OEM628 Ethernet Configuration

Application Note

OEM628 Ethernet Configuration

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1 Overview

This application note describes how to communicate with the OEM628 receiver by sending commands and obtaining logs through *Ethernet* interface and gives the step-by-step process for connecting the OEM628 through the Ethernet interface using NovAtel CDU or terminal, setting up a base/rover configuration through Ethernet connectivity, and utilizing the NTRIP interface. PC/laptop Ethernet port connections are also described for both Windows XP (with SP3) and Windows7 operating systems.

2 Required Hardware

The following hardware is required to setup an Ethernet interface to an OEM628 unit:

- user supplied PC/laptop with an available Ethernet, serial and/or USB port
- OEM628 with an OEM628 Dev Kit, power cable and serial communication cables
- one (1) RS-232 null modem cable
- two (2) CAT5 Ethernet cables
- optional USB-to-serial adaptor
- user supplied Ethernet network, hub or wired router
- one (1) or two (2) GNSS antenna – GPS 702-GGL antennas
- one (2) or two (2) standard 5 meter 50 ohm TNC-to-TNC antenna cable

3   Static IP Address Configuration

For this configuration, unique IP addresses are assigned to both OEM628 and PC. TCP/IP will be used to for the connection in this simple network. This configuration can be used in a bench test environment to confirm Ethernet functionality. Connect the OEM628 as shown in the diagram below.
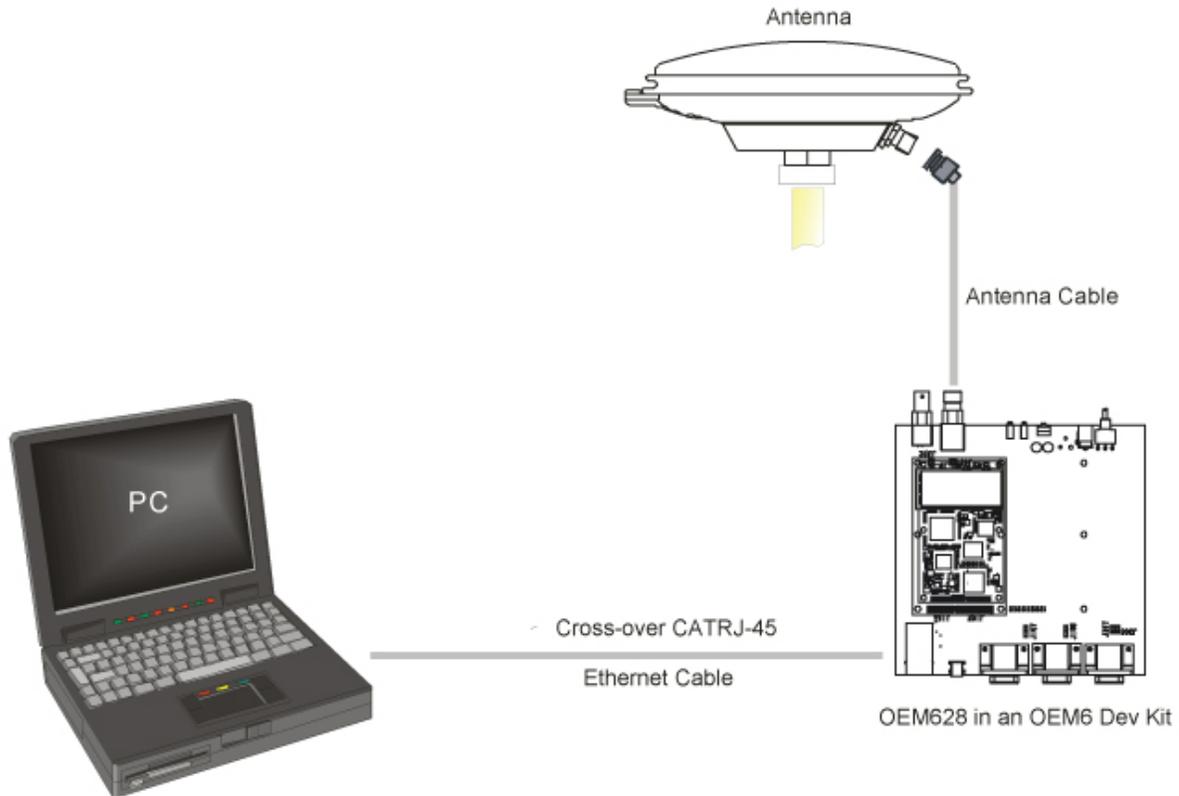

Figure 1: Cross-Over RJ45 Ethernet Cable Configuration

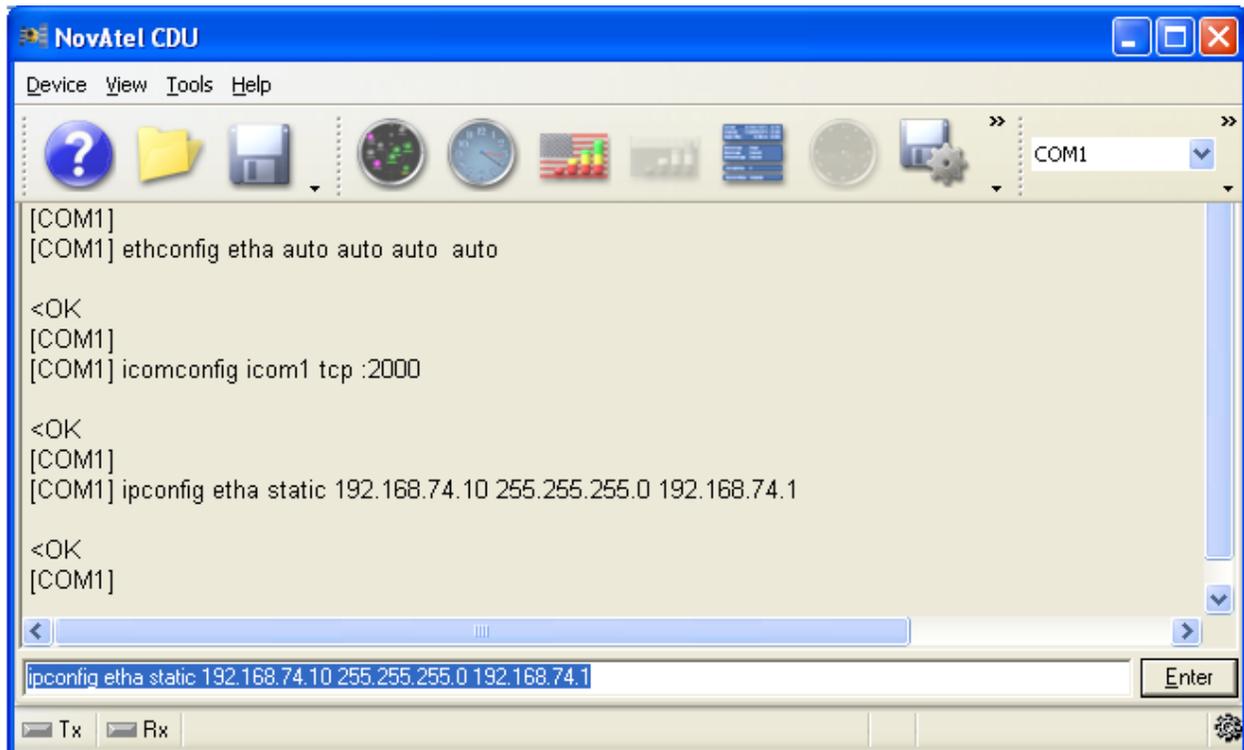**Note:**   The following static IP addresses will be assigned to the OEM628 to illustrate the setup:

```
IP address = 192.168.74.10
Subnet mask = 255.255.255.0
Gateway = 192.168.74.1
```

1. Connect to your OEM628 through a cross-over serial cable or a USB port with either NovAtel CDU or another terminal program such as Windows HyperTerminal. For more information on receiver communication, please refer to our online video tutorial *Communicating with the Receiver* found at http://www.novatel.com/support/knowledge-and-learning/video-tutorials-and-tech-presentations/.

2. Send the following commands:
```
ETHCONFIG ETHA AUTO AUTO AUTO AUTO
ICOMCONFIG ICOM1 TCP :2000
IPCONFIG ETHA STATIC 192.168.74.10 255.255.255.0
192.168.74.1
SAVECONFIG
```

Note: The receiver will echo with an `<OK` acknowledgement for each command entered.

To confirm the TCP/IP configuration, issue the following command:

```
LOG IPCONFIG ONCE
```

To configure your computer with a pre-assigned static IP address, follow the steps listed in Section 3.1 for Windows XP running Service Pack 3 or skip to Section 3.2 for Windows7.

3.1 PC Static IP Address configuration – Windows XP with SP3

Follow these steps to set up a pre-assigned static IP address. The following static IP addresses will be assigned to the PC:

```
IP address = 192.168.74.11
Subnet mask = 255.255.255.0
Gateway = 192.168.74.1
```

1. Select *START | Settings | Network Connections*.
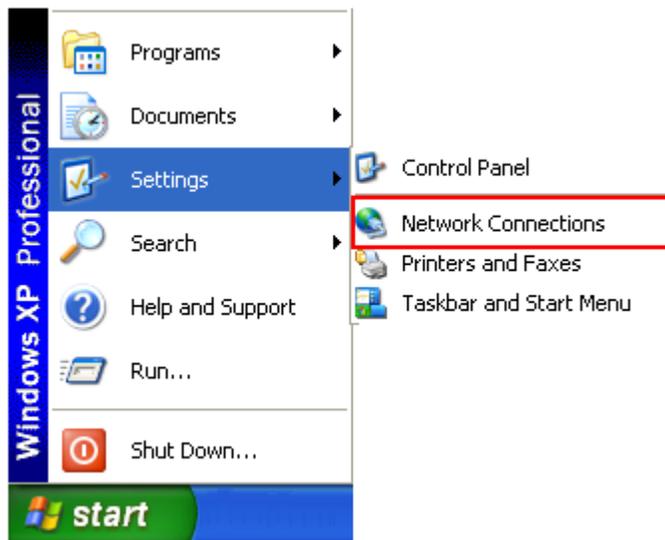
2. Right click on *Local Area Connection* and select *Properties*.
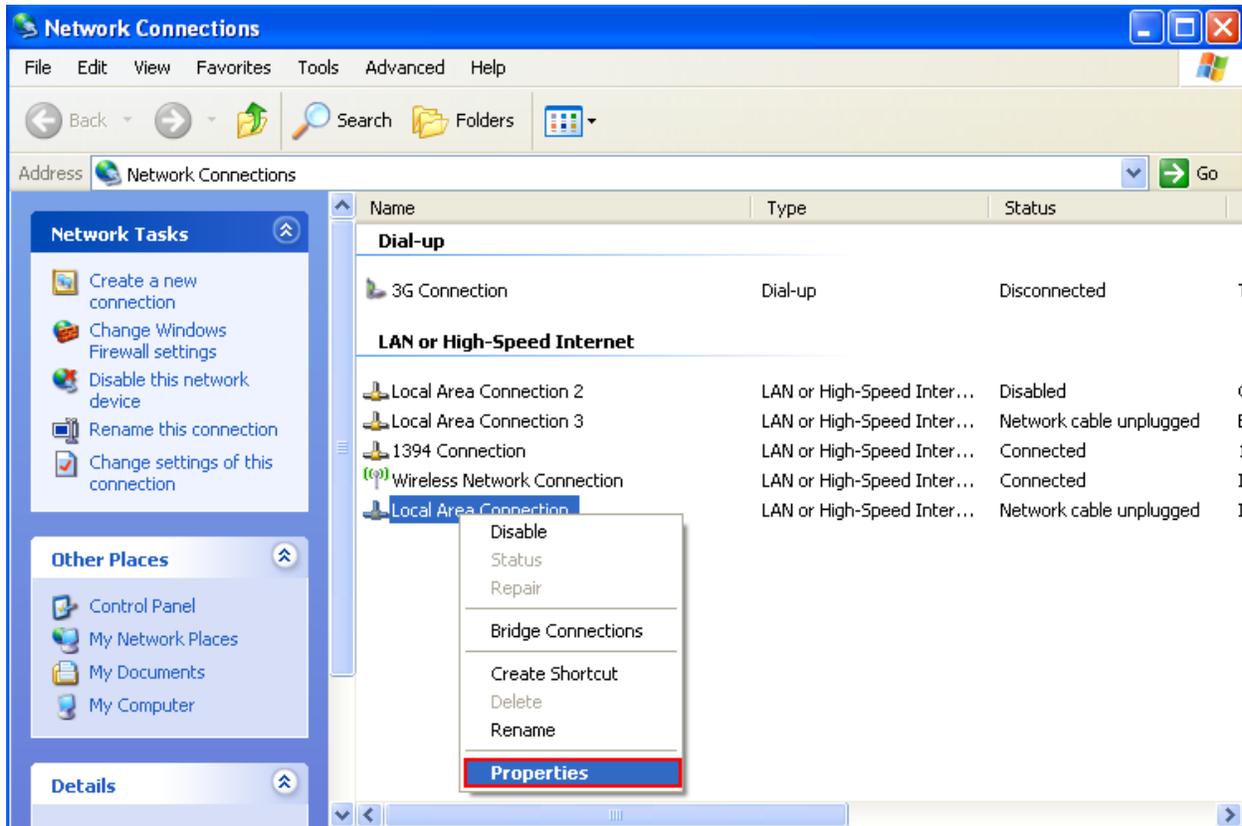
3. Select *Internet Protocol (TCP/IP) | Properties*.
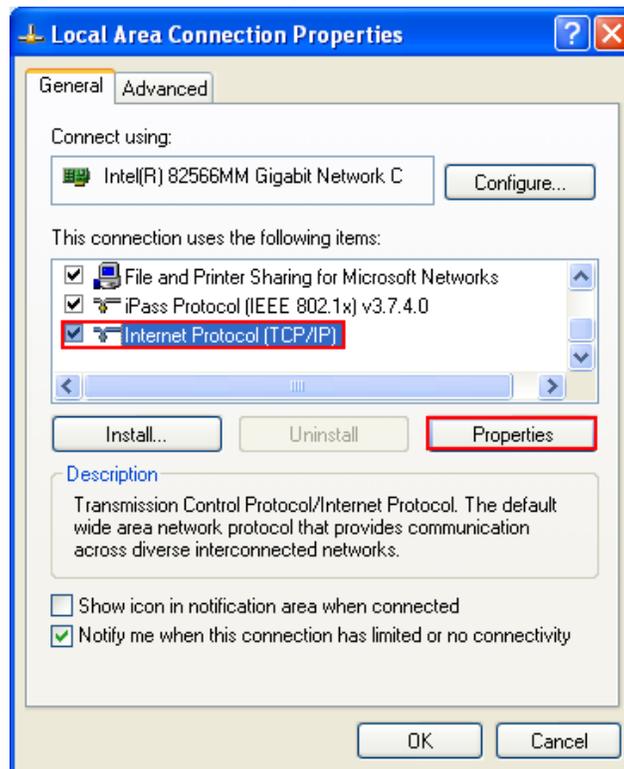
4. Define the static IP address configuration on your PC's Ethernet port, select *OK* to incorporate the settings.
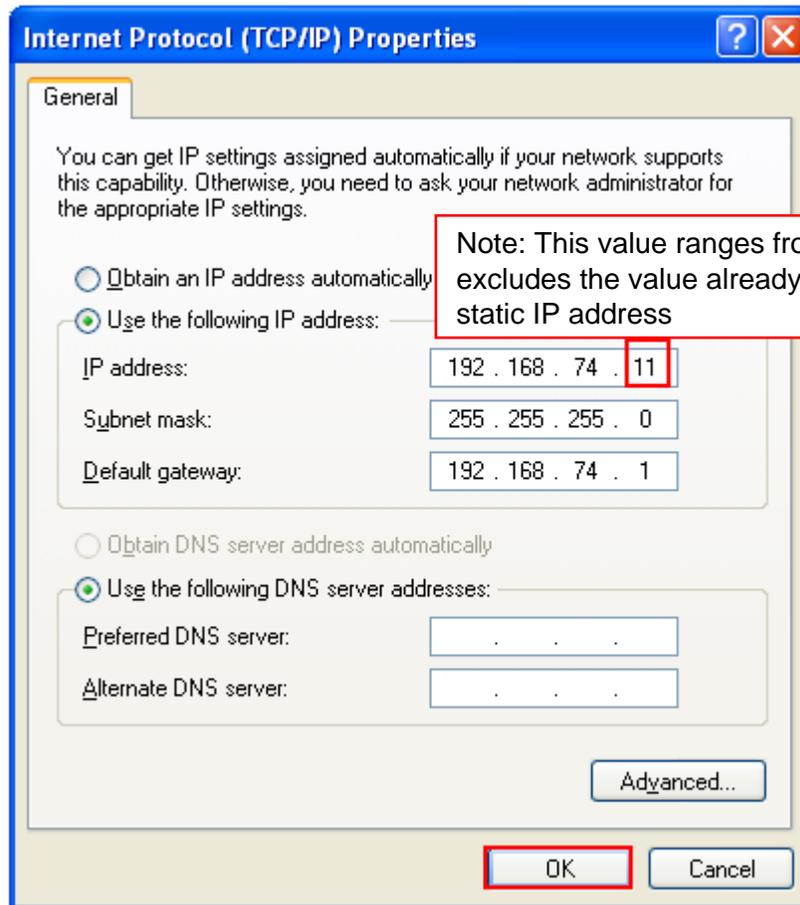
5. Click *Close* when finished.
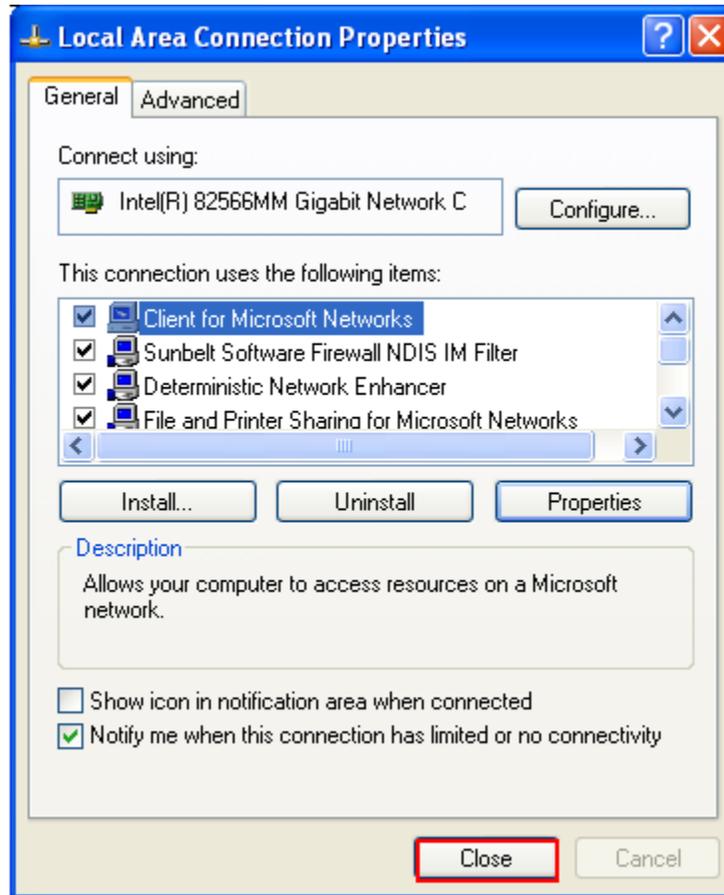
6. Once completed, please proceed to Section 3.3.

3.2 PC Static IP Address configuration – Windows 7

1. Select *Start | Control Panel*.
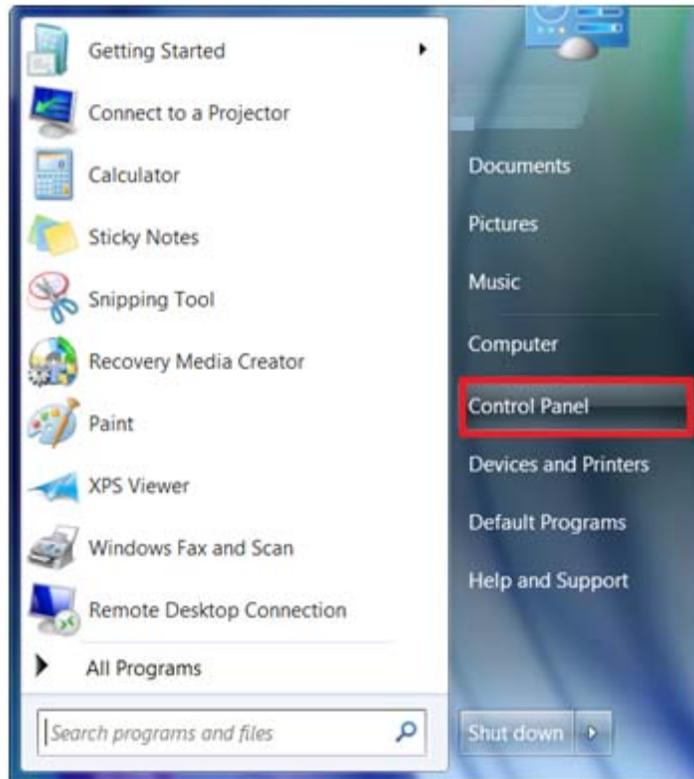
2. Select *View network status* under *Network and Internet*.
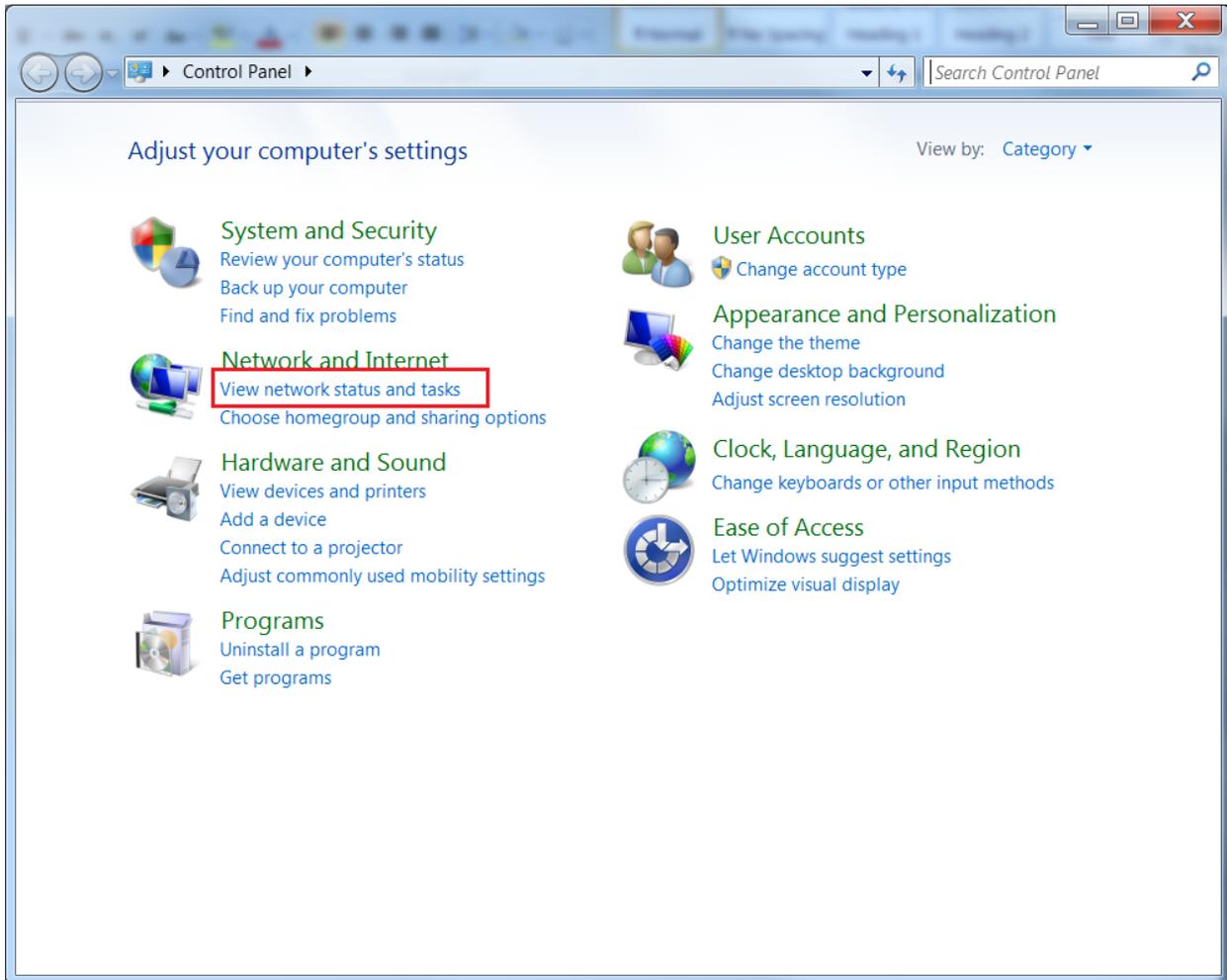
3. Left mouse click on *Local Area Connection*.
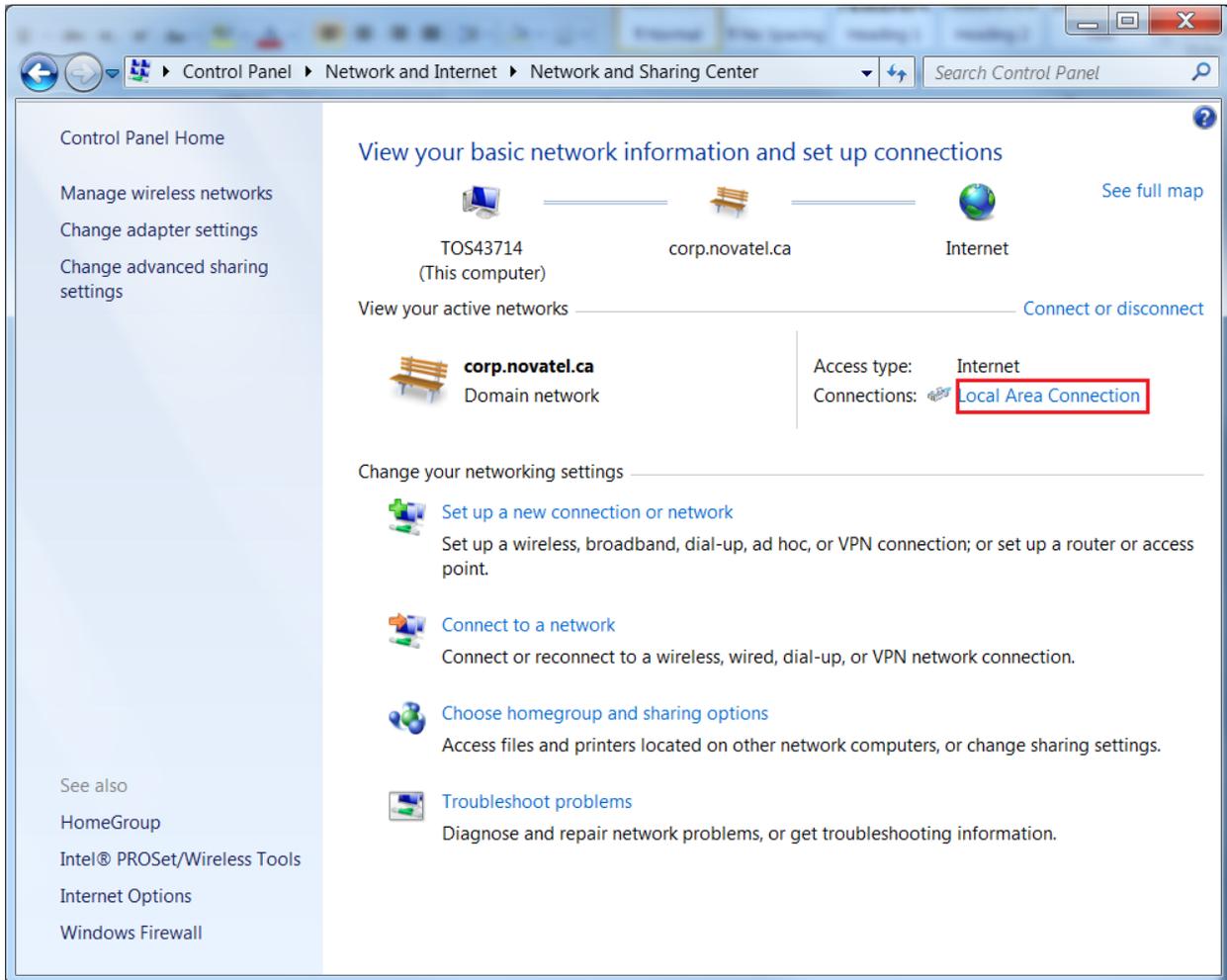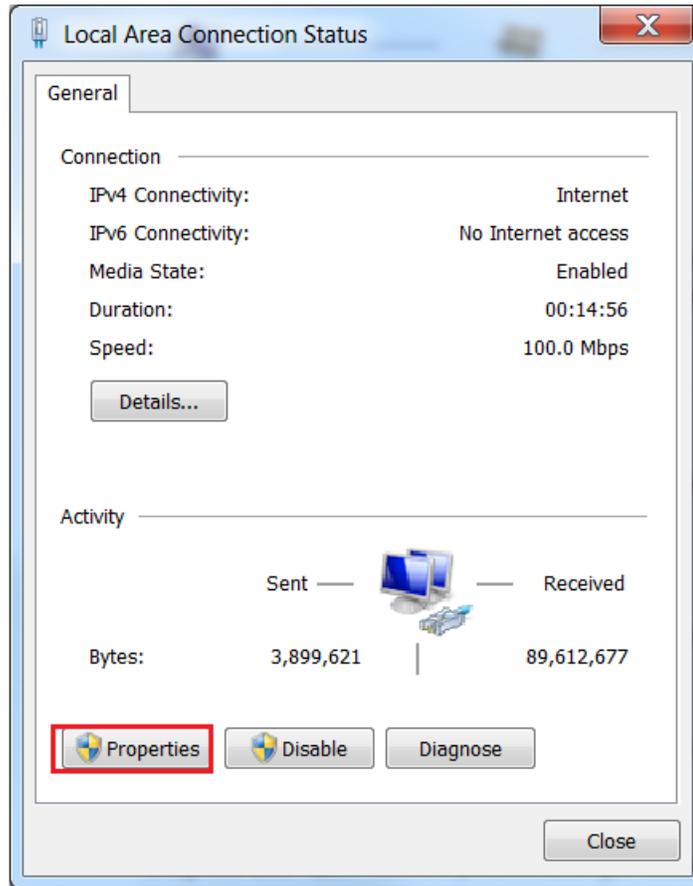
4. Click on *Properties*.

5. Select *Internet Protocol Version 4 (TCP/IPv4)* and click on *Properties*.
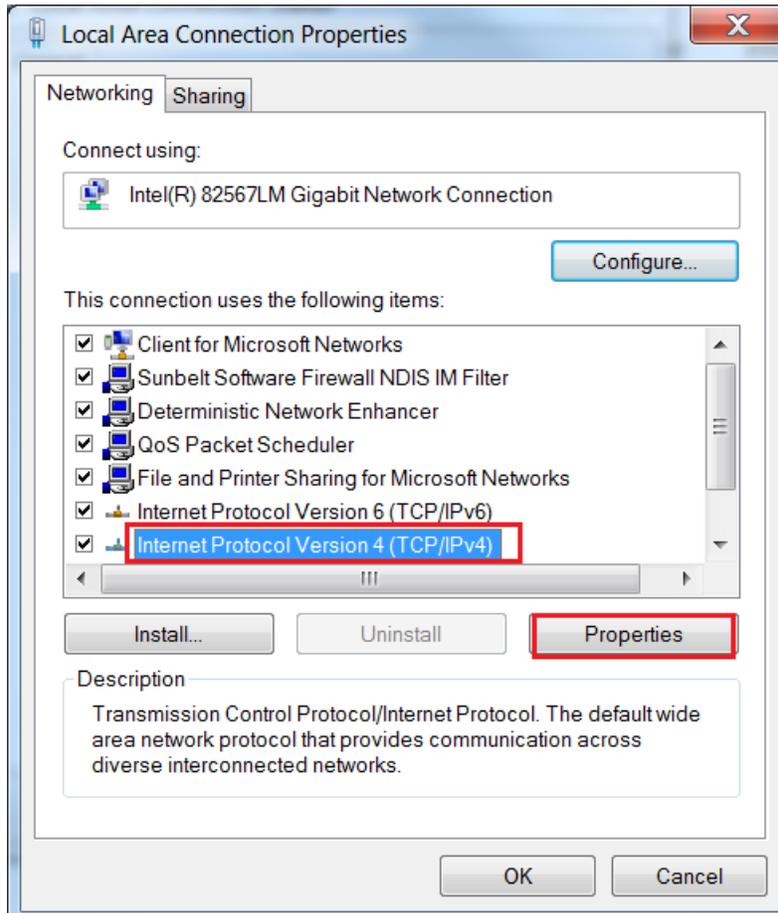
6.   Enter the following static IP addresses:

7.   Select *OK* when completed and proceed to Section 3.3.

3.3 Confirming Ethernet Setup

1. Connect using NovAtel CDU's Network connection or any third party terminal program that supports TCP/IP connections.

2. Enter the assigned static IP address and predefined port number

   Note: The port number is defined from the `ICOMCONFIG` log. ICOM1 is the assigned virtual port for Ethernet connectivity.
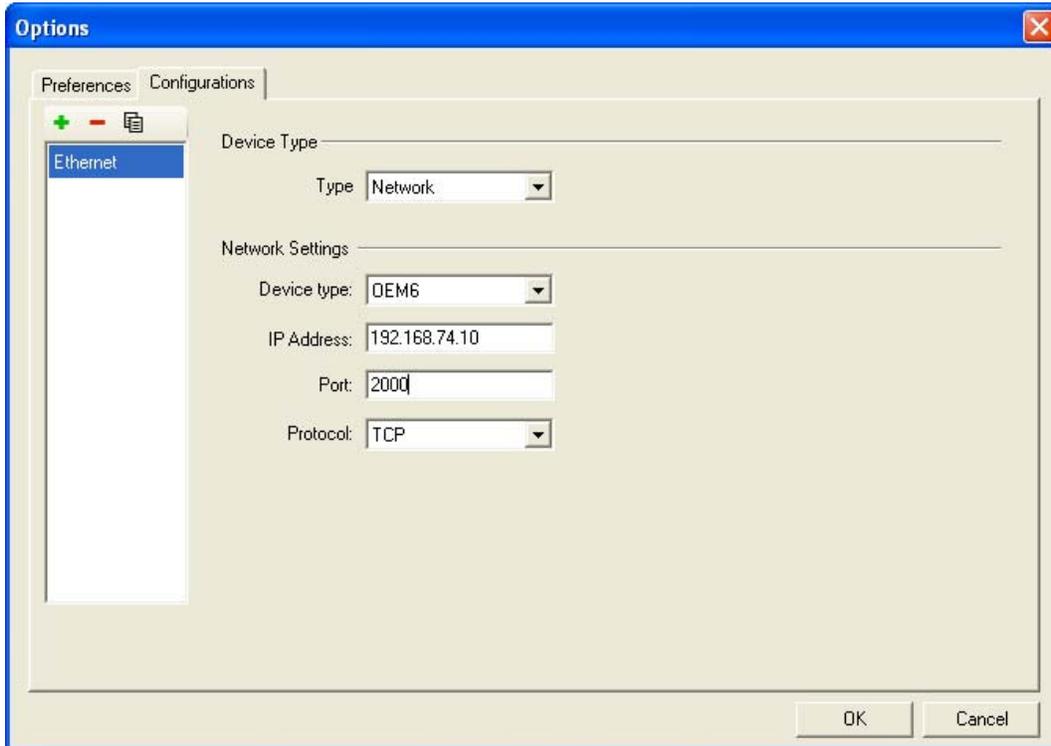
[`ICOM1`] appears in the console window when communication has been successfully established (see below).
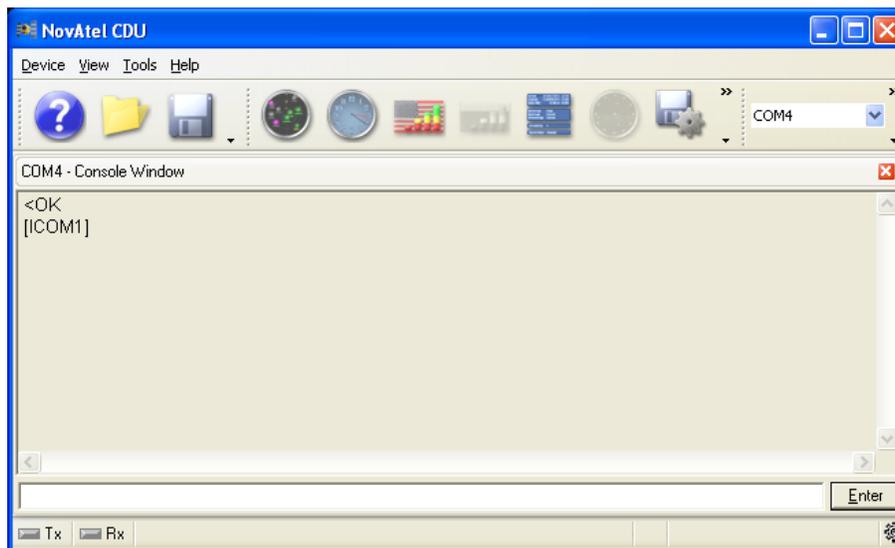
4 Dynamic IP Address Configuration

For this configuration, a direct connection is made from the OEM628 to a Dynamic Host Communication Protocol (DHCP) network and into a PC. The DHCP server will automatically assign IP addresses to the OEM628, based on its predetermined free IP addresses. Use this configuration in a bench test environment to confirm Ethernet functionality.
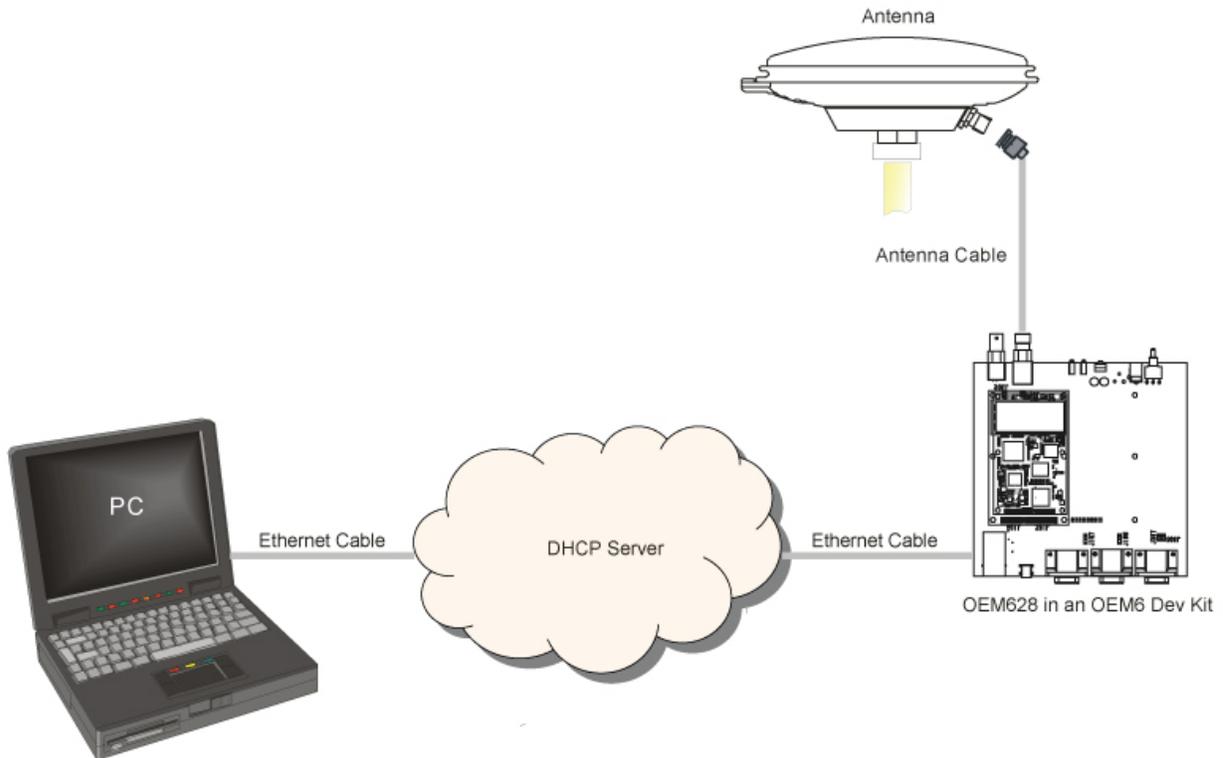
Figure 2: Dynamic IP Address Configuration through a DHCP Server

To set up a Dynamic IP Address Configuration, follow these steps:

1. Connect to your OEM628 through a serial or USB port with either NovAtel CDU or another terminal program such as Windows HyperTerminal. For more information on receiver communication, please refer to our online video tutorial *Communicating with the Receiver* found at http://www.novatel.com/support/knowledge-and-learning/video-tutorials-and-tech-presentations/.

2. Send the following commands:

   ```
   ETHCONFIG ETHA AUTO AUTO AUTO AUTO
   ```
   Note: Enable the Ethernet port after a factory reset command.

   ```
   LOG IPSTATUS ONCE
   ```
   Note: This obtains the assigned IP address to the OEM628 from the network

   ```
   LOG IPCONFIG ONCE
   ```
   Note: This command is to confirm that DHCP is enabled.
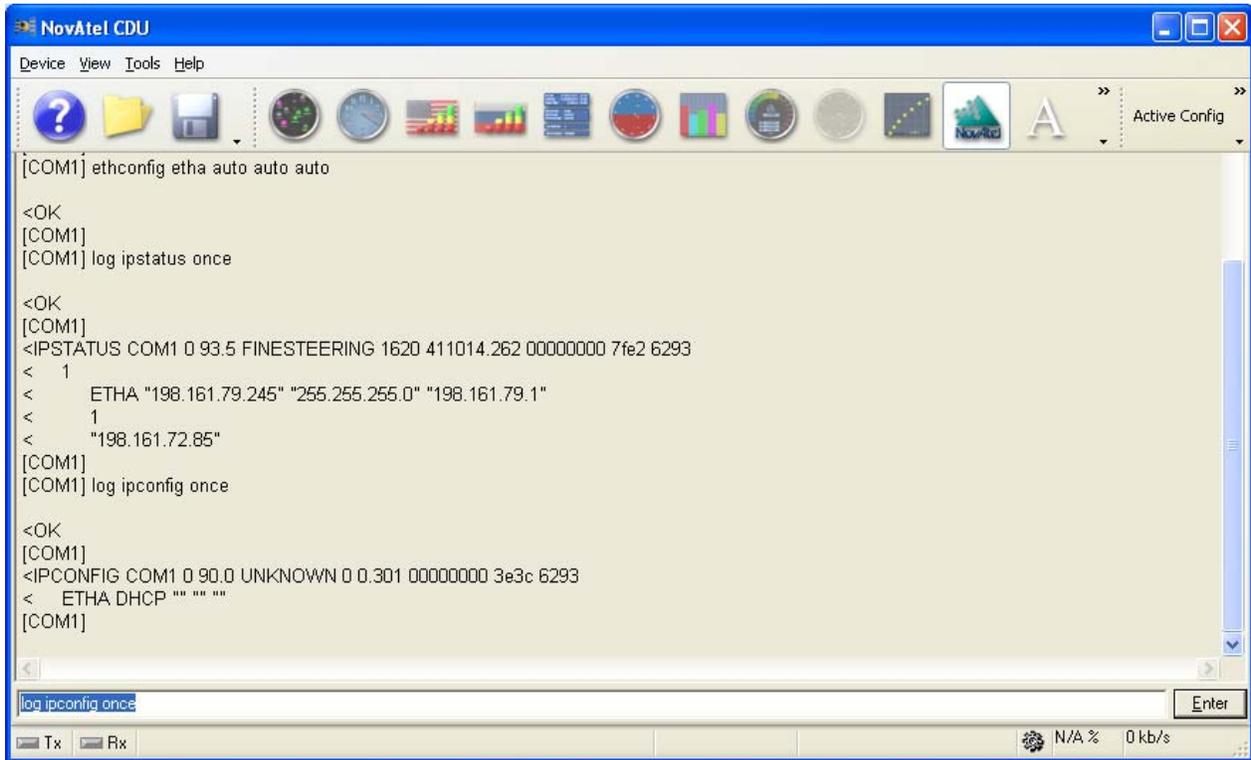
```
ICOMCONFIG ICOM1 TCP :2000
```

> **Note:** This command assigns the TCP/IP port number

```
LOG ICOMCONFIG ONCE
```

> **Note:** This command confirms the assigned port number to ICOM1
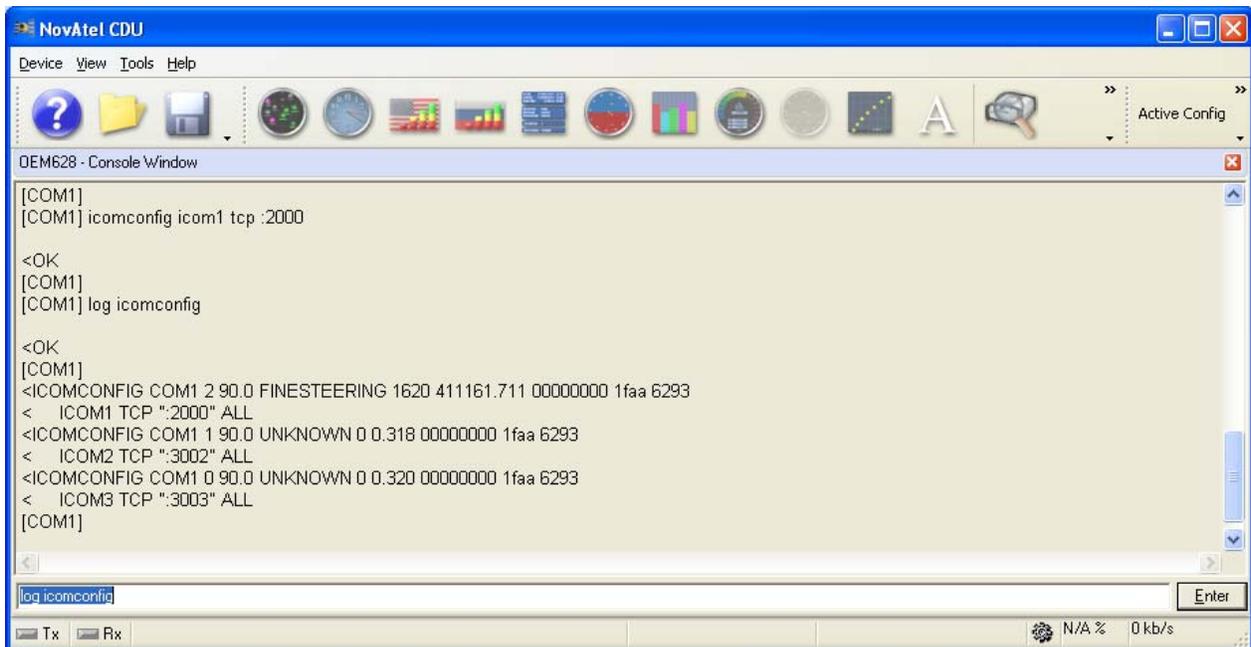
3. Using NovAtel CDU or another terminal program, establish connection with the dedicated IP address and port number assigned in Step 2. IP address is provided by the `IPSTATUS` log.
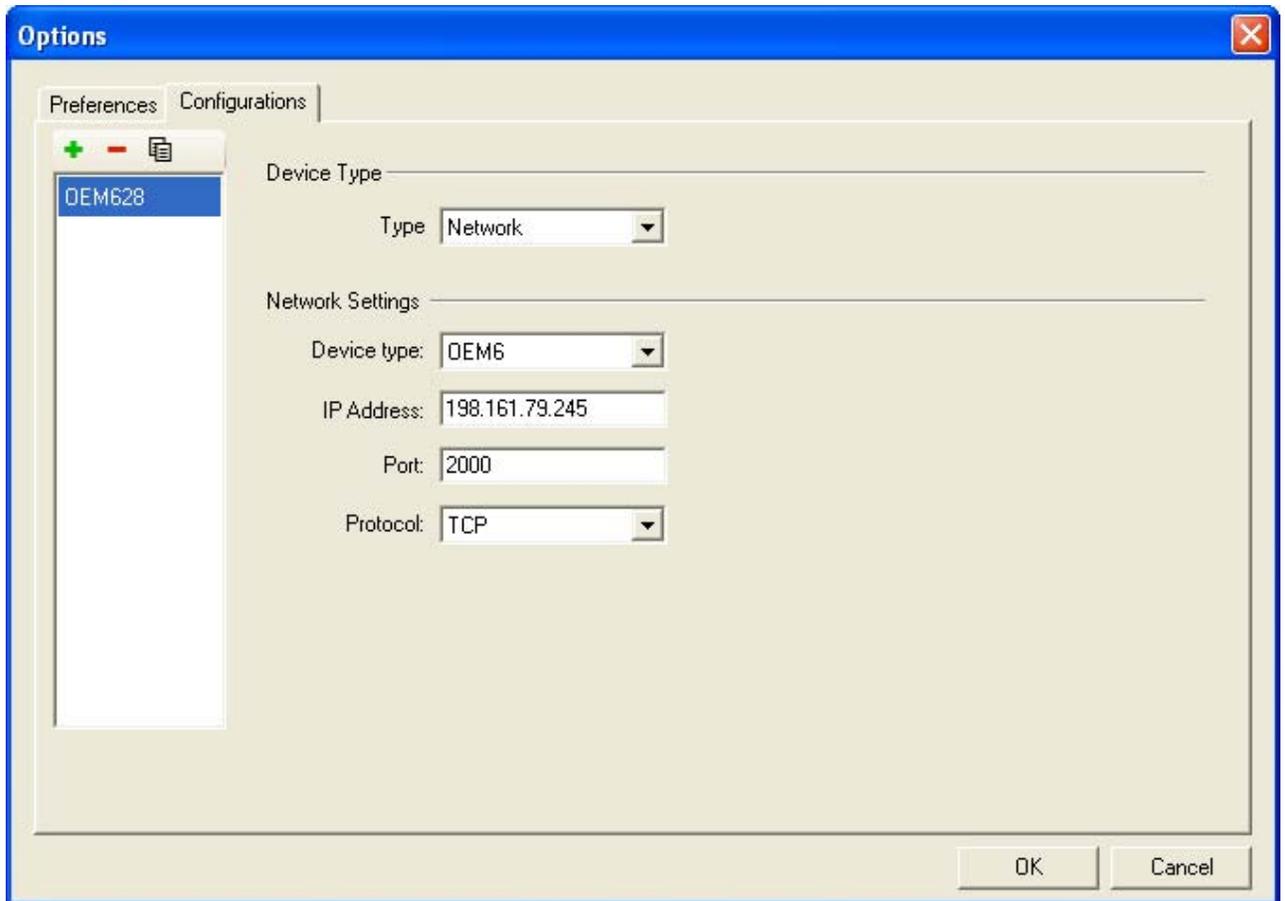
`[ICOM1]` appears in the console window when communication has been successfully established.
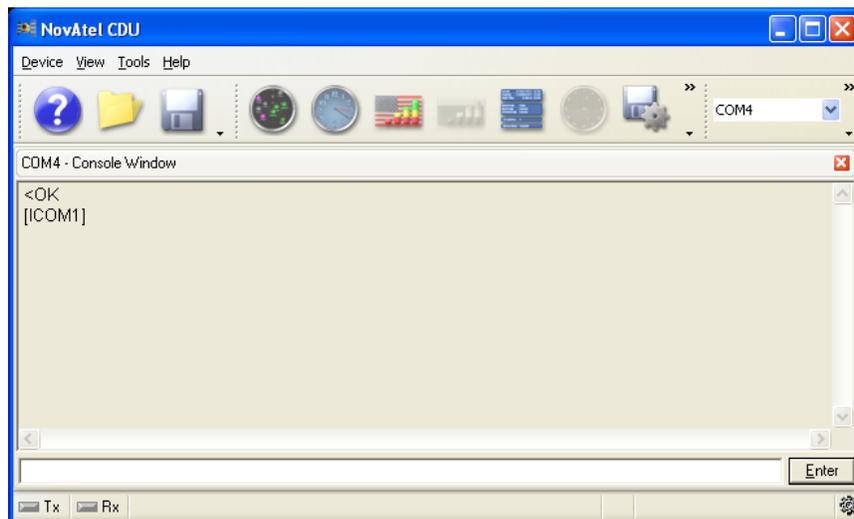
5 Ethernet Power On/Off

The OEM628 is equipped with the ability to enable or disable the Ethernet com port. With the Ethernet port disabled, the power consumption of the board is reduced by approximately 250 mW. The factory default of the OEM628 has power to the Ethernet disabled.

Factory default is: `ETHCONFIG ETHA AUTO AUTO AUTO`

Following these steps to enable the Ethernet port:

1. Connect to your OEM628 through a serial or USB port with either NovAtel CDU or another terminal program such as Windows HyperTerminal. For more information on receiver communication, please refer to our online video tutorial *Communicating with the Receiver* found at http://www.novatel.com/support/knowledge-and-learning/video-tutorials-and-tech-presentations/.

2. Send the following commands:
    ```
    ETHCONFIG ETHA AUTO AUTO AUTO AUTO
    SAVECONFIG
    ```
    Note: The Ethernet module will be powered down after a factory reset. Issue the `SAVECONFIG` command to save this setting.

For more information about the `ETHCONFIG` command, see Section A.3.

6 NovAtel Base/Rover Configuration through Ethernet Connectivity

You can either assign a static IP address or connect through the DHCP server on your network. For full static/DHCP IP address configurations, see Sections 3 and 4.

1. Establish communication with the base and rover OEM628 receivers. Refer to the *OEM6 Family Quick Reference Guide* and the *OEM6 Family Installation and Operation Guide* found on our Website at http://www.novatel.com/support/firmware-software-and-manuals/product-manuals-and-doc-updates/oem6/ for more details about how to do this.

2. Connect the power cable to the OEM628 receiver(s) and apply power to the unit(s).
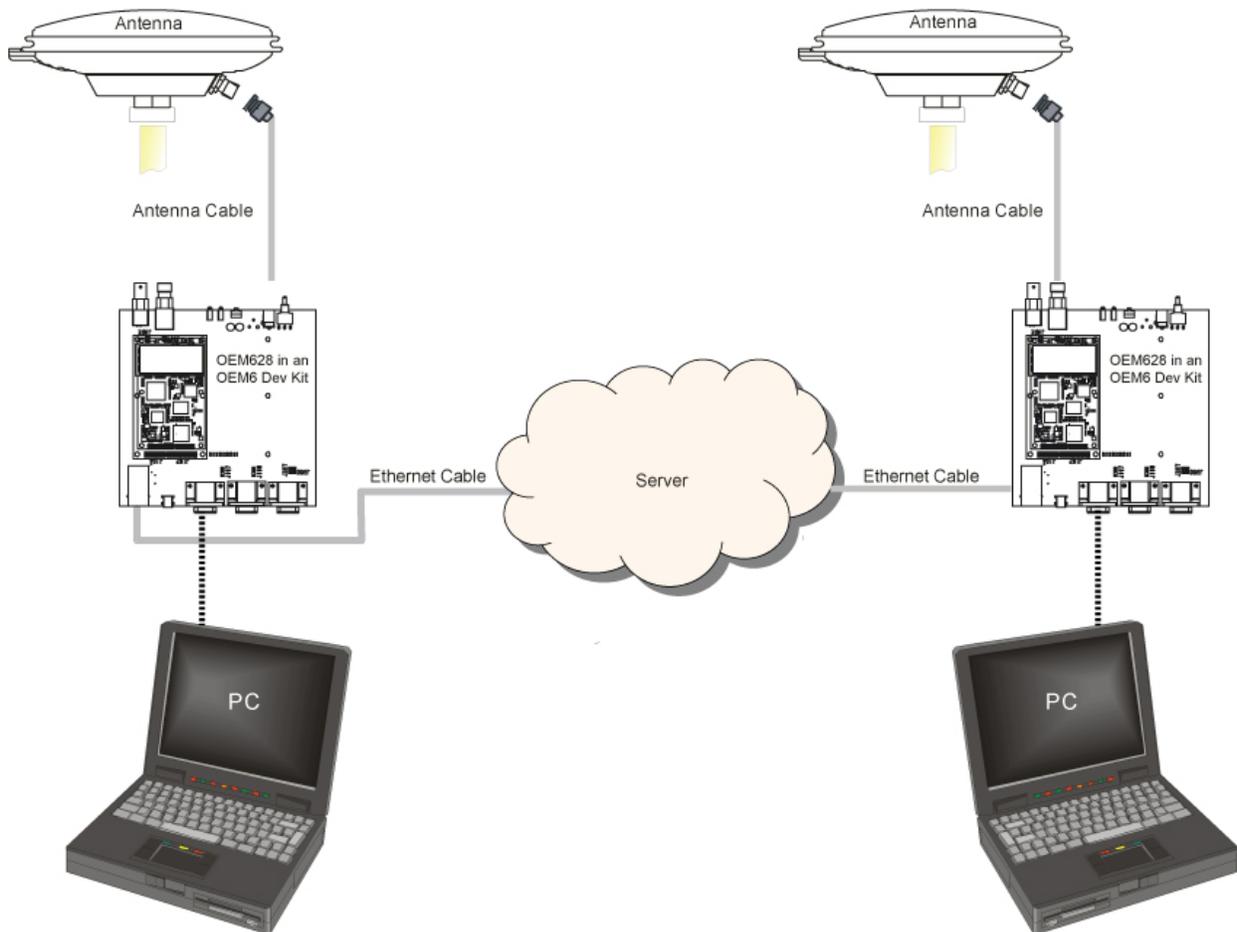
Figure 3: Base/Rover Ethernet Setup

3. Connect the Ethernet cables to both Ethernet ports on the OEM628 receivers.

4. Establish your Ethernet connection, either static or dynamic configurations, by referring to Sections 3 or 4, respectively.

5. Send the following commands to each receiver either through serial, USB or Ethernet ports:

Base:

```
FIX POSITION <lat> <long> <height>
interfacemode icom1 none rtca off
log icom1 rtcaobs2 ontime 1
log icom1 rtcaref ontime 10
log icom1 rtca1 ontime 5
SAVECONFIG
```

Rover:
```
ICOMCONFIG ICOM1 TCP <base ip address>:<base port #>
INTERFACEMODE ICOM1 RTCA NONE OFF
LOG BESTPOSA ONTIME 1 (optional)
SAVECONFIG
```

Use the BESTPOS log to confirm that the OEM628 rover is in RTK mode.

7   Large Com port Data Throughput

For high data rate Ethernet logging using TCP/IP, Window's DAA (Delayed Ack Algorithm) needs to be disabled for complete data logging because data gaps are present due to Window's Ethernet buffer.

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DISCLAIMER: Proceed at your own risk. Registry may damage the operation of your PC if done incorrectly. Editing the Windows Registry is for advanced Microsoft Windows users. NovAtel Inc. is not able to provide any technical support for any actions you take regarding information found in Microsoft's Knowledge Base.

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Windows XP (SP3) and Windows Server 2003:

http://support.microsoft.com/kb/328890

http://support.microsoft.com/kb/815230

8 Network Transport of RTCM via Internet Protocol (NTRIP) Configuration

NTRIP is an application protocol used to stream GNSS differential correction data over the internet. NovAtel provides NTRIP server and client functionality. For more information about NovAtel's NTRIP, refer to our NTRIP Product Sheet on our Website at http://www.novatel.com/assets/Documents/Papers/Ethernet_NTRIP.pdf

NovAtel gives you the capability of configuring either an NTRIP server or an NTRIP client. The NTRIP caster is an HTTP internet service provided by third party sources, acting as a communication medium between NTRIP servers and NTRIP Clients.

```
┌─────────────────────┐        ┌─────────────────────┐
│   NTRIP Client 1    │        │   NTRIP Client 2    │
│                     │        │                     │
│     DGPS/RTK        │        │     DGPS/RTK        │
│  Rover Receiver 1   │        │  Rover Receiver 2   │
└─────────────────────┘        └─────────────────────┘
          ▲                              ▲
          │        HTTP Streams          │
          ▼                              ▼
┌───────────────────────────────────────────────────┐
│                   NTRIP Caster                     │
└───────────────────────────────────────────────────┘
          ▲                              ▲
          │        HTTP Streams          │
          ▼                              ▼
┌─────────────────────┐        ┌─────────────────────┐
│   NTRIP Server X    │        │   NTRIP Server Y    │
│   NTRIP Source      │        │   NTRIP Source      │
│     (Base 1)        │        │     (Base 2)        │
└─────────────────────┘        └─────────────────────┘
```
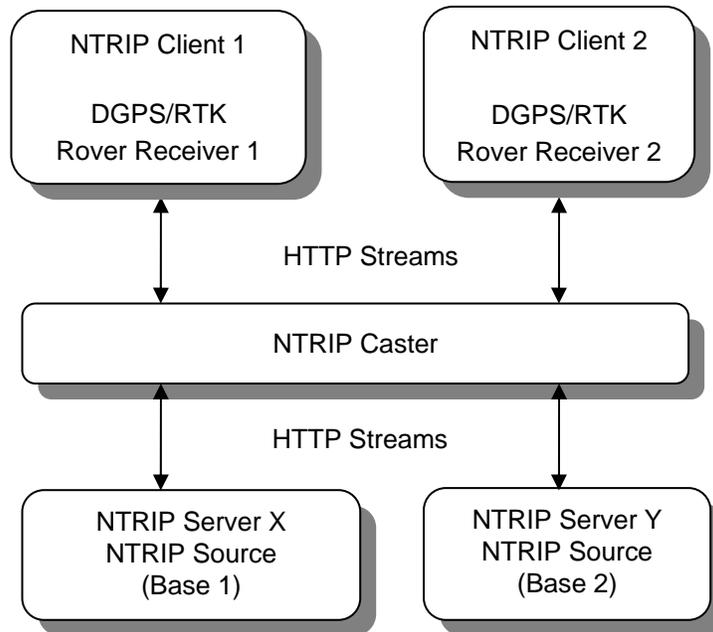
Figure 4: NTRIP System

For a full list of NTRIP casters, refer to the following link: http://www.rtcm-ntrip.org/home. The following configuration is recommended for optimal RTK performance, configuration of a NovAtel base and a NovAtel rover through a third party NTRIP caster.

1. Establish communication with the base and rover OEM628 receivers. Refer to the *OEM6 Family Quick Reference Guide* and the *OEM6 Family Installation and Operation Guide* found on our Website at http://www.novatel.com/support/firmware-software-and-manuals/product-manuals-and-doc-updates/oem6/ for more details about how to do this.

2. Connect the Ethernet cable to the Ethernet ports on both the OEM628s. For this setup, it is suggested to use a cross-over Ethernet cable.

3. Establish your Ethernet connection, either static or dynamic configurations, by referring to Sections 3 or 4, respectively.

8.1 NTRIP Server (NovAtel Base)

Use the following commands to enable the OEM628 as an NTRIP Server:

```
NTRIPCONFIG NCOM1 SERVER V2[1] <endpoint>[1] <mountpoint>[1]
<username>[1] <password> ETHA
INTERFACEMODE NCOM1 NONE RTCA OFF
FIX POSITION <lat> <long> <height>
LOG NCOM1 RTCAOBS2 ONTIME 1
LOG NCOM1 RTCAREF ONTIME 10
LOG NCOM1 RTCA1 ONTIME 1
SAVECONFIG
```

8.2 NTRIP Client (NovAtel Rover)

Use the following commands to enable the OEM628 as an NTRIP Client:

```
ETHCONFIG ETHA AUTO AUTO AUTO AUTO
NTRIPCONFIG NCOM1 CLIENT V1 [1] <endpoint>[1] <mountpoint>[1]
<username>[1] <password > ETHA
```

Note: If you are using a specific Network RTK system, certain NMEA strings are required to be sent from the rover back to the RTK network. For example, if you are connected to the VRS mount point, the rover is required to send its position to the network in a standard NMEA (National Marine Electronics Association) GGA message. This can be achieved by issuing the following command: LOG NCOMx GPGGA ONTIME 5, until data is received by the caster. For more information about Network RTK options and properties, refer to our *Application Note on Network RTK for OEMV Receivers* found on our website at http://www.novatel.com/support/knowledge-and-learning/published-papers-and-documents/application-notes/.

The following is an NTRIP Client configuration example without the use of a Network RTK system:

```
INTERFACEMODE NCOM1 RTCA NONE OFF
RTKSOURCE AUTO ANY
PSRDIFFSOURCE AUTO ANY
LOG BESTPOS ONTIME 1 (optional)
SAVECONFIG
```

---

[1] For information about published NTRIP casters, refer to this Website: http://www.rtcm-ntrip.org/home.

A.   ETHERNET COMMANDS AND LOGS

A.1   DNSCONFIG Command

This command is part of the Ethernet set up. It configures the Domain Name Servers (DNS) so that hostnames can be used instead of IP addresses.

Message ID: 1244

Abbreviated ASCII Syntax: `DNSCONFIG number_of_DNS_server IP`

Factory Default:
```
dnsconfig 0
```

ASCII Examples:
```
DNSCONFIG 2 192.168.1.223 192.168.74.10
```

Field #	Field Type	ASCII Value	Binary Value	Data Description	Format	Binary Bytes	Binary Offset
1	DNSCONFIG Header	-	-	This field contains the command name or the message header depending on whether the command is abbreviated ASCII, ASCII or binary, respectively	-	H	0
2	NumDNSServer	None	0	Number of DNS server	Enum	4	H
		1 server	1				
		2 servers	2				
3	IP address	xxx.xxx.xxx.xxx (10.0.0.2)		IP address of primary DNS server	String	16	H+4
		xxx.xxx.xxx.xxx (10.0.0.2)		IP address of secondary DNS server			

A.2   ECHO Command

This command sets a port o echo.

Message ID: 1247

Abbreviated ASCII Syntax: ECHO [port] [echo]

Factory Default:

```
echo com1 off
echo com2 off
echo com3 off
echo aux off
echo usb1 off
echo usb2 off
echo usb3 off
echo icom1 off
echo icom2 off
echo icom3 off
echo ncom1 off
echo ncom2 off
echo ncom3 off
```

ASCII Example: ECHO icom1 on

Field #	Field Type	ASCII Value	Binary Value	Data Description	Format	Binary Bytes	Binary Offset
1	ECHO Header	-	-	This field contains the command name or the message header depending on whether the command is abbreviated ASCII, ASCII or binary, respectively	-	H	0
2	port	See Table 1: COM Port Identifiers		Port to configure. (default = THISPORT)	Enum	4	H
3	echo	OFF	0	Echo is off.	Enum	4	H+4
		ON	1	Echo is on			
		AUTO	2	Auto setting			
		DEFAULT	3	Default setting			

Table 1: COM Port Identifiers

Binary	ASCII	Description
1	COM1	COM port 1
2	COM2	COM port 2
3	COM3	COM port 3
6	THISPORT	The current COM port
8	ALL	All COM ports
9	XCOM1	Virtual COM1 port
10	XCOM2	Virtual COM2 port
13	USB1	USB port 1
14	USB2	USB port 2
15	USB3	USB port 3
16	AUX	AUX port
17	XCOM3	Virtual COM3 port
23	ICOM1	Virtual serial ports (over Ethernet)
24	ICOM2	
25	ICOM3	
26	NCOM1	NTRIP ports (over Ethernet)
27	NCOM2	
28	NCOM3	

A.3 ETHCONFIG Command

This command allows Ethernet physical layer configuration.

Message ID: 1245

Abbreviated ASCII Syntax: ETHCONFIG interface_name [speed] [duplex] [crossover] [power_mode]

Factory Default:

    ETHCONFIG etha auto auto auto auto

ASCII Example: ETHCONFIG etha 100 full mdix normal

Field #	Field Type	ASCII Value	Binary Value	Data Description	Format	Binary Bytes	Binary Offset
1	ETHCONFIG Header	-	-	This field contains the command name or the message header depending on whether the command is abbreviated ASCII, ASCII or binary, respectively	-	H	0
2	interface	ETHA	2		Enum	4	H
3	speed	AUTO	1	Auto-negotiate speed (default)	Enum	4	H+4
		10	2	Force 10BaseT			
		100	3	Force 100BaseT			
	duplex	AUTO	1	Auto-negotiate duplex	Enum	4	H+8
		HALF	2	Force half duplex			
		FULL	3	Force full duplex			
	crossover	AUTO	1	Auto-detect crossover	Enum	4	H+12
		MDI	2	Force MDI (straight through)			
		MDIX	3	Force MDIX (crossover)			
	power mode	AUTO	1	Energy detect mode	Enum	4	H+16
		POWER DOWN	2	Soft power down mode			
		NORMAL	3	Normal mode			

A.4   ICOMCONFIG Command

This command is used for Ethernet set up. It allows you to configure the transport/application layer of the configuration.

Message ID: 1248

Abbreviated ASCII Syntax: `ICOMCONFIG [port] protocol [endpoint] [interface_name]`

Factory Default:

```
icomconfig icom1 tcp :3001
icomconfig icom2 tcp :3002
icomconfig icom3 tcp :3003
```

ASCII Examples: `ICOMCONFIG ICOM1 TCP :2000 ETHA`

Note: Due to security concerns, the configuration `ICOMCONFIG UDP :3000` should only be used by customers on a closed system, that is, board to board. NovAtel is not liable for any security breaches that may occur if not used on a closed system.

Field #	Field Type	ASCII Value	Binary Value	Data Description	Format	Binary Bytes	Binary Offset
1	ICOMCONFIG Header	-	-	This field contains the command name or the message header depending on whether the command is abbreviated ASCII, ASCII or binary, respectively	-	H	0
2	port	See Table 1: COM Port Identifiers		Name of the port (default = THISPORT)	Enum	4	H
3	protocol	DISABLED	1	Disable this service	Enum	4	H+4
		TCP	2	Use Raw TCP			
		UDP	3	Use Raw UDP			
4	endpoint	Host: Port For example: 10.0.3.1:8000 mybase.com:3000:2000		Endpoint to wait on, or to connect to where host is a hostname or IP address and port is the TCP/uDP port number. If host is blank, act as a server	String	80	H+8
5	bindInterface	ALL (default)	1	All, or an interface that supports TCP/IP	Enum	4	H+88
		ETHA	2				

A.5 IPCONFIG Command

This command configures static/dynamic TCP/IP properties for the Ethernet connection.

Message ID: 1243

Abbreviated ASCII Syntax: `IPCONFIG [interface_name] address_mode [IP [mask [gateway]]]`

Factory Default:

    ipconfig etha dhcp

ASCII Examples: `IPCONFIG ETHA STATIC 192.168.74.10 255.255.255.0 192.168.74.1`

Field #	Field Type	ASCII Value	Binary Value	Data Description	Format	Binary Bytes	Binary Offset
1	IPCONFIG Header	-	-	This field contains the command name or the message header depending on whether the command is abbreviated ASCII, ASCII or binary, respectively	-	H	0
2	interface	ALL	1	Name of the Ethernet interface (default = ETHA)	Enum	4	H
		ETHA	2				
4	mode	DHCP	1	Use Dynamic IP address (default)	Enum	4	H+4
		STATIC	2	Use Static IP address			
5	IP address	xxx.xxx.xxx.xxx (For example: 10.0.0.2)		IP Address – decimal dot notation	String	16	H+8
6	netmask	xxx.xxx.xxx.xxx (For example: 255.255.255.0)		Netmask – decimal dot notation	String	16	H+24
7	gateway	xxx.xxx.xxx.xxx (For example: 10.0.0.1)		Gateway – decimal dot notation	String	16	H+40

A.6   ETHSTATUS Log

This log provides the current status of the Ethernet ports.

Message ID: 1288

Log Type: Async

Recommended Input: `log ethstatusa once`

ASCII Example:
```
#ethstatusa,com1,0,89.5,finesteering,1609,500138.174,00000000,e89
d,6259;1,etha,"00-21-66-00-05-a2",100_full*98d86b04
```

Field #	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	ETHSTATUS Header	Log header	-	H	0
2	#of interfaces	Number of records to follow	Ulong	4	H
3	interface	ETHA	Enum	4	H+4
4	MAC address	This is an identifier assigned to your network adapters or network interface card	String	18	H+8
		Reserved			
5	interface configuration	Relates to the connectivity, speed and duplex settings of the Ethernet interface		4	H+28
	xxxx	32-bit CRC (ASCII and Binary only)	Hex	4	
	[CR][LF]	Sentence terminator (ASCII only)			

A.7   IPSTATUS Log

This log provides the configuration of IP address, netmask, gateway and a list of DNS servers currently in use.

Message ID: 1289

Log Type: Async

Recommended Input: `log ipstatus once`

ASCII Example:
```
#ipstatusa,com1,0,90.5,finesteering,1609,500464.121,00000000,7fe2
,6259;1,etha,"10.4.44.131","255.255.255.0","10.4.44.1",1,"198.161
.72.85"*ec22236c
```

Field #	Field Type	Data Description	Format	Binary Bytes	Binary Offset
1	IPSTATUS Header	Log header	-	H	0
2	IP status	Number of records to follow.	Ulong	4	H
3	interface	ETHA	Enum	4	H+4
4	IP address	IP Address - decimal dot notation	String	16	H+8
	xxxx	32-bit CRC (ASCII and Binary only)	Hex	4	H+34
	[CR][LF]	Sentence terminator (ASCII only)			

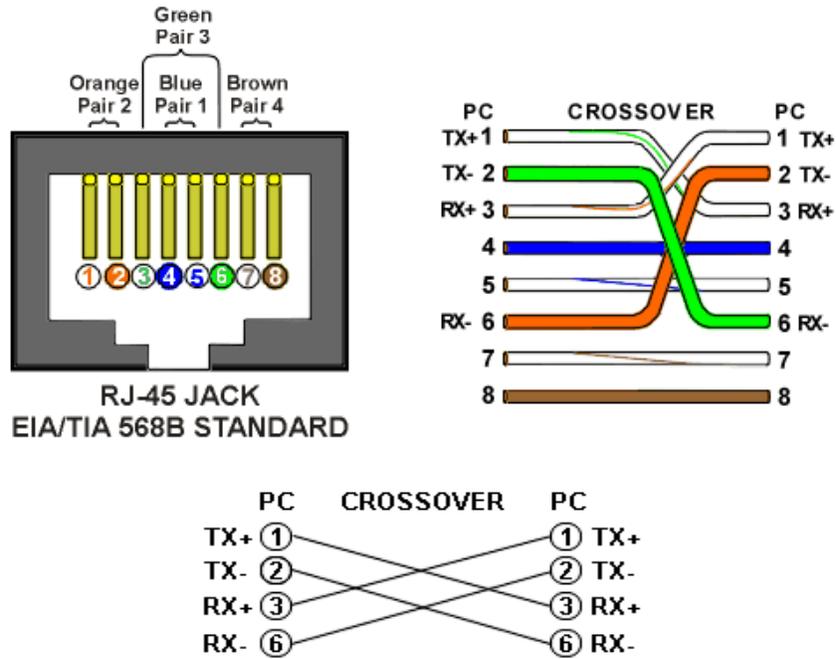## B.   CAT5 CROSS-OVER ETHERNET CABLE WIRING SCHEMATIC

Figure 5: CAT5 Cross-over Ethernet Cable Pin Out Diagram