Haxxio UDP Serial Port Redirector

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Haxxio UDP Serial Port Redirector

1 General

1.1 Overview

General (see page 1) Overview

The Haxxio UDP Serial Port Redirector is a system tool that allows applications that are coded to communicate using the serial port on a PC to instead communicate with a virtual serial port, which is exposed on the local area network.

The Examples (see page 12) section shows a number of ways in which this is useful.

However, a word of caution is required - serial communication is prone to errors, and adding additional layers as the Redirector does increases the possibilities of data loss or corruption. Any serial protocol used for any purpose should have at the least some form of checksum mechanism, and packetization, so that the receiving application can be sure that it received the data uncorrupted. An application that has these protections will not be compromised by using a virtual serial cable, as the Redirector provides, rather than a real physical serial cable.

1.2 Technical Support

Technical support is available by email, write to support@haxxio.com

Also check out the website, http://www.haxxio.com/udpser

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2 Field Specific Help

2.1 AutoStart Behaviour CheckBox

If this box is checked, then an entry is made in the Windows Registry that will cause the Redirector to start automatically each time Windows is started.

This setting only takes effect the next time windows is started.

2.2 Bind To UDP Port Checkbox

If this box is ticked, the Redirector will "bind" to the port in order to receive incoming data.

Only one program on a PC can be bound to a particular port at one time, and thus if the port is in use by another application the Redirector will be unable to bind. Thus the Redirector will be unable to receive data.

2.3 Buy Now Button

This button only appears if you have not purchased a licence to use this software.

It will take you to the purchase portal, which will allow you to purchase a licence for this particular computer.

2.4 Bytes Transmitted Statistic

This field is a counter which shows how many bytes of data have been sent to your application through the virtual serial port your application is connected to. If you don't have an application connected to the virtual serial port, or it has been disconnected then no bytes are being sent anywhere, so this counter does not increment.

This field is reset to zero whenever you change the serial port setting, or press the adjacent reset (see page 7) button.

2.5 Bytes Received Statistic

This field is a counter that shows how many bytes have been received from your application into the Redirector's Virtual Serial port.

This field is reset to zero whenever you change the serial port setting, or press the adjacent reset (see page 10) button.

2.6 Disable Exit Button Checkbox

If checked then this box disables the Exit Button (see page 5).

Check this box to prevent the application accidentally being closed.

2.7 Exit Button

This button closes the application.

If an application is connected to the Redirector, you will be asked if you really mean to exit. The reason for this is that if you terminate the Redirector, a virtual serial port to which you application is connected will get "stuck". If you restart the Redirector, it will attempt to reconnect to the "stuck" port.

This button can be disabled using the Disable Exit Button Checkbox (see page 5).

2.8 Packets Transmitted Statistic

This field counts how many UDP packets have been sent.

This field is reset to zero whenever you change the UDP port settings, or press the adjacent UDP Statistics Reset Button (see page 10) .

2.9 Packets Received Statistic

This field records how many packets have been received on the UDP interface you have configured.

Packets will only be received, and thus counted if you have ticked the Bind to UDP Port Checkbox

This field is reset to zero whenever you change the UDP port settings, or press the adjacent UDP Statistics Reset Button (see page 10).

2.10 Remote IP Address

This field has a number of functions, depending on what mode is selected using the UDP Transmit Mode Selection (see page 10) feature.

Transmission Mode	Field Function
No Transmissions	This field is hidden, as it has no function at all
Reply to last sender	This field displays the IP address of the sender of the last UDP packet that was received. It will update as each packet is received, and you may not change it.
Reply to first sender	This field displays the IP address of the sender of the first UDP packet that was received, and you may not change it.
Broadcast replies	The field will be set to "255.255.255.255", and you may not change it.
Send to fixed address	When UDP configuration is enabled, you may enter an IP address in this field.

2.11 Serial Port Configure Button

This button will have one of two captions, either "Open" or "Configure"

If the button is captioned "Open", when pressed the Redirector will create the serial port you have selected or defined in the Serial Port Selection Entry (see page 6) field. Prior to pressing the button you can change the serial port setting.

if the button is entitled "Configure" then the port is currently created, and you may not change the setting. Press the button to enable configuration of the port.

2.12 Serial Port Selection Entry

Select which Virtual Serial Port you would like to have created here.

You may either select a port from the list provided, or you may enter a port name directly.

The port list provided is edited to remove ports that are already present in your system. You can override this by creating another (eg) COM1, but this is not recommended, and may lead to system instability.

Serial ports do not have to begin COM, they can have any name. However, many applications that operate with serial ports only provide for a subset of fixed names, sometimes as limited as COM1 through COM4. Under these circumstances, you have to configure a port in the Redirector that matches a port that is both available, and can be selected from your target application.

2.13 Serial Port Status

This field displays the status of the created Virtual Serial Port.

If there is no application connected to the port, it will be captioned as "Closed".

Once an application connects, the field will reflect the settings of the port as set by your connecting application. The field will then display something like "Open 4800,N,8,1" reflecting the state of the port.

The string displayed is built up as the connecting application calls for settings of the serial port, so there may be either an incomplete string, or just the word "Open" if the connecting application hasn't got around to setting the port parameters yet. The setting of the serial parameters normally happens so quickly that the field changes from "Closed" to "Open 2400,N,8,1" apparently instantly.

See Also: Why does the Redirector not have flow control (see page 17)

2.14 Serial Port Stats Reset Button

Pressing this button resets the counters for the serial port.

2.15 Startup behaviour Radio Buttons

This set of radio buttons determines how the Redirector looks and acts when it starts up.

Note: You can choose the Redirector to start automatically each time Windows starts, see AutoStart (see page 4)Behavior

Radio Button Selection	Behavior
Normal start with visible window	With this setting the Redirector behaves the same as any normal Windows application. The Redirector starts with a normal window, which you may minimize if required. The Redirector minimizes to the task bar, as per a normal application. Any of the normal methods of restoring the application window may be used, for example, double-clicking on the task bar button. This is the default setting.
Start minimized to Task Bar	The Redirector starts but rather than starting with a normal window, starts minimized, so that it appears in the task bar. Any of the normal methods of restoring the application window may be used, for example, double-clicking on the task bar button.
Start minimized to System Tray	The Redirector starts in the System Tray. To restore the Redirector window, the System Tray icon must be right-clicked, and the "open" setting selected from the pop-up window. This setting is recommended when there is no interaction required with the Redirector, as it just sits hidden in the system tray.

2.16 Timer Interval Selection

This dropbox selects how frequently the Redirector considers transmitting a packet of data.

If the UDP Transmit Mode Selection (see page 10) is set for "No Transmissions" then this setting does not appear.

The appropriate setting of this variable is the most critical tuning setting for the Redirector. Generally, the higher the baud rate of the connecting application, and the greater volume of data that needs to be sent, and the faster the application response time needs to be, then the shorter should be the inter packet interval.

If the transmit frequency is too great, then many short packets of data will be sent, which is generally considered wasteful of network bandwidth. If the transmit frequency is too low, then a small number of large packets will be sent. This is good from the network's perspective, but may introduce unacceptable delays into the communication process.

A number of statistics are provided to help you optimize your setting, see Maximum Block Size (see page 9) and Average Packet Size (see page 9) statistics.

A single UDP packet can hold 1492 bytes of data. If in a single transmit slot the Redirector has more than 1492 bytes of data to send, then an "Oversize" indicator will appear. This does not mean that either an oversize packet has been sent (which would be illegal from the network's perspective) or that data has been lost; merely it indicates that two or more packets have been sent in this time interval. Whether this is acceptable or not depends on the receiving application. If there is something special about a packet, then it may matter. if the data is just transmitted as a stream, then there is probably not going to be any negative impacts.

2.17 UDP Average Packet Size Statistic

This statistic shows the average size of UDP network transmitted packets. The maximum possible size is 1492 bytes, the size of a full UDP packet.

This counter is reset whenever the network communications parameters are changed, or when the UDP Statistics Reset Button (see page 10) is pressed.

2.18 UDP Bytes transmitted Statistic

This is a simple count of the number of bytes transmitted in UDP packets.

This counter is reset whenever the network communications parameters are changed, or when the UDP Statistics Reset Button (see page 10) is pressed.

2.19 UDP Configure Button

This button will have one of two captions, either "Open" or "Configure"

If the button is captioned "Open", when pressed the Redirector will open a network port according to the setting configured. Prior to pressing the button you can change the UDP port setting, which are held within the frame entitled "Transmitted data". Note many fields in this frame appear and disappear according to the UDP Transmit Mode Selection (see page 10).

if the button is entitled "Configure" then the UDP port is currently open, and you may not change the setting. Press the button to enable configuration of the port.

2.20 UDP Maximum Block Size Statistic

This statistic records the maximum number of bytes of data that have been sent in one transmission interval. This number can be greater than 1492 bytes, the maximum size of a UDP packet, as the data may have been split into several packets.

See also: Timer Interval Selection (see page 8)

2.21 UDP Port Selection Entry

Select which UDP port you wish to transmit and/or receive on here.

Whilst the Redirector is running, this field is not editable, to make it editable use the adjacent "Configure" (see page 9) button.

Choice of port should be made carefully. Many of the UDP ports have pre-assigned functions, particularly those below 1024.

2.22 UDP Statistics Reset Button

This button resets all the statistics related to UDP transmission and reception.

2.23 UDP Transmit Mode Selection

This selection controls how the Redirector sends data.

There are five distinct transmission modes.

Transmission Mode	Description
No transmissions	Exactly what it says - the Redirector will not transmit any data to the network. Any data sent by your application to the virtual serial port will be discarded.
Reply to last sender	Each time a packet is received by the Redirector, it notes the source address of that packet. All subsequent transmissions by the Redirector will be made to that source address. This can work very well for a many-to-many type scenario, see the Groups of PCs and/or terminal Servers communicating (see page 13) example. However, the Timer Interval Selection (see page 8) must be set short enough that data intended for different recipients doesn't get jumbled into the same packet. If all the devices are on the same network (or more correctly, on the same broadcast domain) and the application uses some sort of device addressing, so it can tell serial data streams apart, the broadcast mode may work better.
Reply to first sender	The source address of the first packet will be captured, and all replies sent to that address. This mode is most useful when there is only one other communicating device on the network, and for some reason (eg DHCP assignment) you don't know what it's address is.
Broadcast replies	This is one of the most useful modes, as it allows a group of devices on the same network (or more correctly, on the same broadcast domain)to communicate without further setup.

Send to fixed address	This mode specified the address of the communicating device. This is generally used in one of two situations a) A point to Point serial link, where both end-points know their address and that of the opposing party. See the example Replacing a Serial Cable (see page 12) b) Where this station is one end (indeed the "one" end) of a many to one scenario. The other endpoint (the "many" will probably use either "broadcast replies", or possibly "reply to last sender"

Unless "No Transmissions" is selected, then the address to which the Redirector is transmitting is shown by the Remote IP Address (see page 6) field.

3 Usage Examples

A few examples of typical usage applications are presented on the following pages.

A slide presentation with pictures is also available http://www.haxxio.com/udpser/slides

3.1 Replacing a Serial Cable

One of the most straight-forward uses for the Redirector is the replacement of a simple serial cable.

Some of the drawbacks of RS232 cables are:

- Serial cables are limited in length. Just how long a serial cable can be depends on many factors, but a commonly used number is 50 feet. Serial cables can be much long, many hundreds or even thousands of feet, but guaranteeing reliable communication at greater distances is more luck than science. The traditional answer is to use line drivers to convert RS232 to a proprietary format and then carry that over twisted pair cabling.
- Serial cables need to have several cores, depending on which control signals require to be carried
- There are no recognized standards for carrying RS232 data across structured wiring. (If you need to do this, then the DEC standards as used by the DECServer 700 series terminal servers appears to be better than most schemes.)

The approach using the Redirector is to use a terminal server at one end of the link, and the Redirector software on the PC.

It is now possible to buy terminal servers at low cost. Using a terminal server and the Redirector may actually work out cheaper than even a newly installed 50 foot run of RS232 cable.

The lowest cost terminal server we are aware of which we have actually used is the SitePlayer telnet box which at the time of writing is $79 US. See the SitePlayer web site.

For a real world example of replacing a serial cable, see Interfacing to X10 over IP (see page 14).

3.2 Wireless RS232

Wireless RS232 has been available for many years, but the existing systems suffer from a number of drawbacks

- They are generally expensive
- The implementation is proprietry to a single manufacturer, so different manufacturers kit does not interwork
- They often use frequencies used by car alarms and other short range devices. In itself this isnt a big issue, but the fact that these devices have no way of managing the sprectrum leads to these devices interfering with each other
- No inherent data corruption error detection

In recent years, Wi-Fi network communications have become cheap and highly available. The suffer much less from any of

the problems noted above. It is not possible to use low cost Wi-Fi Access Points to extend a network to where the serial devices are, often at a cost of less than $100 US per device.

There isn't anything special about wireless networking from the point of view of the Redirector - it requires an IP network to function, and thus is agnostic as to whether that network is wired or wireless.

3.3 Groups of PCs and/or terminal Servers communicating

There are three basic modes in which a group of PCs and/or terminal servers can communicate with each other

- Many-to-One
- One-to-Many
- Many-to-Many

All of these distinct modes have advantages and disadvantages, however whichever one you need to use, the Redirector will support it.

Many-to-One is most often used when a number of things each want to send a message to the central controller. There is no polling from the centre, just messages sent from each device. The central hub may or may not respond to these individual messages.

One-to-Many is the opposite - a central hub polls outlying devices, and they respond. Many SCADA systems work this way, the central controller demands a status report from each outlying data acquisition box, concentrator or RTU. The outlying box responds only as a result of its poll.

Using the Redirector, existing RS485 networks can be replaced or augmented, see Replacing RS485 networks (see page 13)

A variation of the One-to-Many theme is **broadcast**, whereby the central device sends out messages that are heard by all the outlying devices, but there is never a response. This is usually an information display application. Examples would include signs in an airport or railway terminus, or information display boards in trading rooms. Note that not all the signs need to be showing the same information; the signs may be addressable, which implies the serial data is packetized and has an addressing scheme. An example of this may be roadside bus information displays, each of which needs to show different information, but all signs can be on a common communication network.

A Many-to-Many configuration is described in Replacing RS485 networks (see page 13)

3.4 Replacing RS485 networks

RS485 networking is the basis of almost all industrial networking, all SCADA and BMS applications.

RS485 networks work differently to the common RS232 cable.

A RS232 cable connects just two devices.

A RS485 network has a number (generally limited to 32) of devices all connected to a 2 wire (almost always a single twisted pair) bus. All devices can listen on this bus, and one device may transmit at one time.

Generally, one device will be the "master", and it will poll all the other devices, the "slaves".

This type of network is relatively easy to replace with a UDP network based system. In particular, as the application is based on a poll-and-reponse paradigm, with all data neatly packaged into error checked packets, a network based solution can be deployed that is as reliable as the traditional twisted pair.

It is also possible to augment a RS485 network to either allow expansion to non-RS485 devices, or to allow a remote computer using IP to connect to the RS485 network.

The lowest cost terminal server with both an RS485 port and is UDP capable that we are aware of is the Moxa DE-211. The Moxa range shares similar software, so any of the Moxa range should work happily with the Redirector.

The Terminal Servers and Redirerector(s) can be configured either as as one-to-many application, as described in Groups of PCs and/or terminal Servers communicating (see page 13) , or as a genuine many-to-many.

To configure a many-to-many network, all terminal servers and redirectors should be configured to transmit to the broadcast address. That way, any data transmitted by one device will be "heard" by all. This is the traditional mode for RS485 networks, as there is no physical addressing, only devices that know what btheir own addresses is, and can thus respond when spoken to.

3.5 Interfacing to X10 over IP

This is a specific version of Replacing a Serial Cable (see page 12)

X10 is a very low cost Home Automation control system, which uses signals super-imposed on the mains power, using the existing wiring, to monitor and control devices. The actual X10 signal itself is a series of data bits, encoded at 120KHz, sent synchronized to the zero crossings of the mains waveform, at a slow rate.

As the 120KHz mains synchronized signal isn't the easiest signal to generate, and because until recently the X10 signal was patented, the X10 corporation produce a number of interface devices to enable hardware devices and software systems to easily interface to X10.

There are two basic types of X10 interfaces, defined by the interface to the host computer.

The first is the TW523 and variants, which connects to the computer using TTL compatible interface standards, and which the computer has to conform to the timing requirements for X10. This type of interface is used by most of the micro-controller based systems, for example the JDS TimeCommander and Stargate, or the HomeVision system. You cant use a terminal server and the Redirector to remote these devices, as they do not have a serial interface.

The other sort of interface is the CM10 / CM11 / CM12 interfaces, which are controllers in their own right, which communicate with their host using RS232. This category of device an be remoted using a terminal server and the Redirector.

The lowest cost terminal server we are aware of which we have actually used is the SitePlayer telnet box which at the time of writing is $79 US. See the SitePlayer web site.

To remote a CM10 / CM11 / CM12, use the following configuration.

In the Services menu, for the UDP Serial Port setting, pick an unused UDP port, for example 990. In the Serial menu, configure the Baud Rate to *4800*, and check Data Bits and Parity is *8 Bits, No Parity*. Flow Control should be set to *None*. See the discussion below regarding what setting to use for UDP Remote IP. You may also wish to change the default settings in the IP Configuration menu, if you don't want a default DHCP arrangement, though the default DHCP arrangement will work just fine.

The setting for UDP Remote IP depends on how you have configured the computer that has the Redirector and X10 control software on it. The issue is that the Terminal Server needs either to "know" the address of the target PC, or you have to use broadcast mode. If the target PC has a fixed address (ie one not configured using DHCP) then configure that address into the terminal server "UDP Remote IP" setting. Otherwise (ie you are using DHCP for your target PC), configure in 255.255.255.255 as a broadcast address.

Next, on the target PC with the Redirector installed, configure the Redirector UDP port (see page 10) to be the same as you set in the Terminal Server (eg 990), tick the Bind To UDP Port Checkbox (see page 4), and in the Transmitted Data pane, set the UDP Transmit Mode Selection (see page 10) to "*Reply to last sender*"

Set the Minimum packet send interval (see page 8) to *50* ms.

In the Serial Port pane, configure a Virtual Serial Port (see page 6) (VSP) to an appropriate value. What is an appropriate value? This depends on both your PC, and the software you wish to use. ActiveHome, for example, only permits choices of serial port COM1 to COM4, so you need to configure a VSP in that range. If the Redirector doesn't offer you a port in that range, you will need to disable a physical serial port using your computer's BIOS settings, so that the port name becomes free for the Redirector to generate a VSP on. If your software is more accommodating, then a port in the range COM9 to COM16 is recommended.

And that's all there is to it. This configuration has been tested with ActiveHome, and appears to work as well as when the CMxx device is physically connected to the computer.

A word of warning - do not try and share a CMxx device between several computers using the Redirector, there is no protocol level control over the data, and although it may well work most of the time, sometimes (as they say in Ghostbusters) the streams will cross and state information will get garbled.

4 FAQ

The FAQ section of the website is now in the product manual, which is where you are now. If you are viewing this on the Web, at the bottom of every page is a link that will return you to the website information page.

4.1 How can I make broadcasts span subnets?

If you have the right sort of routers connecting your subnets, you can extend broadcasts between subnets, using either "helper" settings, or by enabling "Directed broadcast" support.

Having support for UDP broadcast propogation between networks enabled on routers by default is now deprecated, you will have to make this setting yourself, with a full understanding of the risks of enabling broadcast propogation. A few years ago, Cisco routers were shipped with directed broadcast support enabled, and a bunch of bad people developed the "smurf" attack, which exploited this feature to launch denial-of-service attacks.

Before enabling directed broadcast support on a network which is connected to the internet, ensure your border routers comply with the advice given in the best practice document RFC2827

Point your network manager at Cisco - UDP Broadcast Flooding

4.2 How is the Redirector licenced?

The Redirector is hardware locked to the MAC address of the machine that it is installed in.

4.3 Where are the Baud Rate and other serial parameters set?

These setting are made in your application.

The Redirector doesn't actually care what these settings are, as the created Virtual Serial Port to which your application connects will behave exactly as your application configures them.

4.4 Why does my application see data it has sent?

In any mode where data is broadcast, the sender will see back the data it has sent, as well as receive data others have transmitted.

This behavior is normal for an RS485 type application, as there is only one serial "bus" common to all devices on it, so they see the messages they send.

4.5 Why does the Redirector not have flow control

Before answering this question, it is important to understand why flow control is used.

Flow control is used to prevent a receiving device being overrun with data, ie data is delivered to the port at a faster rate than the application can consume it. With a real physical serial port under an operating system such as DOS, if the application didn't directly service the incoming data quickly enough the UART chip buffer (usually 16 bytes) would be filled and thus data lost.

Under Windows, the physical ports are serviced by Windows, which can buffer significant amounts of data. Applications subsequently ask Windows for this data, which Windows delivers from its buffers.

Under stress testing, the Redirector has been megabytes of data "behind" in terms of servicing, but Windows has all the data buffered up, so eventually all the data gets processed, without data loss.

The Redirector was originally designed to operate with systems that transmit relatively short messages, in a polled type environment. Such messages would never overrun the Redirector. Even when tested with large data streams, no problems have occurred.

Additionally, it is difficult to define exactly what flow control should mean in a many-to-many environment. Thus it is unlikely that we will attempt to add flow control support to the Redirector.

The only final answer is for you to test the Redirector in your environment, and determine if the lack of flow control is an issue for your applications.

4.6 Why does the Redirector use UDP?

Using UDP, and more specifically, UDP Broadcast allows a number of operational modes that cant be delivered using TCP.

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