Control Solutions, Inc.
Web User Guide

i.CanDoIt® BAS-700 R*e*MOTE I/O
Babel Buster® SP

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IMPORTANT SAFETY CONSIDERATIONS:

Proper system design is required for reliable and safe operation of distributed control systems incorporating Control Solutions software, BAS-700 series modules, Babel Buster communication gateways, and other such devices. It is extremely important for the user and system designer to consider the effects of loss of power, loss of communications, and failure of components in the design of any monitoring or control application. This is especially important where the potential for property damage, personal injury, or loss of life may exist. By using any other Control Solutions, Inc., product, the user has agreed to assume all risk and responsibility for proper system design as well as any consequence for improper system design.

1. Introduction

This user guide will introduce you to Control Solutions web based products including i.CanDoIt® BAS-700 ReMOTE I/O and Babel Buster® SP. Most of the documentation for the Control Solutions web based products is online. By "online" we mean self contained within the web pages served up by the product itself. This user guide will get you started using the web based user interface, and also introduce you to some of the non-web features.

2. Getting Started

You will need to know the IP address of the device and have a user name and password. The initial settings are as follows:

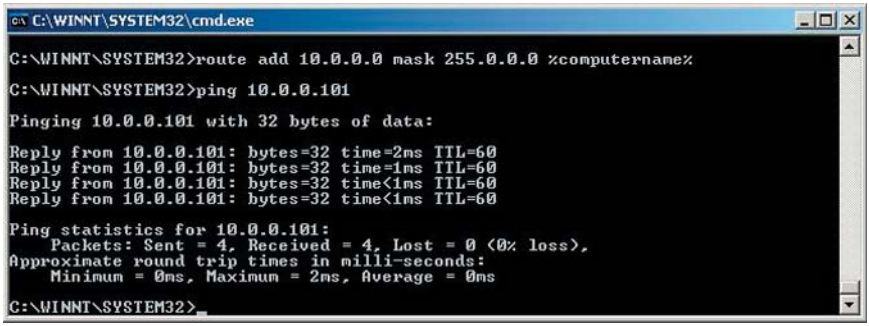
IP address:	10.0.0.101
User name:	system
Password:	admin

Start your favorite browser, and enter ***http://10.0.0.101/*** in the address window. You will see the startup or home page displayed. To log in, click any tab near the top of the screen. You will then be asked for the user name and password. The default as shipped is user name "system" and password "admin". The root user name is "root" and root password is "buster". *You should change the password to both of these to prevent just anyone with a copy of this manual from accessing your system.*

3. Connecting to an IP Address

The initial IP address is 10.0.0.101. You will not be able to reach 10.0.0.101 if your computer is not on the 10.0.0.0 domain. If you are not sure what domain you are on, you can open a command prompt, and type the command ***ipconfig***. To see whether you can reach 10.0.0.101, you can enter the command ***ping 10.0.0.101*** at the command prompt.

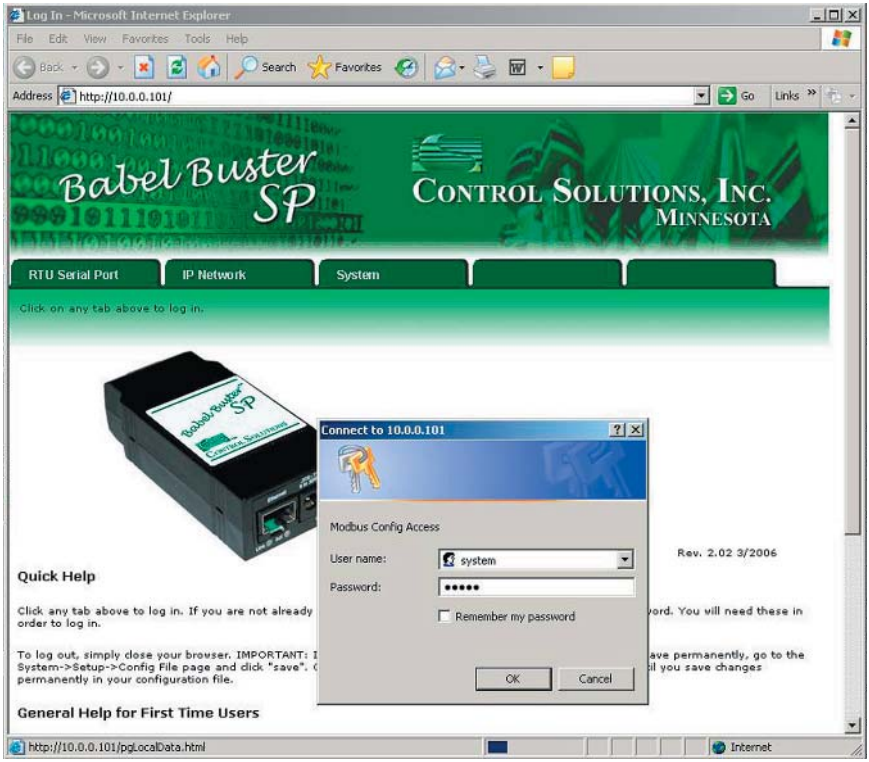
One way of reaching the 10.0.0.0 domain is to go into your control panel network connections dialog, and change your computer's IP address to a static IP address at 10.0.0.X where X is something other than 101. This is somewhat inconvenient and will also upset other network connections such as your access to a networked printer.



The more suitable to create a temporary path is to add to your PC's network routing table. This is done by entering ***route add 10.0.0.0 mask 255.255.255.0 %computername%*** at the command prompt. You should now be able to ping 10.0.0.101.

4. Logging In

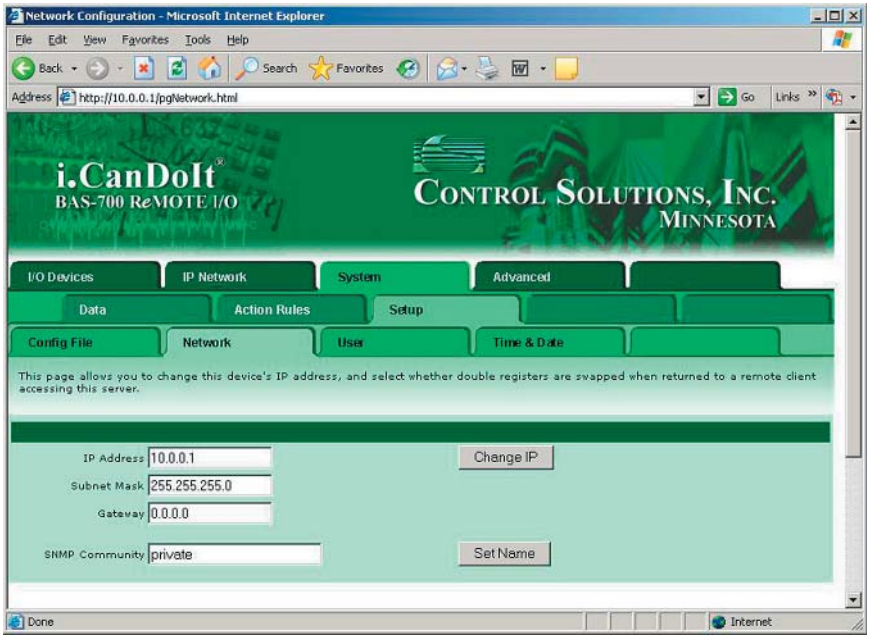
You will see the “home” page simply by entering http://10.0.0.101/ in your browser’s address window. As soon as you click on one of the folder tabs at the top of the screen, you will be asked for a user name and password. The initial user name is system and password is admin.



5. Changing the IP Address

Once logged in, click on the System folder tab, then under System, click the Setup folder tab, and finally the Network tab. (We document this sequence of tabs as System->Setup->Network.) Enter a new IP address, subnet mask, and optionally a gateway IP address. If you want the device to use DHCP, enter 255.255.255.255 for the IP address. This will tell it to use DHCP instead of a static IP address. (If you do not have a DHCP server available, do not enter 255.255.255.255. You will be unable to access the device until you connect it to a DHCP server once you have done this.)

The IP address does not take effect until the next time you cycle power to the device. This allows you to change the IP address if you notice that you made an error in entering it. If the change took effect immediately, you would immediately lose contact with the device. And if an error had been made in entering the new IP address, you wouldn't know where to look for it. Therefore we made sure the IP address change does not take effect immediately.



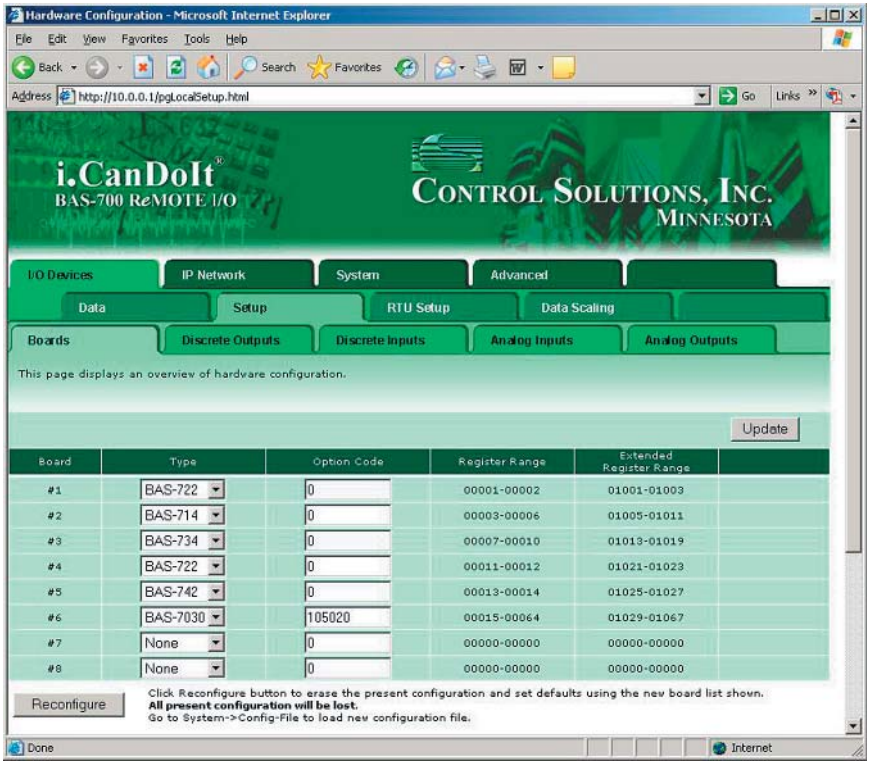
6. Initial Setup - Babel Buster SP

Initial setup requirements for Babel Buster SP depend on your intended use. If you will be interfacing to Modbus RTU serial (RS-485) devices, you will need to set up the baud rate and polling parameters. If you will be interfacing to other Modbus/TCP devices, you will need to enter their IP addresses in the IP Network->Modbus Setup->Devices page. The register read and write rules need to be set up to cause transfer of data between Babel Buster SP and the Modbus devices. As you browse through the various setup pages, you will become familiar with the features and capabilities and determine which parameters you need to define.

7. Initial Setup - i.CanDoIt

The minimum setup required for i.CanDoIt is to tell the system what your hardware configuration is. You will have one or more BAS-700 series I/O boards attached to the BAS-7050 processor. The I/O board closest to the BAS-7050 processor board is referenced as board #1. Simply select the model numbers from the drop down list for each board position that is occupied. When all boards have been selected, click the Reconfigure button at the bottom of the page. At this point, the green LED at the top of the processor board should begin to blink rapidly indicating I/O is being scanned.

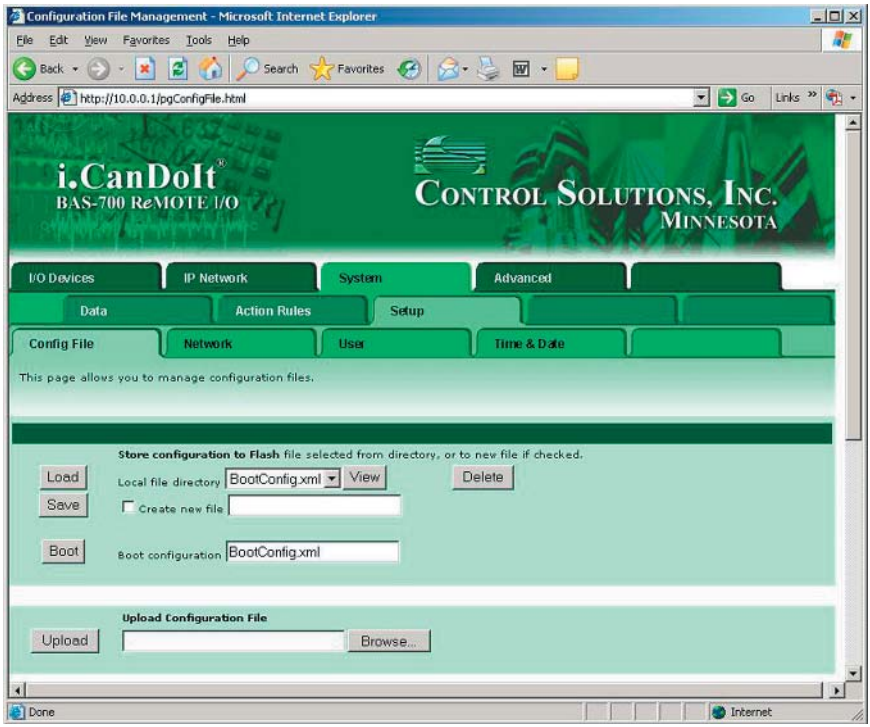
Once you have selected the hardware configuration and "reconfigured", you can begin browsing I/O points under I/O Devices->Data. You can begin accessing this I/O from Modbus or SNMP. You can begin defining threshold rules, Modbus/TCP read/write rules, and even write a Script BASIC program. Browse the various pages in i.CanDoIt and read the Quick Help at the bottom of each page to become familiar with the features and capabilities.



8. Configuration Files

Once you have selected your hardware configuration and optionally entered any number of other configuration parameters, you need to save it to a Flash file. If you do not save your configuration, you will need to re-enter it the next time power is cycled.

Saving your configuration is simple. Go to the System->Setup->Config File page. If this is the first time you are saving the configuration, type a file name in the window next to the “Create new file” check box, check that box, and click Save. We suggest you use the name BootConfig.xml initially since this name is already assigned as the startup configuration. Once the configuration has been saved to the file named as the Boot configuration file, I/O scanning will begin automatically each time power to the system is turned on.

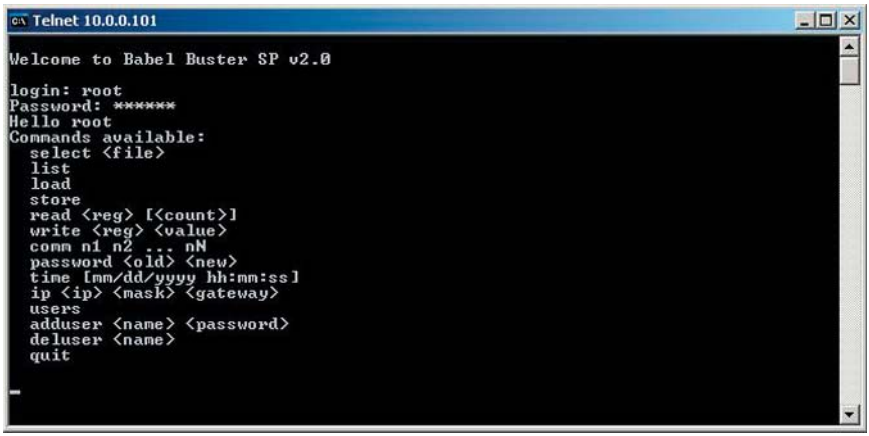


9. Adding User Names

User names are added via a Telnet session. To open a Telnet session, open a command prompt on your PC, then enter the command ***telnet 10.0.0.101 10000***. The initial IP address is used in this example, but should be replaced with whatever you changed the IP address to. You do need to specify port 10000 (ten thousand) after the IP address.

The Telnet menu is very similar among different device models. The adduser command is used to create a new user ID, and the deluser command is used to remove one. You may define up to 5 user accounts in addition to the user known as “root” which is always present.

You may use most of the Telnet commands logged in as any of the known users; however, to add or delete users, you must be logged in as “root”. The password for “root” is “buster” when shipped (for both Babel Buster SP and i.CanDoIt).



10. Telnet Command Summary

The Telnet command summary is as follows:

select is followed by a file name, and selects this file in the FLASH0 directory for subsequent operations using list, load, store or run.

list will simply display the selected file in text form.

load will load device configuration from the selected file the FLASH0 directory.

store will store the configuration to the selected file name in the FLASH0 directory.

run is available if Script BASIC is supported by the device, and will run the program from the selected file in the FLASH0 directory.

read will display the contents of one or more local registers.

write will set the value of a local register.

comm is available only on Babel Buster SP and allows constructing a Modbus RTU command in raw hex bytes starting with the unit number. The CRC is added automatically to the string of 2-digit hex bytes (separated by spaces). The response from the addressed Modbus device is displayed in hex.

password changes the password of the user name you logged in with.

time displays the contents of the real time clock-calendar if supported by hardware, and optionally sets the clock-calendar.

ip changes the IP address of the device.

users displays a list of currently defined user names.

adduser adds a new user to the user list.

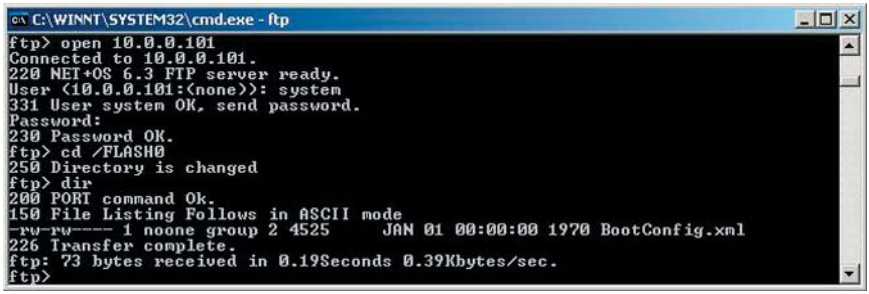
deluser removes a user from the user list.

quit ends the Telnet session and logs you off.

11. FTP File Management

You may open an ftp session from a command prompt and log in using the same user name and password used for web access or Telnet access. There are two directories, RAM0 and FLASH0. You may use RAM0 for temporary files that will be lost in the next power cycle. You may use FLASH0 to store files in persistent memory. Configuration files with a .xml suffix are stored in the FLASH0 directory. Program files with a .sb suffix may be stored in either directory, but should be in the FLASH0 directory if they are to be saved beyond the next power cycle.

Once logged in, any of the standard ftp commands may be used, including ***cd*** to change directory, ***dir*** to list files, ***del*** to delete a file, ***send*** to transfer a file from your PC to the device, or ***get*** to transfer a file from the device to your PC. Use the ***close*** command to end the session, followed by ***quit*** to exit the ftp client program on your PC.



12. File System Maintenance

The default file capacity for devices is 256K bytes of Flash memory in the FLASH0 directory, and 1MB of RAM in the RAM0 directory.

In the event the file system becomes corrupt, you can verify the corruption by attempting to get, send, or delete files in the FLASH0 directory. These operations will fail for no apparent reason. Corruption can occur if power is lost while writing a file.

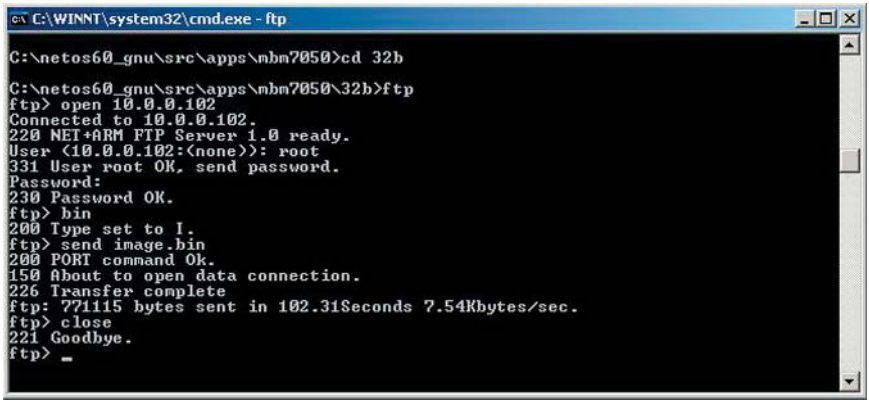
If the file system becomes corrupt, the equivalent of “erase disk” is to log in via Telnet as the root user, and change the root user password to “killfilesystem”. Now reboot the system twice, then log back in as root and change the password back to anything but killfilesystem.

13. Firmware Upgrade

Firmware upgrades will become available from time to time which may include bug fixes, enhancements, and new features. Odds are that new features are in development even as you read this. When a firmware upgrade becomes available, you will in general follow the procedure outlined here; however, be sure to observe any special instructions provided with the upgrade. Upgrades may be made available for download via Control Solutions' web site. If you find upgrades on www.csimn.com, do not upgrade without making certain that the upgrade is compatible with your existing system. There is more than one version of firmware in circulation for the BAS-7050 for example, and certain upgrades if installed incorrectly will cause the hardware to become nonfunctional and unrecoverable due to incompatibilities between system images.

The general procedure for upgrading firmware is as simple as sending a file to the device via ftp. You must log in as root (no other user can upgrade firmware). Once logged in, you must issue the bin command, followed by send image.bin. When you get the completion message indicating the number of bytes sent (usually after about 2 minutes), you must issue the close command to cause Flash programming to finish. You then leave the system alone for a few minutes and allow it to automatically reboot itself. Once rebooted, you may resume normal operation.

It should be noted that user names, passwords, the device's IP address, and contents of the FLASH0 file directory will not normally be changed by firmware upgrades.

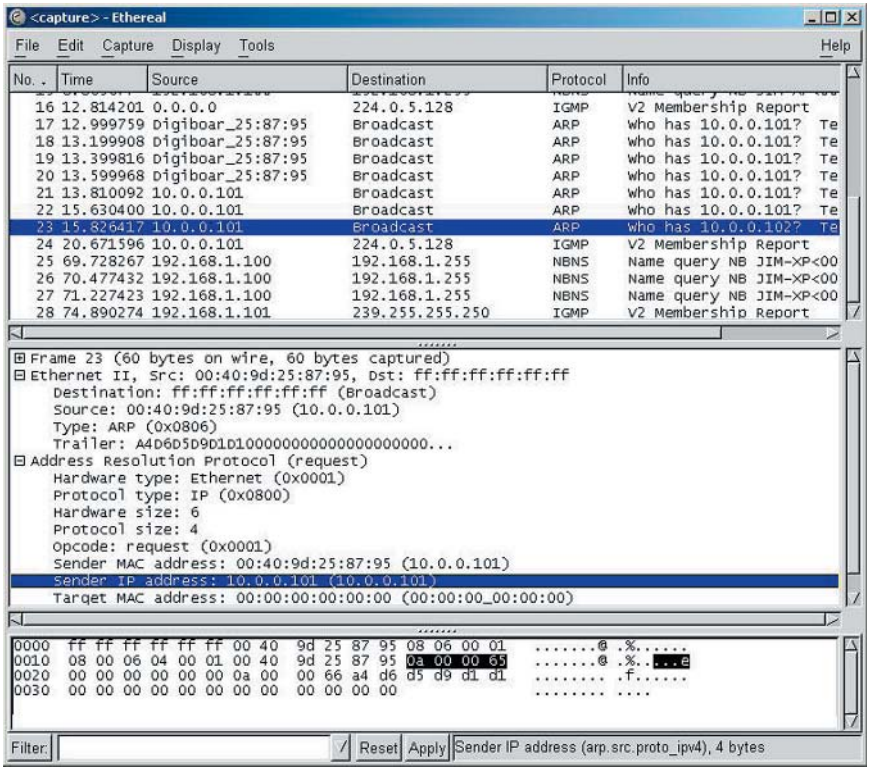


In the event you lose power during a firmware upgrade, the device will become largely nonfunctional; however, if you have access to a DHCP server which is capable of also serving BOOTP, and also have a TFTP server on the same machine, the device can be recovered. The corrupt device will recognize that its application is corrupt and attempt to reload the image.bin file from the TFTP server identified by the BOOTP server when the device powers up.

14. Recovering Lost IP Address

There is no “console” for these devices, and the only way to change the IP address requires knowing what it is in the first place. Once you have the IP address, you can log in to either Telnet or the web site and change it. However if it got changed incorrectly or you lost track of it, that presents a problem. Fortunately there is a solution for this problem.

Obtain the packet analyzer program Ethereal by downloading it from www.ethereal.com. Also obtain the packet capture drivers & DLLs known as WinPcap at www.winpcap.org. Install these, and start capturing packets on the network via your PC.



During the bootup process of the web based devices, they will send out a series of ARP requests. The first few requests are generated by the device pinging its own IP address. That is followed by one ping of the IP address one greater than its own. An example of this process is illustrated above. In this case, the device still has its initial IP address of 10.0.0.101.

The packet padding in that last ARP request also contains an encrypted copy of

the root password. This is useful in the event the root password is lost. Without it, you cannot change other user accounts or do certain things like firmware upgrade. The encryption changes from one device to the next, so you will need to contact support@csimn.com to decrypt a lost password.

15. LED Indications

LEDs on Babel Buster SP are assigned as follows: Green is the link LED, and is on any time a link is present (cable connected, etc.). Yellow is the activity LED and will flash any time there is network traffic. The default use for the red LED is power-on, but it is further programmed to indicate serial traffic. The hardware does not provide sufficient LEDs to follow Modbus standard, but a minimal indication of activity is available. Further diagnostics may be obtained via the error codes web pages. The red LED on Babel Buster SP will blink off when waiting for a reply when it is an RTU master, or will blink off while sending a reply when it is an RTU slave.

LED indications on the BAS-7050 are assigned as follows: The green LED on the RJ-45 network jack is the activity LED and the yellow LED is the link LED (colors are opposite Babel Buster SP). The green LED near the top of the board is under software control. The behavior of this LED is defined by the application. Generally it will flash rapidly indicating I/O scanning is taking place.

LED indications for various other BAS-700 series boards are described, if applicable, in the BAS-700 Hardware User Guide available at www.csimn.com.

16. DIP Switches and Jumpers

The various jumper settings on BAS-700 series I/O boards may be found in the BAS-700 Hardware User Guide available at www.csimn.com. Connector pin-outs may also be found there.

DIP switch settings for Babel Buster SP may be found in a web page in the product itself. These settings select RS-232 or RS-485 2- or 4-wire. One DIP switch setting also selects line termination. This DIP switch should always be turned on (termination enabled).

17. Device Capacities

Devices are register oriented since this architecture suits the network protocols well. Modbus is essentially a register addressing scheme. SNMP is an object addressing scheme, and register contents are an explicitly addressable type of object. The limits of the device's capability may then be defined by the number of registers and register related rules that are available. A web page displaying these capacities is available in all but some early releases of software. This page will have a link appearing on the index or home page, which is the first page displayed when the device is powered up. (To return to the index page at any time, simply click the graphic at the top of the page.)

System Capacity		
Maximum TCP device count	50	
Integer register count	1000	
Floating point register count	500	
Client read rule count	1000	
Client write rule count	1000	
Server map register count	1000	
Threshold rule count	500	
Cascade rule count	100	
Calculation rule count	100	
Constant count	100	
RTU read rule count	1000	
RTU write rule count	1000	

18. XML Configuration File

The i.CanDoIt or Babel Buster SP is configured by uploading an XML (text) file via FTP or via HTTP file upload. The format of that file is summarized on the following pages.

A typical file might look something like this:

```
<?xml version="1.0" encoding="ISO-8859-1" ?>
<!-- i.CanDoIt BAS-700 ReMOTE I/O configuration file -->

<configuration>

<hardware>
  <board slot="1" model="722"/>
  <board slot="2" model="714"/>
  <board slot="3" model="734"/>
  <board slot="4" model="722"/>
  <board slot="5" model="742"/>
  <board slot="6" model="7030" option="105020"/>
</hardware>

<channels>
  <chan pos="3,1" type="1" scale="1,1,0"/>
```

```
   <chan pos="3,2" type="1" scale="1,1,0"/>
   <chan pos="3,3" type="1" scale="1,1,0"/>
   <chan pos="3,4" type="1" scale="1,1,0"/>
   <chan pos="5,1" type="1" scale="1,1,0"/>
   <chan pos="5,2" type="1" scale="1,1,0"/>
</channels>

<configuration>
```

The above configuration file is only a subset of a relatively simple configuration. The configurations can become much more complex. A full discussion of the language is beyond the scope of this user guide. However, examining the examples shown here will lead to a reasonable understanding of additional data found in the file.

The elements found in the above example incldue the following:

```
<hardware>
</hardware>
```

This section identifies the I/O boards on the track with position #1 being the first I/O board after the BAS-7050 processor module. Each board is identified with a

```
<board … >
```

configuration line. Valid fields in the board configuration are as follows:

slot="n"

Identifies the board's position with #1 being the first board after the processor module. There are no address jumpers to configure. Boards are addressed by position on the track (i.e., they are position dependent). There is no requirement to the order. The maximum number of I/O boards is 8. The maximum number of relays that may be powered by the BAS-7050 without a power booster in the track is 12.

model="n"

Identifies the type of board by model number. Valid models are:

714	4-channel discrete input
718	8-channel discrete input
722	2-channel discrete output
724	4-channel discrete output
728	8-channel discrete output
734	4-channel analog input
738	8-channel analog input
742	2-channel analog output

<channels>
</channels>

This section further qualifies hardware definition with lines beginning with "chan".

<chan … >

It is not necessary to have a line in the "channels" paragraph for every I/O point. Only certain point types need qualification beyond board model, using the following qualifiers:

pos="a,b"

This identifies which point is being referenced, with "a" being slot number 1..8, and "b" being the channel number 1..N (where N is most often 4 or 8).

type="n"

Type defines the type of analog input or output. All of the selections apply to the 734 & 738 analog input, but only "current" and "unipolar" apply to the 742 analog output. In addition, the "bipolar" selection only applies to a 738 that is isolated (model BAS-738/3) since only this model includes the on-board power converter to generate the negative supply voltage.

Valid types, with the indicated number substituted for "n" above, are:

typedef enum
CURRENT = 0
UNIPOLAR = 1
BIPOLAR = 2
TEMP10K3_C = 3
TEMP10K3_F = 4
TEMP10K2_C = 5
TEMP10K2_F = 6

Temperature may be measured using either 10K type 2 or type 3 thermistors with readings returned in degrees C or F. These readings are linearized using a lookup table and interpolation between points. A 39 point linearization table is used.

scale="a,b,c">

Scale applies to analog I/O points. When converting from register data to raw hardware data, the register (scaled) data is multiplied by a, then divided by b, and then c is added. The raw hardware value for an analog output should be in the range of 0 to 255.

Input data is in a range of 0-4095 or -2048 to +2047 as read from the A/D. This is scaled by the A/D input software to allow for overrange and still produce a raw count of 4095 at 10.0VDC in. The overrange allowance will produce a maximum count of 4192 (102%). This data is then multiplied by a, divided by b, and added to c to produce the value that is presented to the Modbus register.

19. Additional Information

Most of the help you should need for configuring the system may be found in the online help in the device itself. I you do not have access to a device but need to review its help file, you may find a demo version of the same web site at www.csimn.com. Additional information available at www.csimn.com includes the SNMP MIB file (ASN.1 source), and links to other useful information including the Modbus protocol specifications. If you have further questions, additional support is available by email at support@csimn.com.