



Connecting Vorne Displays to Ethernet Networks

AN-100

August 24, 2000 (Version 1.0)

Introduction

This document explains how to connect Vorne displays to an existing Ethernet Local Area Network (LAN). Because Vorne displays are designed to communicate natively over RS-232 or RS-422/RS-485 serial connections, they cannot connect directly to a LAN. Instead, they require an additional piece of hardware to serve as an Ethernet to serial gateway. The gateway converts data from the LAN into serial data for use with Vorne displays. Although there may be several products that can accomplish this, we recommend a piece of hardware manufactured by Lantronix®, called the UDS-10 Device Server. This device can be purchased from Vorne or directly from Lantronix.

The diagram below depicts examples of the UDS-10 in use on a LAN with Vorne displays. The UDS-10 sits on an Ethernet network as a typical node. It receives data formatted within one of the protocols that rides on top of Ethernet and IP (TCP, UDP, or Telnet), strips off the given protocol specific packaging, and sends the internal data

serially to the Vorne displays. The serial data can either be sent over an RS-232 or an RS-422/RS-485 connection.

This application note describes all of the steps necessary to integrate the Lantronix UDS-10 Gateway with your network and Vorne displays. Covered topics include installing and configuring the UDS-10, sending data to Vorne displays through the UDS-10, and configuring Vorne displays and Vorne software to work with the UDS-10.

The steps in this application note are geared toward users running TCP/IP on a network with Windows® based workstations. This does not mean that the UDS-10 and Vorne displays cannot be used on other platforms (i.e. UNIX, AS400). Non Windows-based platforms will simply require additional attention to the Lantronix documentation as well as platform specific knowledge.

If, after reading through these sections, you have questions regarding this topic, please call Vorne technical support to receive further assistance.

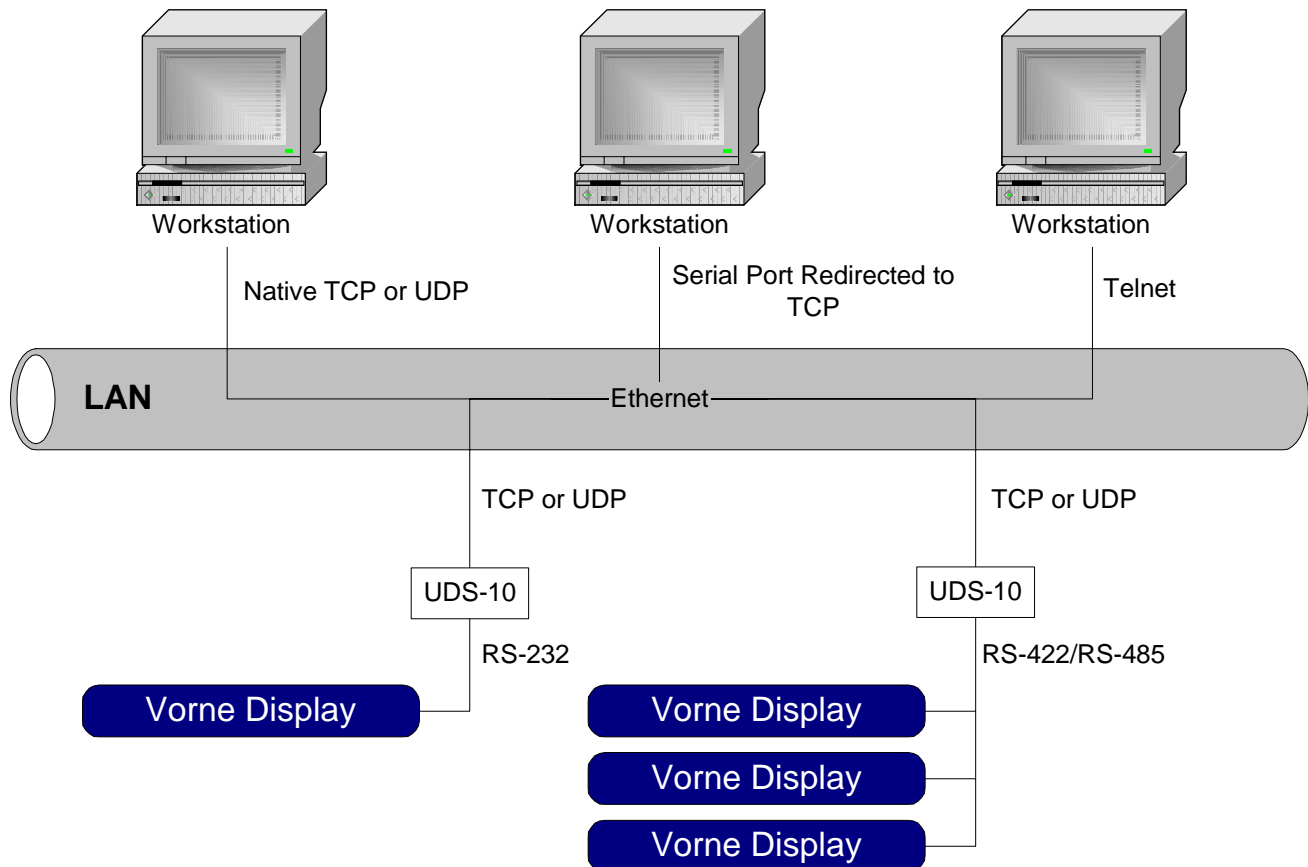


Table of Contents

Introduction	1
Table of Contents	2
Specifications	2
Applicable Vorne Displays and Software	2
Hardware Needed	2
One display per network drop	2
Multiple displays per network drop	2
Software Needed	2
Information Needed	2
The UDS-10 Gateway	3
UDS-10 Components	3
Serial connection	3
10BASE-T network connection	3
Power connection	3
Indicator lights	3
Configuring the UDS-10 for Ethernet	3
IP Address via Terminal Emulation	3
IP Address via ARP/Telnet	5
DHCP Considerations	6
Additional Communication Parameters	6
Configuring the UDS-10 Serially	6
Choosing a Serial Protocol	7
Setting the Baud Rate	7
Using a Local Port	7
Other settings	7
Sending Data to the UDS-10	7
The Lantronix Redirector Service	7
Installing the Redirector	8
Configuring the Redirector	8
Adding a logical Serial Port	8
Mapping IP to Serial ports	8
Sending data to the Redirector	9
Configuring Vorne Products	9
Configuring Vorne Software	9
Configuring Vorne Displays	9
Connecting to the UDS-10 via RS-232	9
Connection to the UDS-10 via RS-422	9
For More Information	9
Revision History	10

Specifications

This section describes which of the Vorne products this solution will work with as well as what supplies you may need to implement it.

Applicable Vorne Displays and Software

The Ethernet solution described in this document applies to many Vorne products. The displays that can be used include the 87 Series, M1000, GY2200, 2000 Series, and 2100 Series. The Vorne software that can be used with this solution includes Serial 97, M1000 Express, and Clock 87.

Hardware Needed

The hardware needed for this application depends on how you plan to use Vorne displays over your network. The number of displays you wish to connect to the network and the number of physical network locations that you plan to connect displays to will determine what you need.

One display per network drop

One display connected directly to the network is the simplest of all configurations. To do this, you will need one UDS-10 Gateway, one RS-232 serial cable, and one Ethernet cable.

Multiple displays per network drop

If you are going to network multiple Vorne displays serially from the gateway, you will need one UDS-10 Gateway, enough RS-422 cabling to connect the UDS-10 to all of the displays, and one Ethernet cable.

NOTE: Each additional network drop that you want to add one or more Vorne displays to will require an additional UDS-10 Gateway.

NOTE: Additional items that may be needed depending on how you install and configure the UDS-10 include a DB9 to DB25 serial cable and a soldering iron with solder.

Software Needed

Besides the software you are using to send information to the Vorne displays, you may also need some additional software for use with the UDS-10. To configure the UDS-10 within your network, you will need access to either a Terminal Emulation program (such as HyperTerminal supplied with the Windows® operating system), or access to a Telnet utility (which is also supplied with Windows®). You will also need a browser such as Internet Explorer® or Netscape®, with Java installed and enabled. Depending on the software you are going to use to communicate with Vorne displays, you may need the Lantronix Redirector service that is supplied with the purchase of the UDS-10.

Information Needed

There are several pieces of information that you will need in order to configure the UDS-10 on your network. If you are not the network administrator, you will need to get this information.

- An available IP address for use with your UDS-10.
- The Subnet Mask used on your network.
- The Gateway IP address if your UDS-10 will be on a different network from your PC.

NOTE: Choosing the IP address will depend on whether or not your network uses DHCP. This topic is described later in the UDS-10 configuration section. Read these directions and see your network administrator about configuring this correctly.

The UDS-10 Gateway

The UDS-10 Gateway connects serial devices to Ethernet networks using the IP protocol family (TCP, UDP, etc.). Although there are many IP protocols supported by this device, only TCP, UDP, and Telnet apply for use with Vorne displays (see the UDS-10 documentation for more information on additional protocols). The UDS-10 operates on networks running TCP/IP and is designed to run at 10 MPS. This means that your network must either support native 10 MPS communication, or it must have a switch/hub capable of supporting both 10MPS and 100MPS.

This section provides detailed information on several concepts regarding use of the UDS-10. It describes the device physically, it walks you through installing and configuring the device, and it describes how to write and/or use software on your PC to send data to Vorne displays through the UDS-10. Reading each of these sections should give you an in depth and comprehensive understanding of how to use the UDS-10 to provide Ethernet connectivity to Vorne displays.

UDS-10 Components

Serial connection

One side of the UDS-10 has a single connector and is marked with the word 'serial'. The connector is a female DB25 connector used for serial ports.

10BASE-T network connection

The other side of the UDS-10 has a connection marked '10Base-T'. This connector is a standard RJ45 Ethernet port.

Power connection

The UDS-10 also has a connection marked '6vdc'. The slot below this label is used to connect power to the UDS-10. It is rated for between 6 and 9 volts DC. The UDS-10 product includes a power supply.

Indicator lights

There are several indicator lights on the UDS-10. They are used to indicate various states of the device. Some of these will be mentioned later during the discussion of installing and configuring the UDS-10.

Configuring the UDS-10 for Ethernet

Configuring the UDS-10 for use consists of two distinct steps. The first step is to give the UDS-10 an IP address and TCP port number. The second step deals with setting various other communication parameters that differ depending on how you are going to use the UDS-10.

Setting the IP address can be accomplished in several ways. One possibility is to use a terminal emulation program, such as HyperTerminal, to program the UDS-10 directly through its serial port. Another way is to use the ARP and Telnet protocols to program the UDS-10 over the network. Or, if your network uses DHCP, the UDS-10 will

automatically be assigned an IP address. DHCP may force the need for other considerations that are discussed later.

Setting the additional communications parameters is accomplished through the use of a web browser such as Internet Explorer® or Netscape®.

IP Address via Terminal Emulation

Before you can run the terminal emulation utility you must physically connect the UDS-10 to a communication port on your PC. In order to do this you will need a DB9 to DB25 serial cable capable of connecting your PC to the UDS-10. Also, be sure the UDS-10 is connected to power.

The Windows operating system includes a terminal emulation utility called HyperTerminal. This section will describe how to use HyperTerminal to configure the UDS-10. To run this utility, you should be able to click on Start>Programs>Accessories>HyperTerminal. If you do not find it in this location, it probably wasn't installed with the operating system. In this case, simply click Start>Settings>ControlPanel>Add/RemovePrograms, choose the Windows NT Setup tab, and then make sure the communications option has a check mark next to it.

When you start HyperTerminal it will automatically start a wizard that will walk you through creating a new connection. The wizard will present you with several windows, prompting you for various pieces of information. The first window, pictured in figure 1, asks you to name the connection you are about to create. Just give it a simple name such as 'UDS-10', then click OK.

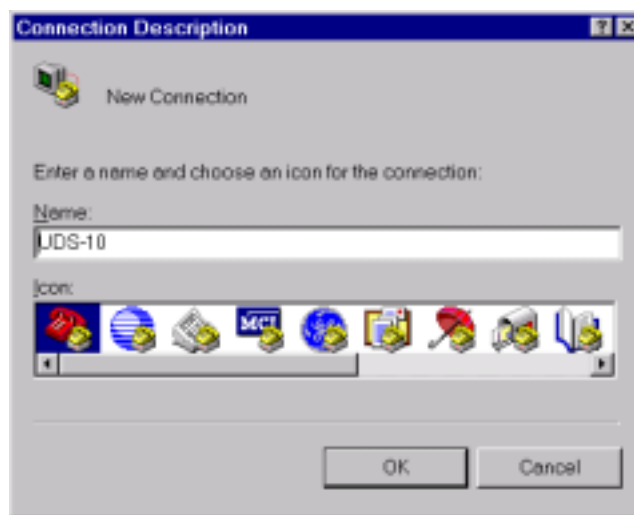


Figure 1

The next window, shown in figure 2, may ask for several items (depending on whether or not you have a modem installed), the important one here is labeled 'Connect using'. Here you must select which com port to use for the connection. Choose the com port that the UDS-10 is physically connected to.



Figure 2

The properties window, figure 3, asks for the port settings. These should be set to 9600 Baud, 8 bits, no parity, 1 stop bit, and None for flow control.

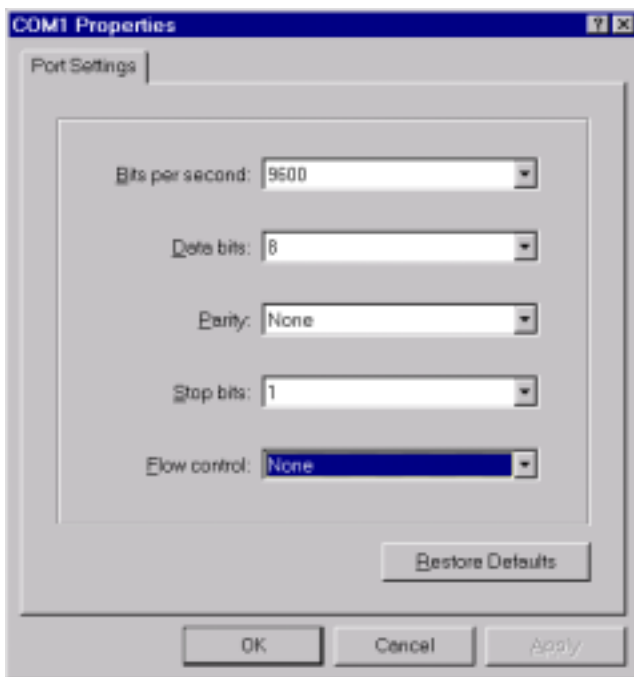


Figure 3

At this point, if your UDS-10 is connected to power and the serial lines are properly connected, you should have an open connection to the UDS-10. The only visual clue to this in the HyperTerminal window is the timer in the lower left corner. Now you will need to get the UDS-10 into configuration mode. To do this, remove power from the UDS-10, then, while holding down the 'x' key on your keyboard, reapply power to the UDS-10.

Release the 'x' key when you see some quick lines of information about the UDS-10 and a prompt to press enter for setup mode. Press enter and you will be brought to the main menu, as shown in figure 4.

NOTE: you have to press Enter quickly or you will receive a timeout error. If this happens, simply repeat the steps to get the UDS-10 into configuration mode and press Enter quicker.

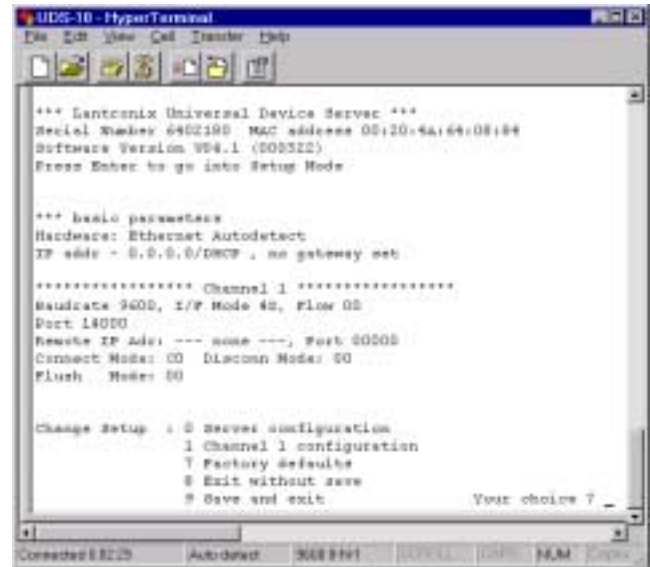


Figure 4

Choose '0' for Server configuration and press Enter. You will then be prompted to enter the IP address. As you enter your address you will see '(000)' automatically entered next to each byte of the address. Don't worry about these, simply enter your number as you normally would (i.e. 192.168.1.145), and then press Enter. It should look similar to the window shown in figure 5.



Figure 5

After entering the IP address, you will be further prompted to enter additional information. Disregard these for now. As each one comes up, simply press Enter to accept the default. You will eventually arrive at the main menu of setup choices. Choose '9' to save and exit, then press Enter. The UDS-10 now has an IP address.

NOTE: The steps you have just performed temporarily set the IP address in the UDS-10. You **MUST** go on to the next step (Additional Communication Parameters) in order to save the address permanently.

Close the HyperTerminal window and skip to the section labeled 'Additional Communication Parameters' on page 5.

IP Address via ARP/Telnet

Before you can use the ARP and Telnet protocols to configure your UDS-10, you must physically connect the UDS-10 to the network. Also, be sure the UDS-10 is connected to power. Once you connect it, the indicator light marked 'link' on the UDS-10 should be solid green.

ARP and Telnet can be used from within a UNIX or a Windows® environment. The following instructions will assume a Windows® environment.

Using the ARP and Telnet protocols in a Windows® environment is done from a DOS command prompt. To get to a command prompt, click Start>Programs>Command Prompt. From the prompt you will want to use the arp command with the switch '-s' to create an entry in the ARP table using your intended IP address and the hardware address of the UDS-10. An example of what is required is shown below in figure 6. Simply replace the example IP address with your own and replace the example hardware address with the one you will find on the back of your UDS-10.

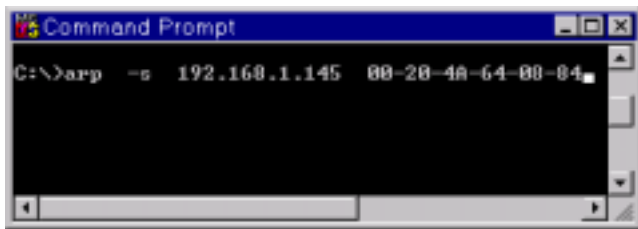


Figure 6

NOTE: In a Windows® environment, the arp command will only work if there is already at least one IP address defined in the given PCs ARP table other than its own. If you get an error message when executing the above command, simply use the 'ping' command with another address defined on your network. This will automatically add that address into your local ARP table, then retry the above command.

After registering the IP address with your network, the next step is to program the UDS-10 with its IP address. You will do this by using the Telnet utility. At the command prompt, enter the text as shown in figure 7, replacing the example IP address with your IP address.

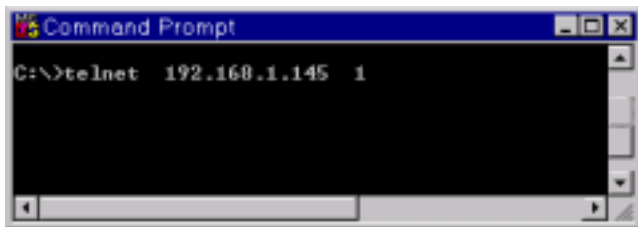


Figure 7

Entering this command will open a telnet window and will quickly tell you the connection failed. The failure is the expected result. If you do not get the failure message, the command will eventually time out.

NOTE: The probable cause of this is a mistake in the mapping of your IP address to the physical MAC address on the UDS-10. Type 'arp -a' at the command prompt to look at the mappings defined on your computer. Carefully check the IP address and the MAC address to make sure they are correct. If they are not, repeat the step in figure 6.

Now, close the telnet window and go back to your command prompt. Enter the text as shown in figure 8, again replacing the example IP address with your own.

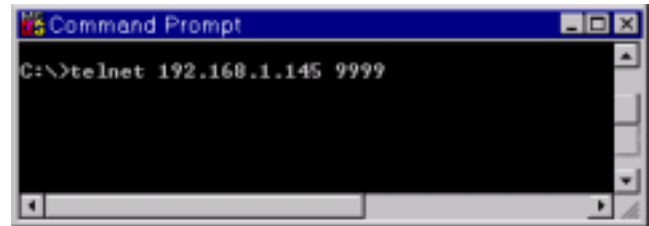


Figure 8

Entering this command will again open a telnet window, this time you should see some information at the top of the window about your UDS-10. The last line asks you to press Enter to enter setup mode. Go ahead and press enter. You should see the window as shown in figure 9. **NOTE:** If you do not press Enter quick enough, you may get a message telling you that the connection was lost. If this happens, you must repeat BOTH of the telnet steps again, in order (figure 7 & 8).



Figure 9

At this point you should enter '0' and then press Enter. The window will then prompt you for an IP address. Notice that the configuration utility will automatically put '(000)' into your IP address as you type. Don't worry about this. Simply type your IP address as you normally would, and then hit Enter.

The configuration utility will continue to ask you for several other parameters, but you will not be setting them at this time. Simply continue to press Enter until you are back to

the main menu. Enter '9' to save and exit, then press Enter. You may get a message that the connection was lost, but this should not matter. If the settings did not get saved in the UDS-10, you would not be able to proceed with setting the communication parameters. At this point, you will have to perform this step again (figure 7,8, and 9).

NOTE: The steps you have just performed only set the IP address temporarily within the UDS-10 itself. You **MUST** go on to the next step (Additional Communication Parameters) in order to save the address permanently.

Close the HyperTerminal window and skip to the section labeled 'Additional Communication Parameters' on page 5.

DHCP Considerations

The DHCP protocol is used on many Ethernet networks running TCP/IP in order to conserve IP addresses. The UDS-10 ships with a default address of 0.0.0.0, which automatically enables DHCP within the UDS-10. If a DHCP server exists on the network, it will automatically supply the UDS-10 with an IP address, gateway address, and subnet mask when the UDS-10 boots up.

For most installations, you will need to have the network administrator configure the UDS-10's IP address to be kept permanently. If you do not do this, any software that tries to send data to the UDS-10 will have to handle the fact that the IP address may change.

Additional Communication Parameters

There are several other communication parameters that must be set before you can start using your UDS-10. These can be set in one of two ways. You could use telnet or a terminal emulation utility as you might have done in order to configure the UDS-10 IP address (see the UDS-10 documentation if you wish to use either of these methods). You may also use a web browser such as Internet Explorer® or Netscape® (Version 4.0 or higher for each is required). The following instructions will assume that you are using a web browser.

The first step is to start your web browser. Then, in the address box, type 'http://192.168.1.145', replacing this example IP address with the one assigned to the UDS-10. It may take a few seconds, but eventually you should see the window presented below in figure 10.



Figure 10

Click on the button labeled 'Connect'. You should see the buttons above become enabled fairly quickly. Now, click on

the button labeled 'Server Properties'. You should now see the window shown in figure 11.

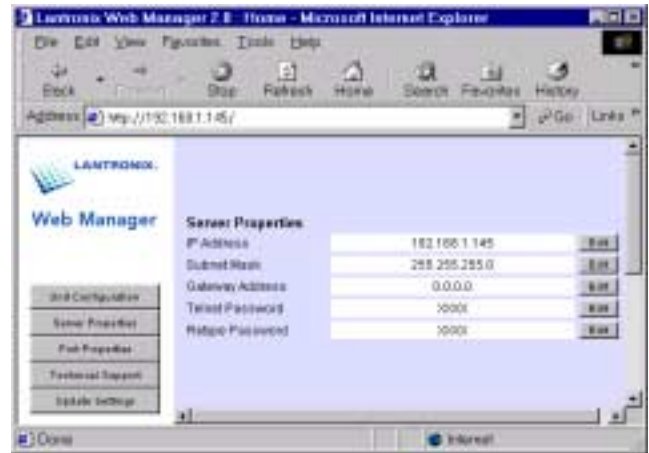


Figure 11

From here there are two things you will need to do, and possibly a third. First, make sure the IP address listed is the correct one (it is almost impossible for it not to be). Then, check the Subnet Mask and decide if it needs to be changed. Subnet masks are specific to each network, check with your network administrator to get the value of yours. The third item you may need to set is the Gateway Address. This is only necessary if your UDS-10 is located on a LAN separate from the one your PC is located on. If this is the case, you will need to again check with your network administrator to get the proper value. When you are sure all of these items are correct, click on the button labeled 'Update Settings'. Your UDS-10 is now configured correctly for communication over the network.

Configuring the UDS-10 Serially

There are several parameters that must be set within the UDS-10 in order for it to communicate correctly over its serial port. The parameters are set using a web browser, the same as the Ethernet communication parameters were.

From the UDS-10's web page, click on the button labeled 'Port Properties'. This should present you with the page as shown in figure 12.



Figure 12

There are really only three settings here that may need to be changed in order for you to communicate with Vorne displays. How you configure these depends on which

displays you are using and how many of them you are using.

Choosing a Serial Protocol

First, you need to choose the proper serial protocol. If you click on the button labeled 'Edit' next to the serial protocol option, you will see a list of three choices: RS-232, RS-422/485 - 4 wire, and RS-485 - 2 wire. If you are only wiring a single Vorne display to your UDS-10, you should wire it using RS-232. Therefore you should choose the RS-232 option as your serial protocol. On the other hand, if you are going to wire multiple Vorne displays together off of the serial port, you should wire them using RS-422. Therefore you should choose the RS-422/485 - 4 wire option as your serial protocol. Once you choose your protocol, press Enter. If you need help figuring out how to wire these standards correctly, consult the Vorne display manual for complete instructions including wiring diagrams and pin-outs. There are also wiring diagrams later in this document, in the section 'Configuring Vorne Displays'.

Setting the Baud Rate

The second thing you need to do is set the speed (Baud rate) of the serial port. This speed needs to match the speed set on your Vorne display. Most Vorne displays are defaulted to a baud rate of 9600 (the M1000 being the exception at 19200). This is configurable, however, and may be different on your display. If you do not know how to determine what speed the display is set to, consult the product manual.

Once you have determined the speed, click on the button labeled 'Edit' next to the speed option. This will give you a list of speeds to choose from. Select one speed and press Enter.

Using a Local Port

The third setting you need to configure is the Local Port. This is the TCP port that the UDS-10 will listen on for remotely initiated connections. Valid values are within the range of 1 to 65535, however, some numbers are reserved. Numbers 0, 7, and 9999 are reserved by the UDS-10. Numbers 14000 to 14009 are reserved by the Redirector service. Before you can set this number correctly, you will need to decide how your PC software is going to communicate with the UDS-10 gateway.

If the software you are going to use on the PC will be communicating directly to the UDS-10 using TCP, UDP, or Telnet, then you may set this number to anything within the valid range mentioned above. If, on the other hand, your software sends data to a serial port (all of the Vorne software utilities fall into this category), then it will need to use the Lantronix Redirector service. In this case, you should choose one of the numbers reserved by this service, namely 14000 to 14009.

Other settings

The remainder of the serial port settings are defaulted to the same settings that Vorne displays are defaulted to (8 data bits, 1 stop bit, no parity, no flow control). They should not need to be changed unless you have changed them on the Vorne display. If this is the case, then you will need to set them on the UDS-10 to match your display. If you would rather change them on the display to match the UDS-10, then consult the display manual for details.

Once you are satisfied that all of your serial port settings are correct, click on the button labeled 'Update Settings'. Leave this window open for now because you will most likely need to use it to set additional options such as the TCP port mentioned above.

Sending Data to the UDS-10

Conceptually, there are three ways to communicate to a Vorne display using the UDS-10. The first is to natively use TCP or UDP, wrapping the display specific data inside the packets used by these protocols, and sending them directly to the gateway. The second is to use the Lantronix Redirector service, allowing display specific data to be sent directly to a serial port on a PC. The Redirector intercepts the data bound for the serial port and instead sends it out over the LAN to the gateway. The third is to open a telnet session between the PC and the UDS-10, thus allowing the display specific data to be sent straight through untouched.

In the case of a TCP or Telnet type connection, the UDS-10 can also convert serial information sent by Vorne displays back into the sending protocols packets and send them back to the original sender. This works because TCP and Telnet are connection-based protocols. This comes in handy when you need assurance that your data has made it to its destination. With UDP, on the other hand, you would only be able to send data to the displays from the workstation, without any assurance it arrived. This is because UDP is a connection-less protocol.

If you are using any of the software Vorne currently provides for its displays, you will use the Redirector service. This is because all Vorne software is currently designed to write out to a serial port. Also, if you have already written software for Vorne displays that writes data to a serial port, you will use the Redirector service. If, however, you are writing custom software to drive a display, you can use either method.

NOTE: If you are writing software for the Windows® platform, and you are using one of the common development environments (VB, Delphi, Visual C++, C++ Builder, etc.), you should be able to find drop in components that will allow you to easily take advantage of any of the above mentioned methods. Many of these environments come with pre-packaged components, but, if not, there are also many 3rd party components. Look for components that allow you to write to a serial port or components that allow you to send data over TCP and/or UDP.

The Lantronix Redirector Service

For software applications that have already been written to send data directly to a serial port, Lantronix provides the Redirector service. This service runs on your PC, taking data that your software thinks it is sending to a serial communications port, and instead sending it out onto your network to the UDS-10 gateway. The interface to the software allows you to configure your PC to correctly use 1 or more gateways, mapping the IP address of each gateway to a logical serial port. All you have to do is configure your software to write to the logical serial port that the Redirector knows about instead of the physical serial port that used to be connected directly to a Vorne display.

Installing the Redirector

You must install the Redirector service on any PC that will run software requiring its serial port bound data to be redirected to a gateway. The software is available free on the Lantronix website (www.lantronix.com) and is also included on the CD-ROM delivered with the UDS-10. If you download it from the web, it will come in the form of an executable called 'Red32Bit.exe'. If you install it from the CD_ROM, you would run the 'Launch.exe' program, which is simply a front end to the same 'Red32Bit.exe' program. In either case, run the executable and follow the on screen installation instructions to install it on your PC.

The Redirector actually consists of two programs. One is the service that runs transparently in the background. The other is a front-end utility that allows you to configure the service.

Configuring the Redirector

Configuring the Redirector basically consists of two steps. The first step is to choose a logical serial communication port for the Redirector to use. The term 'logical' is used here because the Redirector does not allow you to use any real, physical communication ports that you may have installed on your PC. The second step is to map the IP address and port number of a UDS-10 Gateway to that logical communication port. If you have multiple UDS-10 gateways on your network, you can map multiple logical communication ports, one to each UDS-10.

To proceed with configuring the Redirector service you will need to start the interface program. To do this, select Start>Programs>Lantronix Redirector>Configuration. You will see the window presented in figure 13.



Figure 13

Adding a logical Serial Port

To add a logical serial port, click on the button labeled 'Com Setup'. You should see the window presented in figure 14.

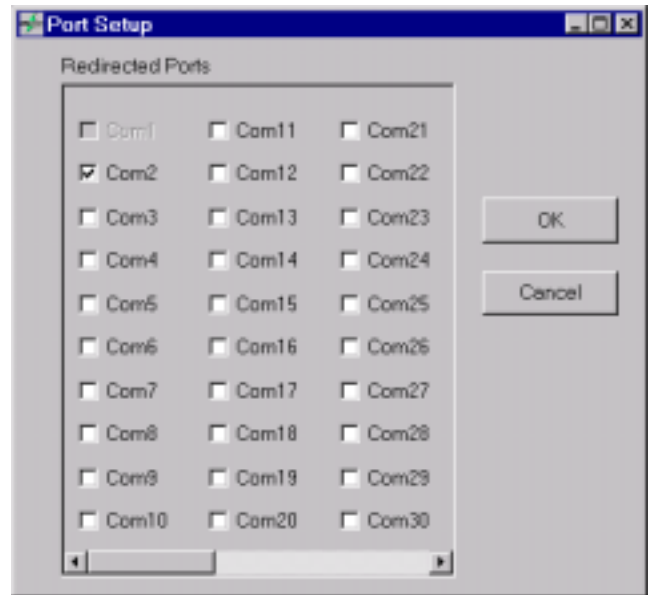


Figure 14

You may have noticed that there are a lot of logical com ports to choose from. For most applications, only one or two will actually be needed. You may also notice that some com ports are disabled. These are physical com ports that are already defined on your system.

To use any of the logical com ports, simply place a check in the box next to them. Then click on the 'OK' button. When you get back to the main window, you may click on the 'Redirect' drop down box to see all of your logical com ports. The maximum number of com ports supported by the Redirector service at one time is four.

Mapping IP to Serial ports

Once you have defined your logical serial ports, you must map each one to a UDS-10 IP address and port number. Complete the following process for each serial port that you need to map to a UDS-10.

First, click on the button labeled 'Add IP'. You will then see the window shown in figure 15.

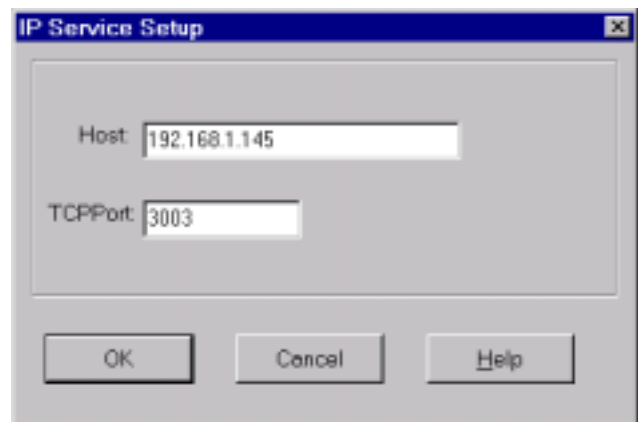
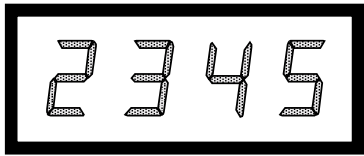
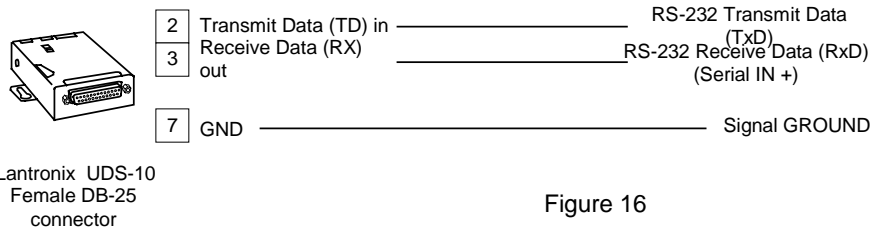


Figure 15

In the box labeled 'Host', enter the IP address you assigned to a specific UDS-10 (i.e. 192.168.1.145). In the box labeled 'TCPPort', you must enter a port number between 3000 and 3009. The number you choose for this should be



VORNE DISPLAY with RS-232 Input

Figure 16

the value you chose when you configured your UDS-10 minus 11000. For example, if you set your UDS-10 to use port 14003, then you should enter 3003 here. Click on 'OK'.

You should now be back to the main window. Place a check in the box labeled 'Silent Mode'. This will keep the Redirector from displaying status messages while it is operating. Click on the button labeled 'Save'. You will have to reboot your computer in order for the new communication ports to be properly registered on your system.

Sending data to the Redirector

It should be relatively simple for your software to use the Redirector to send data to the UDS-10. Your software should offer some way to change which serial communication port it uses to send data out. Use that mechanism to configure your software to send data to one of the logical serial ports you created in the Redirector. Then, run your software as you always did. The Redirector will intercept the data and properly wrap it to be sent out onto the network.

Configuring Vorne Products

Configuring Vorne Software

The Vorne software utilities that are currently supported for use with the UDS-10 are Serial 97, M1000 Express, and Clock 87. The only change that must be made to these utilities in order to take advantage of the UDS-10, is to change the serial port the given utility is configured to use. Specifically, you want the utility to use the logical serial port you created using the Redirector.

Each utility offers a way to configure which serial port is used, and should be fairly easy to find. If you cannot find it easily, see the help file that should accompany each utility.

Configuring Vorne Displays

The main concern with configuring Vorne displays deals with correctly wiring your displays to the UDS-10's DB25 serial connector. You will either wire the displays for RS-

232 or RS422, depending on the number of displays you are connecting.

Connecting to the UDS-10 via RS-232

If you are only connecting one display within 50' of your UDS-10, then you will want to use RS-232 with 3 wires. One wire connects the Receive Data (RX) pin of the UDS-10 to the receive pin of the display, a second wire connects the Transmit (TD) pin of the UDS-10 to the Transmit pin of the display, and the final wire connects ground between the two devices. Figure 16 depicts this relationship. NOTE: On the display side, the specific pin numbers are different depending on which Vorne display you are using. See the given display's product manual for a complete description of specific pin outs.

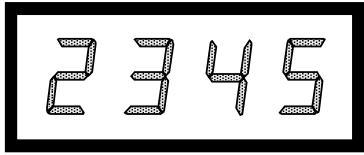
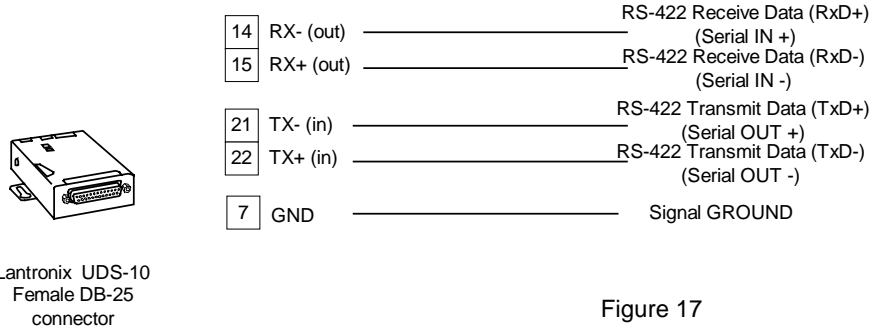
Connection to the UDS-10 via RS-422

If you are connecting one display farther than 50' from the UDS-10 or multiple displays to the UDS-10, then you will want to wire the displays using RS-422 with 5 wires. Two wires connect the positive and negative Receive Data (RX) pins of the UDS-10 to the positive and negative receive pins of the display. Two additional wires connect the Transmit pins of the display to the Transmit (TX) pins of the UDS-10, and the final wire connects ground between the two devices. Figure 17 depicts this relationship. NOTE: On the display side, the specific pin numbers are different depending on which Vorne display you are using. See the given display's product manual for a complete description of specific pin outs.

For More Information

We welcome your questions, comments, and suggestions. For further information please contact us:

- By phone 1-888-DISPLAY (1-888-347-7529)
- By e-mail support@vorne.com
- By fax 1-630-875-3609
- By mail Vorne Industries, Incorporated
 1445 Industrial Drive
 Itasca, IL 60143



VORNE DISPLAY with RS-422 Input

Figure 17

Revision History

The following table shows the revision history for this document.

Table 1: Revision History

Version	Date	Revision Summary
1.0	08/24/00	Initial Release