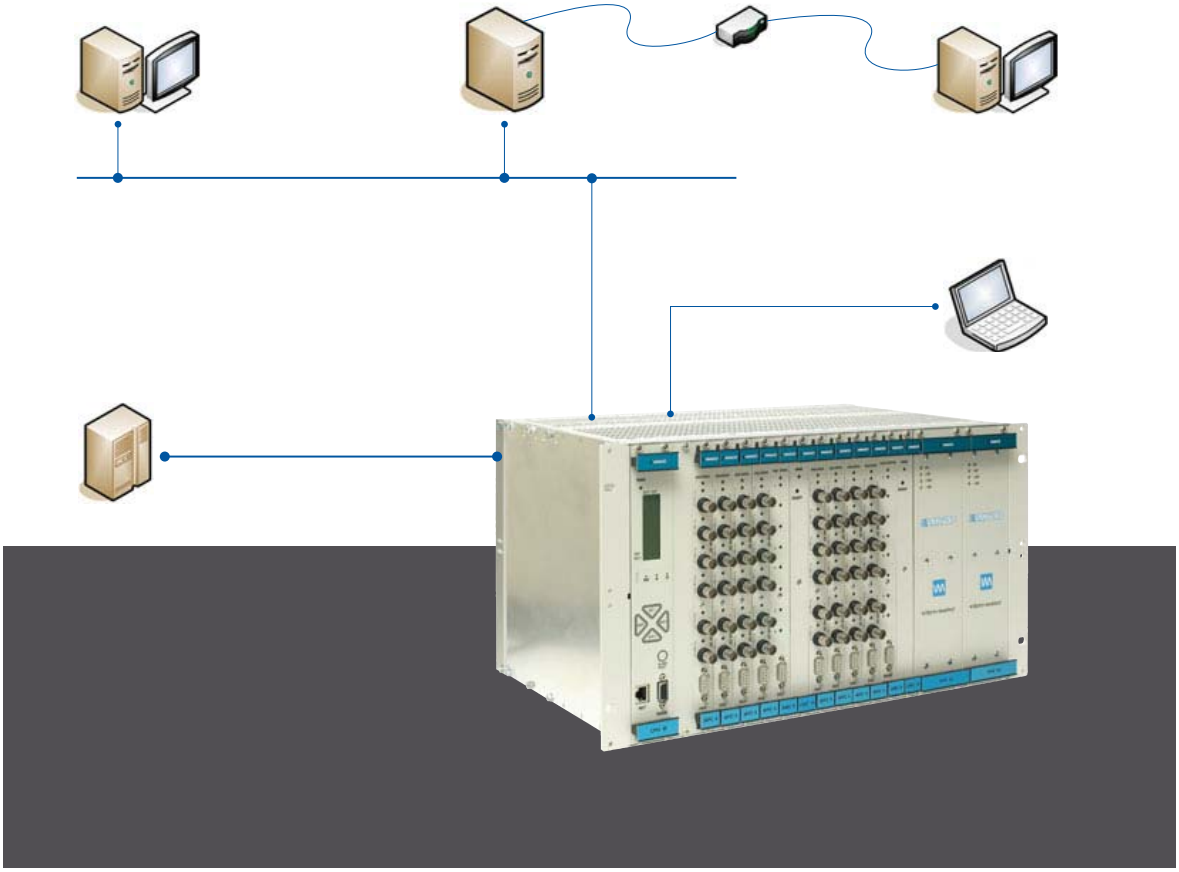
Vibro-Meter

Instruction Manual

VM600 Networking



Vibro-Meter SA
Route de Moncor 4
CH - 1701 Fribourg
SWITZERLAND

www.vibro-meter.com

VM600 Networking Instruction Manual MAVM600-NET/E
Edition 3 - Mai 13/09

MEGGiTT

REVISION RECORD SHEET

Edition	Date of Issue	Written by / Modified by	PM No.	Description	Signature
1	07.10.03	R. Meyer	- - -	Original edition	RM
2	31.03.06	N. Parker	- - -	Update to reflect new corporate identity	NP
3	13.05.09	S. Trono	- - -	Updated for Windows XP Added AMC8 card support	ST

	Department	Name	Date	Signature
Technical content approved by	Development	H. Reiss	13.05.09	HR
	Product Management	S. Adamo	13.05.09	SA
Document released by	Technical Publications	S. Trono	13.05.09	ST

The duly signed master copy of this page is stored by the Technical Publications Department of Vibro-Meter S.A. and can be obtained by writing to the Technical Publications Manager.

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PREFACE

About this manual

This manual provides reference information on using Vibro-Meter's VM600 Series systems in a networked configuration. It is applicable to the following VM600 systems :

- Machinery Protection System (MPS)
- Condition Monitoring System (CMS)

Who should use this manual?

The manual is written for operators of process monitoring/control systems using the VM600 Series systems.

The operator is assumed to have the necessary technical training in electronics and mechanical engineering (professional certificate/diploma, or equivalent) to enable him to install, program and use the system(s).

Concerned parts

The following table presents the part numbers of the CPU M cards concerned by this manual and some of their specifications.

Material	DiskOnChip	Compact Flash	QNX version	PPP protocol enabled	Discrete value coded in analog register
200-595-04x-**C**1x 200-595-061-**C**14 200-595-062-**C**14	16 MB 16 MB 16 MB		4.25 4.25 4.25		
200-595-063-**C**14 200-595-064-**C**14 200-595-065-**C**14	32 MB 32 MB 32 MB		6 6 6	 ✓ ✓	 ✓
200-595-066-**C**14 200-595-067-**C**14		min 512 MB min 512 MB	6 6	✓ ✓	✓ ✓
200-595-70x-**C**14	32 MB		6	✓	✓

In the previous part numbers, the letter **C** can take the following values:

1- Standard version: 1x RS-232 or 485/422 and 1x Ethernet

2- Ethernet redundant

3- RS-485/422 redundant

Structure of the manual

This section gives an overview of the structure of the document and the information contained within it. Some information has been deliberately repeated in different sections of the document to minimize cross-referencing and to facilitate understanding through reiteration.

The chapters are presented in a logical order. You should read those that are most relevant to you and then keep the document at hand for future reference.

The structure of the document is as follows :

Chapter 1 Networking Introduction and Overview

Describes how to use a VT100 terminal (or emulator) to change the IP address of the VM600 rack and edit Modbus configuration files. A brief description of the vi editor is also provided.

Chapter 2 VT100 Terminal Sessions

Introduces the networking options possible with the VM600. Provides a brief overview to networking terms and principles (intended principally for those not familiar with the field).

Chapter 3 Setting up an Ethernet Connection

Provides information on how to configure your PC to communicate with the VM600 over an Ethernet link.

Chapter 4 Setting up a PPP Connection

Provides information on how to configure your PC to communicate with the VM600 over an RS-232 link using the Point-to-Point Protocol (PPP).

Chapter 5 Setting up a Modbus Connection

Describes the Modbus RTU and Modbus TCP protocols. Provides detailed information on reading discrete inputs and registers from the VM600 rack.

Chapter 6 Customer Support

Provides contact details for technical queries and for getting equipment repaired. Includes a customer feedback form allowing the user to provide us with valuable feedback on our documentation.

Related publications and documentation

For further information, the operator is referred to one or more of the following software manuals (the choice depending on the customer's specific application) :

- *VM600 Condition Monitoring System (CMS) Software Manual, Volumes 1 and 2*
  Vibro-Meter Document No. MACMS-SW/E
- *VM600 Condition Monitoring System (CMS) Quick Start Manual*
  Vibro-Meter Document No. MACMS-QS/E
- *MPCC Configuration Software for* VM600 *Series Machinery Protection Card*Vibro-Meter Document No. MAMPCC/E
- *MPS1 Configuration Software for* VM600 *Series Machinery Protection System*
  Vibro-Meter Document No. MAMPS1-SW/E
- *MPS2 Configuration Software for* VM600 *Series Machinery Protection System*
  Vibro-Meter Document No. MAMPS2-SW/E

The operator is also referred to one or more of the following hardware manuals (the choice depending on the customer's specific application) :

- VM600 *Series Condition Monitoring System (CMS) Hardware Manual*
  Vibro-Meter Document No. MACMS-HW/E
- VM600 *Series Machinery Protection System (MPS)*

Abbreviations

The following table defines the abbreviations found in this manual as well as in associated Vibro-Meter documentation.

CMS	Condition Monitoring System
CRC	Cyclic Redundancy Check
DCS	Distributed Control System
IP	Internet Protocol
IPX	Internetwork Packet Exchange
LAN	Local Area Network
MPS	Machinery Protection System
NetBEUI	A proprietary Microsoft networking protocol
NIC	Network Interface Card
NOS	Network Operating System
PLC	Programmable Logic Controller
PPP	Point-to-Point Protocol
RAS	Remote Access Service
RTU	(Modbus) Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition
SLIP	Serial Line Internet Protocol
STP	Shielded Twisted Pair
TCP/IP	Transmission Control Protocol / Internet Protocol
UTP	Unshielded Twisted Pair
WAN	Wide Area Network

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1 NETWORKING INTRODUCTION AND OVERVIEW

1.1 Communication possibilities

Several possibilities exist for communicating with a VM600 rack. These are listed below and summarized in Figure 1-1 (the number in parenthesis refers to the figure) :

- **Ethernet / TCP/IP** (1a & 1b)

  Allows configuration of a rack using Vibro-Meter's MPS software (e.g. MPS1, MPS2) or CMS software
- **Communication possible via CPU M card or IOC N card**

  Refer to Chapter 3 for further information.
- **Ethernet / Modbus TCP** (2)

  Allows a Distributed Control System (DSC) to read discrete inputs and registers.

  Communication possible via IOC N card.

  Refer to Chapter 5 for further information.
- **RS-232, RS-485/422 / Modbus RTU** (3)

  Allows a Distributed Control System (DSC) to read discrete inputs and registers.

  Communication possible via IOC N card.

  Refer to Chapter 5 for further information.
- **RS-232 / VT100 terminal** (4)

  Allows communication directly with the CPU M card in order to configure an IP address, modify Modbus parameters (baudrate, parity, etc.) and modify the allocation of Modbus registers.

  Communication possible via CPU M card.

  Refer to Chapter 2 for further information.
- **RS-232 / PPP (Point-to-Point Protocol)** (5)

  Allows configuration of a rack using Vibro-Meter's MPS software (e.g. MPS1, MPS2) or CMS software

  Communication possible via CPU M card.

  Refer to Chapter 4 for further information.
- **RS-232 / Proprietary protocol** (6)

  Allows configuration of a stand-alone rack using Vibro-Meter's software (e.g. MPS1)

  Communication possible via MPC 4 or AMC 8 card.

  This is not strictly a case of "networking" and it will not be considered further in this manual.

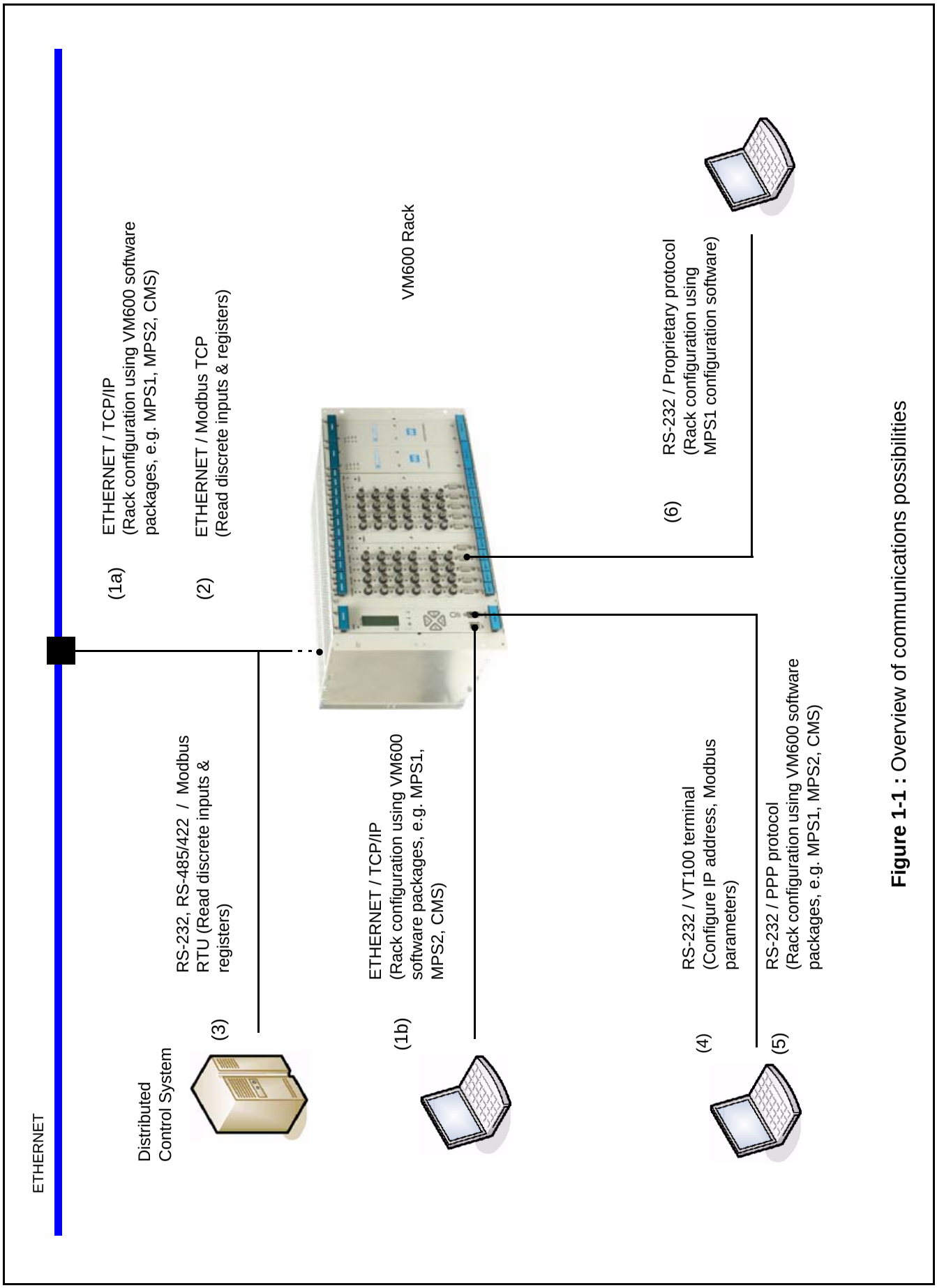


Figure 1-1 : Overview of communications possibilities

1.2 Some networking terms and definitions

This section provides a brief overview of networking terms and definitions. It is intended for users who are unfamiliar with this field.

Further information can be found in the literature or on numerous web sites.

1.2.1 Network types

Two principal types are outlined below. Refer also to Figure 1-2.

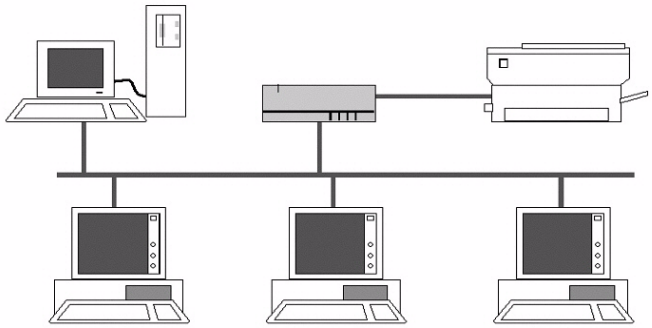
1.2.1.1 Local Area Network (LAN)

- Usually limited to short distances
- Owned by the organization that uses it
- Usually employs solid cable, though wireless LANs are increasingly common
- Transmission rates tend to be in the range of 10 Mbps to 1000 Mbps

1.2.1.2 Wide Area Network (WAN)

- Cover extremely large areas
- Usually owned by major communications companies
- Systems often connected to WAN through public networks such as the telephone system.
- Most common WAN protocol is TCP/IP
- The Internet is an example of a WAN

(a) Local Area Network (LAN)



(b) Wide Area Network (WAN)

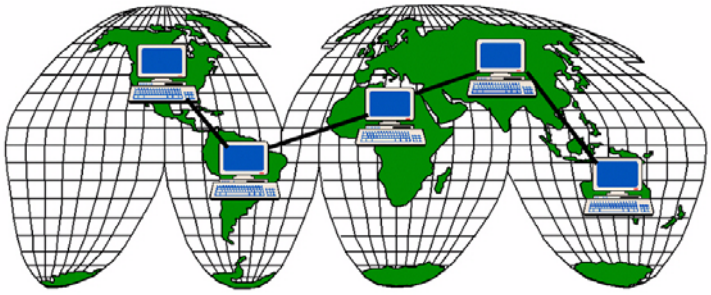


Figure 1-2 : Network types (LAN and WAN)

1.2.2 Connectivity within networks

The following devices may be found in networks (see also Figure 1-3) :

1- Hub

A common connection point for devices in a network. Hubs are commonly used to connect segments of a LAN. A hub contains multiple ports. When a packet arrives at one port, it is copied to the other ports so that all segments of the LAN can see all packets.
The availability of low-priced network switches has largely rendered hubs obsolete but they are still seen in older installations and more specialized applications.

2- Switch

A network device that cross-connects clients, servers and network devices. Also known as a "frame switch", stand-alone LAN switches are common in all Ethernet networks. A four-port switch is also typically built into a wired or wireless router for homes and small businesses.

3- Router

A router is a network device that forwards packets from one network to another. Based on internal routing tables, routers read each incoming packet and decide how to forward it.
Most routers in homes and small offices do nothing more than direct Web, e-mail and other Internet transactions from the local network to the cable or DSL modem, which is connected to internet service provider and then to the internet.
In larger companies, routers are also used to separate local area networks (LANs) into subnetworks (subnets) in order to balance traffic within workgroups and to filter traffic for security purposes and policy management.

4- Gateway

- A network gateway converts packets from one protocol to another.
  A protocol translation/mapping gateway interconnects networks with different network protocol technologies by performing the required protocol conversions.
- A device that acts as a go-between two or more networks that use the same protocols. In this case, the gateway functions as an entry/exit point to the network. Transport protocol conversion may not be required, but some form of processing is typically performed.

Routers exemplify special cases of gateways.

5- Firewall

A firewall allows or blocks traffic into and out of a private network or the user's computer. Firewalls are widely used to give users secure access to the Internet as well as to separate a company's public Web server from its internal network. Firewalls are also used to keep internal network segments secure; for example, the accounting network might be vulnerable to snooping from within the enterprise.
In homes, a personal firewall is typically a software that is installed on the user's computer. In organizations, a firewall can be a stand-alone machine or software in a router or server. It can be as simple as a single router that filters out unwanted packets, or it may comprise a combination of routers and servers each performing some type of firewall processing.

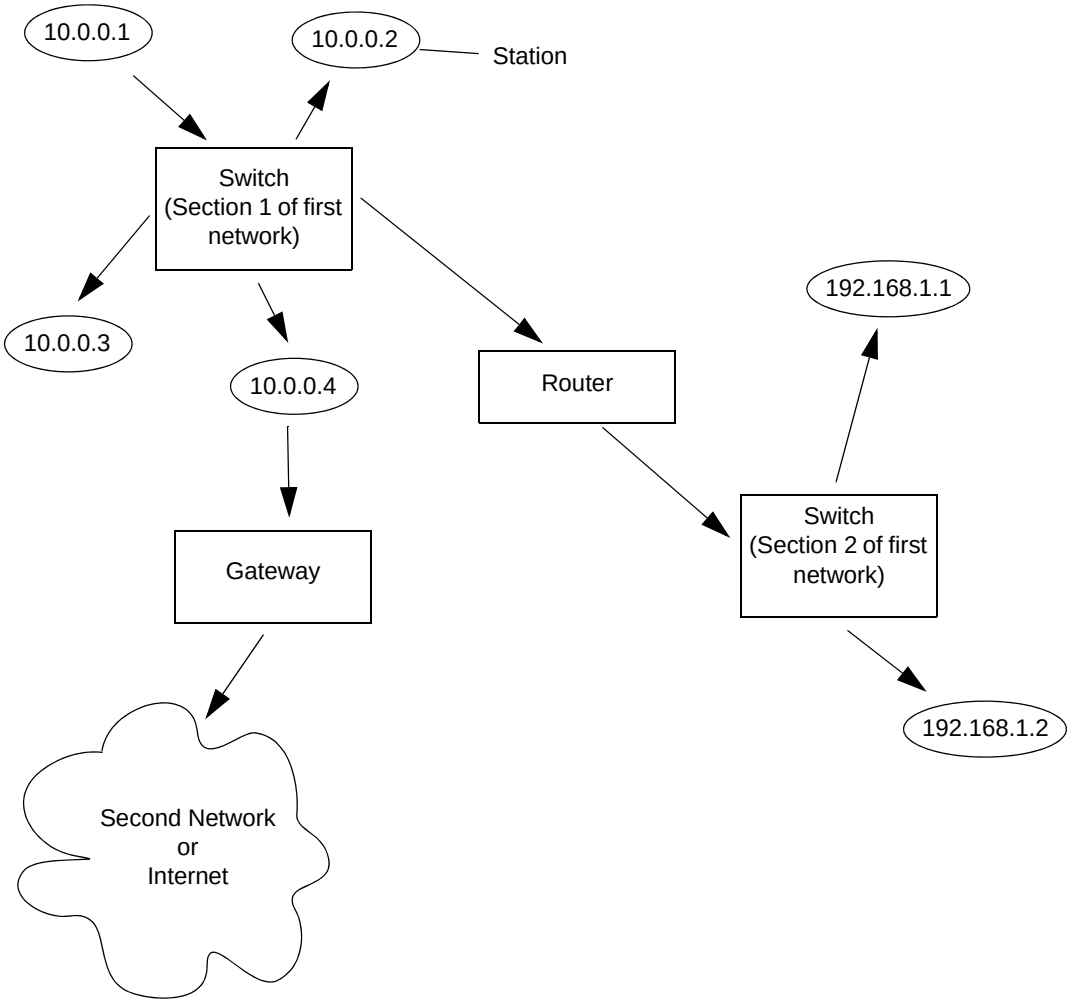


Figure 1-3 : Network devices

1.2.3 Ethernet

Ethernet provides a method for high-bandwidth communication between devices on a LAN. It is presently the most commonly used protocol.

The original Ethernet specification served as a basis for the IEEE 802.3 standard. This designates both physical transmission media and the method of transmission along the media.

Over 20 variations of Ethernet are presently available. The ones most applicable to the VM600 system are :

1- 10Base-T

- Operates at 10 Mbps and uses baseband transmission methods
- Uses least expensive cable type, i.e. shielded twisted pair (STP) or unshielded twisted pair (UTP) cable (most use UTP)
- Maximum cable segment length is 100 meters
- Cables use RJ-45 connectors
- Star or star-bus topology is created, with systems connected to each other via hubs
- Easy to expand

2- 100Base-T (also known as Fast Ethernet)

- Operates at 100 Mbps and uses baseband transmission methods
- Variants depending on physical transmission media are :

  100Base-TX (2 pairs of high-quality twisted pairs, allowing full duplex transmission)

  100Base-T4 (4 pairs of normal-quality twisted pairs)

  100Base-FX (2 multimode fiber optic cables)
- Star topology, therefore requires a hub
- Used mainly for network backbones or server-to-server connections (clustering)

In terms of the VM600, Ethernet communication is nevertheless possible with a very simple configuration that uses a crossover cable to connect the VM600 rack directly to the host computer. Refer to Section 3.1 for further information.

1.2.4 Network protocols

Important network protocols for the VM600 system are :

1- TCP/IP (Transmission Control Protocol / Internet Protocol)

2- PPP (Point-to-Point Protocol)

1.2.4.1 The TCP/IP protocol

- The most widely used protocol suite in the world (used on Internet)
- Most major network operating systems (NOSs) support the use of TCP/IP
- Originally designed for WAN use, now commonly used for LANs as well
- Routable protocol that offers true internetworking and interoperability between disparate NOSs
- Dynamic Host Configuration Protocol (DHCP) allows automatic IP address assignment
- Not as fast as NetBEUI (a proprietary Microsoft networking protocol) on small networks
- Provides full internetwork routing support

1.2.4.2 The Point-to-Point Protocol (PPP)

- Developed in the early 1990s
- Designed to overcome the problems with Serial Line Internet Protocol (SLIP)
- Can be used with Internet Protocol (IP), Internetwork Packet Exchange (IPX) protocol and NetBEUI (a proprietary Microsoft networking protocol)
- Includes cyclic redundancy check (CRC) to look for errors
- Includes compression so it does not have to rely on hardware compression

The structure of a PPP frame is shown in Figure 1-4.

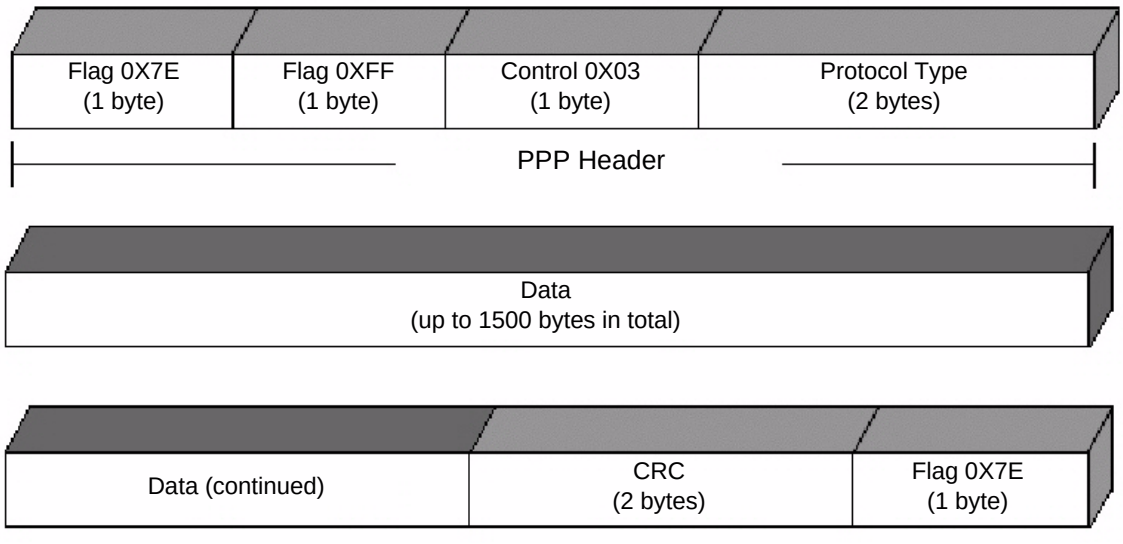


Figure 1-4 : Constitution of a PPP frame

1.2.5 IP addressing (TCP/IP protocol)

1.2.5.1 Basic rules

- Each network must have a unique network address
- Each workstation on a network must have a unique host address
- Your IP address must be unique to the rest of the network
- Never use an IP address not assigned to you if you are going to be connected to a network, e.g. the Internet.

1.2.5.2 IP addressing and address classes

IP addressing uses a 32-bit (4-byte) address with two parts :

- Network number
- Host number

Each byte is converted into a decimal number between 1 and 255 and they are separated by periods (dots). Example : 100.100.100.100

Three common IP address classes exist (see also Figure 1-5) :

- Class A

  Supports approx. 16 million hosts on each of 127 networks
  Address format : Network.Host.Host.Host
- Class B

  Supports approx. 65 000 hosts on each of approximately 16 000 networks
  Address format : Network.Network.Host.Host
- Class C

  Supports 254 hosts on each of approximately 2 million networks
  Address format : Network.Network.Network.Host

1.2.5.3 Subnets and subnet masks (netmasks)

Subnets allow you to subdivide a larger network into smaller, more manageable units. You must provide a subnet mask (also known as a netmask).

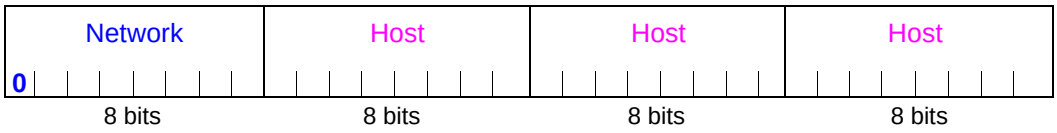
Benefits of subnetting :

- Reduced network traffic by selecting the path any information has to be sent to
- Optimized network performance
- Simplified management
- Facilitates spanning large geographical distances

Default subnet masks (also known as “natural masks”) are :

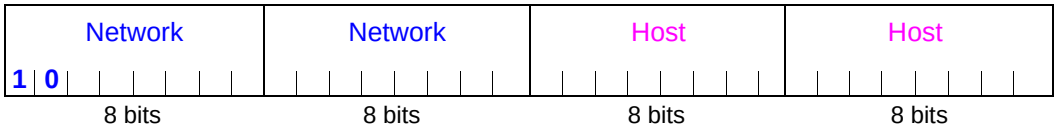
- Class A : 255.0.0.0 (decimal)
  11111111.00000000.00000000.00000000 (binary)
  F F 0 0 0 0 0 0 (hexadecimal)
- Class B : 255.255.0.0
  11111111.11111111.00000000.00000000
  F F F F 0 0 0 0
- Class C : 255.255.255.0
  11111111.11111111.11111111.00000000
  F F F F F F 0 0

Class A



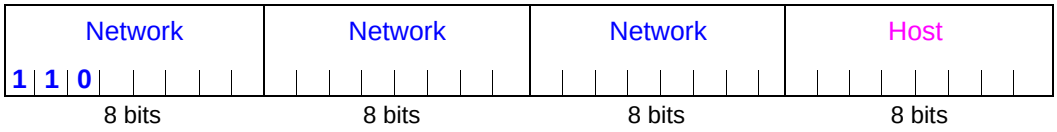
Binary network address starts with “0”, so first byte can be between 1 and 127 (decimal).
The first byte identifies the network and the remaining 3 bytes identify the host.
Example : 104.122.245.10 (where “104” identifies the network and “122.245.10” the host)
Number of possible networks : 127
Max. number of hosts : 16 777 214

Class B



Binary network address starts with “10”, so first byte can be between 128 and 191 (decimal).
The first 2 bytes identifies the network and the remaining 2 bytes identify the host.
Example : 155.113.16.102 (where “155.113” identifies the network and “16.102” the host)
Number of possible networks : 16 384
Max. number of hosts : 65 534

Class C



Binary network address starts with “110”, so first byte can be between 192 and 223 (decimal).
The first 3 bytes identifies the network and the remaining 1 byte identifies the host.
Example : 210.222.126.55 (where “210.222.126” identifies the network and “55” the host)
Number of possible networks : 2 097 152
Max. number of hosts : 254
(Note : although theoretically 256 host addresses should be possible, the addresses “00000000” and “11111111” are reserved)

Figure 1-5 : Overview of IP address classes

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2 VT100 TERMINAL SESSIONS

2.1 Purpose

A VT100 connection allows parameters in the CPU M card's operating system files to be customized before the VM600 is used with an Ethernet connection or before a Modbus configuration is set up. These system files are on the card's "disk-on-chip".

Using a VT100 terminal session, allows you to:

- Configure an IP address for the VM600 rack
- Modify Modbus communication parameters such as baud rate and parity.
- Modify the allocation of Modbus registers

2.2 Getting started

2.2.1 If a VT100 terminal is available

If you have a VT100 terminal, use a suitable serial cable to connect it to the 9-pole RS-232 connector on the front panel of the CPU M card.

The required settings are :

57600 baud
8 bits
1 stop bit
No parity

If no VT100 terminal is available, you can use a Windows tool (such as HyperTerminal) to emulate one (see Section 2.2.2).

2.2.2 Emulating a VT100 terminal from Windows (HyperTerminal)

NOTE : The exact procedure to be followed depends on the operating system used. This description assumes Windows XP is installed. If you are using a different operating system you can still follow this description for guidance, but the menus and dialog boxes shown in screen shots may look quite different.

In case of questions or problems, please consult first the Windows online help utility or contact your System Administrator. If still no solution can be found, contact your nearest Vibro-Meter representative.

To get started, proceed as follows .

1- Click **Start** > **Programs** > **Accessories** > **Communications** and choose **HyperTerminal**. The Connection Description dialog box appears (see Figure 2-1).

Figure 2-1 : The “Connection Description” dialog box

2- Select an appropriate icon from the choice provided, then type in a suitable name for the terminal emulation. Click **OK** to obtain the Connect To dialog box (see Figure 2-2).

Figure 2-2 : The “Connect To” dialog box

3- Choose the correct port in the “Connect using” field, then click **OK**.

4- Set the communication parameters for the chosen port as shown in Figure 2-3, then click **OK**.

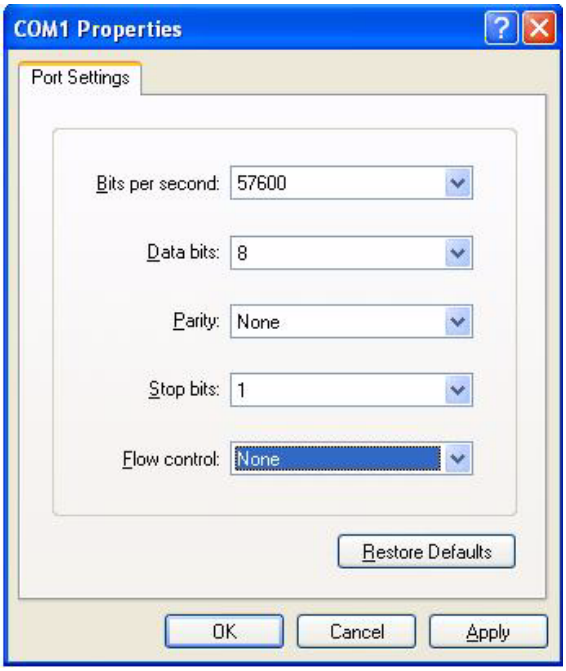


Figure 2-3 : Defining the port settings

5- Choose **Properties** from the **File** menu and set the communication parameters for the chosen port as shown in Figure 2-4.

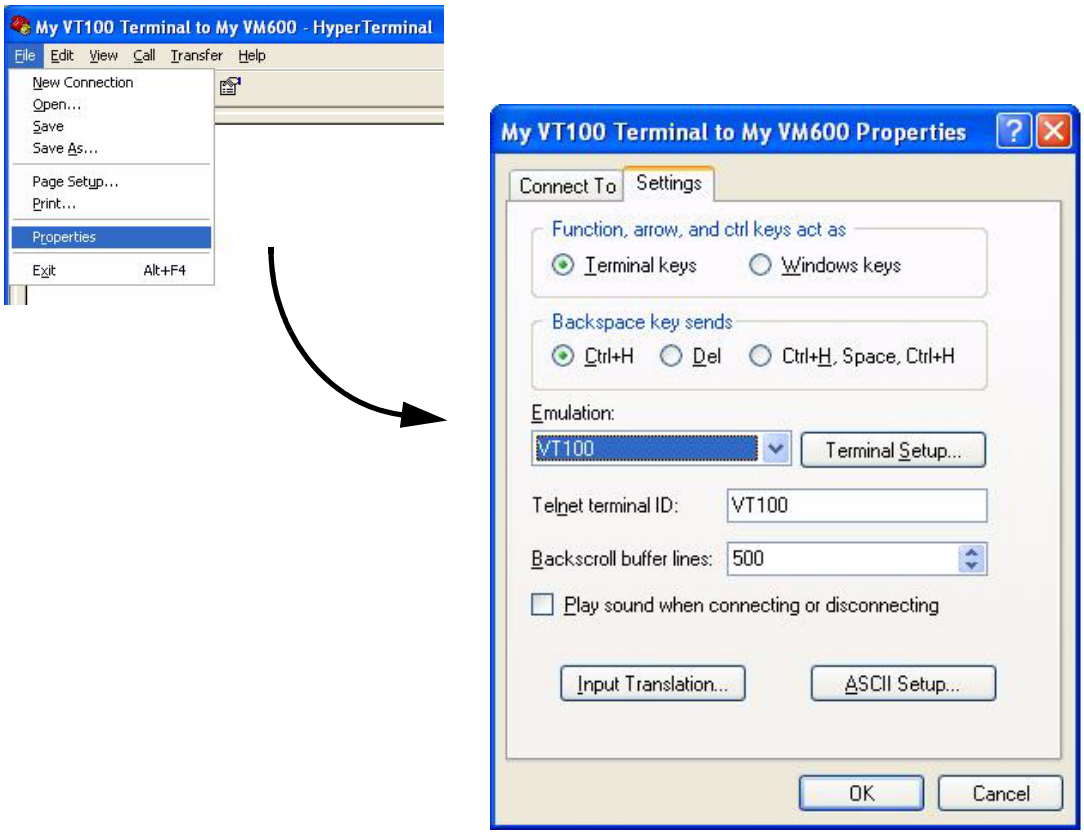


Figure 2-4 : Configuring the Settings dialog box for a VT100 terminal

6- Click on the **Terminal Setup** and **ASCII Setup** buttons and check the resulting screens are as shown in Figure 2-5.

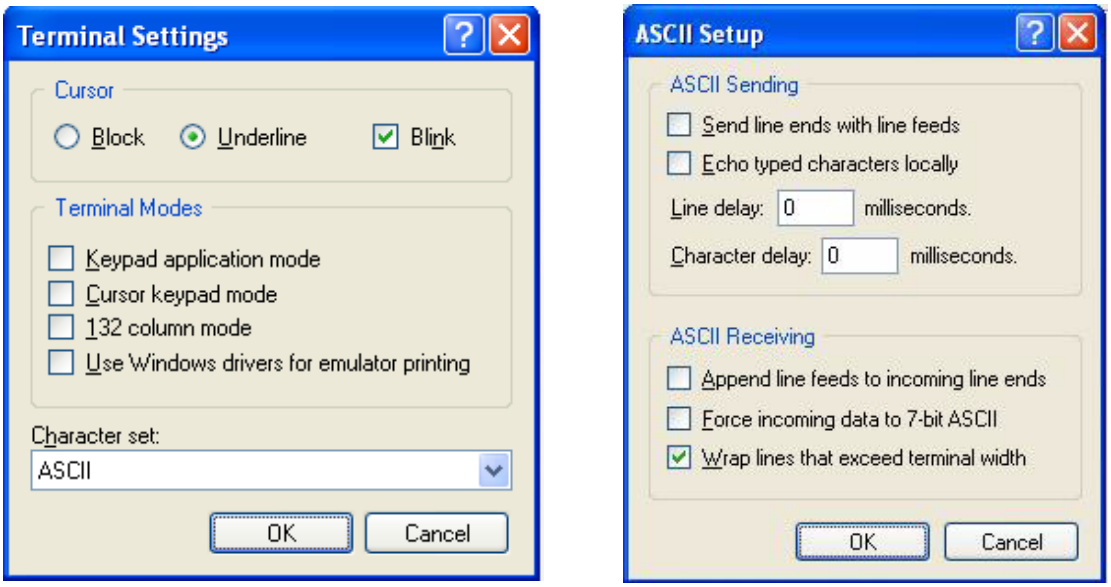


Figure 2-5 : The Terminal Settings and ASCII Settings dialog boxes

7- Login by typing (see Figure 2-6)

login : **user**	(press the <Enter> key)
password : **config**	(press the <Enter> key)

NOTE : Refer to Section 2.6 for a list of most commonly required commands when using a vi Editor.

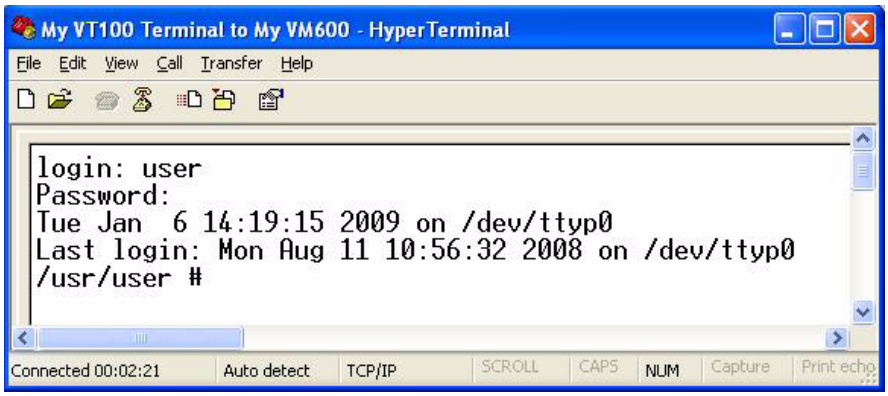


Figure 2-6 : Logging into the session

8- Use the “ls” command to list the files in the directory (see Figure 2-7).

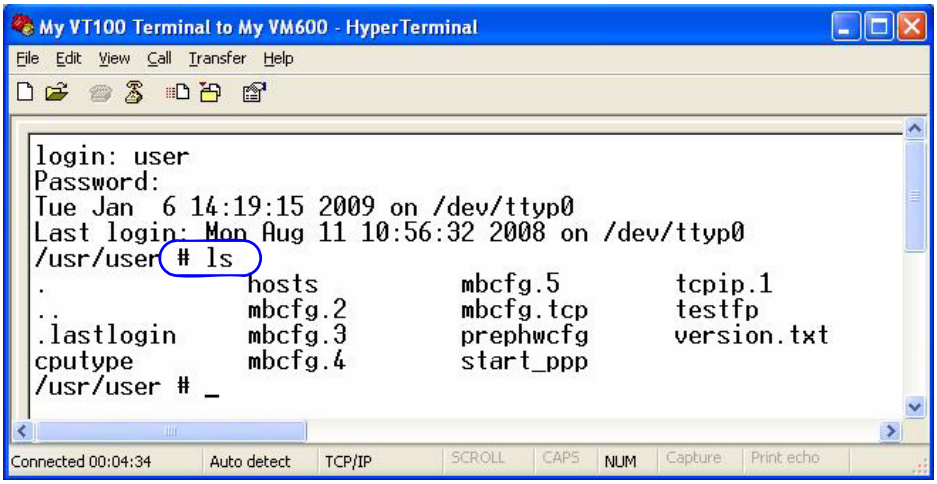


Figure 2-7 : Listing the files in the directory

The following files are typically found :

`mbcfg.2`	Configuration file for Modbus communication through 9-pole RS-232 connector on front of CPU M card File contains the Modbus address for the rack, the definition of communications parameters (baud rate, parity, etc.) and the definition of all discrete inputs and registers that can be read.
`mbcfg.3`	Configuration file for Modbus communication through RS connector (RJ11-type) on IOC N card File contains the Modbus address for the rack, the definition of communications parameters (baud rate, parity, etc.) and the definition of all discrete inputs and registers that can be read.
`mbcfg.tcp`	Configuration file for Modbus communication through Ethernet connector on IOC N card File contains the Modbus address for the rack, the definition of communications parameters (baud rate, parity, etc.) and the definition of all discrete inputs and registers that can be read.
`hosts`	This file contains the local host address, the IP address of the VM600 rack (= the “node1” address) and the IP address of the gateway (if applicable)
`tcpip.1`	This file contains the commands to configure network adapter(s). It uses IP addresses defined in the `hosts`, and contains definitions of subnet mask(s) and gateway(s).

Depending on the CPU sub-module options ordered and installed, the following files can also be found :

`mbcfg.4`	Configuration file for Modbus communication through the two “A” connectors (RJ11-type) on IOC N card File contains the Modbus address for the rack, the definition of communications parameters (baud rate, parity, etc.) and the definition of all discrete inputs and registers that can be read.
`mbcfg.5`	Configuration file for Modbus communication through the two “B” connectors (RJ11-type) on IOC N card File contains the Modbus address for the rack, the definition of communications parameters (baud rate, parity, etc.) and the definition of all discrete inputs and registers that can be read.

2.3 Changing the IP address of the rack

The `hosts` file on the CPU M must be edited in order to change the IP address of the VM600 rack :

1- Use the **vi** command to edit the `hosts` file (see Figure 2-8).

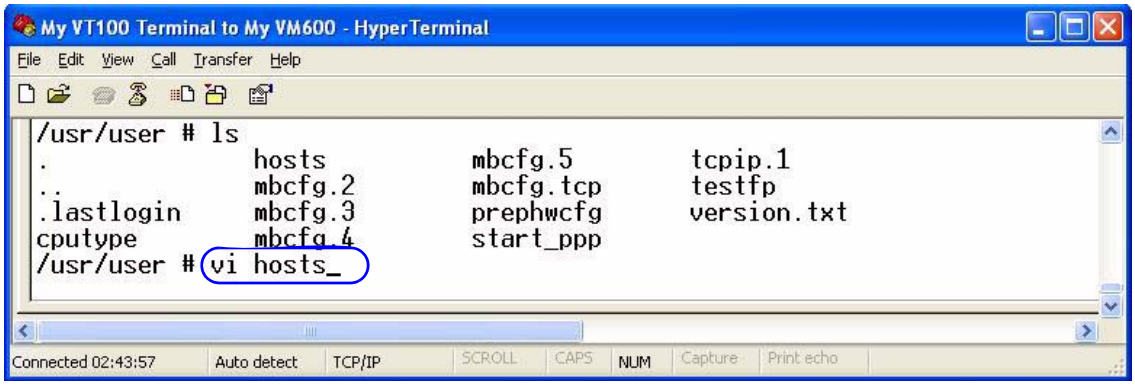


Figure 2-8 : To edit the “hosts” file

2- Modify the line defining the IP address of the rack. This line is shown in Figure 2-9.

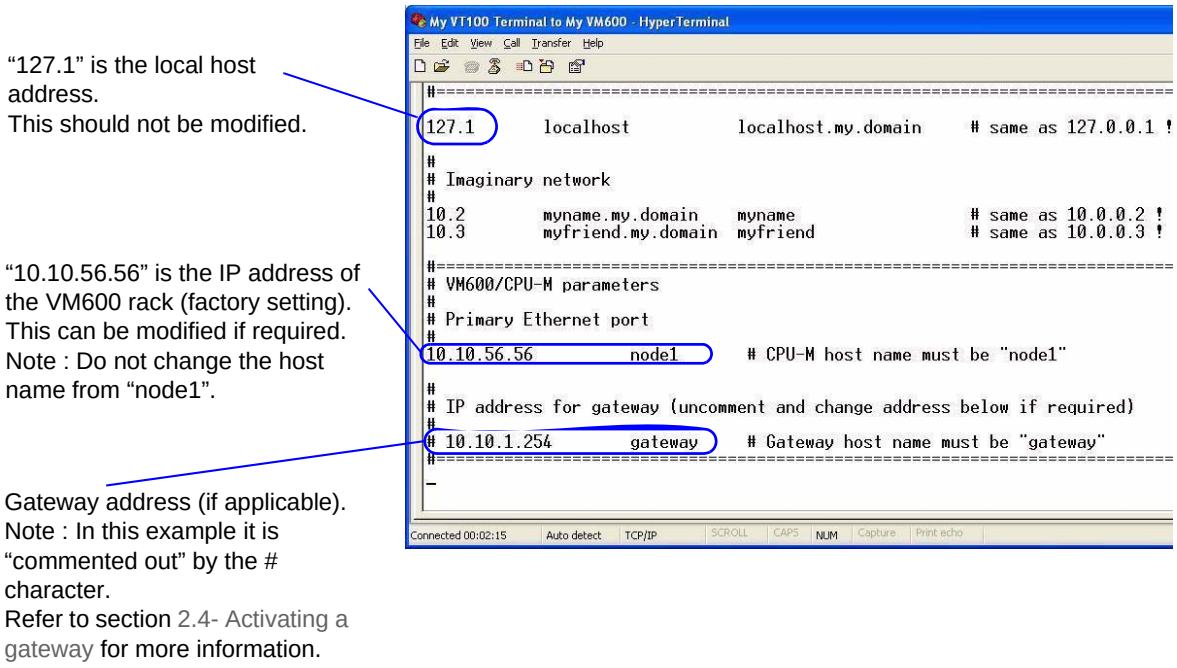


Figure 2-9 : To edit the IP address of the rack

3- If a gateway is required, remove the # character preceding the gateway address, this will activate the address. Refer to Section 2.4 for further information.

4- Use the “wq” command to save the changes, type :

:wq <Enter>

The `tcpip.1` file on the CPU M card’s memory must be edited in order to change the subnet mask according to your network parameters :

5- Use the “vi” command to edit the `tcpip.1` file.

6- If the subnet mask has to be changed, modify the value of the variable NETMASK (the default value is set to 255.255.0.0 in hexadecimal) by editing the line beginning with “NETMASK” (see Figure 2-10). For example, if the required subnet mask is 255.255.255.0, change the value of the variable by modifying this line as follows :

```
NETMASK = 0 x f f f f f f 0 0
```

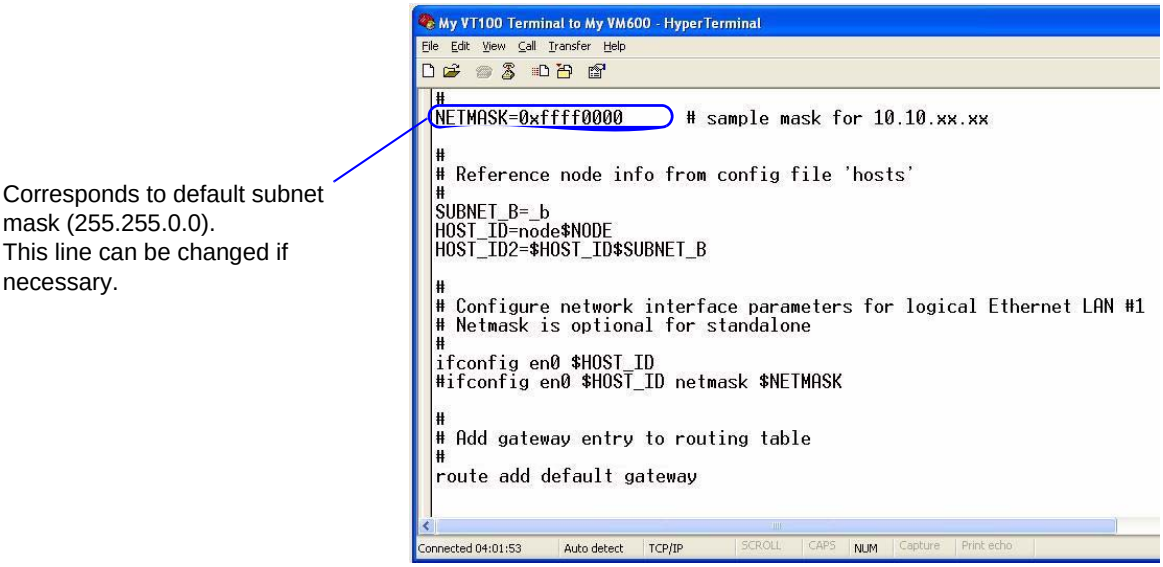


Figure 2-10 : Editing the “tcpip.1” file to change the subnet mask

7- Use the “wq” command to save the changes and leave the VT100 editor.

8- Power down and turn back on the VM600 rack.

If you are unable to power down the rack you can use the **shutdown -f** command instead.

NOTE : Further information on VT100 commands (vi Editor) can be found in Section 2.6.

2.4 Activating a gateway

2.4.1 When is a gateway necessary?

In general terms, a gateway is needed to allow communication between two different subnets (see Figure 2-11).

In the example shown, System 1 can communicate directly with System 2, as both have an IP address beginning with *10.10.*

System 1 cannot communicate directly with System 3 as the IP addresses are very different. A gateway is therefore needed.

System 1 can communicate with the gateway as both have an IP address beginning with *10.10.* Likewise, System 3 can communicate with the gateway as both have an IP address beginning with *194.11.227*.

Note that if the subnet mask for subnet “A” was changed from 255.255.0.0 to 255.255.255.0, communication would no longer be possible between System 1 and System 2 or between System 1 and the gateway.

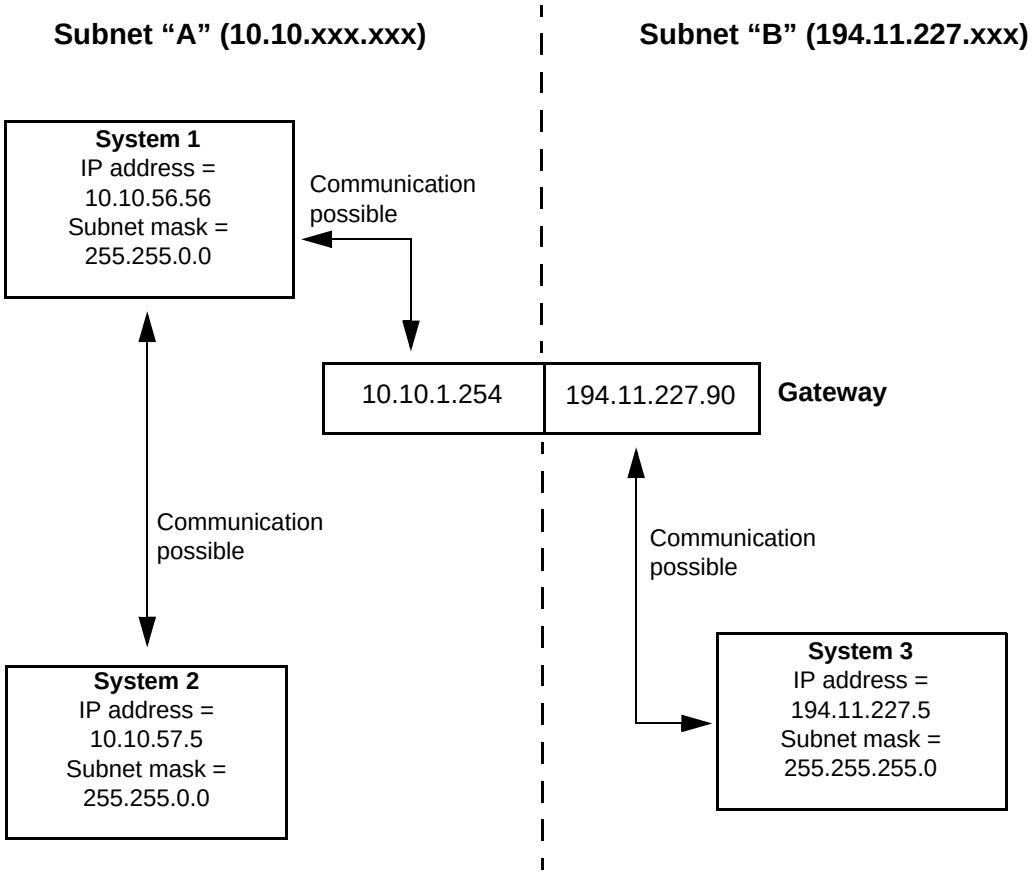


Figure 2-11 : Communication between two subnets via a gateway

In terms of the VM600 rack, Ethernet communication between the host PC and the VM600 rack (CPU M card) can only take place if the IP addresses of the host PC and the VM600 rack belong to the same subnet.

To get around this potential problem, a gateway must be defined in the CPU M.

NOTE : For proper operation, the IP addresses of the gateway and the CPU M must belong to the same subnet. If this is not the case, the gateway cannot be accessed by the CPU M.

The host PC and the gateway must also have IP addresses that are visible to each other.

Finally, the host PC can run on any operating system but must be able to emulate a VT100 terminal.

2.4.2 Procedure

To activate the gateway, proceed as follows :

1- Add (or activate) the IP address of the gateway in the `hosts` file stored in the memory of the CPU M (refer to Section 2.3).

The `hosts` file may already contain a commented out line defining the IP address of the gateway, as shown in Figure 2-9. In this case, it is sufficient to remove the # character at the beginning of the line and type in the actual IP address of your gateway.

Otherwise, type in the IP address (followed by the word “gateway”) as shown in Figure 2-12.

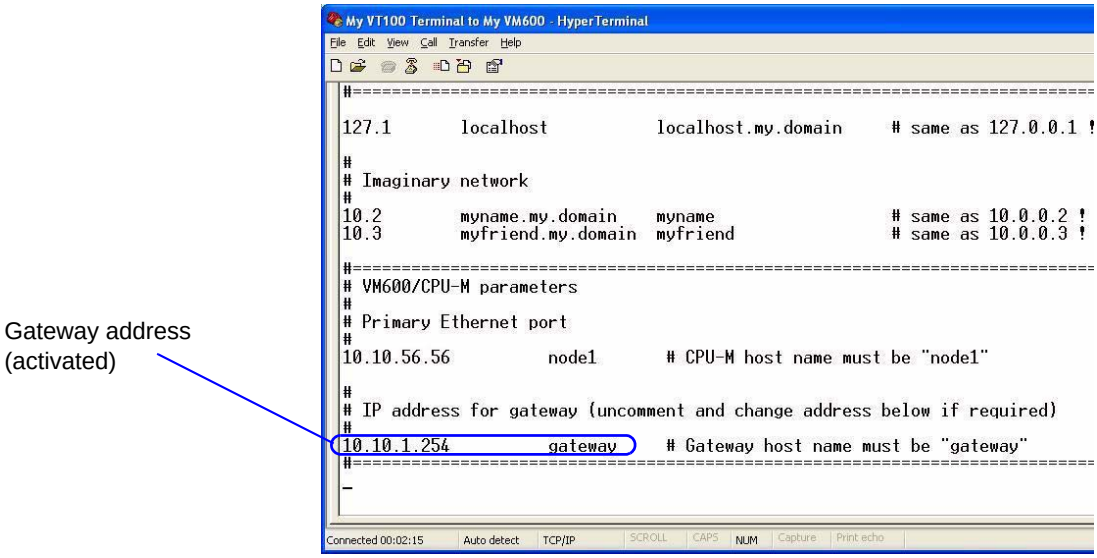


Figure 2-12 : The “hosts” file with the gateway address activated

2- The file on the CPU M called `tcpip.1` must now be modified.

Use the following “vi” command to edit this file :

 # vi tcpip.1

3- Activate the following line at the end of the file by removing the # character (see Figure 2-13) :

route add default gateway

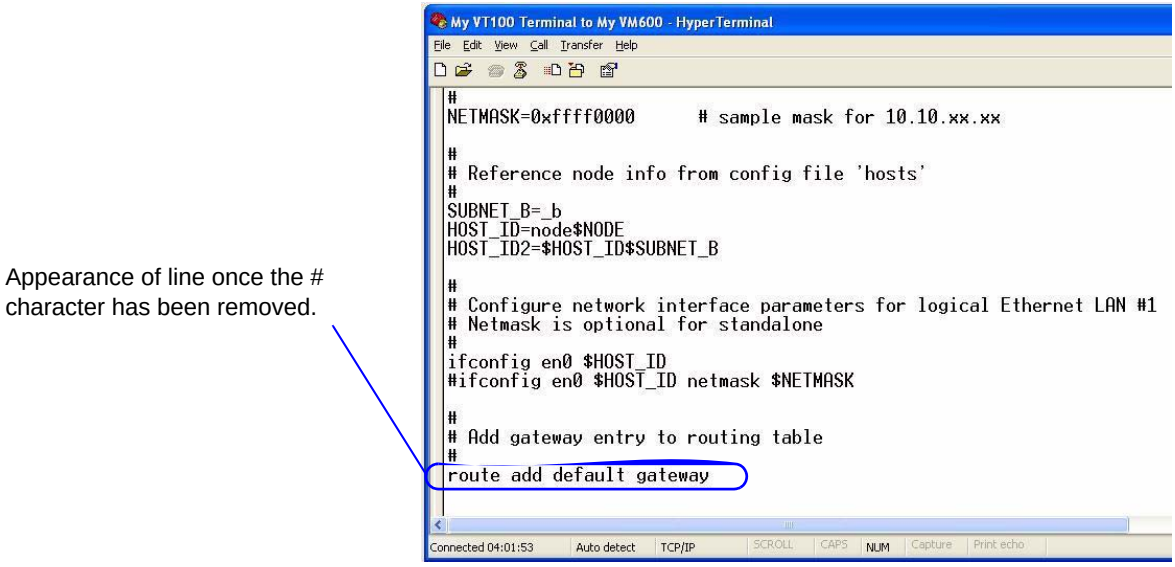


Figure 2-13 : Editing the “tcpip.1” file to activate the gateway

4- Use the **vi** command to edit the `hosts` file (see Figure 2-8). Power down and turn back on the VM600 rack.

If you are unable to power down the rack you can use the **shutdown -f** command instead.

2.5 Editing modbus configuration files

It is sometimes necessary to change the Modbus address of a rack or various communications parameters such as baud rate or parity. This is done by editing one of the following configuration files stored on the CPU M :

`mbcfg.2`	When communication occurs through 9-pole RS-232 connector on front of CPU M card
`mbcfg.3`	When communication occurs through the RS connector (type RJ11) on IOC N card
`mbcfg.4`	When communication occurs through the “A” connectors (RJ11) on IOC N card
`mbcfg.5`	When communication occurs through the “B” connectors (RJ11) on IOC N card
`mbcfg.tcp`	When communication occurs through Ethernet connector on IOC N card

2.5.1 Opening the configuration file

1- Start the VT100 terminal session as described in Section 2.2.

2- Use the “vi” command to edit the file in question. A screen similar to that shown in Figure 2-14 will appear.

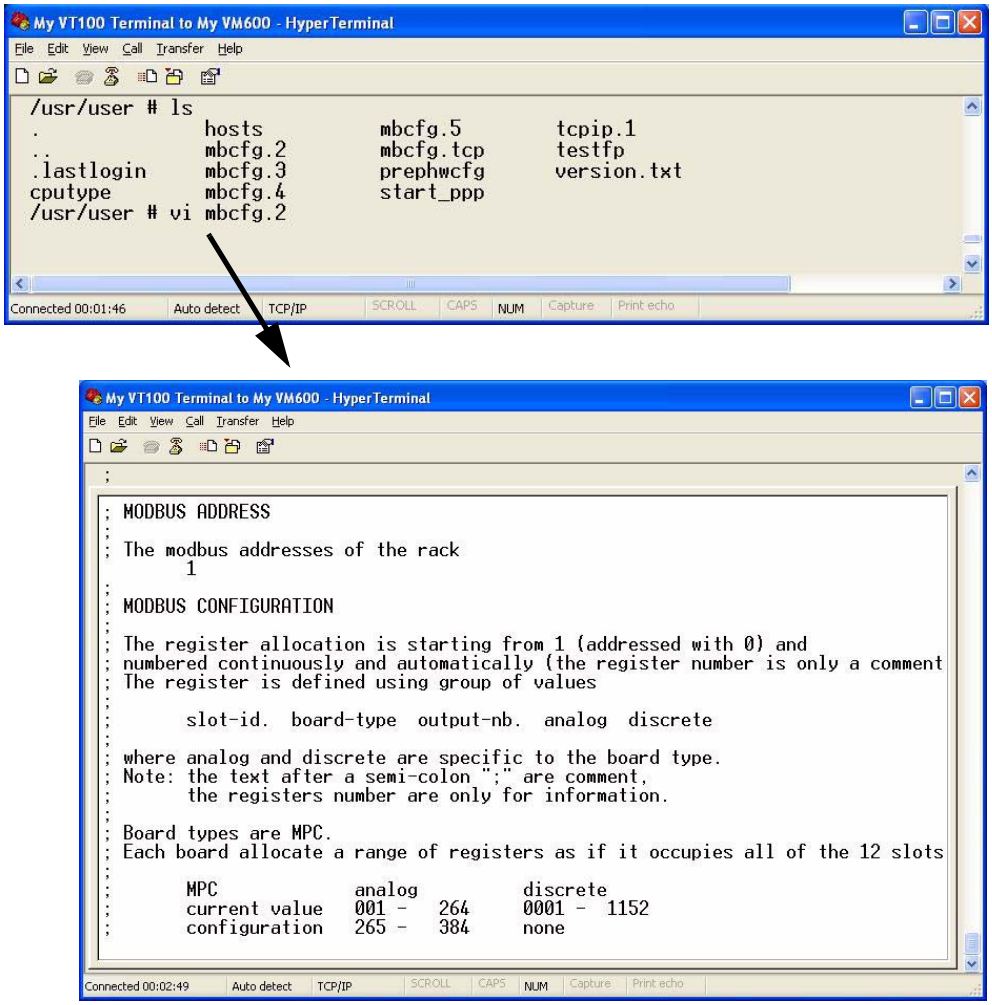


Figure 2-14 : Editing a Modbus configuration file (e.g. mbcfg.2)

2.5.2 Changing the modbus address of the rack

1- Open the configuration file as described in Section 2.5.1.

2- Modify the line containing the existing Modbus address (see Figure 2-15).

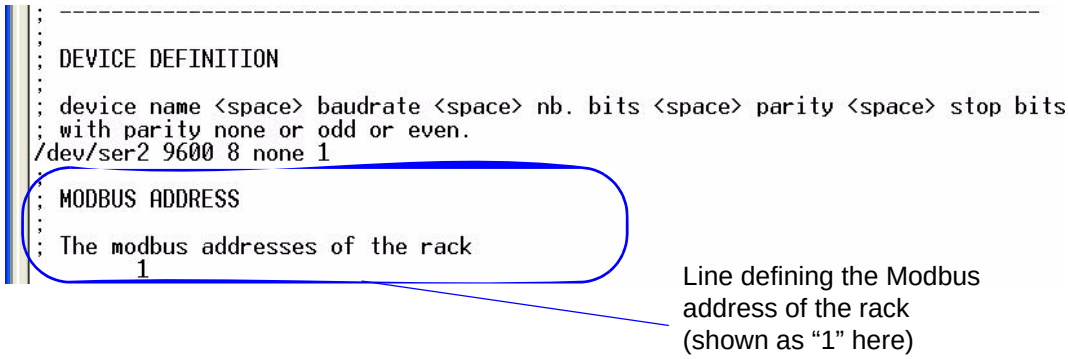


Figure 2-15 : Changing the Modbus address

2.5.3 Changing the modbus communications parameters (Device Definition)

1- Open the configuration file as described in Section 2.5.1.

2- Modify the line containing the existing device definition (see Figure 2-16).

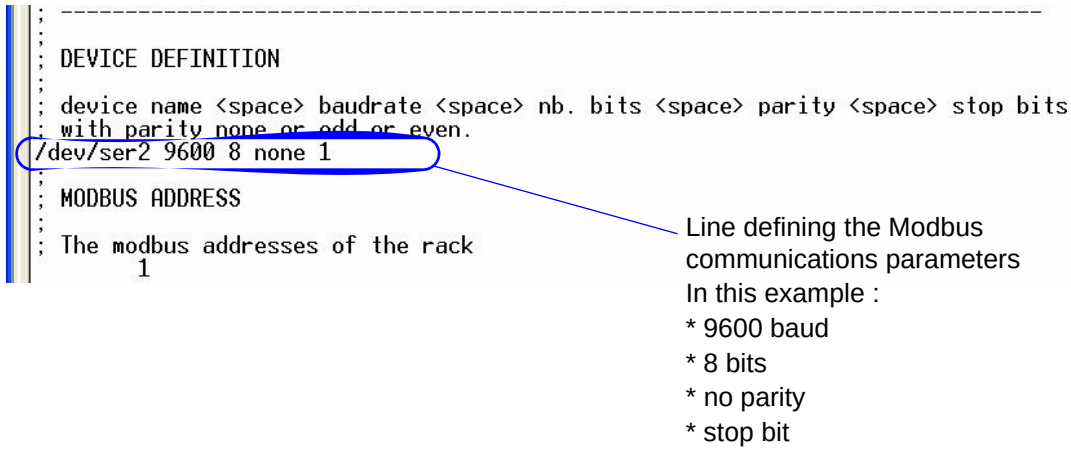


Figure 2-16 : Changing the Modbus communications parameters

2.6 Using the vi editor

The vi editor is a screen-based editor used by the VT100 terminal. It is also the editor used when a VT100 terminal is emulated using HyperTerminal. It has two distinct operating modes : a “command mode” (<Esc> key) and a “text insertion mode” (i key).

The most commonly required vi commands are listed in Table 2-1. For further information, consult one of the various sites on the internet offering short guides.

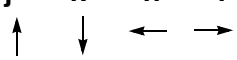
Command	Function
vi file1	*Invokes the editor*
j k h l 	*Use the arrow keys to move the cursor around the text. Alternatively, use j instead of the up arrow, k instead of the down arrow, h instead of the left arrow and l instead of the right arrow.*
:wq	*Writes and quits the editor (changes are saved)*
:q!	*Quits the editor (changes are discarded)*
i	*Changes to text insertion mode, at cursor position*
<Esc>	*Toggles to command mode*
dd	*Erases the current line*
ndd	*Erases n lines, starting from the current line*
a	*Toggles to text insertion mode, after cursor position*
<Ctrl> f	*Scrolls down one page*
<Ctrl> b	*Scrolls up one page*
1G	*Goes to first line of the file*
G	*Goes to last line of the file*
x	*Erases current character*
u	*Undoes last command*
/xyz	*Searches the next occurrence of xyz*
?xyz	*Searches the previous occurrence of xyz*
n	*Repeats the most recent search command, in the same direction*
:1,$s/xyz/abc	*Replaces all occurrences of xyz by abc, from first to last line*
J	*Joins two lines*
yy	*Copies current line (into a temporary area)*
nyy	*Copies n lines starting from the current line*
p	*Inserts copied lines at the current line*
:r file2	*Inserts contents of file2 at current line*

Table 2-1 : Common vi commands

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3 SETTING UP AN ETHERNET CONNECTION

3.1 Introduction

A direct Ethernet connection is the quickest and simplest method of communicating with the VM600 rack (see Figure 3-1).

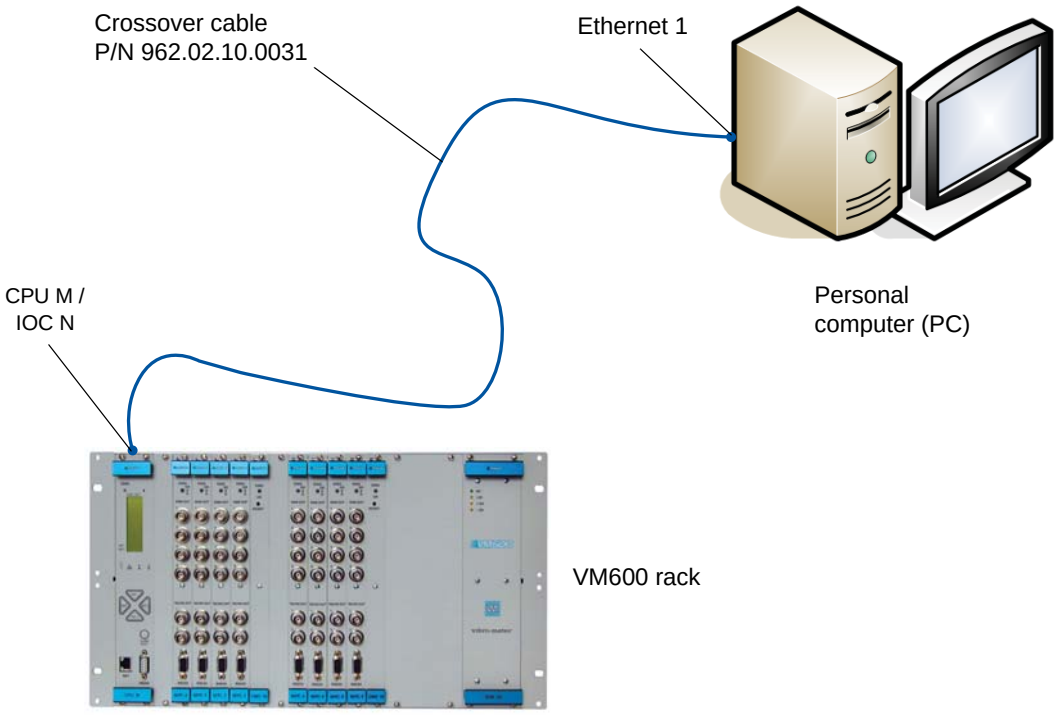

Figure 3-1 : Direct connection of a PC to a VM600 rack (without using LAN)

For this you will require :

- A CPU M card with an Ethernet sub-module.
- A crossover cable allowing Ethernet communication via the CPU M or the IOC N. This is available from Vibro-Meter : P/N 962.02.10.0031

If your CPU M does not allow Ethernet communications, you can still communicate with the rack using a PPP connection. Refer to Chapter 4 for further information.

NOTE : The exact procedure to be followed depends on the operating system used. This description assumes Windows XP is installed. If you are using a different operating system you can still follow this description for guidance, but the menus and dialog boxes shown in screen shots may look quite different.

In case of questions or problems, please consult first the Windows online help utility or contact your System Administrator. If still no solution can be found, contact your nearest Vibro-Meter representative.

3.2 Requirements

1- One of the following operating systems (or higher) :

- Windows XP
- Windows 2000
- Windows 98
- Windows NT 4

2- A CPU M card with a fully-installed Ethernet sub-module (plug & play)

You should check the CPU M card visually to confirm the presence of this sub-module. It is installed on the lower half of the card (see Figure 3-2).

3- A unique IP address for your PC

4- A unique IP address for your VM600 rack

NOTE : The IP address of the VM600 rack (CPU M card) is set in the factory to 10.10.56.56.
It is highly recommended to change this address.
To do this, change the address in the “hosts” file stored on the CPU M using a VT100 terminal (or emulator such as HyperTerminal). Refer to Section 2.3 for further information.

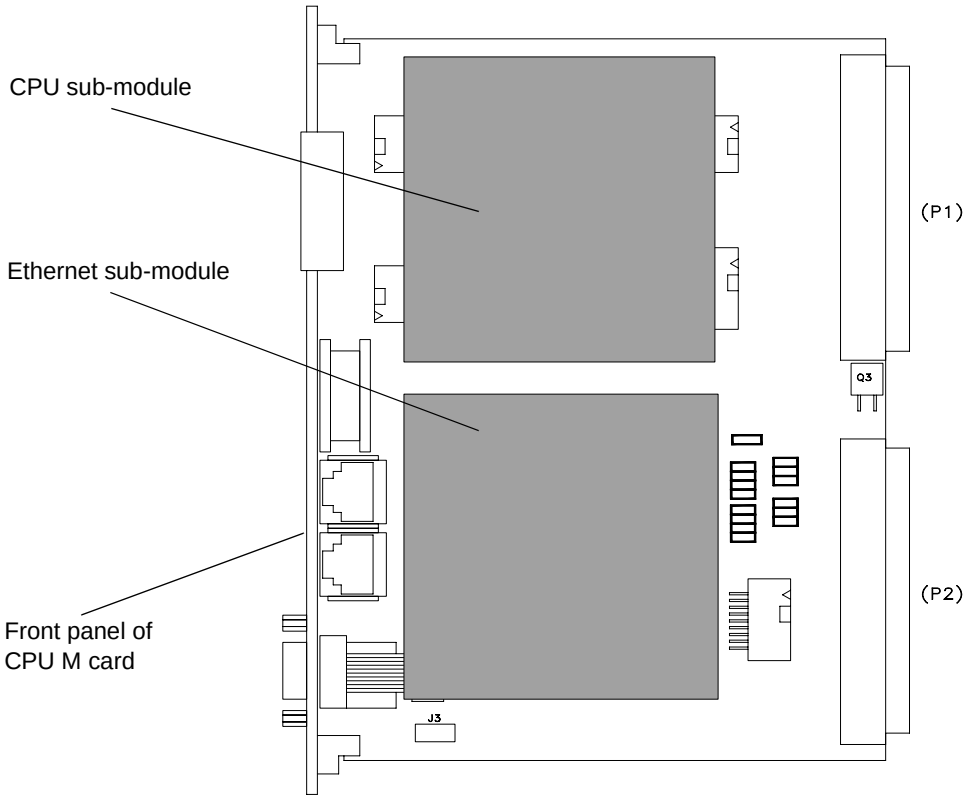

Figure 3-2 : Position of Ethernet submodule on the CPU M card

3.3 Configuration

To get started proceed as follows.

1- Click **Start > Control Panel > Network and Internet Connections > Network Connections**, then right click on the “Local Area Connection” icon and select **Properties**. The window shown on **Figure 3-3** should appear.

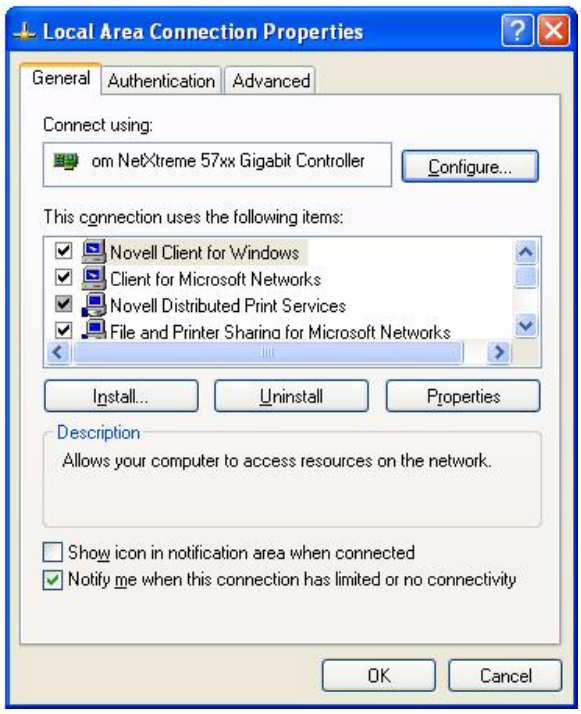

Figure 3-3 : Defining an Ethernet card

2- A protocol (TCP/IP) has to be defined, as shown in the example in Figure 3-4.

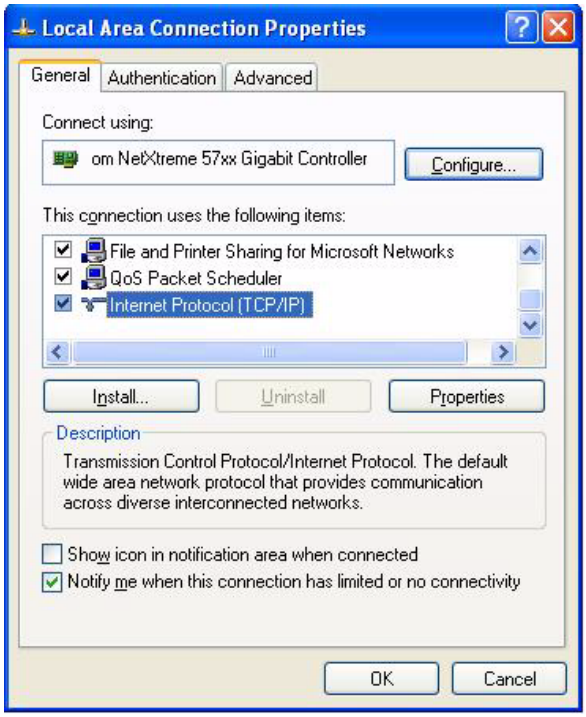

Figure 3-4 : Defining a protocol

3- Click the **Properties** button to get the “Internet Protocol (TCP/IP) Properties” dialog box (see Figure 3-5). Enter an IP address for the PC (and for the gateway if applicable) and the correct subnet mask.

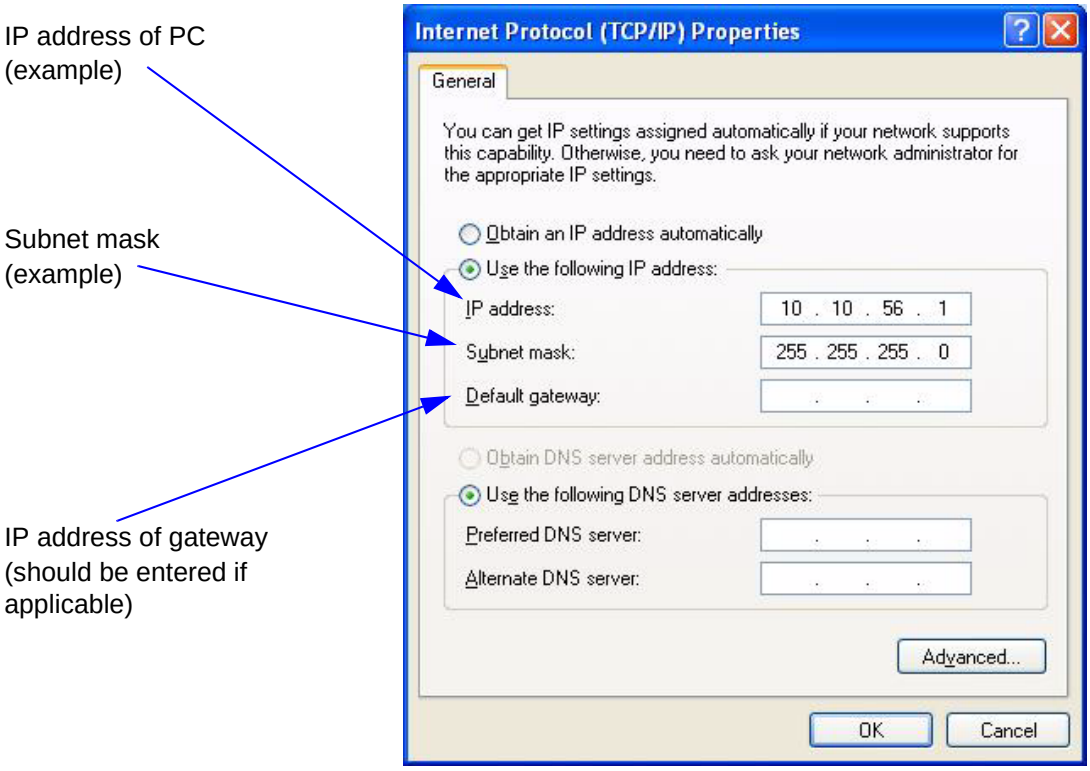

Figure 3-5 : Setting up the IP address and subnet mask

4- Open the “hosts” file on your system disk using Notepad or a similar editor. This file is in the Windows area of the system disk. If Windows XP is installed it will be in :

`C:\WINNT\system32\drivers\etc`

A window like the one shown in Figure 3-6 appears.

VM600 rack having IP address 10.10.56.56 is given the hostname “rack1” (example)

VM600 rack having IP address 10.10.56.58 is given the hostname “rack3” (example). NB: This rack is “commented out” by the # character

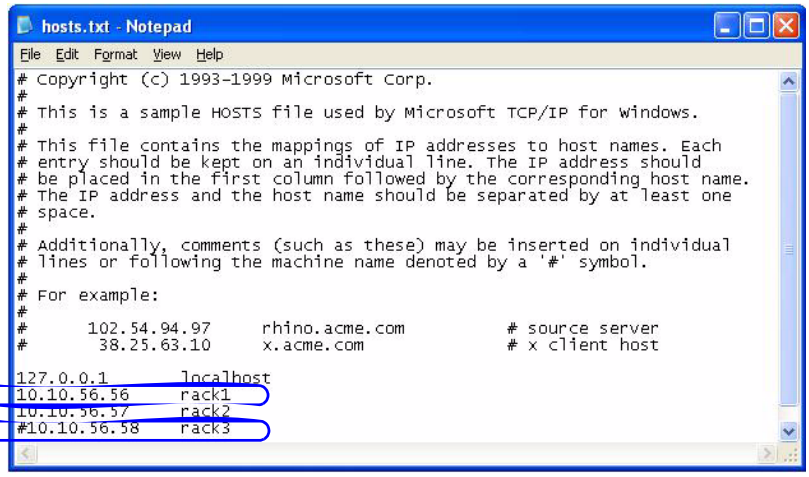

Figure 3-6 : Typical “hosts” file

NOTE : If you read or modify this file, be careful to save it **without** a file extension (i.e. **don’t** give it the extension .txt).

5- Define a suitable hostname for the rack. Host names for several racks can be defined in this file. The # character can be used to temporarily “comment out” a line until it is required some time in the future (see Figure 3-6)

NOTE : The IP address of the rack is not actually defined in this “hosts” file, but in a different “hosts” file on the CPU M card’s “disk-on-chip”. Refer to Section 2.3 for further information.
The IP address of a given rack should of course be the same in both of these “hosts” files.

6- Find the application called “cmd.exe” which is located in the Windows directory. When you run this application, a window like that shown in Figure 3-7 appears.

“ping” command for IP address 10.10.56.56 (example)

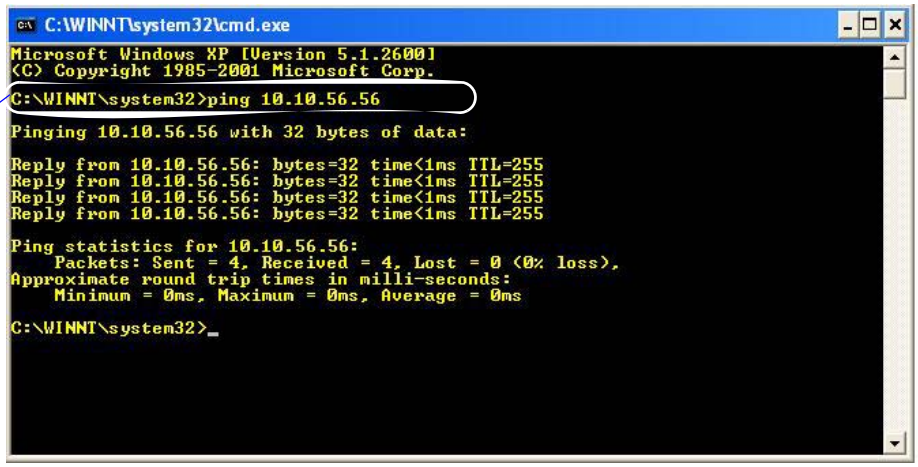

Figure 3-7 : Using the “ping” command to check the connection

7- Use the “ping” command to check the connection to the VM600 rack. Enter the IP address of the VM600 rack.

3.4 Ethernet redundancy

NOTE : Ethernet redundancy is available only with CPU M cards equipped with a second optional Ethernet module.

In case of an ethernet redundant connection, two different IP addresses are attributed to a single CPU M/IOC N card pair. These addresses must be chosen carefully, in particular, they must follow two principles:

1- Both IP addresses of the CPU M must be defined in different subnets (For more information about subnets, refer to 1.2.5.3- Subnets and subnet masks (netmasks)).

2- The host PC which will communicate with one of the CPU M address must have its IP address in the same subnet as the corresponding CPU M address.

An IP address is divided into a subnet part and a host part. The subnet range is defined with the netmask.

Some examples of usual netmask values are presented here:

netmask decimal	netmask hexadecimal	IP address
255.000.000.000	0xFF000000	nn.hh.hh.hh
255.255.000.000	0xFFFF0000	nn.nn.hh.hh
255.255.255.000	0xFFFFFF00	nn.nn.nn.hh
255.255.255.128	0xFFFFFF80	nn.nn.nn.0-127/128-255 (n=sub-network, h=host)

Table 3-1: Examples of netmasks and corresponding IP addresses

The following table presents some valid IP addresses and netmask values for the two ethernet modules of the CPU M and for the two host PC's:

netmask	CPU M	Host PC
255.255.255.128	IP#1 10.10.56.56 IP#2 10.10.56.156	10.10.56.55 10.10.56.155
255.255.255.0	IP#1 10.10.56.56 IP#2 10.10.57.56	10.10.56.55 10.10.57.55
255.255.0.0	IP#1 10.10.56.56 IP#2 10.11.56.56	10.10.56.55 10.11.56.55
255.0.0.0	IP#1 10.10.56.56 IP#2 11.10.56.56	10.10.56.55 11.10.56.55
255.0.0.0	IP#1 10.10.56.56 IP#2 11.12.34.78	10.98.76.54 11.21.43.87

Table 3-2: Valid IP addresses examples

3.4.1 Changing the IP addresses of the rack (ethernet redundant)

Let's consider a subnet nn.nn.nn.hh with the following IP addresses and netmask:

IP address #1: 10.10.56.56
IP address #2: 10.10.57.56
netmask: 0xFFFFFF00

To modify the IP addresses of the CPU M, you need to access the `hosts` file as explained in Section 2.3- Changing the IP address of the rack. Unlike what is presented in Section 2.3 there should be two IP addresses in the hosts file, one called node1 and the other called node1_b (see Figure 3-8). When you entered the correct IP addresses use the **wq** command to save the changes and then reboot the rack.

The first IP address of the CPU M is called node1 and set to 10.10.56.56

The second IP address is called node1_b and set to 10.10.57.56

```
#=============================================================================
# VM600/CPU-M parameters
#
# Primary Ethernet port
#
10.10.56.56          node1       # CPU-M host name must be "node1"
#
# Redundant Ethernet port
#
10.10.57.56          node1_b     # CPU-M 2nd host name must be "node1_b"
#
# IP address for gateway (uncomment and change address below if required)
#
#10.10.1.254          gateway     # Gateway host name must be "gateway"
#=============================================================================
```

Figure 3-8 : IP addresses in the file /etc/hosts

To change the netmask, you have to access the `tcpip.1` file which can be found at the following path: /etc/config/bin/tcpip.1. Edit the netmask value (see Figure 3-9), then save the changes using the **wq** command and complete the procedure by rebooting the rack, either switching it off then back on or using the command **`shutdown-f`**.

The netmask can be changed here. In this example the netmask is set to 255.255.255.000 which corresponds to 0xffffff00 in hexadecimal

```
# VM600/CPUM network settings
#
# 301 initial tcp/ip for ethernet redundant
#
#! /bin/ksh

SUBNET_B=_b
HOST_ID=node$NODE
HOST_ID2=$HOST_ID$SUBNET_B
export SOCK=$NODE
NETMASK=0xffffff00 # sample mask for 10.10.56.xx

/usr/ucb/Socklet -p 1 $HOST_ID &
/usr/ucb/ifconfig lo0 localhost up
/usr/ucb/ifconfig en1 $HOST_ID up
/usr/ucb/ifconfig en1 netmask $NETMASK
# * Ethernet redundant
/usr/ucb/ifconfig en2 $HOST_ID2 up
/usr/ucb/ifconfig en2 netmask $NETMASK
# * Gateway
#/usr/ucb/route add default gateway host name must be "node1_b"
```

Figure 3-9 : Netmask in the file /etc/config/bin/tcpip.1

After the CPU M is correctly configured, the IP addresses of the two PC's connected to each ethernet port must be set as described in Section 3.3- Configuration. They must be chosen in the same subnet as the corresponding CPU M IP address.

In this example, the first PC IP address corresponding to the first CPU M address (10.10.56.56) can be set to 10.10.56.55 and the second one 10.10.57.55.

3.5 Using VM600 software with an ethernet connection

3.5.1 Using MPS Software

1- Start up the MPS software (refer to the relevant MPS software manual for further information).

2- Select the rack in question from the “tree” on the left-hand side of the screen (see Figure 3-10).

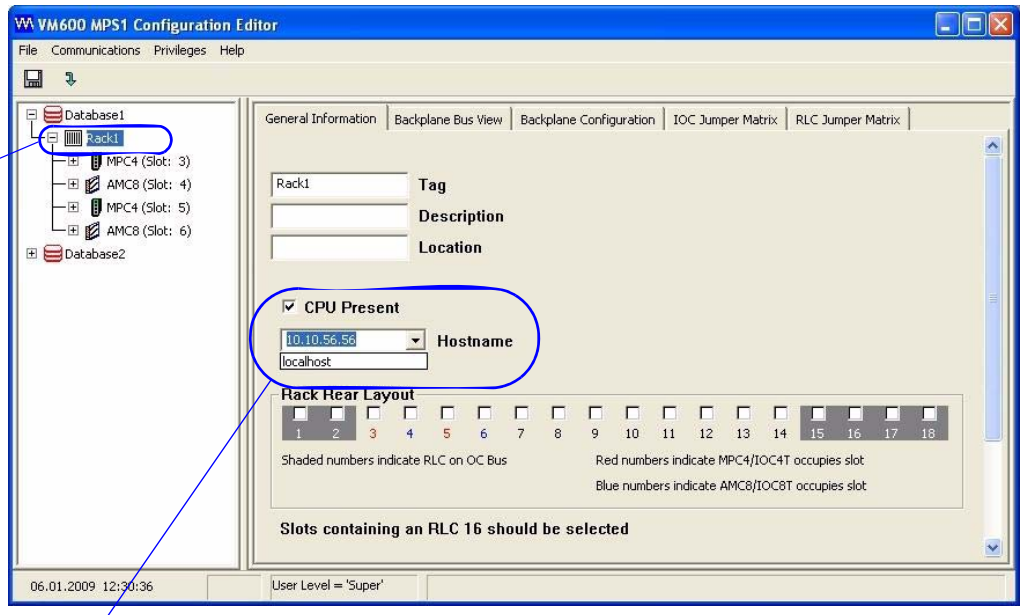

Figure 3-10 : Defining the hostname in the MPS software

3- Activate the **CPU Present** check box.

4- Drop down the **Hostname** list and select the host name (i.e. rack name) that corresponds to the rack in question (see Figure 3-10).

Alternatively, you can type the IP address of the rack (e.g. 10.10.56.56) directly in the **Hostname** field.

Communication via Ethernet should now be possible.

3.5.2 Using CMS software

1- Start up the CMS software (refer to the relevant CMS software manual for further information).

2- Display the Architectural view.

3- Select the rack in question from the “tree” on the left-hand side of the screen (see Figure 3-11).

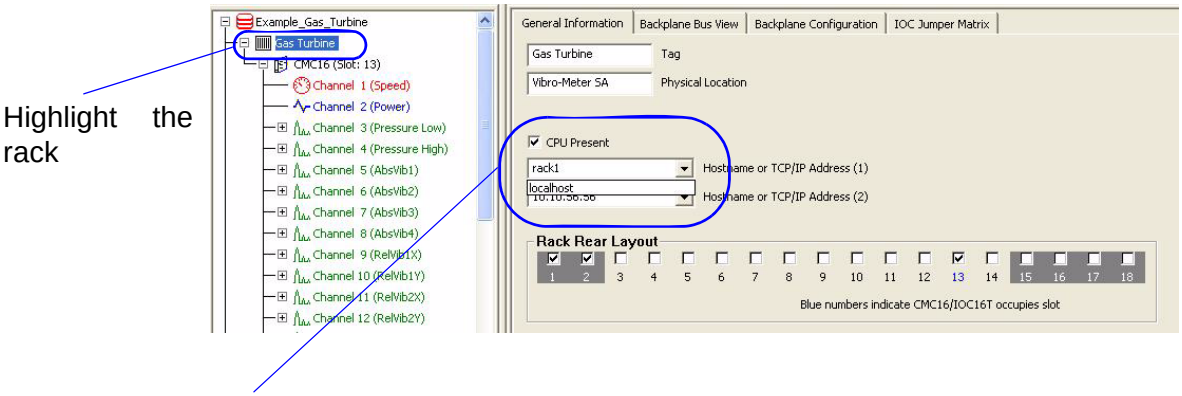

Figure 3-11 : Defining the hostname in the CMS software

4- Activate the **CPU Present** check box.

5- Drop down the **Hostname** or TCP/IP Address list and select the hostname (i.e. rack name) that corresponds to the rack in question (see Figure 3-11).

Alternatively, you can type the IP address of the rack (e.g. 10.10.56.56) directly in the field.

Communication via Ethernet should now be possible.

4 SETTING UP A PPP CONNECTION

NOTE : The exact procedure to be followed will depend on the operating system used. This description assumes Windows XP is installed. If you are using a different operating system you can still follow this description for guidance, but the menus and dialog boxes shown in screen shots may look quite different.

In case of questions or problems, please consult first the Windows on-line help or contact your System Administrator. If still no solution can be found, contact your nearest Vibro-Meter representative.

4.1 Requirements

1- A PC running Windows XP operating system

NOTE : A PPP connection can be set-up using other operating systems, please contact Vibro-Meter for further information.

2- An RS-232 communication port on your PC

3- A PPP RS-232 handshake adapter (Vibro-Meter P/N 957.18.09.0909)

4- An RS-232 cable as shown in Figure 4-1 (Vibro-Meter P/N 957.18.09.030X)

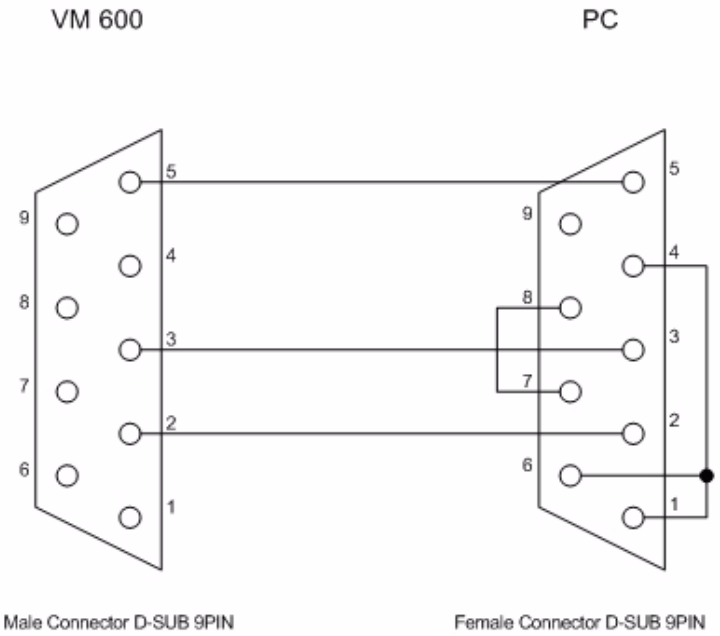

Figure 4-1 : Interface cable (with adapter) to connect CPU M card to the serial port of personal computer to allow PPP communication

5- Two IP addresses in your LAN (by default 10.10.56.1 and 10.10.56.2)

NOTE : Refer to Section 2.3 for information on changing the IP address of the rack.

NOTE : Refer to Section 4.1.1 for information concerning restrictions on IP addresses.

4.1.1 IP address restrictions

The PC used for PPP communication with the VM600 rack may already be connected to a network (LAN). If this is the case, its Ethernet card will already have been configured with an IP address (belonging to “Subnet 1”) allowing communication with other systems on the network (see Figure 4-2).

The VM600 rack you are trying to communicate with must have an IP address that does not belong to Subnet 1, but to some other subnet (e.g. “Subnet 2”).

NOTE : Subnet 1 and Subnet 2 must be different to allow messages to be directed onto either physical interface.

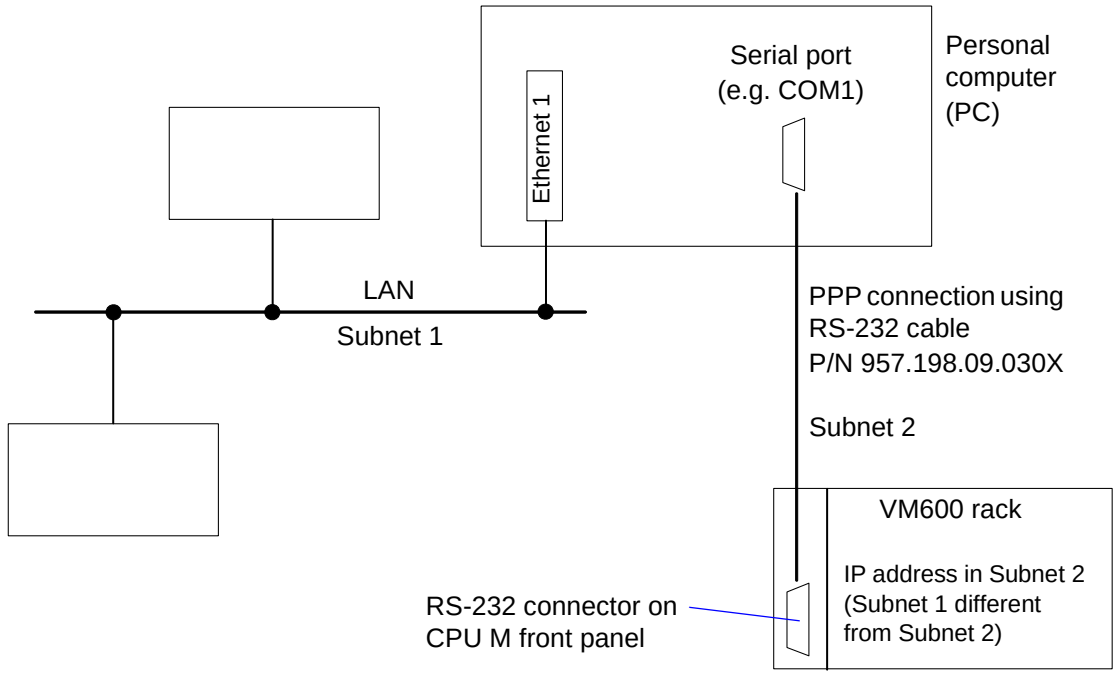

Figure 4-2 : PPP connection to a VM600 rack (serial communications)

4.2 Installing a communication cable

NOTE : A communications cable must be installed before PPP communication is attempted.

A “null modem” must be installed before PPP communication is attempted :

1- Click **Start > Control Panel > Printers and Other Hardware**.

2- Double-click the **Phone and Modem Options** icon to obtain the dialog box shown in Figure 4-3.

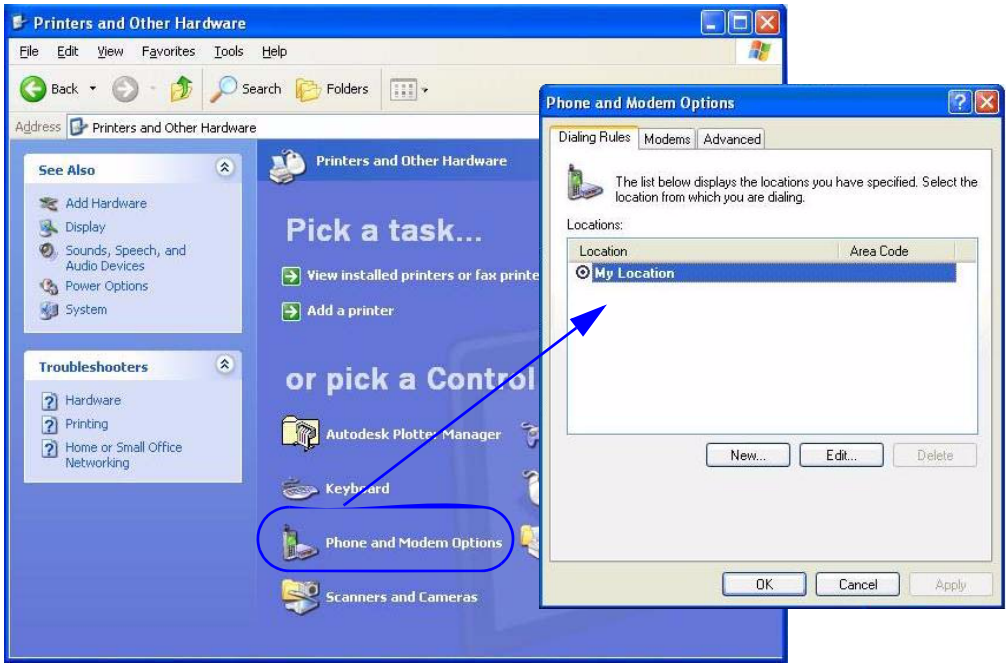

Figure 4-3 : The Phone and Modem Options icon and dialog box

3- Select the **Modems** thumb tab (see Figure 4-4) and click on **Add** to call up the Add/Remove Hardware Wizard. Configure the first page of the wizard as shown. Select **Don't detect my modem; I will select it from a list** and click **Next**.

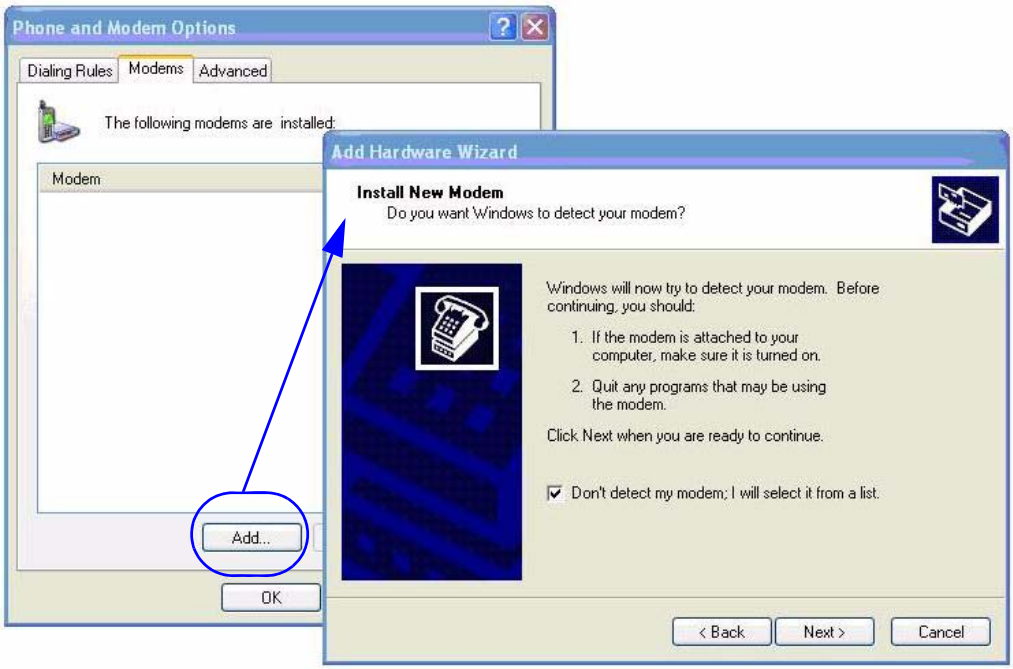

Figure 4-4 : The Phone and Modem Options icon and dialog box

4- Select **Standard Modem Types** (see Figure 4-5), then select the model called **Communications Cable between two computers**.

Figure 4-5 : The Add Hardware Wizard with Install New Modem window

5- Select a communication port for the **Communications Cable between two computers** as shown in Figure 4-6. Click **Next** then **Finish** to end the wizard. The Communications cable between two computers is now installed.

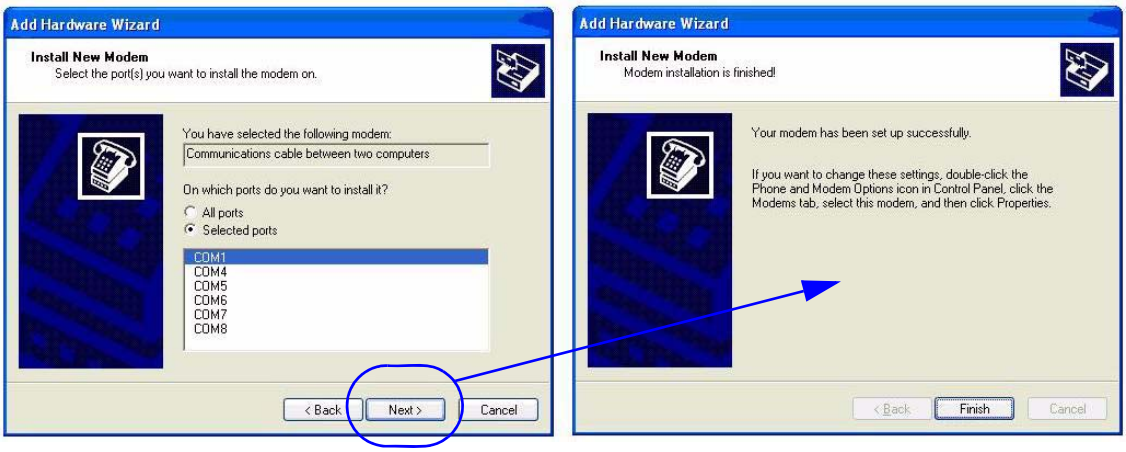

Figure 4-6 : Selecting a communications port

4.3 Configuring the communication modem

1- Select the **Communications Cable between two computers** from the **Modems** thumb tab of the **Phone and Modems Options** dialog box (See Figure 4-7). Click on the

Properties key and check that the fields/options on the **Modem** thumb tab are configured as shown in Figure 4-7.

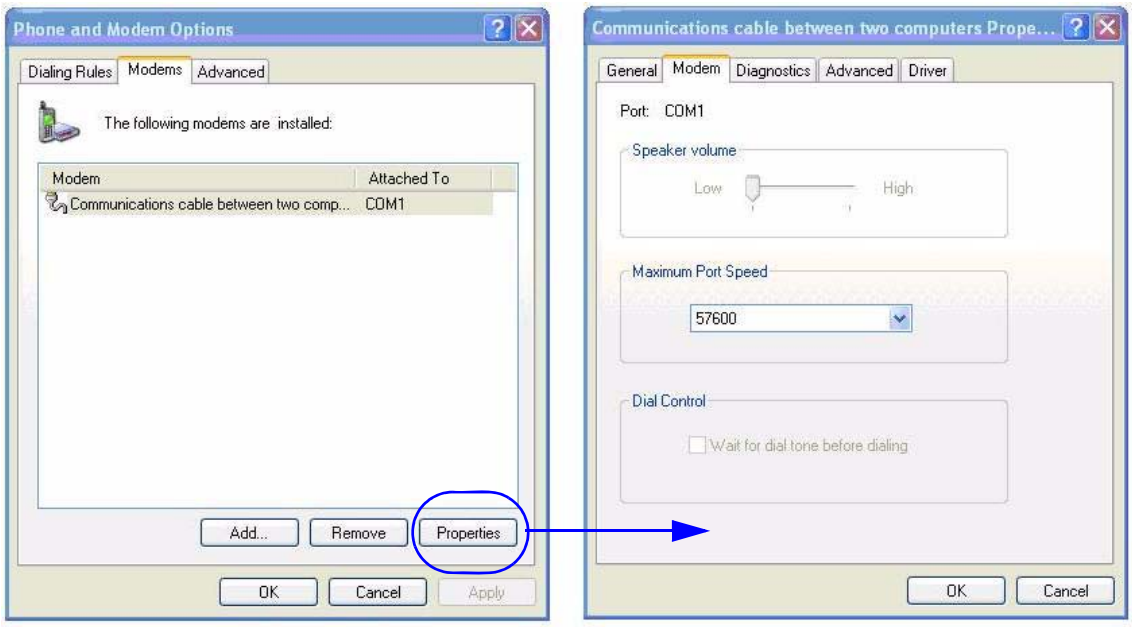

Figure 4-7 : The phone and modem options window, modem tab

2- Select the **Advanced** thumb tab (see Figure 4-8 Left). Click on the **Change Default Preferences** key and check that the fields/options on the **General** and **Advanced** thumb tabs are configured as shown in Figure 4-8 right.

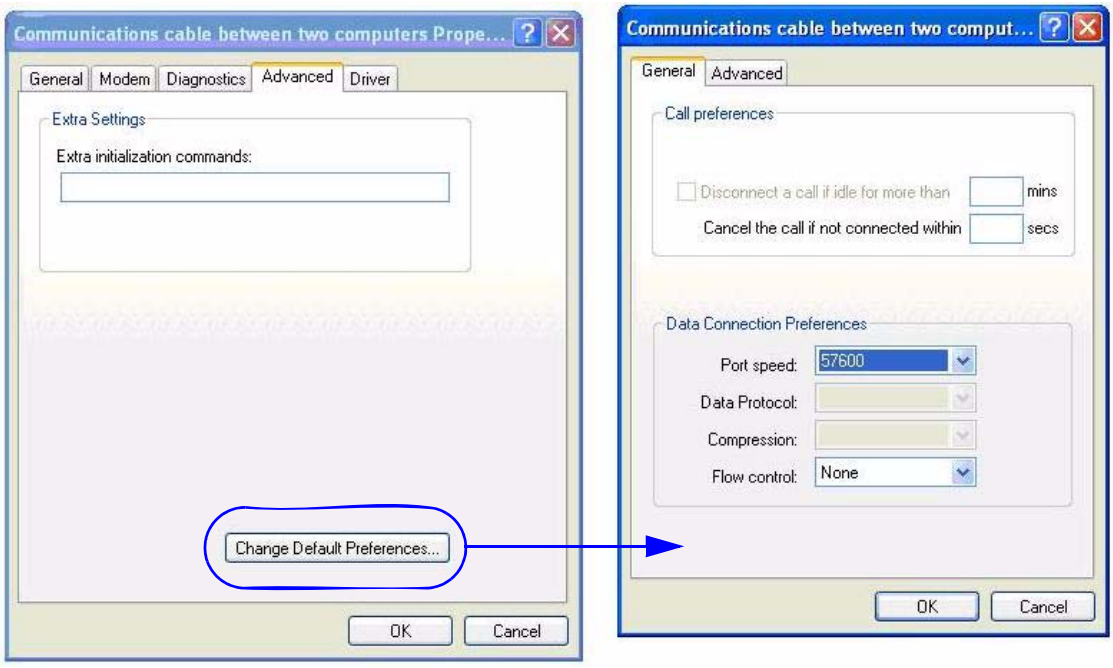

Figure 4-8 : The General and Advanced thumb tabs

4.4 Setting up the PPP network connection

1- Find Network Connections (for example Click **Start** > **Control Panel**, and then click **Network and Internet Connections** and then **Network Connections**). Finally click the **Create a new connection** icon. The Network Connection Wizard will appear (see Figure 4-9).

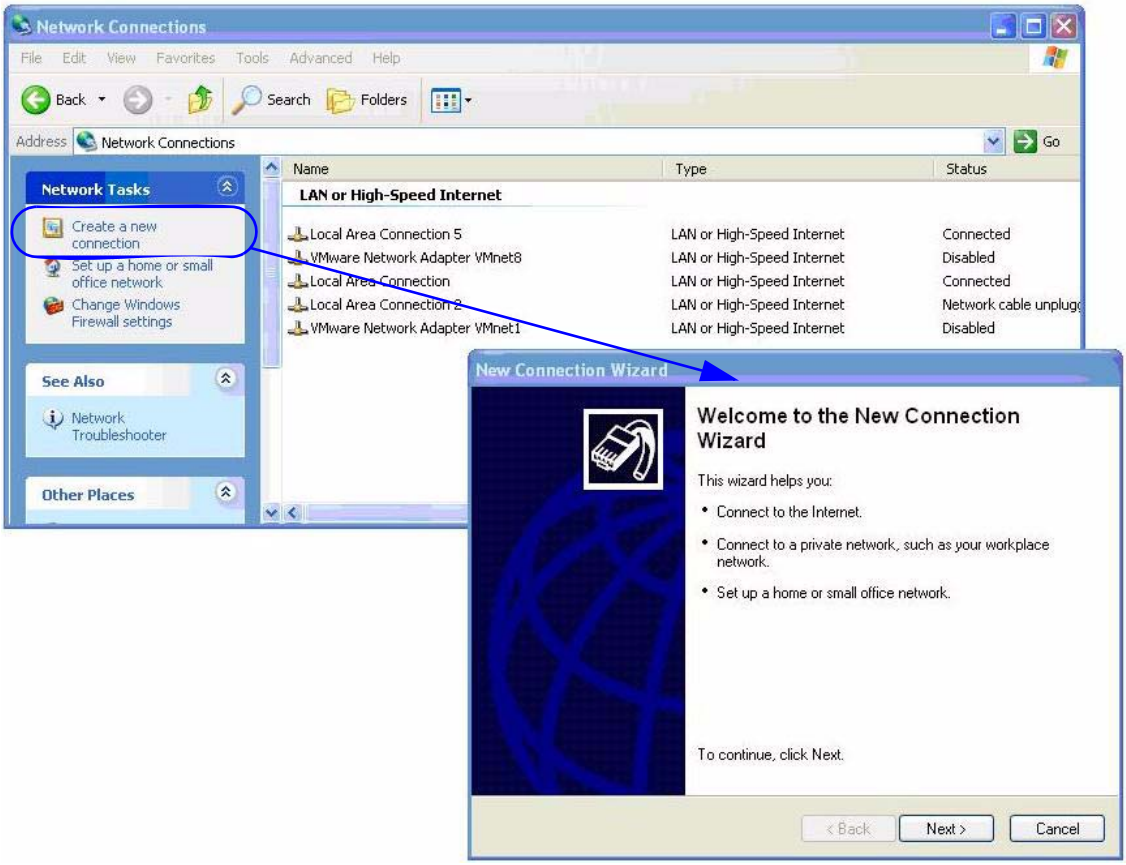

Figure 4-9 : Starting the network connection wizard

2- Follow the wizard and select **Set up an advanced connection** and click **Next** (see Figure 4-10).

Figure 4-10 : Connection wizard, network connection type

3- Choose the **Connect directly to another computer** option and click **Next** (see Figure 4-11).

Figure 4-11 : Connection wizard, advanced connection options

4- Select **Guest** and click **Next** (see Figure 4-12).

Figure 4-12 : Connection wizard, host or guest

5- Enter a suitable name for the connection and click **Next** (see Figure 4-13)

Figure 4-13 : Connection wizard, connection name

6- Choose a device from the list and click **Next** (see Figure 4-14).

Figure 4-14 : Connection wizard, select a device

7- When the **Finish** key is clicked, a screen resembling the one in Figure 4-15 will appear. (This screen can also be obtained from **Start > Control Panel > Network and Internet Connections > Network Connections > My VM600 Rack**).

Figure 4-15 : The “Connect My VM600 rack” window

8- Click the **Properties** key of the screen in Figure 4-15 to get the General thumb tab (see Figure 4-16). Select a connection from the list. Click **Configure** key to obtain the “Modem Configuration” dialog box and set it up as shown in Figure 4-16.

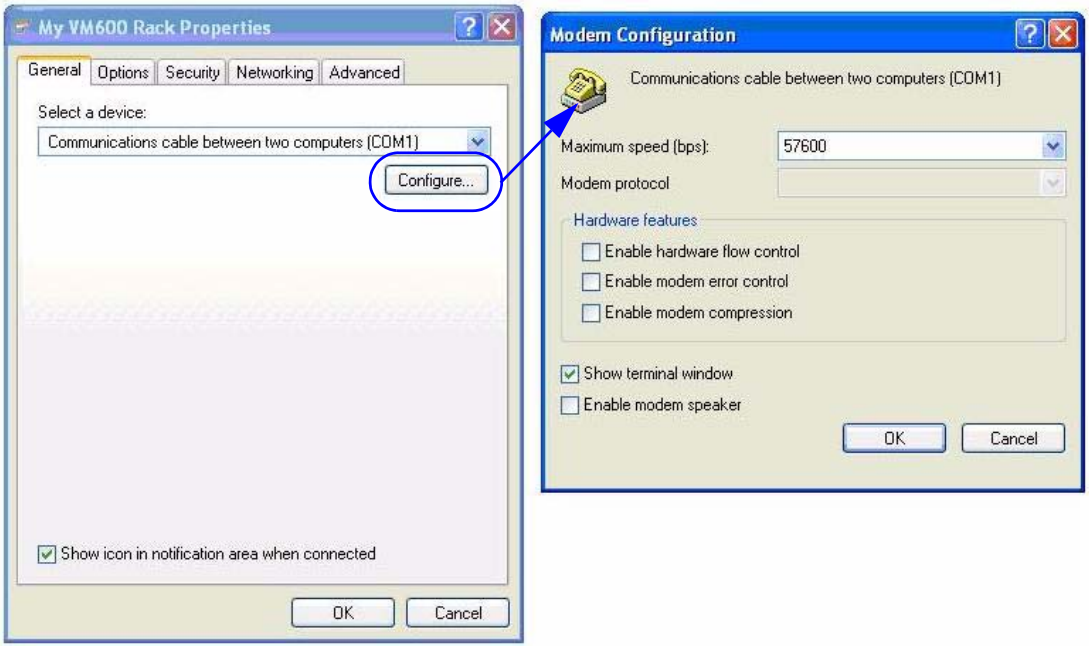

Figure 4-16 : My VM600 rack properties / modem configuration windows

9- Configure the **Options** and **Security** dialog boxes as shown in Figure 4-17.

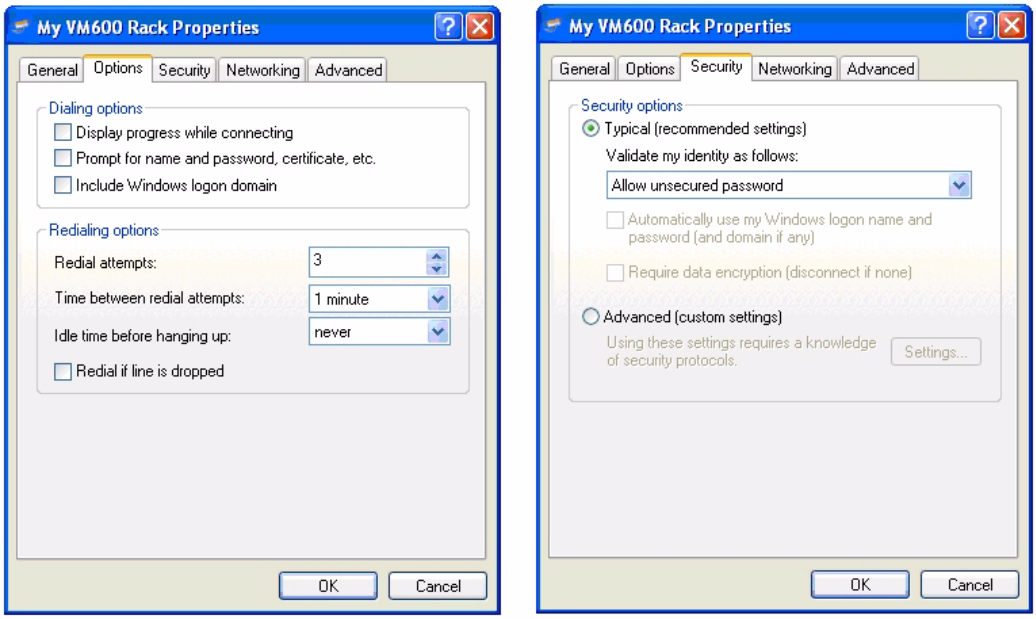

Figure 4-17 : My VM600 rack properties Options and Security thumb tabs

10- Select the **Networking** thumb tab (see Figure 4-18, left). Check if PPP is the type of dial-up server. Click on the Settings key to obtain the **PPP Settings** dialog box and configure it as shown in Figure 4-18, right.

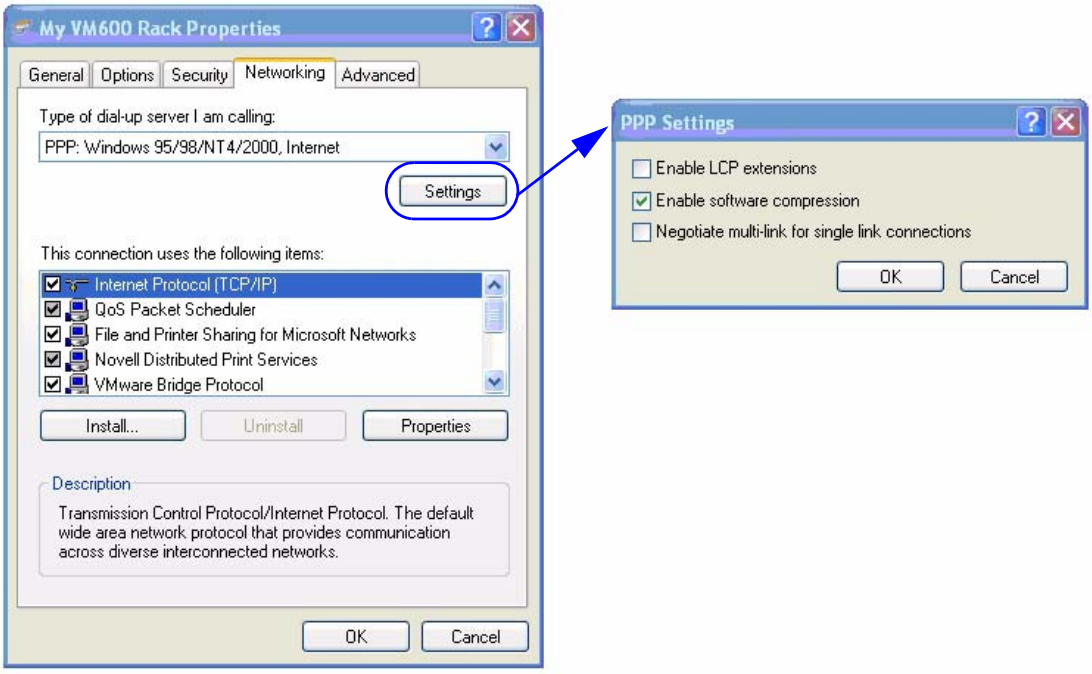

Figure 4-18 : My VM600 rack properties Networking tab and PPP Settings window

11- It is advisable to check the network connection as described in Section 4.5.

4.5 Testing the network connection

To test the network connection once it is installed, proceed as follows :

1- Start the connection by double clicking on the “My VM600 Rack” icon in the **Network Connections** window. (To open Network Connections you can for example click **Start** > **Run**, and then type control.exe in the **Open** box, click **Network and Internet Connections** and then **Network Connections**) (see Figure 4-19).

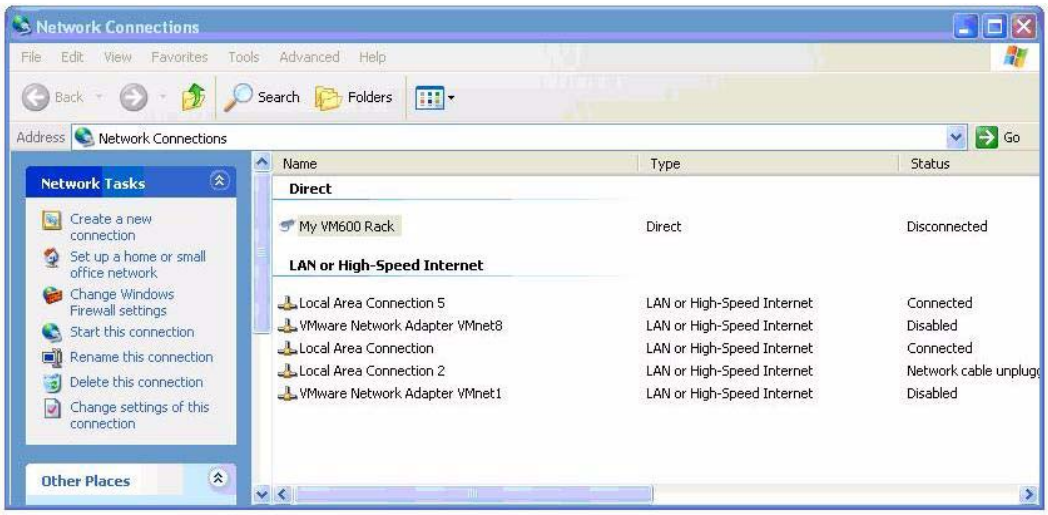

Figure 4-19 : My VM600 rack network connections

2- Click on the **Dial** key to obtain the “Pre-Dial Terminal Screen” and hit the **<Enter>** key, an error message will be displayed (see Figure 4-20).

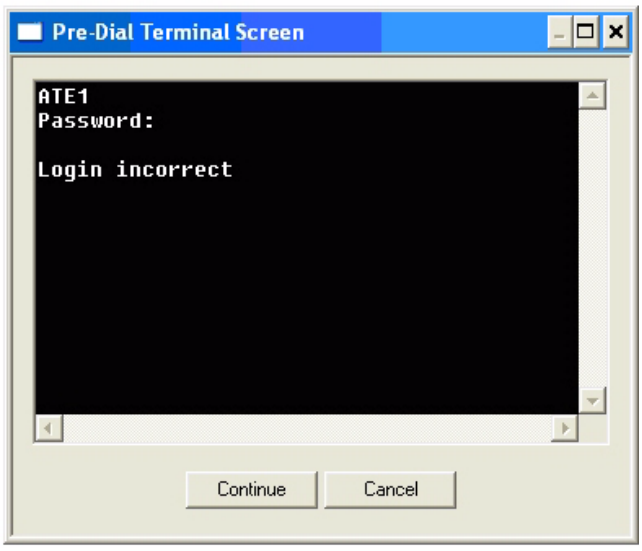

Figure 4-20 : Pre-dial terminal screen

3- Login by typing :

login : **pppuser** then hit **<Enter>**

password : **ppp** then hit **<Enter>**

Click the **Continue** key to proceed further (see Figure 4-21)

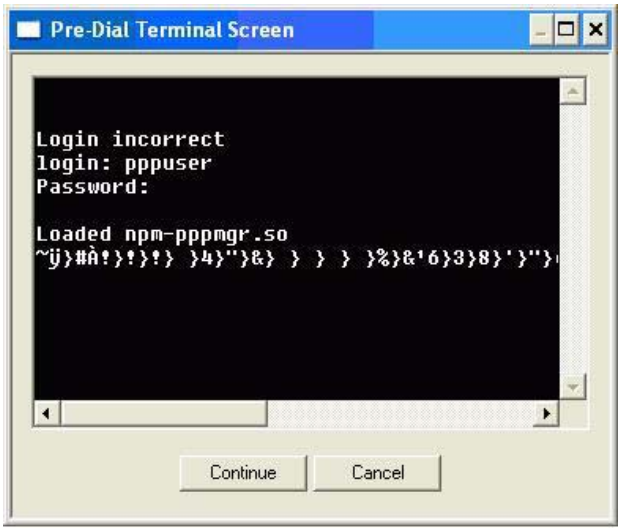

Figure 4-21 : Pre-dial terminal screen connecting

4- A small icon appears on the Windows taskbar (See Figure 4-22). Double-click the icon to obtain status information if required (you do not have to keep this window open).

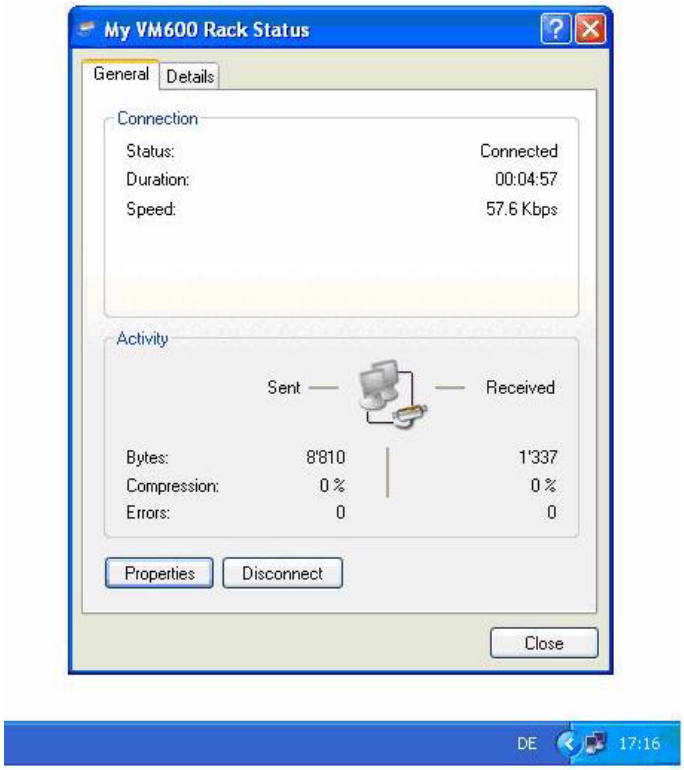

Figure 4-22 : Icon and status information

5- Click **Start** > **Run** and type “cmd” in the field, then click **OK**.

6- Use ping command to check the connection to the VM600 rack. The default address of the VM600 for PPP connection is 10.10.56.1. (Type ping 10.10.56.1).

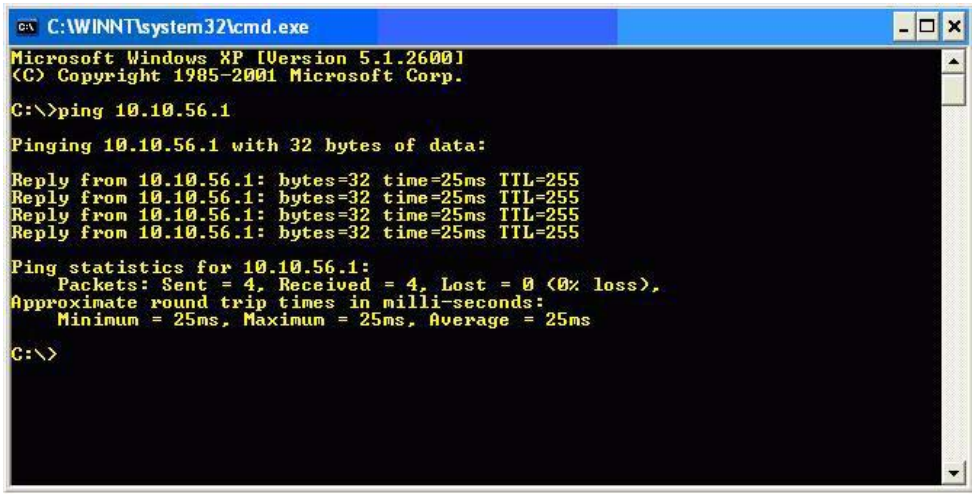

Figure 4-23 : Using the "ping" command to check the connection

4.6 Using VM600 software with a PPP connection

4.6.1 Using MPS software

1- Start up the PPP network connection as described in the first 3 steps of Section 4.5 (refer to Figure 4-19 and Figure 4-20).

2- Start up the MPS software

NOTE : Refer to the relevant MPS software manual for further information.

3- Select the rack in question from the “tree” on the left-hand side of the screen (see Figure 4-24).

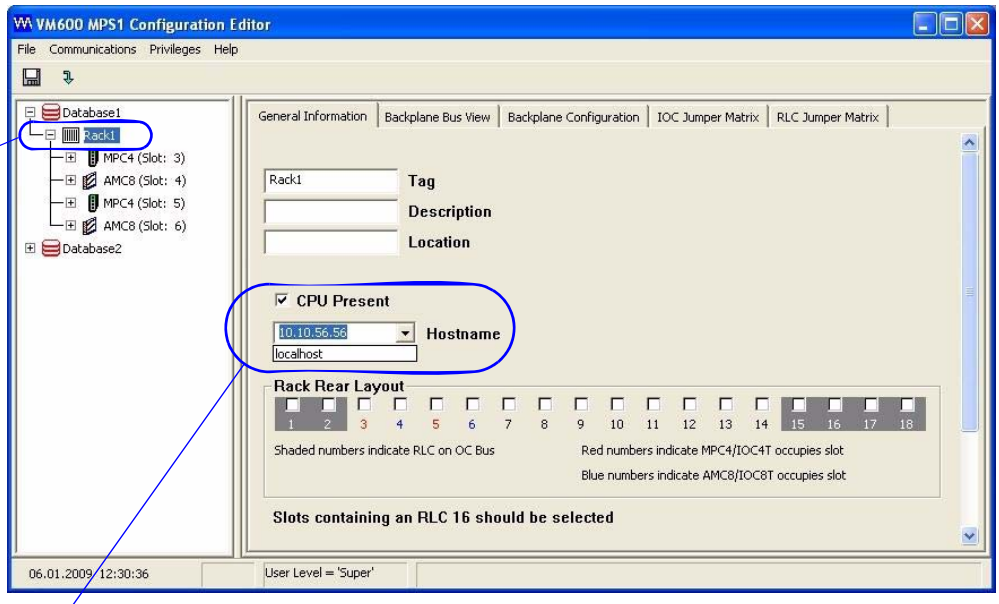

Figure 4-24 : Defining the hostname in the MPS software

4- Activate the CPU Present check box.

5- Drop down the **Hostname** list and select a hostname (i.e. rack name) that corresponds to the rack in question (see Figure 4-24).

Alternatively, you can type the IP address of the rack (e.g. 10.10.56.56) directly in the **Hostname** field.

Communication via the PPP connection should now be possible.

4.6.2 Using CMS software

1- Start up the PPP network connection as described in the first 3 steps of Section 4.5 (refer to Figure 4-19 and Figure 4-20).

2- Start up the CMS software

NOTE : Refer to the relevant CMS software manual for further information.

3- Display the Architectural view.

4- Select the rack in question from the “tree” on the left-hand side of the screen (see Figure 4-25).

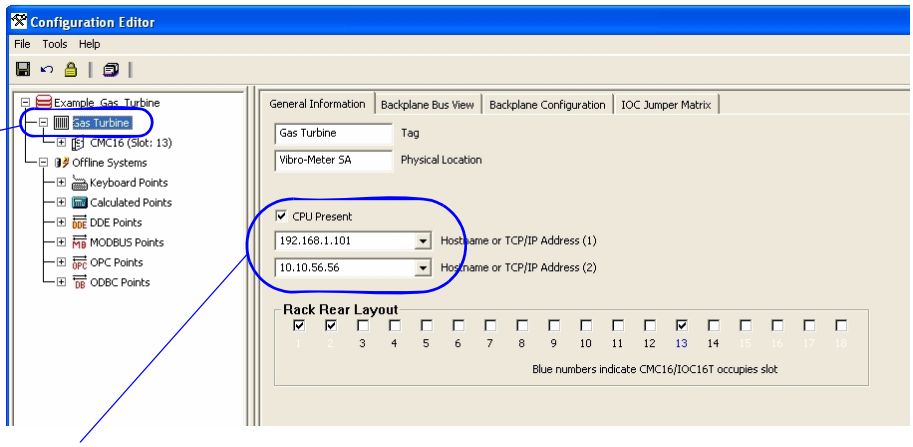

Figure 4-25 : Defining the hostname in the CMS software

5- Activate the **CPU Present** check box.

6- Drop down the **Hostname** or **TCP/IP Address** list and select a hostname (i.e. rack name) that corresponds to the rack in question (see Figure 4-25).

Alternatively, you can type the IP address of the rack (e.g. 10.10.56.56) directly in the field.

Communication via the PPP connection should now be possible.

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5 SETTING UP A MODBUS CONNECTION

5.1 Introduction

This chapter describes the implementation of the Modbus software interface for the VM600 rack.

Communication is done through either :

- A serial line using the Modicon standard Modbus RTU protocol

  and/or
- An Ethernet line using the Modicon standard Modbus TCP protocol

The transmitted data consists of real-time values (vibration level, pressure, etc…), status and configuration information (alarms). This data can be used by any external system (e.g. distributed control system) for the purposes of machinery monitoring.

The interface presently supports the following VM600 cards :

- MPC 4
- AMC 8

The Modbus RTU protocol can be used indifferently with RS-232 and RS-485 serial interfaces. In RS-485 mode, a master device can address up to 99 instruments. The link can be half-duplex or full-duplex with selectable transmission rates from 1200 to 19200 bits/s.

NOTE : Note that when the CPU M card contains an optional RS-485 / RS-422 communications module (allowing communication over the “A” and “B” pairs of connectors on the IOC N), only full duplex transmission is possible.

The Modbus TCP protocol has exactly the same layout as the Modbus RTU protocol, with the exception of the "framing" sequence check pattern and the address interpretation.

Communications are based on the master-slave principle. The VM600 rack is the slave in the system. The master equipment requests data from the addressed slave, which can only respond. The slave cannot initiate a transaction. The master can address individual slaves to request or send data. It can also request an action to be taken by one or all the slaves in the network.

5.2 Description of modbus RTU protocol

5.2.1 Frame and timing

NOTE : The following definitions of the Modbus protocol are adapted to the VM600 MPS.

The Modbus RTU protocol is a serial data transmission format widely used in communications with programmable controllers. It is easily adaptable to other types of remote units thanks to its particular message structure (it doesn't operate with variables but with memory addresses).

The first character of a frame is the slave address, followed by the Modbus function code and the information field. Finally, two bytes are reserved for an error check code based on cyclic redundancy checking (CRC). Refer to Figure 5-1.

Each character is composed of 10 bits : 1 start bit, 8 data bits and 1 stop bit

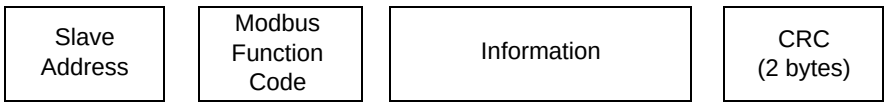
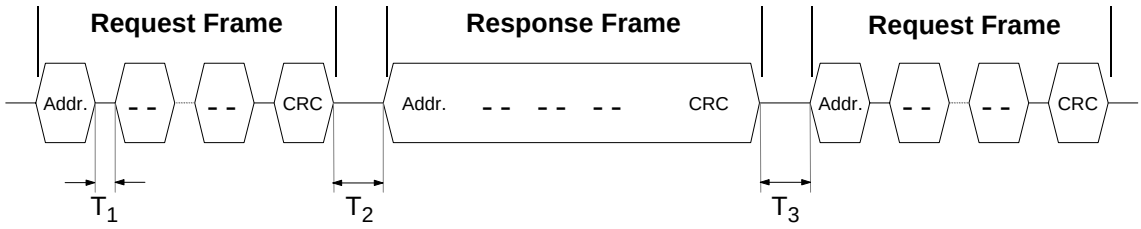


Figure 5-1 : Constitution of a frame

The Modbus RTU protocol has no delimiter character neither at the beginning nor at the end of a message. Each frame must be preceded and followed by a silent interval of at least 3.5 CT (where CT = character time). Refer to Figure 5-2.

The connected equipment (VM600 rack) detects the start of a message when any valid character (containing its address or the address 00) has been received after a silent interval of at least 3.5 CT. The end of a message is interpreted by a silent interval of the same duration.



T_1 = time between two characters (min. = 0, max. = 3.5 CT)
T_2 = time between request and response (min. 3.5 CT)
T_3 = time between response and next request (min. 3.5 CT)
CT = 1 character time (= the time needed to transmit one character consisting of 10 bits)

Baud (bits/s)	Time for 3.5 CT
1200	30 ms
2400	15 ms
4800	8 ms
9600	4 ms
19200	2 ms

Figure 5-2 : Timing considerations

5.2.2 Communications parameters for the VM600

By default, the communications parameters for the VM600 are :

- Baud rate 9600
- Parity None
- Number of bits 8
- Number of stop bits 1
- Slave address 1

These settings can be modified if required by editing the appropriate configuration file stored on the CPU M (e.g. “mbcfg.2”, “mbcfg.3”, “mbcfg.4” or “mbcfg.5”). This is done using a VT100 terminal (or emulator from the Windows environment). Refer to Section 2.5 for further information.

5.2.3 Modbus functions supported by the VM600

The Modbus functions supported by the VM600 are shown in Table 5-1.

Function Code	Function Description
01	*Read coils*
02	*Read discrete inputs*
03	*Read holding registers*
04	*Read input registers*

Table 5-1 : Modbus functions supported

Function 01 Used to read status and configuration information (e.g. alarm, danger, OK status, alarm enable).

Function 02 Used to read status information (e.g. alarm, danger, OK status).

NOTE : When used to read values from the MPC 4 card, function 01 and function 02 can be used indifferently. They both return the same result.

Function 03 Used to read dynamic values and configuration information in 16-bit integer format.

Function 04 Used to read dynamic values in 16-bit integer format.

NOTE : When used to read values from the MPC 4 card, function 03 and function 04 can be used indifferently. They both return the same result.

NOTE : If any other function (apart from the above 4) is requested, an exception code “01” will be returned to indicate the use of an illegal function.

5.2.4 Function formats

5.2.4.1 Functions 01/02

NOTE : A maximum of 2040 discrete values (coils) can be requested at one time.

The Request and Response frame formats are shown in Figure 5-3.

Functions 01/02 (Read coils/Read discrete inputs)

Request frame				
1 byte	1 byte	2 bytes	2 bytes	2 bytes
Slave address	Modbus function	First coil address to be read	Number of coils to be read	CRC

Response Frame				
1 byte	1 byte	1 byte	n bytes	2 bytes
Address	Function	Byte count	Bit values (least significant bit is first coil value)	CRC

NOTE : When requesting a variable that is out of the range configured in the VM600, the exception code “02” will be returned to indicate the use of an illegal data address.

Example : Read 8 discrete values from Modbus address 01, starting from first coil (= coil 0)

H’01	**H’01**	**H’00**	**H’00**	**H’00**	**H’08**	**H’??**	**H’??**
Slave address	Modbus function	First register address to be read = H’0000		8 bits to be read		CRC	

Response (supposing value of coil

0	is	0	Least significant bit
1	is	1	
2	is	1	
3	is	0	
4	is	1	
5	is	0	
6	is	0	
7	is	1	Most significant bit)

Binary value is B’1001’0110, corresponding to hexadecimal H’96

Response frame :

H’01	H’01	H’01	H’96	2 bytes
Address	Function	Byte count	1 byte of data	CRC

Figure 5-3 : Formats and example for Modbus Function 01

5.2.4.2 Reading registers

Registers can be read using Function 03 or Function 04 of the Modbus protocol.

NOTE : A maximum of 127 registers can be requested at one time.

The Request and Response frame formats are shown in Figure 5-4.

Function 03/04 (Read Multiple Register)

Request frame				
1 byte	1 byte	2 bytes	2 bytes	2 bytes
Slave address	Modbus function	First register address to be read	Number of words (registers) to be read	CRC

Response Frame				
1 byte	1 byte	1 byte	n bytes	2 bytes
Address	Function	Byte count	Register values	CRC

NOTE : When requesting a variable that is out of the range configured in the VM600, the exception code “02” will be returned to indicate the use of an illegal data address.

Example : Read 1 register from Modbus address 01, starting from register 55 (decimal)

H’01	H’03	H’00	H’36	H’00	H’01	H’??	H’??
Slave address	Modbus function	First register address to be read = H’0036 (See Note 1)		1 register to be read		CRC	

Note 1 :
Register 1 (decimal) has register address H’00
Register 17 (decimal) has register address H’10
Register 49 (decimal) has register address H’30
etc.

If the value of register 55 is 4660 (decimal), corresponding to hexadecimal H’1234, the response will be as follows :

H’01	H’03	H’02	H’12	H’34	2 bytes
Address	Function	Byte count	Register value		CRC

Figure 5-4 : Formats and example for Modbus Function 03

5.2.4.3 Error handling

If an error occurs, the slave returns a message in which the Modbus function has its most significant bit forced to “1” (see Figure 5-5) :

- Function 01 is replaced by Function 81

- Function 03 is replaced by Function 83

This is followed by one of the following exception codes :

- Exception code 01=Illegal function
- Exception code 02=Illegal data address

Error Handling

Example : Read 1 register from Modbus address 01, starting from register 256 (decimal)

H'01	H'03	H'00	H'FF	H'00	H'01	H'??	H'??
Slave address	Modbus function	First register address to be read = H'00FF (See Note 1)		1 register to be read		CRC	

Note 1 :
Register 1 (decimal) has register address H'00
Register 17 (decimal) has register address H'10
Register 256 (decimal) has register address H'FF
etc.

Assuming register 256 does not exist, the response will be as follows :

H'01	H'83	H'02	2 bytes
Address	Function	Exception code	CRC

Figure 5-5 : Formats and example for error message

5.3 Description of modbus TCP protocol

The Modbus TCP protocol has exactly the same layout as the Modbus RTU protocol, with the exception of the "framing" sequence check pattern (CRC) and the address interpretation.

NOTE : All requests are sent via TCP on registered port **502**.

Requests are normally sent in half-duplex mode on a given connection. Effectively, there is no benefit in sending additional requests on a single connection while a response is outstanding.

The Modbus 'slave address' field is replaced by a single-byte 'Unit Identifier'. This may be used to communicate via devices such as bridges and gateways which use a single IP address to support multiple independent end units. The VM600 does not use this feature. In the response, this field is always set to the received value, but it is not checked by the system.

The request and response are prefixed by six bytes as follows :

Byte 0 Transaction identifier - copied by server - usually 0
Byte 1 Transaction identifier - copied by server - usually 0
Byte 2 Protocol identifier = 0
Byte 3 Protocol identifier = 0
Byte 4 Length field (upper byte) = 0 (since all messages are smaller than 256)

Byte 5 Length field (lower byte) = number of bytes following

Byte 6 Unit identifier (previously 'slave address') - copied by server but ignored

Byte 7 Modbus function code

Byte 8 onwards Data as needed

Example :

If request is “Read 1 register at offset 55” and if returned value is decimal 4660 (= hexadecimal H’1234), this would give :

		TCP						Modbus					
Request	:	00	00	00	00	00	06	0F	03	00	36	00	01
Response	:	00	00	00	00	00	05	0F	03	02	12	34	
Byte	*:*	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*

Refer to Section 5.2 for examples of data.

Users familiar with Modbus RTU should note that the 'CRC-16' or 'LRC' check fields are NOT needed in Modbus TCP. The TCP/IP and link layer (e.g. Ethernet) checksum mechanisms are used instead to verify accurate delivery of the data packet.

5.4 MPC 4 card

5.4.1 Definition of registers

The register allocation is defined in files stored on the CPU M that are read when the VM600 rack is started up. These files are :

- `mbcfg.2` For Modbus RTU communication through 9-pole RS-232 connector on front of CPU M card
- `mbcfg.3` For Modbus RTU communication through RS connector (RJ11-type) on IOC N card
- `mbcfg.tcp` For Modbus TCP communication through Ethernet connector on IOC N card

These files can be modified if required by editing them with a VT100 terminal (or emulator from the Windows environment). Refer to Section 2.5 for further information.

Each file is organized in 7 columns (see Figure 5-6) :

Slot — This is the number of the slot occupied by the DAU (data acquisition unit, i.e. card) in the VM600 rack.

It can have a value of between 3 and 14.

DAU — Indicates the type of card in the slot :

- MPC = MPC 4

Output — Defines the channel and/or output of the card in question. See Section 5.4

Type — Specifies whether the (analog) value returned is the actual measured value or the full-scale setting defined for the output in question :

- VAL = Measured value
- FSD = Full-scale value

STS/NOT	Defines whether the discrete values concerning the output in question are requested or not : • STS = Values requested (NB : STS = status) • NOT = Values not requested
Analog Reg. No.	Register used for analog values concerning the output in question
Digital Reg. No.	Register used for discrete (digital) values concerning the output in question

The registers for analog values and discrete values are numbered sequentially and in parallel. The configuration file is scanned, with the numbering of both sets of registers starting at 1 (addressed as 0). Each time an analog register declaration or a discrete input is encountered, the register number (current number) is incremented.

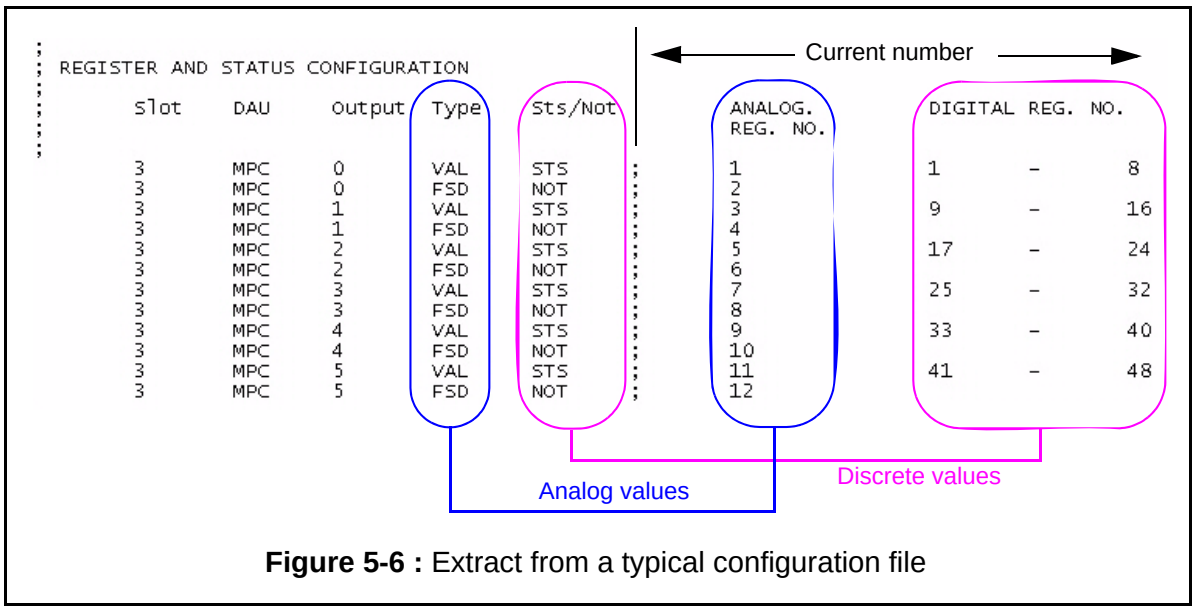


Figure 5-6 : Extract from a typical configuration file

5.4.2 Definition of outputs for MPC 4 cards

The outputs listed in column 3 of the configuration file (see example in Figure 5-6) can have 11 possible values for MPC 4 cards, as defined in Table 5-2.

Output Number	Definition
0	*Measurement Channel 1, Output 1*
1	*Measurement Channel 1, Output 2*
2	*Measurement Channel 2, Output 1*
3	*Measurement Channel 2, Output 2*
4	*Measurement Channel 3, Output 1*
5	*Measurement Channel 3, Output 2*
6	*Measurement Channel 4, Output 1*
7	*Measurement Channel 4, Output 2*
8	*Dual Channel 1&2, Output 1*

Table 5-2 : Output channel coding for MPC 4 cards (Part 1 of 2)

Output Number	Definition
9	*Dual Channel 3&4, Output 1*
10	*Speed Channel 1, Output 1*
11	*Speed Channel 2, Output 1*

Table 5-2 : Output channel coding for MPC 4 cards (Part 2 of 2)

5.4.3 Analog values (Registers)

Possible settings are :

- *VAL Actual measured value*
  VAL is coded as a 16-bit signed value (see Figure 5-7).
  16383 (H'3FFF) represents 100% of the full-scale defined in the FSD register.
  0 represents 0% of the full-scale defined in the FSD register.
  49152 (H'C000) represents -100% of the full-scale defined in the FSD register.

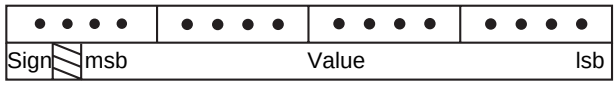


Figure 5-7 : Signed 16 bit Integer

- *FSD Full-scale value*
  FSD is coded as a 16-bit unsigned value (see Figure 5-8).

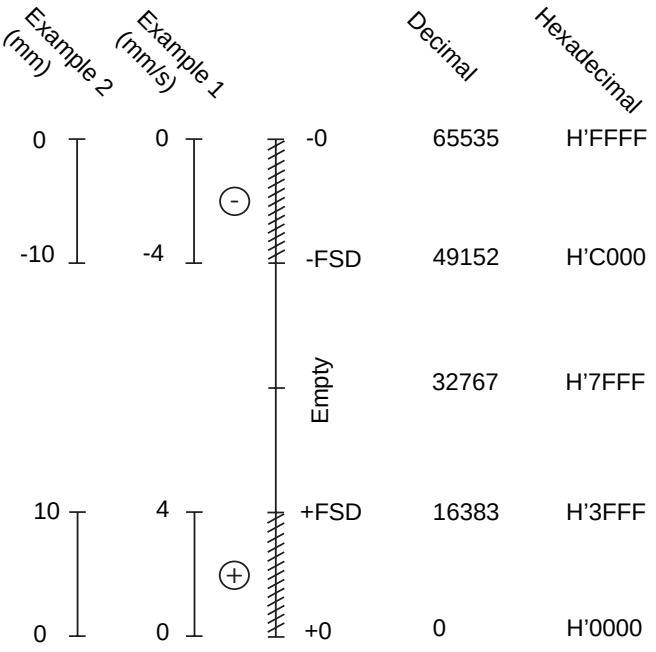


Figure 5-8 : Analog Values

Example 1:

A value of 10000 is returned with a full-scale defined as 4.
(The physical unit is mm/s, but this information is not available via Modbus.)

The corresponding mechanical value is then calculated as follows :

(10000 / 16383) x 4 = 2.44 mm/s.

Example 2:

A value of 50000 is returned with a full-scale defined as 10.
The corresponding mechanical value is then calculated as follows :

(50000 - 65535) / 16383 x 10 = -9.48 mm.

NOTE : The two speed values (outputs 10 and 11 in Table 5-2) are coded differently, i.e. directly in RPM divided by 4.
To obtain RPM values, simply multiply the returned value by 4.

5.4.4 Discrete values (Coils, Discrete Inputs)

The possible settings are :

- STS Status (values) requested
- NOT Status (values) not requested

The map of all discrete values available for an output can be activated or not using the STS or NOT indication. The 8 discrete values available for the output will be mapped as shown in Table 5-3.

Bit	Definition
b0 (= LSB)	*1 = Point is defined* *0 = Point is not defined*
b1	*1 = Point is in Alarm+ condition* *0 = Point is not in Alarm+ condition*
b2	*1 = Point is in Alarm- condition* *0 = Point is not in Alarm- condition*
b3	*1 = Point is in Danger+ condition* *0 = Point is not in Danger+ condition*
b4	*1 = Point is in Danger- condition* *0 = Point is not in Danger- condition*
b5	*1 = OK status indicates no problem at the point* *0 = OK status indicates there is a problem at the point*
b6	*Reserved*
b7 (= MSB)	*Reserved*

Table 5-3 : Mapping of discrete values

Discrete values are not available individually (e.g. you cannot request only bit b3). All 8 bits have to be requested.

5.4.5 Discrete values coded in analog value register

The discrete values presented in Section 5.4.4 can also be accessed with functions 03 and 04 at register numbers after 1001 (see Table 5-4).

The mapping is the same as the one defined in Table 5-3 with the bits 8 to 15 set to 0.

5.4.6 Table of register definitions (MPC card)

The following table is used in order to determine the analog and discrete register numbers.

Rack Slot No.	Card (DAU) Type	Output Number (see Table 5-2)	Type (for Analog Registers)	STS/NOT (for Discrete Registers)	Analog Register Number (and Hex. Address)	Discrete values coded in analog value register (and Hex. Address)	Discrete Register Numbers (& Hex. Addresses) (Sequence : Bits b0 - b7 of Table 5-3)	Additional Information Chan. = Channel, Dual = Dual Channel, O/P = Output
3	MPC 4	0	VAL	STS	1 (H'0000)	1001 (H'03E9)	1 - 8 (H'0000 - H'0007)	Chan. 1, O/P 1
3	MPC 4	0	FSD	NOT	2 (H'0001)			Chan. 1, O/P 1
3	MPC 4	1	VAL	STS	3 (H'0002)	1002 (H'03EA)	9 - 16 (H'0008 - H'000F)	Chan. 1, O/P 2
3	MPC 4	1	FSD	NOT	4 (H'0003)			Chan. 1, O/P 2
3	MPC 4	2	VAL	STS	5 (H'0004)	1003 (H'03EB)	17 - 24 (H'0010 - H'0017)	Chan. 2, O/P 1
3	MPC 4	2	FSD	NOT	6 (H'0005)			Chan. 2, O/P 1
3	MPC 4	3	VAL	STS	7 (H'0006)	1004 (H'03EC)	25 - 32 (H'0018 - H'001F)	Chan. 2, O/P 2
3	MPC 4	3	FSD	NOT	8 (H'0007)			Chan. 2, O/P 2
3	MPC 4	4	VAL	STS	9 (H'0008)	1005 (H'03ED)	33 - 40 (H'0020 - H'0027)	Chan. 3, O/P 1
3	MPC 4	4	FSD	NOT	10 (H'0009)			Chan. 3, O/P 1
3	MPC 4	5	VAL	STS	11 (H'000A)	1006 (H'03EE)	41 - 48 (H'0028 - H'002F)	Chan. 3, O/P 2
3	MPC 4	5	FSD	NOT	12 (H'000B)			Chan. 3, O/P 2
3	MPC 4	6	VAL	STS	13 (H'000C)	1007 (H'03EF)	49 - 56 (H'0030 - H'0037)	Chan. 4, O/P 1
3	MPC 4	6	FSD	NOT	14 (H'000D)			Chan. 4, O/P 1
3	MPC 4	7	VAL	STS	15 (H'000E)	1008 (H'03F0)	57 - 64 (H'0038 - H'003F)	Chan. 4, O/P 2
3	MPC 4	7	FSD	NOT	16 (H'000F)			Chan. 4, O/P 2
3	MPC 4	8	VAL	STS	17 (H'0010)	1009 (H'03F1)	65 - 72 (H'0040 - H'0047)	Dual 1&2, O/P 1
3	MPC 4	8	FSD	NOT	18 (H'0011)			Dual 1&2, O/P 1
3	MPC 4	9	VAL	STS	19 (H'0012)	1010 (H'03F2)	73 - 80 (H'0048 - H'004F)	Dual 3&4, O/P 1
3	MPC 4	9	FSD	NOT	20 (H'0013)			Dual 3&4, O/P 1
3	MPC 4	10	VAL	STS	21 (H'0014)	1011 (H'03F3)	81 - 88 (H'0050 - H'0057)	Speed 1, O/P 1
3	MPC 4	11	VAL	STS	22 (H'0015)	1012 (H'03F4)	89 - 96 (H'0058 - H'005F)	Speed 2, O/P 1
4	MPC 4	0	VAL	STS	23 (H'0016)	1013 (H'03F5)	97 - 104 (H'0060 - H'0067)	Chan. 1, O/P 1
4	MPC 4	0	FSD	NOT	24 (H'0017)			Chan. 1, O/P 1
4	MPC 4	1	VAL	STS	25 (H'0018)	1014 (H'03F6)	105 - 112 (H'0068 - H'006F)	Chan. 1, O/P 2
4	MPC 4	1	FSD	NOT	26 (H'0019)			Chan. 1, O/P 2
4	MPC 4	2	VAL	STS	27 (H'001A)	1015 (H'03F7)	113 - 120 (H'0070 - H'0077)	Chan. 2, O/P 1
4	MPC 4	2	FSD	NOT	28 (H'001B)			Chan. 2, O/P 1
4	MPC 4	3	VAL	STS	29 (H'001C)	1016 (H'03F8)	121 - 128 (H'0078 - H'007F)	Chan. 2, O/P 2
4	MPC 4	3	FSD	NOT	30 (H'001D)			Chan. 2, O/P 2
4	MPC 4	4	VAL	STS	31 (H'001E)	1017 (H'03F9)	129 - 136 (H'0080 - H'0087)	Chan. 3, O/P 1
4	MPC 4	4	FSD	NOT	32 (H'001F)			Chan. 3, O/P 1

Table 5-4 : Modbus register definitions (Part 1 of 8)

Rack Slot No.	Card (DAU) Type	Output Number (see Table 5-2)	Type (for Analog Registers)	STS/NOT (for Discrete Registers)	Analog Register Number (and Hex. Address)	Discrete values coded in analog value register (and Hex. Address)	Discrete Register Numbers (& Hex. Addresses) (Sequence : Bits b0 - b7 of Table 5-3)	Additional Information Chan. = Channel, Dual = Dual Channel, O/P = Output
4	MPC 4	5	VAL	STS	33 (H'0020)	1018 (H'03FA)	137 - 144 (H'0088 - H'008F)	Chan. 3, O/P 2
4	MPC 4	5	FSD	NOT	34 (H'0021)			Chan. 3, O/P 2
4	MPC 4	6	VAL	STS	35 (H'0022)	1019 (H'03FB)	145 - 152 (H'0090 - H'0097)	Chan. 4, O/P 1
4	MPC 4	6	FSD	NOT	36 (H'0023)			Chan. 4, O/P 1
4	MPC 4	7	VAL	STS	37 (H'0024)	1020 (H'03FC)	153 - 160 (H'0098 - H'009F)	Chan. 4, O/P 2
4	MPC 4	7	FSD	NOT	38 (H'0025)			Chan. 4, O/P 2
4	MPC 4	8	VAL	STS	39 (H'0026)	1021 (H'03FD)	161 - 168 (H'00A0 - H'00A7)	Dual 1&2, O/P 1
4	MPC 4	8	FSD	NOT	40 (H'0027)			Dual 1&2, O/P 1
4	MPC 4	9	VAL	STS	41 (H'0028)	1022 (H'03FE)	169 - 176 (H'00A8 - H'00AF)	Dual 3&4, O/P 1
4	MPC 4	9	FSD	NOT	42 (H'0029)			Dual 3&4, O/P 1
4	MPC 4	10	VAL	STS	43 (H'002A)	1023 (H'03FF)	177 - 184 (H'00B0 - H'00B7)	Speed 1, O/P 1
4	MPC 4	11	VAL	STS	44 (H'002B)	1024 (H'0400)	185 - 192 (H'00B8 - H'00BF)	Speed 2, O/P 1
5	MPC 4	0	VAL	STS	45 (H'002C)	1025 (H'0401)	193 - 200 (H'00C0 - H'00C7)	Chan. 1, O/P 1
5	MPC 4	0	FSD	NOT	46 (H'002D)			Chan. 1, O/P 1
5	MPC 4	1	VAL	STS	47 (H'002E)	1026 (H'0402)	201 - 208 (H'00C8 - H'00CF)	Chan. 1, O/P 2
5	MPC 4	1	FSD	NOT	48 (H'002F)			Chan. 1, O/P 2
5	MPC 4	2	VAL	STS	49 (H'0030)	1027 (H'0403)	209 - 216 (H'00D0 - H'00D7)	Chan. 2, O/P 1
5	MPC 4	2	FSD	NOT	50 (H'0031)			Chan. 2, O/P 1
5	MPC 4	3	VAL	STS	51 (H'0032)	1028 (H'0404)	217 - 224 (H'00D8 - H'00DF)	Chan. 2, O/P 2
5	MPC 4	3	FSD	NOT	52 (H'0033)			Chan. 2, O/P 2
5	MPC 4	4	VAL	STS	53 (H'0034)	1029 (H'0405)	225 - 232 (H'00E0 - H'00E7)	Chan. 3, O/P 1
5	MPC 4	4	FSD	NOT	54 (H'0035)			Chan. 3, O/P 1
5	MPC 4	5	VAL	STS	55 (H'0036)	1030 (H'0406)	233 - 240 (H'00E8 - H'00EF)	Chan. 3, O/P 2
5	MPC 4	5	FSD	NOT	56 (H'0037)			Chan. 3, O/P 2
5	MPC 4	6	VAL	STS	57 (H'0038)	1031 (H'0407)	241 - 248 (H'00F0 - H'00F7)	Chan. 4, O/P 1
5	MPC 4	6	FSD	NOT	58 (H'0039)			Chan. 4, O/P 1
5	MPC 4	7	VAL	STS	59 (H'003A)	1032 (H'0408)	249 - 256 (H'00F8 - H'00FF)	Chan. 4, O/P 2
5	MPC 4	7	FSD	NOT	60 (H'003B)			Chan. 4, O/P 2
5	MPC 4	8	VAL	STS	61 (H'003C)	1033 (H'0409)	257 - 264 (H'0100 - H'0107)	Dual 1&2, O/P 1
5	MPC 4	8	FSD	NOT	62 (H'003D)			Dual 1&2, O/P 1
5	MPC 4	9	VAL	STS	63 (H'003E)	1034 (H'040A)	265 - 272 (H'0108 - H'010F)	Dual 3&4, O/P 1
5	MPC 4	9	FSD	NOT	64 (H'003F)			Dual 3&4, O/P 1
5	MPC 4	10	VAL	STS	65 (H'0040)	1035 (H'040B)	273 - 280 (H'0110 - H'0117)	Speed 1, O/P 1
5	MPC 4	11	VAL	STS	66 (H'0041)	1036 (H'040C)	281 - 288 (H'0118 - H'011F)	Speed 2, O/P 1
6	MPC 4	0	VAL	STS	67 (H'0042)	1037 (H'040D)	289 - 296 (H'0120 - H'0127)	Chan. 1, O/P 1

Table 5-4 : Modbus register definitions (Part 2 of 8)

Rack Slot No.	Card (DAU) Type	Output Number (see Table 5-2)	Type (for Analog Registers)	STS/NOT (for Discrete Registers)	Analog Register Number (and Hex. Address)	Discrete values coded in analog value register (and Hex. Address)	Discrete Register Numbers (& Hex. Addresses) (Sequence : Bits b0 - b7 of Table 5-3)	Additional Information Chan. = Channel, Dual = Dual Channel, O/P = Output
6	MPC 4	0	FSD	NOT	68 (H'0043)			Chan. 1, O/P 1
6	MPC 4	1	VAL	STS	69 (H'0044)	1038 (H'040E)	297 - 304 (H'0128 - H'012F)	Chan. 1, O/P 2
6	MPC 4	1	FSD	NOT	70 (H'0045)			Chan. 1, O/P 2
6	MPC 4	2	VAL	STS	71 (H'0046)	1039 (H'040F)	305 - 312 (H'0130 - H'0137)	Chan. 2, O/P 1
6	MPC 4	2	FSD	NOT	72 (H'0047)			Chan. 2, O/P 1
6	MPC 4	3	VAL	STS	73 (H'0048)	1040 (H'0410)	313 - 320 (H'0138 - H'013F)	Chan. 2, O/P 2
6	MPC 4	3	FSD	NOT	74 (H'0049)			Chan. 2, O/P 2
6	MPC 4	4	VAL	STS	75 (H'004A)	1041 (H'0411)	321 - 328 (H'0140 - H'0147)	Chan. 3, O/P 1
6	MPC 4	4	FSD	NOT	76 (H'004B)			Chan. 3, O/P 1
6	MPC 4	5	VAL	STS	77 (H'004C)	1042 (H'0412)	329 - 336 (H'0148 - H'014F)	Chan. 3, O/P 2
6	MPC 4	5	FSD	NOT	78 (H'004D)			Chan. 3, O/P 2
6	MPC 4	6	VAL	STS	79 (H'004E)	1043 (H'0413)	337 - 344 (H'0150 - H'0157)	Chan. 4, O/P 1
6	MPC 4	6	FSD	NOT	80 (H'004F)			Chan. 4, O/P 1
6	MPC 4	7	VAL	STS	81 (H'0050)	1044 (H'0414)	345 - 352 (H'0158 - H'015F)	Chan. 4, O/P 2
6	MPC 4	7	FSD	NOT	82 (H'0051)			Chan. 4, O/P 2
6	MPC 4	8	VAL	STS	83 (H'0052)	1045 (H'0415)	353 - 360 (H'0160 - H'0167)	Dual 1&2, O/P 1
6	MPC 4	8	FSD	NOT	84 (H'0053)			Dual 1&2, O/P 1
6	MPC 4	9	VAL	STS	85 (H'0054)	1046 (H'0416)	361 - 368 (H'0168 - H'016F)	Dual 3&4, O/P 1
6	MPC 4	9	FSD	NOT	86 (H'0055)			Dual 3&4, O/P 1
6	MPC 4	10	VAL	STS	87 (H'0056)	1047 (H'0417)	369 - 376 (H'0170 - H'0177)	Speed 1, O/P 1
6	MPC 4	11	VAL	STS	88 (H'0057)	1048 (H'0418)	377 - 384 (H'0178 - H'017F)	Speed 2, O/P 1
7	MPC 4	0	VAL	STS	89 (H'0058)	1049 (H'0419)	385 - 392 (H'0180 - H'0187)	Chan. 1, O/P 1
7	MPC 4	0	FSD	NOT	90 (H'0059)			Chan. 1, O/P 1
7	MPC 4	1	VAL	STS	91 (H'005A)	1050 (H'041A)	393 - 400 (H'0188 - H'018F)	Chan. 1, O/P 2
7	MPC 4	1	FSD	NOT	92 (H'005B)			Chan. 1, O/P 2
7	MPC 4	2	VAL	STS	93 (H'005C)	1051 (H'041B)	401 - 408 (H'0190 - H'0197)	Chan. 2, O/P 1
7	MPC 4	2	FSD	NOT	94 (H'005D)			Chan. 2, O/P 1
7	MPC 4	3	VAL	STS	95 (H'005E)	1052 (H'041C)	409 - 416 (H'0198 - H'019F)	Chan. 2, O/P 2
7	MPC 4	3	FSD	NOT	96 (H'005F)			Chan. 2, O/P 2
7	MPC 4	4	VAL	STS	97 (H'0060)	1053 (H'041D)	417 - 424 (H'01A0 - H'01A7)	Chan. 3, O/P 1
7	MPC 4	4	FSD	NOT	98 (H'0061)			Chan. 3, O/P 1
7	MPC 4	5	VAL	STS	99 (H'0062)	1054 (H'041E)	425 - 432 (H'01A8 - H'01AF)	Chan. 3, O/P 2
7	MPC 4	5	FSD	NOT	100 (H'0063)			Chan. 3, O/P 2
7	MPC 4	6	VAL	STS	101 (H'0064)	1055 (H'041F)	433 - 440 (H'01B0 - H'01B7)	Chan. 4, O/P 1
7	MPC 4	6	FSD	NOT	102 (H'0065)			Chan. 4, O/P 1
7	MPC 4	7	VAL	STS	103 (H'0066)	1056 (H'0420)	441 - 448 (H'01B8 - H'01BF)	Chan. 4, O/P 2

Table 5-4 : Modbus register definitions (Part 3 of 8)

Rack Slot No.	Card (DAU) Type	Output Number (see Table 5-2)	Type (for Analog Registers)	STS/NOT (for Discrete Registers)	Analog Register Number (and Hex. Address)	Discrete values coded in analog value register (and Hex. Address)	Discrete Register Numbers (& Hex. Addresses) (Sequence : Bits b0 - b7 of Table 5-3)	Additional Information Chan. = Channel, Dual = Dual Channel, O/P = Output
7	MPC 4	7	FSD	NOT	104 (H'0067)			Chan. 4, O/P 2
7	MPC 4	8	VAL	STS	105 (H'0068)	1057 (H'0421)	449 - 456 (H'01C0 - H'01C7)	Dual 1&2, O/P 1
7	MPC 4	8	FSD	NOT	102 (H'0069)			Dual 1&2, O/P 1
7	MPC 4	9	VAL	STS	107 (H'006A)	1058 (H'0422)	457 - 464 (H'01C8 - H'01CF)	Dual 3&4, O/P 1
7	MPC 4	9	FSD	NOT	108 (H'006B)			Dual 3&4, O/P 1
7	MPC 4	10	VAL	STS	109 (H'006C)	1059 (H'0423)	465 - 472 (H'01D0 - H'01D7)	Speed 1, O/P 1
7	MPC 4	11	VAL	STS	110 (H'006D)	1060 (H'0424)	473 - 480 (H'01D8 - H'01DF)	Speed 2, O/P 1
8	MPC 4	0	VAL	STS	111 (H'006E)	1061 (H'0425)	481 - 488 (H'01E0 - H'01E7)	Chan. 1, O/P 1
8	MPC 4	0	FSD	NOT	112 (H'006F)			Chan. 1, O/P 1
8	MPC 4	1	VAL	STS	113 (H'0070)	1062 (H'0426)	489 - 496 (H'01E8 - H'01EF)	Chan. 1, O/P 2
8	MPC 4	1	FSD	NOT	114 (H'0071)			Chan. 1, O/P 2
8	MPC 4	2	VAL	STS	115 (H'0072)	1063 (H'0427)	497 - 504 (H'01F0 - H'01F7)	Chan. 2, O/P 1
8	MPC 4	2	FSD	NOT	116 (H'0073)			Chan. 2, O/P 1
8	MPC 4	3	VAL	STS	117 (H'0074)	1064 (H'0428)	505 - 512 (H'01F8 - H'01FF)	Chan. 2, O/P 2
8	MPC 4	3	FSD	NOT	118 (H'0075)			Chan. 2, O/P 2
8	MPC 4	4	VAL	STS	119 (H'0076)	1065 (H'0429)	513 - 520 (H'0200 - H'0207)	Chan. 3, O/P 1
8	MPC 4	4	FSD	NOT	120 (H'0077)			Chan. 3, O/P 1
8	MPC 4	5	VAL	STS	121 (H'0078)	1066 (H'042A)	521 - 528 (H'0208 - H'020F)	Chan. 3, O/P 2
8	MPC 4	5	FSD	NOT	122 (H'0079)			Chan. 3, O/P 2
8	MPC 4	6	VAL	STS	123 (H'007A)	1067 (H'042B)	529 - 536 (H'0210 - H'0217)	Chan. 4, O/P 1
8	MPC 4	6	FSD	NOT	124 (H'007B)			Chan. 4, O/P 1
8	MPC 4	7	VAL	STS	125 (H'007C)	1068 (H'042C)	537 - 544 (H'0218 - H'021F)	Chan. 4, O/P 2
8	MPC 4	7	FSD	NOT	126 (H'007D)			Chan. 4, O/P 2
8	MPC 4	8	VAL	STS	127 (H'007E)	1069 (H'042D)	545 - 552 (H'0220 - H'0227)	Dual 1&2, O/P 1
8	MPC 4	8	FSD	NOT	128 (H'007F)			Dual 1&2, O/P 1
8	MPC 4	9	VAL	STS	129 (H'0080)	1070 (H'042E)	553 - 560 (H'0228 - H'022F)	Dual 3&4, O/P 1
8	MPC 4	9	FSD	NOT	130 (H'0081)			Dual 3&4, O/P 1
8	MPC 4	10	VAL	STS	131 (H'0082)	1071 (H'042F)	561 - 568 (H'0230 - H'0237)	Speed 1, O/P 1
8	MPC 4	11	VAL	STS	132 (H'0083)	1072 (H'0430)	569 - 576 (H'0238 - H'023F)	Speed 2, O/P 1
9	MPC 4	0	VAL	STS	133 (H'0084)	1073 (H'0431)	577 - 584 (H'0240 - H'0247)	Chan. 1, O/P 1
9	MPC 4	0	FSD	NOT	134 (H'0085)			Chan. 1, O/P 1
9	MPC 4	1	VAL	STS	135 (H'0086)	1074 (H'0432)	585 - 592 (H'0248 - H'024F)	Chan. 1, O/P 2
9	MPC 4	1	FSD	NOT	136 (H'0087)			Chan. 1, O/P 2
9	MPC 4	2	VAL	STS	137 (H'0088)	1075 (H'0433)	593 - 600 (H'0250 - H'0257)	Chan. 2, O/P 1
9	MPC 4	2	FSD	NOT	138 (H'0089)			Chan. 2, O/P 1

Table 5-4 : Modbus register definitions (Part 4 of 8)

Rack Slot No.	Card (DAU) Type	Output Number (see Table 5-2)	Type (for Analog Registers)	STS/NOT (for Discrete Registers)	Analog Register Number (and Hex. Address)	Discrete values coded in analog value register (and Hex. Address)	Discrete Register Numbers (& Hex. Addresses) (Sequence : Bits b0 - b7 of Table 5-3)	Additional Information Chan. = Channel, Dual = Dual Channel, O/P = Output
9	MPC 4	3	VAL	STS	139 (H'008A)	1076 (H'0434)	601 - 608 (H'0258 - H'025F)	Chan. 2, O/P 2
9	MPC 4	3	FSD	NOT	140 (H'008B)			Chan. 2, O/P 2
9	MPC 4	4	VAL	STS	141 (H'008C)	1077 (H'0435)	609 - 616 (H'0260 - H'0267)	Chan. 3, O/P 1
9	MPC 4	4	FSD	NOT	142 (H'008D)			Chan. 3, O/P 1
9	MPC 4	5	VAL	STS	143 (H'008E)	1078 (H'0436)	617 - 624 (H'0268 - H'026F)	Chan. 3, O/P 2
9	MPC 4	5	FSD	NOT	144 (H'008F)			Chan. 3, O/P 2
9	MPC 4	6	VAL	STS	145 (H'0090)	1079 (H'0437)	625 - 632 (H'0270 - H'0277)	Chan. 4, O/P 1
9	MPC 4	6	FSD	NOT	146 (H'0091)			Chan. 4, O/P 1
9	MPC 4	7	VAL	STS	147 (H'0092)	1080 (H'0438)	633 - 640 (H'0278 - H'027F)	Chan. 4, O/P 2
9	MPC 4	7	FSD	NOT	148 (H'0093)			Chan. 4, O/P 2
9	MPC 4	8	VAL	STS	149 (H'0094)	1081 (H'0439)	641 - 648 (H'0280 - H'0287)	Dual 1&2, O/P 1
9	MPC 4	8	FSD	NOT	150 (H'0095)			Dual 1&2, O/P 1
9	MPC 4	9	VAL	STS	151 (H'0096)	1082 (H'043A)	649 - 656 (H'0288 - H'028F)	Dual 3&4, O/P 1
9	MPC 4	9	FSD	NOT	152 (H'0097)			Dual 3&4, O/P 1
9	MPC 4	10	VAL	STS	153 (H'0098)	1083 (H'043B)	657 - 664 (H'0290 - H'0297)	Speed 1, O/P 1
9	MPC 4	11	VAL	STS	154 (H'0099)	1084 (H'043C)	665 - 672 (H'0298 - H'029F)	Speed 2, O/P 1
10	MPC 4	0	VAL	STS	155 (H'009A)	1085 (H'043D)	673 - 680 (H'02A0 - H'02A7)	Chan. 1, O/P 1
10	MPC 4	0	FSD	NOT	156 (H'009B)			Chan. 1, O/P 1
10	MPC 4	1	VAL	STS	157 (H'009C)	1086 (H'043E)	681 - 688 (H'02A8 - H'02AF)	Chan. 1, O/P 2
10	MPC 4	1	FSD	NOT	158 (H'009D)			Chan. 1, O/P 2
10	MPC 4	2	VAL	STS	159 (H'009E)	1087 (H'043F)	689 - 696 (H'02B0 - H'02B7)	Chan. 2, O/P 1
10	MPC 4	2	FSD	NOT	160 (H'009F)			Chan. 2, O/P 1
10	MPC 4	3	VAL	STS	161 (H'00A0)	1088 (H'0440)	697 - 704 (H'02B8 - H'02BF)	Chan. 2, O/P 2
10	MPC 4	3	FSD	NOT	162 (H'00A1)			Chan. 2, O/P 2
10	MPC 4	4	VAL	STS	163 (H'00A2)	1089 (H'0441)	705 - 712 (H'02C0 - H'02C7)	Chan. 3, O/P 1
10	MPC 4	4	FSD	NOT	164 (H'00A3)			Chan. 3, O/P 1
10	MPC 4	5	VAL	STS	165 (H'00A4)	1090 (H'0442)	713 - 720 (H'02C8 - H'02CF)	Chan. 3, O/P 2
10	MPC 4	5	FSD	NOT	166 (H'00A5)			Chan. 3, O/P 2
10	MPC 4	6	VAL	STS	167 (H'00A6)	1091 (H'0443)	721 - 728 (H'02D0 - H'02D7)	Chan. 4, O/P 1
10	MPC 4	6	FSD	NOT	168 (H'00A7)			Chan. 4, O/P 1
10	MPC 4	7	VAL	STS	169 (H'00A8)	1092 (H'0444)	729 - 736 (H'02D8 - H'02DF)	Chan. 4, O/P 2
10	MPC 4	7	FSD	NOT	170 (H'00A9)			Chan. 4, O/P 2
10	MPC 4	8	VAL	STS	171 (H'00AA)	1093 (H'0445)	737 - 744 (H'02E0 - H'02E7)	Dual 1&2, O/P 1
10	MPC 4	8	FSD	NOT	172 (H'00AB)			Dual 1&2, O/P 1
10	MPC 4	9	VAL	STS	173 (H'00AC)	1094 (H'0446)	745 - 752 (H'02E8 - H'02EF)	Dual 3&4, O/P 1
10	MPC 4	9	FSD	NOT	174 (H'00AD)			Dual 3&4, O/P 1

Table 5-4 : Modbus register definitions (Part 5 of 8)

Rack Slot No.	Card (DAU) Type	Output Number (see Table 5-2)	Type (for Analog Registers)	STS/NOT (for Discrete Registers)	Analog Register Number (and Hex. Address)	Discrete values coded in analog value register (and Hex. Address)	Discrete Register Numbers (& Hex. Addresses) (Sequence : Bits b0 - b7 of Table 5-3)	Additional Information Chan. = Channel, Dual = Dual Channel, O/P = Output
10	MPC 4	10	VAL	STS	175 (H'00AE)	1095 (H'0447)	753 - 760 (H'02F0 - H'02F7)	Speed 1, O/P 1
10	MPC 4	11	VAL	STS	176 (H'00AF)	1096 (H'0448)	761 - 768 (H'02F8 - H'02FF)	Speed 2, O/P 1
11	MPC 4	0	VAL	STS	177 (H'00B0)	1097 (H'0449)	769 - 776 (H'0300 - H'0307)	Chan. 1, O/P 1
11	MPC 4	0	FSD	NOT	178 (H'00B1)			Chan. 1, O/P 1
11	MPC 4	1	VAL	STS	179 (H'00B2)	1098 (H'044A)	777 - 784 (H'0308 - H'030F)	Chan. 1, O/P 2
11	MPC 4	1	FSD	NOT	180 (H'00B3)			Chan. 1, O/P 2
11	MPC 4	2	VAL	STS	181 (H'00B4)	1099 (H'044B)	785 - 792 (H'0310 - H'0317)	Chan. 2, O/P 1
11	MPC 4	2	FSD	NOT	182 (H'00B5)			Chan. 2, O/P 1
11	MPC 4	3	VAL	STS	183 (H'00B6)	1100 (H'044C)	793 - 800 (H'0318 - H'031F)	Chan. 2, O/P 2
11	MPC 4	3	FSD	NOT	184 (H'00B7)			Chan. 2, O/P 2
11	MPC 4	4	VAL	STS	185 (H'00B8)	1101 (H'044D)	801 - 808 (H'0320 - H'0327)	Chan. 3, O/P 1
11	MPC 4	4	FSD	NOT	186 (H'00B9)			Chan. 3, O/P 1
11	MPC 4	5	VAL	STS	187 (H'00BA)	1102(H'044E)	809 - 816 (H'0328 - H'032F)	Chan. 3, O/P 2
11	MPC 4	5	FSD	NOT	188 (H'00BB)			Chan. 3, O/P 2
11	MPC 4	6	VAL	STS	189 (H'00BC)	1103 (H'044F)	817 - 824 (H'0330 - H'0337)	Chan. 4, O/P 1
11	MPC 4	6	FSD	NOT	190 (H'00BD)			Chan. 4, O/P 1
11	MPC 4	7	VAL	STS	191 (H'00BE)	1104 (H'0450)	825 - 832 (H'0338 - H'033F)	Chan. 4, O/P 2
11	MPC 4	7	FSD	NOT	192 (H'00BF)			Chan. 4, O/P 2
11	MPC 4	8	VAL	STS	193 (H'00C0)	1105 (H'0451)	833 - 840 (H'0340 - H'0347)	Dual 1&2, O/P 1
11	MPC 4	8	FSD	NOT	194 (H'00C1)			Dual 1&2, O/P 1
11	MPC 4	9	VAL	STS	195 (H'00C2)	1106 (H'0452)	841 - 848 (H'0348 - H'034F)	Dual 3&4, O/P 1
11	MPC 4	9	FSD	NOT	196 (H'00C3)			Dual 3&4, O/P 1
11	MPC 4	10	VAL	STS	197 (H'00C4)	1107 (H'0453)	849 - 856 (H'0350 - H'0357)	Speed 1, O/P 1
11	MPC 4	11	VAL	STS	198 (H'00C5)	1108 (H'0454)	857 - 864 (H'0358 - H'035F)	Speed 2, O/P 1
12	MPC 4	0	VAL	STS	199 (H'00C6)	1109(H'0455)	865 - 872 (H'0360 - H'0367)	Chan. 1, O/P 1
12	MPC 4	0	FSD	NOT	200 (H'00C7)			Chan. 1, O/P 1
12	MPC 4	1	VAL	STS	201 (H'00C8)	1110 (H'0456)	873 - 880 (H'0368 - H'036F)	Chan. 1, O/P 2
12	MPC 4	1	FSD	NOT	202 (H'00C9)			Chan. 1, O/P 2
12	MPC 4	2	VAL	STS	203 (H'00CA)	1111 (H'0457)	881 - 888 (H'0370 - H'0377)	Chan. 2, O/P 1
12	MPC 4	2	FSD	NOT	204 (H'00CB)			Chan. 2, O/P 1
12	MPC 4	3	VAL	STS	205 (H'00CC)	1112 (H'0458)	889 - 896 (H'0378 - H'037F)	Chan. 2, O/P 2
12	MPC 4	3	FSD	NOT	206 (H'00CD)			Chan. 2, O/P 2
12	MPC 4	4	VAL	STS	207 (H'00CE)	1113 (H'0459)	897 - 904 (H'0380 - H'0387)	Chan. 3, O/P 1
12	MPC 4	4	FSD	NOT	208 (H'00CF)			Chan. 3, O/P 1
12	MPC 4	5	VAL	STS	209 (H'00D0)	1114 (H'045A)	905 - 912 (H'0388 - H'038F)	Chan. 3, O/P 2

Table 5-4 : Modbus register definitions (Part 6 of 8)

Rack Slot No.	Card (DAU) Type	Output Number (see Table 5-2)	Type (for Analog Registers)	STS/NOT (for Discrete Registers)	Analog Register Number (and Hex. Address)	Discrete values coded in analog value register (and Hex. Address)	Discrete Register Numbers (& Hex. Addresses) (Sequence : Bits b0 - b7 of Table 5-3)	Additional Information Chan. = Channel, Dual = Dual Channel, O/P = Output
12	MPC 4	5	FSD	NOT	210 (H'00D1)			Chan. 3, O/P 2
12	MPC 4	6	VAL	STS	211 (H'00D2)	1115 (H'045B)	913 - 920 (H'0390 - H'0397)	Chan. 4, O/P 1
12	MPC 4	6	FSD	NOT	212 (H'00D3)			Chan. 4, O/P 1
12	MPC 4	7	VAL	STS	213 (H'00D4)	1116 (H'045C)	921 - 928 (H'0398 - H'039F)	Chan. 4, O/P 2
12	MPC 4	7	FSD	NOT	214 (H'00D5)			Chan. 4, O/P 2
12	MPC 4	8	VAL	STS	215 (H'00D6)	1117 (H'045D)	929 - 936 (H'03A0 - H'03A7)	Dual 1&2, O/P 1
12	MPC 4	8	FSD	NOT	216 (H'00D7)			Dual 1&2, O/P 1
12	MPC 4	9	VAL	STS	217 (H'00D8)	1118 (H'045E)	937 - 944 (H'03A8 - H'03AF)	Dual 3&4, O/P 1
12	MPC 4	9	FSD	NOT	218 (H'00D9)			Dual 3&4, O/P 1
12	MPC 4	10	VAL	STS	219 (H'00DA)	1119 (H'045F)	945 - 952 (H'03B0 - H'03B7)	Speed 1, O/P 1
12	MPC 4	11	VAL	STS	220 (H'00DB)	1120 (H'0460)	953 - 960 (H'03B8 - H'03BF)	Speed 2, O/P 1
13	MPC 4	0	VAL	STS	221 (H'00DC)	1121 (H'0461)	961 - 968 (H'03C0 - H'03C7)	Chan. 1, O/P 1
13	MPC 4	0	FSD	NOT	222 (H'00DD)			Chan. 1, O/P 1
13	MPC 4	1	VAL	STS	223 (H'00DE)	1122 (H'0462)	969 - 976 (H'03C8 - H'03CF)	Chan. 1, O/P 2
13	MPC 4	1	FSD	NOT	224 (H'00DF)			Chan. 1, O/P 2
13	MPC 4	2	VAL	STS	225 (H'00E0)	1123 (H'0463)	977 - 984 (H'03D0 - H'03D7)	Chan. 2, O/P 1
13	MPC 4	2	FSD	NOT	226 (H'00E1)			Chan. 2, O/P 1
13	MPC 4	3	VAL	STS	227 (H'00E2)	1124 (H'0464)	985 - 992 (H'03D8 - H'03DF)	Chan. 2, O/P 2
13	MPC 4	3	FSD	NOT	228 (H'00E3)			Chan. 2, O/P 2
13	MPC 4	4	VAL	STS	229 (H'00E4)	1125 (H'0465)	993 - 1000 (H'03E0 - H'03E7)	Chan. 3, O/P 1
13	MPC 4	4	FSD	NOT	230 (H'00E5)			Chan. 3, O/P 1
13	MPC 4	5	VAL	STS	231 (H'00E6)	1126 (H'0466)	1001 - 1008 (H'03E8 - H'03EF)	Chan. 3, O/P 2
13	MPC 4	5	FSD	NOT	232 (H'00E7)			Chan. 3, O/P 2
13	MPC 4	6	VAL	STS	233 (H'00E8)	1127 (H'0467)	1009 - 1016 (H'03F0 - H'03F7)	Chan. 4, O/P 1
13	MPC 4	6	FSD	NOT	234 (H'00E9)			Chan. 4, O/P 1
13	MPC 4	7	VAL	STS	235 (H'00EA)	1128 (H'0468)	1017 - 1024 (H'03F8 - H'03FF)	Chan. 4, O/P 2
13	MPC 4	7	FSD	NOT	236 (H'00EB)			Chan. 4, O/P 2
13	MPC 4	8	VAL	STS	237 (H'00EC)	1129 (H'0469)	1025 - 1032 (H'0400 - H'0407)	Dual 1&2, O/P 1
13	MPC 4	8	FSD	NOT	238 (H'00ED)			Dual 1&2, O/P 1
13	MPC 4	9	VAL	STS	239 (H'00EE)	1130 (H'046A)	1033 - 1040 (H'0408 - H'040F)	Dual 3&4, O/P 1
13	MPC 4	9	FSD	NOT	240 (H'00EF)			Dual 3&4, O/P 1
13	MPC 4	10	VAL	STS	241 (H'00F0)	1131 (H'046B)	1041 - 1048 (H'0410 - H'0417)	Speed 1, O/P 1
13	MPC 4	11	VAL	STS	242 (H'00F1)	1132 (H'046C)	1049 - 1056 (H'0418 - H'041F)	Speed 2, O/P 1
14	MPC 4	0	VAL	STS	243 (H'00F2)	1133 (H'046D)	1057 - 1064 (H'0420 - H'0427)	Chan. 1, O/P 1
14	MPC 4	0	FSD	NOT	244 (H'00F3)			Chan. 1, O/P 1

Table 5-4 : Modbus register definitions (Part 7 of 8)

Rack Slot No.	Card (DAU) Type	Output Number (see Table 5-2)	Type (for Analog Registers)	STS/NOT (for Discrete Registers)	Analog Register Number (and Hex. Address)	Discrete values coded in analog value register (and Hex. Address)	Discrete Register Numbers (& Hex. Addresses) (Sequence : Bits b0 - b7 of Table 5-3)	Additional Information Chan. = Channel, Dual = Dual Channel, O/P = Output
14	MPC 4	1	VAL	STS	245 (H'00F4)	1134 (H'046E)	1065 - 1072 (H'0428 - H'042F)	Chan. 1, O/P 2
14	MPC 4	1	FSD	NOT	246 (H'00F5)			Chan. 1, O/P 2
14	MPC 4	2	VAL	STS	247 (H'00F6)	1135 (H'046F)	1073 - 1080 (H'0430 - H'0437)	Chan. 2, O/P 1
14	MPC 4	2	FSD	NOT	248 (H'00F7)			Chan. 2, O/P 1
14	MPC 4	3	VAL	STS	249 (H'00F8)	1136 (H'0470)	1081 - 1088 (H'0438 - H'043F)	Chan. 2, O/P 2
14	MPC 4	3	FSD	NOT	250 (H'00F9)			Chan. 2, O/P 2
14	MPC 4	4	VAL	STS	251 (H'00FA)	1137 (H'0471)	1089 - 1096 (H'0440 - H'0447)	Chan. 3, O/P 1
14	MPC 4	4	FSD	NOT	252 (H'00FB)			Chan. 3, O/P 1
14	MPC 4	5	VAL	STS	253 (H'00FC)	1138 (H'0472)	1097 - 1104 (H'0448 - H'044F)	Chan. 3, O/P 2
14	MPC 4	5	FSD	NOT	254 (H'00FD)			Chan. 3, O/P 2
14	MPC 4	6	VAL	STS	255 (H'00FE)	1139 (H'0473)	1105 - 1112 (H'0450 - H'0457)	Chan. 4, O/P 1
14	MPC 4	6	FSD	NOT	256 (H'00FF)			Chan. 4, O/P 1
14	MPC 4	7	VAL	STS	257 (H'0100)	1140 (H'0474)	1113 - 1120 (H'0458 - H'045F)	Chan. 4, O/P 2
14	MPC 4	7	FSD	NOT	258 (H'0101)			Chan. 4, O/P 2
14	MPC 4	8	VAL	STS	259 (H'0102)	1141 (H'0475)	1121 - 1128 (H'0460 - H'0467)	Dual 1&2, O/P 1
14	MPC 4	8	FSD	NOT	260 (H'0103)			Dual 1&2, O/P 1
14	MPC 4	9	VAL	STS	261 (H'0104)	1142 (H'0476)	1129 - 1136 (H'0468 - H'046F)	Dual 3&4, O/P 1
14	MPC 4	9	FSD	NOT	262 (H'0105)			Dual 3&4, O/P 1
14	MPC 4	10	VAL	STS	263 (H'0106)	1143 (H'0477)	1137 - 1144 (H'0470 - H'0477)	Speed 1, O/P 1
14	MPC 4	11	VAL	STS	264 (H'0107)	1144 (H'0478)	1145 - 1152 (H'0478 - H'047F)	Speed 2, O/P 1

Table 5-4 : Modbus register definitions (Part 8 of 8)

5.5 AMC 8 card

The following sections describe the values or configuration parameters, either discrete or analog, that can be retrieved using the 4 modbus functions. (Refer to Section 5.2.3 for a list of these functions.) It ends with the table listing the addresses of the registers.

5.5.0.1 Read coil registers (Function 01)

The first function is used to read the configuration of the alarms (discrete values) ; wether they are enabled or not. These configurations were made in the MPS Software in the **Processing and alarms** screen (for the Channels) and under the **Alarms screen** (for the Multi-Channels).

The four alarm outputs that can be enabled are:

- Alert - Low
- Alert + High
- Danger - Low
- Danger + High

5.5.0.2 Read discrete inputs registers (Function 02)

The function number 2 can retrieve discrete values such as channel status (error & fail) and alarm register.

The five following registers define whether the system is in Alert condition on each channel and multi-channel or if there is a Global Channel OK Failure.

- Alarm+
- Alarm-
- Danger+
- Danger-
- Global Channel OK Fail

The ten following registers specify wether there is an error or a standby state for each channel and multi-channel.

- ADC[1] Error
- ADC Standby
- ADC PLL[2] Lock Error
- ADC Transmission Error
- ADC Dynamic Configuration Error
- BIT Result Fail
- No Sample Error
- OK Error Fail
- Linearization Error
- Cold Junction Error

The last two registers define whether each of the 16 Basic Functions and each of the 8 Advanced Functions were activated in the **Alarms Logical Combination** screen of the MPS Software.

- Basic Functions

1. ADC = Analog to Digital Converter
2. PLL = Phase Lock Loop

- Advanced Functions

5.5.0.3 Read holding registers (Function 03)

The function 3 can read analog values, in particular it is used to read the current values on each channel of the AMC 8 and the results of the logical combinations of alarms.

This function, as well as function 2 can be used to read the alarm status.

The meaning of the Input Registers is defined in Table 5-5.

Register	Definition
Processed Values	The current value for each channel and multi-channel.
Logical Results	The result of the logical combinations defined in the **Alarms Logical Combination** screen of the MPS for Basic Functions 1 - 16 and Advanced Functions 1 - 8 as follows: • Bit 0: BF1 ... • Bit 15: BF16 • Bit 16: AF1 ... • Bit 23: AF8 • Bit 24: 0 ... • Bit 31: 0
Alarm Status	Defines the system status and alarms with the following bit definitions : • Bit 0 : Alarm+ • Bit 1 : Alarm- • Bit 2 : Danger+ • Bit 3 : Danger- • Bit 4 : Global Channel OK Fail • Bit 5 : ADC Error • Bit 6 : ADC Standby • Bit 7 : ADC PLL Lock Error • Bit 8 : ADC Transmission Error • Bit 9 : ADC Dynamic Configuration Error • Bit 10 : BIT Result Fail • Bit 11 : No Sample • Bit 12 : OK Error Fail • Bit 13 : Linearization Error • Bit 14 : Cold Junction Error • Bit 15 : Reserved

Table 5-5 : Read Input Register Definitions

5.5.0.4 Read input registers (Function 04)

The fourth function is used to read configuration values such as minimum and maximum displayed values and alarm levels for each channel and multi-channel using the Output Unit defined.

The complete list of Holding Registers is shown below :

- Minimum Displayed Value
- Maximum Displayed Value
- Alert - Low Level
- Alert + High Level
- Danger - Low Level
- Danger + High Level
- Output Unit
  - Bit 0 : User defined
  - Bit 1 : Degrees Kelvin
  - Bit 2 : Degrees Celsius
  - Bit 3 : Degrees Fahrenheit
  - Bits 4 - 15 : Not used

5.5.1 Address map (AMC card)

The MODBUS Starting Address can be determined using the following technique:

1- Decide in which slot the card will be inserted (Snum)

2- Use Table 5-6 to determine the Address Offset (Aoff) for the function

3- Use the following formula to determine the MODBUS Starting Address (MSA) :

$$\mathbf{MSA = 4096 + Aoff + (256 * Snum)} \quad (5.1)$$

NOTE : To obtain the register number simply add 1 to the MSA value.

Example :

Your AMC 8 card is in slot 14 and you want to read the result of the logical combinations of alarms for the 16 basic functions you defined in thee MPS Software (they correspond to bits 0 to 15). To do so, you have to use function 4 ; Read Input Registers. Looking into Table 5-6 you can find that the Address Offset Aoff = 24 and finally, using equation (5.1) you obtain the following MODBUS Starting Address :

$$MSA = 4096 + 24 + (256 * 14) = 7704$$

and the register number: 7704+1=7705

NOTE : A complete list of MODBUS Starting Addresses under the form of an Excel spreadsheet is available from Vibro-Meter upon request.

Rack Slot No. (Snum)	Address Offset (Aoff)	Bit(s)	Channel	Internal Value Type	Value Description	MODBUS Starting Address (MSA)	Value Type
Read Coil Registers (MODBUS Function Code 01)							
from 3 to 14	0	n/a	Channel 1	CONFIGURATION	Alert - Low Enable	see equation (5.1)	Bit
	1		Channel 2				
	2		Channel 3				
	3		Channel 4				
	4		Channel 5				
	5		Channel 6				
	6		Channel 7				
	7		Channel 8				
	8		Multi-channel 1				
	9		Multi-channel 2				
	10		Multi-channel 3				
	11		Multi-channel 4				
	12		Channel 1		Alert + High Enable		
	13		Channel 2				
	14		Channel 3				
	15		Channel 4				
	16		Channel 5				
	17		Channel 6				
	18		Channel 7				
	19		Channel 8				
	20		Multi-channel 1				
	21		Multi-channel 2				
	22		Multi-channel 3				
	23		Multi-channel 4				
	24		Channel 1		Danger - Low Enable		
	25		Channel 2				
	26		Channel 3				
	27		Channel 4				
	28		Channel 5				
	29		Channel 6				
	30		Channel 7				
	31		Channel 8				
	32		Multi-channel 1				
	33		Multi-channel 2				
	34		Multi-channel 3				
	35		Multi-channel 4				

Table 5-6 : AMC register definitions (Part 1 of 15)

Rack Slot No. (Snum)	Address Offset (Aoff)	Bit(s)	Channel	Internal Value Type	Value Description	MODBUS Starting Address (MSA)	Value Type
from 3 to 14	36	n/a	Channel 1	CONFIGURATION	Danger + High Enable	see equation (5.1)	Bit
	37		Channel 2				
	38		Channel 3				
	39		Channel 4				
	40		Channel 5				
	41		Channel 6				
	42		Channel 7				
	43		Channel 8				
	44		Multi-channel 1				
	45		Multi-channel 2				
	46		Multi-channel 3				
	47		Multi-channel 4				

Table 5-6 : AMC register definitions (Part 2 of 15)

Rack Slot No. (Snum)	Address Offset (Aoff)	Bit(s)	Channel	Internal Value Type	Value Description	MODBUS Starting Address (MSA)	Value Type
Read Discrete Input Registers (MODBUS Function Code 02)							
from 3 to 14	0	n/a	Channel 1	VALUE	Alarm+	see equation (5.1)	Bit
	1		Channel 2				
	2		Channel 3				
	3		Channel 4				
	4		Channel 5				
	5		Channel 6				
	6		Channel 7				
	7		Channel 8				
	8		Multi-channel 1				
	9		Multi-channel 2				
	10		Multi-channel 3				
	11		Multi-channel 4				
	12		Channel 1		Alarm-		
	13		Channel 2				
	14		Channel 3				
	15		Channel 4				
	16		Channel 5				
	17		Channel 6				
	18		Channel 7				
	19		Channel 8				
	20		Multi-channel 1				
	21		Multi-channel 2				
	22		Multi-channel 3				
	23		Multi-channel 4				
	24		Channel 1		Danger+		
	25		Channel 2				
	26		Channel 3				
	27		Channel 4				
	28		Channel 5				
	29		Channel 6				
	30		Channel 7				
	31		Channel 8				
	32		Multi-channel 1				
	33		Multi-channel 2				
	34		Multi-channel 3				
	35		Multi-channel 4				

Table 5-6 : AMC register definitions (Part 3 of 15)

Rack Slot No. (Snum)	Address Offset (Aoff)	Bit(s)	Channel	Internal Value Type	Value Description	MODBUS Starting Address (MSA)	Value Type
from 3 to 14	36	n/a	Channel 1	VALUE	Danger-	see equation (5.1)	Bit
	37		Channel 2				
	38		Channel 3				
	39		Channel 4				
	40		Channel 5				
	41		Channel 6				
	42		Channel 7				
	43		Channel 8				
	44		Multi-channel 1				
	45		Multi-channel 2				
	46		Multi-channel 3				
	47		Multi-channel 4				
	48		Channel 1		Global Channel OK Fail		
	49		Channel 2				
	50		Channel 3				
	51		Channel 4				
	52		Channel 5				
	53		Channel 6				
	54		Channel 7				
	55		Channel 8				
	56		Multi-channel 1				
	57		Multi-channel 2				
	58		Multi-channel 3				
	59		Multi-channel 4				
	60		Channel 1		ADC Error		
	61		Channel 2				
	62		Channel 3				
	63		Channel 4				
	64		Channel 5				
	65		Channel 6				
	66		Channel 7				
	67		Channel 8				
	68		Multi-channel 1				
	69		Multi-channel 2				
	70		Multi-channel 3				
	71		Multi-channel 4				
	72		Channel 1		ADC Standby		
	73		Channel 2				
	74		Channel 3				

Table 5-6 : AMC register definitions (Part 4 of 15)

Rack Slot No. (Snum)	Address Offset (Aoff)	Bit(s)	Channel	Internal Value Type	Value Description	MODBUS Starting Address (MSA)	Value Type
from 3 to 14	75	n/a	Channel 4	VALUE	ADC Standby	see equation (5.1)	Bit
	76		Channel 5				
	77		Channel 6				
	78		Channel 7				
	79		Channel 8				
	80		Multi-channel 1				
	81		Multi-channel 2				
	82		Multi-channel 3				
	83		Multi-channel 4				
	84		Channel 1		ADC PLL Lock Error		
	85		Channel 2				
	86		Channel 3				
	87		Channel 4				
	88		Channel 5				
	89		Channel 6				
	90		Channel 7				
	91		Channel 8				
	92		Multi-channel 1				
	93		Multi-channel 2				
	94		Multi-channel 3				
	95		Multi-channel 4				
	96		Channel 1		ADC Transmission Error		
	97		Channel 2				
	98		Channel 3				
	99		Channel 4				
	100		Channel 5				
	101		Channel 6				
	102		Channel 7				
	103		Channel 8				
	104		Multi-channel 1				
	105		Multi-channel 2				
	106		Multi-channel 3				
	107		Multi-channel 4				
	108		Channel 1		Dynamic Configuration Error		
	109		Channel 2				
	110		Channel 3				
	111		Channel 4				
	112		Channel 5				
	113		Channel 6				

Table 5-6 : AMC register definitions (Part 5 of 15)

Rack Slot No. (Snum)	Address Offset (Aoff)	Bit(s)	Channel	Internal Value Type	Value Description	MODBUS Starting Address (MSA)	Value Type
from 3 to 14	114	n/a	Channel 7	VALUE	Dynamic Configuration Error	see equation (5.1)	Bit
	115		Channel 8				
	116		Multi-channel 1				
	117		Multi-channel 2				
	118		Multi-channel 3				
	119		Multi-channel 4				
	120		Channel 1		BIT Result Fail		
	121		Channel 2				
	122		Channel 3				
	123		Channel 4				
	124		Channel 5				
	125		Channel 6				
	126		Channel 7				
	127		Channel 8				
	128		Multi-channel 1				
	129		Multi-channel 2				
	130		Multi-channel 3				
	131		Multi-channel 4				
	132		Channel 1		No Sample		
	133		Channel 2				
	134		Channel 3				
	135		Channel 4				
	136		Channel 5				
	137		Channel 6				
	138		Channel 7				
	139		Channel 8				
	140		Multi-channel 1				
	141		Multi-channel 2				
	142		Multi-channel 3				
	143		Multi-channel 4				
	144		Channel 1		OK Error Fail		
	145		Channel 2				
	146		Channel 3				
	147		Channel 4				
	148		Channel 5				
	149		Channel 6				
	150		Channel 7				
	151		Channel 8				
	152		Multi-channel 1				

Table 5-6 : AMC register definitions (Part 6 of 15)

Rack Slot No. (Snum)	Address Offset (Aoff)	Bit(s)	Channel	Internal Value Type	Value Description	MODBUS Starting Address (MSA)	Value Type
from 3 to 14	153	n/a	Multi-channel 2	VALUE	OK Error Fail	see equation (5.1)	Bit
	154		Multi-channel 3				
	155		Multi-channel 4				
	156		Channel 1		Linearization Error		
	157		Channel 2				
	158		Channel 3				
	159		Channel 4				
	160		Channel 5				
	161		Channel 6				
	162		Channel 7				
	163		Channel 8				
	164		Multi-channel 1				
	165		Multi-channel 2				
	166		Multi-channel 3				
	167		Multi-channel 4				
	168		Channel 1		Cold Junction Error		
	169		Channel 2				
	170		Channel 3				
	171		Channel 4				
	172		Channel 5				
	173		Channel 6				
	174		Channel 7				
	175		Channel 8				
	176		Multi-channel 1				
	177		Multi-channel 2				
	178		Multi-channel 3				
	179		Multi-channel 4				
	180		n/a		BasicFunction1		
	181				BasicFunction2		
	182				BasicFunction3		
	183				BasicFunction4		
	184				BasicFunction5		
	185				BasicFunction6		
	186				BasicFunction7		
	187				BasicFunction8		
	188				BasicFunction9		
	189				BasicFunction10		
	190				BasicFunction11		
	191				BasicFunction12		

Table 5-6 : AMC register definitions (Part 7 of 15)

Rack Slot No. (Snum)	Address Offset (Aoff)	Bit(s)	Channel	Internal Value Type	Value Description	MODBUS Starting Address (MSA)	Value Type
from 3 to 14	192	n/a	n/a	VALUE	BasicFunction13	see equation (5.1)	Bit
	193				BasicFunction14		
	194				BasicFunction15		
	195				BasicFunction16		
	196				AdvancedFunction1		
	197				AdvancedFunction2		
	198				AdvancedFunction3		
	199				AdvancedFunction4		
	200				AdvancedFunction5		
	201				AdvancedFunction6		
	202				AdvancedFunction7		
	203				AdvancedFunction8		

Table 5-6 : AMC register definitions (Part 8 of 15)

Rack Slot No. (Snum)	Address Offset (Aoff)	Bit(s)	Channel	Internal Value Type	Value Description	MODBUS Starting Address (MSA)	Value Type
Read Input Registers (MODBUS Function Code 03)							
from 3 to 14	0	0-15	Channel 1	VALUE	Processed Values (see Table 5-5)	see equation (5.1)	Float 32
	1	16-31					
	2	0-15	Channel 2				
	3	16-31					
	4	0-15	Channel 3				
	5	16-31					
	6	0-15	Channel 4				
	7	16-31					
	8	0-15	Channel 5				
	9	16-31					
	10	0-15	Channel 6				
	11	16-31					
	12	0-15	Channel 7				
	13	16-31					
	14	0-15	Channel 8				
	15	16-31					
	16	0-15	Multi-channel 1				
	17	16-31					
	18	0-15	Multi-channel 2				
	19	16-31					
	20	0-15	Multi-channel 3				
	21	16-31					
	22	0-15	Multi-channel 4				
	23	16-31					
	24	0-15	n/a		Logical Results (see Table 5-5)		U32
	25	16-31					
	26	0-15	Channel 1		Alarm Status (see Table 5-5)		U16
	27		Channel 2				
	28		Channel 3				
	29		Channel 4				
	30		Channel 5				
	31		Channel 6				
	32		Channel 7				

Table 5-6 : AMC register definitions (Part 9 of 15)

Rack Slot No. (Snum)	Address Offset (Aoff)	Bit(s)	Channel	Internal Value Type	Value Description	MODBUS Starting Address (MSA)	Value Type
from 3 to 14	33	0-15	Channel 8	VALUE	Alarm Status (see Table 5-5)	see equation (5.1)	U16
	34		Multi-channel 1				
	35		Multi-channel 2				
	36		Multi-channel 3				
	37		Multi-channel 4				

Table 5-6 : AMC register definitions (Part 10 of 15)

Rack Slot No. (Snum)	Address Offset (Aoff)	Bit(s)	Channel	Internal Value Type	Value Description	MODBUS Starting Address (MSA)	Value Type
Read Holding Registers (MODBUS Function Code 04)							
from 3 to 14	0	0-15	Channel 1	CONFIGURATION	Minimum Displayed Value	see equation (5.1)	Float32
	1	16-31					
	2	0-15	Channel 2				
	3	16-31					
	4	0-15	Channel 3				
	5	16-31					
	6	0-15	Channel 4				
	7	16-31					
	8	0-15	Channel 5				
	9	16-31					
	10	0-15	Channel 6				
	11	16-31					
	12	0-15	Channel 7				
	13	16-31					
	14	0-15	Channel 8				
	15	16-31					
	16	0-15	Multi-channel 1				
	17	16-31					
	18	0-15	Multi-channel 2				
	19	16-31					
	20	0-15	Multi-channel 3				
	21	16-31					
	22	0-15	Multi-channel 4				
	23	16-31					
	24	0-15	Channel 1		Maximum Displayed Value		
	25	16-31					
	26	0-15	Channel 2				
	27	16-31					
	28	0-15	Channel 3				
	29	16-31					
	30	0-15	Channel 4				
	31	16-31					
	32	0-15	Channel 5				
	33	16-31					
	34	0-15	Channel 6				
	35	16-31					

Table 5-6 : AMC register definitions (Part 11 of 15)

Rack Slot No. (Snum)	Address Offset (Aoff)	Bit(s)	Channel	Internal Value Type	Value Description	MODBUS Starting Address (MSA)	Value Type
from 3 to 14	36	0-15	Channel 7	CONFIGURATION	Maximum Displayed Value	see equation (5.1)	Float32
	37	16-31					
	38	0-15	Channel 8				
	39	16-31					
	40	0-15	Multi-channel 1				
	41	16-31					
	42	0-15	Multi-channel 2				
	43	16-31					
	44	0-15	Multi-channel 3				
	45	16-31					
	46	0-15	Multi-channel 4				
	47	16-31					
	48	0-15	Channel 1		Alert - Low		
	49	16-31					
	50	0-15	Channel 2				
	51	16-31					
	52	0-15	Channel 3				
	53	16-31					
	54	0-15	Channel 4				
	55	16-31					
	56	0-15	Channel 5				
	57	16-31					
	58	0-15	Channel 6				
	59	16-31					
	60	0-15	Channel 7				
	61	16-31					
	62	0-15	Channel 8				
	63	16-31					
	64	0-15	Multi-channel 1				
	65	16-31					
	66	0-15	Multi-channel 2				
	67	16-31					
	68	0-15	Multi-channel 3				
	69	16-31					
	70	0-15	Multi-channel 4				
	71	16-31					
	72	0-15	Channel 1		Alert + High		
	73	16-31					

Table 5-6 : AMC register definitions (Part 12 of 15)

Rack Slot No. (Snum)	Address Offset (Aoff)	Bit(s)	Channel	Internal Value Type	Value Description	MODBUS Starting Address (MSA)	Value Type
from 3 to 14	74	0-15	Channel 2	CONFIGURATION	Alert + High	see equation (5.1)	Float32
	75	16-31					
	76	0-15	Channel 3				
	77	16-31					
	78	0-15	Channel 4				
	79	16-31					
	80	0-15	Channel 5				
	81	16-31					
	82	0-15	Channel 6				
	83	16-31					
	84	0-15	Channel 7				
	85	16-31					
	86	0-15	Channel 8				
	87	16-31					
	88	0-15	Multi-channel 1				
	89	16-31					
	90	0-15	Multi-channel 2				
	91	16-31					
	92	0-15	Multi-channel 3				
	93	16-31					
	94	0-15	Multi-channel 4				
	95	16-31					
	96	0-15	Channel 1		Danger - Low		
	97	16-31					
	98	0-15	Channel 2				
	99	16-31					
	100	0-15	Channel 3				
	101	16-31					
	102	0-15	Channel 4				
	103	16-31					
	104	0-15	Channel 5				
	105	16-31					
	106	0-15	Channel 6				
	107	16-31					
	108	0-15	Channel 7				
	109	16-31					
	110	0-15	Channel 8				
	111	16-31					

Table 5-6 : AMC register definitions (Part 13 of 15)

Rack Slot No. (Snum)	Address Offset (Aoff)	Bit(s)	Channel	Internal Value Type	Value Description	MODBUS Starting Address (MSA)	Value Type
from 3 to 14	112	0-15	Multi-channel 1	CONFIGURATION	Danger - Low	see equation (5.1)	Float32
	113	16-31					
	114	0-15	Multi-channel 2				
	115	16-31					
	116	0-15	Multi-channel 3				
	117	16-31					
	118	0-15	Multi-channel 4				
	119	16-31					
	120	0-15	Channel 1		Danger + High		
	121	16-31					
	122	0-15	Channel 2				
	123	16-31					
	124	0-15	Channel 3				
	125	16-31					
	126	0-15	Channel 4				
	127	16-31					
	128	0-15	Channel 5				
	129	16-31					
	130	0-15	Channel 6				
	131	16-31					
	132	0-15	Channel 7				
	133	16-31					
	134	0-15	Channel 8				
	135	16-31					
	136	0-15	Multi-channel 1				
	137	16-31					
	138	0-15	Multi-channel 2				
	139	16-31					
	140	0-15	Multi-channel 3				
	141	16-31					
	142	0-15	Multi-channel 4				
	143	16-31					

Table 5-6 : AMC register definitions (Part 14 of 15)

Rack Slot No. (Snum)	Address Offset (Aoff)	Bit(s)	Channel	Internal Value Type	Value Description	MODBUS Starting Address (MSA)	Value Type
from 3 to 14	144	0-15	Channel 1	CONFIGURATION	Output Unit	see equation (5.1)	U16
	145	0-15	Channel 2				
	146	0-15	Channel 3				
	147	0-15	Channel 4				
	148	0-15	Channel 5				
	149	0-15	Channel 6				
	150	0-15	Channel 7				
	151	0-15	Channel 8				
	152	0-15	Multi-channel 1				
	153	0-15	Multi-channel 2				
	154	0-15	Multi-channel 3				
	155	0-15	Multi-channel 4				

Table 5-6 : AMC register definitions (Part 15 of 15)

6 CUSTOMER SUPPORT

6.1 Contacting us

Vibro-Meter's worldwide customer support network offers a range of support including 6.2- Technical support and 6.3- Sales and repairs support. For customer support, please contact your local Vibro-Meter representative. Alternatively, contact our main office:

Customer support
Vibro-Meter SA
Route de Moncor 4
PO Box 1616
CH-1701 Fribourg
Switzerland

Tel.: +41 (0)26 407 11 11
e-mail: energysupport@ch.meggitt.com
web: www.vibro-meter.com

6.2 Technical support

Vibro-meter's technical support team provide both pre-sales and post-sales technical support, including:

1- General advice

2- Technical advice

3- Troubleshooting

4- Site visits

NOTE : For further information, please contact Vibro-Meter (see 6.1- Contacting us).

6.3 Sales and repairs support

Vibro-Meter's sales team provide both pre-sales and post-sales support, including advice on:

1- New products

2- Spare parts

3- Repairs

NOTE : If a product has to be returned to Vibro-Meter for repairs, then it should be accompanied by a completed Failure report form on page 6-3.

6.4 Customer feedback

As part of our continuing commitment to improving customer service, we warmly welcome your opinions. To provide feedback, please complete the Customer feedback form on page 6-5 and return it Vibro-Meter's main office (see 6.1- Contacting us).

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FAILURE REPORT FORM

If the product has to be returned to Vibro-Meter for repairs, then:

1- Complete this failure report form

2- Attach a photocopy of this report to the faulty unit and retain the original copy for your records

3- Send the product together with the attached failure report form to Vibro-Meter by registered post

NOTE : Please provide as much information as possible in order to assist fault diagnosis.

NOTE : A failure report MUST be sent with each faulty product.

Contact details:

Name _____ Job title _____

Company _____ Email _____

Address _____

Country _____ Post code _____

Telephone _____ Fax _____

Signature _____ Date _____

Product details:

Product type: _____

Serial number (S/N): _____ Part number (P/N): _____

Vibro-Meter order number: _____

Date of purchase: _____ Site where installed: _____

Is the failure (put an ☒ where appropriate):

☐ Continuous ? ☐ Intermittent ? ☐ Temperature dependent?

Description of failure:

_____

_____

_____

_____

_____

(Please continue overleaf)

(Continued)

(Please continue on a separate sheet if necessary)

CUSTOMER FEEDBACK FORM

Title of manual:

VM600 Networking Instruction Manual

Reference: MAVM600-NET/E **Version:** Edition 3 **Date of issue:** Mai 13/09

Customer contact details:

Name _____ Job Title _____

Company _____ *Email* _____

Address _____

Signature _____ *Date* _____

General feedback:

Please answer the following questions:

• Is the document well organized?	**Yes**	**No**
• Is the information technically accurate?	**Yes**	**No**
• Is more technical detail required?	**Yes**	**No**
• Are the instructions clear and complete?	**Yes**	**No**
• Are the descriptions easy to understand?	**Yes**	**No**
• Are the examples and diagrams/photos helpful?	**Yes**	**No**
• Are there enough examples and diagrams/photos?	**Yes**	**No**
• Is the style/wording easy to read?	**Yes**	**No**
• Is any information not included? (please list in “comments” below)	**Yes**	**No**

Additional feedback:

(Please continue overleaf)

(Continued)

(Please continue on a separate sheet if necessary)