

User Guide – MODBUS TCP/IP protocol
Firmware Version: 8910

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

Register	Description	Access
40002	Firmware [0]	RO
40003	Firmware [1]	RO
40004	-Reserved-	RO
40005	-Reserved-	RO
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
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
40050	Break status	RO
41241	Offset Input 0	R/W
41242	Offset Input 1	R/W
41243	Offset Input 2	R/W
41244	Offset Input 3	R/W
41245	Offset Input 4	R/W
41246	Offset Input 5	R/W
41247	Offset Input 6	R/W
41248	Offset Input 7	R/W

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:

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

Two read-only registers, containing the firmware version.

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 Event 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	09	08	07	06	05	04	03	02	01	00
Coil	-	-	-	-	-	163	162	161	-	-	-	-	-	-	-	-
Descr.	<div style="display: flex; justify-content: space-between; align-items: center;"> <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, in seconds. If the Watchdog is enabled and the device doesn't receive a command before this timer expires, the Watchdog bit will be set to 1 (see the description of "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

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 register format is a 16 bit unsigned integer.

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	09	08	07	06	05	04	03	02	01	00
Input	-	-	-	-	-	-	-	-	#7	#6	#5	#4	#3	#2	#1	#0
Descr.									Break input #7	Break input #6	Break input #5	Break input #4	Break input #3	Break input #2	Break input #1	Break input #0

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

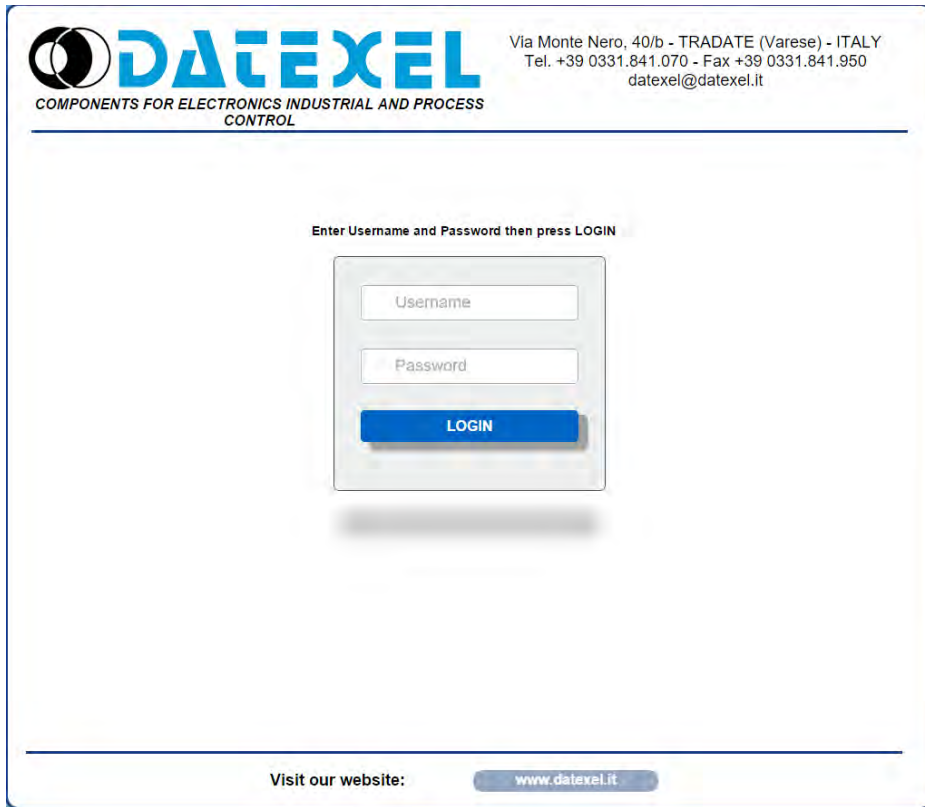
41241 : OFFSET INPUT #0
41242 : OFFSET INPUT #1
41243 : OFFSET INPUT #2
41244 : OFFSET INPUT #3
41245 : OFFSET INPUT #4
41246 : OFFSET INPUT #5
41247 : OFFSET INPUT #6
41248 : OFFSET INPUT #7

These registers contain the offset values for each input. 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 register format is a 16 bit unsigned integer.

WEB SERVER 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, Edge* and *Safari*. 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.



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.



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.

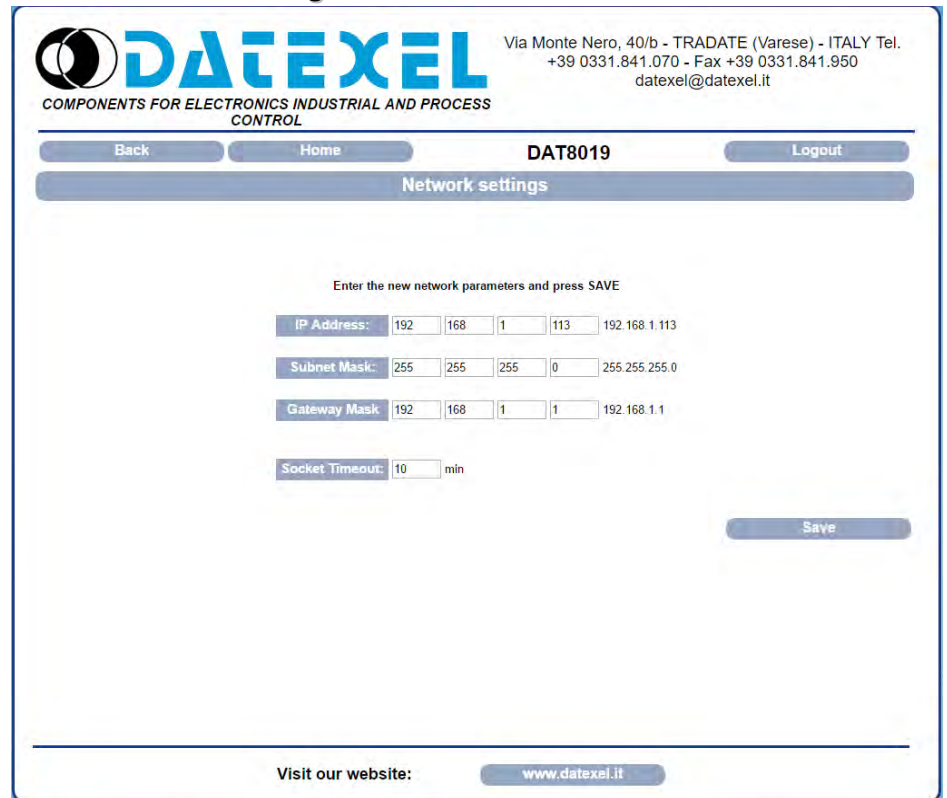
Software Update: allows to execute, if necessary a software update.

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 Configuration



Name	DAT8019		
Modbus Address:	1		
MAC Address:	D8:80:39:B9:2F:54		
WatchDog Enable	<input type="checkbox"/>	TimeOut:	10 (max 255 s)
WatchDog Event	<input type="checkbox"/>		
PowerUp Event	<input checked="" type="checkbox"/>		

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



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!

UPGRADE

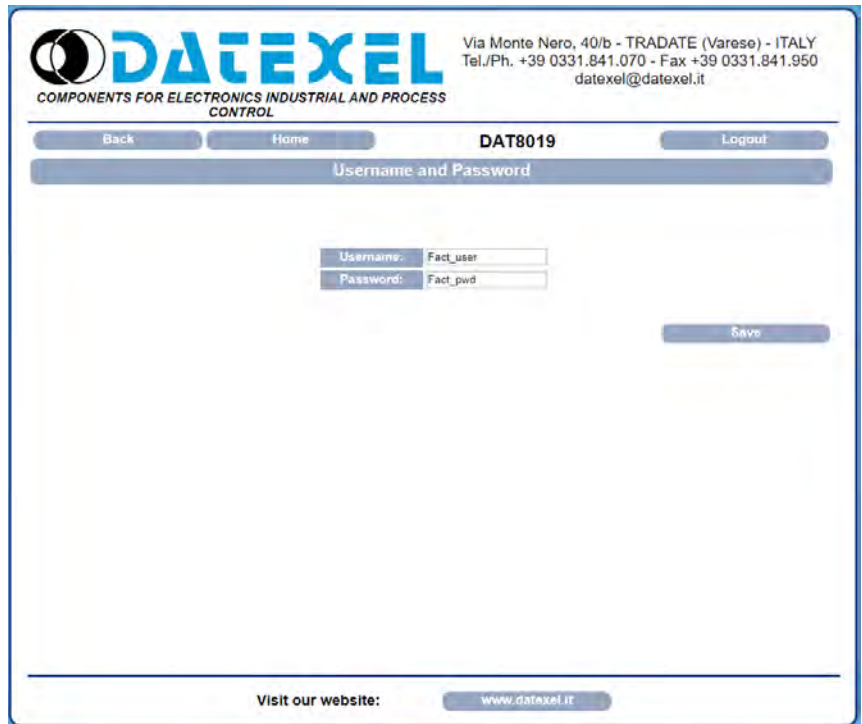
Actual Firmware:	Ver. 8.9.1.0
WebPage Version:	301019

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



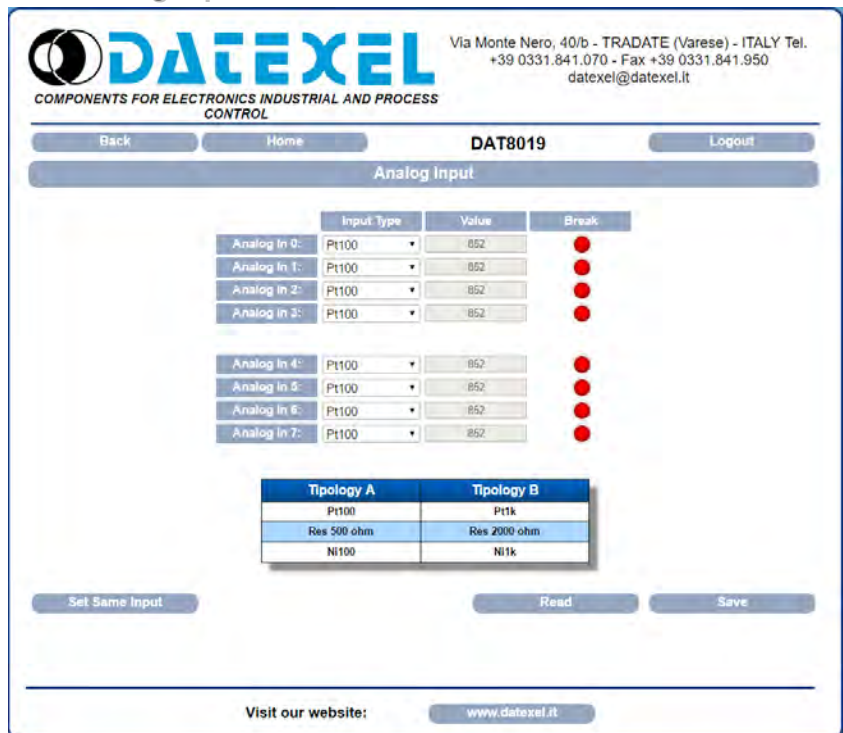
This section allows to set user name and password to access to the Webserver of the device.

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



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 Ni100 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).

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.

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 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 configured 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 activates 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

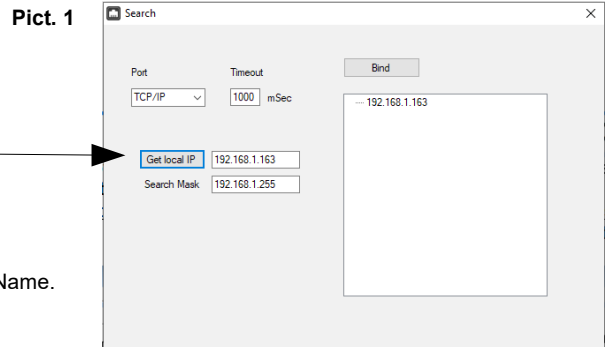
SEARCH A DEVICE AND EDIT NETWORK PARAMETERS USING "SEARCH DEVICE" SOFTWARE

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)



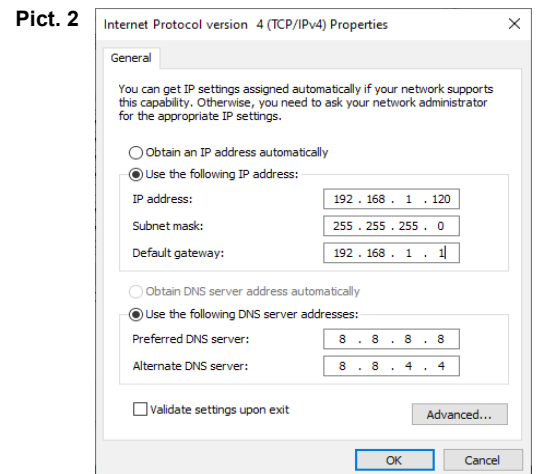
- 1) Select the correct network (if present in the list) and click on "Bind".
- 2) Click on "Search" button to search device in the selected network.
- 3) After searching, the IP address of the device will appear followed by the NetBios Name.
Make sure that the IP identified is used in the network which 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.

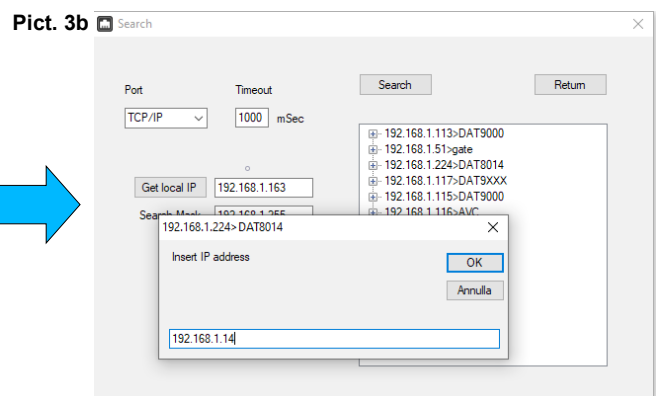
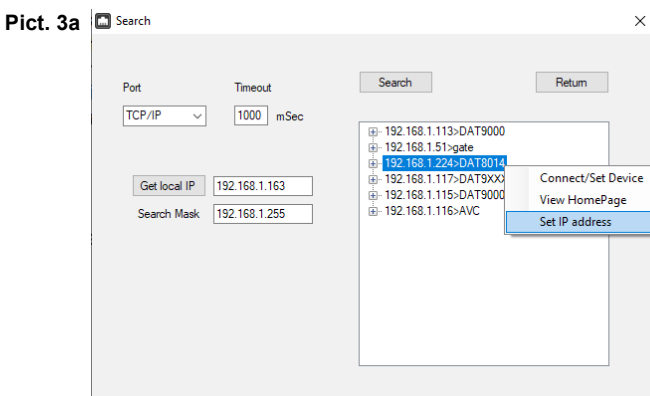


Factory/Default parameters:

- 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)



ADDITIONAL COMMANDS TO IDENTIFY THE NETWORK IN USE

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:

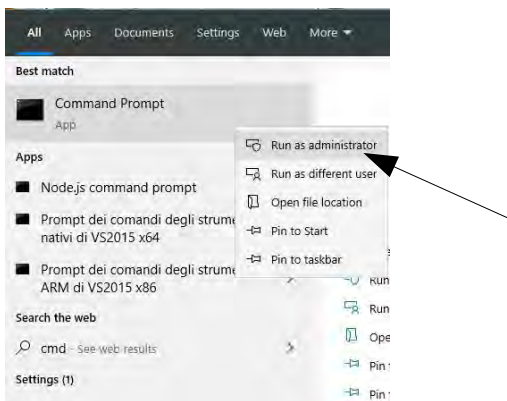
```
ping 192.168.1.100
```

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

```
Administrator: Command Prompt
Microsoft Windows [Version 10.0.18362.418]
(c) 2019 Microsoft Corporation. All rights reserved.

C:\WINDOWS\system32>ipconfig

Windows IP Configuration

Ethernet adapter Ethernet:

    Connection-specific DNS Suffix . : 
    Link-local IPv6 Address . . . . . : fe80::9c67:4c59:b502:f8c7%7
    IPv4 Address. . . . . : 192.168.1.163
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 192.168.1.1

C:\WINDOWS\system32>
```

Pict. 3

```
Administrator: Command Prompt
C:\WINDOWS\system32>ping 192.168.1.100

Pinging 192.168.1.100 with 32 bytes of data:
Reply from 192.168.1.100: bytes=32 time<1ms TTL=100
Reply from 192.168.1.100: bytes=32 time=1ms TTL=100
Reply from 192.168.1.100: bytes=32 time=1ms TTL=100
Reply from 192.168.1.100: bytes=32 time=1ms TTL=100

Ping statistics for 192.168.1.100:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\WINDOWS\system32>ping 192.168.1.123

Pinging 192.168.1.123 with 32 bytes of data:
Reply from 192.168.1.163: Destination host unreachable.
Reply from 192.168.1.163: Destination host unreachable.
Reply from 192.168.1.163: Destination host unreachable.
Reply from 192.168.1.163: Destination host unreachable.

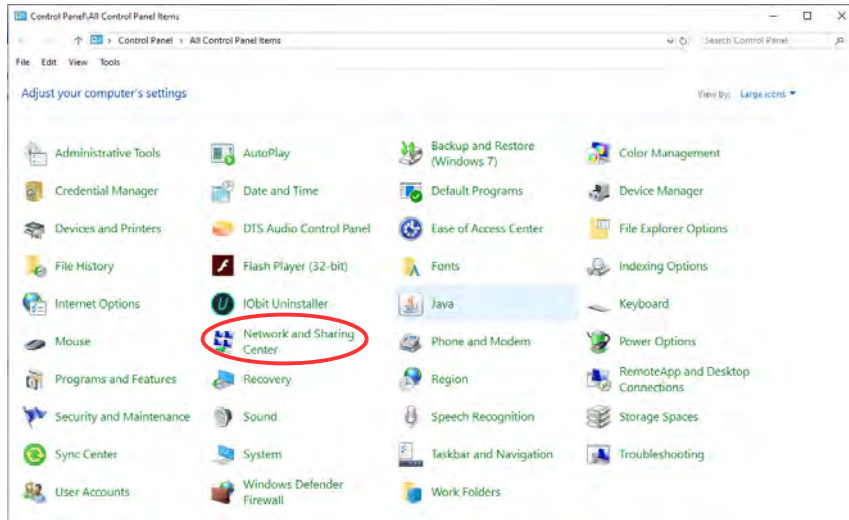
Ping statistics for 192.168.1.123:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\WINDOWS\system32>
```

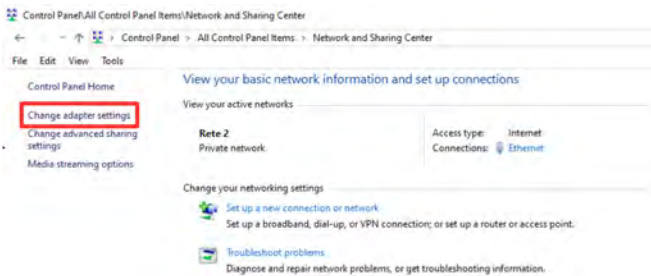
EXAMPLE TO CHECK WINDOWS® CONFIGURATION

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

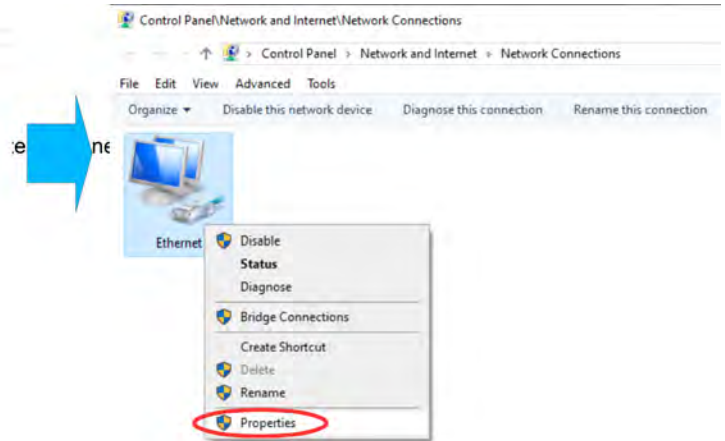
1) Access to Control Panel → *Network and Sharing Center*



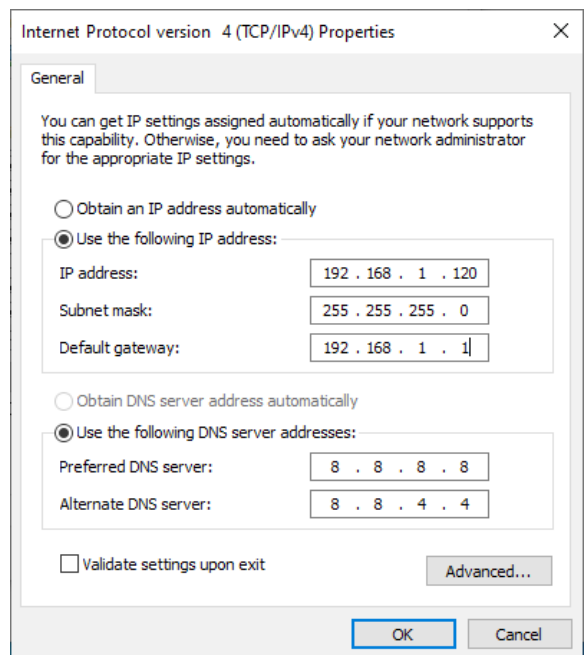
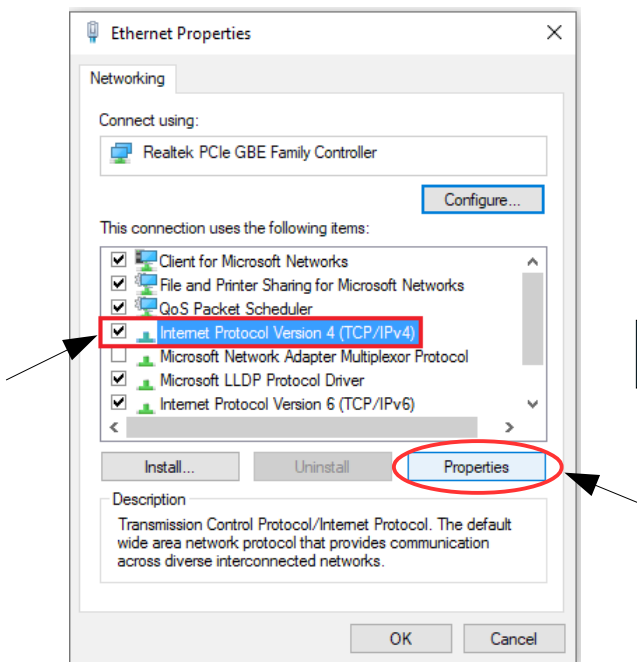
2) Network and Sharing Center → *Change Adapter Settings*



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



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



5) Change parameters and click OK.