

Hy-Can III Data Over IP Technical Document

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The following table shows changes to this document over time. The most recent version is presented in the top row of the table.

History	Effective Date
Rev B. Page 13 added: Firewalls and Internet Security Page 20 added: Hy-Can-link Setup (Panels Recap) Pages 21-22 added: Testing Hy-Can-link Data over IP Without a Hy-Can Page 23 added: Testing a Hy-Can Data Over IP Connection Page 24 added: Starting a Hy-Can Data Over IP Connection Without SMS Page 25 added: A Terminal over IP	03-Nov-2014
Rev A. Not complete, for evaluation only.	29-Oct-2014

BACKGROUND

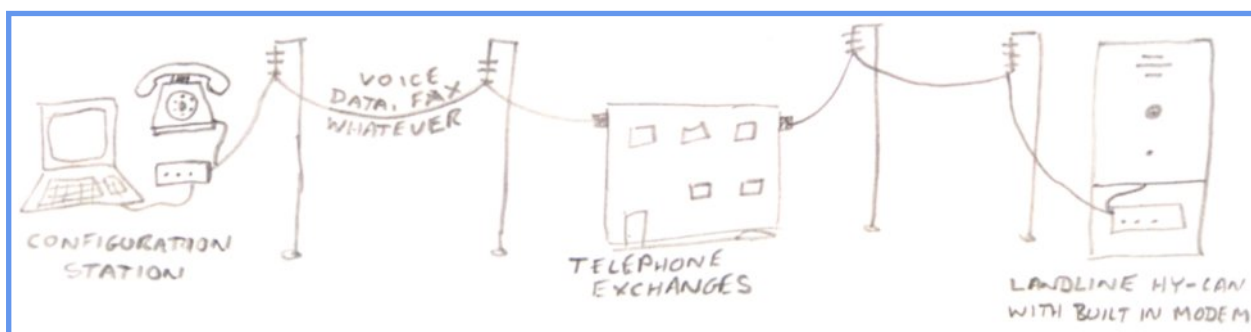
LANDLINE

The Hy-Can with a Landline Bridgeboard has an on-board modem which is used to transfer configuration data between the Hy-Can and a configuration station. This works in the following (simplified) manner:

The configuration station (such as a PC running a terminal emulator or Hy-Can-link) places a normal audio call to the Hy-Can. When the Hy-Can answers, the caller plays DTMF tones to the Hy-Can which correspond to a data command and login passcode. If the passcode is correct, the Hy-Can switches to its data modem and communicates with a corresponding modem at the configuration station end. Data is then exchanged.

Although it seems as if the Hy-Can and the configuration station have two telephone modes (audio and data), the telephone line behaves no differently for both cases. During an audio call, the telephone line conveys the sound of speech and in a data call, the telephone line carries squeaky tones which the modems at each end generate and use to convey the digital ones and zeroes to be exchanged.

So for Landlines, as long as there is good audio between the Hy-Can and the caller, either voice or data may travel along the telephone line with no interaction from the telephone network or its service provider.



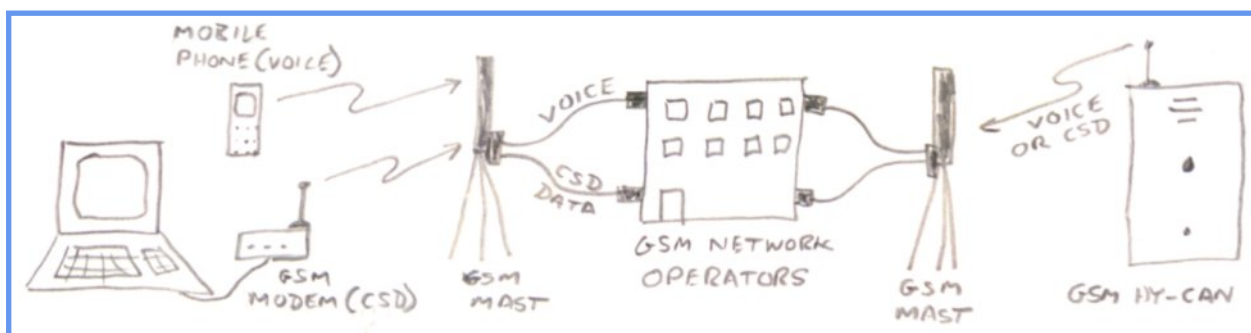
GSM

With GSM telephony, it is not possible to connect a modem at each end of a telephone call, because GSM speech is digitised and compressed at the sending end of a call, then uncompressed and converted back to audible sounds at the receiving end. During these conversions, some portions of the audio information are discarded, and some is lost in the compression. This doesn't stop people from understanding what is being said, but would cause the modem's squeaky tones to get all confused and the data they were trying to convey to each other to become corrupted or lost.

But the GSM network uses digital data throughout, and because people wanted to use their mobile phones for faxing and data transfer, the GSM network operators provided Circuit Switched Data (also known as Mobile Fax and Data).

Circuit Switched Data uses two suitably equipped GSM units or mobile phones, typically connected to PCs or laptops. One of them dials up the telephone number of the other as a data call. The GSM network operator recognises a data call as such, and treats it differently to a speech call. The digital ones and zeroes are transported by the network between each end of the call with no information discarded or lost. Squeaky tones are not required, since the ones and zeroes to be transferred are already digital and remain so as they traverse the GSM network.

This is the method used by the Hy-Can when equipped with a GSM Bridgeboard. It suits the Hy-Can quite well, since a Hy-Can spends most of its time making and receiving stand alone GSM audio calls. When it is required to remotely reconfigure a Hy-Can, the configuration station dials it up from a GSM 'modem', using the telephone number of the Hy-Can's installed SIM card. The Hy-Can gets its cue from the network that the incoming call is data, so there's no need for the DTMF tone login and the passcode is requested digitally from the caller. The calling station pays for the call, which is charged to the caller by the length of time for which the data call lasts.



INTERNET ENABLED PHONES

Unfortunately, dial-up data is not a good fit with internet browsing. To browse in this way from an internet enabled phone would first require that the phone dialled up an internet access point. Once connected, the browser could be set to display a web page. The caller would be charged all the while the data call is active, so the person browsing might want to decide if they were going to tap on a page link soon, or were going to take a while reading the current page and either disconnect or continue the data call accordingly. Once disconnected, it would be necessary to dial the access point again before tapping on a link to move to a different page.

The continuous call charge also reflects the exclusive use of GSM radio links for the caller in the same manner as a voice call reserves GSM resources exclusively for use during an audio call. This doesn't suit the GSM operators either, as it ties up resources during the natural pauses between data flow whilst reading web pages, which could otherwise be used to service more mobile phone users.

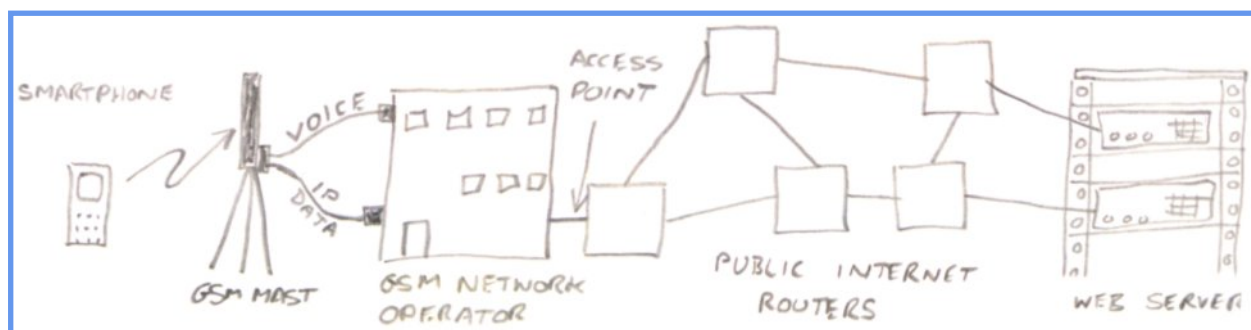
GENERAL PACKET RADIO SERVICE

To the rescue of phone internet users comes GPRS. This service is geared toward transferring data as IP (Internet Protocol) packets. It doesn't maintain a continuous use of GSM resources. Rather, it uses the spare capacity of GSM radio communications as and when data transfer is called for. This matches internet browsing more closely, where tapping on a page link causes a flurry of data transfer whilst the page is loaded, followed by inactivity whilst the user examines the newly downloaded web page.

Charges are made by volume of data transferred (by the megabyte), regardless of whether the phone remains 'attached' to the GPRS network or not.

This isn't quite so convenient for the Hy-Can, since the user ends up paying for the data transferred (although the amount of data for the average Hy-can is usually quite small). Also, there's no way of calling a remote Hy-Can by GPRS. It cannot be dialled up using a SIM card's phone number.

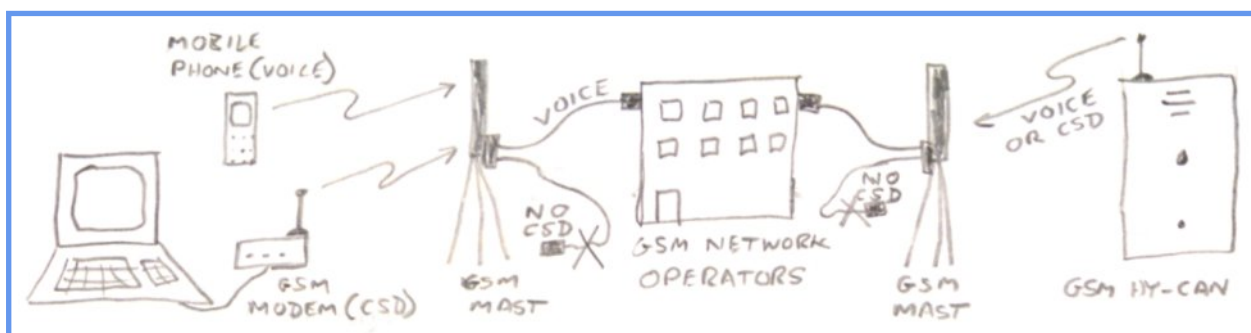
GPRS works using IP addressing over the public internet. So whilst a dial-up modem style link is not possible, the configuring station may exchange data with a Hy-Can over any internet connection for which its public IP address is known.



WHY USE DATA OVER IP

Unlike the pair of Landline modems which make squeaky noises instead of speech across a normal audio telephone line, a GSM Circuit Switched Data call requires the active participation of the GSM network provider (see 'Background' above for an explanation). If a GSM operator decides not to provide Circuit Switched Data, then a CSD call on that GSM network doesn't happen.

- One famous U.K. GSM network provider gave up on CSD calls around the year 2006 for its Pay As You Go services, then abandoned CSD for contract customers some while later.
- Some GSM virtual network providers aren't bothering with CSD at all.
- The ones that still provide CSD services often hint at not providing the service in future.
- The SIM5215 GSM module used on the latest Hy-Can's CU and CU2 PAL camera equipped Bridgeboards doesn't do CSD in a form which any of the U.K. GSM network providers want to carry.



CURRENT ALTERNATIVES

The Hy-Can does have alternative configuration methods:

- SMS messaging is ok for systems with only a few phone numbers to call, but gets unwieldy when multi Call Point or complicated configurations are required.
- Synthesised speech menu (or Metal Man as it is often called) suffers from the same limitations as SMS, is slower and cannot handle the text of names etc.

DATA OVER IP

Although the dial-up phase of Data over IP can never be the same as a Circuit Switched Data call, since there is no telephone call switching involved. Once the connection has been established, data flows between the configuration station and the Hy-Can. This data is carried across the public internet in 'packets' using the TCP/IP protocols and provides access to most of the Hy-Can's menu system.

HOW HY-CAN DATA OVER IP WORKS

HY-CAN GSM NETWORK CONFIGURATION

Each GSM network operator has different configurations for accessing the internet. These settings are usually sent by SMS the moment you switch on a mobile phone with a different SIM card installed.

With the Hy-Can, it is necessary to send the correct settings by SMS from Hy-Can-link. This only needs to be done once, or again if the Hy-Can has its SIM changed for an alternative GSM network operator. The required parameters are easily found by Google and Hy-Can-link comes pre-loaded with some popular GSM network operator configurations, with the ability to add more or modify current settings.

Some GSM network operators use different configurations depending upon whether the SIM is a contract or pay as you go type.

GSM network operators use some or all of the following parameters in order to access "Internet Data" as it is often called:

Protocols:	These must be TCP and IP for the Hy-Can.
Access Point Name:	This is usually something like "pp.vodafone.co.uk", a bit like a web address and is usually specific to a particular GSM network operator.
Authentication Type:	This may be NONE, PAP or CHAP.
User Name:	Not used if authentication type is NONE. If used, it is a generic username used by everyone. It is not specific to a particular SIM or person's account with a GSM operator.
Password:	Not used if authentication type is NONE. If used, it is a generic password which is not a secret and is used by everyone. It is not specific to a particular SIM or person's account with a GSM operator.

Hy-Can-link has a button to click which sends an SMS with the chosen GSM operator configuration to the Hy-Can.

This sets the Hy-Can up in readiness to connect to the public internet, but no connection is actually made at this time. Unlike many networked items, the Hy-Can does not connect nor remain connected to the public internet when not communicating data with Hy-Can-link. This makes it less vulnerable to hacking than it might be if it were permanently connected and listening for a connection and login.

TCP/IP CLIENTS AND SERVERS

INTERNET PROTOCOL (IP)

The Hy-Can uses the Client/Server model to make a connection with Hy-Can-link. The Hy-Can is the TCP client, whilst Hy-Can-link becomes a TCP server. This closely matches the way a smart phone might access the internet. The phone's web browser is a client and the remote server has the web pages that the user wishes to view.

IP is responsible for routing data between two IP addresses. (IP addresses are those numbers separated by full stops such as 203.0.113.1). IP addressing enables a client on one side of the world to contact a server on the other and exchange data with it. Everything connected to the public internet has an IP address that is unique to it in the whole world at that moment in time.

To start a Data over IP connection with a Hy-Can, it is necessary to know the public IP address at which the server in Hy-Can-link can be reached. This IP address is then sent by Hy-Can-link via SMS to the Hy-Can along with a command that instructs the Hy-Can to connect to the public internet and contact the server it finds at that IP address.

After sending the SMS, Hy-Can-link fires up its built-in server and waits to be contacted by the Hy-Can. If the Hy-Can makes contact, a login ensues and from then on, the data link behaves mostly like a CSD connection, although behind the scenes the data is split up into small chunks called packets, sent across the internet then re-assembled at the receiving end. This makes operating Hy-Can-link appear a little more choppy than with a CSD connection.

If nothing makes contact, Hy-Can-link times out and goes back to idle (or goes back to idle if the "Logout and Disconnect" button is clicked). When idling, Hy-Can-link's server is shut down and is not available to respond to malicious requests as perhaps a permanently enabled web server might be.

TRANSMISSION CONTROL PROTOCOL (TCP)

TCP is responsible for splitting the data to be sent into packets, then getting IP to deliver them to their destination. At the receiving end TCP reassembles the packets from IP, sorts out the re-sending of any lost packets and the correct ordering of those received, then passes that data on to the thing that requires it as though it were one stream of data. All this makes for reliable data transfer, but may well cause pauses and stutters in the data flow whilst TCP is ensuring that every byte makes it from sender to receiver across the public internet.

When Hy-Can-link sends an SMS to start a Data over IP connection, it includes a Port number for TCP to use.

Port numbers allow TCP to split up data between different things when those things are all at the same IP address. A common example of this might be a web server and an email server both on the same IP. A web browser (client) requesting a web page would do so with TCP port 80. TCP port 80 is a "Well known port" used for web pages, so TCP at the server end would ensure that it was the web server that received the browser's request.

At the same time, an email client might be sending an email using an email server located at the same IP address. In that case, the email client would use well known TCP port number 25. TCP would then ensure that the data arriving on port 25 was moved on to the email server for it to process.

In theory, it shouldn't matter what port number is used for Data over IP, since the Hy-Can and Hy-Can-link are having a private conversation with each other. As long as they both use the same port, TCP will ensure the data reaches the right thing at each end of the link.

In practice, there might be advantages and disadvantages to using certain port numbers. From the Hy-Can's point of view, using port 80 might be a good choice (and has worked well in some tests). Since the GSM network operators consider the Hy-Can to be a mobile phone and would like that phone to browse the internet successfully, they would be unlikely to block communications over port 80. Conversely, the Internet Service Provider connecting Hy-Can-link's server to the public internet on port 80 might decide that they don't want someone running their own web server. They would rather be paid extra for the use of their own great big web servers.

Both the Hy-Can and Hy-Can-link ends of a Data over IP link rely on service providers who could interfere with communications on certain TCP ports. Some experimentation may be required to find TCP ports amenable to the service providers at both ends of a Hy-Can Data over IP link.

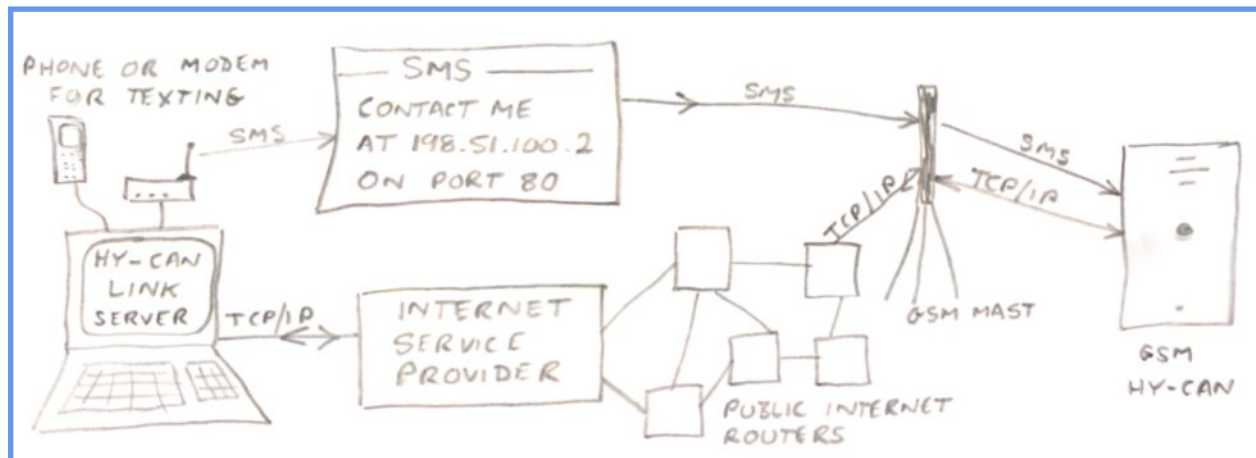
HY-CAN DATA OVER IP

The following diagram is a simplified overview.

It begins when Hy-Can-link sends an SMS containing the IP address, TCP port and an instruction to try and make a data connection by contacting a TCP server at the address and port in the SMS.

After the command SMS logs out, there is a default 15 second delay before the Hy-Can fires up its GPRS networking and attempts to make contact.

As soon as Hy-Can-link has sent the SMS, it starts its TCP server and listens for a Hy-Can to make contact. By default it waits 120 seconds and if a Hy-Can hasn't made contact by then, it shuts down the server.



LOCAL AREA NETWORK (LAN)

Unfortunately, things are never quite as simple as they first appear.

These days, it is unusual for an individual PC to have a public IP address. Most are connected to a LAN (either by cable or wirelessly).

A Local Area Network is a small, private collection of PCs and other network connectable things such as printers and tablets. The PCs on the LAN are not directly connected to the public internet. They usually access the public internet through one single device called a router.

Usually, a router has one public IP address and is the piece of equipment connected to the Internet Service Provider's line. Quite often, such a router is provided by the Internet Service Provider as part of the package of internet services.

Each PC connected to that LAN has a private IP address. These addresses are not available on the public internet. The PCs only use them to communicate with each other, printers and the router.

The router provides a "Gateway" between the PCs on the private LAN (with their private IP addresses) and the public internet. As well as having a public IP address for use on the internet, a router also has a private IP address for the PCs on the LAN to talk to. This is known as the gateway IP address.



NETWORK ADDRESS TRANSLATION (NAT)

If both PC 1 and PC 2 are both requesting pages from different web servers, it would be no good sending the private IP addresses as the return addresses to those web servers. The devices routing traffic around the public internet would have no idea where to send IP packets intended for private IP addresses. Across the world at any one time, there might be vast numbers of LANs in operation all using the same groups of private IP addresses.

So as the packets from each PC arrive at the router as they head out towards the public internet, the router translates the private IP addresses into the router's public IP address. At the same time, it makes a note of which PC is sending what, then sends the IP packets out on their merry way across the public internet.

As far as a remote web server is concerned, the request it receives appears to come from the router with its public IP address, so that's where the web server sends its web pages reply back to.

The public internet carries the packets back to the router's public IP address (which is unique in the world), so the router receives the web server's response.

Then, the router looks up the notes that it made when it sent the packets out, and from those is able to send the web server's response across the private LAN, back to the correct PC which wanted the web pages.

PORT FORWARDING

So with PCs on a LAN, when Hy-Can-link sends an SMS to tell a remote Hy-Can to make contact with Hy-Can-link's server at an IP address, it would be no good sending the Hy-Can the private IP of the PC running Hy-Can-link. If it did, the public internet wouldn't know where to send the IP packets from the Hy-Can, and they would never reach their intended destination.

Instead, Hy-Can-link needs to send the Hy-Can the public IP address which the router has. This enables the Hy-Can to reach out for a server with a proper IP address on the public internet. Packets of data sent by the Hy-Can will then arrive from across the public internet at the router's doorstep.

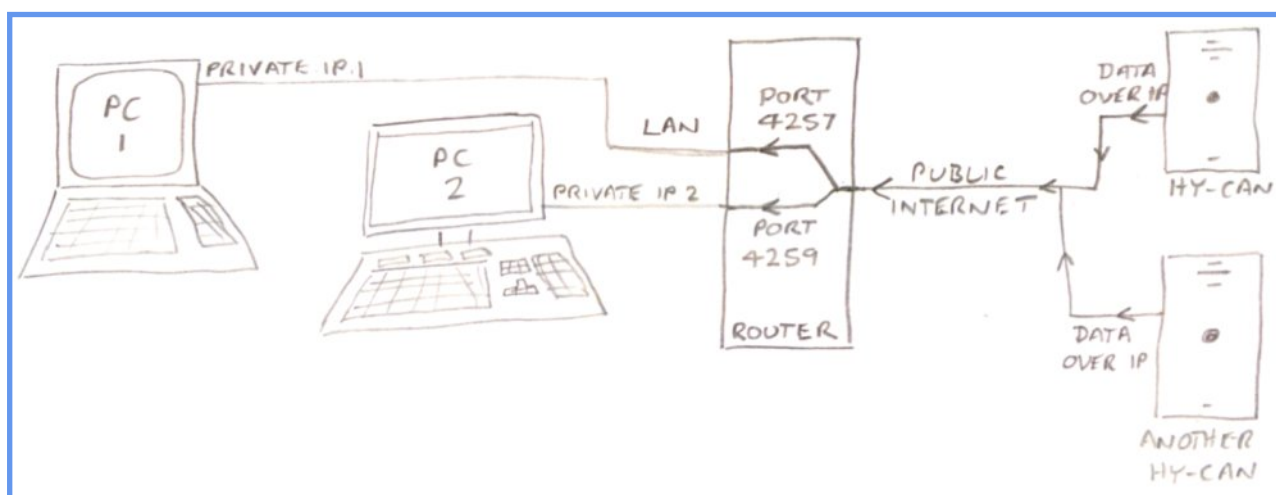
But what should the router do with such packets arriving out of the blue from a remote Hy-Can? The router won't have any references to look up like it would if a particular PC was browsing for web pages, so it won't automatically know what to do with the Hy-Can's packets.

Port forwarding is a configuration which needs to be set up in the router, so that it is pre-prepared and knows where to send a Hy-Can's incoming packets. In router-speak, this is often known as a 'rule'.

Examples of such rules might be:

RULE1: Whenever IP packets arrive with TCP port number 4257, forward those packets to the PC on the LAN which is at private IP address 192.168.0.1 and let that PC deal with them.

RULE2: Whenever IP packets arrive with TCP port number 4259, forward those packets to the PC on the LAN which is at private IP address 192.168.0.2 and let that PC deal with them.



This is where port forwarding comes in handy. Several configuration stations may exist on the same LAN. As long as the router has been told which port numbers should be sent where, and Hy-Can-link has been set up to use the port chosen for the particular PC it is running on, then each configuration station will receive the packets from the Hy-Can with which it wishes to communicate.

It is still necessary to set up one port forwarding rule, even if there is only one PC running Hy-Can-link. The router still needs to know what it should do with those incoming packets.

DYNAMIC HOST CONFIGURATION PROTOCOL (DHCP)

Unless the LAN to which the PCs are connected is run by a networking tech-head, who personally gives each PC a unique private IP address, keeps records of which PC has what address, makes absolutely sure no two PCs end up with the same IP address and configures each new PC accordingly, the LAN is probably using DHCP.

DHCP normally resides in the router. Whenever a PC boots up, it requests an IP address from the router and the router dishes out the next one it has available, whilst ensuring that no two PCs on the same LAN end up with the same IP addresses. This saves having a tech-head to set up and maintain the network, but does mean that each PC on the network gets whatever private IP address the router is thinking of at the time.

This means that each PC on the LAN might well end up with a different private IP address every day, depending upon which one booted up first etc. and if one has to reboot during the day, it might end up with a different IP address than it had before the reboot.

As it stands, this would ruin any Port Forwarding rules set up in the router to send information for certain ports to particular IP addresses. The same PC might not end up with the same IP address from one day to the next.

One easy way around this is to find an option in the router's DHCP settings which says something like "Always use this IP address for this computer". First, the PC(s) that is/are going to use Data over IP in Hy-Can-link must be booted up and connected normally to the LAN. Then, after identifying the IP address of each PC, selecting the "Always use this IP..." option in the router will cause DHCP to always give those PCs the same IP. Doing it this way means that DHCP still gets to ensure no other PCs on the LAN clash with identical IP addresses, and newly connected PCs still automatically get given an IP address.

FIREWALLS AND INTERNET SECURITY

The final hoop for incoming and outgoing Hy-Can data to jump through is a firewall (or internet security suite) installed on the PC running Hy-Can-link.

It is normal for security suites to be suspicious of software communicating over the internet, unless it's well known stuff like web browsers and email clients. Firewalls often come ready to accept the everyday software which uses the internet, but will most likely have to be told that a particular app such as Hy-Can-link (which has only a few users worldwide) is safe.

Firewall security on a PC usually associates particular apps with things those apps can and cannot do via the network. Those settings might be under a heading such as "Network" and "Firewall", then maybe "Program rules" or something similar. At the time of writing, there are over 50 different antivirus products available, which are often combined with firewalls and other security measures into "Security Suites" so it is impossible to describe an exact sequence of menu actions.

Under the firewall settings, try to find a list of apps, then look for "hyCANlink.exe". It might already be there with some rules generated automatically. It's probably worth editing the rules to make sure they are correct.

If "hyCANlink.exe" doesn't appear anywhere on the list, it'll need to be added to the list of rules. After selecting the option to add a new app, choose:

Program Files\Telguard\Hy-Can-link\hyCANlink.exe

Now set the rules for "hyCANlink.exe" as follows:

- Allow (not block) connections to/from in/out with other computers.
- TCP protocol.
- The port chosen for Hy-Can-link's TCP server (such as 80).

To avoid constant pestering of the PC user with pop-up messages, firewalls often stay quiet when they block an app from communicating across the network. The only indication that the firewall is getting in the way of Hy-Can-link's communications might be buried within the firewall's logs.

Firewalls have to make sure that those apps which it allows access to the network really are what they say they are. A common ploy by those playing foul on the internet is to nobble a piece of legitimate software by underhandedly adding some extra code to it.

So if Hy-Can-link is updated, a firewall might think that it has been surreptitiously changed, even though it is still called "hyCANlink.exe", and might start blocking its network connection until it is told that Hy-Can-link is an ok app again.

SETTING UP HY-CAN-LINK

COMMUNICATION METHODS

Hy-Can-link V1.0.1.51 or later is required for Data over IP communication. It has a new "Communication method" in the "Connect & Login" section.

Communication Methods | Login Details | Progress

Select communication method

☐ Avit lead direct to J1

☐ Dial up landline modem

☐ Dial up mobile modem

☒ TCP/IP data connection

Serial communications for J1

Port: COM4 | Baud: 9600 | Parity: None | Data: 8 | Stop: 2 | Timeout: 0

Serial communications for landline modem

Port: COM6 | Baud: 2400 | Parity: None | Data: 8 | Stop: 1 | Timeout: 300

Serial communications for mobile (GSM) modem

Port: COM3 | Baud: 9600 | Parity: None | Data: 8 | Stop: 1 | Timeout: 300

Settings for Hy-Can-link as a TCP/IP server (this end of the link)

Local server IP address: 192.168.000.014 | Find local IP... | Auto find local IP | TCP port: 80 | Timeout: 180

To search for the port used by a communications device, click a Find button. Alternatively, click the Device Manager button.

Device Manager...

LOCAL IP ADDRESS

When using Hy-Can-link on a PC connected to a LAN, set "Local server IP address" to the IP address of the PC's connection with the LAN. Clicking the "Find local IP..." button brings up a box which lists all the local IP addresses the PC has. Usually, there will be only one, but there might be more if the PC has both a wired and a WiFi connection. Double clicking an IP address in the list puts it into the Local server IP address box.

Settings for Hy-Can-link as a TCP/IP server (this end of the link)

Local server IP address: 192.168.000.014 | Find local IP... | Auto find local IP | TCP port: 80 | Timeout: 180

Whilst the "Auto find local IP" setting can be ticked, it only searches when Hy-Can-link is started up. While it performs the search, Hy-Can-link takes considerably longer to start, so this setting is best only used if the PC's local IP address changes a lot.

TCP PORT

This should be set to the port which this Hy-Can-link will use to receive Port Forwarded data from the LAN router. It is the TCP port on which Hy-Can-link's TCP server listens for a connection.

Settings for Hy-Can-link as a TCP/IP server (this end of the link)

Local server IP address: 192.168.000.014 | Find local IP... | Auto find local IP | TCP port: 80 | Timeout: 180

TIMEOUT

This is the timeout which occurs when a Hy-Can is connected to Hy-Can-link, but nobody is doing anything with it. Just like a CSD call, Data over IP blocks the Hy-Can from making and receiving telephone calls, so this timeout (in seconds) prevents a forgotten Hy-Can from being tied up for a long time.

Settings for Hy-Can-link as a TCP/IP server (this end of the link)

Local server IP address: 192.168.000.014 | Find local IP... | Auto find local IP | TCP port: 80 | Timeout: 180

COMMUNICATION METHODS (CONTINUED)

Also necessary for kicking off a Data over IP connection and the one time sending of the GSM Operator's network configuration is the "Dial up mobile modem" COM port. This needs to be set to a GSM device which can connect to a PC and send SMS messages when the PC commands it. If CSD is never to be used with Hy-Can-link on this PC, then many mobile phones have the ability to connect to a PC and send texts.

The screenshot shows the 'Communication Methods' configuration window. On the left is a sidebar with buttons: 'Connect & Login', 'Numbers', 'Relay Ops', 'Time Periods', 'T-Emulator', 'More Functions', and 'Engineering'. The main window has tabs for 'Communication Methods', 'Login Details', and 'Progress'. Under 'Communication Methods', there's a 'Select communication method' section with four radio buttons: 'Avit lead direct to J1', 'Dial up landline modem', 'Dial up mobile modem', and 'TCP/IP data connection'. The 'TCP/IP data connection' is selected. Below these are three sections for serial communications: 'Serial communications for J1' (Port: COM4, Baud: 9600, Parity: None, Data: 8, Stop: 2, Timeout: 0), 'Serial communications for landline modem' (Port: COM6, Baud: 2400, Parity: None, Data: 8, Stop: 1, Timeout: 300), and 'Serial communications for mobile (GSM) modem' (Port: COM3, Baud: 9600, Parity: None, Data: 8, Stop: 1, Timeout: 300). The 'Serial communications for mobile (GSM) modem' section is circled in red. At the bottom, there's a 'Settings for Hy-Can III as a TCP/IP server (this end of the link)' section with 'Local server IP address: 192.168.0.0014', a 'Find local IP...' button, an 'Auto find local IP' checkbox, 'TCP port: 80', and 'Timeout: 180'. A 'Device Manager...' button is at the bottom right. A note at the bottom states: 'To search for the port used by a communications device, click a Find button. Alternatively, click the Device Manager button to find a port manually.'

Only the Dial up mobile modem port and serial comms parameters are important. The timeout has no effect and "TCP/IP data connection" needs to be selected for Data over IP. By using the same COM port settings as for a GSM CSD modem, a configuration station already set up for GSM CSD can use that modem to send SMS messages without changes.

LOGIN DETAILS

When the "Communication method" is set to TCP/IP data connection, the "Login details" tab looks like:

SMS CONNECT AND LOGIN

The "SMS connect and login" panel contains the usual telephone number of the Hy-Can and its login. The telephone number is used for sending the GSM operator internet settings and the Data over IP kickoff commands by SMS. The login is needed for the SMS messages to operate the Hy-Can's menu as usual, and the login is also used when a Hy-Can makes contact with Hy-Can-link's server over TCP/IP.

LOGIN DETAILS (CONTINUED)

HY-CAN GSM OPERATOR INTERNET ACCESS SETTINGS

The Hy-Can needs the details of the GSM operator's internet access point. Clicking the "GSM network" drop down arrow reveals a list of operator settings. Choosing one automatically fills in the other details pertaining to that GSM operator. This does nothing other than to show them in Hy-Can-link. To get them out to a Hy-Can, ensure that the "Telephone number" and login are correct, then click "Send GSM network configuration using SMS" button. Hy-Can-link then sends the Hy-Can a text to set up the selected configuration. This only needs to be done once, or again if the Hy-Can SIM is changed for a different operator or where appropriate, if the network operator has different settings between contract and PAYG and this has been changed.

It is suggested that 3 minutes is allowed to pass between sending the one off operator settings SMS and any attempt to start a Data over IP link.

If the operator settings are not going to be sent to the Hy-Can by SMS, it makes absolutely no difference what network operator settings are on show to a Data over IP connection. If the Hy-Can is known to be correctly configured, it is not necessary to go hunting around for the correct network operator in the drop down list. It can simply be ignored.

Sometimes, when network operators merge, split or change their company names, the internet access settings change with them. Hy-Can-link allows the various settings fields to be edited. If the network operator name has not changed, clicking the green "+" button updates that operator's details. Alternatively, the "GSM network" name may be edited along with its details. Clicking the "+" adds the new network operator to the list under the new name.

Choosing a "GSM network" name from the drop down list, then clicking the red "X" deletes that name and its details from the list.

The "Timeout" parameter isn't part of the GSM network operator's parameters. It determines the time in seconds for which the Hy-Can will wait for a response when trying to join the network operator's GPRS service. This has nothing to do with how long the Hy-Can waits to try and connect with a server. Usually, if the Hy-Can tries to join the GPRS service with incorrect parameters, it is rejected straight away and never gets as far as waiting the timeout.

Hy-Can GSM operator internet access settings (remote end of the link)

GSM network:	Vodafone Internet (PAYG)	<input type="button" value="X"/>	<input type="button" value="+"/>
Protocol:	Access point name:		
IP	pp.vodafone.co.uk		
Authentication:	User name:	Password:	Timeout:
None			30
Activation:	<input type="button" value="Send GSM operator network configuration using SMS"/>		
"TCP"	0		

LOGIN DETAILS (CONTINUED)

TCP/IP SERVER WHICH THE HY-CAN SHOULD CONTACT

It is from this panel that the SMS is sent which kicks off a Data over IP connection with a remote Hy-Can.

PUBLIC IP ADDRESS OF HY-CAN-LINK

The first entry requires the public IP address of this Hy-Can-link. As explained earlier in the document, this is usually the public IP address of the router connecting the LAN to the public internet.

TCP/IP server which the Hy-Can should contact

Public IP address to which the Hy-Can should connect:	TCP port number which the Hy-Can should use:	Retries:	Retry interval:	Contact timeout:	Get public IP address
198.051.100.029	80	1	15	120	

Searching for "My IP address" in many search engines will lead to either a site or the search engine itself returning the current public IP address of the LAN router from which the search originated. At the time of writing, Google actually shows the IP in a box at the top of the search list.

As a shortcut, the "Get public IP address" button calls up a web browser to perform the Google search for "My IP". Type, or copy and paste the result into the "Public IP address to which the Hy-Can should connect" box.

TCP/IP server which the Hy-Can should contact

Public IP address to which the Hy-Can should connect:	TCP port number which the Hy-Can should use:	Retries:	Retry interval:	Contact timeout:	Get public IP address
198.051.100.029	80	1	15	120	

Unless you have paid for a fixed IP address, internet service providers usually have a block of IP addresses which they 'own'. They dish these out to their customers as and when those customers connect their LAN routers to their service. As long as the router stays connected, the IP address given to it by the internet service provider is unique in the whole world. It can remain the same for many days, but could change if:

- The router is powered off or restarted.
- The connection with the internet service provider is interrupted.
- The router is commanded to disconnect from the internet.
- The router does a firmware update.

...and probably some other situations. Normally, throughout the day, the router's public IP address doesn't change.

A good plan would be to check it before starting the first Data over IP connection of the day, and if every Data over IP connection is now failing but was working.

LOGIN DETAILS (CONTINUED)

TCP/IP PORT NUMBER WHICH THE HY-CAN SHOULD USE

This is the TCP port number which the LAN router has been set up to forward to the PC on which this Hy-Can-link is running. The remote Hy-Can will use this port to communicate with the router across the public internet when it makes a Data over IP link.

TCP/IP server which the Hy-Can should contact
Public IP address to which the Hy-Can should connect: 198.051.100.029
TCP port number which the Hy-Can should use: 80
Retries: 1
Retry interval: 15
Contact timeout: 120
Get public IP address

RETRIES

Having a 1 here is the command that actually causes the Hy-Can to hook up to the GPRS service when "Send connect and login SMS" (or the large main "Connect and login" button) is clicked. When the Hy-Can receives the SMS containing it, it begins the process of contacting the Hy-Can-link server.

It is recommended that this setting be kept at a one, unless for example, a Hy-Can is known to always fail on the first attempt but succeed on the second. In which case, setting this as 2 for that Hy-Can might help.

If there's something else wrong with the link, then jacking this number up won't help, and will likely cause the Hy-Can to become unresponsive to panel operations and subsequent SMS messages whilst it repeatedly tries and fails to make a connection.

TCP/IP server which the Hy-Can should contact
Public IP address to which the Hy-Can should connect: 198.051.100.029
TCP port number which the Hy-Can should use: 80
Retries: 1
Retry interval: 15
Contact timeout: 120
Get public IP address

RETRY INTERVAL

This is the number of seconds the Hy-Can waits between Data over IP connection attempts.

Even with retries set to 1, this setting is still important. It forms the delay between the Data over IP kickoff command being received by SMS and Hy-Can firing up its GPRS networking connection. Lowering this number is not recommended, since the Hy-Can needs time to settle down after the menu logout from the kickoff SMS and to return to idle. Starting up a GPRS connection whilst the menu is still logged in or when the Hy-Can is still shutting down menu operations will likely fail.

TCP/IP server which the Hy-Can should contact
Public IP address to which the Hy-Can should connect: 198.051.100.029
TCP port number which the Hy-Can should use: 80
Retries: 1
Retry interval: 15
Contact timeout: 120
Get public IP address

CONTACT TIMEOUT

This is the number of seconds both the Hy-Can and Hy-Can-link will wait whilst trying to make a Data over IP connection with each other.

Hy-Can-link counts down the remaining time its TCP server is prepared to wait in the information box at the top of the Hy-Can-link window. This time needs to allow for the following possible delays:

- The time it takes for the kickoff SMS to arrive at the Hy-Can and be processed.
- The Retry Interval time.
- The time it takes the Hy-Can to join the GPRS network.
- The time it takes for the public internet to route the Hy-Can's connection attempt.

So a large value like 120 seconds (2 minutes) gives a wide margin for this.

Although it might seem that the Hy-Can will also wait 120 seconds, this is rarely the case. Whilst trying to connect via Data over IP, the Hy-Can is in the "call answered but not yet logged in" state, as it would be for a CSD call. If the maximum call timer is set to the usual 60 seconds, then this will end a failed connection attempt first from the Hy-Can end.

HY-CAN-LINK SETUP (PANELS RECAP)

TCP/IP DATA CONNECTION

This panel sets up Hy-Can-link's built in TCP server and its LAN IP address and port for the PC. This is a one time setup which doesn't need changing again unless the local network configuration changes.

Settings for Hy-Can-link as a TCP/IP server (this end of the link)

☒ TCP/IP data connection

Local server IP address: ☐ Auto find local IP

TCP port: Timeout:

CONNECT AND LOGIN

This panel contains the usual telephone number and login required when dealing with any remote Hy-Can. It is different for each Hy-Can.

SMS connect and login

Telephone number:

Serial number: or Full passcode:

HY-CAN GSM OPERATOR INTERNET ACCESS SETTINGS

This panel sets up the remote Hy-Can, so that it can join the GPRS network service provided by its GSM operator. This gives the Hy-Can the ability to access the internet. It is a one time setup for each Hy-Can.

Hy-Can GSM operator internet access settings (remote end of the link)

GSM network: Protocol: Access point name:

Authentication: User name: Password: Timeout:

Activation:

TCP/IP SERVER WHICH THE HY-CAN SHOULD CONTACT

This panel tells a remote Hy-Can where across the whole wide internet it can reach Hy-Can-link. It is sent to a Hy-Can whenever "Connect and Login" is clicked. Stays the same for each Hy-Can, but needs changing whenever the public IP address of the LAN changes.

TCP/IP server which the Hy-Can should contact

Public IP address to which the Hy-Can should connect: TCP port number which the Hy-Can should use: Retries: Retry interval: Contact timeout:

TESTING HY-CAN-LINK DATA OVER IP WITHOUT A HY-CAN

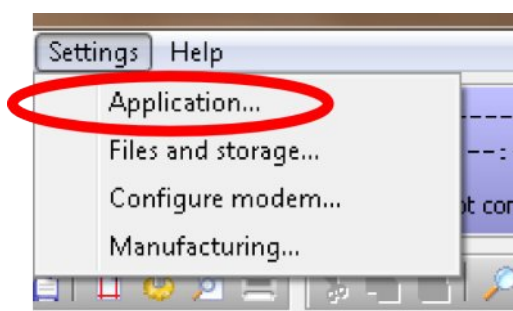
To assist testing the Hy-Can-link end of a connection without involving a Hy-Can, Hy-Can-link comes with a built-in simple web page server. This can temporarily take the place of the TCP server, so that someone remote from Hy-Can-link's LAN connection can see if they are able to communicate with it.

The tester needs an internet connection that is not using the same LAN to which Hy-Can-link is connected. The tester could be:

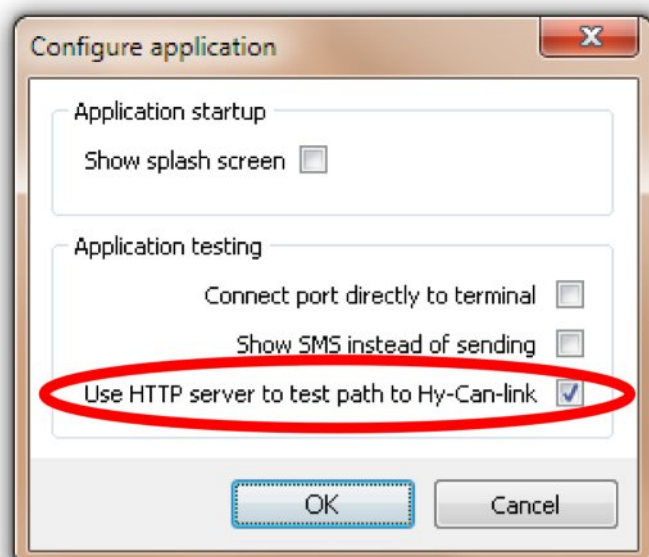
- Someone at a remote PC with web browser, has a remote internet connection and is in communication with the person testing Hy-Can-link.
- Someone close by with a web enabled smartphone which is not using the LAN via WiFi for its internet connection. The smartphone should use GPRS/3G for the test, with its WiFi temporarily disabled.

First, Hy-Can-link must be set up entirely as though it is going to connect to a Hy-Can.

Before clicking "Connect and Login", choose the "Settings/Application..." menu.



In the window that opens, tick the "Use HTTP server to test path to Hy-Can-link", then click "OK".



Unlike most other configurations of Hy-Can-link, this setting is not stored when Hy-Can-link is closed.

Now prime the remote tester to get their web browser ready and be prepared to type the details you give them into the address bar (not a search bar).

Next, click the "Connect and Login" button. Hy-Can-link should switch to the "Progress" panel and a message appears containing the address the remote tester should enter. Scroll down to find the message if necessary.

The remote tester should now type the following into their browser address bar (not the search bar):

`http://198.51.100.29:80`

then press Enter or click/tap Go etc.

HTTP test server: listening on port 80

Of course, the address and port will be those pertaining to the particular set up of the Hy-Can-link under test.

After the remote tester goes for the address (and a pause), the progress panel should show that a "client connected", that a "page was served" and that a "client disconnected". The remote tester should see a very simple web page announcing itself as Telguard Hy-Can-link test server.



If the remote tester sees the web page, it confirms that the following are correct:

- The "Settings for Hy-Can-link as a TCP/IP server" are good.
- Any firewall installed on the PC is allowing Hy-Can-link to communicate across the network.
- The public IP and port given to the tester were right.
- The LAN router's port forwarding is correctly configured.

TESTING A HY-CAN DATA OVER IP CONNECTION

Where access to the Hy-Can is available, J1 may be used to download the Hy-Can's logs to see what happened during a Data over IP connection. The following is an extract of a Hy-Can log from a successful Session:

This part is where the Hy-Can connects to the GSM operator's GPRS service access point. If this part fails, then the settings transferred by SMS from Hy-Can-link's "Hy-Can GSM operator internet access settings" should be checked.

```
Data over IP: begin network operations
Data over IP: network socket protocol: IP
Data over IP: network APN: pp.vodafone.co.uk
Data over IP: network auth: NONE
Data over IP: network opened
```

Other reasons for failure here might be that Internet Data is not enabled for the SIM card, or that the SIM is out of credit and is not being allowed to join the network.

The next section is where the Hy-Can has gained access to the network, but now is trying to reach the server in a Hy-Can-link across the public internet:

```
Data over IP: TCP client connect to addr: 198.51.100.29
Data over IP: TCP client connect to port: 80
Data over IP: TCP client protocol: 0
Data over IP: TCP client connected with server
```

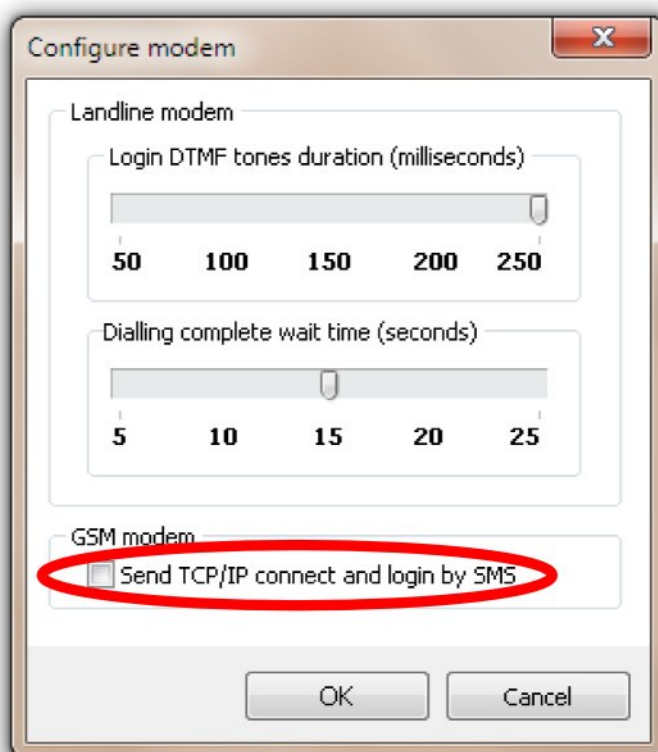
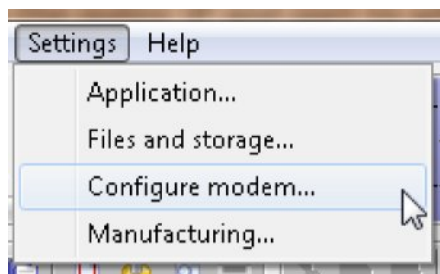
Note that depending upon the type of GSM Bridgeboard installed in the Hy-Can, the "Data over IP: TCP client protocol:" might be 0 or "TCP". Either is correct. It should be "TCP" for GSM modules SIM5215 and SIM800 and 0 for Telit modules.

Where it is "TCP", the double quotes are very important. If they are missing, it won't work.

STARTING A HY-CAN DATA OVER IP CONNECTION WITHOUT SMS

If the Hy-Can has previously been set up with the GSM Operator Internet Access Settings for its SIM card, then a Data over IP session can be kicked off by dialling up and logging into its "Metal Man" menu and entering the public IP and port to which it should connect, using the telephone keypad.

First, it is necessary to prevent Hy-Can-link from trying to send an SMS. To do this, go to the "Settings/Configure modem..." menu:



Un-tick the "Send TCP/IP connect and login by SMS", then click "OK".

VOICE CALL THE HY-CAN

Log in to the full menu, then choose:

4 star for the Telephony Menu

11 star to Manually start TCP/IP client

Metal Man will then prompt for each octet of the IP address, starting from the left. As usual, Metal Man says "Press star now to keep...". If the public IP address which the Hy-Can should contact is still the same as last time, then star can be used to retain each octet (or those octets which haven't changed).

Lastly, Metal Man asks for the port number, again with the option to keep whatever number is already in there.

To abandon kicking off a Data over IP attempt at this stage, use the hash key to clear an IP octet or the port number, then press star without entering a number. Metal Man then returns to the Telephony Menu.

After pressing star on a valid port number, Metal Man says "Exiting configuration. Goodbye" and ends the call.

Click "Connect and Login" in Hy-Can-link to wait for the Hy-Can to hook up to its TCP server.

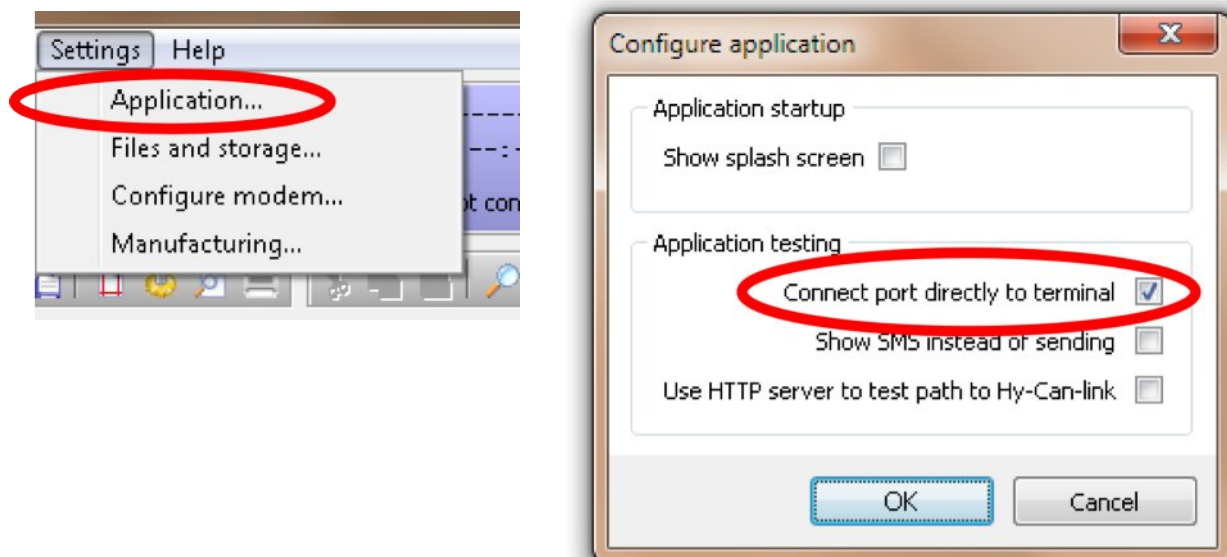
When bench-testing a Hy-Can Data over IP link, the terminal full menu may be used to enter the octets and kick off a Data over IP session without sending an SMS.

A TERMINAL OVER IP

When using a dial up CSD or direct connection to J1, it is not always necessary to use Hy-Can-link. A terminal emulator may be substituted instead. From a terminal, it is possible to issue the modem dialling commands manually, or simply type the login for a J1 connection.

Terminal emulator software doesn't normally include a TCP server (they do exist), but to provide a familiar terminal based link to a Hy-Can, the T-Emulator built in to Hy-Can-link may now be linked directly to the selected "Communication method".

Whilst Hy-Can-link is not connected to anything tick the "Connect port directly to terminal" in the "Settings/Application" menu.



Clicking "Connect and Login" when either "Avit lead direct to J1", "Dial up landline modem" or "Dial up mobile modem" is selected, results in a direct connection to the appropriate COM port.

The "T-Emulator" window may then be used to issue direct modem commands which may include dialling up and logging in to a Hy-Can.

When "TCP/IP data connection" is selected, Hy-Can-link performs the Data over IP kickoff procedure by sending the SMS and firing up the TCP server to listen for a connection.

If/when a Hy-Can connects, the "T-Emulator" behaves like a terminal connected to the Hy-Can via the TCP/IP link.

The remote Hy-Can begins as it would for a manual terminal session over CSD, by prompting for "Passcode:". It expects the "87xxxxxx" or "79xxxxxx" and probably will need a press of the Enter key to cause TCP/IP to send the data packet out to the Hy-Can.

Expect a stuttered response to typing. TCP/IP tries to put as many bytes as it can into each IP packet, and is quite reluctant to send a single character until it is quite sure nothing else is going to be typed at the keyboard.

Currently, it is not possible to transfer data files to/from the Hy-Can in direct T-Emulator mode.

A NOTE OF CAUTION

When using direct T-Emulator mode with the COM port based communication methods, clicking "Logout and disconnect" only disconnects the T-Emulator from the COM port. It does not tell the Hy-Can to exit its menu. Nor does it tell a landline or GSM modem to hang up. To avoid leaving a Hy-Can dangling on a forgotten line, always exit the menu or manually command a modem to hang up before clicking "Logout and disconnect".

Only a TCP/IP connection is ended by clicking "Logout and disconnect" when in direct T-Emulator mode, since a TCP/IP connection cannot continue if either end disconnects. It doesn't make sense for the T-Emulator to remain connected to a TCP server as there is no physical device and so there are no modem commands to be typed.