The IBC Tcp/ip manual gives a good explanation of how to program and set up the tcp/ip parameters, however that document does not dive into the potential problems which you may encounter if there is an incompatibility between your current network and the reader's default parameters. This document attempts to fill that void.

The first thing that you should do when connecting the reader is to run the IBC Tcp utility software, and perform the local network search. Make sure the reader is on the local network, and not on a remote network or a different segment of a local network. There should not be a router or proxy server between your PC and the reader when you are first setting it up, because those devices can restrict the flow of traffic to and from the reader, and may cause you to believe that the reader is not functioning properly. If your're not sure of your network configuration, then take the easy way out initially by connecting the reader to the *same* switch or hub that the PC is on.

Run the IBC Tcp/ip utility and perform the *local network search*. The reader should show up <u>irregardless</u> of the settings in the reader or your pc. If the reader does not show up, stop here, because the information in this document is not helpful in diagnosing that condition. If you cannot see the reader with the utilty, contact IBC support directly to discuss the installation.

Assuming you can see the reader with the local network search, the next step is to actually attempt a connection to the reader. Go to the *Server Connect* screen. The default reader parameters (ip:192.168.1.55 port:57) should already be entered in the screen. Click the connect button to see if you can connect.

If you cannot connect, then there may be a compatibility problem between the reader and the PC. There are a number of possible reasons for this, but rather than diagnose the problem it is much easier to simply start at the beginning and check everything.

The first thing we need to look at is the IP addresses and subnet masks of the reader and pc. The subnet masks should be the same, and the network segment portion of the IP addresses should be the same.[1] To get the IP address and subnet masks for the pc, go into DOS (command prompt on XP) and type in the command IPCONFIG. IPconfig will return a lot of information about the network on the pc, including the IP address and also the subnet mask. Since the reader's subnet mask defaults to 255.255.255.0, your pc should also have the same subnet mask. If it does not, then the subnet mask will have to be changed in the pc in order to communicate with the reader. Note that it is possible to change the subnet mask in the reader as well, but to do this you need to be able to communicate with the reader in order to change it, which means that we will have to change the subnet mask temporarily in the pc to at least initially talk with the reader.

Later in this document we will get into the details of matching the IP address and subnet mask in the reader to those on your local network,, but for now we will explain what needs to be done to at least initially get communications going. To initially talk with the reader, the IP address in your pc needs to be 192.168.1.x, where x can be any number. The subnet mask needs to be 255.255.255.0. If these are not the values in your pc, you will need to go into

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[1] In reality, the subnet masks do not need to match as long as the fully masked address resolves to a valid local subnet address. For the purpose of setting up the reader, however, we suggest making them match completely.

the network settings under the windows control panel and change them. Make sure that you write down the current IP address and subnet mask in the pc so that you will be able to change them back after you have set up the reader. If you are using DHCP on your pc, then you will also have to change that setting as well, so that you have a static IP address in the pc.

Change the pc IP address to any unused IP address, such as 192.168.1.50 and change the subnet mask to 255.255.255.0 and reboot. When the pc comes back up, you should now be able to communicate directly with the reader. Go into the utility program and attempt to connect to the reader. If you are successful, the screen should show that you are now connected. If you still cannot establish a connection into the reader, then the problem could be with a firewall on your computer. Check to see if you are running a firewall, and if so turn it off and then try the reader connection again.

Once you are able to communicate with the reader directly, you can go into the Program Reader screen and change the parameters in the reader. The parameters which you most likely may want to change will be the IP address, and the subnet mask. Change them, and any other parameter you need to change at this time, and then click on the *Set Parameters* button. Once you set them, you can either disconnect power from the reader, or click on the *Reboot* button. The reader should now be ready to use with the new parameters that you have programmed. If you had to change the IP address or subnet mask values of your pc, then you can now change them back and reboot the pc.

Understanding IP Addresses and Subnet Masks

If you need to reprogram the reader IP address to one that is not in the 192.168.1.x family, or need to change the subnet mask in the reader, an understanding of how the IP address and subnet mask works is required.

There are two components to an IP address. The first is the network address and the second is the subnet address. If you look at your IP address and subnet mask, you will notice that they are always written in what is called *dotted notation*, which is 4 numbers seperated by dots. The 4 numbers are actually byte vales (0 to 255) and the 4 bytes together, from left to right, form a 32 bit address. It is necessary to understand this concept before proceeding. For those which are not mathematically inclined, with a little help from someone who is you should be able to get through the following discussion quite easily.

The subnet mask is shown in dotted notation, 4 bytes forming a 32 bit mask. The 32 bits of the subnet mask consist of a number of 1 bits, followed by a number of 0 bits. The 1 bits represent the <u>network</u> portion of the address, and the 0 bits represent the <u>subnet</u> addresses. The network portion of the address (with the 1 bits) is the portion of the address which must remain static and common to all devices on the local network. The subnet portion (the 0 bits) can contain any value. Let's take the default subnet mask for the reader (255.255.255.0) and examine it. That number is 24 one bits (255.255.255) followed by 8 0 bits (.0). What this mask is telling the pc is that the first 24 bits of the address, or the first 3 numbers in dotted notation, represent the local network address. This means that all devices on the local network must have IP addresses with the

same first 3 numbers. This is known as a class C address. You might also see a subnet mask that is 255.255.0.0. With this mask, the first 16 bits (255.255) represent the network, and the last 16 bits (.0.0) represent the local subnet. With this type of subnet mask, the ip addresses of all devices on the local network must have the same first 2 numbers. This is known as a class B network mask. Hopefully, you will find that your pc has one of these two types of subnet masks (255.255.255.0 or 255.255.0.0). This will make the job of setting up the reader easy. If your subnet mask is something other than 255.255.255.0 or 255.255.0.0 then it will take a little more work to set it up properly.

Let's assume for a moment that your subnet mask on the pc is 255.255.255.0. This says that you have 256 different possible ip addresses on your local subnet. The first 3 bytes (24 bits) are all ones which means that those portions of the ip address represent the static network address, and cannot change. The last byte of 0 represents the subnet address, which in this case can be 0 through 255 because you have 8 bits allocated to the subnet address. Applying this formula to the default values in the reader (ip:192.168.1.55, subnet:255.255.255.0) means that to initially talk with the reader, the pc talking to it must have an ip address of the form 192.168.1.x, where x can be any number from 0 to 255. Here are some examples of IP addresses that will be valid (and invalid) using a subnet mask of 255.255.255.0:

Subnet Mask	255.255.255.0	First 3 bytes are static at 192.168.1
IP Address	192.168.1.1	valid
IP Address	192.168.1.80	valid
IP Address	192.168.2.5	invalid

Note that 192.168.2.5 is invalid, because the first 3 bytes (24 bits) must be the same for all machines on the local network.

Now let's look at the scenario where your pc has a subnet mask of 255.255.254.0. This says you have 512 different possible local addresses on your subnet. There are 23 one bits at the beginning of the mask, followed by 9 zero bits. This means that the first 23 bits of the ip address for the reader must match the first 17 bits of the ip address on the pc, and the remaining 9 bits represent the local address. Here are valid/invalid combinations for this subnet mask:

Subnet Mask	225.225.254.0	First 23 bits are static
IP Address	205.201.254.200	valid
IP Address	205.201.255.100	valid
IP Address	205.201.250.12	invalid

The first two are valid because the first 23 bits are the same, but the third example does not have the same first 23 bits and therefore cannot talk with the first 2 directly.

Now that you know exactly how the subnet mask works, it is easy to come up with IP addresses which will be valid for your local network. Program up the reader and you should now be ready to go.

Understanding Port Numbers and Firewalls

We mentioned earlier about turning off your firewall in the pc while you are programming the reader. The reason for this is quite simple. Software firewalls are programs designed to restrict unwanted network traffic. If you are running a firewall on the pc, it is possible that the firewall will not allow you to directly communicate with the reader, or program the reader because the port number being used to program, or communiate with the reader, is being blocked by the firewall. The IBC Tcp readers use port 87 (by default) for programming, and port 57 (by default) for data communications. If either of these ports are blocked, you will not be able to connect or program the reader.

Note that if you change the data port or control port in the reader, and are running a software firewall on the pc, then you will also have to make sure that traffic to and from the new port numbers you assigned is not blocked in the firewall.

Hardware firewalls and proxy servers operate a little differently in that there are more things being done than just the examination of ports. If you are sending traffic through a hardware firewall or a proxy server then you may need to consult the manuals for those devices to see what additional programming, if any, is required to allow reader traffic to go through them.

Understanding Remote Connections

The IBC Tcp/ip readers can be run on remote networks either through an intranet or through the internet. It is possible, for example, to run software on a pc in New York which talks directly (through the internet) to a reader located in Chicago. To program the reader to operate in this type of mode requires that you have knowledge of the IP Address, subnet, and ports which will be valid at the remote location. Be aware that once you program the reader with this information, it most likely will not work on your local network so take this into consideration when you program the reader locally. Once the reader is installed at the remote location, if there are any problems with the parameters and you cannot communicate with it, you should still be able to have someone at the remote location connect locally.

Also note that when installing a reader at a remote location, not only do you have to make sure that all parameters (IP address, subnet mask, port) are correct, you must also make sure that the traffic to and from the reader is not being restricted by a router. Routers are basically "traffic cops" which not only route traffic but also perform firewall functions at the same time. When installing at a remote location you may have to program the router to allow the traffic flow to and from the reader.