Installation and Configuration for Linux

This section discusses the following topics:

- How to locate the latest version of the NS-Link device driver and related installation documentation.
- Information about NS-Link, such as:
  - NS-Link hardware, software, and device connectivity requirements.
  - IP or MAC addressing issues.
  - Overview of port sharing.
- Installation and configuration

Products Supported with NS-Link for Linux

This document discusses installing and configuring NS-Link drivers for the following hardware platforms:

- DeviceMaster® Serial Hub
- DeviceMaster RTS
- DeviceMaster PRO
- RocketPort® Serial Hub *Si*
- RocketPort Serial Hub ia

Note: *Install the NS-Link driver if you want to use DeviceMaster serial ports as native COM ports. You can also configure the ports as sockets after the NS-Link installation. If you want to configure the port for socket mode or serial tunneling, you do not need to install NS-Link. See the User Guide for your product for socket configuration information.*

Locating Hardware Installation Documentation

Use the hardware installation documentation to install the hardware before installing NS-Link. The hardware installation documentation is available on the Comtrol CD ships with your product or you can download the current version from the ftp site using the following links.

- *DeviceMaster Serial Hub User Guide* or http://support.comtrol.com/download.asp?partnumber=2000337
- *DeviceMaster RTS User Guide* or http://support.comtrol.com/download.asp?partnumber=2000340
- *DeviceMaster PRO User Guide* or http://support.comtrol.com/download.asp?partnumber=2000334
- *RocketPort Serial Hub ia Hardware Installation* document or http://support.comtrol.com/download.asp?partnumber=2000169
- *RocketPort Serial Hub Si 2-Port Hardware Installation* document or http://support.comtrol.com/download.asp?partnumber=2000153

Locating NS-Link Software and Installation Documentation

You can download the latest NS-Link device driver updates at no charge from the Comtrol web site at: http://support.comtrol.com/download.asp or http://support.comtrol.com/download.asp?partnumber=1800026. Always check the web or ftp sites to make sure that you have the current driver and documentation. The software files that you download from the web site are self-extracting zipped files that you must extract before installing.

NS-Link Overview

The following subsections discuss NS-Link features and topics that you may want to review before installation.

NS-Link Requirements

This subsection discusses installing and configuring the NS-Link driver. NS-Link requires at least one host running the Linux operating system (kernel version 2.2.9 or higher).

The Linux operating system is distributed from several sources. While all distributions share general file structure and functionality, there are differences that can impede the installation of device drivers. The instructions in this document outline a generic installation procedure. You may need to adjust for differences in a particular distribution using the Linux system documentation as a reference.

This document assumes that you have already installed the Linux operating system (Kernel Version 2.2 or 2.4 only) and that you have a basic understanding of Linux OS operation.

In order to build the driver, the kernel sources are required. These are located by the driver using a symlink, which points to the base of the kernel source tree. By convention, this symlink is **/lib/modules/<kernel version>/build**, which is created by all major Linux distribution, RPM installs or by running **make dep** on the source. This symlink must point to the same kernel source version as is running on the machine.

If a build symlink is not found, the driver will search for a symlink named **/usr/src/linux** pointing to the source tree. Users who have no build symlink can create this in order to build the driver.

For example, if the kernel version (**uname -r**) is 2.4.20, and the source is installed in **/usr/src/linux-2.4.20**, the alternative symlink can be created by:

```
cd /usr/src
ln -s /usr/src/linux-2.4.20 linux
```

The **nslinktool**(8) GUI administration tool requires Python 1.52 or later and Tkinter.

The **nslinkadmin**(8) program requires a kernel that supports the raw packet interface to the Ethernet device. This may either be compiled into the kernel or loaded as kernel module **af_packet**.

The **nslinkrelease.py** program requires Python 2.0 or later.

Note: *The Linux operating system is distributed from several sources. While all distributions share general file structure and functionality, there are differences that can impede the installation of device drivers. The instructions in this document outline a generic installation procedure. You may need to adjust for differences in a particular distribution using the Linux system documentation as a reference.*

NS-Link Port Names

When configured, the serial ports are accessible as Linux serial devices with **/dev/ttySI0** through **/dev/ttySI31** (depending on the model) as the port names. If you have multiple devices installed, the mapping of port names t serial ports is displayed in **/proc/drivers/nslink/status**.

Connectivity Requirements

An Ethernet connection, either to an Ethernet hub or to a network interface card (NIC) in the host system.

Product Type	Connected to	Ethernet Cable	Connector Name
DeviceMaster Serial Hub 8	NIC	Standard	DOWN
	Ethernet hub	Standard	UP
DeviceMaster Serial Hub 16	Ethernet hub or NIC	Standard	10/100 NETWORK
DeviceMaster RTS 1	Ethernet hub or NIC	Standard	10/100 ETHERNET
DeviceMaster RTS 1 Embedded	Ethernet hub or NIC	Standard	RJ45 port (not labeled)
DeviceMaster RTS 4/8/16 with external power supply	NIC	Standard	DOWN
	Ethernet hub	Standard	UP
DeviceMaster RTS 16/32-port with internal power supply	Ethernet hub or NIC	Standard	10/100 NETWORK
DeviceMaster PRO 8	NIC	Standard	DOWN
	Ethernet hub	Standard	UP
DeviceMaster PRO 16	NIC	Standard	DOWN
	Ethernet hub	Standard	UP
RocketPort Serial Hub *ia*	NIC	Crossover	Network
	Ethernet hub	Standard	
RocketPort Serial Hub *Si* (2-Port)	NIC	Crossover	10/100BASE-T
	Ethernet hub	Standard	

IP or MAC Addressing Issues

IP and MAC addressing issues may affect how you configure the Comtrol device with a brief discussion of advantages of either method.

The IP addressing scheme has the following advantages:

- Uses an industry standard protocol.
- Allows you to configure systems to use ports on the Comtrol device that are outside of the host system's Ethernet segment.

Note: *This IP address must be a unique reserved IP address, do not use an address from a dynamic address pool. If necessary, see the system administrator for an IP address.*

The MAC addressing method has the following advantages:

- Simplifies implementation and ongoing support by eliminating the address administration issues inherent in network protocols. MAC addresses are predefined by Comtrol and there is no potential for an "address conflict" at setup.
- It is isolated from foreign LAN segments minimizing potential security issues.

Configuration Overview

If the Comtrol device is on the same LAN segment as the Linux server is on, then you can use either IP or MAC addressing. The network interface is normally **eth0**, unless you have multiple Ethernet cards. If you have multiple Ethernet cards, you should set the interface which is servicing the Ethernet LAN to be the same as where the Comtrol device resides.

- If the Comtrol device is on the same LAN segment as the Linux server, you can optionally use MAC addressing. During configuration use the Comtrol device's hardware address, the server's Ethernet interface, and the number of ports available on this unit.

  Note: *The MAC address is on a label on the Comtrol device and has this format:* ***00:C0:4E:##:##:##****.*

- If the Comtrol device is on a *different LAN segment* than the Linux server, then you must use IP addressing. During configuration use the Comtrol device's IP address and the number of ports available on the Comtrol device. The Comtrol device gets its IP address through the network's DHCP server or with static configuration.

Programming an IP Address

You can use either the **nslinkadmin** or **nslinktool** programs to configure IP information. See the **nslinkadmin** and **nslinktool** man pages. For additional information about these programs, see *NS-Link Requirements* on Page 2.

- **nslinkadmin**, a command-line utility used to query, erase, or set the IP address information stored in non-volatile memory in the Comtrol device.
- **nslinktool**, an X11-based GUI front-end that allows you to perform common administrative tasks related to the Comtrol device. **nslinktool** is written in Python using the Tkinter package, both must be installed to run **nslinktool**.

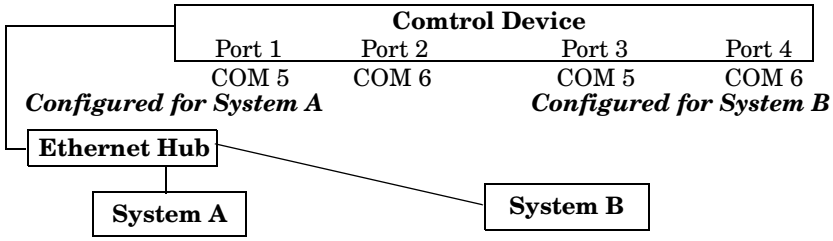
  Note: *For* ***DeviceMaster*** *models, you can also use telnet or a serial connection. See Locating Hardware Installation Documentation on Page 1 to locate the document for your product for IP programming information.*

The ports of the Comtrol device have selectable modes. You can configure each port individually as RS-232, RS-422, or RS-485 (RS-422 and RS-485 are not supported on the DeviceMaster Serial Hub). For each Comtrol device configured, you have to define the modes for the ports. This section has to immediately follow the addressing line. Define the mode for each port, even if you are only using some of the ports. The definition contains the port number of the mode (RS-232, RS-422, or RS-485).

Using the Port Sharing Feature

The Comtrol device can be shared with multiple systems on a network. To do so, follow the *Installing NS-Link* discussion for each system that you want to permit access to the serial ports.

You can implement the port sharing feature in several ways. You can share the same port with multiple systems or you can set up multiple systems to share specific ports on the Comtrol device.



Tty port names must be unique to each system.
Multiple systems can use the same tty port names.

Note: *Most applications do not release ports, so you may not be able to use port sharing across multiple systems with the same port. Also, if using port sharing, make sure that two computers do not try to access the same port at the same time. Only one computer can control a given port at a given time.*

Product LEDs

Use the appropriate table to verify that your hardware was installed properly and is ready for NS-Link installation. See the hardware installation documentation (Page 1) if you need to install the hardware.

- *DeviceMaster Serial Hub LEDs* (below)
- *DeviceMaster RTS LEDs* on Page 6
- *DeviceMaster RTS Pro LEDs* on Page 7
- *RocketPort Serial Hub ia LEDs* on Page 7
- *RocketPort Serial Hub Si LEDs* on Page 7

DeviceMaster Serial Hub LEDs

Use this table to verify that your DeviceMaster Serial Hub is ready for NS-Link installation.

Model	How to tell if the DeviceMaster Serial Hub is working properly:
DeviceMaster Serial Hub 8	• The **PWR** LED on the front of the unit is lit, which indicates it has power and has completed the boot cycle. ***Note:*** *The **PWR** LED flashes while booting and it takes approximately 15 seconds for the bootloader to complete the cycle.* • The red **LNK/ACT** LED is lit, which indicates a working Ethernet connection. • If the red **100** LED is lit, it indicates a working 100 MB Ethernet connection (100 MB network, only).
DeviceMaster Serial Hub 16	• The **Status** LED on the front of the unit is lit, which indicates it has power and has completed the boot cycle. ***Note:*** *The **Status** LED flashes while booting and it takes approximately 15 seconds for the bootloader to complete the cycle.* • The red **LNK/ACT** LED is lit, which indicates a working Ethernet connection. • If the red **Duplex** LED is lit, it indicates full-duplex activity. • If the red **100** LED is lit, it indicates a working 100 MB Ethernet connection (100 MB network, only).

DeviceMaster RTS LEDs

Use this table to verify that your DeviceMaster RTS is ready for NS-Link installation.

Model	How to tell if the DeviceMaster RTS is working properly:
DeviceMaster RTS 1-Port	• The **Status** LED on the front of the unit is lit, which indicates that it has power and has completed the boot cycle. ***Note:*** *The **Status** LED flashes while booting and it takes approximately 15 seconds for the bootloader to complete the cycle.* • The red **Link Act** LED is lit, which indicates a working Ethernet connection. • If the red **Duplex** LED is lit, it indicates full-duplex activity. • If the red **100** LED is lit, it indicates a working 100 MB Ethernet connection (100 MB network, only).
DeviceMaster RTS 1-Port Embedded	The LEDs are located between the RJ45 connector and the power terminal block. • The amber **Status** LED (**D1**) on the adapter is lit, which indicates that it has power and has completed the boot cycle. ***Note:*** *The **Status** LED flashes while booting and it takes approximately 15 seconds for the bootloader to complete the cycle.* • The red **Link Act** LED (**D2**) is lit, which indicates a working Ethernet connection. • If the red **Duplex** LED (**D3**) is lit, it indicates full-duplex activity. • If the red **100** LED (**D4**) is lit, it indicates a working 100 MB Ethernet connection (100 MB network, only).
DeviceMaster RTS 4/8/16 With External Power Supply	• The **PWR** LED on the front of the unit is lit, which indicates it has power and has completed the boot cycle. ***Note:*** *The **PWR** LED flashes while booting and it takes approximately 15 seconds for the bootloader to complete the cycle.* • The red **LNK/ACT** LED is lit, which indicates a working Ethernet connection. • If the red **100** LED is lit, it indicates a working 100 MB Ethernet connection (100 MB network, only).
DeviceMaster RTS 16/32RM With Internal Power Supply	• The **Status** LED on the front of the unit is lit, which indicates it has power and has completed the boot cycle. ***Note:*** *The **Status** LED flashes while booting and it takes approximately 15 seconds for the bootloader to complete the cycle.* • The red **LNK/ACT** LED is lit, which indicates a working Ethernet connection. • If the red **Duplex** LED is lit, it indicates full-duplex activity. • If the red **100** LED is lit, it indicates a working 100 MB Ethernet connection (100 MB network, only).

DeviceMaster RTS Pro LEDs

Use this table to verify that your DeviceMaster RTS Pro is ready for NS-Link installation.

Model	How to tell if the DeviceMaster RTS Pro is working properly:
DeviceMaster PRO 8	• The **PWR** LED on the front of the unit is lit, which indicates it has power and has completed the boot cycle. ***Note:*** *The **PWR** LED flashes while booting and it takes approximately 15 seconds for the bootloader to complete the cycle.* • The red **LNK/ACT** LED is lit, which indicates a working Ethernet connection. • If the red **100** LED is lit, it indicates a working 100 MB Ethernet connection (100 MB network, only).
DeviceMaster PRO 16	• The **Status** LED on the front of the unit is lit, which indicates it has power and has completed the boot cycle. ***Note:*** *The **Status** LED flashes while booting and it takes approximately 15 seconds for the bootloader to complete the cycle.* • The red **LNK/ACT** LED is lit, which indicates a working Ethernet connection. • If the red **Duplex** LED is lit, it indicates full-duplex activity. • If the red **100** LED is lit, it indicates a working 100 MB Ethernet connection (100 MB network, only).

RocketPort Serial Hub *ia* LEDs

Use this table to verify that your RocketPort Serial Hub *ia* is ready for NS-Link installation.

Model	How to tell if the RocketPort Serial Hub *ia* is working properly:
RocketPort Serial Hub *ia*	• The yellow **PWR** LED is flashing, which means that the device is waiting for the driver installation. ***Note:*** *If the **PWR** LED is lit, it means that the device driver has loaded.* • The green **LNK LED** is lit, which indicates a working Ethernet connection. • The yellow **ACT LED** flashes, which indicates Ethernet activity on the network.

RocketPort Serial Hub *Si* LEDs

Use this table to verify that your RocketPort Serial Hub *Si* is ready for NS-Link installation.

Model	How to tell if the RocketPort Serial Hub *Si* is working properly:
RocketPort Serial Hub *Si* 2-port	• The **Power** LED in the front of the unit is flashing, which indicates that the device is waiting for the driver installation. ***Note:*** *If the **Power** LED is lit, it means that the device driver has loaded.* • Both **10/100BASE-T** LEDs are lit, which indicates a working Ethernet connection.

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Configuring NS-Link for Linux

NS-Link Device Driver Installation and Configuration

Use this procedure to install the driver.

1. If you have not done so already, install the hardware (see *Page 1*).
2. Log into the host with root privileges.
3. If necessary, download the device driver (Page 2*)* to the **/usr/src/** directory on the Linux system. For example:

   ```
   cp 1800026H.tgz  /usr/src/
   ```

4. Change to the **/usr/src** directory and use the **tar** command to extract the files. For example:

   ```
   cd /usr/src
   tar xzvf 1800026H.tgz
   ```

   A subdirectory of **/usr/src** now exists called **nslink**, which contains the driver and associated files.

5. Change to the **/user/src/nslink** directory. For example:

   ```
   cd nslink
   ```

6. Compile the driver.

   ```
   make clean
   make
   ```

7. Install the driver as **root**:

   ```
   make install
   ```

8. Start the **nslinktool** program to edit the **nslink.conf** file as needed. **nslinktool** is an X11-based GUI front-end that allows you to perform common administrative tasks related to the Comtrol device. **nslinktool** is written in Python using the Tkinter package, both must be installed to run **nslinktool**. See *NS-Link Requirements* on Page 2 for software version information.

   Note: *See the **nslinktool** manual page for information on how to use this program.*

   Optionally, you can edit the **nslink.conf** file with any text editor.

   The network address type is the MAC address or an IP address of the Comtrol device. The following information provides you with basic information and examples of the **nslink.conf** file. See the **nslink.conf** file for detailed information.

IP Programming Example:

This example illustrates configuring a 4-Port device to use IP addressing. Ports 1 and 2 are configured to use RS-232 and Ports 3 and 4 are configured to use RS-485.

```
# /etc/nslink.conf --- configuration file for NS-Link
# IP address interface number of ports (2/4/8/16)
192.168.1.13 4
# Port Number (1-8) RsMode (232,422,485, or Off)
1  232
2  232
3  485
4  485
```

MAC Address Example:

This example illustrates configuring a 4-Port device to use MAC addressing. Ports 1 and 2 are configured to use RS-232 and Ports 3 and 4 are configured to use RS-485

```
# /etc/nslink.conf --- configuration file for NS-Link
# Ethernet MAC address interface number of ports (2/4/8/16)
00:C0:4E:07:FF:F0 eth0 4
# Port Number (1-8) RsMode (232,422,485, or Off)
1  232
2  232
3  485
4  485
```

9. If necessary, edit your **/etc/rc.d/rc.S** file (or other appropriate boot-up script) so that the **rc.nslink** script runs automatically each time your system boots.

   Note: *This is done for you automatically if you are using a system with System V* **init** *files, such as is used in the RedHat or Debian releases.*

10. Either reboot to load the driver into the currently running system, or manually load the driver by running the **rc.nslink** script with the **start** argument. For example:

    ```
    /usr/src/nslink/rc.nslink start
    ```

11. Configure your applications and/or your **getty** scripts as appropriate for your application.
12. Optionally, configure **inittab** to run the **gettys**.
13. Verify that the hardware is working properly, see *Product LEDs* on Page 5.
14. Connect your devices to the Comtrol unit.

    Caution

    The driver's default port setting is RS-232. Make sure that you do not connect devices until the appropriate port interface type has been configured in the device driver.

15. If necessary, configure your devices.

    For current information on how to configure your devices for Linux, use the http://www.tldp.org link to locate *HOWTO* documents.

Port Configuration Examples

File Transfer

You can transfer a file using the following information. The default settings are 9600, 8, n, 1.

To send a file you can redirect output to a device; for example:

```
Cat /etc/inittab > /dev/ttyR0
```

Sends the contents of the **/etc/inittab** file to the **ttyR0** device at 9600 baud, 8, n, 1.

Changing Serial Port Settings (stty)

Use the following if you need help changing or viewing the baud rate settings.

To change the baud rate, use the following example, which changes the baud rate to 19200:

```
stty 19200 </dev/ttyR0
```

To view the current serial port settings for **ttyR0**, enter:

```
stty -a </dev/ttyR0
```

Note: *Settings changes via* ***stty*** *are only valid during current log in session. For permanent setting changes, use the* ***/etc/inittab*** *file.*

Setting Up Terminals and Modems (mgetty, getty)

Add the appropriate line or lines to the **/etc/inittab** then restart:

Terminal Example:

```
T0:23:respawn:/sbin/getty -L ttyR0 57600 vt100
```

Modem Example:

```
T1:23:respawn:+/sbin/mgetty -m ‘”” AT&F OK’ -D -x9 -s 115200 ttyR0
```

Note: *If necessary, see the manual pages for more information on* ***mgetty****.*

Daisy-Chaining DeviceMaster Units (Upstream and Downstream Ports)

Some DeviceMaster models follow the IEEE specifications for standard Ethernet topologies. When using the **UP** and **DOWN** ports, the DeviceMaster is classified as a switch. When using the **UP** port only, it is a simple end node device.

The maximum number of DeviceMaster units, and the maximum distance between units is based on the Ethernet standards and will be determined by your own environment and the conformity of your network to these standards.

Comtrol has tested with seven DeviceMaster units daisy-chained together using 10 foot CAT5 cables, but this is not the theoretical limit. You may experience a performance hit on the devices at the end of the chain, so it is recommended that you overload and test for performance in your environment. The OS and the application may also limit the total number of ports that may be installed.

Following are some quick guidelines and URLs of additional information. Please note that standards and URLs do change.

- Ethernet 10BASE-T Rules
  - The maximum number of repeater hops is four.
  - You can use Category 3 or 5 twisted-pair 10BASE-T cables.
  - The maximum length of each cable is 100m (328ft).

    Note: *Category 3 or 5 twisted pair cables look the same as telephone cables but they are not the same. The network will not work if telephone cables are used to connect the equipment.*

- Fast Ethernet 100BASE-TX rules
  - The maximum number of repeater hops is two (for a Class II hub). A Class II hub can be connected directly to one other Class II Fast Ethernet hub. A Class I hub cannot be connected directly to another Fast Ethernet hub.
  - You must use Category 5 twisted-pair 100BASE-TX cables.
  - The maximum length of each twisted-pair cable is 100m (328ft).
  - The total length of twisted-pair cabling (across directly connected hubs) must not exceed 205m (672ft).

    Note: *Category 5 twisted pair cables look the same as telephone cables but they are not the same. The network will not work if telephone cables are used to connect the equipment.*
- IEEE 802.3 specification: A network using repeaters between communicating stations (PCs) is subject to the "5-4-3" rule of repeater placement on the network:
  - Five segments connected on the network.
  - Four repeaters.
  - Three segments of the 5 segments can have stations connected. The other two segments must be inter-repeater link segments with no stations connected.

    See http://www.optronics.gr/Tutorials/ethernet.htm for more specific information.

    Additional information may be found at http://compnetworking.about.com/cs/ethernet1/ or by searching the web.

Troubleshooting Linux Installations

If you are having trouble with the Comtrol device, try the following.

Note: *Most customer problems reported to Comtrol Technical Support are eventually traced to cabling or network problems.*

1. Verify that you are using the correct types of cables in the correct places and that all cables are connected securely.
2. Reboot the server.
3. Verify that the Ethernet hub and any other network devices between the server and unit are powered up and operating.
4. Isolate the unit from the network, see *Connectivity Requirements* on Page 3.
5. Use Minicom to test the serial ports. Make sure that you configure the serial ports in the Minicom setup. For example, **A - Serial Device: /dev/ttySI0**.
6. Verify that the unit is powered on.
7. Verify that the network (MAC) address in the driver matches the MAC address on the Comtrol device.
8. Verify that the network IP address is what the Comtrol device acquired from the DHCP server or was manually entered. If you are using IP addressing, the server should be able to ping the Comtrol device.
9. If you have a spare unit, try replacing the unit. If this corrects the problem, the Comtrol device that you have removed from service may be defective or in need of repair.
10. Remove and reinstall the driver.

Technical Support

If you need technical support, contact Comtrol using one of the following methods.

Contact Method	Corporate Headquarters	Comtrol Europe
FAQ/Online	http://support.comtrol.com/support.asp	
Downloads	http://support.comtrol.com/download.asp	
Email	support@comtrol.com	support@comtrol.co.uk
Web site	http://www.comtrol.com	http://www.comtrol.co.uk
Fax	(763) 494-4199	+44 (0) 1 869-323-211
Phone	(763) 494-4100	+44 (0) 1 869-323-220

Reporting NS-Link Bugs

Please send Linux-related bug reports to support@comtrol.com. Comtrol technical support can resolve issues related to the Comtrol hardware and Linux driver software, but given the nature of Linux and the many variant distributions available, we cannot be held responsible for the behavior of the operating system.

Trademark Notices

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