 2000 Ohm	12h	18
Res 500 Ohm	0Ch	12
Pt100	0Dh	13
Ni100	0Fh	15
Pt1000	0Eh	14
Ni1000	10h	16

INPUT TYPE DIVIDED BY TYPOLOGY (GAIN)

Typology A	Typology B
Res 500 Ohm	Res 2000 Ohm
Pt100	Pt1k
Ni100	Ni1k

40036 : BREAK STATUS

When the sensor connected to a channel is in break condition (for the breaking of the sensor, for the disconnected cable or for the over-temperature), the bit corresponding to the channel is set to 1.

Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Input	-	-	-	-	-	-	-	-	#7	#6	#5	#4	#3	#2	#1	#0
Descr.																

40041 : ANALOG INPUT #0
40042 : ANALOG INPUT #1
40043 : ANALOG INPUT #2
40044 : ANALOG INPUT #3
40041 : ANALOG INPUT #4
40042 : ANALOG INPUT #5
40043 : ANALOG INPUT #6
40044 : ANALOG INPUT #7

These registers return the measure of each channel , converted to engineering units: the values are expressed in ohm for Res 2000 ohm inputs, decimals of ohm for Res 500 ohm inputs and decimals of °C for RTD inputs.

The format is an integer number of 16 bit with sign.

Example of reading:

- The input is set in **RTD**
Value read in the register: 246 → 24,6 °C
- The input is set in **Res 2000 ohm**
Value read in the register: 1256 → 1256 Ω
- The input is set in **Res 500 ohm**
Value read in the register: 1352 → 135,2 Ω

WEB SERVER STRUCTURE

To access the server, run the Web browser and edit in the Address Bar the IP address of the device. It will appear the following window. Depending on the Web browser used some icons and/or writings may have little variation of shape and colour. If necessary, it is possible to connect to the Datexel web site to download the data-sheet and the user guide of the device in use clicking on the button "www.datexel.it" in the bottom part of the window.

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datexel@datexel.it

COMPONENTS FOR ELECTRONICS INDUSTRIAL AND PROCESS CONTROL

Enter Username and Password then press LOGIN

Username

Password

LOGIN

Visit our website: www.datexel.it

Write Username and Password. If the default settings are in use the parameters to access are:

Username: *Fact_user*; Password: *Fact_pwd*

Click on the button *Login* to access to the Home page of the device; it will appear as follows.

In all the web pages, on the top part of the window there are the buttons:

"Page Back" to go back to the page previously visualized; "Home" to return to the main page; "Logout" to quit and get back to the Login page.

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Back Home **DAT8019** Logout

Select Language

ENGLISH OK

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To access the page "Main Menu" of the device, select the language by the combobox and click the button "OK". The following window will appear.



By this page it is possible to access the internal parameters of configuration of the device. If the mouse pointer is moved on the button related to a specific menu, it will appear a green tool tip that will help the user with the selection of menus that are the following:

Network Settings: allows to set the Ethernet communication parameters.

System Configuration: allows to set the system configuration parameters.

Software Update: allows to execute, if necessary a software update.

Username and Password: allows to set the access data used in the Login page.

Analog Input: allows to visualize the value of the analog inputs and if necessary to disable one or more .

In the next sections there is the description of the menus.

Network Settings



IP Address: allows to visualize and set the unique IP address of the device in the network in use.

Subnet Mask: allows to set the parameter of the Subnet Mask in order to determine the local network of the device.

Gateway Mask: allows to set the parameter of Gateway Mask for the correct addressing of the device.

Socket Timeout: allows to set the time expressed as minutes; that when it expires without to receive commands, the device will close the socket of communication.

To save the modified parameters, click the button "Save". Wait for the reset of the device and access to it via the new parameters set.

System Configuration



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Back Home **DAT8019** Logout

System Configuration

Name:

Modbus Address:

WatchDog Enable: TimeOut:

WatchDog Event:

PowerUp Event:

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Name: allows to visualize and set the parameter NetBios Name of the device; this parameter, composed by max 15 alphanumeric characters, is visualized beside the IP address in the software Dev9k; it can also be used in the software that implement the use of this data.

Modbus Address: allows to visualize the modbus address of the device; this parameter is forced to 245 in INIT condition.

Watchdog Enable (ref. Reg "System Flags"): this flag allows to enable the Watchdog event (0 = WatchDog disabled, 1 = WatchDog enabled).

Timeout (ref. Reg "WatchDog timer"): allows to set the value, expressed as step of 1 second, of the WatchDog timer .

Watchdog Event (ref. Reg "System Flags"):this flag is used to signal that the Watchdog condition is happened (0 = Normal condition;1 = Alarm condition).

Power-up Event (ref. Reg "System Flags"):this flag is forced to 1 at each power-on and indicates that the device has been switched-off or a reset has occurred. (0 = reset not happened ; 1 =reset happened).

To save the modified parameters, click the button "Save". To read the parameters from the device click the button "Refresh".

Software Update



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Back Home **DAT8019** Logout

Software Update

To update the system software press **UPGRADE**, enter your Username and Password, then select the appropriate file from a local folder.

Do not turn the power off to the device during the upgrade process!

Actual Firmware:

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This section allows to update the versions of the firmware or web server and is used in case of necessity. To execute the update click on the button "Upgrade"; the system will open a pop-up window where to insert the credentials to proceed with the update. Contact the Technical Assistance service for information about the procedure to follow. The parameter "Actual Firmware" shows the firmware version loaded on the device.



Username and Password



This section allows to set user name and password to access the Webserver of the device.

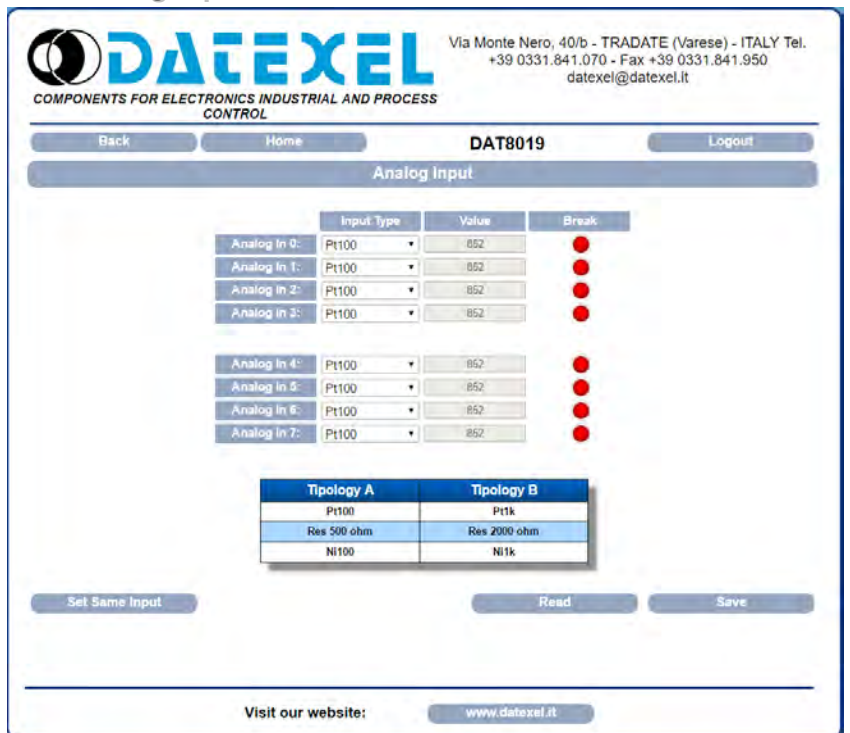
Username: allows to set and visualize the user name of the device. Default "Fact_user".

Password: allows to set and visualize the password of the device. Default "Fact_pwd".

To save the modified parameters, click the button "Save".



Analog Input



This section allows to visualize the value of the analog inputs in the unit of measurement defined by the "Input Type". It is possible to set different sensors for each input because the channels are isolated from each other.

Each input can be disabled selecting "Disabled" from the combobox under the column "Input Type". Clicking the button "Read" it updates the value read from the device and so each field under the column "Value" and "Break"

Input Type (ref. Reg "Input Type"): allows to choose and visualize the type of the input(in relation to the sensor connected) or to disable it. Each pair of input type selected must necessarily belong to the same typology according to the table. *This involves that won't be possible to set the Analog In 0 as typology A and Analog In 1 as typology B; the input types must be of the same typology (both as Pt100, one Pt100 and one Res 500 ohm, one Ni1k and one Pt1k, etc).* It will be possible to set the first pair of input type as typology A (or B) and the second pair of input type as typology B (or A).

Value (ref. Reg "Analog Input"): shows the value contained in the register associated to the analog input.

Break (rif. Reg "Break"): indicates that the sensor in input is not connected, so one of the wires of the sensor is interrupted, or that the sensor is in over-temperature. The warning is shown by a red LED under the column "Break" at the channel where it occurred.

Set Same Input: this button allows the user to set the same input type for each input channels. To use this feature select the desired input from the combobox refers to the first channel ("Analog In 0 ") and then click the button "Set Same Input" to automatically set the same input type for each channels. Press the button "Save" to save the configuration.

To save the modifies related to "Input Type", click the button "Save".

PROCEDURES

USE OF THE FUNCTION "INIT" (*)

All of the devices of DAT8000 series are equipped with the INIT modality. This is a procedure to access the device by the default parameters and to proceed with its configuration:

IP Address: XXX.XXX.XXX.XXX (assigned by DHCP if enabled)
192.168.1.174 (DHCP disabled, verify that the IP is not in use)

Modbus address: 245

By these parameters it is possible to access the device in INIT modality to set and check how it is configured.

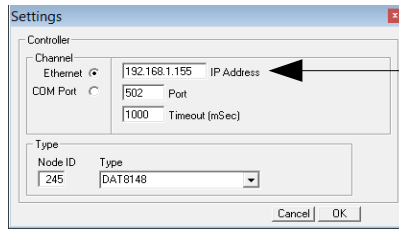
To work in INIT follow the procedure:

- Switch-off the device;
- Connect the terminal INIT to terminal -V as shown in the technical datasheet of the device.
- Power-on the device;
- Connect to the device by use of the default above parameters.

When the user finish to work in INIT:

- Switch-off the device;
- Disconnect INIT;
- Power-on the device and connect to it by the known parameters or by those set in INIT modality.

(*): If the software Dev9k is in use, with the goal to allow the correct identification of the device the parameter Netbios name must be set as "DAT8019". If different after the to have searched for the device (Pict 1 in next page), access by the menu Settings->Controller as shown in the picture below.



IP address assigned by DHCP visualised in the menu Search.

WATCHDOG

The devices of the DAT8000 series are equipped with the Watchdog timer; if enabled it activates an alarm each time that there is not communication between the device and the master for a time greater than that specified .

During this alarm condition the green led PWR on the front of the device blinks and the coil "Watchdog Event" is forced to 1. To exit from the alarm condition, send any command to the device and reset the coil "Watchdog Event".

FUNCTION BUTTON "P"

In the case it is necessary to restore the default parameters of the device , with device powered and not in INIT condition, push the button "P" located on the front for at least 5 seconds.

The green led PWR will switch-off, the yellow led STS will become orange and the reset of the device will occur.

When the reset procedure is finish, both the leds will set back to the default condition and will be loaded the following parameters:

Ethernet:

- IP Address : 192.168.1.100
- Subnet Mask : 255.255.255.0
- Gateway Mask: 192.168.1.1

Username: Fact_user

Password: Fact_pwd

Modbus:

Address : 1

SEARCH A DEVICE OVER THE NETWORK

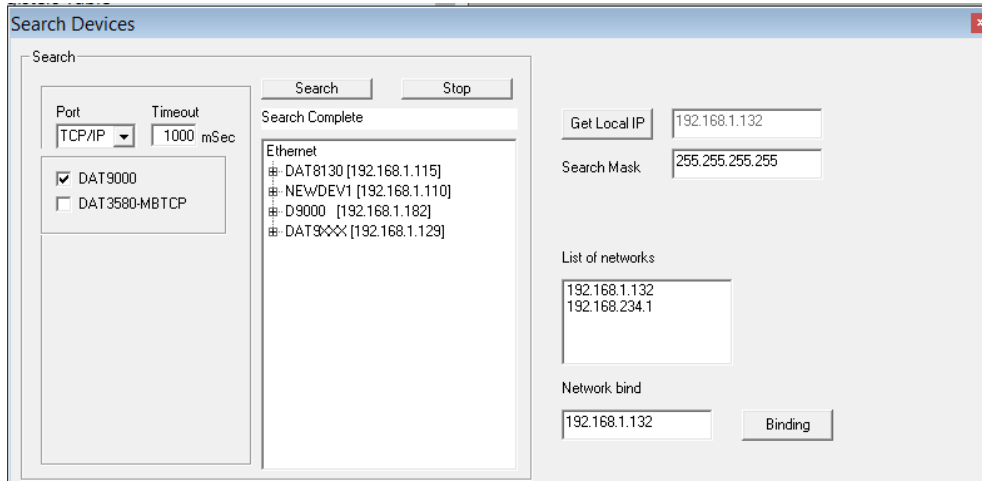
The devices of DAT8000 series are provided with default IP address: 192.168.1.100, modbus address 1.

The PC could work with multiple subnets.

In order to connect with the device, the PC and the device of DAT8000 series must be in the same network.

It is possible to visualize the PC's IP address running the software Dev9K clicking the button "Get Local IP" under the menu Tools / Search (Pict 1)

Pict. 1



Make sure the IP identified is used in the Network which the device is connected to.

Click the button "Search"; in the field "List of networks" the available networks for the PC in use will be shown. The IP addresses visualized are those assigned to the PC from each network.

Click, if present, the interested network (192.168.1.xxx) to select the network to use.

Click the button "Binding" to set the network over to search the device. Note: the assignment is executed only for the Dev9k that is running. If the PC is in a subnet different from the one of default of the device , the user has to change the IP of the PC to make possible the change of the device's IP.

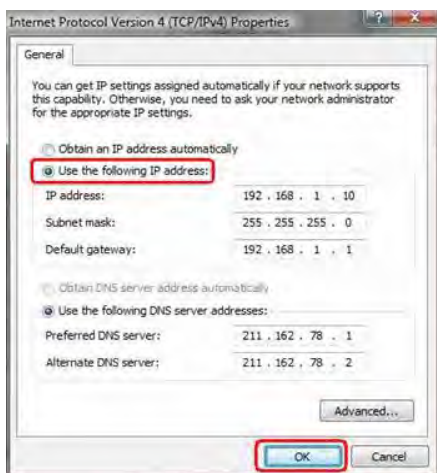
To do this, open the " Network and Sharing center " of the operating system, go to the Properties of Internet Protocol version 4 of PC (Pict 2) and configure the network parameters in according to the default IP of device : (refer to the section "examples to check Windows configurations")

IP Address : 192.168.1.XXX; modbus address (xx)

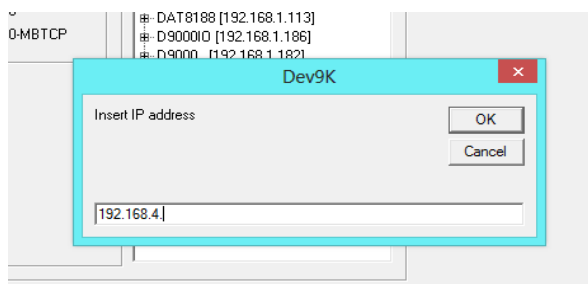
Subnet Mask: 255.255.255.0

Default Gateway: 192.168.1.1

Pict. 2



Now the device of DAT8000 series is searchable and the user can change its IP with the desired one. It must be different from the other ones in the network (right click → Set IP address).
Once the device's IP address has been modified, the device will not appear in the results of Dev9k. So the user has to modify the network parameters of PC again in order to display the device.



ADDITIONAL COMMANDS TO DETERMINE THE NETWORK IN USE

It is possible to use the following additional commands to determine to which network is connected the PC.

To use it run the command Prompt (cmd.exe) as Administrator in the Windows in use .

Command "Ipconfig"

It is possible to visualize the nets used by the PC writing this command and press enter.

The system will return a list of all the nets used by the PC. Before to try to establish a communication with the device the user must be sure to be in the correct subnet (ref previous chapter).

Command "ping"

To determine if a device is connected on the net it is possible to use the "ping " command that is an utility for computer networks used to measure the time, in milliseconds, used by one or more packets to reach a network device and to return to the origin.

To use the command , type the command " ping " followed by the IP address of the device and press Enter .

Example:

```
ping 192.168.1.100
```

If the device is connected the system will return the answer from the device with the IP mentioned.

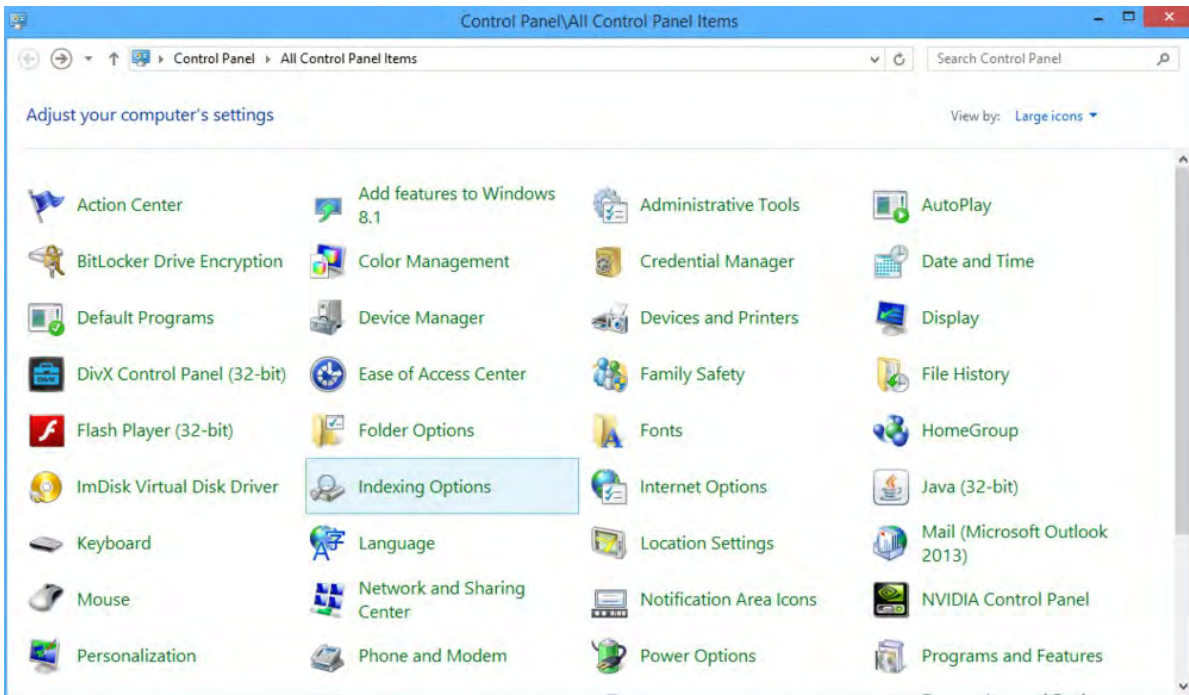
If the systems returns the message Host Unreachable the device is not connected in the net in use.

In this case it is suggested to check the network assignment.

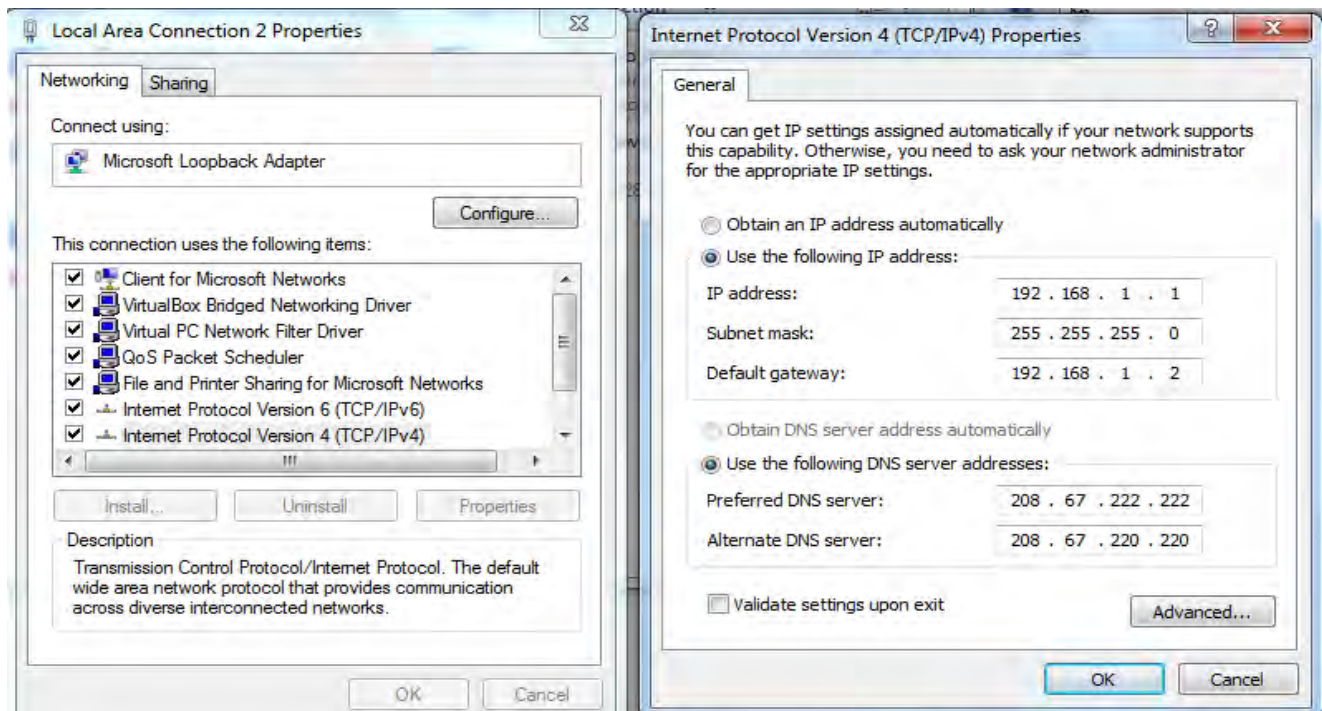
EXAMPLE TO CHECK WINDOWS® CONFIGURATION

How to change the IP address of the PC (each version of the operative system could change in part from others)

- Access to Control Panel of PC



- Network and Sharing Center → Change Adapter Settings → select the interested network → right click → Property → Internet Protocol version 4 → Property.



- Change parameters and click OK.