User Manual

RVON-8
RTS™ Voice Over Network

9350-7756-000 Rev E 11/2003

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Immediately upon receipt of the equipment, inspect the shipping container and the contents carefully for any discrepancies or damage. Should there be any, notify the freight company and the dealer at once.

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Technical questions should be directed to:

Customer Service Department
RTS/Telex
12000 Portland Avenue South
Burnsville, MN 55337 U.S.A.
Telephone: (800) 392-3497
Fax: (800) 323-0498

RETURN SHIPPING INSTRUCTIONS
PROCEDURE FOR RETURNS

If a repair is necessary, contact the dealer where this unit was purchased.

If repair through the dealer is not possible, obtain a RETURN AUTHORIZATION from:

Customer Service Department
Telex Communications, Inc.
Telephone: (877) 392-3497
Fax: (800) 323-0498

DO NOT RETURN ANY EQUIPMENT DIRECTLY TO THE FACTORY WITHOUT FIRST OBTAINING A RETURN AUTHORIZATION.

Be prepared to provide the company name, address, phone number, a person to contact regarding the repair, the type and quantity of equipment, a description of the problem and the serial number(s).

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All shipments of RTS products should be made via United Parcel Service or the best available shipper, prepaid. The equipment should be shipped in the original packing carton; if that is not available, use any suitable container that is rigid and of adequate size. If a substitute container is used, the equipment should be wrapped in paper and surrounded with at least four inches of excelsior or similar shock-absorbing material. All shipments must be sent to the following address:

Factory Service Department
Telex Communications, Inc.
8601 East Cornhusker Hwy
Lincoln, NE 68507
Attn: Service Dept.

Upon completion of any repair the equipment will be returned via United Parcel Service or specified shipper collect.

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Table of Contents

General Description of the RVON-8 Voice Over Network card

Installed directly into the ADAM Intercom frame, the RVON-8 provides voice over IP (Internet Protocol) communications for the RTS™ ADAM intercom family. In general, voice over IP means sending voice information in digital form using discrete packets rather than the traditional telephone network. The RVON-8 delivers an integrated solution for connecting custom keypanels to the Intercom matrix over standard IP networks by supporting 8 channels (ports) of audio in and out.

The RVON-8 card supports all standard hot-swappable and configurable features through Telex's AZedit configuration software as well as support for remote keypanels and virtual keypanels via VOIP (Voice Over IP).

RVON-8 supports Telex® Intelligent Trunking over IP. Trunking is a method of using relatively few audio paths for a large number of potential users. Because it is flexible, a trunked system can expand along with your business, to accommodate a growing number of users. RTS' Intelligent Trunking is a proven technology, which provides the same capabilities and ease of use for intercoms—seamless routing and path finding of communications between facilities regardless of distance—as does the long distance telephone system for phone calls.

RVON-8 is fully compatible with internationally recognized standards and supports the following protocols: G.711, G.729AB, and G723 (2 speeds).

Features

Installation:	The RVON-8 card is hot-swappable and installs in any available slot in an ADAM Intercom System. It provides a single RJ-45 Ethernet connection for use with any 10/100 base network. It also has a DB-9 connection for an RS-232 or RS485 pass-thru serial port.
8 Channels of Audio In and Out:	Expands the connectivity of the ADAM intercom by supporting 8 channels (ports) in and out. Each channel has configurable network and bandwidth parameters that can be tailored to individual network functions, as well as ancillary data for keypanels and trunking control.
Ethernet Compatible:	Fully Ethernet capable. The RVON-8 card uses standard Ethernet protocols and is compatible with all Ethernet compliant devices and networks.
AZedit Configurations:	Users have the ability to adjust the audio parameters of each RVON-8 channel to optimize the available bandwidth on the network.
Trunk Capable:	The RVON-8 card supports ancillary data control for use with Telex® Intelligent Trunking.
Addressing:	Eight individually addressable audio channels. The RVON-8 card can feed simultaneously VOIP (voice over internet protocol) capable keypanels as well as various other matrix intercom systems.
Pass-Through Serial Port:	Provides a virtual serial connection via an IP connection. Which, if used while trunking, may eliminate the need for multiple IP resources.

Specifications

Digital

Compression	Bit Rate	Coding Delay	Playout Delay	Bandwidth
G.711	64K	125µs	20 - 60 ms	160 - 224 kbps
G.729AB	8K	10 ms	20 - 120 ms	32 - 112 kbps
G.723	5.3K/6.3K	30 ms	60 - 120 ms	29 - 45 kbps

*Data Rate Depends on Codec Selection

NOTE: The Playout Delay and Bandwidth depend on the configured amount of audio per packet (for more information, see the Coding Profile table in Appendix B, page 37.

Connections

- RJ-45 Ethernet via backcard
- DB-9 Serial Port via backcard
- High-Density keyed ADAM Compatible Backplane Connector

Power: ..... 12.5 w/ 2.5 A at 5 V
Physical: ..... 5.687" W x 11.024" L

Installation of the RVON-8 Card into the ADAM System

When inserting the RVON-8 card into the ADAM system the following considerations need to be made:

- Gently insert the RVON-8 card into the correct slot. If the card is forced or twisted while inserting, a pin on the backplane could short or break causing the card to become inoperable.

- When inserting the RVON-8 card into the ADAM system, make sure to insert it into a compatible Back Card. If the card is inserted into a incompatible back card, undesirable results can occur.

Note: All cards are now shipped with a colored coding key in the middle of the connector. For more information, see page 9.

Color Key Code

On the RVON-8 card, Telex has provided a color key code and knock-outs for digits 1-8 to ensure a compatible connection between cards. The RVON-8 card color is blue, and will only insert into a blue coded backcard (See figure 1).

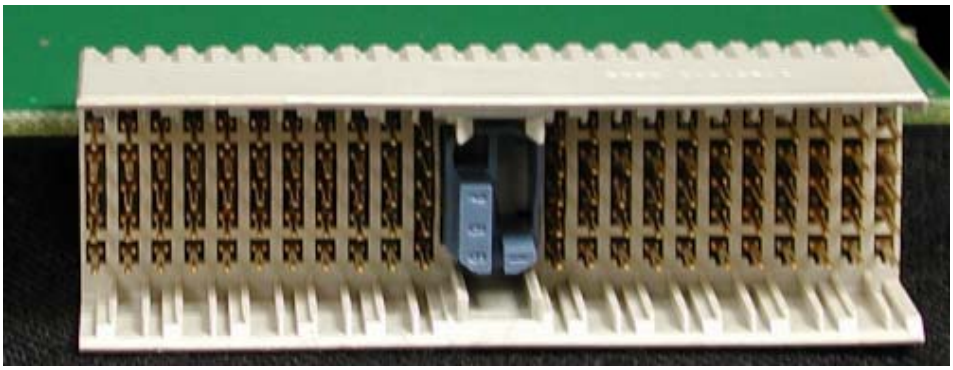


Figure 1. RVON-8 Color Key Code. This Key Code only allows the RVON-8 to plug into an RVON-8 compatible back card.

Note: Only newer systems have the color coded back cards.

CARD	KEY CODE COLOR
AES-3 (7745)	Yellow
RVON-8 (7763)	Blue
AIO-8 (7510)	Orange
Master Controller (7514)	Green
Master Controller - 2 (7734)	Violet

Table 1. Key Code Colors for all ADAM Intercom cards.

Note: The AIO-16 card does not have a color code key because it has a different card size and connector (125 pin).

Addresses and the RVON-8 Card

Because the RVON-8 has an Ethernet interface, it is required to have a MAC (Media Access Control) address. This is a low level address that contains 48 bits. Do not confuse this address with an IP (Internet Protocol) address. In order to be IP compliant, all cards must have a unique MAC ID when shipped from the manufacturer. Typically, the MAC ID of a piece of hardware, such as the RVON-8 card, has a fixed or static address. Whereas, the RVON-8 card's IP address can change over time.

The MAC address uniquely identifies each node of a network and interfaces directly with the network media. The RVON-8 card has a small 8-pin serial device on the board that the processor can read the unique MAC address from. For more information on MAC IDs, contact technical support.

Switches and Connections

Important: You must remove the card from the frame in order to change any DIP switch settings.

Dip Switches

DIP Switch 1:
ON: Configuration via AZedit is disabled

OFF: (Default) Configuration via AZedit is enabled.

Description: Disables configuration changes via AZedit. AZedit will still be able to view the card configuration and connection status. The configuration can still be changed via the serial and Telnet connections.

DIP Switches 2-4..... unused
Keep in OFF position.

DIP Switch 5:
ON: Resets the Telnet username and password to their default values:
User = Telex
Password = Password.
OFF: (Default)Uses current username and password.

Description: Enables the user to reset the Telnet username and password.

DIP Switch 6:
ON: Enables a serial monitor on back card DB9 (J2).
OFF: (Default) Enables a pass-through serial port via the back card DB9 (J2)

Description: Selects DB9 (J2) serial configuration.

DIP Switch 7:
ON: Runs the boot download
OFF: (Default) Runs the native flash program

Description: Switches to the boot download flash program. This program is sent with the RVON-8 card in case the native flash program becomes corrupted.

DIP Switch 8: DEBUG ONLY!

WARNING: Dip switch 8 should always be left in the OFF position. It is reserved for debugging and can have unintended consequences.

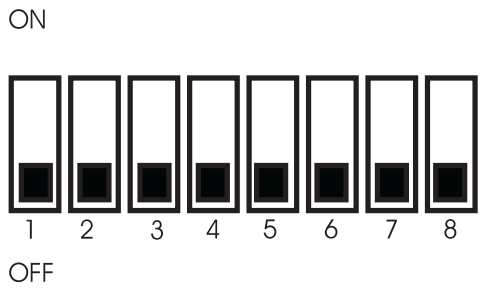


Figure 2. RVON-8 Dip Switch panel

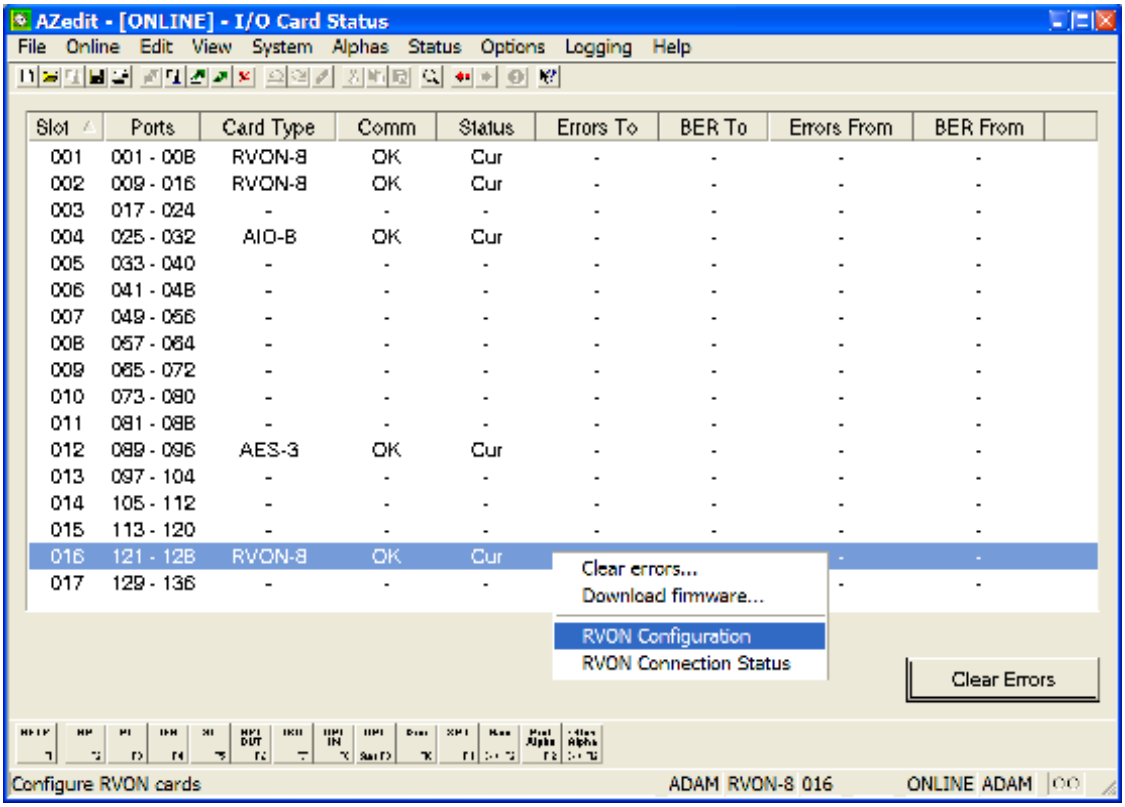
Configuring the RVON-8 Card with AZedit

Once the RVON-8 card is inserted into the Intercom, AZedit will automatically recognize the card.

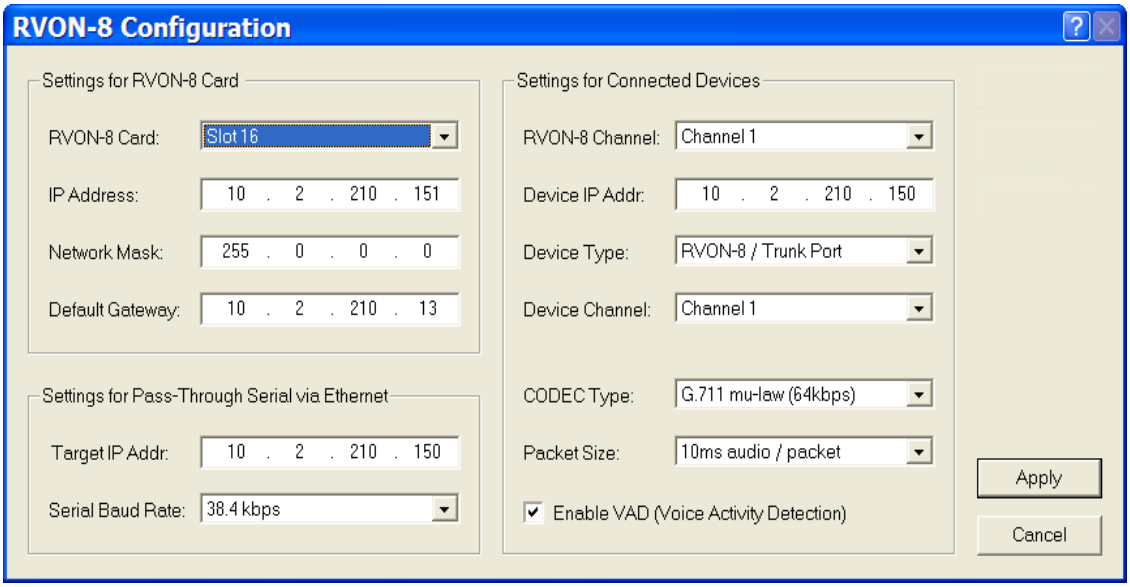
Note: Requires intercom firmware and AZedit software that supports RVON cards.

To configure the RVON-8 card, do the following:

1. From the Status menu, select **I/O Cards**.
   The IO Card Status screen appears showing the types of installed cards.



2. Right click on an RVON-8 card, and select RVON-8 Configuration.
   The RVON-8 Configuration screen appears.



3. From the RVON-8 drop down list, select the slot in which the RVON-8 card resides, if it is not already selected.
4. In the IP address field, enter the **IP address** you have assigned to the RVON-8 card.
5. In the Network Mask field, enter the **Network Mask** of the network to which the RVON-8 card is connected.
6. In the Default Gateway field, enter the **Default Gateway** address (if applicable) of the network to which the RVON-8 card is connected.
   A Default Gateway is only required if the RVON-8 connections are between LANs

Under Settings for Pass-Through Serial via Ethernet

7. In the Target IP Addr. field, enter the **target IP address** of the device you want to connect to over Ethernet.
8. From the Serial Baud Rate drop down list, select the **baud rate** at which the data is transmitted.

Under Settings for Connected Devices

Note: You MUST configure the channel settings on each end of a connection and ensure the same codec and packet size are selected at each end. Remember, the RVON-8 card has 8 different channels which can be configured.

9. In the RVON-8 Channel drop down list, select the **channel** you want to use to communicate to another device across the network.

10. In the Device IP Addr: field, enter the **IP Address** of the device to which you want to connect.
11. From the Device Type drop down list, select the **type of device** to which the RVON-8 card is connecting.
12. From the Device Channel drop down list, select the **channel** on the device to which the RVON-8 card will communicate.
13. From the CODEC Type drop down list, select the **CODEC type** you want to use for this channel.
14. From the Packet Size drop down list, select the **size** of each audio packet.

    Note: A **CODEC** is an algorithm used to compress audio. There are 5 Codecs supported by Telex, G.711 µ law, G.711A law, G.729AB, G.723 (5.3k), and G.723 (6.3k). The type of CODEC will dictate the quality of audio you hear. and the network bandwidth used. The packet size determines how much audio data is carried across the network in each transmitted packet. The CODEC type and packet size chosen require different amounts of bandwidth from the network (see the table on page 8. As with the CODEC type, the packet size you choose for the audio transfer will affect the audio you hear and the bandwidth you use over the network. The larger the audio packet you choose to use, the lower the bandwidth used. How ever, the larger packet size can result in a higher delay and longer gaps if the packet is lost. On the other hand, smaller packet sizes result in larger bandwidth use, but lower delays and smaller gaps if the packet is lost. The Intercom System Engineer and the Network Designer may want to work together in choosing the CODEC type and packet size suitable for the size of the network, so degradation of network resources does not happen. Use the table on page 7 to help you determine the CODEC type and packet size appropriate for your environment.

15. Select **Enable VAD (Voice Activity Detection)**, if you want to conserve bandwidth when the audio level is below a given threshold.

    Note: Voice Activity Detection saves network bandwidth by stopping the flow of audio packets when silence is detected. VAD is similar to VOX.

At this point you may choose another channel to configure or choose another card to configure.

16. Once you are completely finished, click **Apply**.
    Apply sends all of the changes to all the cards in the intercom, or click cancel to discard all changes you make.

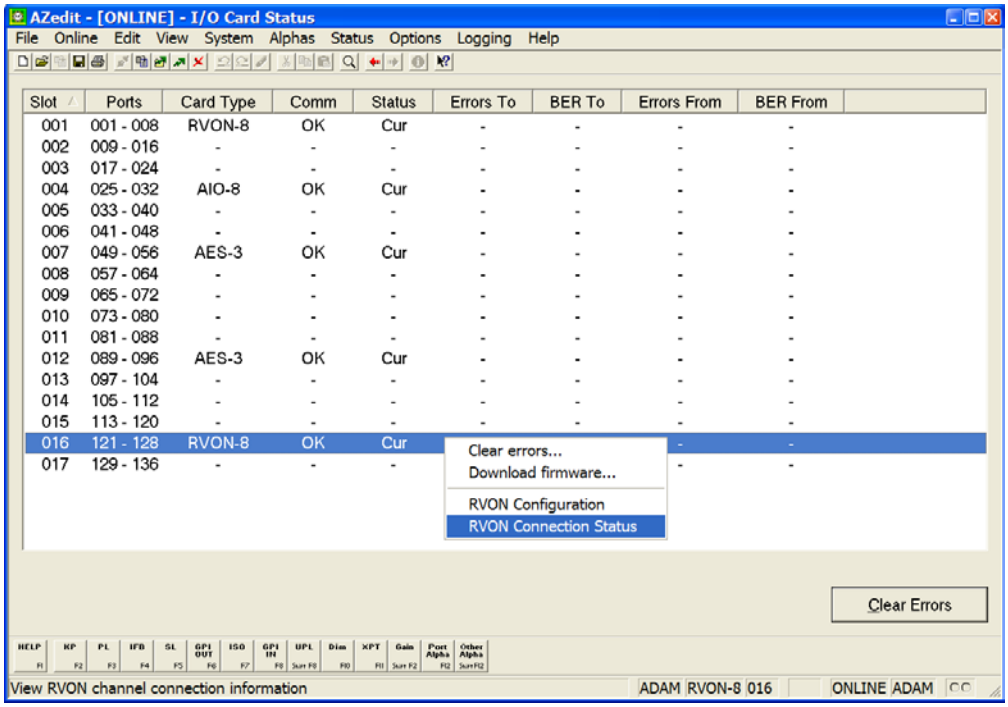
RVON-8 Connection Status Screen

The RVON-8 connection status screens display information pertaining to RVON-8 channel connection. You can only show statistics for one channel on a card at a time.

Note: To view the RVON-8 Connection Status screens, make sure both AZedit and the RVON-8 card are on the same Ethernet network. The reason this is important is because the statistics are updated once per second. At this rate of dynamic update, a serial port could not pass this much data effectively.

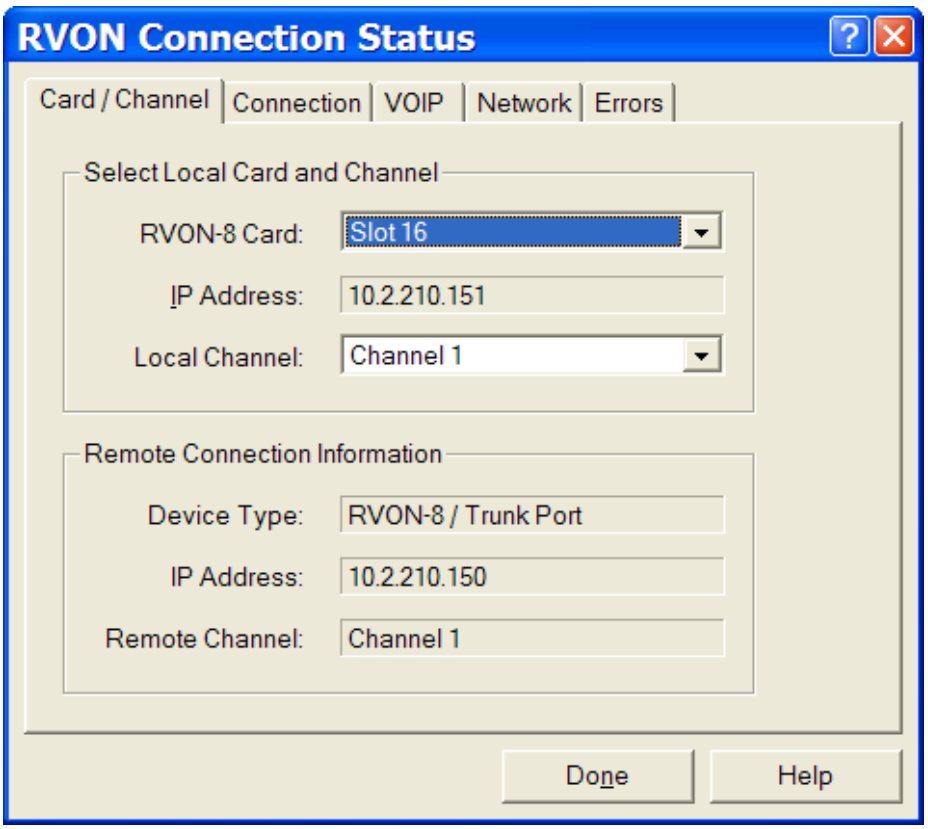
To get to the RVON Connection Status screen, do the following:

1. From the Status menu, select **I/O Cards**.
   The IO Card Status screen appears showing the types of installed cards.

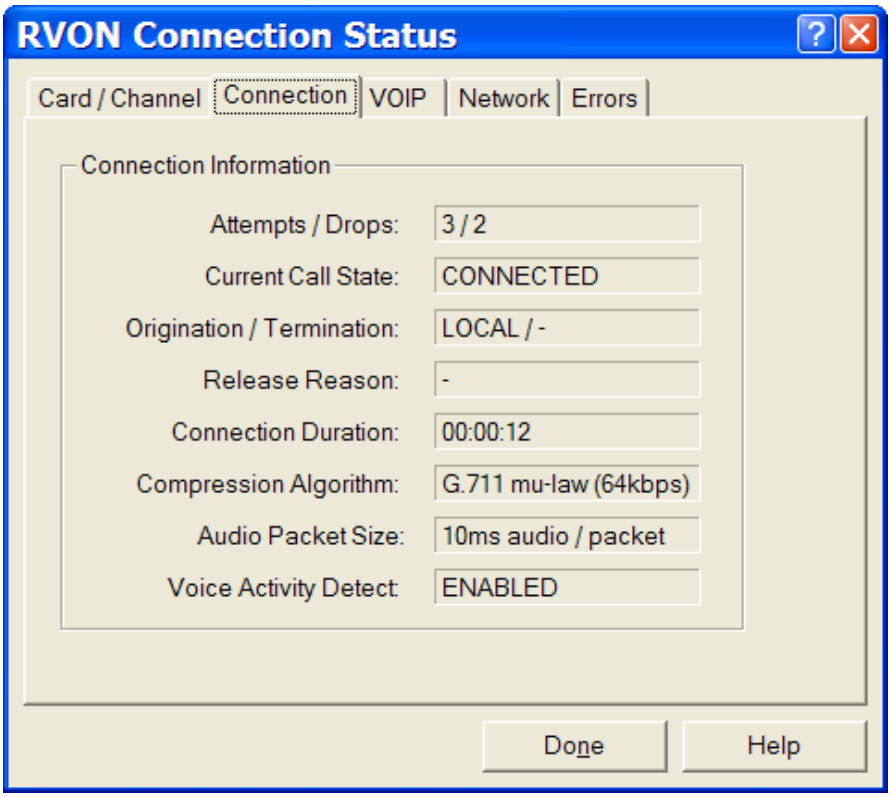


2. Right-click the card with which you want to work.
   A context menu appears.

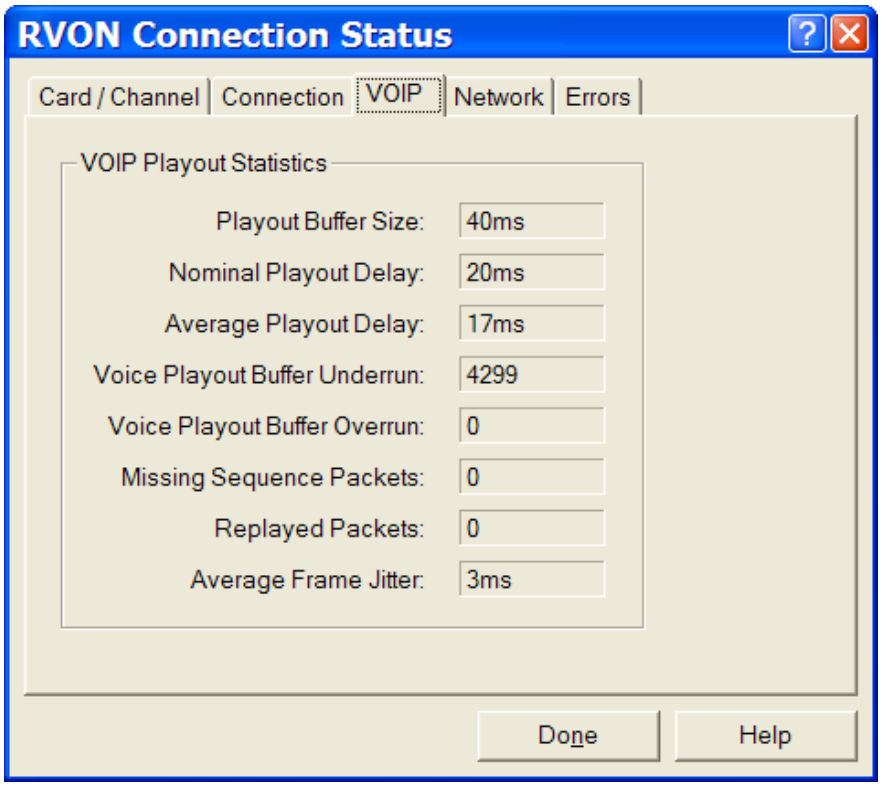
3. Select **RVON Connection Status**.
   The RVON Connection screen appears. The RVON Connection screen contains five pages of information about the selected channel and are described in detail on the following pages.



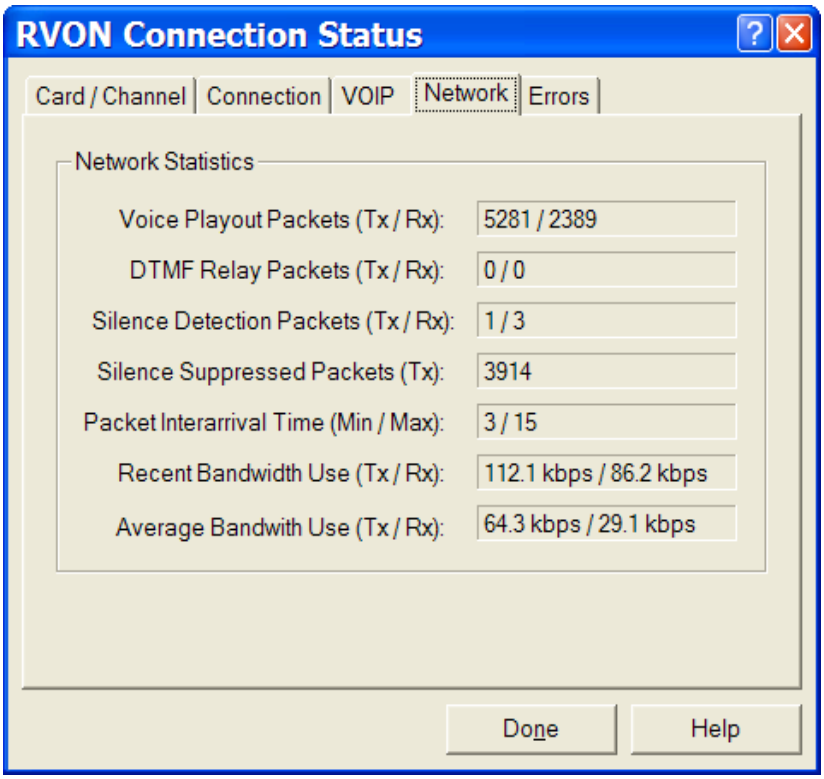
Screen Item	Description
Select Local Card and Channel	
RVON-8 Card	The card for which you want to view the status. From the RVON-8 drop down list, select the card you want to view.
IP Address	Displays the IP (Internet Protocol) Address of the card you select.
Local Channel	One of eight audio channels supported by the RVON-8 card. From the Channel drop down list, select the channel for which you want to view the status.
Remote Connection Information	
Device Type	Displays the type of device the RVON-8 card is connected to on the other end of the channel.
IP Address	Displays the IP address of the device connected at the other end of the channel.
Remote Channel	Displays the channel at the other end of the connection that the device is using.



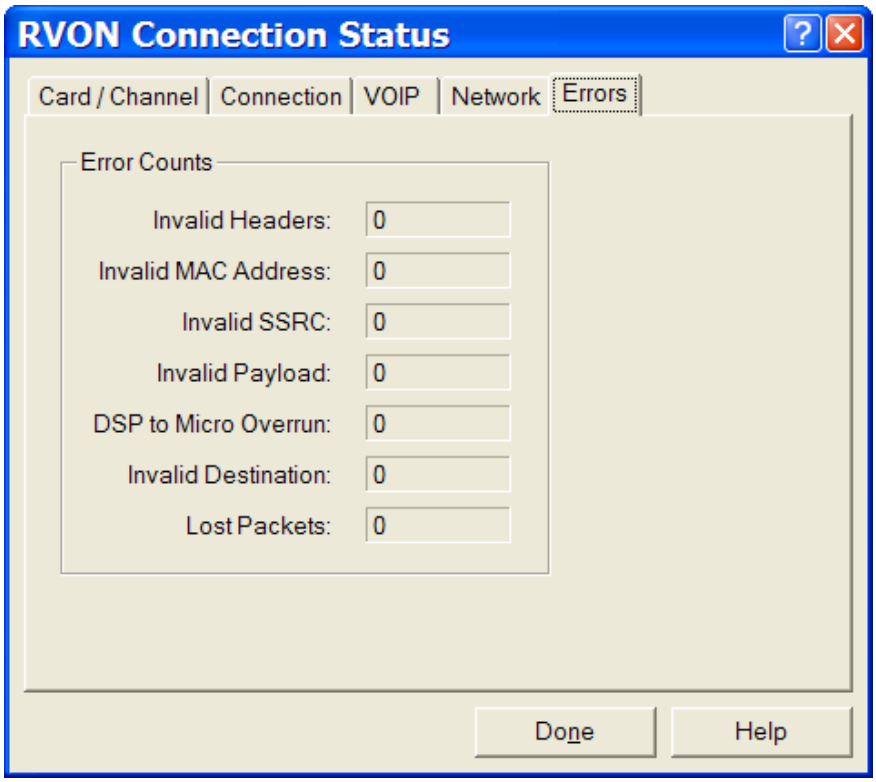
Screen Item	Description
Connection Information	
Attempts / Drops	The number of times a call attempt has been made and dropped. NOTE: The number of attempts should always be one greater than the number of drops.
Current Call State	The state of the connection. There are two connection states, Connected or Idle.
Origination / Termination	Displays which end of the connection originated or terminated the call. Local = RVON-8 card Remote = device at the other end of the connection.
Release Reason	Displays why the connection was terminated, for example, congestion, network error, local release, remote release.
Connection Duration	Displays the duration of the connection. This is shown in hh/mm/ss.
Compression Algorithm	Displays what type of configuration the connection is using. This can be different than original configuration if both ends of channel are not configured the same. If the configuration is different, these fields will be in red.
Audio Packet Size	
Voice Activity Detect (VAD)	



Screen Item	Description
VOIP Playout Statistics	
Playout Buffer Size	Displays how much audio can be received from the network before packets are lost. This is four times bigger than configured packet size. This is a static system setting.
Nominal Playout Delay	Displays how much audio is collected before playout begins. Playout begins at half the Playout Buffer Size, which is two times the configured packet size. This is a static system setting.
Average Playout Delay	Displays the actual average audio collected before packets are played out. This is measured over the length of the connection.
Voice Playout Buffer Underrun	Displays the number of packet times that packets were not played because the Playout Buffer was empty. NOTE: If VAD is enabled, there will be playout buffer runs because there are no packets being received during silence.
Voice Playout Buffer Overrun	Displays the number of packets that were discarded because the Playout Buffer was full.
Missing Sequence Packet	Displays how many audio packets were missed in the sequence.
Replayed Packets	Displays how many audio packets were replayed.
Average Frame Jitter	Displays the measure of consistency of packet arrival times. Lower jitter is better.



Screen Items	Description
Network Statistics	
Voice Playout Packets (Tx / Rx)	Displays the number of voice packets transmitted and received from the other side of the connection.
DTMF Relay Packets (Tx / Rx)	Displays the number of DTMF (dual tone multiple frequency) relay packets transmitted and received. DTMF relay packets are a bandwidth and quality saving feature within the RVON-8 card.
Silence Detection Packets (Tx / Rx)	Displays the number of times a silence detection packet has been sent or received. VAD (voice activity detection) must be enabled.
Silence Suppressed Packets (Tx)	Displays the number of packets never sent because the packets contained silence.
Packet Interarrival Time (Min / Max)	Displays the minimum and maximum time elapsed between packets being sent.
Recent Bandwidth Use (Tx / Rx)	Displays the amount of bandwidth used in Kbytes/sec over the last ten seconds. This is calculated by the number of voice packets transmitted and received over the last ten seconds.
Average Bandwidth Use (Tx / Rx)	Displays the amount of bandwidth used in Kbytes/sec over the length of the call. This is calculated by the number of voice packets transmitted and received and the length of the connection.



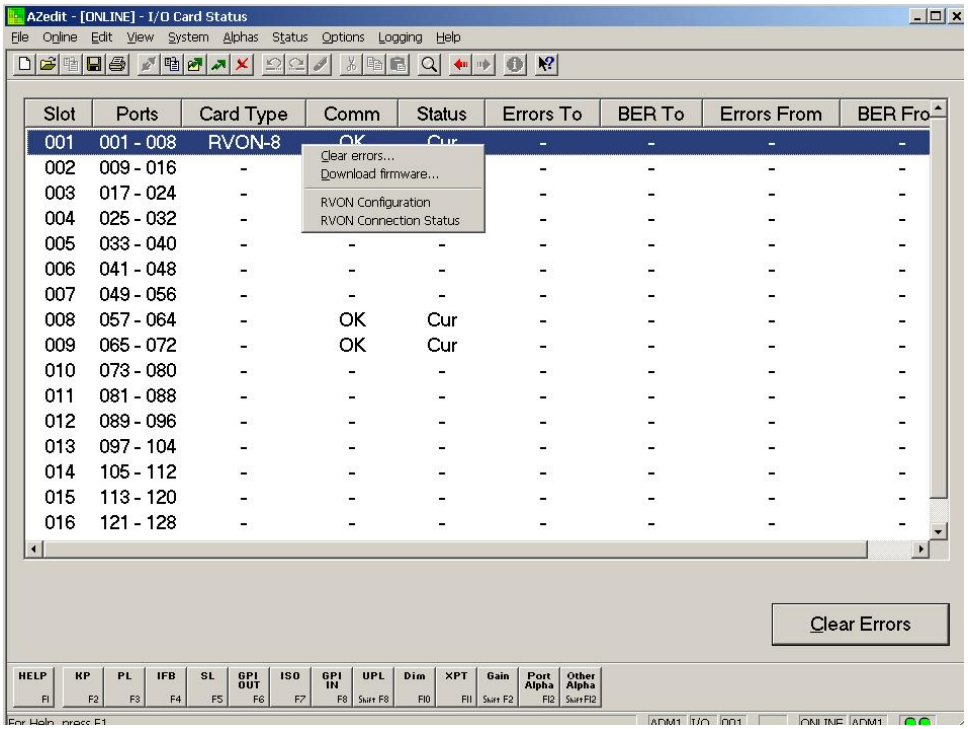
Screen Item	Description
Error Counts	
Invalid Headers	Displays how many IP Packets could not be parsed.
Invalid MAC Address	Displays how many invalid MAC addresses tried to connect.
Invalid SSRC	Displays the number packets with an invalid SSRC.
Invalid Payload	Displays how many incorrectly formatted packets were received.
DSP to Micro Overrun	Displays the number of packets that were lost because the Micro was too busy to receive.
Invalid Destination	Displays how many invalid destinations were received.
Lost Packets	Displays how many packets were lost.

Download RVON-8 firmware through AZedit

Note: AZedit sends the program directly to the RVON-8 card over Ethernet. This is different from other I/O cards that recieve the firmware from the Master Controller. For this reason, verify the PC running AZedit is on the same network as the RVON-8 card. If it is not, AZedit will not be able to find the RVON-8 card. To test the connection, ping the RVON-card from a command line. For more information on testing for a connection, see Appendix A.

1. Open **AZedit**.

2. From the Status menu, select **Software Versions**, then **I/O Cards**.
   The I/O Card Version Information screen appears showing the occupied slots in the system.

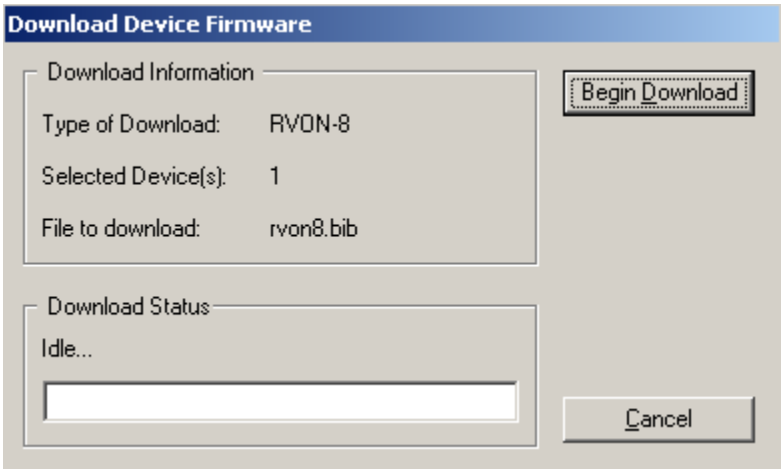


3. Highlight the Version to be updated.
   *You may select more than one version at a time by holding **CTRL** key down while you select*

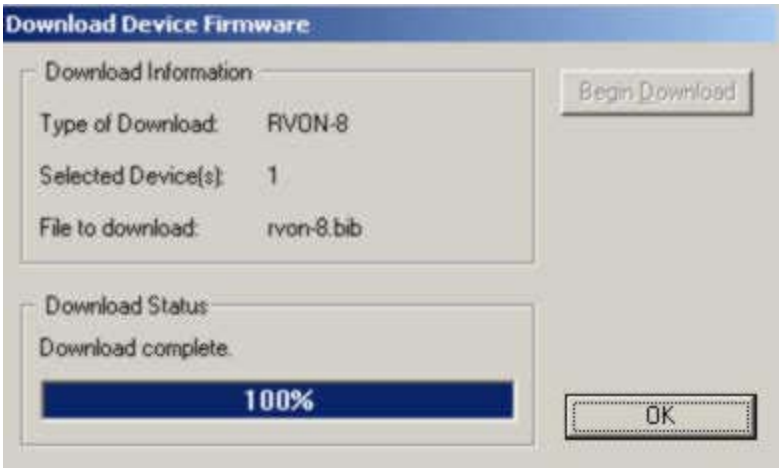
4. Right-click the highlighted selections and select **Download Firmware**.
   The Firmware Download Window appears.

5. Using the browse feature, browse to the file to be downloaded.

6. Click **Open**.
   The Download Device Firmware window appears.



7. Click **Begin Download**.
   The download begins.



8. Click **OK**.
   The RVON-8 firmware download is complete. This takes a minute or two to occur.

9. Verify the version upgrade in the I/O Card Version Information Window is correct.

WARNING! Do **NOT** power down the frame or pull the RVON-8 card(s) from the frame until you have verified the new version information from AZedit. If the card loses power while reprogramming the on-board flash memory, the card may become unbootable, and may need to have its flash chips replaced.

RVON-8 Backcard

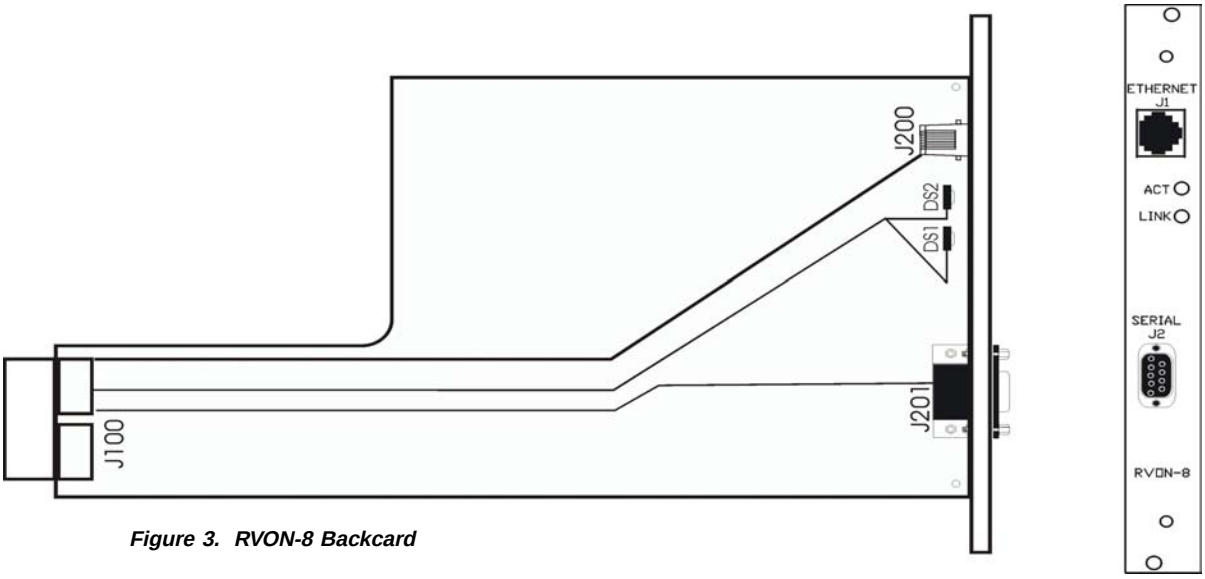


Figure 3. RVON-8 Backcard

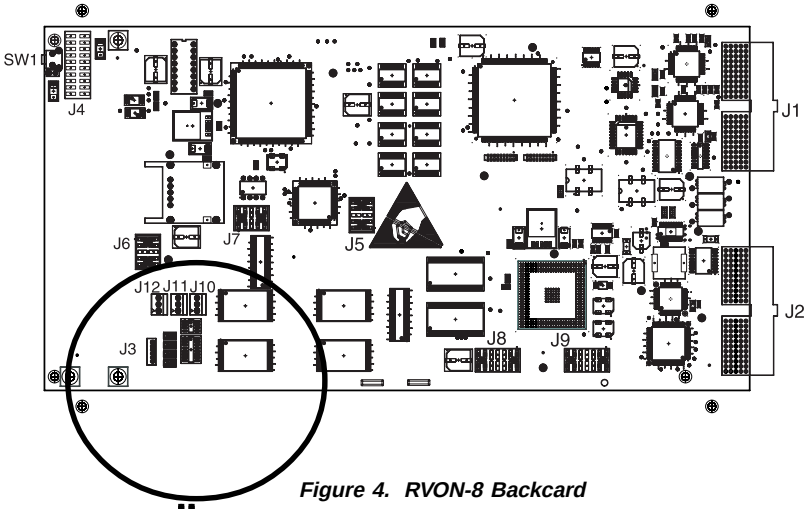
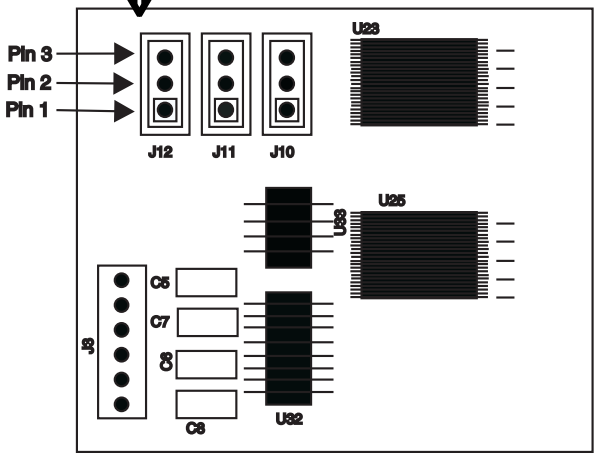


Figure 4. RVON-8 Backcard



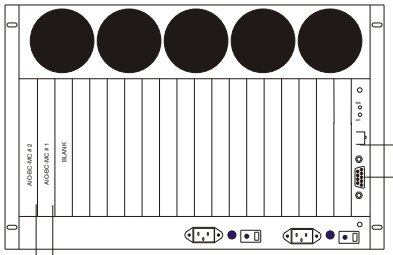
Pinout positions on the RVON-8 backcard DB9 (J2) connector.

Pin #	Signal
2	*RS485_L or RS232_RX
3	*RS485_H or RS232_TX
5	GND

*On jumpers J10,11,and 12 -
- if all 1&2 pins are covered, then RS-485 is active
- if all 2&3 pins are covered, then RS-232 is active

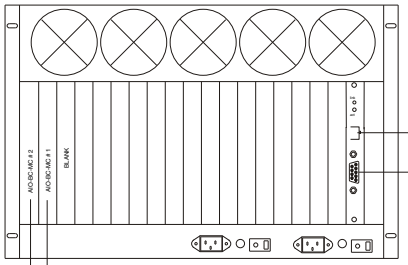
REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED

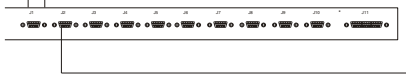
ADAM MATRIX FRAME
REAR VIEW



WAN

ADAM MATRIX FRAME
REAR VIEW





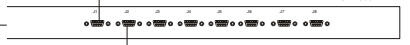
MC-XCP

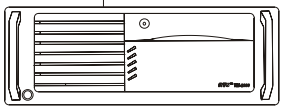
MC-XCP

1

2

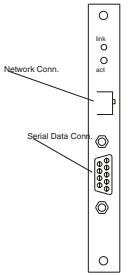
ICP-2000





TM2000

RVON-8
REAR CONNECTOR



Network Conn.

Serial Data Conn.

REAR CONNECTOR
CARD OPTION

—

1

DE-9-P
MALE, 9 PINS
" D " SUB
CONNECT TO MATRIX
XCP-ADAM-MC J2

DE-9-P
MALE, 9 PINS
" D " SUB
CONNECT TO RVON-8
J 1

RS485 +	6	3	RS485 +
RS485 -	1	2	RS485 -
GROUND	2	N/C	GROUND

2

DE-9-P
MALE, 9 PINS
" D " SUB
CONNECT TO MATRIX
XCP-ADAM-MC J2

DE-9-P
MALE, 9 PINS
" D " SUB
CONNECT TO ICP-2000
J1

RS485 +	6	6	RS485 +
RS485 -	1	1	RS485 -
GROUND	2	2	GROUND

NOTE RVON JUMPER J10,J11,AND J12
SHOLD BE SET TO PINS 1 AND 2
FOR RS-485 DATA

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
REMOVE ALL BURRS & BREAK SHARP EDGES
HOLD TOLERANCES PER
ANSI B94.11-1967, R1972
DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± 1/16 | DECIMALS .X ± .060 .XX ± .030 .XXX ± .010 | ANGLES ± 30'
MATERIAL
FINISH

CONTRACT NO.

APPROVALS	DATE
DRAWN W. YAU	29 OCT 96
CHECKED W. YAU	29 OCT 96
ISSUED	

ADAM301C

RTS SYSTEMS
BURBANK, CALIFORNIA, USA

ADAM
INTERCOM SYSTEM
RVON WIRING DETAIL

SIZE	FSCM NO.	DWG NO.	REV
D			A
SCALE NO			SHEET

Appendix A
Basic Network Configuration

Table of Contents

Basic Network Configuration

This section covers basic network configuration set up and testing. Also covered are basic concepts and operations, including the difference between LAN and WAN networks and how IP Addressing is used.

In a networked environment, such as a company, typically there are many computers connected together using a **router** or a **switch** (for more information, see router or switch in the definitions section). In larger companies, there may be several different routers distributed in buildings and plant locations. A router allows any LAN-side computer communicate with computers and devices outside the LAN (local area network). Routers send data packets from one place to another place on a network. Routers use network addresses to route packets to the correct destination. For example, in a TCP/IP network, the IP (internet protocol) address of the network interface is used to direct router destinations.

Because routers help computers inside the LAN "talk" with computers outside of the LAN. The security of a company's LAN may be compromised by gaps of open ports in the router. Security measures may have been instituted to compensate for these vulnerabilities. Consult your network administrator to learn about the security measures taken to protect your network. VPN, or virtual private network, is one such security measure to protect the intelligence of the LAN. A computer outside the LAN must have an address or key known by the VPN to allow access to the LAN. Many companies use a VPN to connect two different LANs, thus allowing the transfer of data between the two networks.

LAN (local area network) vs WAN (wide area network)

Local Area Network

Simply put, a LAN is a computer network that connects a relatively small area (a single building or group of buildings). Most LANs connect workstations and computers to each other. Each computer (also known as a "node"), has its own processing unit and executes its own programs; however, it can also access data and devices anywhere on the LAN. This means that many users can access and share the same information and devices. A good example of a LAN device is a network printer. Most companies cannot afford the budgetary or hardware expense of providing printers for each of its users. Therefore, one printer (i.e., device) is placed on the LAN where every user can access the same printer.

The LAN uses IP addresses to route data to different destinations on the network. An IP Address is a 32-bit numeric address written as four numbers separated by periods (For example, 1.160.10.240.

Note: For more information on IP Addresses, see your local network administrator.

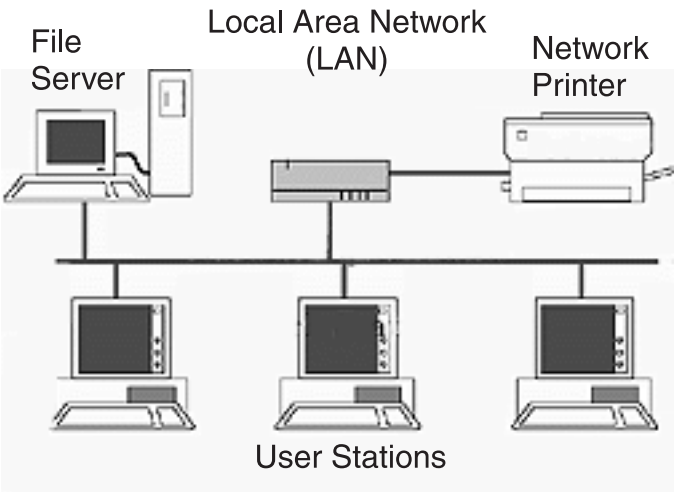


Figure 1. Local Area Network Diagram

Wide Area Network

A wide area network connects two or more LANs and can span a relatively large geographical area. For example, Telex Headquarters in Burnsville, MN is connected to several of its branch offices in Nebraska and Arkansas over the wide area network. The largest WAN in existence is the Internet.

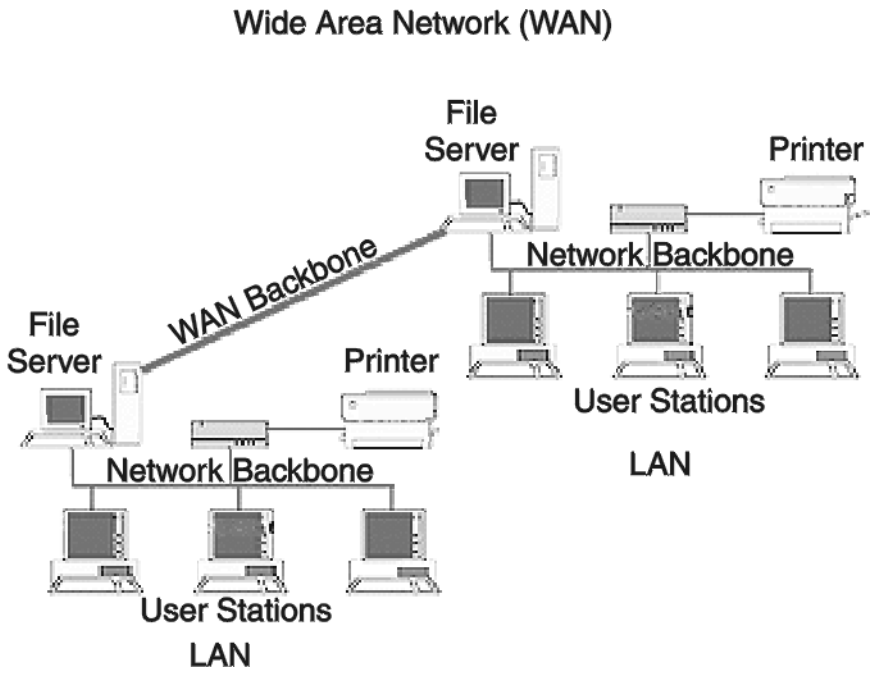
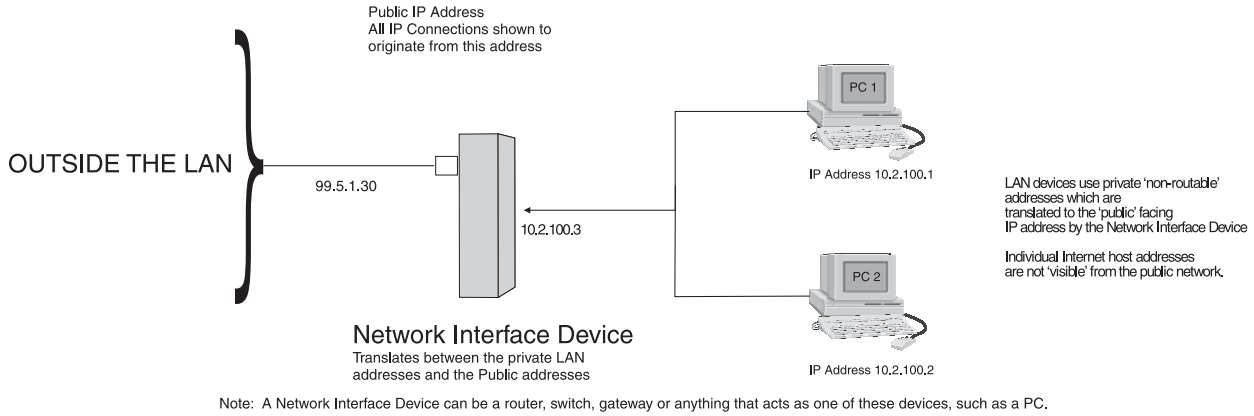


Figure 2. Wide Area Network Diagram.

Accessing the Wide Area Network (WAN)

Figure 3 shows LAN IP addresses using a common IP address, 10.2.100.x (192.168.x.x is another common address). Most devices are shipped with these addresses as its default. It is recommended to use these addresses for LANs.



Note: A Network Interface Device can be a router, switch, gateway or anything that acts as one of these devices, such as a PC.

Figure 3. Network Address Translation

Network Address Translation (NAT)

Using the initial IP address, then converting it to a valid WAN IP address is how the network address translation works in theory. Once the IP address is changed, it is up to the network interface device (such as a router, gateway, switch, etc.) to keep track of which computers are talking on which ports. For example, if two local devices (PC1 and PC2 in Figure 3) both wanted to talk via port 1031, then the network interface device would have to change one of the port requests to the next available port, 1032.

Ports

In general, a network port is an endpoint to a logical connection. The port number identifies what type of port it is. For example, port 80 is used for HTTP traffic. When you type an address into the *address bar* of a web browser, your computer goes to find an IP address for the url you are requesting (http://www.telex.com). To obtain this address, the computer contacts a DNS server (Domain Name Server). Once the IP address is found, it tries to connect to the http port of the network device (port 80). See Table 1 for a list of the more well-known Port numbers.

Each network device can be set up to respond or not respond to the various ports. The function of responding or “hosting a service” is called “serving”.

	Packet before translation				Packet after translation			
	Source		Destination		Source		Destination	
	IP Address	Port Number	IP Address	Port Number	IP Address	Port Number	IP Address	Port Number
To Internet	10.2.100.2	1031	192.156.136.22	80	99.5.1.30	1031	192.156.136.22	80
From Internet	192.156.136.22	80	99.5.1.30	1031	192.156.136.22	80	10.2.100.2	1031

Table 1 Packet Translation

If a second work station on the LAN wants to communicate to the same server, and happens to use the same source port number, then the LAN Modem will translate the source port number as well as the source IP address. In Table 2, a second LAN computer wants to access a web page. The NAT device now uses port 1032 for this connection where it used port 1031 in Table 1.

	Packet before translation				Packet after translation			
	Source		Destination		Source		Destination	
	IP Address	Port Number	IP Address	Port Number	IP Address	Port Number	IP Address	Port Number
To Internet	10.2.100.1	1031	192.156.136.22	80	99.5.1.30	1032	192.156.136.22	80
From Internet	192.156.136.22	80	99.5.1.30	1032	192.156.136.22	80	10.2.100.1	1031

Table 2. Packet Translation

Amazingly, all the address translation that occurs takes place automatically in order to make web browsing and other functions easier. This is also a way for large web hosting services to speed up the network by having different devices perform different functions.

Port Number	Description
1	TCP Port Service Multiplexer (TCPMUX)
5	Remote Job Entry (RJE)
7	ECHO
18	Message Send Protocol (MSP)
20	FTP - Data
21	FTP - Control
23	Telnet
25	Simple Mail Transfer Protocol (SMTP)
29	MSG ICP
37	Time
42	Host Name Server (Nameserv)
43	Whols
49	Login Host Protocol (Login)
53	Domain Name Server (DNS)
69	Trivial File Transfer Protocol (TFTP)
70	Gopher Service
79	Finger
80	HTTP
103	X.400 Standard
108	SNA Gateway Access Server
109	POP2
110	POP3
115	Simple File Transfer Protocol

Port Number	Description
118	SQL Services
119	Newsgroup (NNTP)
137	NetBIOS Name Service
139	NetBIOS Datagram Service
143	Interim Mail Access Protocol (IMAP)
150	NetBIOS Session Service
156	SQL Server
161	SNMP
179	Border Gateway Protocol (BGP)
190	Gateway Access Control Protocol (GACP
194	Internet Relay Chat (IRC)
197	Directory Location Services (DLS)
389	Lightweight Directory Access Protocol (LDAP)
396	Novell Netware over IP
443	HTTPS
444	Simple Network Paging Protocol (SNPP)
445	Microsoft-DS
458	Apple QuickTime
546	DHCP Client
547	DHCP Server
563	SNEWS
569	MSN
1080	Socks

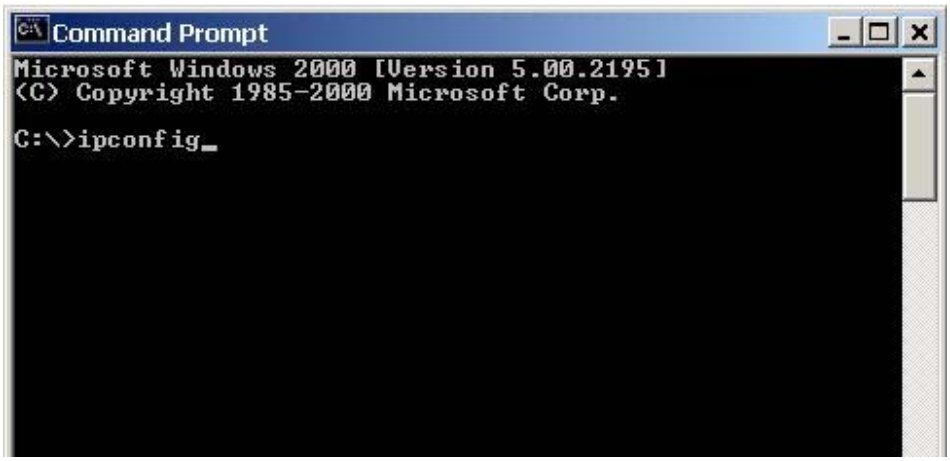
Table 3. Well-Known TCP Port Numbers

IP Addresses

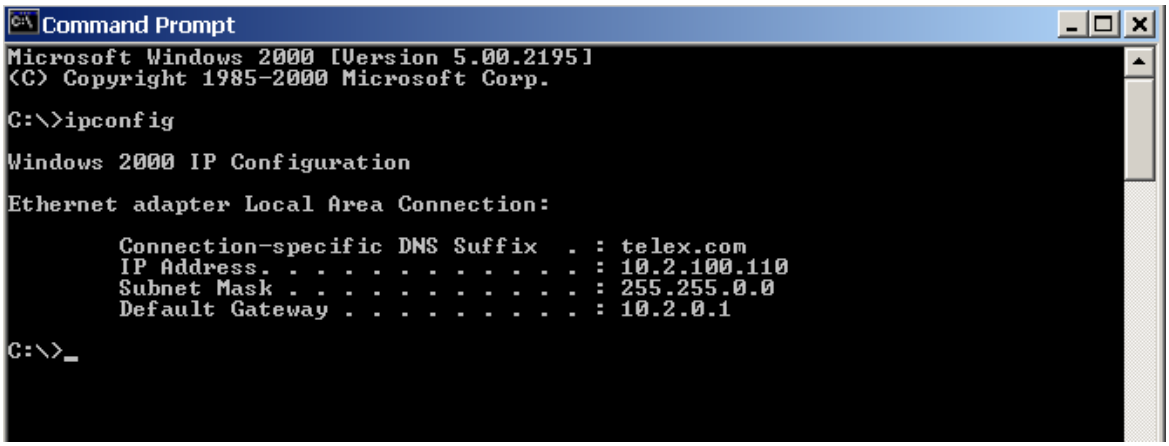
If you do not know your IP Address, you can open a DOS screen in a Windows®-based environment and bring up the ipconfig screen.

To find your IP Address using ipconfig, do the following:

1. From the Start Menu, open a **Command Prompt** screen.



2. At the prompt, type **ipconfig**, then press **Enter**.
The IP configurations appear for your machine, such as the DNS suffix, IP Address, Subnet Mask, and Default Gateway.



3. At the prompt, type **Exit** to close the screen.

Note: If you want more detailed parameters for your machine, type **ipconfig/ All**. This screen shows the computers network configuration settings.

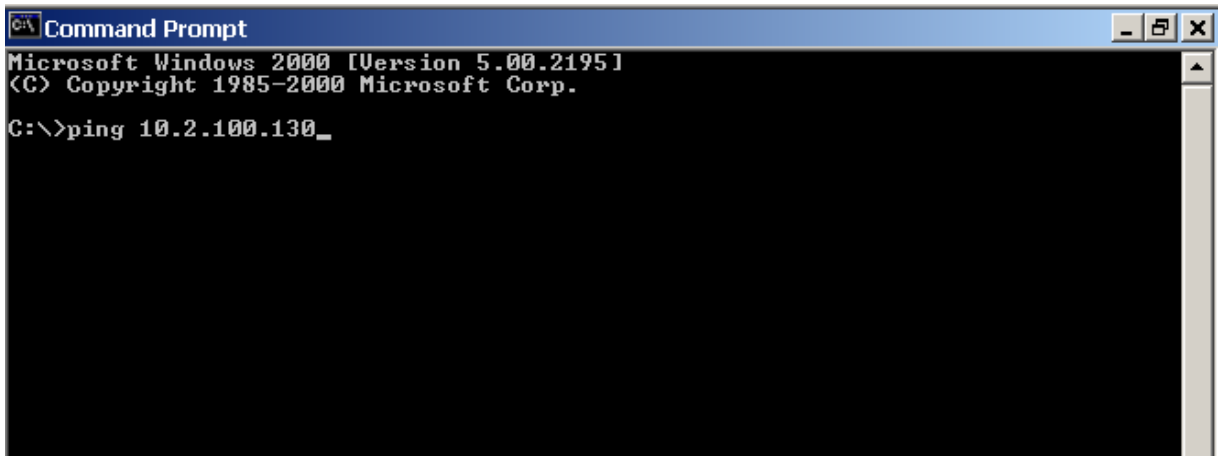
Ping a Computer

Pinging a computer on the network makes sure it is able to be “seen” and receive messages on the network.

> **Note**: You can also ping your RVON-8 card to verify that it is responding over the network by putting the cards IP address in place of the computer IP address.

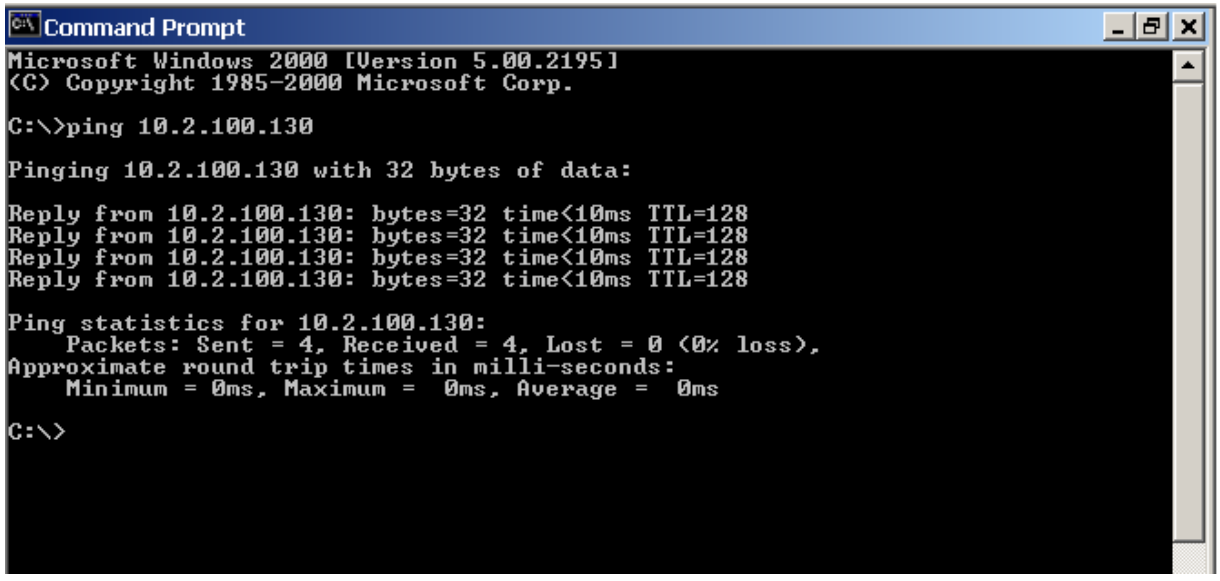
To ping a computer on the network, do the following,

1. From the Start Menu, open a **Command Prompt** screen.



2. At the prompt, type the **IP Address** of the computer you wish to ping. (for example, 10.2.100.130)

3. Press **Enter**.



Note: If the computer you are pinging is not responding to the ping, you will receive a time out message in the command prompt screen.

Possible Pitfall with Routers, Gateways, and Switches

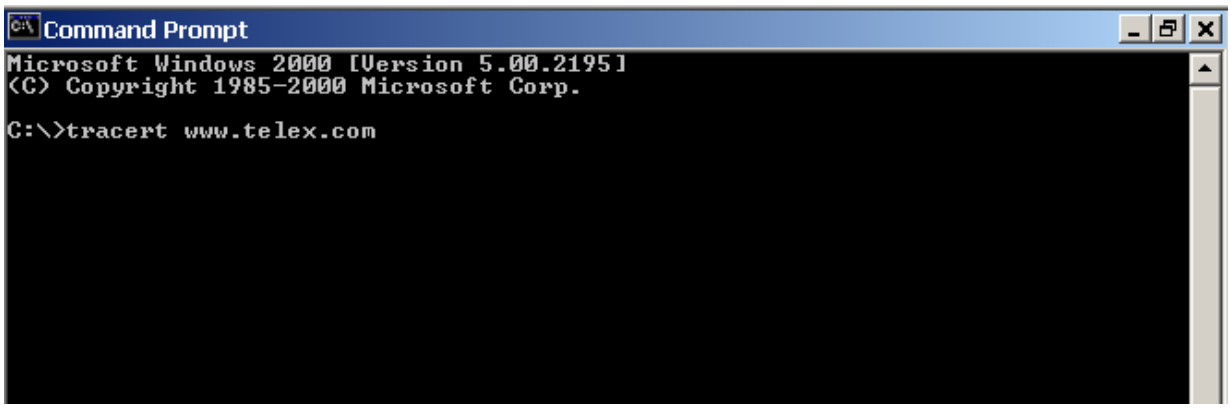
Anytime computers communicate through routers, gateways, and switches, they may be allowed or denied the connection. Network interface devices can be configured to block specific outgoing requests, as well as incoming requests, based on the IP address and/or port. This is one of the security mechanisms of a router. This also happens when broadcast messages are sent and received.

To view the path an IP address takes to retrieve information, you can execute a *tracert* from the Command Prompt screen.

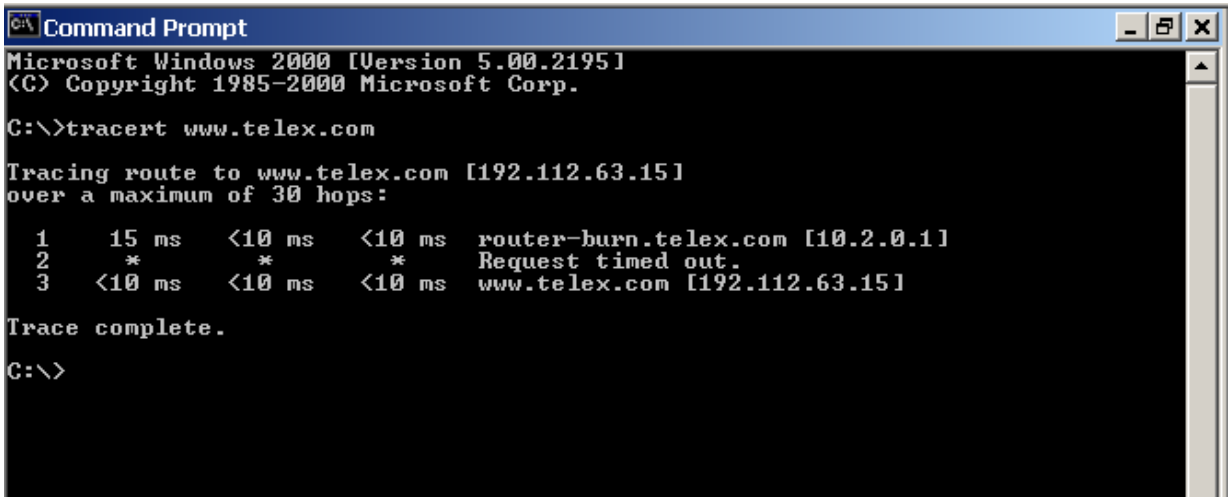
To run tracert, do the following:

1. From the Start Menu, open a **Command Prompt** screen.

2. At the prompt, type **tracert** and type the url or IP address you want to trace.



3. Press **Enter**.
The details of the tracer route are displayed.



Note: You will see the message “request timed out” if the IP address/port in or out is denied to the outgoing or incoming message.

4. When you are finished, type **exit** to close the Command Prompt screen.

RVON-8 Specific Configuration

RVON-8 cards use ports for communication of audio and control packets. Because routers can be configured to block certain incoming and outgoing requests, you will need to open the following ports in your network to allow WAN connections to and from a Network Interface Device. See Table 4 for the ports that need to be opened for the RVON-8 card to operate properly.

Port	Port Description
2076	UDP Call Control Signalling
2077	UDP Audio Packets
2079	UDP Telex Proprietary Signalling
2080	TCP Telex Keypanel Protocol
2081	UDP Pass Through Serial
2082	TCP Firmware Download
2100	Remote Administration
2102	Authentication Server

Table 4. Ports necessary for RVON-8 Card Functionality.

Figure 4 is an example of a router configuration screen. Not all routers are configured the same way and may not look exactly like this figure.

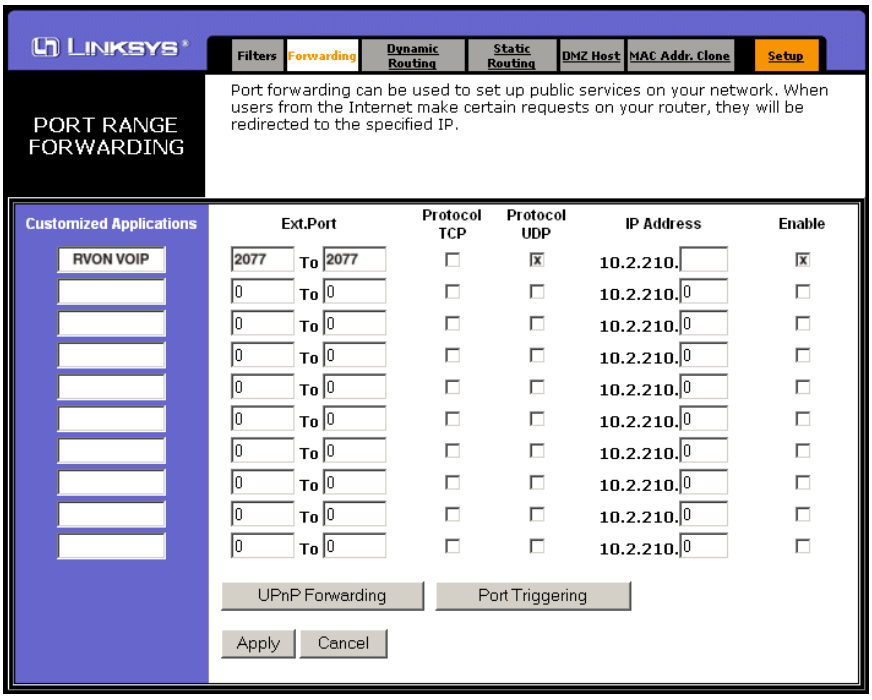


Figure 4. An example of a router configuration screen.

Note: Linksys™ only support up to 253 nodes on a router. This is why it is called a Router/Switch, because there are WAN functions like a router as well as having a 4-port LAN switch. It also does not support simultaneous forward and DHCP.

Network Terminology

Bridges

A **bridge** is a device that connects two LANs, or two segments of the same LAN that use the same protocol. Sometimes called “transparent bridges, they work at the OSI model Layer 2. Simply put, they are not concerned with protocols. Their main job is to pass data to a destination address that is predetermined in the data packet.

With a bridge, all your computers are on the same network subnet (*see* Subnet). This means your computers can communicate with each other and have their own Internet connection. If you assign your own IP Addresses be sure to use the same first 3 “octets” of the IP Address (for example, 192.168.0.X).

Domain Name Server (DNS)

A **DNS Server** is an Internet service that translates domain names (for example, in the URL *http:// www.telex.com,* the domain name is telex.com) into IP Addresses. The Internet is based on IP Addresses which are numeric and since domain names are alphabetic, they are easier to remember. Everytime a domain name is used it must go through the DNS server to be translated into an IP Address.

Gateway

A **gateway** is a node on a network that serves as an entrance to another network. The gateway routes traffic from a computer to an outside network that is serving the web pages. For example, the gateway for a home computer is the ISP provider that connects the user to the Internet.

In a corporate environment, the gateway often acts as a proxy server and a firewall. Gateways are similar to routers and switches in that they forward data to the destination and provide the path for which the data will travel to the destination.

Hub

A **hub** is a common connection point for devices in a network. A hub has multiple ports. When a data packet arrives at a hub, it is copied and distributed to all of its ports so that all nodes on the LAN can see the packets.

There are three types of hubs:

passive hub - this hub serves as a conduit for the data, enabling it to go from one device to another.

intelligent hub (also known as manageable hubs) - this hub includes additional features that enable administrators to monitor traffic through the hub.

switching hub - this hub reads the destination address of each packet and then forwards the data packet to the appropriate port.

IP Address (Internet Protocol Address)

An **IP Address** is an identifier or numerical name for a computer or device on a network. Data between computers are routed over the network using these addresses to identify the computer the message is being sent to and the computer the message is being sent from.

The format of an IP address is a 32-bit numeric address written as four numbers separated by periods. For example, an IP Address looks like 10.100.1.1.

IMPORTANT: When working within an isolated network (meaning there is no Internet access), IP addresses can be assigned at random just as long as they are unique to each computer and device. When the isolated network is connect to the Internet, registered Internet address must be obtained. This is to prevent duplication of addresses.

The four number in an IP add re used in different ways to identify a particular network and host on that network. There are three classes of Internet addresses.

Class A - supports 16 million hosts on each of 127 networks.
Class B - supports 65,000 hosts on each of 16,000 networks.
Class C - supports 254 hosts on each of 2 m million networks.

LAN

A **LAN** is a computer network that connects a relatively small area (a single building or group of buildings). Most LANs connect workstations and computers to each other. Each computer (also known as a “node”), has its own processing unit and executes its own programs; however, it can also access data and devices anywhere on the LAN. This means that many users can access and share the same information and devices. A good example of a LAN device is a network printer. Most companies cannot afford the budgetary or hardware expense of providing printers for each of its users. Therefore, one printer (i.e., device) is placed on the LAN where every user can access the same printer.

The LAN uses IP addresses to route data to different destinations on the network. An IP Address is a 32-bit numeric address written as four numbers separated by periods (For example, 1.160.10.240.

Port

A **port**, when referring to TCP and UDP networks, is an endpoint in a logical connection. The port number identifies the type of port it is. For example, port 80 is used for HTTP traffic.

Routers

A **router** is a device that forward data packets over networks. Most commonly, a router is connected to at least two networks (normally LANs or WANs). Routers are located at gateways, the place where two networks are connected. Routers do little data filtering, they mainly deliver the data.

Subnet

A **subnet** is a portion of a network that shares a common address component. On a TCP/IP network, a subnet is described as all computers or devices whose IP Address have the same prefix.

Subnetting a network is useful because it provides security for the network as well as increases performance of the network. IP networks are divided using subnet masks.

Switches

A **switch** is a device that filters and forwards data packets between networks. Switches operate at the data layer, and sometimes at the network layer.

WAN

A **wide area network** connects two or more LANs and can span a relatively large geographical area. For example, Telex Headquarters in Burnsville, MN is connected to several of its branch offices in Nebraska and Arkansas over the wide area network. The largest WAN in existence is the Internet.

Appendix B

Serial Port Programming of the RVON-8 Card

RVON Serial and Telnet Commands

RVON-8 card programming can also be done via direct serial or telnet connection. There are several physical connections to an RVON board:

- *Direct serial through custom debug cable (J20 6-pin bottom front)*
  The custom debug cable always functions as the general-purpose debug tool.

- *Backcard DB-9 J2*
  The backcard DB-9 must be disabled/enabled via a DIP Switch because it can also be used for serial port pass-thru. The backcard DB-9 can be used for a debug terminal when DIP switch 6 is switched to the ON position.

- *Backcard RJ-45 J1(Telnet only)*

Setup:

Serial Port:	38,400 baud, No-flow control
Telnet:	IP address, port 23

The following is the power-on messages displayed:

```
*****************************
RVON-8 Revision 1.00.00
(C) Copyright 2003 Telex Inc. All Rights Reserved.

Flash File System initialized.

DIP Switch settings: .......X

Configuration via AZedit disabled (via DIP Switch 1 on)
Back card UART enabled for pass-through serial (via DIP Switch 6 off)
Boot downloader disabled (via DIP Switch 7 off)
Autoload enabled (via DIP Switch 8 off)

Monitor Revision               1.00.00
Monitor Compilation time       Sep  4 2003, 15:52:31
Board type / revision          0 (RVON-8) / 1
RTL ID / revision              9 (RVON-8) / 0.16
Processor ID / Revision        0x80 (4Kc) / 0x05
Avalanche Device Type          Avalanche-I, Revision 1.3
Memory Controller Revision     1.204
Endianness                     Big
External Memory rate           Full
CPU Frequency                  125 MHz
Flash memory size              8 MBytes
RAM size                       64 MBytes
First free RAM address         0x9401f1a8
PLL Mode                       Operating 2.50X
-
Press any key to abort OS load, or wait 5 seconds for OS to boot...
** Defragmenting File System flash area(s) **
Reading flash file system... No deleted flash file entries found.
Loading file /bin/telex1 from FFS
PC: 94020000
FTP done!, PC: 94020000
Target Name: vxTarget
Attached TCP/IP interface to emac unit 0
Attaching network interface lo0... done.
NFS client support not included.

Adding 5270 symbols for standalone.
appCreate: autoBootLevel=2
MXP environment is created.
Creating RVON-8 application...
-> Bringing DSP subsystem out of reset...
DSP Daughtercard type is set to NONE - No DSP Daughtercard Found
0000002223 - ROOT: FPGA Version = ff24
0x97e796f0 (tNetTask): Link is up on EMAC A: 100 MBps and HALF duplex.
About to create Idle Task
About to create Measurement Task
Idle Measurement Tasks created
0000002536 - SERV: initializing connection server
0000002536 - DNLD: initializing download server
0000002635 - NMM: ATPM Update Database Granted
```

```
0000002735 - NMM: ATPM Configured for RVON operation
0000002735 - NMM: ATPM Update database done
0000002741 - NMM: 0, states: oper=NORMAL, admin=NORMAL, call=IDLE
0000002741 - NMM: 1, states: oper=NORMAL, admin=NORMAL, call=IDLE
0000002742 - NMM: 2, states: oper=NORMAL, admin=NORMAL, call=IDLE
0000002743 - NMM: 3, states: oper=NORMAL, admin=NORMAL, call=IDLE
0000002744 - NMM: 4, states: oper=NORMAL, admin=NORMAL, call=IDLE
0000002744 - NMM: 5, states: oper=NORMAL, admin=NORMAL, call=IDLE
0000002745 - NMM: 6, states: oper=NORMAL, admin=NORMAL, call=IDLE
0000002746 - NMM: 7, states: oper=NORMAL, admin=NORMAL, call=IDLE
0000002746 - RVON: port 0, now idle
0000002746 - RVON: port 1, now idle
0000002746 - RVON: port 2, now idle
0000002746 - RVON: port 3, now idle
0000002746 - RVON: port 4, now idle
0000002746 - RVON: port 5, now idle
0000002746 - RVON: port 6, now idle
0000002746 - RVON: port 7, now idle
0000003037 - CBTX: MC/DBX is talking
0000003041 - FNRX: control bus FIFO now enabled
0000003093 - FNRX: new card configuration received
```

Following the power-ON messages, press **Return**.
*The **->** appears. This is the operating system prompt.*

There are many different serial port commands supported from here, but it is **NOT** recommended that any be used ***EXCEPT:***

dbgcmd

Type "**dbgcmd**", then press **Return**.
This places the serial port into the **MXP>** *(MXP command mode)*

The MXP Command Mode is the only mode that will be used. Table 1 is a list of commands supported from the MXP Shell Prompt.

Table 1: Command Table

Command	Variable1	Variable2	Description
set rvon			Help screen which lists all "set rvon" commands
set rvon	ip_addr	X.X.X.X	Set the IP address for the RVON-8 Card
set rvon	netmask	X.X.X.X	Set the network mask for the RVON-8 Card
set rvon	gateway	X.X.X.X	Set the gateway IP address for the RVON-8 Card
set rvon	serial_ip	X.X.X.X	Set the pass-thru serial port IP address for the RVON-8 Card
set rvon	serial_baud	X	Set the pass-thru serial port baud rate for the RVON-8 Card
set rvon	user	abcdefg	Set the RVON-8 user name for telnet access *Default "telex"*
set rvon	password	abcdefg	Set the RVON-8 password for telnet access (8-40 characters) *Default "password"*
set rvon	vad_threshold	[adaptive |#]	Set the VAD threshold (silence dectection) Adaptive refers to auto-select. The # can be –20 to +10 dBm.
set channel [chan]			Help screen which lists all "set tcid" commands (TCID 0-7)
set channel [chan]	dest_ip	X.X.X.X	Set the destination IP address for this particular RVON_Channel (same as tcid)
set channel [chan]	dest_type	X	dest_type X = 0(rvon-8) 1(rvon-1) 2(rvon-10),
set channel [chan]	dest_chan	X	Set the destination channel – what port of far-end (0-7)
set channel [chan]	chan_codec	X	Set the profile to use which includes the compression codec see below (0-27)
set channel [chan]	onhook		Force the channel to disconnect the port

set channel [chan]	offhook		Force the channel to connect the port
activate			Must do an activate command to cause changes to take effect.
show rvon			Display current settings.
show channel [chan]			Display current settings.

Coding Profile Table

Coding Profiles	Codec	Codec Rate	Audio (ms) / Packet	Packets / Second	Encoded Audio (bytes)	IP Overhead (bytes)	Total Packet Size (bytes)	Bandwidth (Bytes / sec)	Bandwidth (kbps / side)	Bandwidth (kbps /channel)
0,3,6,9	G.711	64k	10	100.00	80	60	140	14000	112	224
1,4,7,10	G.711	64k	20	50.00	160	60	220	11000	88	176
2,3,8,11	G.711	64k	30	33.33	240	60	300	10000	80	160
12, 16	G.729	8k	10	100.00	10	60	70	7000	56	112
13, 17	G.729	8k	20	50.00	20	60	80	4000	32	64
14, 18	G.729	8k	40	25.00	40	60	100	2500	20	40
15, 19	G.729	8k	60	16.67	60	60	120	2000	16	32
20, 22	G.723	5.3k	30	33.33	24	60	84	2800	22.4	44.8
24, 26	G.723	6.3k	30	33.33	24	60	84	2800	22.4	44.8
21, 23	G.723	5.3k	60	16.67	48	60	108	1800	14.4	28.8
25, 27	G.723	6.3k	60	16.67	48	60	108	1800	14.4	28.8

NOTE: A channel consists of transmitting and a receiving side, so the bandwidth is double for a bi-directional audio stream.

NOTE: Bandwidth values are approximate maximums, actual bandwidth used could be considerably lower with VAD enabled.

Codec: Determines how the audio is compressed/decompressed and the name given to the defined algorithm.

Codec Rate: Actual bits/s of the audio in the compressed form. This is sent over the network through various data packets. Network efficiency can be calculated with IP header for each packet of X ms of audio.

Default Setup
Every attempt is made to ensure the board is shipped from the factory containing the following:

All are "**set rvon**" commands

Variable	Environment Name	Default Value	Description
ip_addr	EMACA_IPADDR	192.168.1.1	IP address for the RVON-8 Card
netmask	EMACA_NETMASK	255.255.255.0	Network mask for the RVON-8 Card
gateway	EMACA_GW	none	Gateway IP address for the RVON-8 Card
serial_ip	RVON_SERIAL_IP	none	Pass-thru serial port IP address for the RVON-8 Card
serial_baud	RVON_SERIAL_BAUD	9600	Set the pass-thru serial port baud rate for the RVON-8 Card
user	RVON_USER	telex	RVON-8 user name for telnet access
password	RVON_PASSWORD	password	RVON-8 password for telnet access (8-40 characters)
vad_threshold	RVON_THRESHOLD_VAD	adaptive	VAD Threshold

There are more parameters that the software will auto-configure if they have not been previously setup. The user can also set these parameters, in which case the software would not modify but take them as they are.

All are "**set chan #**" commands because they are for each audio channel.

Variable	Environment Name	Value	Description
dest_ip	RVON_DEST_IP_#	X.X.X.X	Destination IP Address for this particular RVON_CH
dest_type	RVON_DEST_TYPE_#	X	Destination Type Y = 0(rvon-8) 1(rvon-1) 2(rvon-10)
dest_chan	RVON_DEST_CHAN_#	X	Destination Channel – what port of far-end (0-7)
chan_codec	RVON_CHAN_CODEC_#	X	Profile to use (previous coding table)

Typing, "printenv, then pressing Return" from RVON-8 boot code or "sys_printenv" from the "MXP)" Debug System Prompt may show these commands. The Environment Name is listed because this is the label used by the software.

IMPORTANT!: If the user is attempting to do a "setenv" to change a parameter from the RVON-8 boot code, the Environment Name must be used and NOT the "set rvon variable" name.