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About IHM VoIP

Description of IHM VoIP enabled products and protocols used.



Index:

1 Produ	ets	3
1.1 CO	DM53	3
1.2 H	M817/x	4
1.3 TI	E10-40/3	4
2 TCP/I	P Principe	5
2.1 Ke	ep alive	5
2.2 Co	ontrol of inputs and outputs	5
	pice data	
3 Buildi	ng up a network	6
3.1 IP	-addressing	6
3.1.1	IP-address	
3.1.2	Network mask	6
3.1.3	Default gateway	
3.1.4	MAC address	
	rk configuration	
4.1 Co	onfiguring IP-addresses	
4.1.1	Dynamic allocation (DHCP)	
4.1.2	Fixed IP from DHCP	
4.1.3	Static IP	
	AN	
4.2.1	Simple LAN no other users	
4.2.2	Internal LAN without divided IP-space	
4.2.3	Internal LAN using divided IP-space	
4.2.4	Internal LAN with option for VLAN	
	AN	
4.3.1	Internet direct connected	
4.3.2	Internet via routers	
4.3.3	Internet with MPLS	
4.3.4	Internet using VPN	
4.4 Co	ombination of more network types	14

Document name: I:\Com5x\Com53\Doc\About IHM VoIP.doc			Document project No.				
Author:	Date:	Modified by:	Approved by:	Version:	Page		
Morten Nissen	18-11-14 13:20			0	2 of 14		
Ingeniørfirma H. MORTENSEN P/S							



1 Products

IHM VoIP enabled equipment consist of three products:

HM817/x, COM53 and TE10-40/3, all three types are connected to the IP network via a standard RJ-45 LAN connector with 10MB/s interface.

The equipments IP address is programmed via an RS232 interface and a special PC- Program. All other parameters can hereafter be programmed from a, to same network connected PC with a special PC-program. Using the same PC-program the equipments firmware can be updated or upgraded

The IHM IP enabled products are all IHM own developed hardware, software and protocols that do not collide with ordinary available VoIP protocols for telephony over the Internet. The products can support 'Quality of Service' according to Cisco standards.

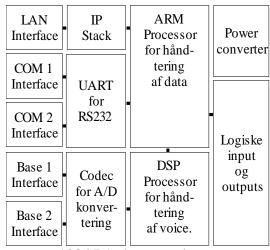
As the products is build around a processor where the software is made especially for this protocol it is not possible to pass illegal data through the products to other units on the network and in the same way it is not possible the get virus infected.

For service purposes the product besides the IHM protocol answers a standard ping command. Further IP standards are not supported.

1.1 **COM53**

COM53 is a stand-alone unit that can be used for both point-to-point voice connections and simultaneous RS232 data connection. A COM53 can carry two voice connections, and two RS232 connections.

COM53 is build on a single board holding interface to LAN, 2 x base station interfaces and 2 x RS232 com-ports.



A COM53 requires up to 128 kB/s data speed.

Document name: I:\Com5x\Com53\Doc\About IHM VoIP.doc			Document project No.				
Author:	Date:	Modified by:	Approved by:	Version:	Page		
Morten Nissen	18-11-14 13:20			0	3 of 14		
Ingeniørfirma H. MORTENSEN P/S							



1.2 HM817/x

HM817/x is a module for the Communications switches COM26xx and COM45xx.

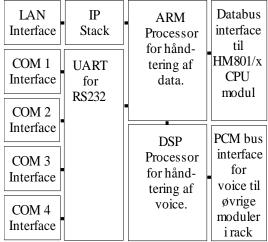
HM817/x is available in two versions:

HM817/1 for communication towards up to 4 x COM53

HM817/2 for communication towards up to 4 x TE10-40/3 or

For establishing up to 8 voice channels between to COM45xx shelves located on different sites.

The principle of communication is however the same for both types.



A HM817/1 requires a data speed of up to 128 kB/s per connected COM53, while HM817/2 requires 64 kB/s per configured voice channel.

1.3 TE10-40/3

Chapter to be included later.

Document name: I:\Com5x\Com53\Doc\About IHM VoIP.doc			Document project No.				
Author:	Date:	Modified by:	Approved by:	Version:	Page		
Morten Nissen	18-11-14 13:20			0	4 of 14		
Ingeniørfirma H. MORTENSEN PIS							



2 TCP/IP Principe

All IHM IP enabled products operates either as a *Master* or as a *Slave* unit. COM53 and HM817/2 can both be configured to both functions, whereas TE10-40/3 is always a slave and HM817/1 is always a master.

Establishment of the IP-connection between 2 products always starts when the *Master* module sends a UDP broadcast request to a specific IP-address and a specific programmable IP-port simply to locate the slave module. The *Slave* module answers the IP-address who called (*Master*), and then the *Master* module sets-up a UDP data stream between these to modules.

This means that Slave modules is only programmed with own IP address and Port, whereas the Master is programmed with own IP-address, Net-mask and default gateway as well as IP-addresses and IP-ports for all associated Slave modules.

2.1 Keep alive

Every 2 seconds a UDP data package is send from master to slave, which the slave answers simply to verify the connection between the two modules. Included in the same package is also an update of status for in- and output ports. If this package and acknowledge is not received this package is retried in up to 8 seconds before the connection is considered faulty.

2.2 Control of inputs and outputs

In the second an input state changes a UDP package is send to the opponent, whom acknowledge the transmission.

If this acknowledge is not received this package is retried in up to 8 seconds before the connection is considered faulty.

2.3 Voice data

When voice is to be transmitted this happens via the DSP processor which collects voice data in 20 msec, forward this package to the ARM processor who packs these data into a UDP package and transmits this package to the opponent unit.

The opponent unit unpacks the UDP package sends it to the DSP processor which unpacks the data to 20 msec of voice which then is presented at the audio port.

If a package is corrupted it is lost as there is no retransmission included in the UDP protocol.

Document name: I:\Com5x\Com53\Doc\About IHM VoIP.doc D			Document project No.					
Author:	Date:	Modified by:	Approved by:	Version:	Page			
Morten Nissen	18-11-14 13:20			0	5 of 14			
Ingeniørfirma H. MORTENSEN PIS								



3 Building up a network

When building up a network many factors influence on the final layout.

Some of the factors are: security against other users to get access, security for transfer of data, simplicity in the addressing and possibility for easy service access.

3.1 IP-addressing

Speaking of IP-addressing we find two structures for this.

Each and every unit in a network holds a unique IP-address while for every IP-address we see a number of Sub-addresses, also known as IP-ports.

Each IP-address can have up to 65536 ports defined. A number of these ports are reserved for special purposes for example is port 80 always for http which is for displaying Internet pages.

3.1.1 IP-address

When configuring an IP-Address for a given unit, this always is done in an address consisting of four blocks. Each of these blocks can hold values from 0-254.

Standards for which addresses should be used for internal networks and external networks are available, ask you network administrator.

A typical internal network address: 192.xxx.xxx.xxx.

3.1.2 Network mask

In order for a network unit to be able to find other units on the network we code the network structure, the so called network mask. This parameter is in the same way as the address defined in four blocks from 0-255.

This is a bit parameter that points out which bit are variables within the local network.

Typically used masks: 255.255.255.0 or 255.255.0.0

Say if the IP-address is 192.168.1.20 and the mask is 255.255.255.0, then the local network can hold IP-addresses in the range 192.168.1.0 to 192.168.1.154.

If the mask is set to 255.255.0.0 then the local network could hold addresses in the range 192.168.0.0 to 192.168.254.254.

3.1.3 **Default gateway**

The Default Gateway is the address of the unit in the network whom provides access to other networks.

This means that if we try to call an IP-address, which we from the mask can see does not belong to the local network this will be called via the Default Gateway. Meaning all signalling to external unit is routed via the Gateway.

The Gateway can then be configured with several form of blocking and translations of addresses. E.g. if an external unit calls a specific IP-port, this will be "translated" to a specific internal IP-address and perhaps another IP-port. This function is known as NAT.

3.1.4 MAC address

Besides the programmable IP-address, the unit holds a unique hardware coded address. These addresses are provided by an international organisation to network component manufactures upon request. This MAC-address is an identity used by switches to control the IP traffic.

Document name: I:\Com5x\Com53\Doc\About IHM VoIP.doc			Document project No.				
Author:	Date:	Modified by:	Approved by:	Version:	Page		
Morten Nissen	18-11-14 13:20			0	6 of 14		
Ingeniørfirma H. MORTENSEN P/S							



4 Network configuration

In the following chapter we will go through different scenarios on how to configure a network. In all scenarios we use configuration of one HM817/1 having connection to four COM53's, as this is the most complex to setup. Other configurations are similar however less complex.

4.1 Configuring IP-addresses

Speaking of network we find three principles for allocation:

4.1.1 Dynamic allocation (DHCP)

In a dynamic allocated network a unit upon activation sends a request to the network for an IP-address. This request is handled by a DHCP server, who acknowledge to the units MAC-address with the allocated IP-address. The IP-address may vary for each time we start-up the unit, simply as the DHCP server registers what addresses are used at the time and from this allocates next available address to next unit requesting an address. Included in the answer from the DHCP server typically also provided is information regarding network mask and default gateway.

4.1.2 Fixed IP from DHCP

In a network using DHCP allocated IP-addresses the unit upon start-up sends a request on the network for an IP-address. This request is handled by a DHCP server, who acknowledge to the units MAC-address with the allocated IP-address. In the DHCP-server a definition of the fixed IP-address to the MAC-addresses are found, meaning that a particular unit always is allocated the same IP-address. Included in the answer from the DHCP server typically also provided is information regarding network mask and default gateway.

4.1.3 Static IP

Using static IP-addressing each and every unit is programmed with a static IP-address, network mask and default gateway. In this kind of network there is no requirement for a DHCP server and we have the possibility to use addresses outside the range standard set for the network.

Please note: IHM IP enabled products solely supports Static IP-addressing.

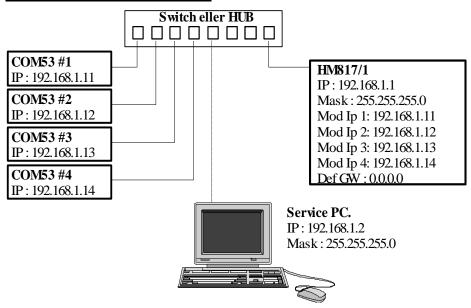
Document name: I:\Com5x\Com53\Doc\About IHM VoIP.doc			Document project No.				
Author:	Date:	Modified by:	Approved by:	Version:		Page	
Morten Nissen	18-11-14 13:20			0		7 of 14	
Ingeniørfirma H. MORTENSEN PIS							



4.2 LAN

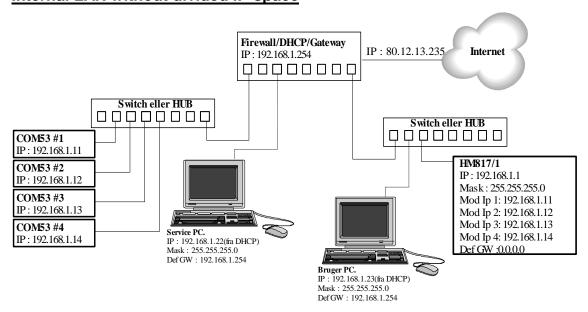
The examples in this chapter are only used in internal networks. It dos not matter if the network is spread over several sites connected via links or fibre optics or kept within one site. The most important is the structure of IP-addressing.

4.2.1 Simple LAN no other users



In the above configuration the network is only used for communication between HM817/1 and COM53. All units have a fixed IP-address and there is no need for further equipment. Using this configuration there are no access from external networks. It however is required that the Service PC is (re-)configured to an IP-address within the range, every time it is connected to the network.

4.2.2 Internal LAN without divided IP-space

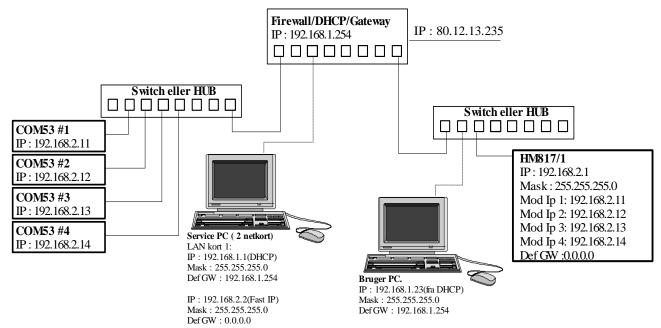


Document name: I:\Com5x\Com53\Doc\About IHM VoIP.doc D			Document project No).			
Author:	Date:	Modified by:	Approved by:	Version:	Page		
Morten Nissen	18-11-14 13:20			0	8 of 14		
Ingeniørfirma H. MORTENSEN PIS							



In the above configuration we use an internal LAN for communication between HM817/1 and COM53. All IHM units have a fixed IP-address. In this configuration can all connected PC's in principle connect to the IHM units (e.g. acting as Service PC). Depending on how the firewall is programmed it is possible to get access to the internet from all PC's.

4.2.3 Internal LAN using divided IP-space

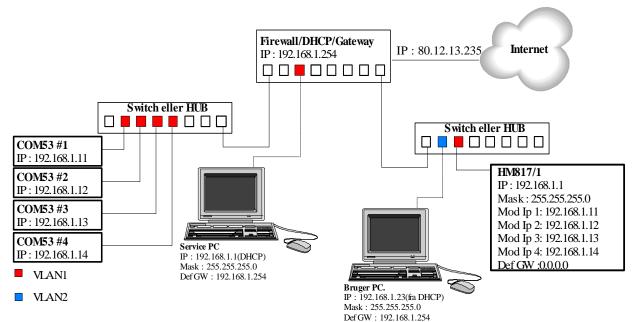


In the above configuration we use an internal LAN for communication between HM817/1 and COM53. All IHM units have a fixed IP-address that dos not collide with other used addresses. It is therefore impossible to get access to the IHM units from other PC's than the Service PC. The Service PC is either configured with two network ports or re-configured each time required for service purposes. Depending on how the firewall is programmed it is possible to get access to the internet from all PC's.

Document name:	Document name: I:\Com5x\Com53\Doc\About IHM VoIP.doc			Document project No.			
Author:	Date:	Modified by:	Approved by:	Version:	Page		
Morten Nissen	18-11-14 13:20			0	9 of 14		
Ingeniørfirma H. MORTENSEN P/S							



4.2.4 Internal LAN with option for VLAN



In the above configuration we use an internal LAN for communication between HM817/1 and COM53. All IHM units have a fixed IP-address, at the same time the ports in the switch where the units are connected defined as private network VLAN (Virtual LAN). In this scenario all data communication coming on of these ports is only routed to other ports within the same VLAN.

Using this configuration all IHM related communication is limited to these specific ports and we can not connect to the IHM units from other ports.

Document name: I:\Com5x\Com53\Doc\About IHM VoIP.doc			Document project N	0.			
Author:	Date:	Modified by:	Approved by:	Version:	Page		
Morten Nissen	18-11-14 13:20			0	10 of 14		
Ingeniørfirma H. MORTENSEN P/S							

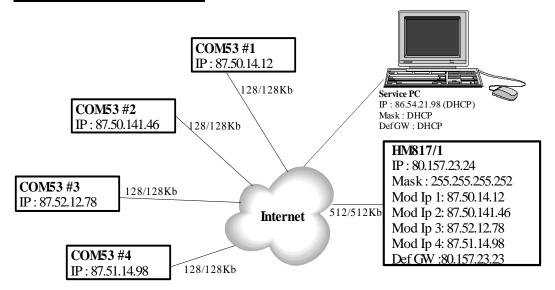


4.3 WAN

The examples in this chapter show scenarios using networks over several sites, where connection between the sites is provided via the internet.

Generally for these examples is that there is not used same address space for IP-addresses in both ends of the connection.

4.3.1 Internet direct connected



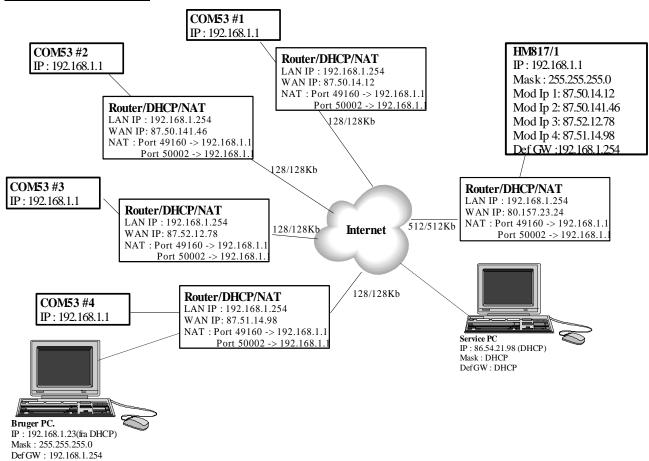
The above configuration is the most simple and dos not need any special configuration. However please note that the Internet connections must be of the type using **static IP**. This is something you have to define upon ordering the connection. There is connection from any PC on the internet holding the appropriate service software.

In the above configuration we cannot have more units attached to the same internet connection.

Document name: I:\Com5x\Com53\Doc\About IHM VoIP.doc D			Document project No.				
Author:	Date:	Modified by:	Approved by:	Version:		Page	
Morten Nissen	18-11-14 13:20			0		11 of 14	
Ingeniørfirma H. MORTENSEN PIS							



4.3.2 Internet via routers



In the above solution a router is fitted between the IHM unit and the internet. The IHM module is connected to the LAN side of the router and the WAN side of the router is connected to the internet.

In this scenario either fixed or static IP addressing can be used, as it is the router who takes care of the DHCP request from the ISP (Internet Service Provider). We are however still using fixed addressing for the IHM units.

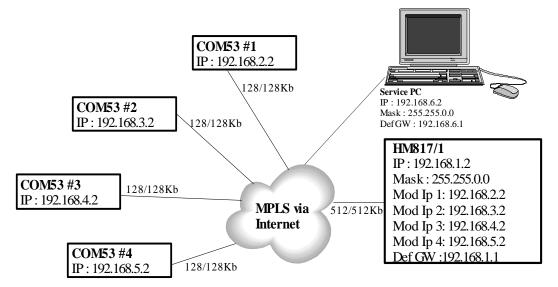
One of the main advantages using this configuration is that all COM53 units hold completely the same programming, providing easier access in case of service. Another advantage is that the routers can be programmed so that communication is only allowed between two specific IP-ports minimising the risk of external attacks dramatically. In this configuration we still have the possibility to connect user PC's to the routers, we just have to remember a minimum of 128kB bandwidth for the COM53. Some routers have for this purpose the possibility to program QoS (Quality of Service), where you can reserve a certain amount of bandwidth for specific services.

In the above configuration it is possible to have more IHM units at the same site, we just have to remember to program more NAT-routings at the COM53 router and in the HM817/1 end to program different IP-ports to each and every unit having the same IP-address.

Document name: I:\Com5x\Com53\Doc\About IHM VoIP.doc			Document project l	No.			
Author:	Date:	Modified by:	Approved by:	Version:	Page		
Morten Nissen	18-11-14 13:20			0	12 of 14		
Ingeniørfirma H. MORTENSEN P/S							



4.3.3 Internet with MPLS



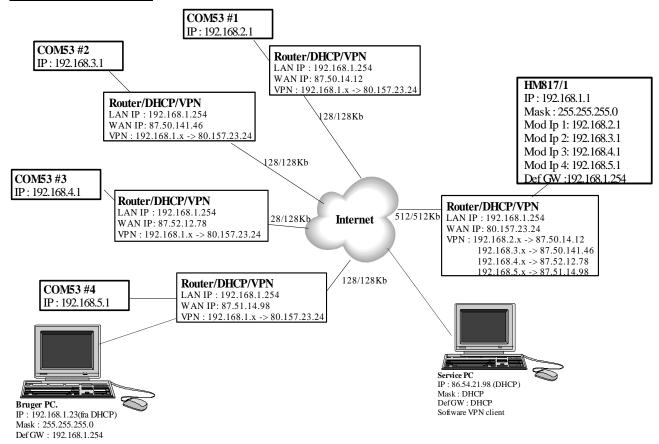
In the above configuration we buy a MPLS service from the ISP. In principle providing an internal network but using Internet connections. In this configuration we use internal IP-dressing as used for an internal network. The network is closed meaning that we cannot access the Internet and the units cannot be accessed from other addresses on the Internet. This also means that the Service PC must be connected on one of the MPLS connection point in the network. There are no external routers and therefore no special configuration needed. All this is taken care of by the ISP.

In this configuration it is possible to connect more IHM unit at the same site. We just have to remember to order more internal IP-addresses per site upon ordering the MPLS network.

Document name:	I:\Com5x\Com53\Doc\About IHM VoIP.doc			Document project No.					
Author:	Date:	Modified by:	Approved by:	Version:	Page				
Morten Nissen	18-11-14 13:20			0	13 of 14				
Ingeniørfirma H. MORTENSEN P/S									



4.3.4 Internet using VPN



In the above scenario we use a special type of routers where we have the possibility of using a technology called VPN (Virtual Private Network). In these routers definitions are made on where other "internal" IP-addresses are located.

When a unit calls on of the defined addresses the router automatically sets up a connection via the internet to the called router. The routers have an internal protocol for exchanging information on IP-addresses which needs to be connected. The connection between the two routers is encrypted.

In the above solution it is possible to have more IHM unit at the same site. We just have to program an IP-address range per site instead of a specific address.

4.4 Combination of more network types

When setting up a system with a combination of internet and internal network we recommend splitting the two networks by using two or more HM817/1 modules simply not to mix the two networks.

Document name:	I:\Com5x\Com53\Doc\About IHM VoIP.doc			Document project No.					
Author:	Date:	Modified by:	Approved by:	Version:	Page				
Morten Nissen	18-11-14 13:20			0	14 of 14				
Ingeniørfirma H. MORTENSEN PIS									