

Piper user Guide

Piper - the IP modem.



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Quick start - for the impatient.

- 1) Power up each unit and see the LEDs cycle through a startup pattern and finally stabilise after a few seconds. The status led (underneath) flashes about once per second to indicate that the unit is running.
- 2) Connect at least two units together by plugging them into a UTP hub, or with a 'back to back' cable.

At this point you have two choices. Piper units can be configured though serial port 2 where a menu system allows you to configure it, or in fact any Piper that is connected to the network. This is described in steps 3 to 7 below. An alternative way of configuring Pipers is to use two Windows utilities available for download at our web site. These are described in steps 8 onwards.

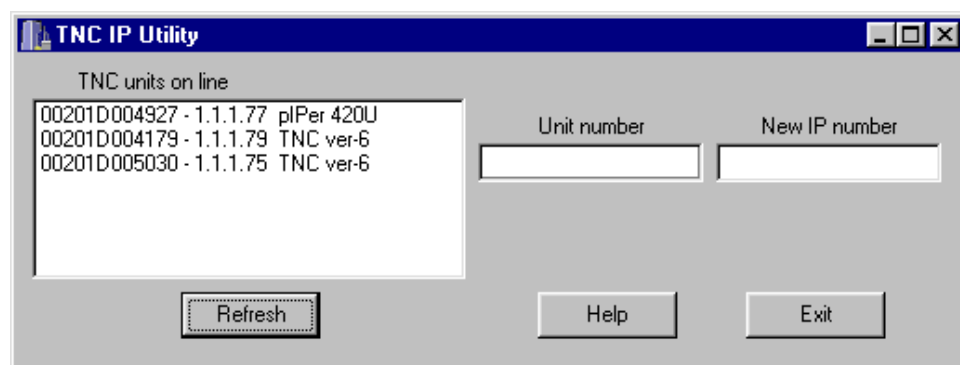
Configuration using the serial menu system.

- 3) Connect a terminal, set for 9600 baud, 8, N, 1 to Piper port 2 (CMD port - 9 pin D towards the bottom of the unit. The serial ports are configured as DCEs, so a straight through cable is needed.
 - 4) Type ++++ to enter the root menu.
 - 5) Use the menu selection 'Display units on line' and ensure you have an entry for each connected unit; one local unit and one or more remote units listed below it. Notice that the firmware version number is displayed for all the units. It is best if all units are the same version- the current version is on our web site at www.mutek.co.uk. Press SPACE or RETURN to return to the main menu.
 - 6) Enter the 'Configure Unit' menu and enter the IP number 1.1.1.55, and the password 'pass'. Enter new IP addresses as required- one for the unit, one for the default gateway, and the sub-net mask. Enter IP numbers as dotted quads e.g. 158.152.46.132. It is also useful to rename the unit otherwise you will have more than one unit with the same name, which is confusing! Save the changes.
- Connect to each unit and repeat steps 4, 5 and 6. Once you have given each unit its own name and IP number, you can configure it remotely.
- 7) Make a link between any two units using source and destination unit IP numbers. Save the link. Exit command mode by pressing Escape. Try passing data across the logical link you have made.

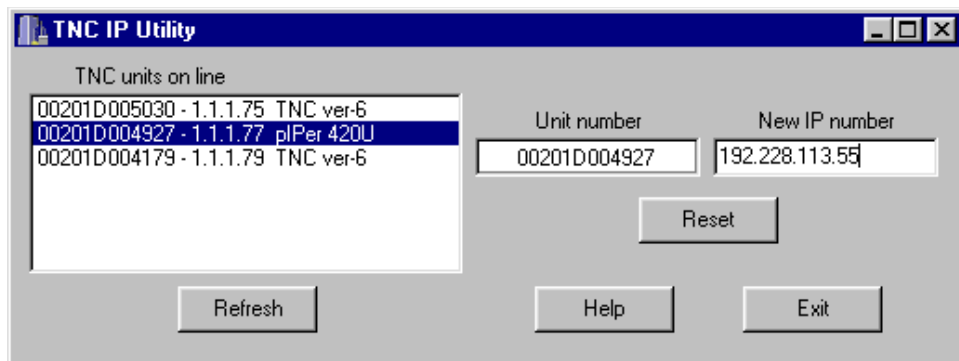
A good first try is to link port 2 on the local unit to port 2 on another unit. Make a wire link on the chosen remote unit's serial port 2- D9 pin 2 to 3 to loop the data back. You can then leave your PC/terminal connected to your local port 2, exit command mode (Esc), and type characters which should echo back onto your screen, having been looped back by the remote unit.

Configuration using the Windows utilities.

First use the 'TNC IP Utility available at www.mutek.co.uk/downloads.htm to discover all units that are connected to the same LAN segment as your workstation. All Piper (and TNC) units that are connected to the local segment will be displayed in the left hand window-

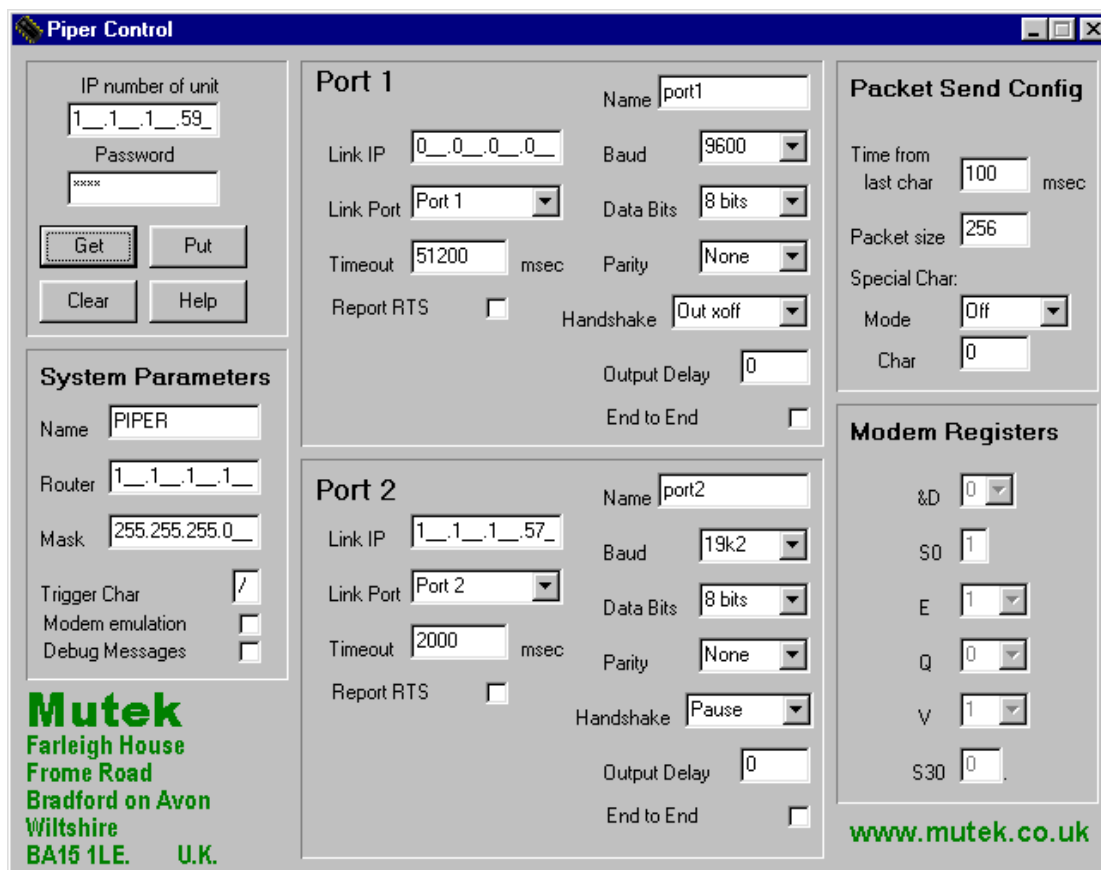


Select a unit and change its IP number by over-writing its existing number shown in the right hand box labelled 'New IP number' –



Press 'Reset' to save it to the unit. The Ip number you have chosen will be saved to the unit and all other settings are restored to the factory defaults settings

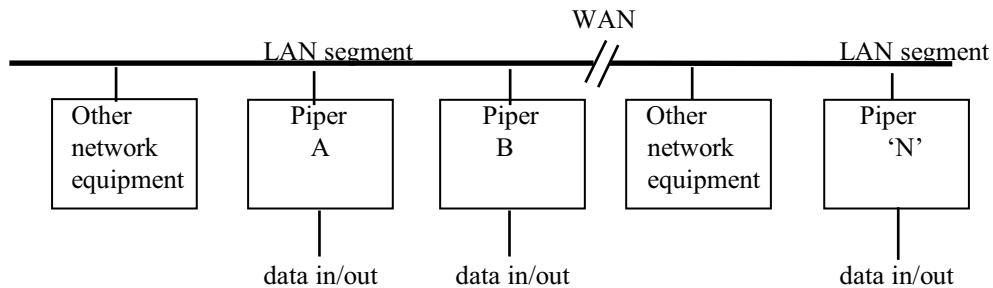
Now download the Piper control software and use it to manage any Piper on your network. Its use is described later in this guide and with its HELP button. A sample screenshot is shown.



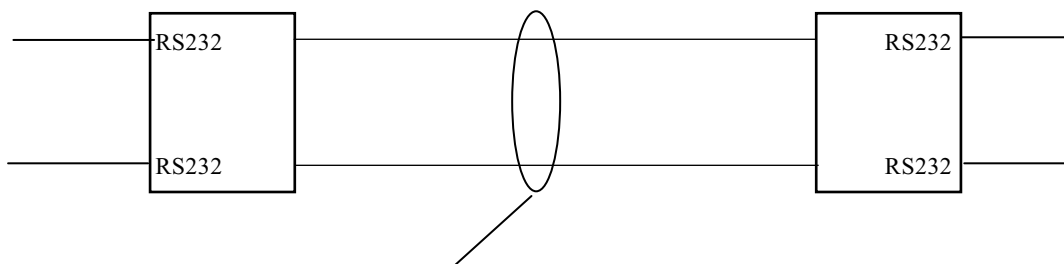
In case of problems, read the detailed sections that follow.

Introduction

Piper lets your serial data cross a standard Ethernet network, allowing it to be used for general data transport tasks without interfering with normal network operations. It is 802.3 compliant and uses protocols from the TCP/IP suite, making it fully routable.

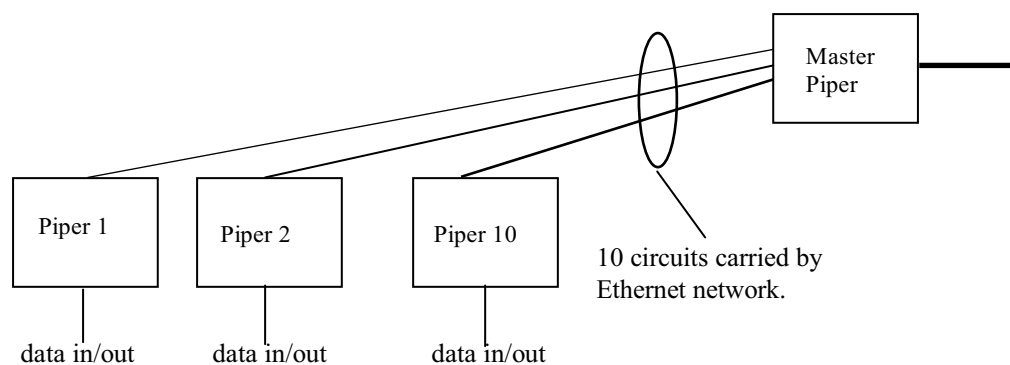


Each unit has two RS232C ports and a network port. You may connect as many units as you wish to the network and establish logical connections between units with complete flexibility. For example, imagine two units each connected to any two points of the network. The two ports can be set up as shown below so that they both carry data simultaneously-



2 logical circuits carried by Ethernet LAN.

Although the above example shows the two RS232C ports linked in a one-to-one fashion to another unit, Piper allows its ports to be individually linked to any port of any other unit. You can connect as many units as you wish to your network and set up connections between units with complete freedom. For example, set one unit to accept data from several other units-



These and many other configurations can be easily set up, monitored and changed at will from any unit on the network. The Piper menu system allows you to make and break links between units and examine and change the configuration of any unit on the network. Security is provided by an access password.

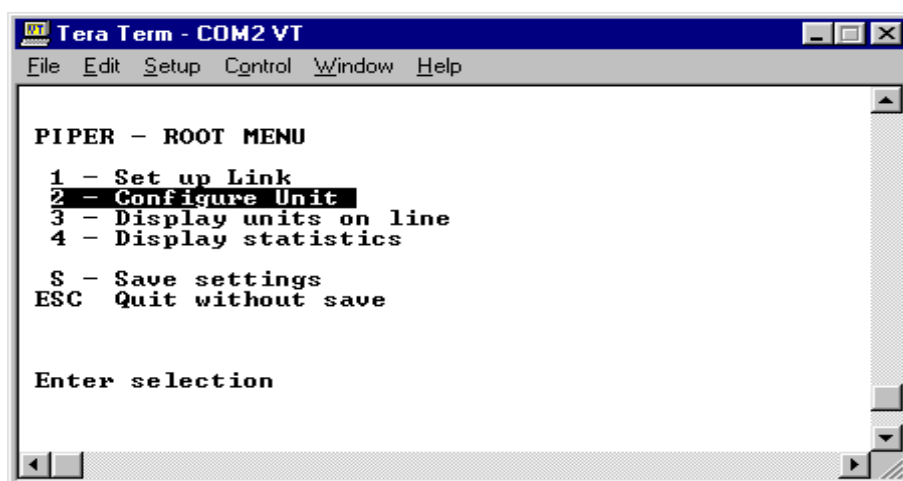
Piper provides error corrected, selfrepairing, logical links. Every network packet is error checked and sequence numbered to ensure all your data is delivered and is error free. Should the network or the power fail, Piper will *automatically* re-link when the problem is resolved.

Pre-connect configuration.

You must configure each unit before connection to a network, most importantly by assigning a unique IP number. Each unit has storage for user settings, and these settings are reloaded each time the unit is powered up.

Power up the unit and allow the initialisation sequence to run, until only the status led (underneath) remains flashing at about once per second. Piper is configured via serial port two, the lower of the two D9 connectors, which defaults to 9600 baud, 8,N,1. The serial ports are configured as DCE so a normal PC serial cable can be used without crossovers.

To enter the Command menu mode type +++ into port 2. The Piper root menu will appear-



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Tera Term - COM2 VT
File Edit Setup Control Window Help

PIPER - ROOT MENU

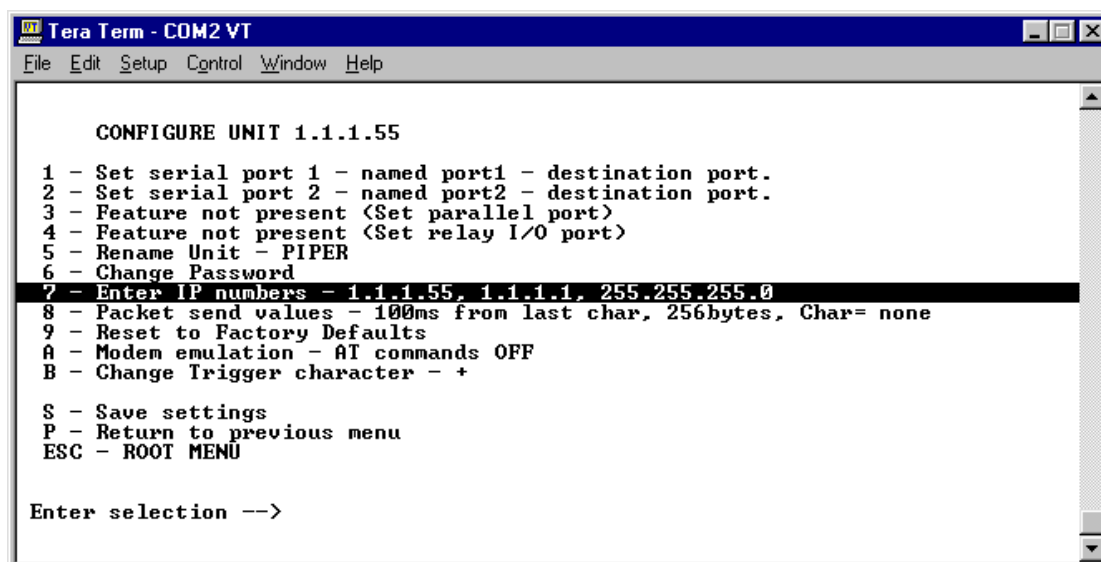
1 - Set up Link
2 - Configure Unit
3 - Display units on line
4 - Display statistics

S - Save settings
ESC Quit without save

Enter selection
```

Use main menu item 2 and at the prompt 'Enter IP number of unit to configure', enter the factory default 1.1.1.55, and then at the prompt 'Enter password for unit', enter the factory default 'pass' in upper or lower case. Characters are echoed as asterisks.

You will now see the Configure Unit menu as shown below. Each line is made up of a menu item number, a description of its action and in some cases the current values of the settings it affects. For example to rename the unit use menu 5, which is showing the current name 'Piper'.



```
Tera Term - COM2 VT
File Edit Setup Control Window Help

CONFIGURE UNIT 1.1.1.55

1 - Set serial port 1 - named port1 - destination port.
2 - Set serial port 2 - named port2 - destination port.
3 - Feature not present <Set parallel port>
4 - Feature not present <Set relay I/O port>
5 - Rename Unit - PIPER
6 - Change Password
7 - Enter IP numbers - 1.1.1.55, 1.1.1.1, 255.255.255.0
8 - Packet send values - 100ms from last char, 256bytes, Char= none
9 - Reset to Factory Defaults
A - Modem emulation - AT commands OFF
B - Change Trigger character - +

S - Save settings
P - Return to previous menu
ESC - ROOT MENU

Enter selection -->
```

You should now enter three IP numbers, an IP address for the unit, the IP address of the default gateway and a sub-net mask. It is very important to assign IP numbers correctly- guessing won't do. You may need to use numbers provided by your network manager.

Notes on assigning IP numbers.

If you are planning to PING units from your workstation, it's IP number will determine the IP numbers you use on any Piper that will be connected to the same LAN segment. If you are using Windows 95/98 or NT workstation, you can find the IP number of your workstation by opening 'Control panel-Network - TCP/IP LAN adapter - properties'. Note the IP number and subnet mask numbers here. The 'Gateway' tab will show the IP address of the default gateway for the LAN segment used by your workstation. Note this number too.

For example, suppose your workstation has an IP number of 192.1.1.55, a gateway IP number of 192.1.1.254 and a subnet mask of 255.255.255.0 you must choose unused IP numbers in the range 192.1.1.0 to 192.1.1.253, remembering that other workstations, devices and gateways may already use some of these numbers. If in doubt, ask your network manager. So continuing this example, you could configure any Piper unit that will be connected to the same segment as your workstation with an unused IP number, perhaps 192.1.1.99, a gateway IP of 192.1.1.254 and subnet mask of 255.255.255.0. Remember that these are just examples.

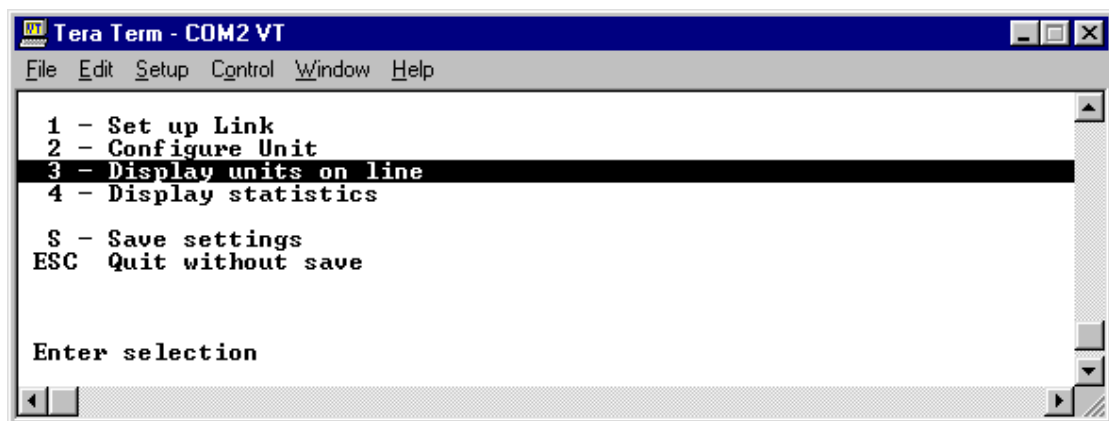
If all the units are going to be connected to the same LAN segment with no gateways to other networks, you can invent IP numbers. For example, assign the default gateway the number 192.1.1.1, assign the units IP numbers in the range 192.1.1.2 to 192.1.1.255, and use a subnet mask of 255.255.255.0.

You should also change the unit name and password at this time. If you wish to change the port names enter the 'Configure port' menus for each port. The factory default port names are; serial port 1 = 'port1'; serial port 2 = 'port2'. Perform the above steps for each unit.

Note - remember to save your changes before escaping from command mode.

Connecting to the network.

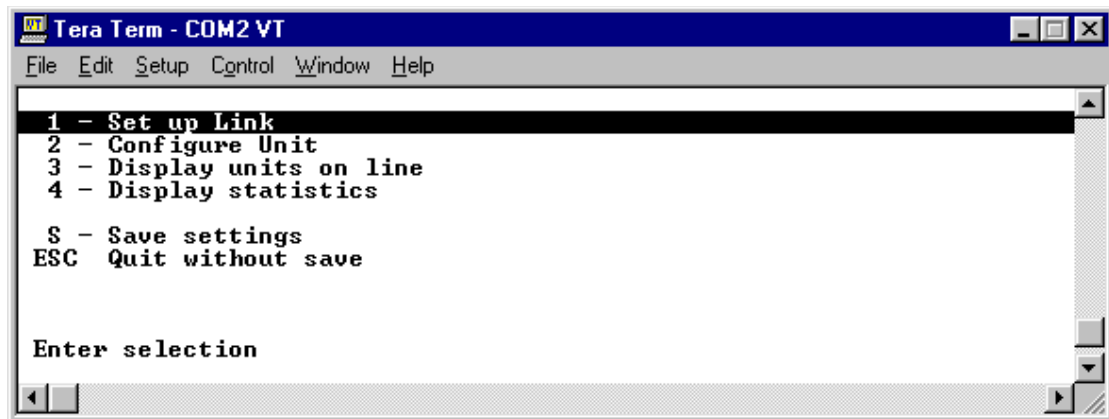
Now you can connect your units to the network. Connect to one unit's command port (port 2) type +++ to enter command mode, then use the 'Display units on line' menu selection to see a report of all the Pipers connected to the local LAN segment. You will not see units on other sub-nets.



This is a good test of the unit's ability to communicate correctly on the network. You should see LEDs flash for outgoing and incoming network packets Note; Piper only responds to Piper packets and all its broadcasts.

Making links.

You can now form links between units. A link is a data route starting at a source port on one unit and ending at a destination port on the same, or any other unit. The source and destination ports may be of different data formats - number of data bits etc.



Use the 'Set up link' menu selection. Enter the unit's IP number and then the source port number, 1 or 2. You will now be prompted for the IP number of the Destination unit and the destination port on that unit. Lastly you will be prompted for a time-out - this time value is passed to the destination port, and will be used by that port to prevent any other unit connecting to it until it has been empty and idle for the chosen time. Choose from 2 sec, 20 sec, 2 minutes or 'never'. Having made the link, remember to save it. Escape to exit without saving changes.

Valid responses to the prompt for the IP number of the destination unit

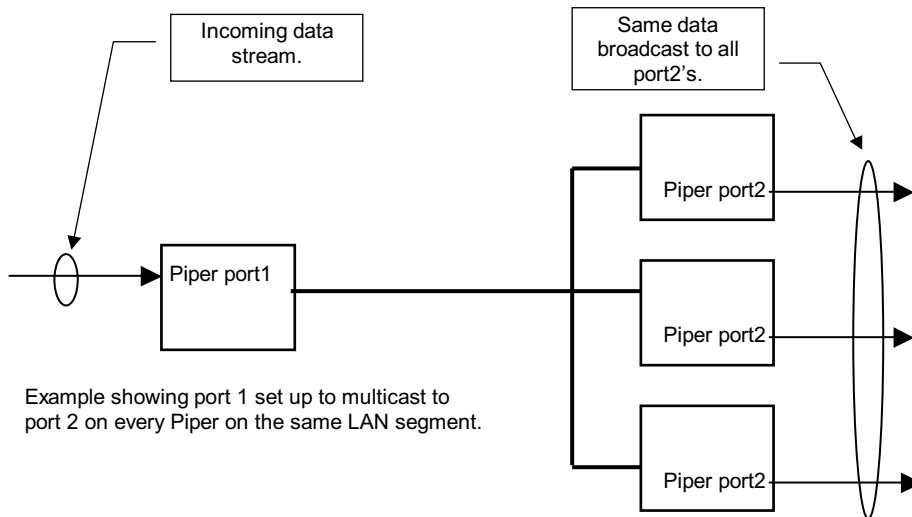
Whenever you are prompted for the IP number of the destination unit you can enter either -

1. An IP number. This can be used to refer to unit (even the same unit), anywhere on the network.
2. The word 'none' - simply a way of clearing a link.
3. The word 'multi' - used to set up Mac multicast from one unit to many units on the same sub-net.

Mac Multicasting (Data broadcast).

Data broadcast may be selected on any port by using the special word 'multi' (which stands for multicast) instead of the IP number of the destination unit. This option allows data to be broadcast to all other units on the same sub-net. Data arriving at the broadcasting source port is sent to all other Pipers connected to the local network (not units on other sub-nets), and output by them on the port you selected as the destination port.

For example, specify unit 192.1.1.55, port 1 as the source unit/port. Enter 'multi' as the destination unit 'name'. Select a destination port, for example port 2, and all data arriving into port 1 of that unit will be sent to port 2 of every other unit on the local network.



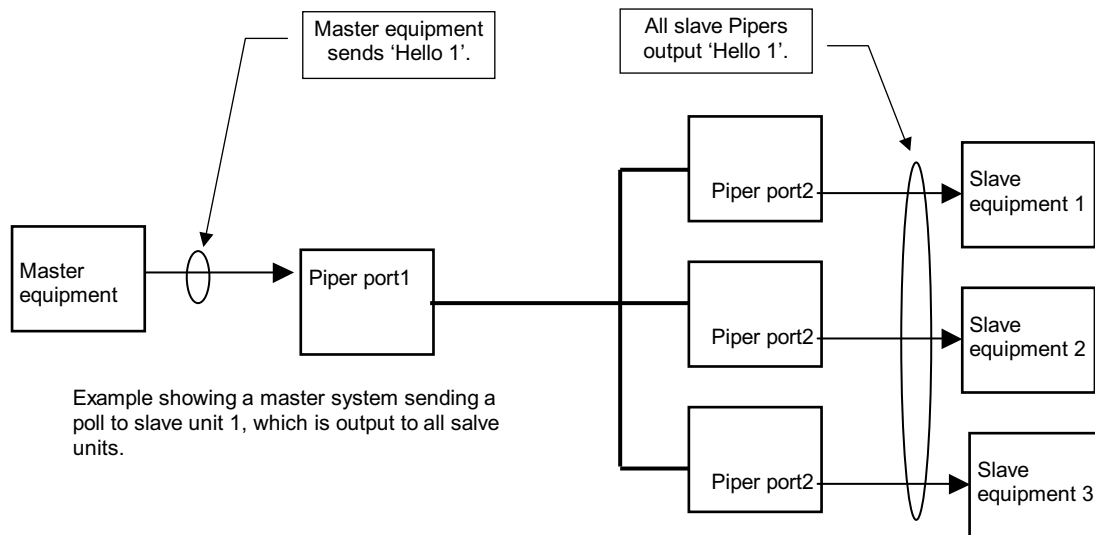
Notes -

- You must assign IP numbers and sub-net masks to all units.
- Broadcast data travels across the network as multicast packets, that is they have the broadcast bit set in the destination Mac address field.
- Multicast packets are not acknowledged by receiving units, making this data delivery method less secure than normal links.

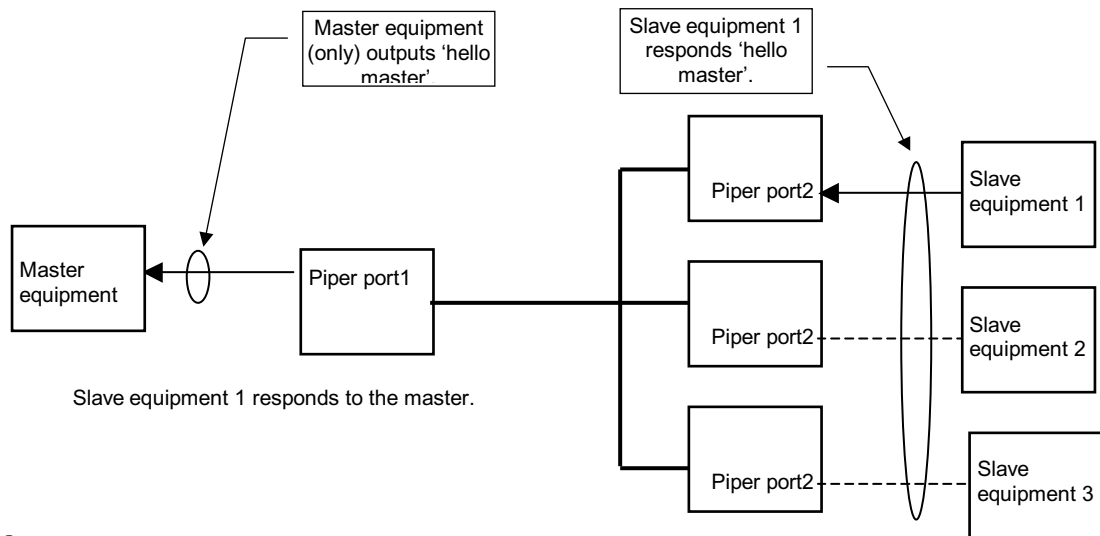
Reverse channel data when using data broadcast-

Equipment's connected to the ports receiving the broadcast data can respond to establish full duplex links back to the broadcast unit. The data sent back only goes to the master unit; it is not broadcast to the other units. This broadcast feature can be very useful in a polled environment as shown in the following example.

1) Master sends a poll, which is seen by all the terminal equipment...



2) If slave equipment recognises the poll, it can respond directly to the master...

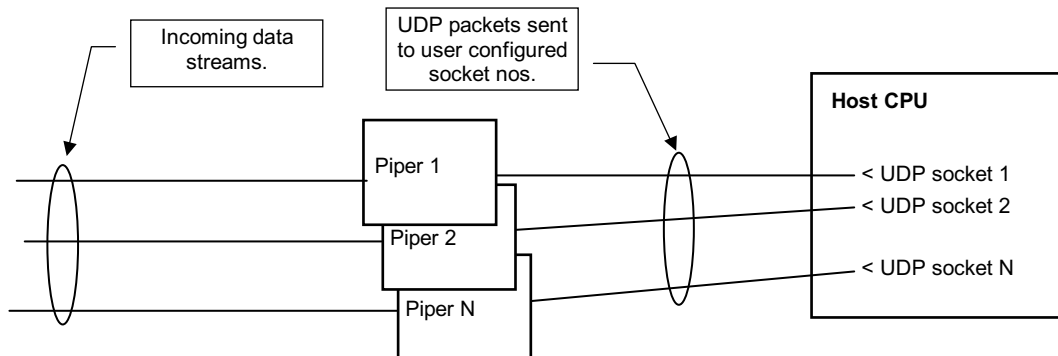


Notes -

- You must assign IP numbers and sub-net masks to all units.
- Clear broadcast links by typing the special word 'none' instead of a destination unit name.
- In the reverse channel link example above, any slave which responds to a poll, has exclusive use of the broadcasting unit until its idle time out lapses. Then any other unit can gain access.
- When the a reverse channel link is made in this way, data from the broadcasting unit is still in broadcast mode - so every other unit on the sub-net hears half of the full duplex conversation between the two.

UDP socket to socket links.

Piper can be configured to send and receive 'raw' UDP packets. The UDP data field does not contain the underlying rugged Piper protocol. Use this type of configuration to send data to a host CPU-



To make a raw UDP link -

- 1) Use Main menu 2 - Configure unit, to enter and save an IP number for the unit, an IP number of the default gateway and a sub-net mask.
- 2) Use main menu item 1 - Set up Link
 - Enter the IP number of the source unit
 - Enter its password
 - Enter the source port number - only ports 1 or 2, the RS232 ports, are applicable.
 - Enter the name of the destination unit in the special form- **UDP IPnumber Socketnumber**
E.g. to make a raw UDP link to UDP socket 7200 on host 152.48.158.39 enter **UDP 152.48.158.39 7200** (the spaces are important).

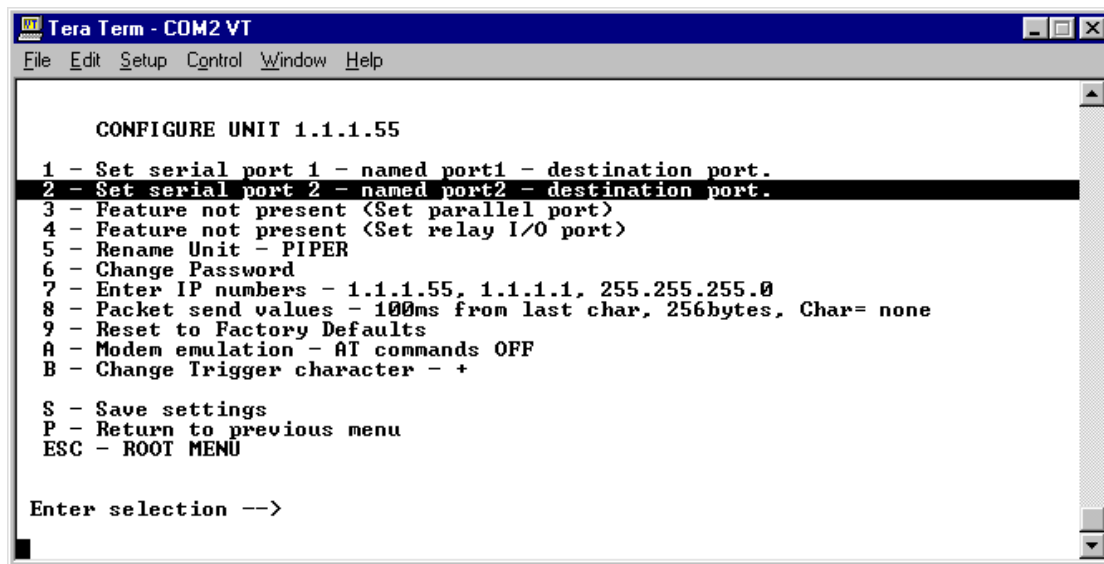
3) Save the setting. Notices that the link information for the unit now shows the UDP socket number in the parameter normally used to name the port.

Notes -

- If the host computer wishes to send data back to the Piper it should send to UDP socket 6000 for serial port 1, or 6001 for serial port 2. NB: Piper discards incoming network packets that are over 400 bytes long.
- To make a bi-directional raw UDP link between two Pipers, it is necessary to make a link on each unit pointing to the appropriate socket number on the other.
- Do not use socket number 8500 or socket number 256 or below. (Piper 'normal mode' packets use 8500 for both the source and destination sockets numbers).
- If you link to a UDP socket on your host that is not in use by some process, it may respond with an ICMP 'destination unreachable' message. Piper ignores these.
- There is no end-to-end flow control when using raw UDP links. The receiving equipment must remove the incoming packets as quickly as they arrive.

Serial port configuration.

The factory default settings for the two serial ports are 9600 baud, 8 data bits, No parity, 1 stop bit, Xon/Xoff controlled output port. This sub-menu allows setting baud rates in the range 110 to 115k, 7 or 8 data bits, odd, even or no parity, 1 or 2 stop bits.

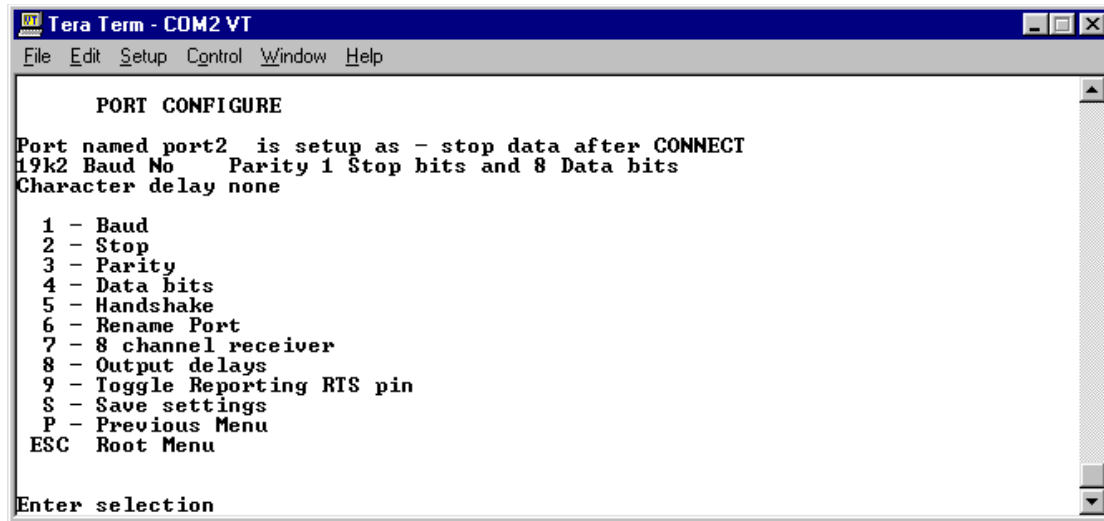


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Tera Term - COM2 VT
File Edit Setup Control Window Help

CONFIGURE UNIT 1.1.1.55
1 - Set serial port 1 - named port1 - destination port.
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3 - Feature not present <Set parallel port>
4 - Feature not present <Set relay I/O port>
5 - Rename Unit - PIPER
6 - Change Password
7 - Enter IP numbers - 1.1.1.55, 1.1.1.1, 255.255.255.0
8 - Packet send values - 100ms from last char, 256bytes, Char= none
9 - Reset to Factory Defaults
A - Modem emulation - AT commands OFF
B - Change Trigger character - +

S - Save settings
P - Return to previous menu
ESC - ROOT MENU

Enter selection -->
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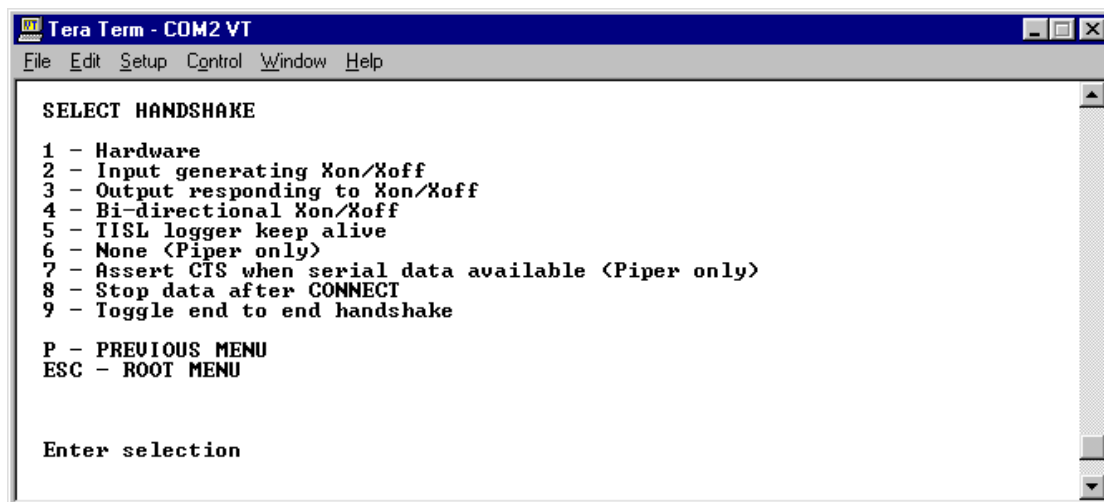


Output character delay.

The serial port configuration sub-menu also allows an inter-character delay of between 0 and 255msec (approximate timings) to be selected. The effect of setting a value other than 0 is that Piper waits for the chosen delay time between outputting characters to the serial port, slowing down the data stream. This may be useful when connecting a Piper to equipment that can be overrun by a continuous stream of characters.

Serial port handshake, or flow control.

Whenever you make links between units using the serial ports it is important to set up the handshake correctly. To do this, enter main menu '2- Configure unit' and then select either serial port. A list of serial port configurable items is shown; handshake is item 5, which offers five options-



The first two options allow Piper serial ports to generate handshakes to stop and start the data flowing *into* it -

- By raising and lowering its CTS output- select 'Hardware' handshake – selection 1.
- By sending Xon and Xoff characters- select 'Input generating Xon/Xoff' handshake– selection 2.

Piper can respond to handshakes from equipment trying to stop and start the data flowing *out* of its serial ports in two ways -

- By monitoring the incoming RTS signal- select 'Hardware' handshake– selection 1.
- By looking for incoming Xon and Xoff characters- select 'Output responding to Xon/Xoff'– selection 2.
- Use Bi-directional Xon/Xoff, if you want a serial port to both- respond to Xon/Xoff characters and also to generate them to control data flow into itself– selection 4.
- Option 5 is only for use with TISL Ltd proprietary equipment.
- Use No flow control when the connected equipment has its own overlying protocol– selection 6.
- Option 7 is useful when connecting to equipment that requires an indication that data is being sent on a hardware signal. For example, an RS232 to RS485 converter may use this signal to control the direction of data.
- Option 8 is a special handshake for use with call logger polling systems where the Piper unit is being used to dial out. Once it has dialled and issued the CONNECT message it will not output any serial data until it receives Xon.
- Option 9 'end to end' handshake copies the state of the RTS input (pin 7) to the CTS output (pin 8) on the destination unit, and vice versa. This option must be set on both units concerned and the handshake chosen must be either 'None' or one of the Xon/Xoff choices i.e. selections 1 and 7 cannot be used in conjunction with option 9.

Notes -

1. Remember to save changes before exiting.
2. Incorrectly set handshakes result in data loss.

Changing packet send parameters.

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Tera Term - COM2 VT
File Edit Setup Control Window Help

CONFIGURE UNIT 1.1.1.55

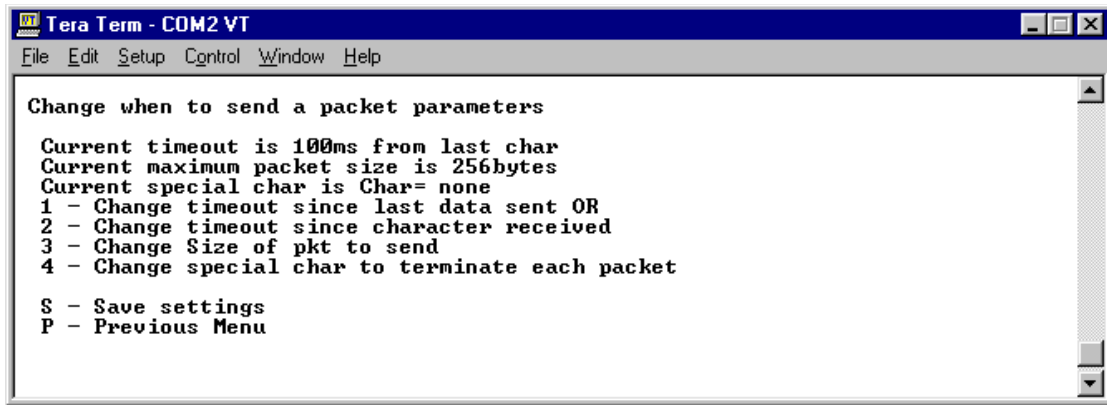
1 - Set serial port 1 - named port1 - destination port.
2 - Set serial port 2 - named port2 - destination port.
3 - Feature not present <Set parallel port>
4 - Feature not present <Set relay I/O port>
5 - Rename Unit - PIPER
6 - Change Password
7 - Enter IP numbers - 1.1.1.55, 1.1.1.1, 255.255.255.0
8 - Packet send values - 100ms from last char, 256bytes, Char= none
9 - Reset to Factory Defaults
A - Modem emulation - AT commands OFF
B - Change Trigger character - +

S - Save settings
P - Return to previous menu
ESC - ROOT MENU

Enter selection -->

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Whenever data enters a serial port the unit has to make a decision about when to create a data packet and send it out to the network. You can adjust four settings that affect this –



1. The time the unit waits since the last data packet was sent.

An internal timer relating to each serial input port counts down approximately every millisecond. If there is data waiting to send when it reaches zero, the data is formed into a packet and sent.

Valid choices for this value are 0 = never time out, 1 = 1ms, up to 127 = 127msec.

2. The time it waits after the last character was received from the RS232 port.

Alternatively, you can choose to wait to see if more data is coming into the serial port before sending the packet. In this case the port timer is reset to the full value each time a character is received, but if it reaches zero, any characters waiting are formed into a packet and sent. Valid choices for this value are 0 = never time out, 1 = 10ms, up to 127 = 1270msec.

3. The number of characters to be sent in each packet.

This setting allows you to choose the quantity of data waiting in the serial buffer to be sent. The default is 256 bytes. When the chosen number of characters is present they are formed into a packet and sent. Valid choices for this value are from 1 to 256 bytes. Once the chosen number of bytes are present they are sent, regardless of the other timed settings or the special character setting below.

4. Specify that a special character will cause the packet to be sent.

This setting tells Piper to look for a special character arriving into the serial port. When it is seen the waiting characters are formed into a packet, with the special character on the end and output to the network. For example, use the value 10 (line feed) to send each line of text in its own packet. Valid choices for this setting are from 0 (ASCII null) to 255 (ASCII delete); 'N' to indicate feature disabled and 'A' for Andover Control Protocol (ACP), which checks for several special characters to optimise for ACP.

Note - each input port is independent i.e. it is using its own copies of these parameters, but the values you select apply to both the serial ports.

Statistics.

From the main menu a 'Display Statistics' menu selection provides a screen, mainly for diagnostic purposes, showing the packets sent and received by the local unit. Counts of total packets, and counts of different types of packets used in the protocol, are shown.

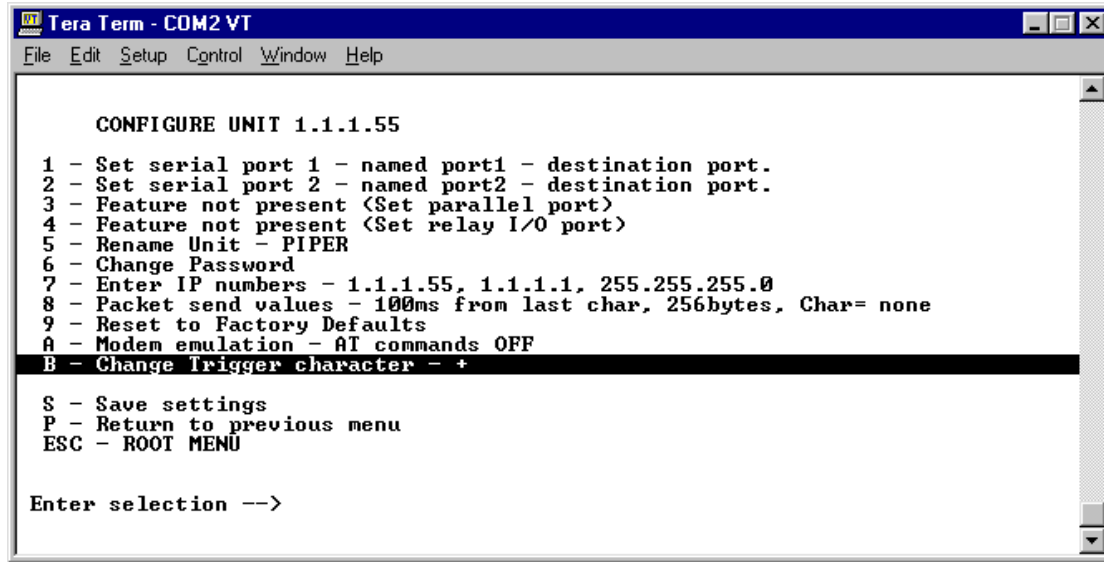
Modem emulation mode.

It is possible to set Piper to recognise many of the common commands used to control modems. A table of supported commands appears at the end of this section.

Quick start –

Follow these steps on the *dialing* (source) Piper unit only–

1. Change the menu entry (trigger) character from + to another character of your choice– menu B.

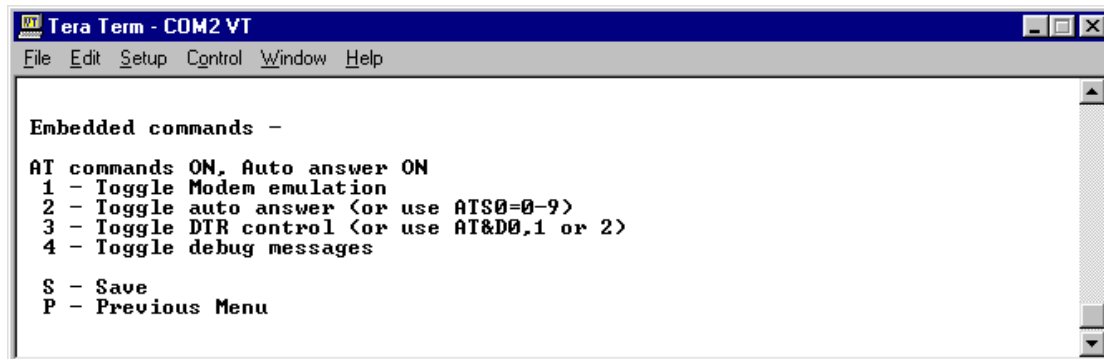


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Tera Term - COM2 VT
File Edit Setup Control Window Help

CONFIGURE UNIT 1.1.1.55
1 - Set serial port 1 - named port1 - destination port.
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6 - Change Password
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8 - Packet send values - 100ms from last char, 256bytes, Char= none
9 - Reset to Factory Defaults
A - Modem emulation - AT commands OFF
B - Change Trigger character - +
S - Save settings
P - Return to previous menu
ESC - ROOT MENU

Enter selection -->
```

2. Turn AT commands on (auto answer will turn on too)– main menu selection A is shown; choose 1.



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Tera Term - COM2 VT
File Edit Setup Control Window Help

Embedded commands -
AT commands ON, Auto answer ON
1 - Toggle Modem emulation
2 - Toggle auto answer <or use AT&M=0-9>
3 - Toggle DTR control <or use AT&D0,1 or 2>
4 - Toggle debug messages
S - Save
P - Previous Menu
```

3. Save and escape from menu mode and test that AT commands are working by typing AT followed by enter. Piper should respond 'OK'.
4. Test dial up by typing ATD<IP number of called unit>P<Port number on called unit>
E.g. ATD192.23.67.230P2. Piper should respond 'CONNECT 9600'.
NB: make sure that the port on the unit you are dialing does not already have a link set to somewhere else. If so clear it.
5. Check that data can be sent each way.
6. Hang up by typing +++ into the dialing unit. Piper should respond 'OK'.

Other Modem emulation menu selections–

Choice 2 toggles 'auto answer' on and off. Use this setting if the equipment connected to the dialled unit needs a ringing indication – more below. Auto answer corresponds to modem S register 0. When in

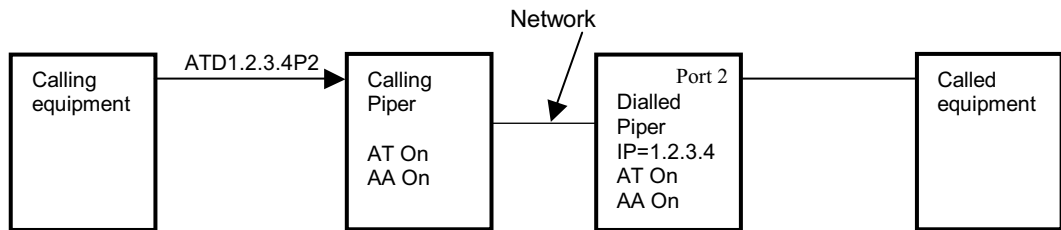
modem emulation mode you can enter `ATS0=0` to turn auto answer off, or `ATS0=1` (or any value up to 9) to turn it on.

Choice 3 toggles DTR control on and off. When this modem feature is turned ON, the unit will only connect when DTR is true, and will drop any existing link if DTR goes false. Since Piper does not support the DTR signal, instead it monitors the RTS pin and acts on that as if it were DTR. If you use this feature you will need to connect to Piper's RTS signal on pin 7, not DTR on pin 4. See Piper serial port pin outs for details of supported RS232 signals. This feature corresponds to modem command `AT&D` and you can enter `AT&D0` = ignore DTR or `AT&D1` or `2` = hang up if DTR goes false.

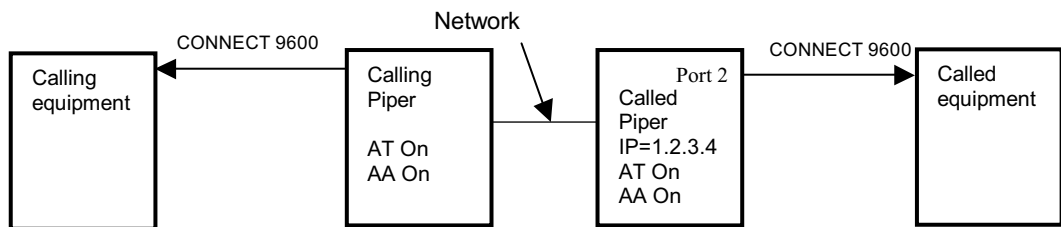
Choice 4 toggles debug messages, which are useful when using first using modem emulation features.

Dialling examples –

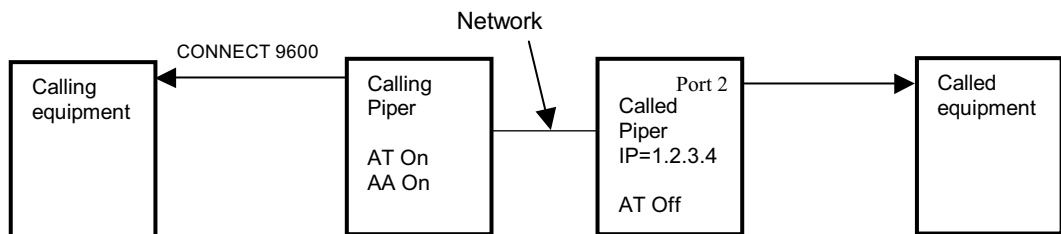
1. The calling equipment dials the remote IP number and port number. The calling Piper tries to connect to the Piper with that IP number, which acknowledges the connection request.
- 2.



2a) If the called Piper has modem emulation turned on, both units say CONNECT and go ONLINE. Data can be passed both ways.



2b) If the called Piper does not have modem emulation turned on, only the calling unit says CONNECT.

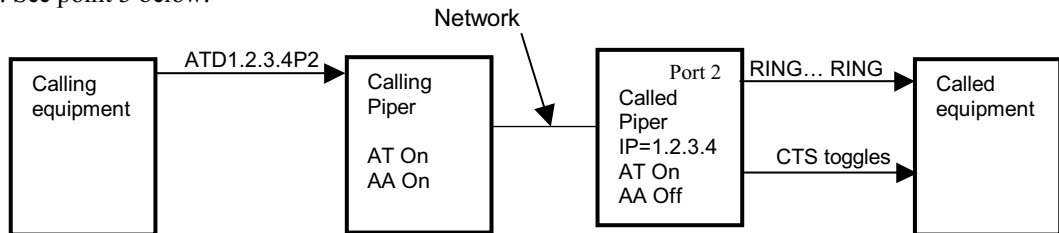


If auto answer is OFF.

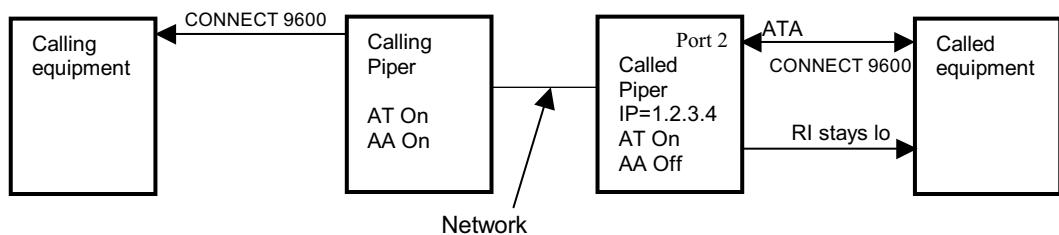
Use menu item 2 to turn auto answer off. The messages ‘AT commands ON, Auto answer OFF– CTS acts as RI!’ will appear. Use this setting if the connected equipment must see a ringing indication. Piper does not support the Ring Indicate (RI) interface pin, but simulates its action with the CTS pin.

Example of how a connection is made when the called unit is set to ‘ATcommands ON, Auto answer OFF – CTS acts as RI!’ -

1. The calling equipment dials the remote IP number and port number, The local Piper tries to connect to the Piper with that IP number, which says RING and simulates the Ring Indicate (RI) signal with CTS. See point 3 below.



2. The called equipment recognises RING or sees the toggling RI line, and tells its unit to answer by issuing the command ATA. Both units then say CONNECT, go ONLINE and data can be passed both ways. If ATA is not received within 9 rings, the calling unit says NO CARRIER.



3. Using CTS as Ring Indicate (RI).

Piper will raise and lower CTS in time with the RING response so that it can be used as the RI control signal. It only does this when the unit is not set for auto answer. A suggested cable wiring to use this feature is shown below -

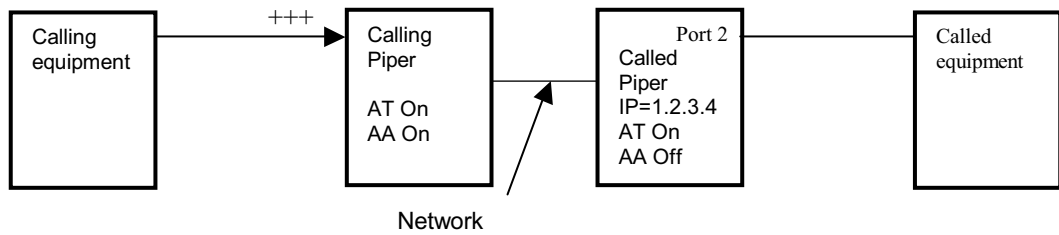
Signal name	Piper serial port 1 & 2	Terminal equipment
N/C (DCD)	1	1
Data out of unit	2	2
Data into unit	3	3
N/C (DTR)	4	4 If pin 4 is high...
Signal ground	5	5
N/C (DSR)	6	6
RTS into unit	7	7
CTS out of unit	8	8 ...use it to pull CTS high.
N/C (RI) CTS.	9	9 Drive RI from Piper's CTS.

Breaking a connection

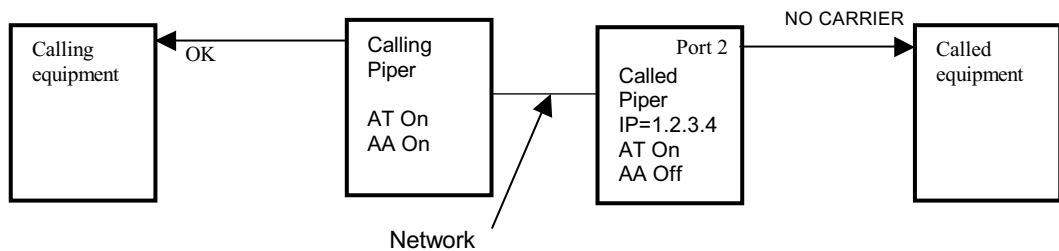
The normal method to gain the attention of an online modem is to enter three plus characters with a time gap between them. (Piper requires a minimum of 100ms and a maximum of 2 seconds between plusses- this is the time T in the example below) Piper supports this mechanism and will respond OK and go Offline. Optionally you may then enter the hangup command, ATH.

Example of how to break a connection–

1. The calling equipment sends +++ and waits-



2. After 1/2 second the dialling unit says OK, the dialled unit says NO CARRIER and both go OFFLINE. It is optional to output the hang-up command, ATH.



Notes 1. If the menu mode trigger character is set to + (the normal setting!), Piper will not allow AT commands to be turned on. It says 'select a different trigger character'. Use the main menu 2, sub menu item B, to choose any other convenient trigger character.

2. If you have difficulties with the characters needed in the dial string (. and P), ommas may be used instead of periods, and ! may be used instead of a P. E.g. ATD192,23,67,230P2 or ATD192,23,67,230!2 . Alternatively use four 3 digit clusters for the IP number e.g. ATD192023067230P2 or ATD192023067230!2

PIPER modem emulation – table of supported AT commands.

Command	Usage & Actions	Response
<p>ATD<IP no. Port no.> ATDT<IP no. Port no.> ATDP<IP no. Port no.> E.g. ATD192.23.67.230P2 Other valid characters- , may be used instead of. E.g. ATD192,23,67,230P2 ! may be used instead of P E.g. ATD192,23,67,230!2 Or you may use four 3 digit clusters for the IP no. - E.g. ATD192023067230P2</p>	<p>Dial control. Used to 'dial' i.e. make a link to a port on another unit. If successful, Piper goes into 'Online' mode (it will not respond to any further AT commands until +++ is seen).</p> <p>The dialling unit sends a connection request (Start Link packet) to the target unit, and waits for an ACK packet. It retries 9 times at 5second intervals.</p> <p>Once Online, in the absence of any other traffic, the dialling unit sends a StartLink packet every 5 seconds. If 9 retries 5 seconds apart do not elicit an ACK, the unit outputs 'NO CARRIER' and goes Offline.</p>	<p>CONNECT <baud rate> - when ACK received. E.g. CONNECT 9600</p> <p>NO CARRIER - if an ACK is not received after 9 retries, 5 seconds apart.</p>
ATA	<p>Answer control. If the dialled unit is set to autoanswer this command is not required as it will immediately ACK the connect request and go Online. No response is output.</p> <p>If the dialled unit is not set to autoanswer it outputs 'RING' each time a connect request is received. When ATA is seen, it ACKs the next connection request and goes into 'Online mode'.</p> <p>Once Online, the dialled unit monitors incoming packets. If no packets are received for 30 seconds it outputs 'NO CARRIER' and goes Offline.</p>	<p>RING</p> <p>CONNECT <baud rate></p> <p>NO CARRIER - if no packets are received for 30 seconds.</p>
<p>ATH'anything' e.g. ATH Z or ATH0 Z</p>	'Hang-up' – clears all link information and goes Offline.	OK
ATZ	Reset unit – actions as for 'Hangup'.	OK
<p>+++ Literally +T+T+ where T is a time gap between 100ms and 2 seconds.</p>	<p>Actions as for 'Hangup'. (+++ is normally followed by ATH). Response is OK if the unit was online, or NO CARRIER if trying to link.</p> <p>The dialled unit says NO CARRIER and goes offline.</p>	<p>OK - after 1/2 second of guard time.</p> <p>NO CARRIER</p>
ATE	Controls the echo of command mode characters: ATE1 or ATE = echo on (default) ATE0 = no echo.	OK
ATQ	Turns 'result codes' such as 'OK', on and off: ATQ0 or ATQ = result codes on (default) ATQ1 = silent, no result codes.	OK
ATV	Select text result codes such as 'OK', or numeric codes:- ATV1 or ATV = text result codes (default) ATV0 = numeric result codes as follows – Note – text result codes have CR LF before and after. Numeric codes have CR before and after.	<p>OK or 0 = OK 1 = CONNECT 2 = RING 3 = NO CARRIER 4 = ERROR</p>
AT&D	DTR control. &D0 unit ignores DTR (default) &D1 unit goes offline if DTR is false. &D2 as &D1.	OK
AT&F	Restore to factory default modem settings.	OK

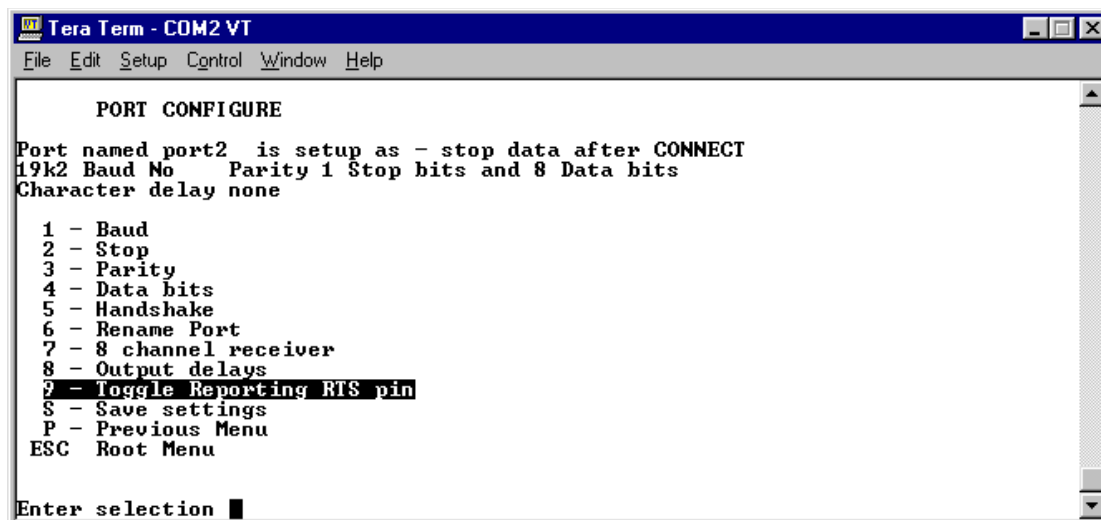
AT&V	View modem emulation settings.	OK
AT&W	Write current port's modem settings to flash. Notes – The stored values are restored to <u>both</u> ports at power on. However, each port's settings can be independently changed with the commands above (e.g. ATE0Q1V0&D1S0=1).	OK
ATS0	Auto answer control- modem S register 0– ATS0=0 turns auto answer off. ATS0=1 (or any value up to 9) turns auto answer on. This is the default when modem emulation is turned on.	OK
ATS30	Idle timeout- modem S register 30– ATS30=0 turns the timer off. Default. ATS30=1 (or any value up to 30) sets the idle timeout in tens of seconds. Range 10 to 300 seconds The unit hangs up if no data is passed in o tr direction during this time.	OK
AT	Allows connected equipment to check that the unit is responding.	OK
AT 'unsupported command' e.g. ATS0? AT\$D	No action	OK
'Any text ending in CR'	If AT appears anywhere in the line, the unit will attempt to interpret it as above. If AT does not appear, the line is ignored. For example if the line contains ATA the modem will attempt to answer.	Ignored, ERROR , or NO CARRIER
CR (alone)	No action	

Notes.

1. If the menu mode trigger character is set to + (the normal setting!), Piper will not allow AT commands to be turned on. Select any other convenient trigger character.
2. Piper responds to unrecognised / unsupported commands with 'OK'.
3. All AT commands should be terminated with CR.
4. An LED underneath the unit, nearest to the power connector, indicates when a Piper set for modem emulation is Online.

Sending alarms

Piper can be set to send alarms if the state of the RTS signal into either serial port changes state. Enter the configuration menu and choose sub-menu 1 for port 1 or sub-menu 2 for port 2. These sub-menus allow setting many serial port settings such as baud rate; option 9 reads 'Toggle Reporting RTS pin'. Toggle it to ON, and see in the summary of settings at the head of the menu.



For the alarm reporting to have any effect it is necessary to set a link from the chosen port to another Piper unit. Once this is done the serial port will continue to act normally, but will also generate messages of the form <Unit name> <port name> <state> whenever RTS changes state. For example, if the feature is enabled on a port named 'ALARM2' on a unit named 'BRISTOL', the messages 'BRISTOL ALARM2 OFF' and 'BRISTOL ALARM2 ON' are sent to the chosen destination unit as RTS on the chosen port changes state.

Notes –

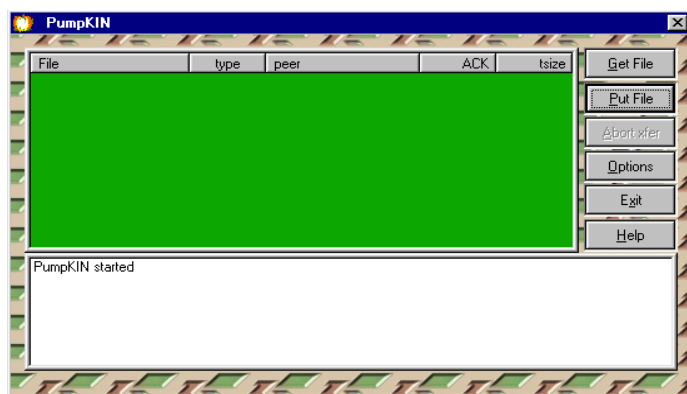
- Remember that you can configure ten character names for the unit and the serial ports; so two meaningful alarm messages can be created, one for each RTS signal.
- Do not use Hardware handshake on a port set to send alarms (unless you want to see how the RTS pin is being driven by the terminal equipment!).

Upgrading Piper software.

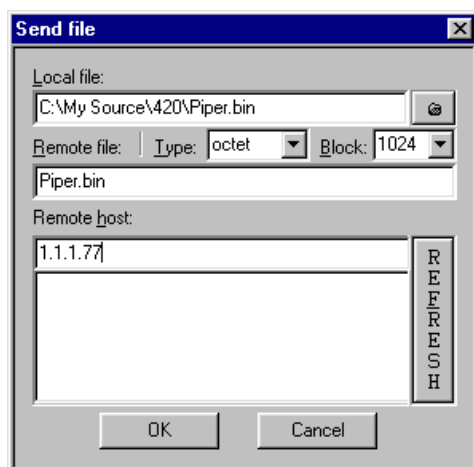
Our web site has various revisions of Piper software and links to TFTP client software needed to upload it, please visit - www.mutek.co.uk/downloads.htm.

Piper software is provided as a file called PIPER.BIN, which should not be renamed (it is 128k long and is terminated with a Fletcher checksum to ensure integrity). To upgrade a Piper, upload PIPER.BIN of your choice using TFTP.

For example, if you use the shareware program Pumpkin–



Click the 'Put File' button and enter the full path and file name to Piper.bin into the 'Local file' box, (alternatively, browse to it using the browse button on the right hand side of the Local file box). You will notice that Pumpkin has automatically entered Piper.bin into the 'Remote file' box – **do not change this name** as Piper will only accept the file if it is called Piper.bin. Leave the 'Type' as octet and the Block size as 1024. Into the 'Remote Host' box enter the IP number of the target unit and then press OK. The file should download immediately and the unit will automatically restart and run the new program.



Notes –

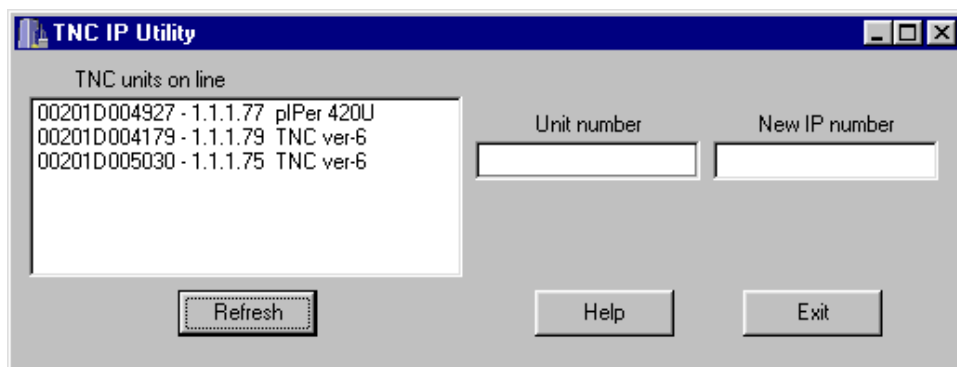
- Do not change piper.bin to any other name.
- Piper only supports TFTP 'Put' (file sent to unit) not 'Get' (file retrieval).
- Pumpkin may appear to do nothing for about 10 seconds, and then the file is sent. This is normal.
- Having successfully uploaded the new software to the unit, enter the menu system and perform a 'Reset to factory defaults' as explained below.

Restoring factory defaults or initialising the IP number.

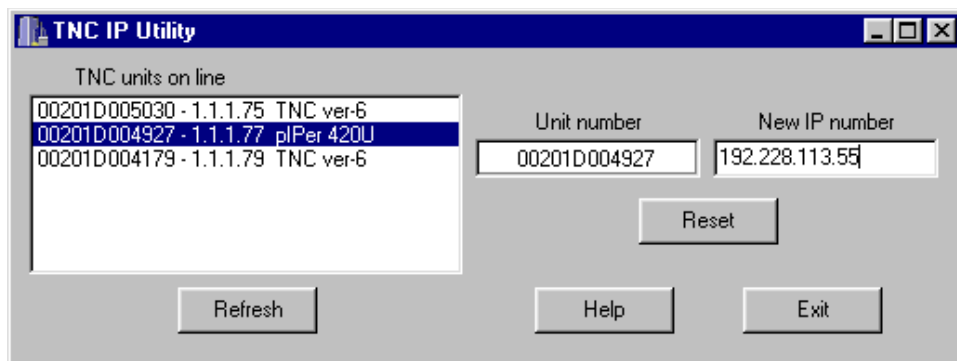
The factory default settings of any unit may be restored with the menu system. Use main menu selection 'Configure unit', specifying the IP number of the target unit. Enter the password, and then use the 'Restore factory defaults' menu selection. All settings *except* the three IP numbers (IP of the unit, default gateway and sub-net mask) are reset to the factory default values. This ensures that you can reset a remote unit to its factory default settings without losing access to it.

An alternative method is to use the 'TNC IP Utility, available at www.mutek.co.uk/downloads.htm. This method is particularly useful if you cannot use the menu method above because you do not know the password assigned to the unit or the settings assigned to port 2.

Make sure the unit is connected to the same LAN segment as your workstation. This is necessary because the utility searches by outputting an all 1's broadcast packet. Routers do not forward broadcasts by design – if they did networks all over the world would soon overload! Run the utility. All units that are connected to the local segment will be displayed in the left hand window–



Select a unit and change its IP number by over-writing its existing number shown in the right hand box labelled 'New IP number' –



Press 'Reset' to save it to the unit. **All other settings are restored to the factory defaults settings .**

Piper Control Software.

Piper units may be configured using a Windows utility available on our web site at www.mutek.co.uk/downloads.htm. This software is an alternative to using the Piper menu system described previously. A screen shot is shown below –

Piper Control

IP number of unit
1.1.1.59
Password
xxxxx
Get Put
Clear Help

System Parameters
Name: PIPER
Router: 1.1.1.1
Mask: 255.255.255.0
Trigger Char: /
Modem emulation:
Debug Messages:

Port 1
Name: port1
Link IP: 0.0.0.0
Link Port: Port 1
Timeout: 51200 msec
Report RTS:
Baud: 9600
Data Bits: 8 bits
Parity: None
Handshake: Out xoff
Output Delay: 0
End to End:

Port 2
Name: port2
Link IP: 1.1.1.57
Link Port: Port 2
Timeout: 2000 msec
Report RTS:
Baud: 19k2
Data Bits: 8 bits
Parity: None
Handshake: Pause
Output Delay: 0
End to End:

Packet Send Config
Time from last char: 100 msec
Packet size: 256
Special Char: Mode: Off, Char: 0

Modem Registers
&D: 0
S0: 1
E: 1
Q: 0
V: 1
S30: 0

Mutek
Farleigh House
Frome Road
Bradford on Avon
Wiltshire
BA15 1LE. U.K.

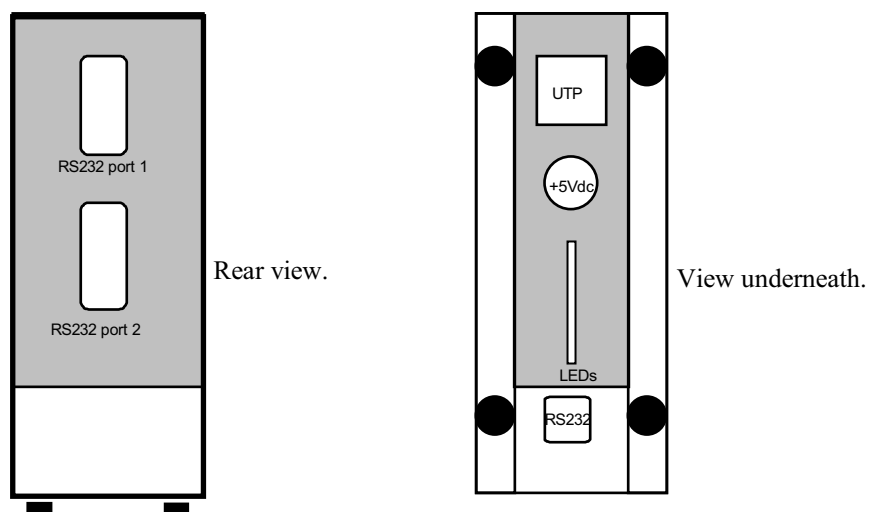
www.mutek.co.uk

Enter the IP number of the unit of interest into the top left hand box and enter its password in the box below (the default is 'PASS' in upper case) then click the GET button.

Settings and links may now be modified as required and saved back to the target unit with the PUT button. Note that you cannot GET settings from one unit and PUT them to another by overtyping the IP number.

Further instructions for use are available under the HELP button.

Layout of the connectors.



Serial port pin connections. Factory fixed as DCE-

<u>Signal name</u>	<u>D9 connector pin number</u>
No connection (dcd)	1
Data out of unit	2
Data into unit	3
No connection (dtr)	4
Signal ground	5
No connection (dsr)	6
RTS into unit	7
CTS out of unit	8
No connection (ri)	9

General comments about Piper.

Using Piper with bridges and routers.

Ethernet bridges learn where the various MAC addresses on your network are and forward packets accordingly. They will normally forward all Piper packets perfectly, but some bridges allow filtering of packets based on certain criteria, for example broadcasts and multicasts can be discarded. If Multicasts are disabled, menu option 3, 'display units on line', will not display units on the far side of the bridge. Routers and intelligent hubs will rarely pass broadcasts or multicasts, so units on the far side of them will not be seen by menu option 3 either.

Piper's use of UDP.

Piper uses UDP as the data transport and embeds its own protocol within it. Piper uses the UDP source and destination socket numbers of 8500 (unless you have configured the unit to send raw UDP packets).

Piper's effect on Ethernet traffic.

Piper normally only sends network packets when data arrives on its serial ports. If data arrives slowly, say at typing speed, each character may be sent singly in its own packet. If data arrives faster, many bytes (the factory default is 256) share one packet. The receiving unit acknowledges every packet. Flat out serial data at 115kb produces 256 bytes in about 22msec, which equates to about 46 data packets and 46 Ack packets per second. This is a very low packet rate compared to most other network attached devices.

Piper specification.

Part numbers – desktop unit PIP02, OEM unit PIPOEM, and power supply PSU5.

Two RS232C ports - speeds to 115.2k baud, 7 or 8 bit data, 1 stop bit, odd, even or no parity. Presented on D9 female connectors supporting TxD, RxD, RTS, CTS and signal ground.

Network port - 10Mbit/s Ethernet presented as 10baseT (UTP) on RJ45 connector.

Network protocols - IEEE 802.3 Ethernet encapsulates IP packets, as defined in RFC 894: IP, UDP, ARP, ICMP (ping) and TFTP.

Power supply – external universal switch mode PSU producing regulated +5Vdc. The PSU will operate correctly on AC voltages between 100Vac to 240Vac, 50/60Hz. Piper power requirement is 400ma at 5Vdc \pm 5%.

Indicators - LEDs are provided as follows -

- LAN port: - Front panel LEDs show, link made, error, transmitted data and received data
- Serial ports: - Bottom panel LEDs for Tx data, Rx data. Port 2 has a 'command mode' led.
- Status - Bottom panel LED flashes regularly to show correct operation.

User settings are saved in internal flash memory and automatically restored at power up.

Enclosure - all metal case, compliance with EMI/RFI standards.

Size - Length 140mm; Width 50mm; Height 140mm. Weight 0.7Kg.

PIP02 mounting arrangements - desktop + wall mounting plate.

PIPOEM is provided with PC mounting holes. See www.mutek.co.uk/piper.htm and download 'OEM version'

Environmental - 0 to 40 degrees centigrade; 5 to 95% humidity (non-condensing).

Addendum 1 - Piper protocol.

Piper supports members of the TCP/IP suit of protocols, namely IP, ARP, ICMP, TFTP and UDP. It will also respond to a Ping (ICMP). Piper's uses UDP transport exclusively, and its own protocol and the transported data is carried inside UDP datagrams. The data carried is 1 byte minimum (after time out) and 256 bytes maximum. The Ethernet encapsulation is as defined in RFC 894 and mandated by RFC 1022. The packet format is shown below -

Mac Header -

- 6 bytes Destination MAC address
- 6 bytes Source MAC address
- 2 bytes Type - 0800 for IP packets, 0805 for ARP requests and 0806 for ARP replies.

IP header -

- 2 bytes IP Version - 4, header length - 20, TOS - 16 (4510h)
- 2 bytes IP packet length including header
- 2 bytes identifier (packet number, unique over a short period)
- 2 bytes fragmentation - 00
- 2 bytes TTL - 64, protocol - 17= UDP (4011h)
- 2 bytes header checksum
- 4 bytes Source IP number
- 4 bytes Destination IP number

The UDP fields contain either - 1) Normal Piper mode

UDP header -

- 2 bytes Source port - 8500 (2134h)
- 2 bytes Destination port - 8500 (2134h)
- 2 bytes length of UDP portion including header
- 2 bytes optional UDP checksum - set to 00.

Piper header -

- 2 bytes spare
- 2 bytes byte 1 - 34h or 0b4h, byte 2 - 32h. Piper ID code.
- 1 byte Command(1)= 0000cccc where cccc is decoded as -
 - 01 - ACK
 - 02 - Start link
 - 03 - Multicast - who is there?
 - 04 - Multicast reply
 - 05 - Command packet
 - Sequence # bits re-used as -
 - 01 - enquiry; send configuration
 - 02 - reply to enquiry
 - 03 - new configuration data to be adopted
 - 08 - Data packet
- 1 byte Command(2)= ddss0nnn -
 - where dd= destination port # and ss= source port #, range 0- 2,
 - and where nnn= packet sequence number; range 0- 7.

Piper data -

- 1- 256 bytes - May be user data or protocol data, as defined above.

Or 2) if 'raw UDP packets' are chosen -

UDP header -

- 2 bytes Source port - 6000 (serial port 1) or 6001 (serial port 2)
- 2 bytes Destination port - user selected
- 2 bytes length of UDP portion including header
- 2 bytes optional UDP checksum - set to 00.

UDP data -

- 0- 256 bytes - user data.