NeXT™ Serial Port Connectivity

NeXT Technical Support Notes

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Contents

Introduction

This document provides information on how to connect peripheral devices to the serial ports of the NeXT™ Computer. There are sections for the various devices that can be connected to a serial port. Each section includes the following:

- Hardware requirements (cables, ports, settings)
- Software setup (UNIX® files, connectivity software)

For additional information, see also the following on-line UNIX manual pages:

zs(4)	Serial ports
ttys(5)	Terminal initialization data
printcap(5)	Printer capability data base
tip(1c)	Connection to a remote system
uucp(1c)	UNIX-to-UNIX copy

and the on-line NeXT documentation about serial lines and **uucp**.

The NeXT serial ports can also be used for MIDI connection. See *The NeXT System Reference Manual* for further information.

The types of cables and gender changer described in this document may be purchased at Businessland. To order any of the Businessland equipment listed below by telephone, call 1-800-551-2468.

Description	**Order No.**
Macintosh-to-modem	476-66688
Macintosh-to-ImageWriter	200-66696
Macintosh-to-ImageWriter I	200-66704
Gender changer DB25-F/F	200-93013

Warning: The Buinessland Macintosh-to-modem cable (#476-66688) listed above can only be used with some but not all modems. For example, this cable works with the Telebit™ T2500 and Hayes® Smartmodem 9600 V.32, but it won't work with the Hayes Smartmodem 2400. In order to be sure that the cable will work with a given modem, check the modem's manual to see whether or not the DSR modem signal can be controlled so that it's on only when a remote carrier is detected, and will stay on until the remote carrier drops.

Warning: If you switch from using one device to using another on a serial port, be sure that the setup is correct and that there is no **tty**, printing, or other software process running on the port. An extraneous software process can prevent the newly connected device from working properly.

Modem

The following table describes the control signals of the NeXT serial ports and the expected modem behavior.

Signal	Behavior
DTR	This signal is an output for the serial port and an input to the modem. *Serial port behavior*: The cube asserts DTR whenever the serial connection is "open." *Expected modem behavior*: When DTR is asserted, a modem should accept incoming calls. If the modem is an autodial modem, it should also accept commands when DTR is asserted. When DTR is deasserted, the modem should hang up any call in progress (both incoming and outgoing) and refuse to answer incoming calls.
DCD	This signal is an input to the serial port and an output of the modem. *Serial port behavior*: The cube allows communication to occur when DCD is asserted. When DCD is deasserted, the cube disallows communication and signals the software on the cube that the connection has been lost. *Expected modem behavior*: The modem should assert DCD only when the carrier has been sensed from a remote modem. When the connection with a remote modem is lost, it's essential that DCD is deasserted so that the software on the cube can react to the lost connection.

There are two modem flow control issues:

- The NeXT serial ports don't support hardware flow control. Because of this, modems shouldn't be configured to use hardware flow control.

- Some modems support XON/XOFF flow control. If the modem is mainly used with the UNIX **tip** command, it's preferable to enable XON/XOFF flow control on the modem. If the modem will be used mainly with **uucp** or other programs, XON/XOFF flow control on the modem should be disabled.

Hardware

Cable Macintosh®-to-modem (DIN-8 to RS-232), or wire a cable as shown in the section "NeXT-to-Modem Cable" in the Appendix

Modem Telebit, Hayes, and others

Port A or B

Note: If the Macintosh-to-modem cable doesn't work, it may be wired incorrectly; see the Appendix for details.

Software

This section explains how to set up a modem for use with the **tip** command and **uucp** software. To connect to another host using the serial ports, you can also use the Communicae™ terminal emulator. For data transfer between the NeXT Computer and another host using the serial ports, you can use the Kermit application.

1. Set the following registers on your Telebit modem with the command

   ```
   ATSn=#
   ```

   where *n* is the register number and *#* is the decimal value of the register from the table on the following page. (These are the instructions for setting the registers on a Telebit T2500 Modem; other modems should be set up similarly.) The pages referred to in the table are in the *Telebit T2500 Reference Manual* (90100-01 Rev. A).

Register	Value	Page	Explanation
S0	1	5-32	Makes modem answer on the first ring
S7	65	5-34	Wait 65 seconds for a valid carrier tone to be sent from the remote modem
S51	254	5-41	Enables modem to connect to cube at any speed, with 19200B as default
S52	2	5-42	Makes sure the modem hangs up on logout
S54	3	5-43	Prevents modem from being confused by signals
S58	0	5-45	Turns off flow control between cube and modem
S64	1	5-49	Makes modem ignore characters from cube when dialing or answering a call
S68	0	5-51	Turns off flow control between modem and cube, as port doesn't support it
S92	1	5-56	Issues PEP tones at end of search sequence, so non-PEP modems are not confused when dialing in
S110	1	5-63	Data compression is enabled provided the connection is made in PEP mode
S130	5	5-67	DSR is ON only when a carrier is detected from the remote modem
S131	1	5-67	Sets DCD only when a carrier from another modem is sensed
S255	1	5-74	Disables A/B switch and recalls user profile A on power up or reset (optional, used to make the modem more foolproof)

If you use the modem primarily at 2400 bps, the following setting is important:

Register	Value	Page	Explanation
S93	5	5-57	Allows a wider range of V.22bis modems to connect (V.32 AC transmission duration)

At the same time, due to the wide range of "style" of V.32 modems, V.32 handshake problems to the T2500 are corrected by tweaking this same parameter to a slightly higher number. Hence:

Register	Value	Page	Explanation
S93	10	5-57	Enhances purely V.32 connectivity (V.32 AC transmission duration)

Also, enabling the MNP option to allow for error checking at a different level of the protocol stack is strongly recommended. This is nonintrusive to UNIX and is often the final factor in making a solid connection at all. Remember, T2500 modems use their own packetized protocol and the V.32 units almost exclusively use MNP. Failure to enable this will cause a V.32 unit to change to a lower transmission speed.

Register	Value	Page	Explanation
S95	2	5-58	Enable automatic MNP if each supports it

Warning: If you set S92 to 1, and request that the modem start with a V.32 answer sequence, Telebits may not be able to shake hands consistently in PEP mode. The Telebit TrailBlazer™ units (in essence the same as the T2500 without the V.32 support) have been found to be very sensitive to this delay. The majority of the time, the two modems settle on using V.22 as the speed they agree on. To ensure that the calling Telebit can wait this delay out consistently, it's important that the calling modem have the S50 register set to 255 (PEP only).

2. Turn off command echo and turn on quiet mode with the commands

```
ATE0
ATQ1
```

3. Save the state of the modem with the command

```
AT&W
```

4. Print out the modem's saved configuration parameters with the command

```
AT&N
```

It should look like this if you started from the default factory configuration parameters:

```
E0 F1 M1 Q1 T V1 W0 X1 Y0 &P0 &T4     Version GA1.00
S00=001 S01=000 S02=043 S03=013 S04=010 S05=008 S06=002 S07=065 S08=002 S09=006
S10=007 S11=070 S12=050 S18:005 S25=005 S38=000
S41=000 S45=000 S47=004 S48=000 S49=000
S50:006 S51:254 S52:002         S54:003 S55=000 S56=017 S57=019 S58:000 S59=000
S60=000 S61=150 S62=003 S63=001 S64:001 S65=000 S66:001 S67=000 S68:000 S69=000
S90=000 S91=000 S92:001 S93:010 S94=001 S95:002 S96=001
S100=000 S101=000 S102=000 S104=000 S105=001
S110=001 S111=255 S112=001
S121=000 S130:005 S131:001 S255:001
N0:
N1:
N2:
N3:
N4:
N5:
N6:
N7:
N8:
N9:
```

The last registers (N0 through N9) will be different if you stored any phone numbers in your modem. If your other registers are different, you may want to reset them to the factory configuration for enhanced command mode with the command

```
AT&F0
```

(see page 5-26 of the *Telebit T2500 Reference Manual* for more information) and then start from step 2 again. Or you may want to see whether the parameters that are different matter at all by checking the manual. Things like tone versus pulse don't really matter here and are a local preference (tone dialing is indicated by the "T" in the first line of the dump; if we were in pulse mode, it would be a "P").

5. Start up the Shell or Terminal application (**su** to **root**, if you're not logged in as **root**). Use your favorite ASCII editor (for example, Edit or Emacs) and edit the **/etc/ttys** file so the line beginning with **ttyda** looks like this:

```
ttyda "/usr/etc/getty std.19200" dialup on
```

If you use serial port B, change the line beginning with **ttydb** instead of **ttyda**. Don't change **ttya** or **ttyb** at all, as you will lose the ability to both dial in and dial out. 19200 can be replaced by other standard baud rates, like 1200, 2400, 4800, or 9600. (If you change the baud rate, set register S51 accordingly.) Adding **secure** to the end of the above line allows **root** to log in on the line from an arbitrary remote site. This is a security hole. Omitting **secure** still allows **user** to log in on their account and allows them to **su** to **root**. This is a good policy, as it allows some audit trailing. You can also change **dialup** to **vt100**, if you always intend to connect with a VT100-compatible terminal program. See the UNIX manual pages for **ttys** and **tset** for more information.

6. In a Shell or Terminal window, type the command

```
kill -HUP 1
```

(Be sure to include the **-HUP**, which causes the **init** process to reread the **/etc/ttys** file and make appropriate changes to the **getty**s it has fired up. See the UNIX manual page for **init** for more information.) Or, as an alternative, you can just reboot the machine.

7. Use **/dev/cua** to dial out. See the UNIX manual page for **zs** for a detailed explanation. If you use **tip**, change **/dev/ttya** to **/dev/cua** in the **/etc/remote** file; for example, to set up an entry for a 19200 baud modem on serial port A, the **/etc/remote** file must contain the following entry:

```
a19200|a19.2|Dial-out on cua at 19,200 baud:\
        :dv=/dev/cua:br#19200:el=^C^S^Q^U^D:ie=%$:oe=^D
```

If you operate your modem at a different baud rate, change all occurrences of 19200 to the baud rate that you are using. See the UNIX manual page for **tip** (or documentation on any other communications software you'll be using).

You are ready to dial in/dial out.

Note: If the modem is being used for **uucp**, set the following register:

Register	**Value**	**Page**	**Explanation**
S111	30	5-64	The modem supports the **uucp** "g" protocol, when a connection is made in PEP mode

Note: If you are using a Telebit modem and you expect incoming calls from V.32 or "low-speed" (that is, non-PEP) modems, always connect out at the same speed at which you told **getty** to expect an incoming connection. Other modems usually won't connect at over 9600, so you may want to step **getty** down to **std.9600**. The whole problem stems from the fact that the Telebit cannot have different speeds from modem-to-modem and modem-to-cube in low-speed or V.32 mode (see page 5-41 of the *Telebit T2500 Reference Manual*). And a Telebit doesn't seem to do a reset on the cube-to-modem speed when it performs a "hard reset." A Microcom, for example, can have a 1200 baud connection to another modem but a 9600 baud connection from cube to modem. Internal buffers handle the slack. All this is really much simpler with low-speed, non-error-correcting modems.

Printer

General Printers

Hardware

Cable	Macintosh-to-ImageWriter® I, null-modem style (DIN-8 to RS-232), or wire a cable as shown in the section “NeXT Null-Modem Cable (DIN-8 to RS-232)” in the Appendix
Printer	Linotronic® and other line and Postscript® printers
Port	A or B (Port A only if a Macintosh-to-ImageWriter I cable is used; using this cable on Port B could seriously damage the printer and computer)

Software

1. Edit a copy of the file **/etc/printcap** (we’ll call it **myprintcap** in the sample below). There are some example entries for specific printers in the file. Create an entry for your printer. Here’s a sample entry for a Linotronic printer:

```
Lino300:\
    :lp=/dev/ttya:ty=L100 380:sd=/usr/spool/NeXT/Lino300:\
    :lo=/usr/spool/NeXT/Lino300/lock:note=1270 dpi:lf=/usr/adm/lp-log:\
    :af=/usr/adm/lp.acct:br=9600:rw:fc#0000374:fs#0000003:xc#0:xs#0040040:\
    :mx#0:sf:sb:if=/usr/lib/psif:of=/usr/lib/transcript/psof:\
    :gf=/usr/lib/transcript/psgf:nf=/usr/lib/transcript/psnf:\
    :tf=/usr/lib/transcript/pstf:rf=/usr/lib/transcript/psrf:\
    :vf=/usr/lib/transcript/psvf:cf=/usr/lib/transcript/pscf:\
    :df=/usr/lib/transcript/psdf:sharedTo=/dept:sharedAs=Lino_300:
```

Note: In the **lf** and **af** fields, the files named by these fields (in the above case, **/usr/adm/lp-log** and **/usr/adm/lp.acct**) have to exist; if they don’t, you’ll have to create them.

You should also modify the **daily**, **monthly**, and/or **weekly** crontab files (located in **/usr/adm**) to prevent the **lp-log** and **lp.acct** files from getting too large.

2. Delete all other entries in the file **myprintcap**.

3. In a Shell or Terminal window, **su** to **root** if you're not logged in as **root** already.

4. Load the file **myprintcap** into the local NetInfo domain.

```
niload printcap . < myprintcap
```

5. Use the PrintManager application (located in **/NextApps**) to export the printer to the NetInfo network domain if the printer can be accessed from the network.

Note: A Linotronic printer can also be configured using the PrintManager application as explained in step 2 of the LaserWriter® instructions below. Change Printer Type to L 100 380 in instruction c.

LaserWriter

Hardware

Cable	Macintosh-to-ImageWriter I, null-modem style (DIN-8 to RS-232), or wire a cable as shown in the section "NeXT Null-Modem Cable (DIN-8 to RS-232)" in the Appendix
Printer	LaserWriters with version 47 ROMs installed
Port	A or B

Software

1. Set the communications switch in the back of the LaserWriter to point at 9600.

2. Use the PrintManager application to configure the printer:

   a. Click the New button.
   b. Change the Port to either Serial A or Serial B.
   c. Change Printer Type to LaserWriter Plus.
   d. If you want to access the printer on the network, configure Access.
   e. Click OK to confirm your choice and save.

Terminal

Hardware

Cable Macintosh-to-ImageWriter I, null-modem style (DIN-8 to RS-232), or wire a cable as shown in the section "NeXT Null-Modem Cable (DIN-8 to RS-232)" in the Appendix

Terminal VT100 and other styles

Note: The VT100 **termcap** entry has been changed to support the NeXT Terminal application. See the **/etc/termcap** file for more information.

Port A or B (Port A only if a Macintosh-to-ImageWriter I cable is used; using this cable on Port B could seriously damage the terminal and computer)

Software

1. Edit the file **/etc/ttys**. You need to **su** to **root** or log in as **root** to have superuser permission to change the file. Change the line starting with **ttya** if you use serial port A, otherwise change the line starting with **ttyb**. The line should look like this:

```
ttya "/etc/getty std.9600" vt100 on
```

Change 9600 to the baud rate that you want to connect to your terminal—for example, 19200, 4800, or 2400. Check in the file **/etc/gettytab** for a corresponding entry. **vt100** indicates the terminal type. Change this field according to the terminal you use. Look in the file **/etc/termcap** for all possible values.

2. In a Shell or Terminal window, type

```
kill -HUP 1
```

(Be sure to include the **-HUP**.) Or, as an alternative, you can just reboot the machine.

3. Once your terminal is plugged in, you should see a login prompt on its screen.

4. If you see strange characters on the screen or you don't see a prompt, then the baud rates, parity, or terminal types in **/etc/ttys** and in your terminal setup might not match. Check the **/etc/ttys** file and the setup on your terminal. See the UNIX manual pages for **getty**, **gettytab**, and **ttys** for more information. Also consult the terminal manufacturer's documentation.

5. The device driver uses the following characteristics:

word length	7 bits
stop bits	1
parity on output	even

For more information, see the UNIX manual page for **tty**.

Macintosh

Hardware

Cable	Macintosh-to-ImageWriter, null-modem style (DIN-8 to DIN-8), or wire a cable as shown in the section “NeXT Null-Modem Cable (DIN-8 to DIN-8)” in the Appendix
Macintosh	All models
Port	A or B (Port A only if a Macintosh-to-ImageWriter cable is used; using this cable on Port B could seriously damage both computers)

Software

For data transfer between the NeXT Computer and the Macintosh, you can use the Microphone, DataViz, or Kermit application. To use the Macintosh as a terminal for the NeXT Computer, use the RedRyder or Microphone application; follow the steps for Terminal.

IBM PC or Clones

Hardware

Cable Macintosh-to-ImageWriter I, null-modem style (DIN-8 to RS 232), or wire a cable as shown in the section “NeXT Null-Modem Cable (DIN-8 to RS-232)” in the Appendix. If the PC has a male 25-pin connector, use a gender changer (female to female, wired straight) to connect the cable.

PC IBM or clones equipped with a serial board

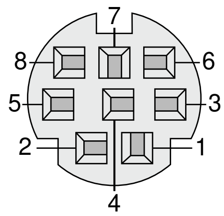
Port A or B (Port A only if a Macintosh-to-ImageWriter I cable is used; using this cable on Port B could seriously damage the PC and the NeXT Computer)

Software

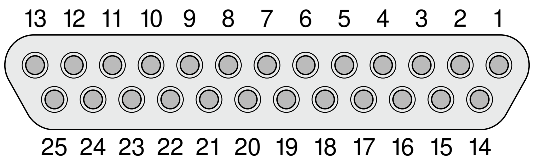
The Kermit application, or the **umodem** program (run on a NeXT Computer) and the **xmodem** program (run on a PC), can be used for file transfer. If you use a terminal program on your PC, follow the steps for Terminal.

Appendix

The DIN-8 pins are numbered in the pattern shown below. (These pin designations are the same as those of the serial ports of the Macintosh Plus and SE.) These are the pin designations for the port looking at it from the back of the cube.



The RS-232 is a 25-pin connector, numbered as shown below. These are the pin designations for the port looking at it on the device, or from the back of the connector on the cable.



Serial A and B

Serial port A is a DIN-8:

Pin	Signal	Pin	Signal
1	DTR	5	RXD–
2	CTS	6	TXD+
3	TXD–	7	DCD/RTXC
4	GND	8	RXD+

Note: Although pin 7 is labeled DCD (Data Carrier Detect), the CD (Carrier Detect) signal is actually sensed at CTS (Clear to Send) on pin 2.

Serial port B is also a DIN-8:

Pin	Signal	Pin	Signal
1	DTR	5	RXD–
2	CTS	6	TXD+
3	TXD–	7	+5 V
4	GND	8	RXD+

Note: Pin 7 is +5 V on serial port B.

NeXT-to-Modem Cable

This is the interface for a NeXT-to-modem cable, used to connect a modem to a NeXT Computer.

DIN-8		RS-232	
Pin	**Signal**	**Pin**	**Signal**
1	DTR	20	DTR
2	CTS	8	DCD
3	TXD–	2	TD
4	GND	7	SG
5	RXD–	3	RD
6		not connected	
7		not connected	
8	RXD+	7	SG

Warning: Some Macintosh-to-modem cables have pin 2 on the DIN-8 side incorrectly wired to pin 5. Pin 2 should be wired to pin 8. The cable doesn't work correctly if pin 2 is wired to pin 5.

NeXT Null-Modem Cable (DIN-8 to RS-232)

This is the interface for a null-modem style cable DIN-8 to RS-232, used to connect a terminal, LaserWriter, or PC to a NeXT Computer.

DIN-8		**RS-232**	
Pin	**Signal**	**Pin**	**Signal**
1	DTR	8	DCD
2	CTS	20	DTR
3	TXD–	3	RD
4	GND	7	SG
5	RXD–	2	TD
6		not connected	
7		not connected	
8	RXD+	7	SG

NeXT Null-Modem Cable (DIN-8 to DIN-8)

This is the interface for a null-modem style cable DIN-8 to DIN-8, used to connect a Macintosh to a NeXT Computer.

DIN-8		**DIN-8**	
Pin	**Signal**	**Pin**	**Signal**
1	DTR	1	DTR
2	CTS	2	CTS
3	TXD–	5	RXD–
4	GND	4	GND
5	RXD–	3	TXD–
6		not connected	
7		not connected	
8		not connected	

Document Revision Notes

This document is revised from time to time. The following lists the release date of each version of this document, and the changes from the previous version.

Date	**Changes from last version**
February 28, 1990	Created
April 5, 1990	Technical clarifications on the Businessland Macintosh-to-modem cable and the Linotronic 300 **printcap** entry example; minor formatting modifications.