



# **2NETWEB Embedded Control Server for DOS**

## **User and Configuration Guide**

**Version 2.1**

**2net Limited**

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## 2NETWEB User and Configuration Guide

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## Contents

<b>1. DESCRIPTION</b>	<b>4</b>
<b>2. SYSTEM REQUIREMENTS</b>	<b>4</b>
<b>3. NETWORK CONFIGURATION</b>	<b>4</b>
3.1. LAN Connection	4
3.2. The [network] section of the 2net.cfg file	5
3.3. Direct Serial Connection	5
3.4. Direct Serial Connection From Windows 95	6
3.5. Dial-up Connection via Modem	7
3.6. Keywords Used In Pppd.cfg	8
<b>4. LOADING 2NETWEB</b>	<b>9</b>
4.1. The [2netweb] section of the 2net.cfg file	10
<b>5. LOADING WEB PAGES</b>	<b>11</b>
<b>6. EMAIL ALERTS</b>	<b>12</b>
6.1. The [smtp] section of the 2net.cfg file	12
<b>7. SETTING PASSWORDS</b>	<b>12</b>
7.1. Genpass	13

## 1. Description

The 2net Embedded Control Server is the “glue” which enables embedded devices to be controlled, monitored and diagnosed from a standard web browser such as Microsoft Internet Explorer or Netscape Navigator. It includes a web server, file browser (Remote Control Centre) and optional Email Alerter

Interaction with the device is by means of web-based forms or Control Variables. A Control Variable is simply a named variable such as a temperature which may be included in a web page as a static value or, using Java Control Applets, its value may be displayed as it changes in real time as a graphical meter or chart. A System Developer's Kit is available separately to develop control programs and control applets.

The optional Email Alerter allows the control program on the device to send a message using the Internet SMTP email protocol, for example to indicate that an error condition has been detected. The message may be routed to a normal email inbox, or via a gateway to a pager or phone.

The Embedded Control Server is available for embedded DOS and Linux operating systems. This guide explains how to configure and use the DOS version.

The Embedded Control Server for DOS is written as a small TSR, enabling the control program to be written as a normal DOS application. It uses an integrated TCP/IP protocol stack, making it easy to set up and deploy. It can interface to any third party Ethernet packet driver for LAN connectivity, or to the supplied serial line driver for direct point to point or dial-up connections.

## 2. System Requirements

- Intel x86 compatible CPU
- 128 KB free RAM
- MS-DOS 3.3 or later
- A network adapter and packet driver or Hays compatible modem or null modem cable.

## 3. Network Configuration

There are three distinct options for connecting the web server to a network: LAN, direct serial cable and dial-up line using a modem.

### 3.1. LAN Connection

A connection over an Ethernet LAN requires a packet driver. Almost all network cards are supplied with one on the distribution diskettes, usually in a directory named PKTDRV. If there isn't one, a collection of packet drivers is freely available for a wide range of PC Ethernet interfaces from Crynwr (<http://www.crynwr.com>). Finally, you can use an ODI driver if you load an ODI to packet converter after the driver. ODIPKT from FTP Software is an example of such a converter.

Once the driver is loaded you can load 2NETWEB. Usually all the command to do this are put in AUTOEXEC.BAT.

## 2NETWEB User and Configuration Guide

In addition, some network parameters must be written into the [Network] section of the 2NET.CFG file

### 3.2. The [network] section of the 2net.cfg file

Keyword	Description
my_ip=<ip address>	The IP address of the PC in standard “dotted decimal” format
netmask=<mask>	The subnet mask in dotted decimal format
gateway=<ip address>	(Optional) the IP address of the IP gateway or router which you use to connect to other networks or the Internet. You will need to set a gateway if you are using the email option and the SMTP server is not on your local network.
nameserver=<ip address>	(Optional) the IP address of a DNS name server. This will only be needed if you are using the Email alerter option <i>and</i> you have given a domain name for the smtp server.  You may specify an additional name server by repeating this keyword on another line.

Here is a sample file:

```
[Network]
my_ip=192.168.1.6
netmask=255.255.255.0
gateway=192.168.1.1
nameserver=192.168.1.1
nameserver=152.158.1.48
```

### 3.3. Direct Serial Connection

You can connect 2netweb to another system using a null modem cable and the pppd driver supplied. The client end acts as the initiator and 2netweb as the responder; 2netweb supplies the IP addresses for both systems.

Pppd emulates a packet driver. It should be loaded before 2netweb, usually from the autoexec.bat file.

The behaviour of pppd is controlled by the pppd.cfg file. For direct serial line connection, pppd.cfg typically contains

```
COM1
57600
auth
silent
resident
asyncmap 0
10.0.0.2:10.0.0.6
```

## 2NETWEB User and Configuration Guide

A detailed description of all the keywords that may appear in the `pppd.cfg` file are given later. The keywords used here are

COM1	Sets the communications port. The default is COM1, so this line can be omitted
57600	The baud rate. The default is 57600, so this line can be omitted also
auth	Enable PAP authentication. The names and passwords are contained in the file <i>pppdpap.cfg</i>
silent	Disables active negotiation. It will remain silent until contacted
resident	Load as a TSR
asynmap 0	Disables character escape codes
10.0.0.2:10.0.0.6	Local and remote IP addresses. When the connection is made, the 2netweb server will have address 10.0.0.2 and the client will have 10.0.0.6

The `pppdpap.cfg` file contains a list of the users allowed to log on to the `pppd` gateway, up to a **maximum of 10**. There is one user and password per line. For example, the user “guest” with password “123” would look like this:

```
guest      *      123
```

Both user name and password may be up to **63 characters** long, **Case is significant**.

### 3.4. Direct Serial Connection From Windows 95

It is common to need to connect to 2netweb using a direct connection from a PC running Windows 95, using the standard Dial Up Networking components. Configuring a Windows null modem driver can be tricky, so this procedure is supplied to make the 2netweb system behave like a standard modem.

#### Windows Configuration

Assuming that Dial Up Networking is already loaded, you need to add a “Standard” modem and create a new dial-up networking connection.

To add the modem, open up the Control Panel and click on the Modems icon. Click on the “Add...” button, and in the next dialog check the box marked “Don’t detect my modem; I will select it from a list”. Click “Next” and in the next dialog select “Standard Modem Types” and from that list select “Standard 19200 bps Modem”. Select the COM port the null modem cable is connected to, and click “Next”, then “Finish”. Back in the “Modem Properties” dialog box, select the newly installed modem and click “Properties”. Drop down the list under “Maximum Speed” and select the baud rate you intend to connect at.

To create a Dial Up Network connection, click on the “Make a New Connection” icon in Dial Up Networking and select the modem you have just added. Click “Next”, and in the next dialog enter some numbers for the telephone number – it doesn’t matter what, I always use “1234”. Click “Next” and then “Finish”, and this time you really are finished.

#### 2netweb Configuration

The `pppd.cfg` file should look something like this:

## 2NETWEB User and Configuration Guide

```
COM1
57600
auth
silent
resident
asynctest 0
10.0.0.2:10.0.0.6
connect "win95.scr"
```

Note a line beginning “connect” has been added. The “connect” keyword tells pppd to run a script that emulates a modem.

### 3.5. Dial-up Connection via Modem

Normally, the system running 2netweb will be answering incoming calls originated from a client system running Windows 95 or similar.

The modem is controlled by pppd using the script specified in a “connect” statement. A typical pppd.cfg file would be:

```
COM1
57600
modem
auth
silent
resident
asynctest 0
10.0.0.2:10.0.0.6
connect "answer.scr"
```

The only difference here is that “local” has been replaced by “modem” to indicate that the modem status lines are to be monitored. The script file “answer.scr” supplied with 2netweb contains the following modem commands:

```
ABORT ERROR ABORT BUSY ABORT 'NO DIALTONE'
ABORT 'NO CARRIER'
REPORT CONNECT
TIMEOUT 60
'' ATZ
OK AT&F
OK AT&C1
OK ATS0=2
OK ''
RING
'' CONNECT
```

This will reset the modem and set it into auto answer mode at the beginning and every time the link is closed or dropped unintentionally.

### 3.6. Keywords Used In Pppd.cfg

Key word	Description	Default
COMn	COM port to use, between COM1 and COM4, using the standard port and interrupt numbers. For non-standard configurations, use the <b>base</b> and <b>irq</b> keywords instead of COMn	COM1
base <port address>	Base port address	0x3f8
irq <irq number>	Hardware interrupt number	4
<speed>	The baud rate: 2400, 4800, 9600, 19200, 38400, 57600 or 115200. The rate to select depends on the type of UART used. The 8250 and 16550 UARTS are supported. The 8250 can only work reliably at speeds up to 9600. If in doubt, start at a low speed and work upwards.	57600
-crtsects	Disable hardware flow control (CTS/RTS)	-
xonxoff	Use software flow control (i.e. XON/XOFF) to control the flow of data to the serial port.	-
modem	Enable modem status line checks (CD and RING)	-
auth	Enable PAP authentication. The names and passwords are contained in the file <i>pppdpap.cfg</i>	-
silent	Disables active negotiation. It will remain silent until contacted	-
resident	Terminate and Stay Resident straight away. Otherwise pppd operates as a foreground application until the PPP link is established	-
dns-addr	The address of a DNS name server	-
connect "<script>"	Run the script file at start up. If <i>resident</i> , it is also run whenever the link is closed or dropped.	-
L.L.L.L: R.R.R.R	Set the local and remote IP addresses to L.L.L.L and R.R.R.R, each given in the standard dotted decimal notation.	-

#### Format of the Script File

#### ABORT STRINGS

An abort string consists of the key word ABORT followed by a string, enclosed in single quotes if it is more than one word. The aborts if one of these strings is received from the modem.



## 2NETWEB User and Configuration Guide

### REPORT STRINGS

Report strings are used to display information returned from the modem. When a string is returned from the modem which matches the report string, the string and all characters to the next carriage return are written to the console. In the example, the string REPORT CONNECT will display the speed at which the connection has been made, e.g.

```
CONNECT 28000 LAPM
```

### TIMEOUT

The TIMEOUT command sets the timeout in seconds for the next expect-send pair (see below). The default timeout is 45s.

### EXPECT-SEND PAIRS

The main part of the script consists of a number of “expect-send” pairs. It waits (for up to the current timeout value) for the “expect” string and then sends the “send” string. An empty expect string (”) indicates that nothing is expected and the “send” string is sent immediately.

## 4. Loading 2NETWEB

2NETWEB takes zero or more option flags on the command line. They are:

- b** Background mode – run in the background as a TSR. This is the default mode of operation.
- f** Foreground mode – runs as a normal DOS application.

In most cases the default operation will be used, so just type 2NETWEB.

At start-up, it first checks for a network driver. If no driver is found it reports the error message:

```
NO PACKET DRIVER FOUND
```

If a driver is found, 2NETWEB reads the 2NET.CFG file and prints out a sign-on message similar to the one below:

```
2net Embedded Control Server 2.1 build 1124 (DOS)
Copyright (c) 1999, 2000 2net Limited. All rights reserved.
Local IP: 10.0.0.2   CVP TCP Port: 80   CVP UDP Port: 80
Web files located in c:\webfiles
Running in background mode
```

### Setting the Ports For CVP

CVP messages can be sent as individual UDP datagrams or as messages over a TCP connection. Typically, UDP is used where the two nodes are on the same LAN and the likelihood of datagrams being lost or re-ordered is small. In these cases UDP is preferable because it is faster and uses fewer resources. TCP is typically used over WANs and the public Internet where UDP datagrams would be filtered out by firewalls and proxies, with the messages encapsulated as HTTP requests so they are routed just like ordinary web traffic.

## 2NETWEB User and Configuration Guide

Normally a connecting CVP node will auto-sense which transport protocol to use, trying UDP first and then falling back to TCP. You can change the ports, or disable CVP over UDP by settings in the /etc/2net.conf file.

### The [2netweb] section of the 2net.cfg file

The operation of 2NETWEB can be determined by entries in the [2netweb] section of the 2NET.CFG file.

Keyword	Description
webroot=<path>	Sets the root of the files visible to users of the server. e.g. webroot=c:\myfiles  Default: c:\webfiles
http_port=<port>	Sets the port number used for connections to the server, where <port> is between 1 and 65535. e.g. http_port=8080  Default : 80
cvp_udp_port=<port>	Sets the UDP port number used for CVP messages. <b>To prevent CVP from using UDP altogether, set to zero.</b>  e.g. cvp_udp_port=0  Default: 80
cvp_buf_len=<size>	Determines the amount of memory allocated for storing Control Variables. <size> is in Kbytes between 1 and 16. If your application requires a lot of Control Variables or if the values are long, set a larger size here. e.g cvp_buf_len=4  Default: 1
tmpdir=<path>	Sets the directory for storing temporary files created by the Remote Control Centre file upload function  e.g. tmpdir=c:\myfiles  Default: same directory as 2netweb.exe
MaxTickSlice=[1..99]	The maximum number of 55ms timer ticks the web server will run before suspending e.g. maxTickSlice=2  Default: 1
MinTickGap=[1..99]	The minimum number of 55ms timer ticks before 2netweb resumes following a suspend. e.g. minTickGap=2  Default: 1

## 2NETWEB User and Configuration Guide

<code>rcc=[ON OFF]</code>	Enable/disable the Remote Control Centre.  Default: ON
<code>ssi_vars=[ON OFF]</code>	Enable/disable Server Side Include (SSI) processing. Disabling will reduce the amount of processing required to send a Web page, since the server does not have to search for SSI tags.  Default: ON

## 5. Loading Web Pages

Creating content for the Embedded Control Server is in most respects the same as for any Web server. You can use standard HTML authoring tools and graphics packages to create attractive Web pages. There are two main restrictions: the format of the file names allowed by the DOS and the supported content types.

### File Names

DOS file names are in 8.3 format and are case insensitive. Consequently, pages, graphics, etc, must be created with names to fit this format. HTML files should end in .htm, not .html; JPEG files should end in .jpg, not .jpeg.

When getting a Web page, 2NETWEB truncates the name given to 8.3 format, so that a link to [home.html](#) will retrieve the file [home.htm](#). Likewise a link to [index-file.html](#) will retrieve [index-fi.htm](#).

Special care must be taken when loading Java applets. First, Java code is usually stored in class files with a .class extension. When copied to the Embedded Control Server, they should be given a .cla extension, and of course the class name must be 8 characters or less. It can be loaded as usual using an applet tag such as this:

```
<applet code=MyApp.class width=400 height=400></applet>
```

Beware of the way Windows 95/98 generates short file names. For example a Java class called *MyApp* will generate a class file called *MyApp.class*. Under Windows 95/98 this will have a short (8.3) name of something like *myapp~1.cla*, so if you simply copy it to a floppy and then from the floppy to the target system running DOS it will not have to right name.

The second problem with Java code is that Java development environments tend to use long names for files. A simple and efficient way round the problem is to put your code into an archive format such as Jar or Zip. Look at the documentation from your Java development environment for details of how to do it. You can then load the applet with an applet tag using the archive attribute:

```
<applet code=MyApplication.class archive=Apps.jar width=400 height=400>  
</applet>
```

### Content Types

To save space 2NETWEB recognises a small range of file types, given in the table below. While the list may seem short, it covers 99% of content relevant to embedded devices. Any file with an extension not in the list will be given the type *application/octet-stream*, that is to say it will be treated as binary data by the browser.

File extension	Content type
bmp	image/x-MS-bmp
gif	image/gif
htm	text/html
jpg	image/jpeg
pdf	application/pdf
txt	text/plain

### Default Page

If a URL ends in a slash (“/”) 2NETWEB will look for a default page named *index.htm* in that directory and return that.

## 6. Email Alerts

Email Alerts are an optional feature, implemented in 2NETWEBE.EXE. It is configured via the [smtp] section of the 2net.cfg file

### 6.1. The [smtp] section of the 2net.cfg file

Keyword	Description
smtp_host=<ip address>	The address of an SMTP gateway server, in dotted decimal format or domain name (not that if you use a domain name here you must have a nameserver configured in the [network] section).  e.g. smtp_host=10.0.0.1
smtp_port=<port number>	(Optional) The port number of the SMTP gateway server.  e.g. smtp_port=1025  Default: 25
smtp_local_id=<mail address>	(Optional). Mail address entered in the “from” field of the email.  Default: <a href="mailto:2mail@2net.co.uk">2mail@2net.co.uk</a>

Here is an example:

```
[smtp]
smtp_host=10.0.0.1
smtp_local_id=device_072@mycompany.com
```

You may also have to set a gateway address in the [network] section of 2net.cfg, see 3.2 *The [network] Section of the 2net.cfg File*.

## 7. Setting Passwords

## 2NETWEB User and Configuration Guide

There may be resources on the device that you do not want unauthorised users to access. For example you may want to limit access to the Remote Control Centre.

2NETWEB allows you to protect up to four different resources on the server with a user name and password. A resource may be a single Web page, a group of Web pages in a sub directory or a CGI application. A separate utility, *GENPASS*, is used to create and list the passwords.

### 7.1. Genpass

Use GENPASS to create the password file, PWD, and then copy PWD into the directory containing 2NETWEB.

GENPASS has two options: add a password and list all passwords. To add a password, use the format

```
genpass -a <user name> <password> <path>
```

where <user name> and <password> are strings of up to 32 characters, without spaces or punctuation, and <path> is the path part of the URL. Valid paths include

/	The whole server
/secret.htm	The single object "secret.htm"
/private	(where "private" is a sub directory from the webroot) all objects in private and sub directories of "private".
/cgi-bin/cgivend	The CGI application "cgivend"

Note that paths are specified relative to the webroot, not the root of the DOS file system, and that the path separator is a forward slash ("/"), not a back slash ("\").

To list passwords, use the command

```
genpass -l
```

When a user requests an object that requires authentication, the browser will issue a prompt. Once entered, it is valid for the remainder of the session or until another username and password are required to access a different resource.

Note that the password is stored in the PWD file in an *encoded* format, but it is not *encrypted*. Hence it is important to protect it from unauthorised access.

## Appendix A

### Null Modem Cable

The table below shows the pin to pin connections for a null modem cable suitable for a direct serial connection between two computers, using D-9 connectors.

Connector A		Connector B	
Signal	Pin	Pin	Signal
Receive Data	2	3	Transmit Data
Transmit Data	3	2	Receive Data
Data Term. Ready	4	6	Data Set Ready
GND	5	5	GND
Data Set Ready	6	4	Data Term. Ready
Ready To Send	7	8	Clear To Send
Clear To Send	8	7	Ready To Send
Ring Indicator	9	9	Ring indicator