HAMEG®
Instruments
A Rohde&Schwarz Company

HMC COMPACT SERIES ETHERNET/USB INTERFACE

Installation guide

English

Content

1 General Information

1.1 Safety hints

Attention!
During operation the interface opening must be closed.

Attention!
All interface connections are galvanically connected to the HAMEG instrument.

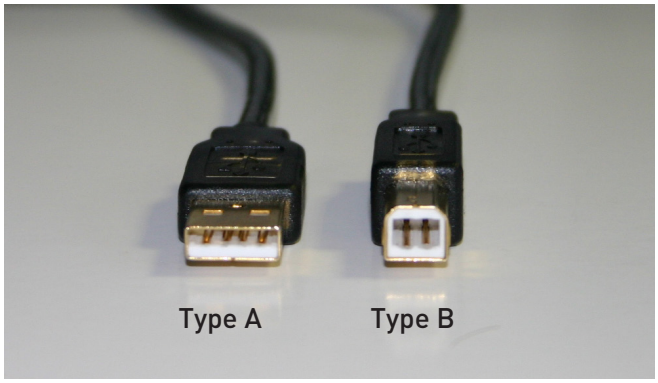
Measurement at high potentials is prohibited and endangers the HAMEG instrument, the interface and all equipment connected to the interface.

If the safety rules are disregarded, any damage to HAMEG Instruments GmbH products will void the warranty. Consequently HAMEG Instruments GmbH will not take any responsibility for damage to people or equipment of other make.

1.2 Interface Description

In addition to a LAN interface, the HMC8012 includes a USB device port. For this interface, the user can select if the instrument is accessed via virtual COM port (VCP) or via USB TMC class. The traditional version of the VCP allows the user to communicate with the HMC using any terminal program via SCPI commands once the corresponding Windows drivers have been installed. These commands are generally compatible with the Agilent multimeters 34401A and 34410A. In addition, you may use the free HAMEG software „HMExplorer". This Windows application offers HMC8012 instruments a terminal function, the option to create screenshots and to sort the measured data storage.

A modern alternative to the virtual COM port (VCP) is the control via USB TMC class. TMC stands for „Test & Measurement Class" which indicates that the connected measurement instrument can be recognized without special Windows drivers if VISA drivers are installed and that it can be used directly in corresponding environments. The GPIB interface serves as model to the structure of the TMC design. A major benefit of the USB TMC class is that by sampling specific registers the user can determine if commands have been terminated and if they have been processed correctly. However, the communication via VCP requires analysis and polling mechanisms within the controlling software which may significantly strain the interface of the measurement instruments. The TMC status registers solve this problem with the USB TMC in the same manner as is the case with the GPIB interface for the hardware, namely via corresponding control lines.



USB

The interface is equipped with a Type A USB female connector. For direct connection with a host controller or an indirect connection via a USB hub, a USB cable equipped with Type B male connector at one end and Type A male connector at the other end is required.

Ethernet

The interface is equipped with an Ethernet type RJ-45 connector according to IEEE standard 802.3. For the direct connection with a host (PC) or indirect connection over a SWITCH, a doubly protected network cable (e.g. CAT.5, CAT.5e, CAT.5+, CAT.6 or CAT.7) is required, equipped with an Ethernet plug type the RJ-45 at each end. Either an uncrossed or a crossed network cable (cross over cable) can be used.

2 Interface selection

The interface (USB or Ethernet) will be chosen and activated in the internal menu of the HMC compact series (SETUP button). Please refer to the manual of the appropriate HMC instrument for information about the interface parameters, which have to be set.

3 USB driver installation (VCP)

Attention!
The following requirement for USB-VCP driver installation are necessary:

1 **An instrument of the HMC compact series with an activated USB-VCP interface.**

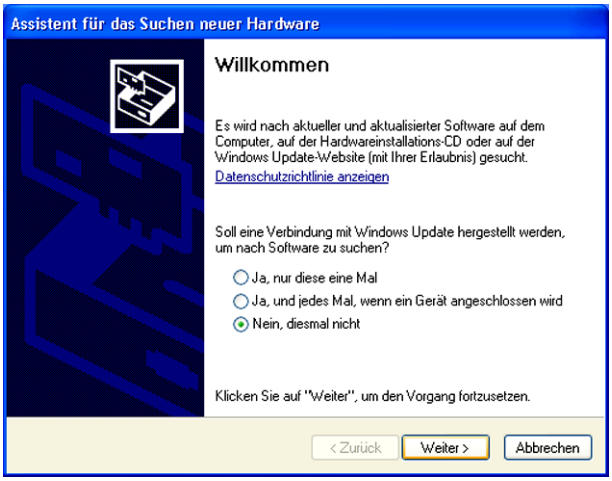
2 **A PC with operating system Windows XP, VISTA or Windows 7 (32 or 64Bit).**

3 **Administrator rights are necessary for the installation of the driver. If an error message regarding spelling errors appears, the rights to install the driver are not given. In this case, please contact your IT department to obtain the necessary rights.**

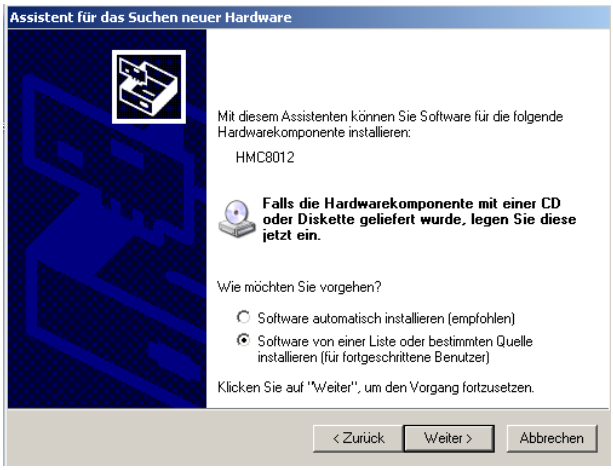
The actual USB-VCP driver can be downloaded from the HAMEG homepage www.hameg.com for free. If a connection between PC and the instrument has been established and no HMC USB-VCP driver is installed, the operating system answers with "Found New Hardware". In addition, the "Found New Hardware Wizard" is displayed. Only in this case the USB-VCP driver must be installed.

3.1 Installation with Windows XP

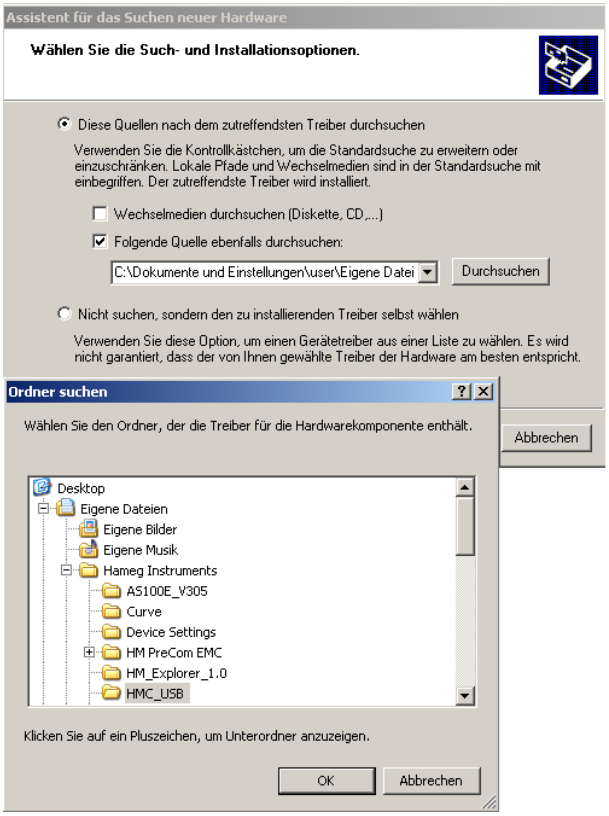
1.) Please choose "No, not this time" and click "Next".



2.) Select "Install from a list or specific location (Advanced)" and click "Next".



3.) „Browse" for the selected drive and select the folder containing the driver. Confirm with "OK".

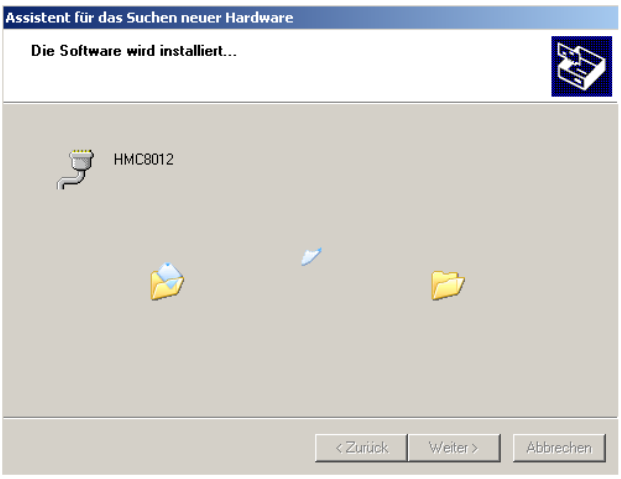


4.) After the selected path is displayed click "Next".

5.) The "Hardware Installation" window will be displayed, showing a warning to continue the installation procedure. In case of installation of the HMC USB-VCP driver, the warning is irrelevant. Click „Continue Anyway".

In case the warning does not appear the installation starts and you can go ahead 7.).

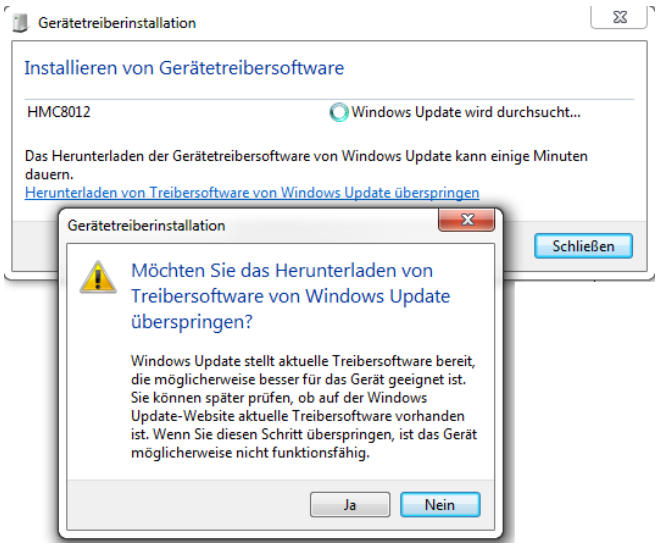
6.) The HMC USB-VCP driver will be installed.



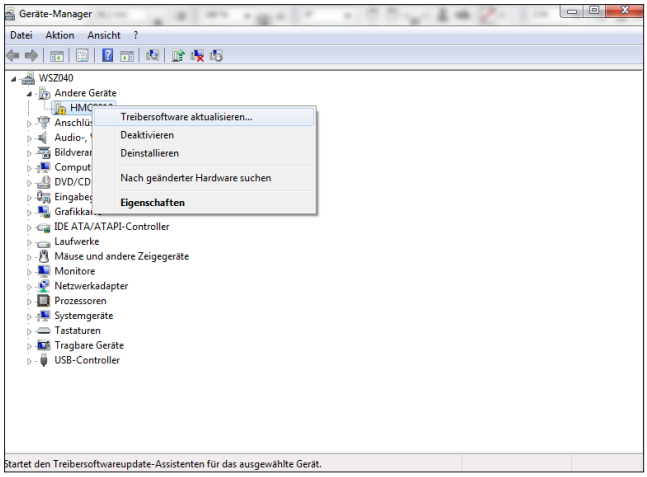
7.) Please click "Finish" to complete the installation.

3.2 Installation with Windows 7

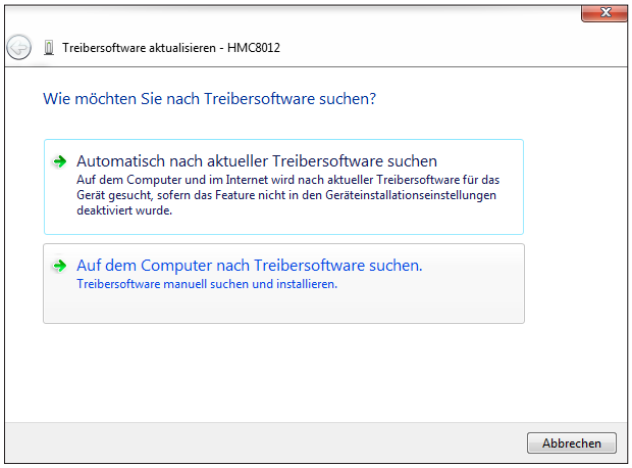
1.) If the window „New Hardware found" appears, please click on „Skip downloading the driver with Windows Update" (menu bar).



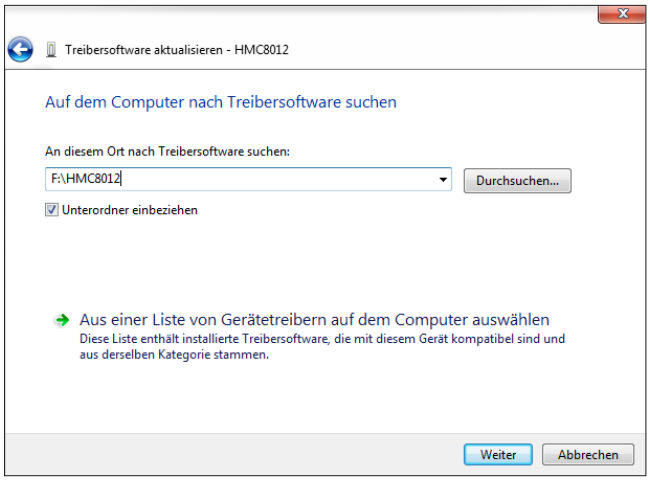
2.) Now, the HMC instrument will be displayed with a yellow exclamation mark in the device explorer of the PC. Choose the HMC instrument and update the driver software via right click.



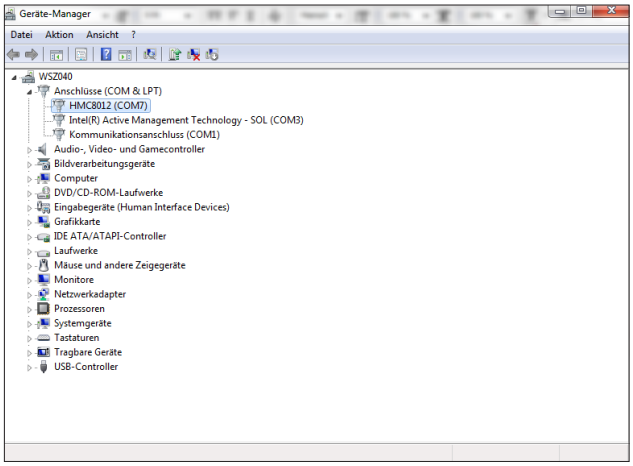
3.) Choose „Browse my computer for driver software".



4.) „Browse" the appropriate folder where the driver was unzipped and saved. Afterwards, press „Next".



5.) After successful installation of the HMC USB-VCP driver the HMC instrument will be displayed as COM connection (virtual COM port).



4 Ethernet configuration

The host (PC) must have an Ethernet LAN interface inserted. For the configuration of this interface you will find further information in its PC manual or in the manual of your network interface.

4.1 IP networks (IP – Internet protocol)

In order that two or several network elements (e.g. measuring instruments, host/PC's, ...) can communicate over a network with one another, some fundamental connections have to be considered, so that data communication is error free and unimpaired.

For each element in a network an IP address has to be assigned, so that they can exchange data among themselves. IP addresses are represented (with the IP version 4) as four decimal numbers separated by points (e.g. 192.168.15.1). Each decimal number is represented by a binary number of 8 bits. IP addresses are divided into public and private address ranges. Public IP addresses will be able to route by the Internet and an Internet service Provider (ISP) can to be made available.

Public IP addresses can be reached directly over the Internet to directly exchange internet data. Private IP addresses are not routed by the Internet and are reserved for private networks. Network elements with private IP addresses cannot be reached directly over the Internet so no data can be directly exchanged over the Internet. To allow network elements with a private IP address to exchange data over the Internet, they require a router for IP address conversion (English NAT; Network address translation), before connection to the Internet. The attached elements can then data exchange over this router, which possesses a private IP address (LAN IP address) and also a public IP address (WAN IP address), via the Internet.

If network elements exchange data only over a local network (without connection with the Internet), appropriate use private IP addresses. Select in addition e.g. a private IP address for the instrument and a private IP address for the host (PC), with which you would like to control the instrument. If you might connect your private network with the Internet later via a router, the private IP addresses used in your local network can be maintained. Since within each IP address range the first IP address is used as network IP address and the last IP address is used as Broadcast IP address, in each case two IP addresses have to be taken off from the "number of possible host addresses" (see table 1: Private IP address ranges).

Apart from the organization of IP addresses into public and private address ranges, IP addresses are also divided into classes (Class: A, B, C, D, E). Within the classes A, B, and C are also include the private IP of address ranges described before. The categorisation from IP addresses is for the assignment of public IP address ranges of importance and essentially depends on the size of a local network (maximum number of hosts in the network), which is to be connected with the Internet (see table 2: Classes of IP addresses). IP addresses can fix (statically) or variable (dynamically) to be assigned. If IP addresses in a network are assigned fix, an IP address must be preset manually with each network element. If IP addresses in a network are assigned to the attached network elements automatically (dynamically), a DHCP server (English DHCP becomes; Dynamic Host Configuration Protocol) is required for the dispatching of IP addresses. With a DHCP server an IP address range for the automatic dispatching of IP addresses can be preset. A DHCP server is usually already integrated in a router (DSL router, ISDN router, Modem router, WLAN router, ...) integrated. If a network element (e.g. an instrument) is connected by a network cable directly with a host (PC), the IP addresses cannot be assigned to the instrument and the host (PC) automatically, since no network with DHCP server is present here. They have to be preset therefore at the instrument and at the host (PC) manually.

Table 1: Private IP adress ranges

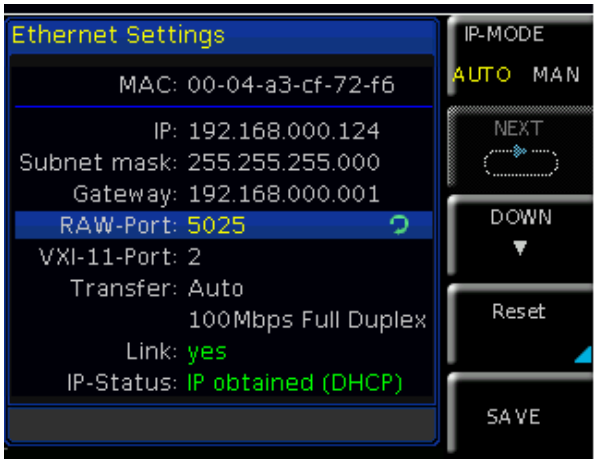
adress range	subnetz mask	CIDR way of writing	number of possible host adresses
10.0.0.0 –10.255.255.255	255.0.0.0	10.0.0.0/8	2^{24} – 2 = 16.777.214
172.16.0.0 –172.31.255.255	255.240.0.0	172.16.0.0/12	2^{20} – 2 = 1.048.574
192.168.0.0 –192.168.255.255	255.255.0.0 255.255.255.0	192.168.0.0/16 192.168.0.0/24	2^{16} – 2 = 65.534 2^{8} – 2 = 254

Table 2: Classes of IP adresses

class	adress range	net quota	host quota	max. number of networks	max. number of hosts
A	0.0.0.1 - 127.255.255.255	8 Bit	24 Bit	126	16.777.214
B	128.0.0.1 - 191.255.255.255	16 Bit	16 Bit	16.384	65.534
C	192.0.0.1 - 223.255.255.255	24 Bit	8 Bit	2.097.151	254
D	224.0.0.1 - 239.255.255.255	Reserved for multicast applications			
E	240.0.0.1 - 255.255.255.255	Reserved for special applications			

IP addresses are divided by using subnet mask into a network quota and into a host quota, so similarly e.g. a telephone number is divided in pre selection (land and local area network number) and call number (user number). Subnet mask have the same form as IP addresses. They are represented with four decimal numbers separated by points (e.g. 255.255.255.0). As is the case for the IP addresses here each decimal number represents a binary number of 8 bits. The separation between network quota and host quota is determined by the subnet mask within an IP address (e.g. the IP address 192.168.10.10 by the subnet mask 255.255.255.0 is divided into a network quota 192.168.10.0 and a host quota of 0.0.0.10). The allocation takes place via the transformation of the IP address and the subnet mask in binary form and afterwards a bit by bit one logical AND operation between IP address and subnet mask. The result is the network quota of the IP address. The host quota of the IP address takes place via the bit by bit logical NAND operation between IP address and subnet mask. By the variable allocation of IP addresses in network quota and host quota via subnet masks, one can specify IP address ranges individually for large and small networks. Thus one can operate large and small IP networks and connect if necessary to the Internet via a router. In smaller local networks the subnet mask 255.255.255.0 is mostly used. Network quota (the first 3 numbers) and host quota (the last number) are simple here without much mathematical expenditure to determine and it can with these subnet mask up to 254 network elements (e.g. measuring instruments, hosts/PC's...) in a network be operated at the same time.

Often also a standard gateway is present in a network. In most local networks is this gateway with the router to the Internet (DSL router, ISDN router, ...) ...) is identical. Using this (gateway -) router a connection can be manufactured with another network. Thus also network elements, which are not in the same (local) network, can be reached and/or network elements from the local network are able to exchange data with network elements from other networks. For a network-spreading data exchange the IP address of the standard gateway must also be preset. In local networks, mostly the first IP address within a network for this (gateway -) router is used. Mostly routers in a local network to be used as gateway have an IP address with a „1" in the last place of the IP address (e.g. 192.168.10.1).



4.2 Different instruments of HAMEG

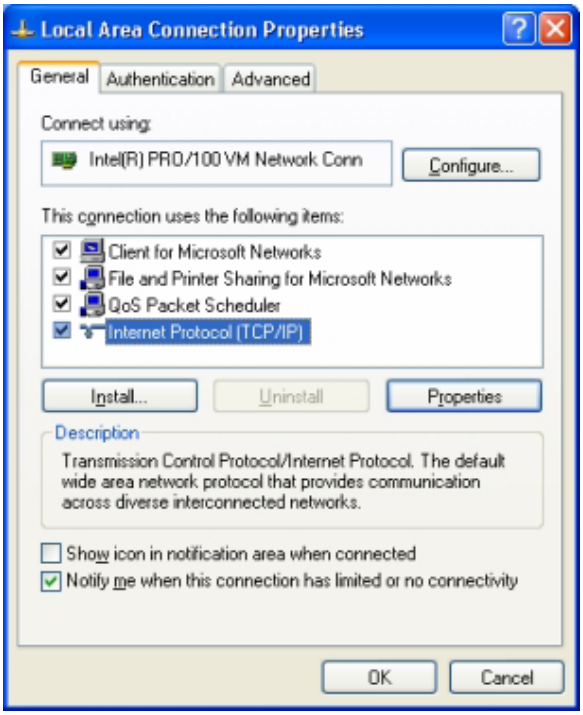
Please refer to the manual of the appropriate HAMEG instrument for information about activating the desired interface and which interface parameters have to be set.

4.3 Ethernet interface parameters at the host (PC)

Parameters under Windows XP

In order to accomplish the following parameters, you need administrator rights at the host (PC) or you have to be member of the user group "administrators" (e.g. in the network).

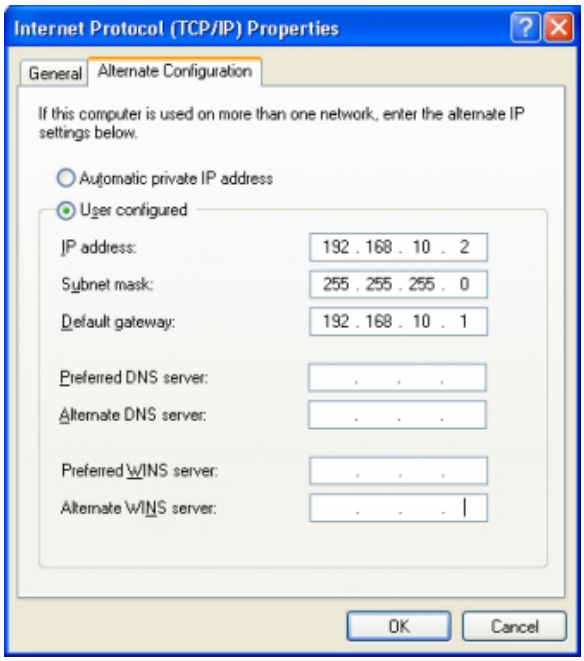
To preset the interface parameters of the Ethernet LAN interface at the host PC please open the "Start" menu and select "Control Panel" --> „Network connections" --> "Local Area Connection". In the new opened window "Local Area Connection Properties" please click on "Internet Protocol (TCP/IP)" and "Properties".



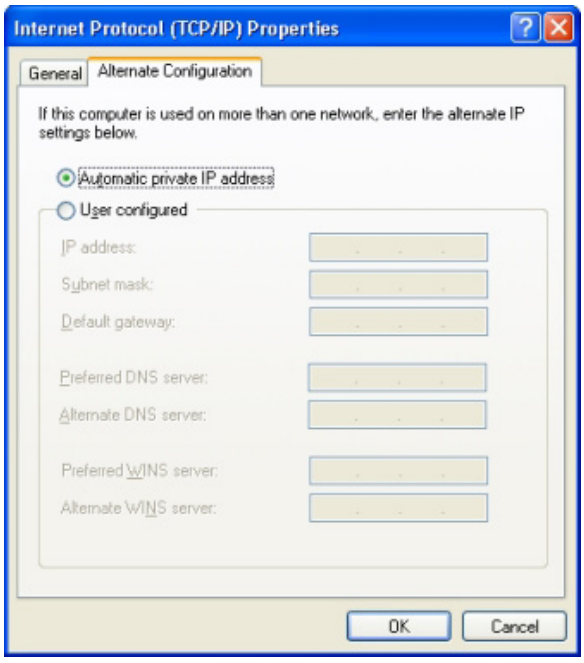
In the new opened window "Internet Protocol (TCP/IP) Properties" please click on "Alternative Configuration" and select the option "User configured" for the manual preset of the network parameters.

- In the input field „IP adress" enter your (or from a network administrator specified) IP address of the PC (e.g. 192.168.10.2).
- In the input field "Subnet mask" enter your (or from a network administrator specified) subnet mask of the PC (e.g. 255.255.255.0).
- In the input field "Default gateway" enter your (or from a network administrator specified) IP address of the gateway (e.g. the IP address of the router of its LAN network).
- If you connect the host (PC) and the Instrument via network cable directly, this setting is optional.

**The preset IP addresses of the instrument and the host (PC) have to be different, but have to be in the same subnet (example: instrument 192.168.010.010,
PC 192.168.010.002, with subnet mask 255.255.255.000).**



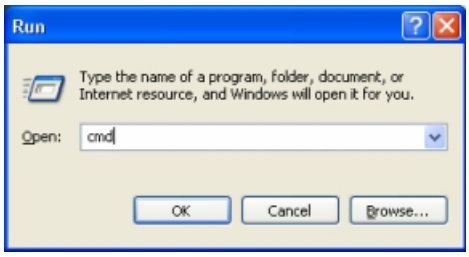
If you connect the instrument and the host (PC) to a network with existing DHCP server (with activated DHCP function), the presets for IP address, subnet mask and gateway of the existing DHCP server are assigned dynamically. In this case, you don't need the described manual presets of IP address, subnet mask and gateway. In the opened window "Internet Protocol (TCP/IP) Properties" please click on „Alternate Configuration" and select the option „Automatic private IP address".



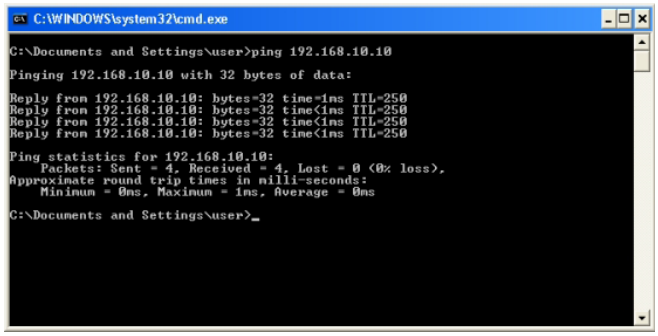
After the presets please confirm the settings with „OK".

4.4 Instrument connection test

For the connection test from host (PC) to the Ethernet interface of the instrument, please go into the "Start" menu and select "Run". Start the command interpreter by input the "cmd" command. Complete the input by the "Enter" key or confirm the input with „OK".



An input window will open. After the input character please input the "ping 192.168.10.10" (in the represented example the Ethernet interface of the instrument has the IP address 192.168.10.10) and confirm the input with Enter.



If the Ethernet interface answers the „Ping" without errors (please refer to the represented example), the connection is correct. If the interface answers with an error message, no connection is present or the connection is disturbed. In this case, please check all network cables between instrument and host (PC), as well as the preset interface parameters of the instrument Ethernet interface and the host (PC) Ethernet LAN interface. If the connection is controlled via further network elements, e.g. switches, routers, network servers, etc., please check these further connections, as well as the presets of the appropriate network elements.

5 Application

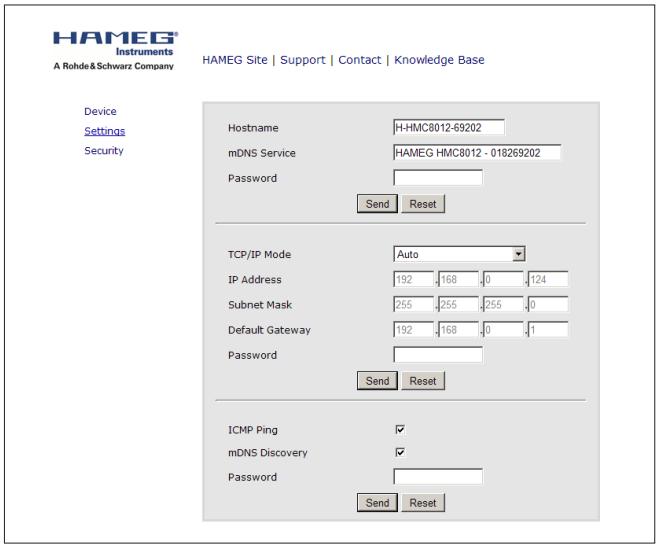
5.1 Application concerning Ethernet

The Ethernet interface offers a web server, which can be used with a web browser (e.g. Internet Explorer, ...). The following functions are supported by the Web server:

- Display of the device information
- Display of the Ethernet setting
- Password setting (security)

Display of the device information

Display of the Ethernet settings

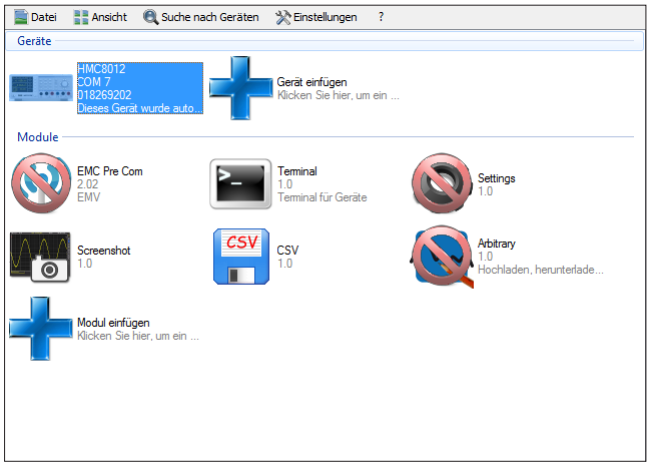


5.2 Remote control via software

The interface can be used via Ethernet or via USB in conjunction with the application software HMExplorer in oder to transfer data (CSV module), screenshots (screenshot module) as well as a command line for sending remote commands (terminal module). The HMExplorer software is available as a free download on the HAMEG homepage www.hameg.com.

Please refer to the internal help of the HMExplorer software for the necessary settings and the features offered.

The SCPI programming commands are also available on www.hameg.com.



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