

User Guide DAT 8016

MODBUS TCP/IP SERVER MODULE - 4 TC AND mV ISOLATED INPUTS

GENERAL 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.

The module configuration can be performed entirely using the web interface (see the "Integrated Web Server Structure" section).

To allow easier searching of the device on the network, it is possible to use the "Search Device" software which can be downloaded from the website www.datexel.it in the "Software & Driver" section.

For correct installation of the device, refer to the product datasheet which can be downloaded from the website www.datexel.it

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SUPPORTED MODBUS FUNCTIONS

Modbus Function Code	Modbus Function	Maximum Reading/Writing
01	Read Coil Status (bank 0xxxx)	128 coils
02	Read Input Status (bank 1xxxx)	128 coils
03	Read Holding Register (bank 4xxxx)	64 registers
04	Read Input Register (bank 3xxxx)	64 registers
05	Write Single Coil	1 coil
06	Write Single Register	1 register
15 (0x0F)	Write Multiple Coils	32 coils
16 (0x10)	Write Multiple Registers	32 registers

REGISTERS STRUCTURE

The internal registers of Modbus devices are mainly represented in two formats: **Unsigned Integer** or **Signed Integer**. In the signed registers (Signed Integer), the most significant bit represents the sign of the contained value therefore the values represented are between ± 32767 while in the unsigned ones (Unsigned Integer) the values represented are between 0 and 65535. Therefore, in the case where Signed Integer registers are read and the value is greater than 32767, it is necessary subtract 65536 from the read value to obtain the true signed value.

The registers have the following 16-bit structure (WORD):

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Descr	MSB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	LSB
Byte	HB (1 byte)								LB (1 byte)							

Legenda:

MSB → Most Significant Bit

LSB → Least Significant Bit

HB → High Byte

LB → Low Byte

MODBUS REGISTERS MAPPING

Modbus Register (base 1)	Modbus Register (base 0)	Description	Register Type/Format	Access	Storage
40002	1	Firmware[0]	-	RO	FW
40003	2	Firmware[1]	-	RO	FW
40004	3	Reserved	-	-	-
40005	4	Reserved	-	-	-
40007	6	Unit ID	16-bit, Unsigned	R/W	EEPROM
40011	10	System Flags	16-bit, Unsigned	R/W	RAM
40013	12	Watchdog Timer	16-bit, Unsigned	R/W	EEPROM
40031	30	Input Type Channel 0	16-bit, Unsigned	R/W	EEPROM
40032	31	Input Type Channel 1	16-bit, Unsigned	R/W	EEPROM
40033	32	Input Type Channel 2	16-bit, Unsigned	R/W	EEPROM
40034	33	Input Type Channel 3	16-bit, Unsigned	R/W	EEPROM
40041	40	Analog Input 0	16-bit, Signed	RO	RAM
40042	41	Analog Input 1	16-bit, Signed	RO	RAM
40043	42	Analog Input 2	16-bit, Signed	RO	RAM
40044	43	Analog Input 3	16-bit, Signed	RO	RAM
40050	49	Break Status	16-bit, Unsigned	RO	RAM
41241	1240	Offset Input 0	16-bit, Signed	R/W	EEPROM
41242	1241	Offset Input 1	16-bit, Signed	R/W	EEPROM
41243	1242	Offset Input 2	16-bit, Signed	R/W	EEPROM
41244	1243	Offset Input 3	16-bit, Signed	R/W	EEPROM

COILS MAPPING

Modbus Coil (base 1)	Modbus Coil (base 0)	Description	Register Type/Format	Access	Storage
00161	160	Watch-dog Enable	1-bit	R/W	RAM
00162	161	Watch-dog Event	1-bit	R/W	RAM
00163	162	Power-Up Event	1-bit	R/W	RAM

NOTES:

1. The registers and coils marked in the 'Access' column with the wording RO are read only registers.
2. The registers and coils marked in the 'Access' column with the wording R / W are read and write registers (Read / Write).
3. The registers and coils marked in the 'Storage' column with the wording EEPROM reside in the non-volatile memory therefore they retain their value permanently even in the event of a power failure.
Warning: these registers / coils must not be written continuously because the EEPROM could be irreparably damaged.
4. For the modules of the DAT8000 series, the bank 0xxxx is the mirror of the bank 1xxxx, as the bank 3xxxx is the mirror of the bank 4xxxx, so for example the first register can be addressed indifferently as 30002 (with function 04) or 40002 (with function 03).
5. FW → fixed by firmware. The value is defined in the firmware.
6. EEPROM → the value is stored in a non-volatile memory permanently (see note 3).
7. RAM → the value is stored in a volatile memory. In the absence of power supply, the stored value is cleared.

MODBUS REGISTERS DESCRIPTION

40002 / 40003: FIRMWARE VERSION

Two read-only registers, containing the firmware version.
Firmware Version: 8500 and later

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: 1 Decimal (01 Hex). INIT value: 245 Decimal (F5 Hex).

40011: SYSTEM FLAGS

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

Watchdog Enable: this bit enables 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. This bit must be set in logic on power up.

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	9	8	7	6	5	4	3	2	1	0
Coil						163	162	161								
Descr	<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="width: 60%;"></div> <div style="width: 35%; text-align: right;"> <p>— Watchdog Enable</p> <p>— Watchdog Event</p> <p>— Power-up Event</p> </div> </div>															

40013: WATCHDOG TIMER

Contains the value of the Watchdog timer, in seconds. If the Watchdog is enabled and the device doesn't receive commands within this time, the Watchdog bit will be set to 1 (see the description of "System Flags").
- Default value: 10 (10 sec.)

40031: INPUT TYPE Channel 0

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Descr	-								Input Type 0							

40032: INPUT TYPE Channel 1

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Descr	-								Input Type 1							

40033: INPUT TYPE Channel 2

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Descr	-								Input Type 2							

40034: INPUT TYPE Channel 3

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Descr	-								Input Type 3							

These registers allow you to configure the type of input for each channel in relation to the type of sensor connected.
The table below shows the types of sensors that can be connected with the corresponding value to be written on the lower part of the register of each channel if the configuration takes place via modbus commands (without using the web interface).

Input Type	Value (Hex)	Value (Dec)	Value (Bin)
Disabled	00	0	00000000
250 mV	01	1	00000001
Tc J	04	4	00000100
Tc K	05	5	00000101
Tc R	06	6	00000110
Tc S	07	7	00000111
Tc T	08	8	00001000
Tc B	09	9	00001001
Tc E	0A	10	00001010
Tc N	0B	11	00001011

Warning: these registers are in EEPROM, therefore they must not be written continuously or at each cycle of the master because it could cause serious damage to the eeprom of the device.

40041: ANALOG INPUT 0
40042: ANALOG INPUT 1
40043: ANALOG INPUT 2
40044: ANALOG INPUT 3

Type	Decimals
TC (°C)	1
mV	2

Reading Examples:

- Input set as **Tc**
Value read on the register: 246 → 24,6 °C
- Input set as **mV**
Value read on the register: 24656 → 246,56 mV

These registers return the measure of each channel, converted to engineering units. The values are expressed in cents of mV for *mV* input and tenths of °C for *TC* input.

Note: in INIT condition, the analogue input measurements are not updated!

40050: 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	9	8	7	6	5	4	3	2	1	0
Input													In 3	In 2	In 1	In 0
Descr													Break Input 3 ———— Break Input 2 ———— Break Input 1 ———— Break Input 0 ————			

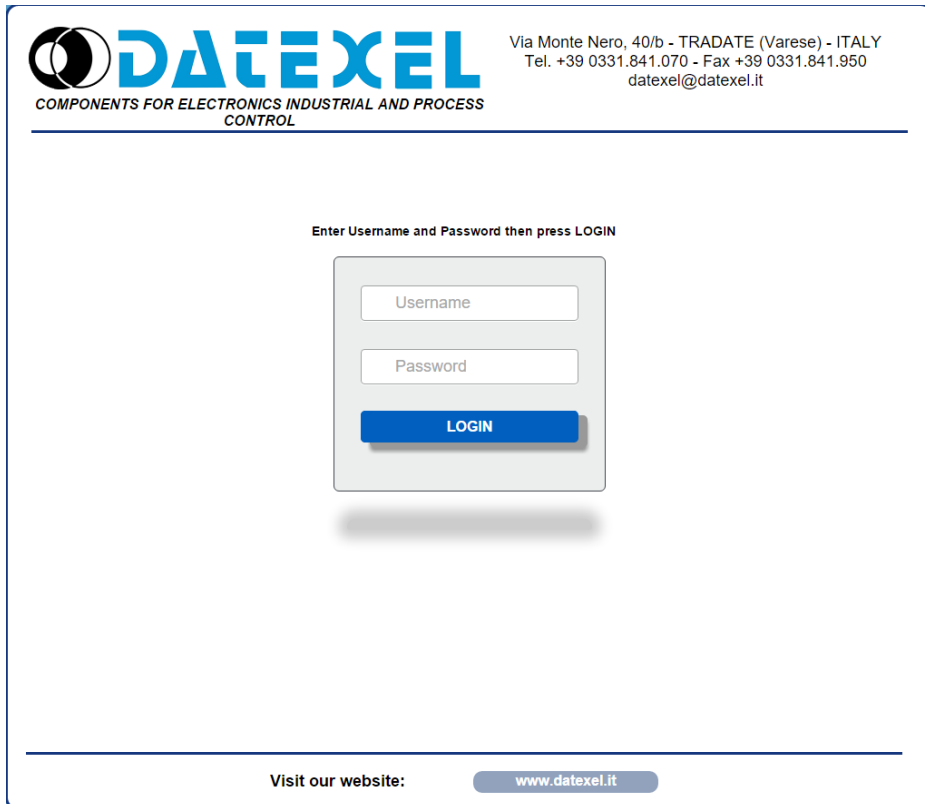
41241: OFFSET INPUT 0
41242: OFFSET INPUT 1
41243: OFFSET INPUT 2
41244: OFFSET INPUT 3

These registers contain the offset values for each input. The values are expressed in cents of mV for *mV* input and tenths of °C for *TC* input.

Warning: these registers reside in EEPROM, therefore they must not be written continuously or at each cycle of the master because it could cause serious damage to the EEPROM of the device.

WEBSERVER STRUCTURE

To access the server, run the web browser and edit in the *address bar* the device IP address (default IP address: 192.168.1.100). 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. The web browser supported are: *Chrome, Firefox, Opera, Internet Explorer and Edge*. 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

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 **DAT8016** 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: when there is no data transmission, this parameter indicates the time that must elapse before Modbus TCP sockets (port 502) are closed.

Click "Save" to apply and store the modified parameters. Wait for the reset of the device and access to it via the new parameters set.

System Settings

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 "Search Device"; 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).

Click "Save" to apply and store the modified parameters. To read the parameters from the device click the button "Refresh".

Software Update


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.

The parameter "WebPage Version" shows the version of the web-based user interface loaded on the device.

Username and Password





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Back
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DAT8016
Logout

Username and Password

Username:	Fact_user
Password:	Fact_pwd

Save

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This section allows to set user name and password to access to 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".

Click "Save" to apply and store the modified parameters.

Analog Input





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Home
DAT8016
Logout

Analog Input

	Input Type	Offset	Value	Break
Analog In 0:	Tc K ▼	0	1421	●
Analog In 1:	Tc K ▼	0	1421	●
Analog In 2:	Tc K ▼	0	1421	●
Analog In 3:	Tc K ▼	0	1421.1	●

Set Same Input
Read
Save

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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.

Offset (ref. Reg "Offset Input"): allows to set an offset value for each input (in relation to the sensor connected).

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.

Click "Save" to apply and store the modified parameters.

USE OF THE FUNCTION "INIT"

All of the devices of DAT8000 series are equipped with the INIT modality. This is a procedure to access to the device if the network parameters are unknown. In this case it is possible to set the new network parameters in order to access the device using a browser and to proceed with its configuration.

*IP Address: XXX.XXX.XXX.XXX (assigned by DHCP if enabled)
 192.168.1.174 (if DHCP disabled, verify that the IP is not in use)*
Modbus address: 245

By these information it is possible to access the device in INIT modality to set and check its configuration. 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;
- Install and run the software "Search Device";
- By the software, search the device on the network and connect to it (refer to the software User Guide);
- Set the new network parameters;

When the user finishes to work in INIT:

- Switch-off the device;
- Disconnect INIT connection;
- Power-on the device and connect to it by the new parameters configurated using a browser;

Note: if the DHCP is disabled and the device is in INIT mode, the IP address is 192.168.1.174. In order to connect to the device, the PC and the device must be in the same network.

Note: in INIT condition, the analogue input measurements are not updated!

WATCHDOG

The devices of the DAT8000 series are equipped with the Watchdog timer. When enabled, if there is not communication between the device and the master for such time, the system actives an alarm condition in order to guarantee the safety condition. 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".

Note: when the device is switched off, the bit "Watchdog Enable" is forced to 0. In order to have the "Watchdog" enabled, it is recommend to set the bit "Watchdog Enable" by the master unit at every power on.

FUNCTION BUTTON "P"

In case it is necessary to set 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 finished, both the leds will be set back to the default condition and the following parameters will be loaded:

Ethernet:

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

Login:

- **Username:** Fact_user
- **Password:** Fact_pwd

Modbus:

Address: 1

SEARCH A DEVICE AND EDIT NETWORK PARAMETERS USING "SEARCH DEVICE" SOFTWARE

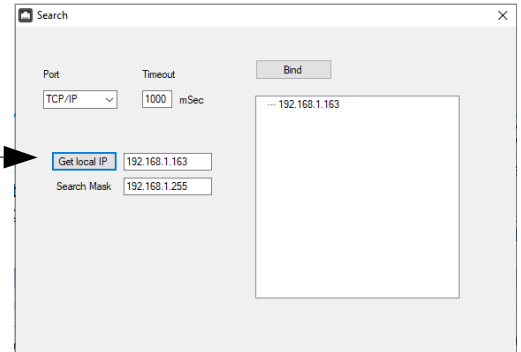
The devices of DAT8000 series are provided with default IP address: 192.168.1.100, modbus address 1.

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 "Search Device" clicking the button "Get Local IP" (Pict. 1)

Pict. 1

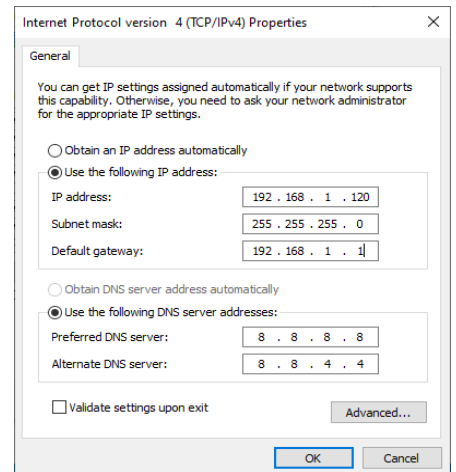


- 1) Select the correct network (if present in the list) and click on "Bind".
- 2) Click on "Search" button to search device in the selected network.
- 3) After searching, the IP address of the device will appear followed by the NetBios Name.
Make sure that the IP identified is used in the network which the device is connected to.
- 4) Select the IP, click the right mouse button and choose "Connect / Set Device".
- 5) After connecting to the device, all the network parameters can be set through the configuration window.

Note: after changing the IP address of the Datexel device, it will not appear in the search results in the "Search Device". It will be necessary to change the PC network parameters again to display the device again in the search results.

(*) If the PC belongs to a different subnet from the default one expected for the device, it is necessary to change the IP of the Personal Computer. To do this, open the "Network and Sharing Center" section of the operating system in use, go to the IPV4 network properties window of the PC (Pict. 2) and configure the network parameters compatible with the default IP of the device (see section "Examples for Windows configurations"). After having appropriately changed the IP of the PC, perform steps 1) to 5) to change the IP of the device.

Pict. 2



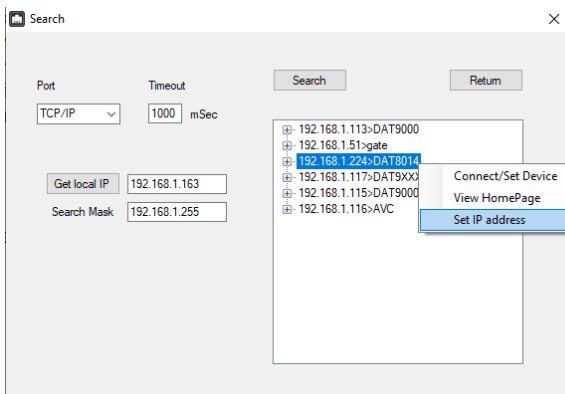
Factory/Default parameters:

- IP Address: 192.168.1.100
- Modbus address: 1
- Subnet Mask: 255.255.255.0
- Gateway Mask: 192.168.1.1

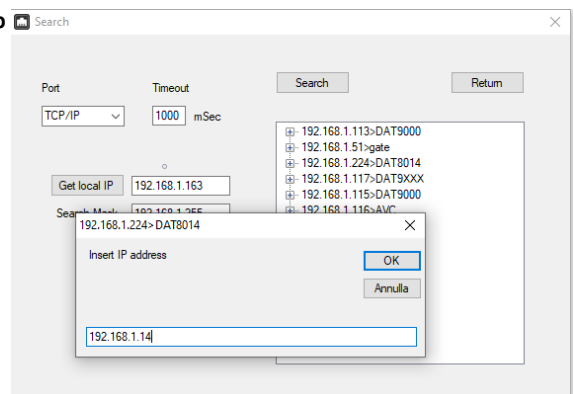
It is possible to set only the IP address (but not the other network parameters) from the "Search Device" software by following the procedure:

- 1) Select the correct network (if present in the list) and click on "Bind".
- 2) Click on the "Search" button to search for the device in the selected network.
- 3) After searching, the IP address of the device will appear followed by the NetBios Name.
Make sure that the IP identified is used in the network which the device is connected to.
- 4) Select the IP, click the right mouse button and select "Set IP address" (Pict. 3a).
- 5) Set the new IP address and press OK (Pict. 3b)

Pict. 3a



Pict. 3b



The following additional commands can be used to identify which network the PC is connected to. To use the following commands, run the Command Prompt (cmd.exe) as Administrator (Pict.1).

"Ipconfig" command

It is possible to display the networks available on the PC by typing this command and pressing Enter.

The system will return a list of all the PC networks (Pict.2). Before trying to establish communication with the device, the user must be sure that he is in the correct subnet.

"Ping" command

To verify if a device is connected to the network, you can use the "ping" command which is an administration utility for computer networks used to measure the time expressed in milliseconds, used by one or more packets to reach a network device and return origin.

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

Example:

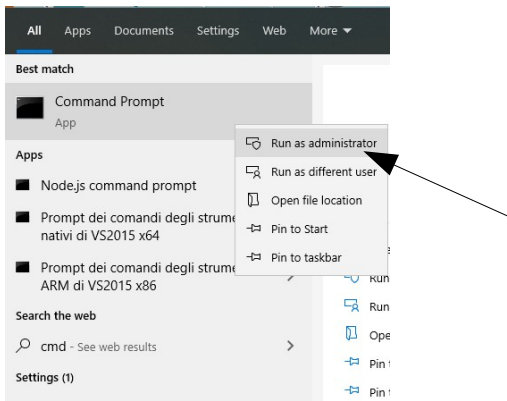
```
ping 192.168.1.100
```

If the device is connected, the system will return the response from the device with the IP address used (Pict.3).

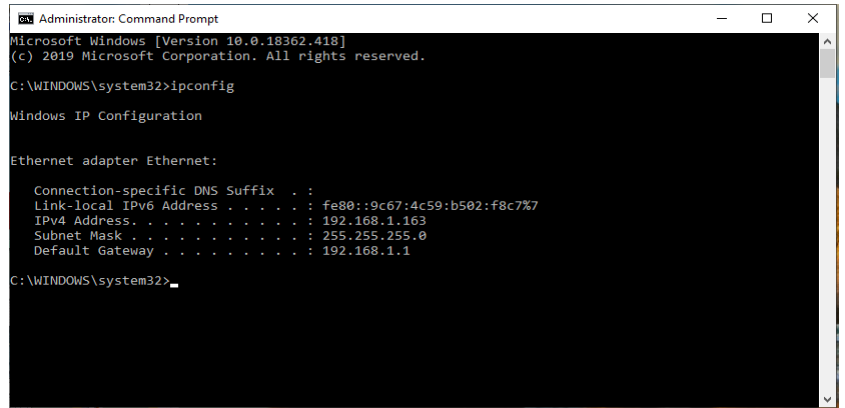
If the system returns the "Destination host unreachable" message, the device is not connected to the network in use.

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

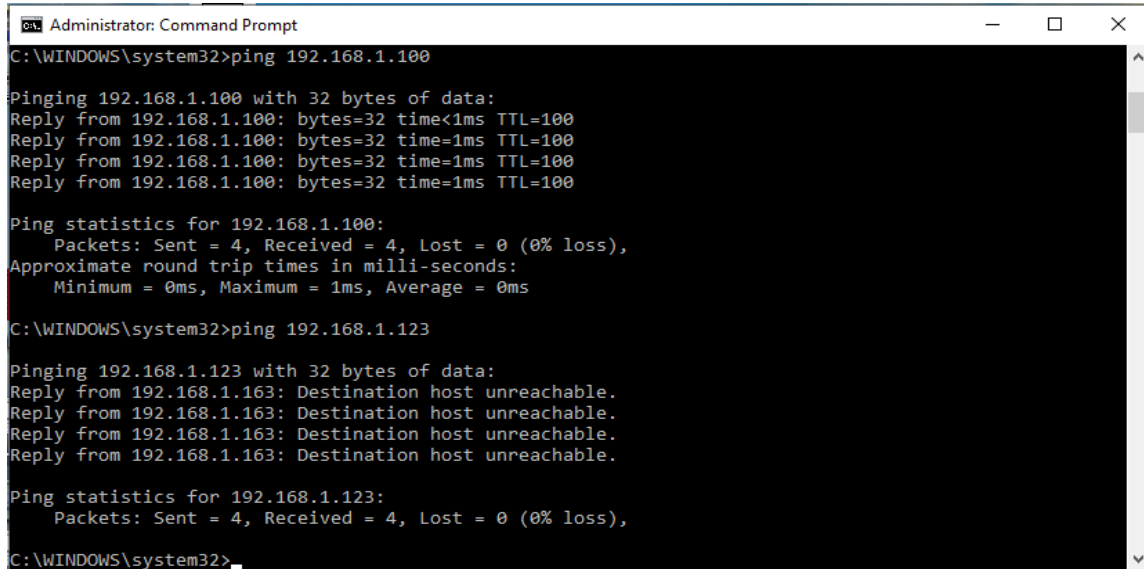
Pict. 1



Pict. 2

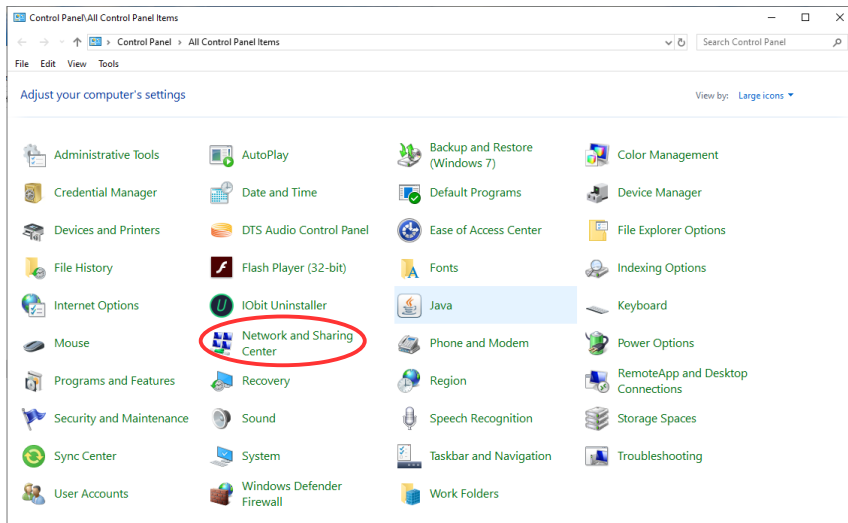


Pict. 3

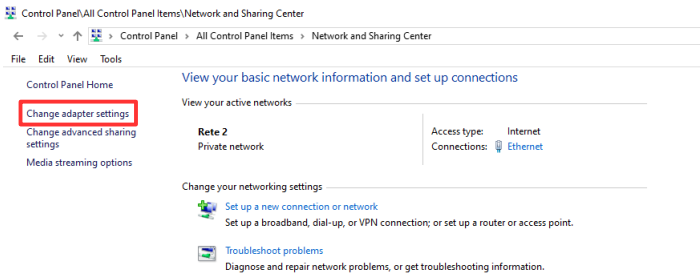


This example shows how to change the IP of the Personal Computer (the graphics and the procedure change in relation to the operating system in use) in order to allow the search for the device on the network with the "Search Device" software.

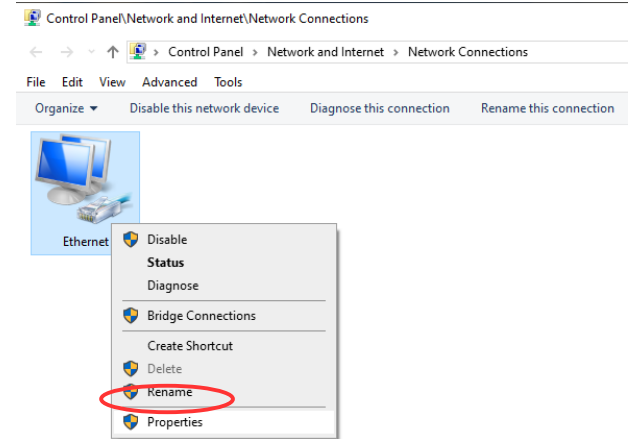
1) Access to Control Panel → *Network and Sharing Center*



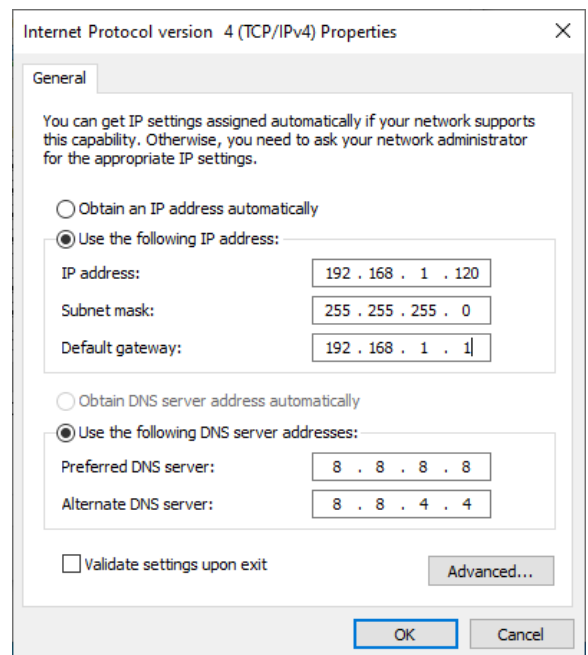
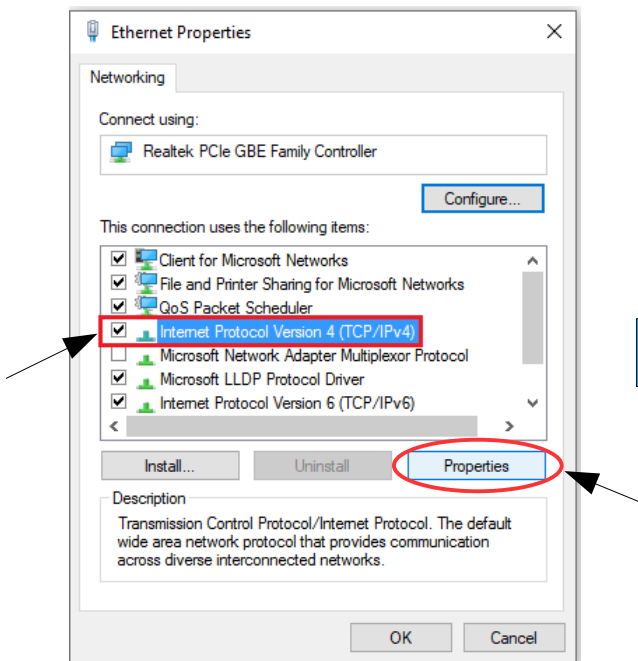
2) Network and Sharing Center → *Change Adapter Settings*



3) Change Adapter Settings → *select the interested network* → *right click* → *Properties*



4) Properties → *Internet Protocol version 4* → *Properties*



5) Change parameters and click OK.