

## Chapter 3: Installing the Hardware Infrastructure

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### Chapter Overview

This chapter describes how to install the DecisioNet hardware infrastructure. This includes the following components:

- CBSs
- CBS power supplies
- Data and power cables
- Transmit and receive antennas

For information about ordering these parts, refer to Appendix A.

After the DecisioNet hardware is installed, the DecisioNet software must be configured and the site must be RF certified. For configuration information, refer to "Chapter 6: Configuring the DecisioNet System Environment" in this guide and the "Certify RF Infrastructure" section of the *DecisioNet Implementation Guide* (B005-0000-1250).

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## Installation Recommendations

- The most efficient way to install the DecisioNet hardware infrastructure is in one pass through the store. Install the CBSs, antennas, power cables, and data cables all at the same time
  - Label all cables and document labeling for future reference.
  - Neatness makes servicing the system much easier.
  - Allow slack in cables, especially in receive antenna cables.
  - Test the system as it is being installed. Refer to Chapter 7, "Testing and Troubleshooting," for information on testing.
  - Provide AC power that meets NCR requirements for the power supplies.
  - Test wiring as it is installed. Some installation problems are extremely difficult to diagnose later.
  - DecisioNet Release 3.0 requires the RF infrastructure to be connected to the site's DecisioNet Software Controller to test the infrastructure. Refer to the following for information on testing the infrastructure and site certification:
    - *DecisioNet Implementation Guide* (B005-0000-1250)
    - *DecisioNet RF Certification Utility Guide*
    - *Certification/Re-Certification Site Survey Policy* (497-0410343)
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## General Layout Instructions

- The cable length between any two devices (hub to CBS or CBS to CBS) cannot exceed 100 m (328 ft.).
- The maximum number of Ethernet levels beyond the primary CBS is three (3).
- The maximum total cable length is as follows:

Cable	Maximum Cable Length
Ethernet (primary CBS to last CBS in chain)	300 m (984 ft.)
Power supply to last CBS in the chain	162 m (532 ft.)

- Use only NCR authorized communication cable.
- Communication cables must be secure and locked into their connectors.
- The maximum number of CBSs per store is 40 except for model 7730-1013-9090 (Netherlands) which has a maximum of 12 CBSs per store.
- If the communication cable is routed through an elevator shaft, it must be in a conduit and the conduit must be connected to the building ground.
- The minimum distance between a communication cable and a fluorescent, neon, or incandescent light is 30 cm (12 in.).

**Note:** The minimum distance from red blown neon-type signs is 9.1 m (30 ft.). See the “Neon Signs” section in Chapter 2 of the *DecisioNet Implementation Guide* for information.

- All communication cable connections must be protected from electrical and mechanical deterioration. The deterioration of communication cable connections due to corrosion or electrolysis, especially in a humid or corrosive atmosphere, may result in electrical noise.

- The minimum distances between a communication cable and electrical equipment/associated power cables are as follows:

Maximum Rated Circuit Power	Unshielded Power Cables	Shielded Power Cables
1 kVA	30.5 cm (14 in.)	2.54 cm (1 in.)
2 kVA	45.7 cm (18 in.)	5.08 cm (2 in.)
5 kVA	60.9 cm (24 in.)	15.24 cm (6 in.)
Over 5 kVA	152.4 cm (60 in.)	30.48 cm (12 in.)

- All interconnecting wiring between the Ethernet hub, CBSs, and power supplies is low voltage wiring. This wiring must conform to all local and national electrical codes for the routing of commercial signal wire.
- Do not route communication cables outside the building.

## Tools and Supplies

DecisioNet infrastructure installers must have access to the tools typically found in an electrician's tool box. Additional tools and supplies an installation team may require are shown in the following table.

Tool/Supply	Quantity
Cable ties	10 per CBS
RJ45 Modular Jacks	2 per cable plus spares
Ideal Modular RJ45 crimp kit	1
Milwaukee 2.4 V low-torque electric screw driver	1
ESL removal tool	1 per installer
Lift truck	1
Ideal LinkMaster CAT5 cable tester Ideal Cat. No. 62-200	1

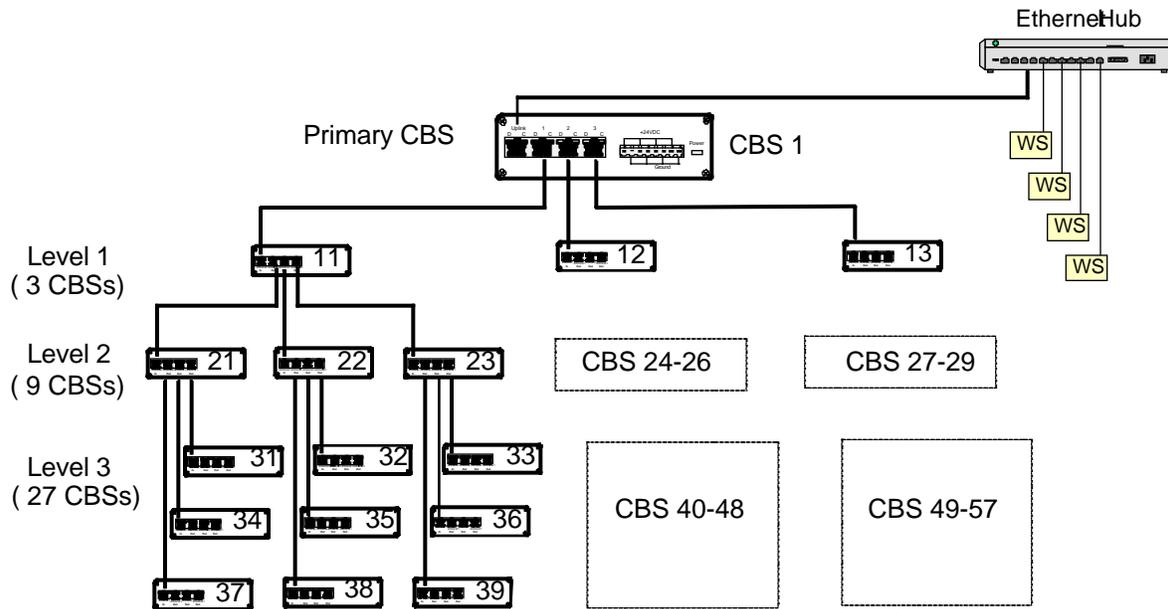
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## CBS Installation

The following sections describe the preparation, cabling, and installation of the CBS and its related components.

### CBS Ethernet Cable Connections

The Release 3.0 CBS uses a star topology and has an integrated Ethernet hub that can connect to three other CBSs. DecisioNet III supports up to three (3) levels below the primary CBS. This topology results in the 40 CBS maximum mentioned in the *General Layout Guidelines* section. The following illustration shows an example 40 CBS configuration, its Ethernet cable connections, and the maximum number of CBSs on each level.



### CBS Numbering

CBS's are identified in the CBS Manager section of the DecisioNet CBS configuration file (DNCBSCONFIG.XML) with a unique number (1-99) and a host name or IP address. Using the numbering scheme shown in the illustration helps identify the level in which the CBS is connected in the topology when running diagnostic tests and analyzing diagnostic logs. This scheme is as follows:

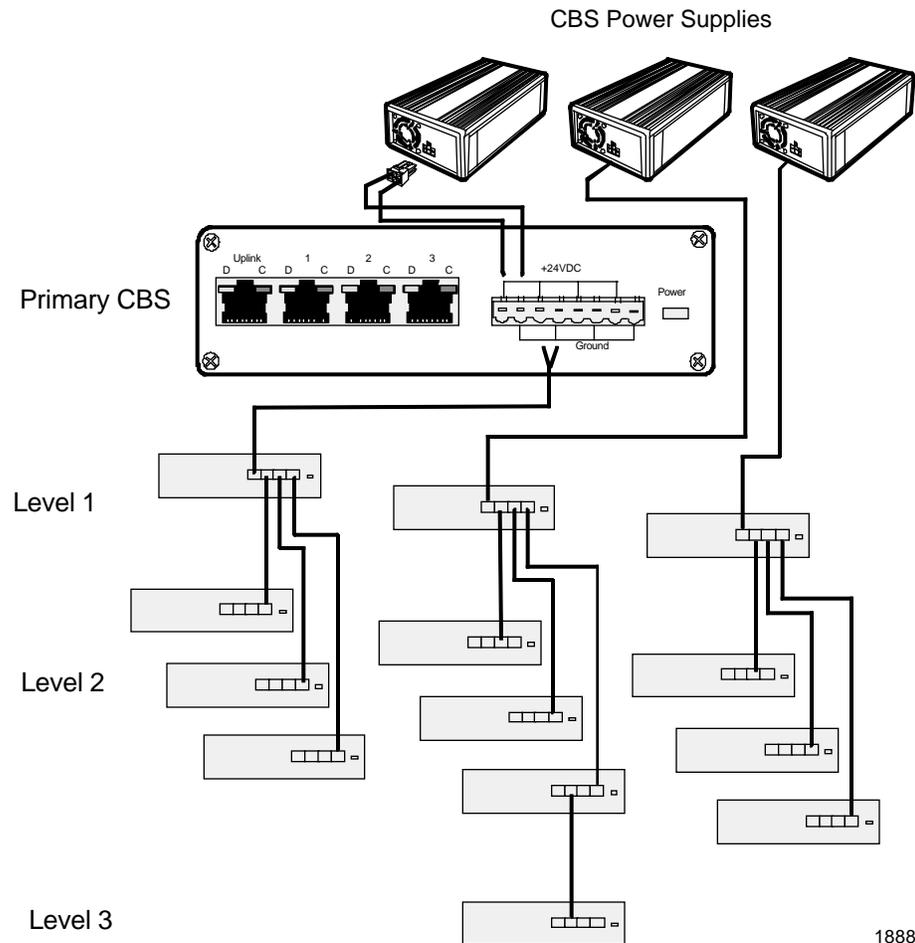
- Primary CBS = always 1
- Level 1 = CBS 11-13
- Level 2 = CBS 21-29
- Level 3 = CBS 31-57

CBS configuration details are described the "Setting the CBS IP Address" section of *Chapter 6, Configuring the DecisioNet System Environment*.

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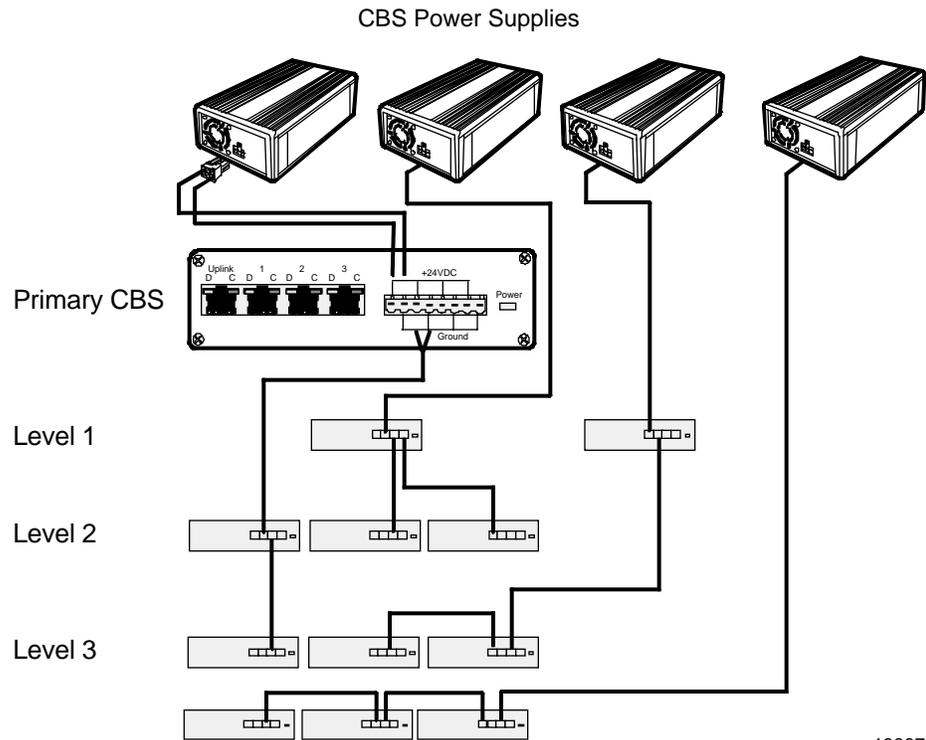
## CBS Power Supply Cable Connections

The CBS Power Supply can support up to five (5) CBSs, however, power requirements in EU/EC countries limit the number of CBSs connected to a power supply to three (3). The following illustration shows an example power supply wiring scheme for a 14 CBS non-EU/EC configuration.



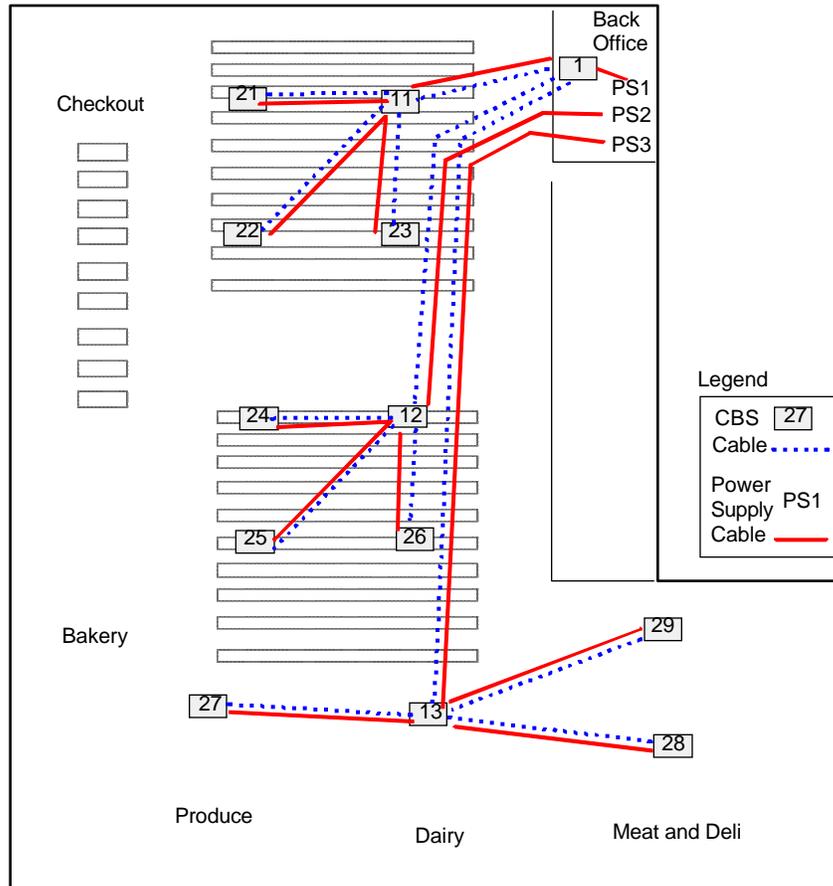
### EU/EC Installations

Power requirements in EU/EC countries limit the number of CBSs connected to a power supply to three (3). The following illustration shows power supply cable connections for a 12 CBS configuration using 4 power supplies. This cabling scheme may be extended to support 40 CBSs.



### Sample Store Cabling

The following illustration shows a non-EU/EC country store layout with 13 CBSs and 3 power supplies. Ethernet and power supply cables originate in the back office and are bundled together to accomplish this configuration.



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## CBS Cables

The following cables are supplied by NCR.

Cable ID (Part Number)	Description	Length m (ft.)	Connect From	Connect To	Comments
1424-Cxxx-0018 (230-0146539)	Transmit antenna cable (plenum rated)	1.8 (5.9)	CBS transmit antenna connector	Transmit antenna	TNC screw-on connector
1424-C057-0180 (230-0134951)	Receive antenna cable (plenum rated)	18 (59)	CBS receive antenna connector A, B, C, or D	Receive antenna	BNC connector
1416-C520-0150 (230-0134953)	Receive antenna cable (plenum rated)	15 (49)	CBS receive antenna connector A, B, C, or D	Receive antenna	BNC connector
1416-C463-9999 (497-0413234)	CBS power supply pigtail		CBS power supply	AWG 14/2 bulk cable	Included with power supply kit
Bulk cable from third-party	Power cable		CBS power supply pigtail	First of up to five CBSs	Refer to tables in next section
Bulk cable from third-party	Data cable		CBS	CBS	Refer to tables in next section

**Note:** All cables conform to type CL2P.

**Power and Data Cables**

The power and data cables must be purchased in bulk from a third party. NCR recommends using the Belden cables described in the following table. Comparable cables from other manufacturers are acceptable.

The wire colors referenced in the text and illustrations that follow are consistent with the recommended Belden cables. If you are using a comparable cable from another manufacturer, your wire colors may be different.

Cable Use	Manufacturer	Manufacturer Part Number	Description
Power	Belden	6100UE	2 conductor, 14 AWG stranded, unshielded, plenum rated
Power	Belden	5100UE	2 conductor, 14 AWG stranded, unshielded, non-plenum rated
Data	Belden	1585A	4 pair, CAT5, 24 AWG solid, unshielded, plenum rated
Data	Belden	1583A	4 pair, CAT5, 24 AWG solid, unshielded, non-plenum rated

**Note:** When installing into a plenum type ceiling, plenum rated wire may be required by local or national electrical codes. Most suspended ceilings are considered plenums; open ceilings are not. Plenum rated wire typically costs twice as much as non-plenum. Choose the correct wire type based on your applicable local and national electrical codes. For general reference, CBS wiring falls under NEC (National Electrical Code) Class 2 type.

**Power Cable Connectors**

Each CBS is shipped with a 4-wire connector that plugs into the 8-wire power receptacle. The only tool required to install the power cable into the connector is a small screwdriver.

**Data Cable Connectors**

An RJ45 connector is required for each of the CBSs data connectors. The RJ45 connectors must be purchased from a third party. A crimp tool is required to install the data cable into the RJ45 connector.

The following table provides information about RJ45 connectors and crimp tools.

Manufacturer	Manufacturer Part Number	Quantity	Description
AMP	5-557315-1	10,000 (loose)	RJ45, 8-position, unshielded type <sup>1</sup>
	5-557315-2	500 (loose)	
	5-557315-3	1,000 (10 boxes of 100)	
	5-557315-4	1,000 (40 bags of 25)	
AMP	1-231666-1	1	Crimp tool <sup>2</sup>
Ideal	33-652	1	Crimp tool <sup>2</sup>
Ideal	30-560	1	AMP die for Ideal crimp tool <sup>3</sup>

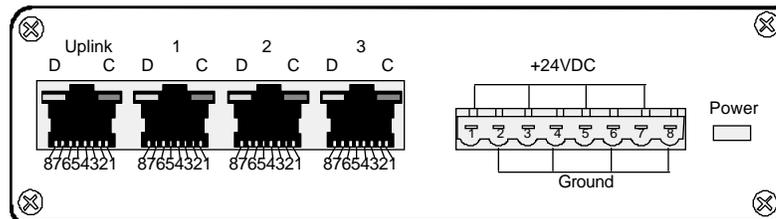
<sup>1</sup> Use any comparable RJ45 connector compatible with your crimp tool.

<sup>2</sup> Use any crimp tool compatible with your RJ45 connector.

<sup>3</sup> Necessary only when using AMP connectors and Ideal crimp tool.

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## CBS Connectors and Status Lights



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### Data Connectors

The CBS has four data connectors:

- Uplink** – used to connect the in-store hub or a higher level CBS hub
- 1, 2 and 3** – used for downlink connections to lower level CBS hubs

Data connector pin and signal use is as follows:

- Pins 1, 2, 3, and 6 carry standard Ethernet transmit and receive data between the Ethernet Hub and the primary CBS and between all CBS's as defined in ISO/IEC Standard 8802.3 paragraph 14.5.1.
- Pins 4, 5, 7, and 8 are used for DecisioNet transmit and receive timing signals between all CBS's.

### Power Receptacle

The following table provides information about the CBS power receptacle.

Pins	Description	Connection	Belden Wire Color
1, 3, 5, 7	+24 VDC	From CBS power supply to primary CBS, and CBS to CBS	White
2, 4, 6, 8	Ground		Black

### CBS Status Lights

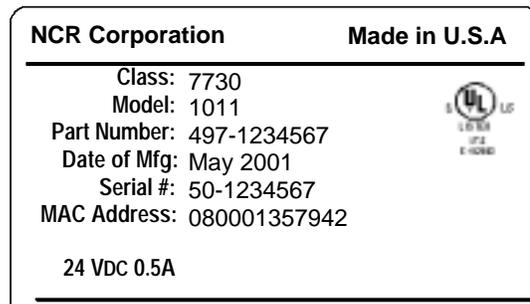
The Ethernet status lights (LEDs) are in the top corners of the data connectors. The Power status light is a red LED shown to the right of the power receptacle in the previous illustration.

The CBS status lights indicate the following conditions.

LED	State	Meaning
Power (red)	On	OK (power is on)
	Off	PROBLEM (no power)
	Blinking	PROBLEM (intermittent power)
C (green)	On	OK (good link)
	Off	PROBLEM (no link)
	Blinking	PROBLEM (intermittent link)
Ethernet link status	Off	PROBLEM (no link)
	Blinking	PROBLEM (intermittent link)
	Blinking	PROBLEM (intermittent link)
D (yellow)	On	NOT DEFINED
	Off	PROBLEM (no receive activity)
	Blinking	OK (receive activity)

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## CBS Identification



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The CBS product label identifies the model number, serial number, and unique MAC address of the CBS. The last 6 hexadecimal characters of the MAC address are used to specify the hostname for each CBS in the CBS Manager section of the DecisioNet CBS Configuration file (DNCBSCONFIG.XML). The hostname format is NCRDNETXXXXXX where XXXXXX is the 6 characters from the MAC address.

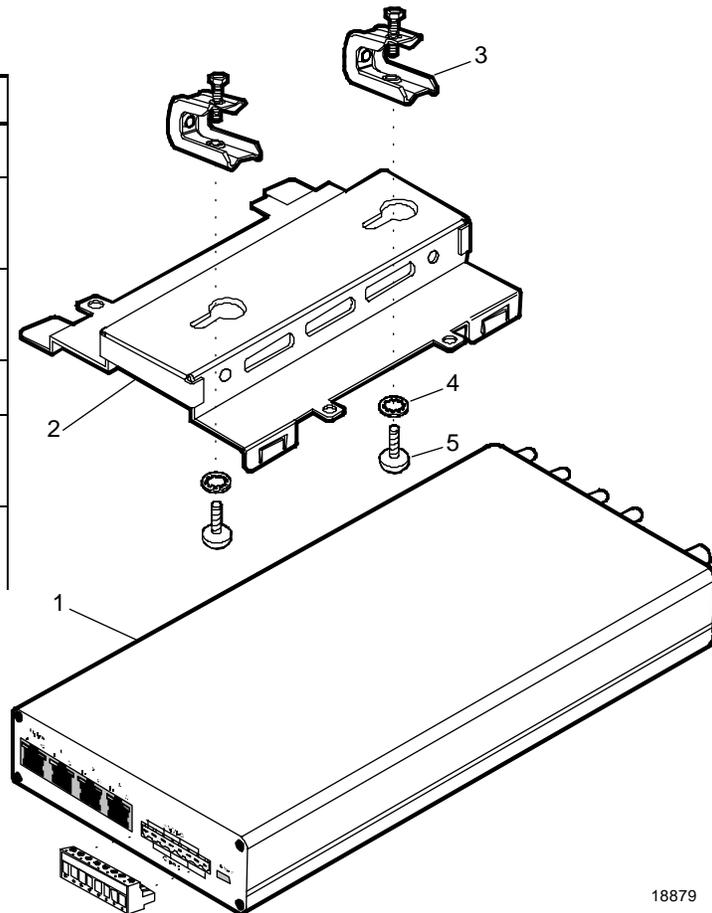
When you complete the RF infrastructure installation, you need to assign IP addresses and verify CBS communications. Refer to "CBS Hardware Configuration" section at the end of this chapter for details about assigning CBS addresses in your Ethernet network. How to enter the CBS configuration information in the CBS Configuration File is described in the "Setting the CBS IP Address" section of *Chapter 6, Configuring the DecisioNet System Environment*.

## CBS Installation

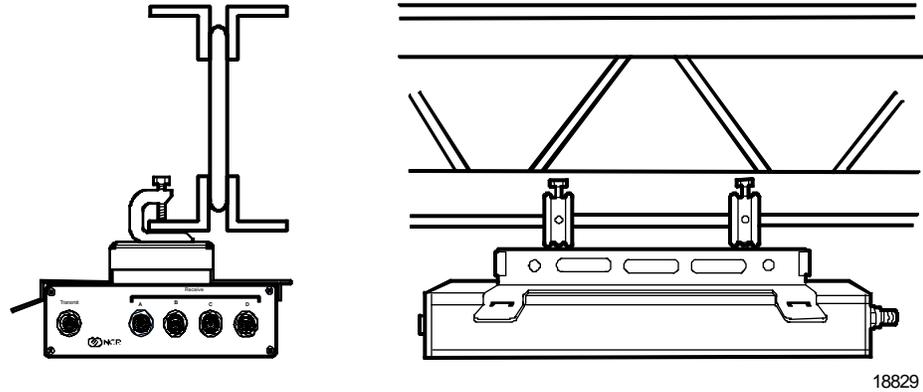
Install the CBSs at the same time you install the power cables, data cables, and antennas. The most efficient way to install the DecisionNet hardware is in one pass through the store.

The following table and illustration show the CBS and associated hardware.

Item	Quantity	Description
1	1	CBS
2	1	CBS mounting bracket
3	2	Universal beam clamp
4	2	Lock washer
5	2	Screw (1/4 -20 x 1/4 Phillips head)
6	2	Power connector (installed on CBS )



The CBS can be mounted in any position. The mounting bracket and universal beam clamps permit a wide variety of installations. Position the CBS for easy LED and connector access. The following example illustrations show a CBS mounted to a roof truss.



**Warning:** The CBS must be mounted securely and installed in accordance with local building codes. The mounting surface must be able to withstand a minimum weight of 2.26 kg (5 lbs.).

**Caution:** DO NOT install a CBS by placing it on a ceiling tile.

The following steps describe a typical installation in which a CBS is mounted to a roof truss as shown in the previous illustration.

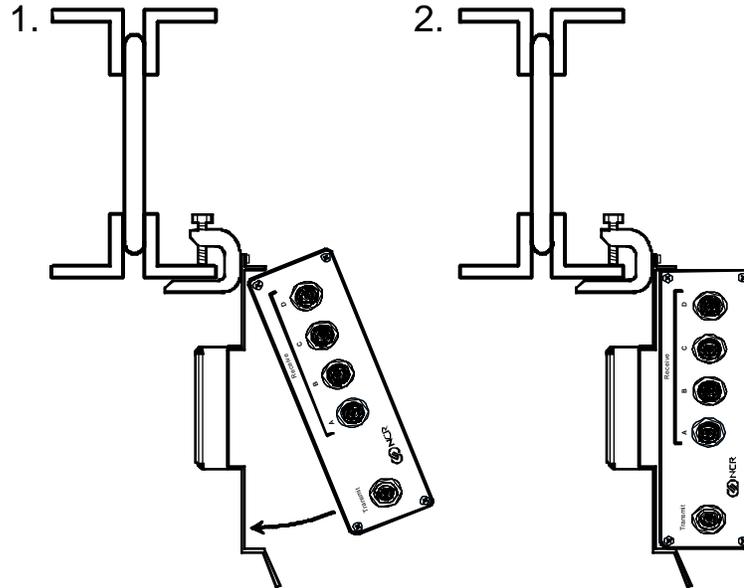
1. Use the screws and lock washers to secure the clamps to the mounting bracket.

**Caution:** Vibrations could loosen the screws holding the mounting bracket to the clamps. It is extremely important to place the lock washers on the screws before installing the screws into the clamps.

2. Position the clamps on the roof truss and tighten the clamp screws.
3. Install the CBS into the mounting bracket.

**Caution:** To prevent damage to the transmitter, the transmit antenna must be connected to the CBS before power is applied to the CBS.

### Preferred CBS Mounting Solution



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1. Attach the CBS Mounting Bracket to the universal beam clamp using the phillips head screws and the tabs on the side of the CBS Mounting Bracket.
2. Attach the clamp to the beam.
3. Insert the CBS as shown in figures 1 and 2.

## Connecting Ethernet Data Cables

From the primary CBS, a data cable connects every secondary CBS in the system as shown previously in “CBS Ethernet Cable Connections” section. Note that the Uplink data connector is used to connect to a higher level CBS and the data connectors 1, 2, and 3 are used to connect to lower level CBSs.

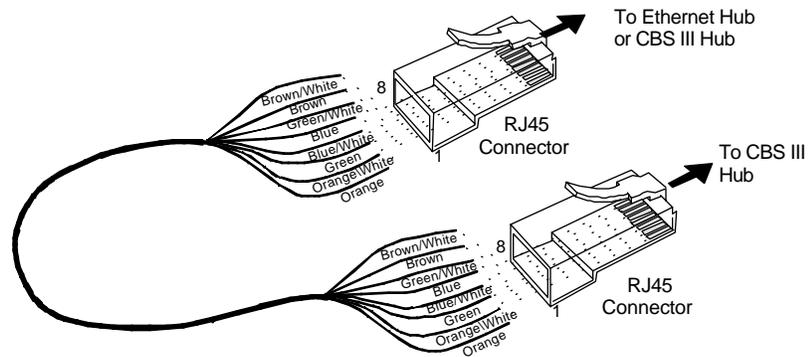
### Connecting the Ethernet Hub to the Primary CBS

Each store configuration has only one primary CBS. All other CBSs are secondary CBSs. The primary CBS is the one connected directly to the

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Ethernet Hub. Standard 4 pair, CAT5, 24 AWG solid, unshielded, plenum rated cables are required for all Ethernet communications.

1. Locate the Ethernet hub.
2. Cut a length of data cable that is long enough to reach from the hub to the primary CBS.
3. On each end of the data cable, install the wires into an RJ45 connector as shown in the following illustration and then crimp the connector onto the cable.



Note: Colors shown are for recommended Belden cables. Your wire colors may be different.

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#### *Belden Wire Colors*

RJ45 Pin	Color	RJ45 Pin	Color
1	Orange	5	Blue
2	Orange/White	6	Green/White
3	Green	7	Brown
4	Blue/White	8	Brown/White

4. Plug the data cable into the Uplink data connector on the primary CBS.

### Connecting Secondary CBSs

Follow these steps to connect the secondary CBSs:

1. Cut a length of data cable that is long enough to reach from one CBS to the next CBS.
  2. On each end of the data cable, install the wires into an RJ45 connector as shown in the previous illustration and then crimp the connector onto the cable.
  3. Plug the RJ45 connector into data connector 1, 2 or 3 and into the Uplink data connector of the next CBS.
  4. Repeat steps 1 – 3 until all secondary CBSs are linked by a data cable.
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## Connecting Power Supply Cables

Refer to the illustrations in the “CBS Power Supply Cable Connections” section. Power supply cable routing is store dependent. The power connector provides flexibility to connect additional CBSs in series from one CBS to another or in parallel from a CBS to three other CBSs.

### Connecting CBS Power Supplies to AC Power

Place the CBS power supplies with the host computer system, if possible. Plug all power supplies into a common power strip so that you can power them on and off at the same time for reset purposes.

In some cases, cable length restrictions may prevent you from installing all power supplies in the same location. In this case, you need to install a separately switched AC main circuit so that you can still control the power supplies at the same time. If local electrical codes or special circumstances require you to install more than one switched AC main circuit for the power supplies, all the main circuit switches should be in the same easily accessible location.

Do not install the CBS power supply in the ceiling.

1. Have an electrician install new AC receptacles if needed.
2. Do not plug the CBS power supply into an AC receptacle until steps 1 – 6 in the next section are complete and the transmit antenna is connected to the CBS.

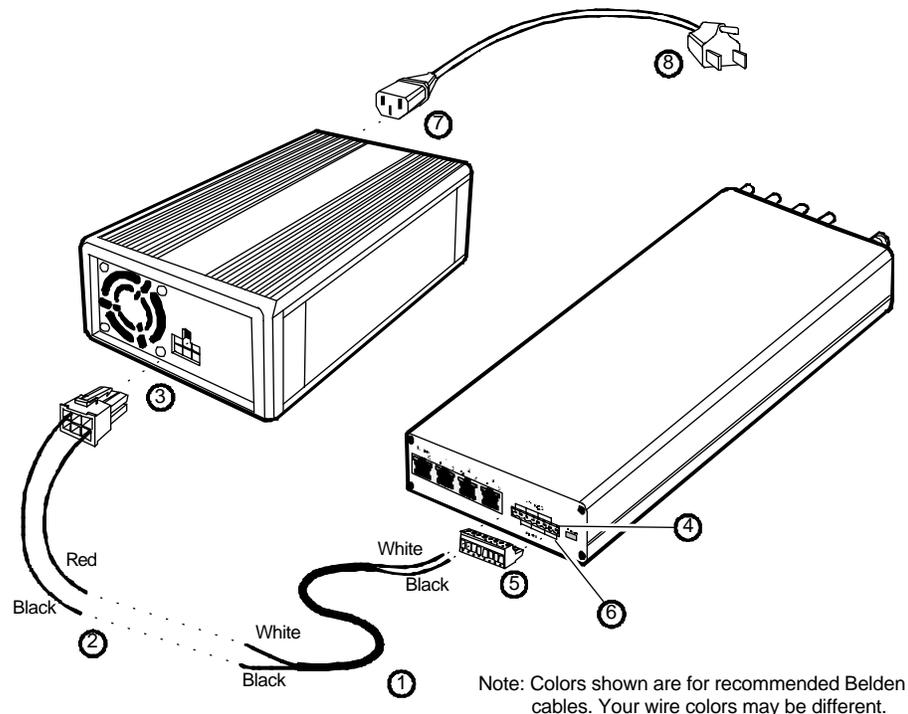
### Connecting CBS Power Supplies to CBSs

Each CBS power supply can power up to five CBSs as shown previously in the store configuration illustration. The wiring is the same for each group of up to five CBSs.

Follow these steps to connect a CBS power supply to each group of up to five CBSs:

1. Cut a length of power cable that is long enough to reach from the power supply to a CBS.
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2. Splice the power cable wires to the pigtail supplied with the power supply (black to black and red to white) and then install the provided crimp connectors over the splices.



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3. Plug the connector into the power supply.
4. On the CBS, unplug the power connector.
5. Install the power cable wires into the connector (white into pin 1, 3, 5 or 7 [24 V] and black into pin 2, 4, 6 or 8 [Ground]). Use pins in pairs: 1-2, 3-4, 5-6, 7-8 for each power cable connection at the CBS.
6. Plug the connector back into the CBS.
7. Insert the AC power cable into the power supply's AC receptacle.
8. Connect the AC plug to the AC power source.

**Caution:** To prevent damage to the transmitter, the transmit antenna must be connected to the CBS before applying power to the CBS.

## CBS Antennas

Two types of antennas are available for the CBS:

- Transmit
- Receive

The transmit and receive antennas look similar, but have the following differences:

- The transmit antenna has a screw-on reverse polarity SMA connector and uses cable 1424-C424-0018 to connect to the CBS. The other end of this cable has a reverse polarity TNC connector.
- The receive antenna has a BNC connector and uses cable 1424-C057-0180 to connect to the CBS. This cable has two BNC connectors.

**Note:** With 100 mW CBSs, a 15 m (49 ft.) receive antenna cable 1416-C520-0150 must be used instead of the usual 18 m (59 ft.) receive antenna cable.

Consider the following when installing antennas:

- Install the antennas at the same time you are installing the CBSs.
  - On a dropped ceiling, mount the antennas from the T-bars. In an open ceiling, hang the antennas from the roof trusses.
  - When mounting the antenna, face the front of the antenna (the side opposite the cable connector) towards the ESLs, with as few obstructions between it and the ESLs as possible.
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## Installing CBS Antennas

The transmit antenna and receive antenna kits include the same mounting hardware. The installation procedures for the transmit and receive antennas are the same.

### Mounting an Antenna on a T-bar

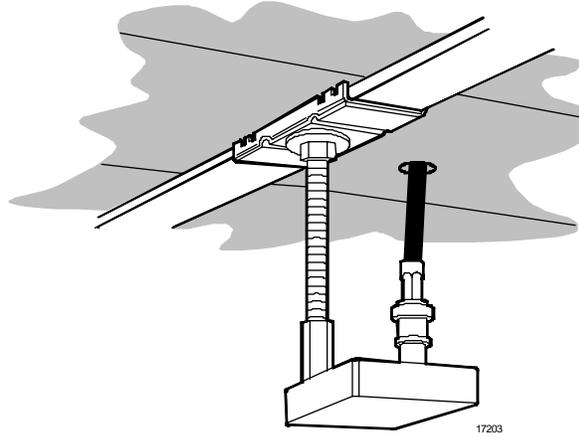
**Note:** Maintain a minimum distance of 9.2 m (30 ft.) between a CBS's transmit and receive antennas.

To install an antenna on a dropped ceiling's T-bar:

1. At the desired location, install a T-bar hanger on the T-bar.
2. Screw the antenna onto the T-bar hanger.
3. Route the antenna cable through a 13 mm (1/2 in.) hole in the ceiling tile or route it between the T-bar and the edge of the ceiling tile.

**Note:** Do not allow debris from the ceiling tile to fall into the antenna connector.

4. Install the cable onto the antenna connector.
  5. Connect the other end of the antenna cable to the CBS.
  6. Use cable ties to secure the antenna cable.
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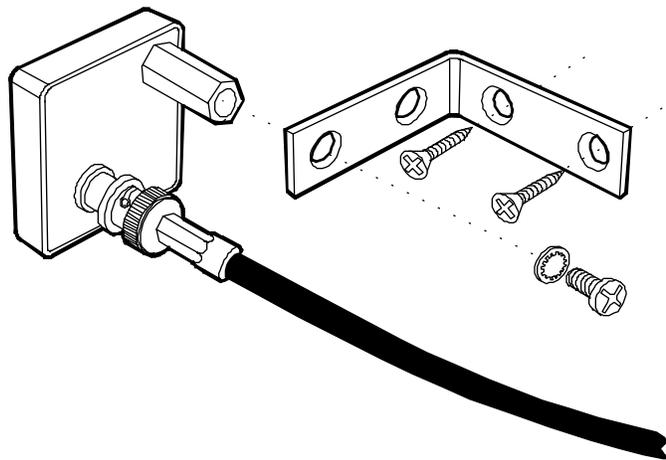
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### Securing an Antenna to a Wall

**Note:** Maintain a minimum distance of 9.2 m (30 ft.) between a CBS's transmit and receive antennas.

To install an antenna on a wall (or other flat object):

1. Place the lock washer on the bolt, put the bolt through the appropriate hole in the bracket and screw the bolt into the antenna.
2. Screw the bracket into the wall.
3. Connect the antenna cable to the antenna.
4. Connect the antenna cable to the CBS.
5. Use cable ties to secure the antenna cable to the structure.



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## Hanging an Antenna from a Roof Truss

**Note:** Maintain a minimum distance of 9.2 m (30 ft.) between a CBS's transmit and receive antennas.

To hang an antenna from a roof truss (or other object) refer to the illustration on the following page and these instructions:

1. Screw the threaded rod into the antenna.
2. Connect the antenna cable to the antenna.
3. Secure the antenna cable to the threaded rod using three equally spaced cable ties.
4. In the desired location, hold the antenna cable against a roof truss and lower the antenna to the desired height.
5. Use a cable tie to hang the antenna cable from the roof truss.

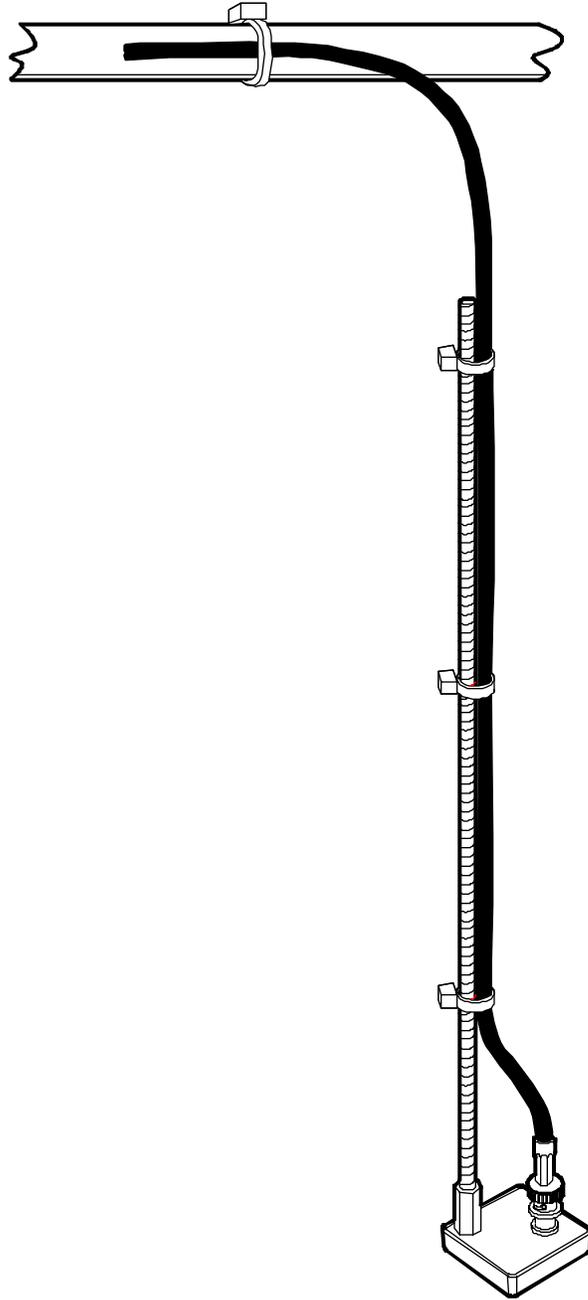
**Caution:** Antenna cables must be secured to a roof truss as shown in the following illustration. Do not allow an antenna to hang from a CBS's connector as the connector cannot withstand the weight of the threaded rod, cable, and antenna.

6. Connect the antenna cable to the CBS.
7. Use cable ties to secure the antenna cable.



**Caution:** This device is required to comply with FCC RF exposure requirements for mobile transmitting devices. A separation of 20 cm (8 inches) or more must be maintained between the antenna and all persons during device operation to satisfy RF exposure compliance.

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## CBS Hardware Configuration

After all RF infrastructure components have been installed and the Ethernet cabling and power supply cabling has been circuit tested for continuity, the system can be powered-up to establish the connection between an Ethernet network and the DecisionNet CBS units.

### Configure the DHCP Service

Obtain the MAC address from each CBS product label.

Use one of the following to obtain IP addresses for the CBS Units.

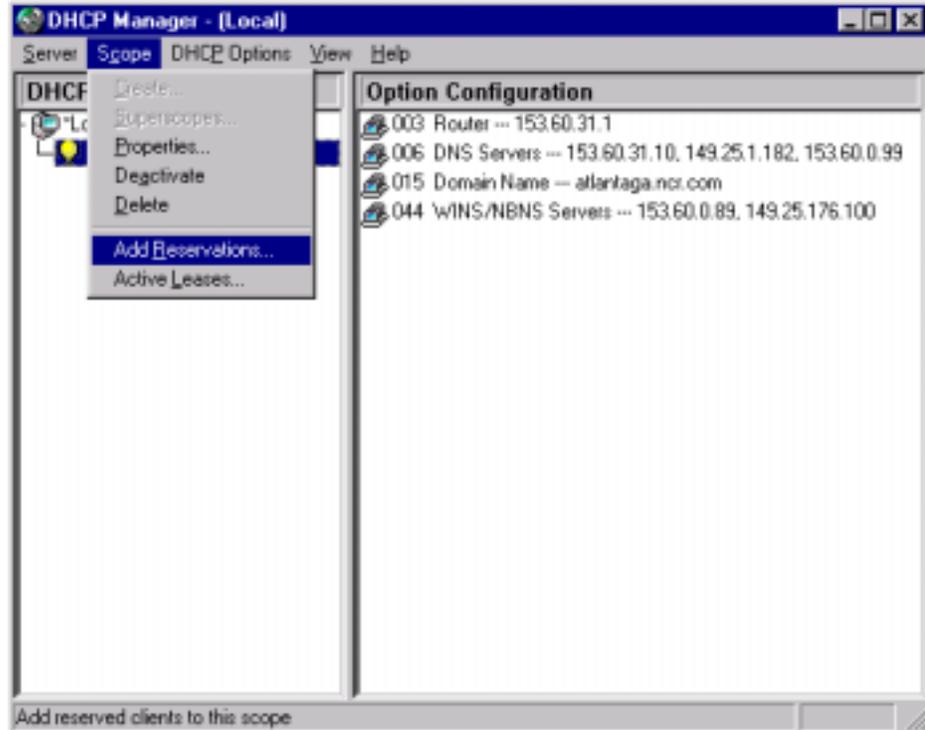
- Dynamic or automatic IP allocation where there exists an automatic DNS link.
- Manual IP allocation is there is no automatic DNS link. For these stores, a block of addresses are assigned to the site. Select a unique IP address from the site block to identify each CBS.

### Manual Allocation on a Windows NT Server

1. Start the system and Log in as Administrator.
2. Click the **Start** icon at the bottom left of the screen.
3. Select **Programs > Administrative Tools (Common) > DHCP Manager**

The *DHCP Manager (Local)* screen displays.

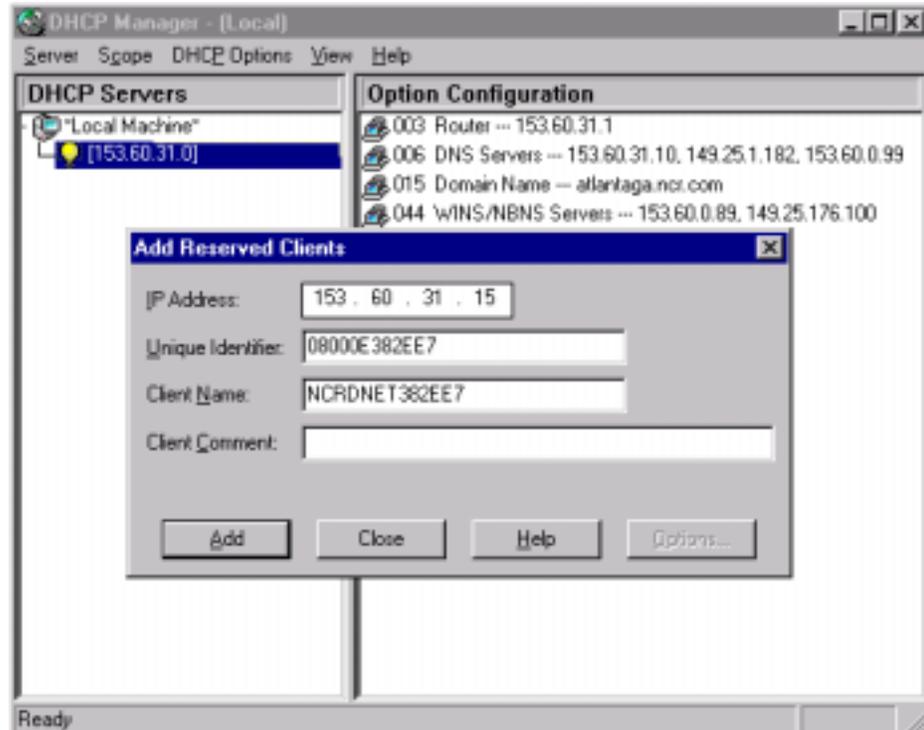
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4. Highlight the Server IP address and select **Scope > Add Reservations**.

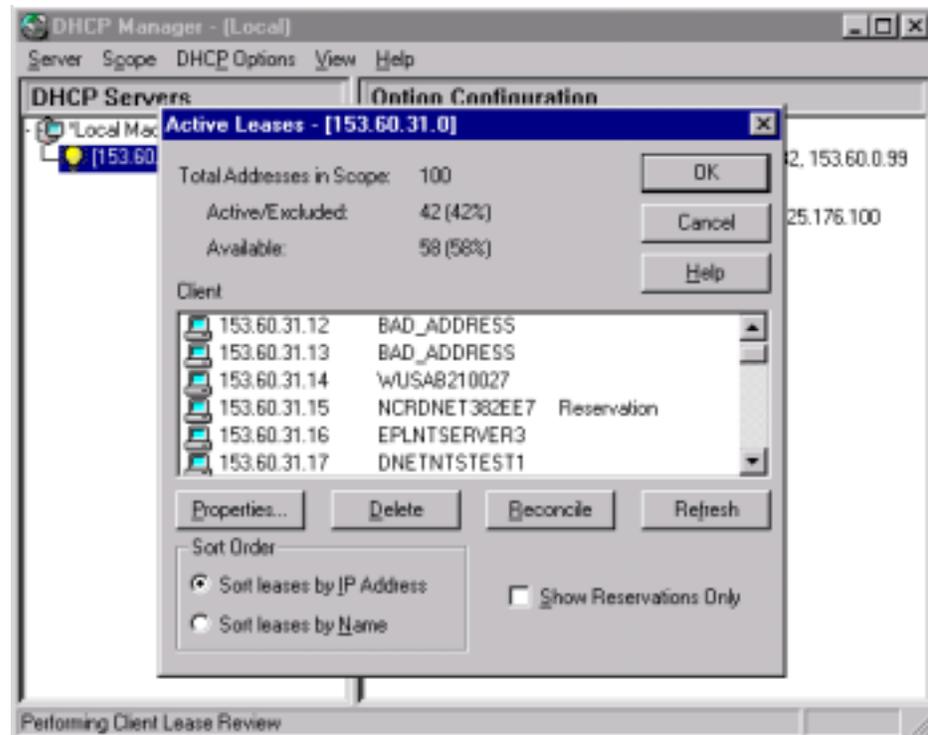
The *Add Reserved Clients* dialog displays.

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5. Enter the next available IP Address in the **IP Address** entry box.
6. Enter the MAC address from the CBS serial number label in the **Unique Identifier** field
7. Enter the DecisioNet Host Name in the **Client Name** field.
8. Click the **Add** button.
9. Repeat steps 5 - 8 for each installed CBS.
10. When finished with the last CBS, click the **Close** button.
11. On the DHCP Manager screen, highlight the Server IP address and select **Scope > Active Leases**.

The *Active Leases* dialog displays showing IP address reserved for your site.



12. Click the **OK** button.
13. Enter these IP addresses or host names in the DecisionNet CBS Configuration file. Refer to the “Setting the CBS IP Address” section of *Chapter 6, Configuring the DecisionNet System Environment*.

### Verify Communication Links

Use the following procedures to verify your communication links.

1. Power-up each CBS.
2. Verify that each CBS link status LED is lit.
3. Use the Ping utility to verify connectivity.
4. Use Notepad and view the `hosts` file in the `\WINNT\system32\drivers\etc\` directory to determine if all the CBS IP Addresses and host names are listed in the file.

### Sample HOSTS file:

```
# Copyright (c) 1993-1995 Microsoft Corp.
#
# This is a sample HOSTS file used by Microsoft TCP/IP for Windows NT.
#
# This file contains the mappings of IP addresses to host names. Each
# entry should be kept on an individual line. The IP address should
# be placed in the first column followed by the corresponding host name.
# The IP address and the host name should be separated by at least one
# space.
#
# Additionally, comments (such as these) may be inserted on individual
# lines or following the machine name denoted by a '#' symbol.
#
# For example:
#
#       102.54.94.97      rhino.acme.com          # source server
#       38.25.63.10     x.acme.com              # x client host

127.0.0.1      localhost
172.164.48.3   SERVER
172.164.48.10  NCRDNETXXXXXX
```

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