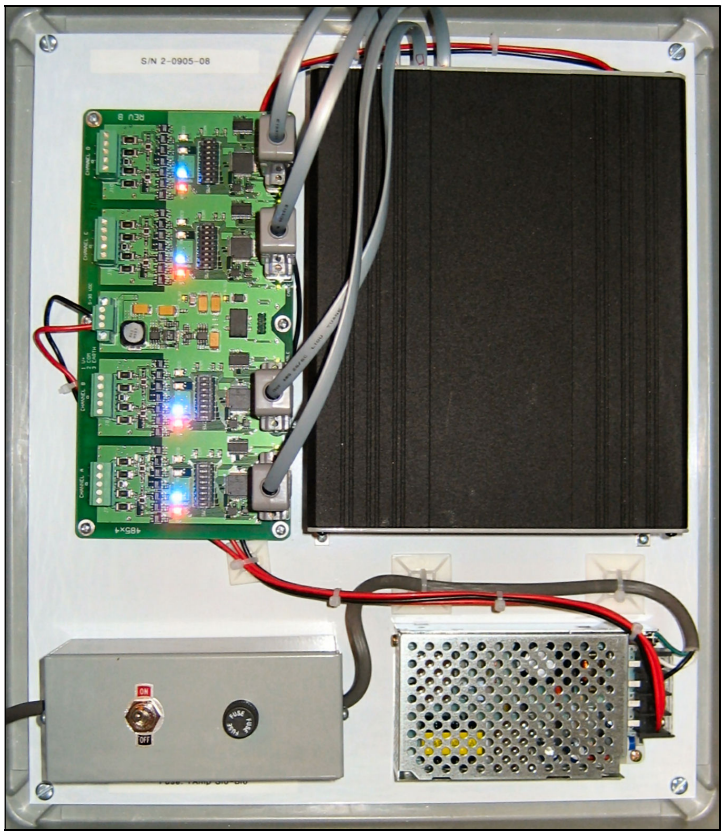
10/2019 VERSION 2.1

CENTAURUS PRIME

Integrations, Custom Programming, Consulting



Barber-Colman

“ASD” Gateway Guide

10/2019 VERSION 2.1

Centaurus Prime

Barber-Colman Gateway Guide

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Chapter 1

Gateway Installation Basic Information

Summary

This section will help to give a basic overview and quick summary of the procedures needed to install the Barber-Colman Gateway Panel. Detailed instructions are also provided later in this guide. The Centaurus Prime Barber-Colman Gateway allows any front-end system (Modbus TCP/IP or BACnet/IP) that communicates using the either industry-standard Modbus or BACnet protocols to communicate to the following Barber-Colman ASD-bus field equipment:

- ***MicroZone-II (Vav box controller)***
- ***MicroFlo-II (Unitary controller)***
- ***PEM (Packaged Equipment Module)***
- ***MicroZone-III (MicroNet, MicroNet 2000) VAV, Heat-Pump/Fan Coil units***

ICON KEY

Valuable information

The Barber-Colman field devices will appear to the front-end system as a series of Modbus SLAVE devices or true BACnet Devices. Each Barber-Colman device will map to one of these devices. Real time point data from the Barber-Colman controllers is then mapped to equivalent registers, coils, and bits on the Modbus system, or as AI, BI, AO, and BO objects on the BACnet system. All operations are transparent to the user and the host computer.

Connections to the Gateway are simple and clearly marked. They consist of:

- Power Supply, 120 to 240 Volts AC
- Barber-Colman ASD-Bus Device trunks (up to two)
- Ethernet for Modbus-TCP/IP Network or BACnet/IP Network (specify when ordering)

- Local Mode Port for commissioning via Laptop Computer

All Hardware necessary to connect the Gateway to the Barber-Colman ASD devices is included in the 16" X 14" X 8" plastic cabinet that is easily mounted in a convenient location.

The BACnet/IP network connection is a 10-Mbaud Ethernet, only. BACnet is a connection-less UDP datagram protocol that uses 47808 (hex BAC0) as the port number (changeable in the GATEWAY.INI file). The Modbus TCP/IP Network connects to the Barber-Colman Gateway via this 10-Mbaud Ethernet, using a connected TCP/IP connection on the standard port 502 (one socket connection only). The Gateway should be set up to be a fixed (static) IP address.

Single Board Computer Basics

The Single Board Computer used in Centaurus Prime Gateways is the Ether 6 manufactured by JK Microsystems. It is made in the United States of America.
The controller is based on an Intel 386Ex processor running at 25Mhz. It is equipped with 1 megabyte of static ram organized as 512K 16-bit words. Also included are 512K bytes of flash memory organized as DOS drives A and B. A 40 Megabyte M-Systems DiskOnChip is added to the 32-pin DIP socket on the controller board, and acts as drive C: There is a switching power converter on the controller, which can accept 7-34 volts DC. Nominal current consumption is 250mA at 12 volts with 10Base-T Ethernet selected.

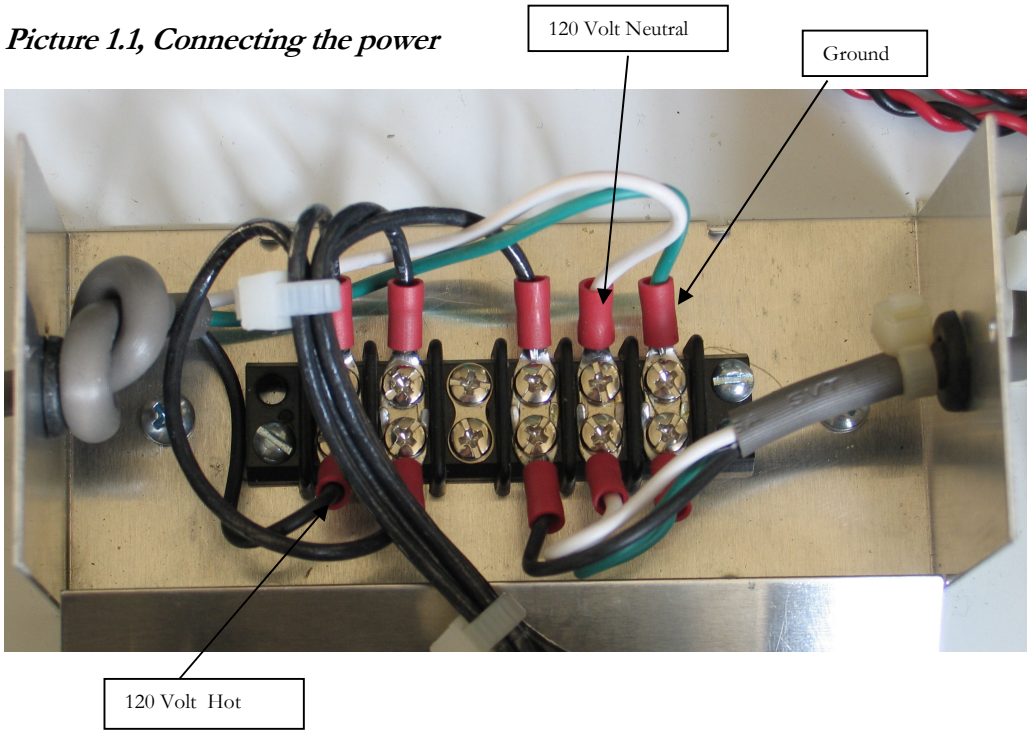
Specifications for the Ether 6 are:

Processor :	Intel 386Ex, 25MHz
Operating System :	XDOS(MS/PC DOS 3.3 compatible)
Memory :	1M SRAM, 512K Flash, 40MB Flash
Ethernet :	10BASE-T, NE2000 compatible automatic media detection, Link status and Activity LEDs
Serial Port 1 :	RS-232 with 5 handshake lines COM1, address 0x3F8, IRQ4 115200 baud maximum
Serial Port 2 :	RS-232 no handshaking or RS-485 half duplex, COM2, address 0x2F8, IRQ 3 115200 baud maximum
Serial Port 3-6 :	RS-232 with handshake lines, 16554 UART,COM3-6 115200 baud maximum 16 byte Rx and Tx FIFO
Digital I/O :	5 Bits (P1.4-P1.7 & P3.1) Pin configurable as input or output 8mA souce/sink
Watchdog :	Hardware, 1.6 second timeout Generates board wide Reset
Clock/Calendar :	Hardware, battery backup
Supply Power :	7-34V unregulated DC ±10%, 3 Watts
Humidity :	5 - 90%, non-condensing
Temperature :	-4 to +158 °F (-20 to +70 °C)
Weight :	53 oz (1.5 kg)
Dimensions :	8.30" x 6.76" x 2.28" (210.8mm x 171.7mm x 57.9mm)

Connecting Power to the Gateway

Power connections are made by removing the 2 screws on either side of the terminal block enclosure. Follow the diagram below for proper terminations.

Picture 1.1, Connecting the power



Connecting Barber-Colman ASD Trunks to the Gateway

Typically, Barber-Colman "ASD Bus" device trunks (possibly several trunks) are connected to a GCM ("Global Control Module"). There are two or more trunks on the GCM. This gateway is NOT for the LCM buss device, or any LON (Echelon™ protocol) devices. This gateway was designed for ASD-bus devices only. Any LCMs ("Local Control Modules") on the LCM trunk are too old, too slow, and too problematic to continue to use, and we highly recommend their replacement. Any LON devices can be brought in to another system with any number of other third-party devices (e.g., Tridium, FieldServer, etc.). This gateway is ONLY for ASD-bus devices, as listed above.

The ASD bus is an RS-485 two-wire communications trunk, running at 19,200 baud (typically). The "ASD bus" trunks from the GCM are removed and simply re-connected to the Centaurus Prime Barber-Colman Gateway. There is some programming that you MUST do (for "globals")

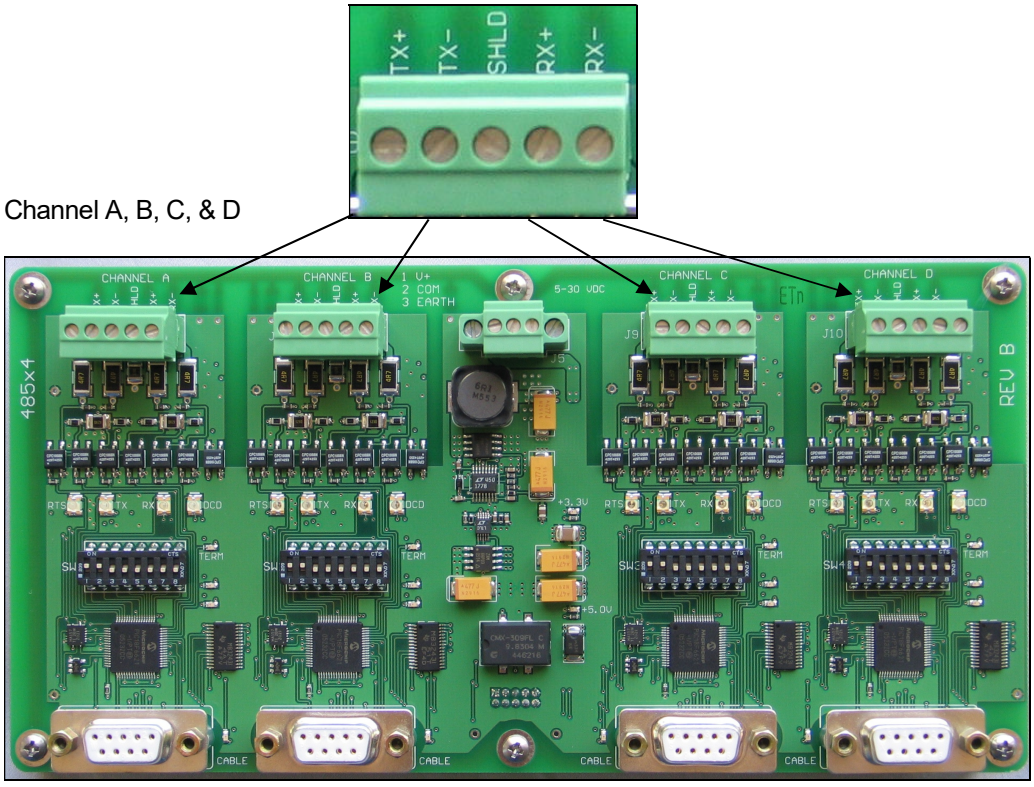
before your system will be fully operational, and there may be a brief upset if you do not have these global values ready when you first connect—so please be careful and not too cavalier with your initial hook-up.

The trunk connections are clearly marked and each trunk is only a two-wire connection. The trunks have a "plus" and "minus" side, and also a "shield" connection that goes to cabinet (AC) ground. Be sure that the polarity is correct, and that the shields are ALL tied together and only connected to ground at ONE place (to avoid ground-loops). This is a two-wire trunk, so it does not matter if you land the field trunk wires on TX+/TX-, or on RX+/RX-. Just make sure the polarity is right!

The "CP-485x4" quad RS-485 converter which is included with the Barber-Colman gateway has four channels. Channels A and B are used for ASD-trunk devices. Channels C and D are factory cross-connected (so that the Gateway can send out a special "wakeup" command at 1200 baud, every minute.

The following picture shows a blow-up of the terminal block (the connection point) for the RS-485 ASD bus, and then points to the location of the four channels (A, B, C, and D) on the converter card. This card is located in the upper-left quadrant of the gateway (see the picture on the cover):

Picture 1.2, RS-485 Trunk identification and hookup



Channel A, B, C, & D are all on one board; They are trunks 1, 2, (with cross-connections between port 3, and 4). ASD Trunk #1 is Channel ""A", while ASD Trunk #2 is Channel "B".

Connecting to the Modbus Master:

Connecting to the Modbus Master is done easily:

You plug in an 8-pin Category 5 or Category 6 cable into the Ethernet connection on the top right-hand corner of the PC. You must set the IP address of the Gateway to a static, fixed address, on the segment that you are in. This is done with the GATEWAY.INI and SOCKET.CFG files, described below. Communications occurs via the connected TCP/IP protocol, using the standard modbus port #502.

Connecting to a BACnet/IP Network

This is quite simple: You plug in an 8-pin Category 5 or Category 6 cable into the Ethernet connection on the top right-hand corner of the PC. You must set the IP address of the Gateway to a static, fixed address, on the segment that you are in. Normally, the standard BACnet port (47808, or hex BAC0) is used, but can be changed. This is done with the GATEWAY.INI file, described in the following section.

Configurations for Your Ethernet Network

You must set the IP address of the Gateway to a static, fixed address, on the segment that you are in. This is done in two files: the SOCKET.CFG file (for the "Windows Sockets" low-level driver) the GATEWAY.INI file (for the Gateway's configuration), described in Chapter 2.

The Gateway defaults to a subnet mask of 255.255.255.0. Should you want to change it, for example, to be on a split subnet (e.g., 255.255.255.128) the SOCKET.CFG file changes, but not the GATEWAY.INI file. This is described in Chapter 2, also.

Since the Gateway does not wander off and waste time with Facebook or write blogs on the internet (that we know of, at any rate), there is no need for a "Gateway address" or DNS Name Resolution addresses. Besides, we want to protect our products from harmful pornography such as E-Bay, Facebook and Twitter. But if your IT department requires that all devices attached to their network have a Gateway address, please call or e-mail Centaurus Prime. We can help you modify the SOCKET.CFG file to add the (Internet) gateway address; it is non-obvious. But if our products then start surfing the web for porn, you have our permission to spank them.

Gateway Overview

Picture 1.3, Gateway Overview and Identification

Chapter

2

Commissioning the Gateway with the Local User Interface

Creating and Downloading the GATEWAY.INI file

The following is an example of the GATEWAY.INI file that must be edited to match your particular installation. There are several sets of parameters in the INI file. One set of parameters deals with the BAUD rates on the two ASD bus trunks. Another parameter sets the Ethernet IP Address of the gateway (it must be a FIXED IP address!), if you are using either Modbus/TCP or BACnet/IP as the host protocol. And, if you are using BACnet, another set of parameters tells the gateway about several network options of BACnet.

The lines for BAUD1, and BAUD2 must be set for the respective Port baud rates which will be "19200" or "9600" (depending up whether you have newer devices or VERY old ones, respectively—most likely it will be 19200). If you have unused trunks, then the baud rate should be set to "0" as seen in the example below for BAUD2 and BAUD4. See "Uploading and Downloading files to the Gateway" for information on accomplishing the upload/download procedures.

The line for IP_ADDR is required only if you have the Ethernet in use (i.e., Modbus/TCP or BACnet/IP protocols in operation. You have to set up the FIXED IP Address of this gateway computer in two places: here in the GATEWAY.INI file, and also in the SOCKET.CFG file (more on that later). But just be aware that they MUST match! If the SOCKET.CFG specifies a different IP address from the GATEWAY.INI file, you will never receive anything from the Gateway!

For the BACnet/IP (Annex J) protocol, a couple other global parameters are necessary. Internally the gateway maps devices in a very simple fashion: Devices 1 through 120 on trunk 1; and Devices 121 to 240 on trunk 2. But you might not want to use those as your Device "Instance numbers", if you have some other addressing scheme (or a number of these gateways) on a system. The BACNET_OFFSET allows you to have these devices show up as a different set of Instances rather than just 1 to 240. The number that you specify is added to the internal device number. Hence, if your offset is 5000, and you are interested in (local) device #124 (the fourth ASD gizmo on trunk #2), the BACnet system sees this device as Instance # 5124.

Also, if you have multiple gateways on one system, you will need to have each of them be a different Network Number (set via the BACNET_NETWORK parameter in the Gateway.ini

file). This is so that there is no confusion between the devices on one gateway and any others (they all could have local device numbers be the same; by having different Network Numbers for each gateway, they become unique, as far as the underlying BACnet protocol works). Also, if the MAKE_ROUTER_DEVICE is set to TRUE, the Gateway itself will appear to your BACnet system as a "Router" device, named "Router-to-Network-***xxxx***", with ***xxxx*** being the BACNET_NETWORK parameter you have chosen. It is important for BACnet systems that there are NO duplicate BACnet networks for Gateways (not only ours, but any others you have!). Remember, if your host system is compliant with BACnet Addendum "al", you must add the "MAKE_ROUTER_DEVICE, TRUE" line to the GATEWAY.INI file.

The ASHRAE committee, in their infinite wisdom, specified that BACnet network numbers are integers. We have found that some systems do not like BACnet network numbers greater than 32767 (they think they are negative numbers…oops). Just keep the BACNET_NETWORK value to less than 32767, and you'll be fine on all systems.

A rarely used option is to set a BACNET_PORT parameter (the default is port 47808, which is "BAC0" in hex). Add this line if necessary.

There are some very old BACnet host systems that require another parameter setup, so that the BACnet Network Data Unit matches the Application Data Unit. You would add the line "MATCH_NPDU_APDU, TRUE" if your BACnet front end requires this. We have not seen a host system in a decade that needed this, so it is unlikely that this line will be needed.

A few older systems require another line for responses to "Who-IS" global commands, in particular the Schneider Electric and Andover hosts. Normally, a "Who-IS", responds with an "I-AM" to the requested IP address that asked for it. However, these system need the "I-AM" to be sent with the "global" subnet (i.e., the final octet of the IP address is 255 for a standard subnet mask of 255.255.255.0). If so add this line: "I_AM_FULL_SUBNET, TRUE". Since 2012 or so, it has been a requirement to send the "I-Am" responses directed, to the sending device, (and these old systems have generally been updated) but this will allow antique systems (that were not very BACnet compliant) to work with the Gateway.

Another rarely used option is to add a couple "special" AV points, that you can write to in the gateway, for each device. This was a special feature added for one site only (One America Plaza), so they could 'store' computed values in the controllers—due to limitations of their host system. It is NOT recommended that you ever do this, but in case it is a necessity you would add the line "MAKE_USER_AV_OBJECTS, TRUE" to the INI file.

Finally, there are a couple optional parameters that are useful in places other than the United States. The line "UNITS, METRIC" tells the Gateway that it should use metric units (that is, Deg C, LPS, MilliBars, Sq. Meters, kPa and kj/kg instead of Deg F, CFM, IWC, Sq. Feet, PSI, and BTU/LB, respectively). The Barbe-Colman equipment sends back values in American units (e.g., Deg F.). This setting allows the Gateway to translate those values into sensible, Metric units. Here is what is supported, based on the Engineering Units in each point on the device:

Engineering Units Text	Converted From	Conversion is for
DEG C	Deg F.	Temperature
LPS	CFM	Air FLow
LPM	GPM	Liquid Flow
MBAR	IWC	Pressure
KPA	PSI	Pressure
KJ/KG	BTU/LB	Enthalpy
SQ M	SQ FT	Area

Here's an example from a Gateway (typed out on the terminal from the DOS prompt):

```
C:\>type gateway.ini
// ---------------------------------------------------------------------
//
// Required for 2 ports: Set the baud rate (set to 0 if channel unused)
//
// Valid baud rates are:   19200 (newer devices) or 9600 (rare, old devices)
//                                0 -- <means that nothing is on that trunk>
BAUD1, 19200
BAUD2, 0
//
// ---------------------------------------------------------------------
//
//   "IP_ADDR" is used for the IP address of what you want this box to be.
//      ( And it MUST match the SOCKET.CFG IP Address! )
//
IP_ADDR, 192.168.0.204
// ---------------------------------------------------------------------
//
//  "BACNET_NETWORK" is used for what BACnet network number we are on
//
BACNET_NETWORK, 1042
//
// "BACNET_OFFSET" is what we will add to the local device numbers (1..240)
//   to yield the BACnet object_ID instances of each mapped BACnet "device"
//
BACNET_OFFSET, 1042000
//
// "MAKE_BACNET_DEVICE" is used to make the device conform to BACnet Annex "al"
//
MAKE_BACNET_DEVICE, TRUE
//
```

Creating and Downloading the SOCKET.CFG file

The following is an example of the SOCKET.CFG file that must be edited to match your particular installation, if you are using the Modbus/TCP or BACnet/IP protocols. If you are not doing an Ethernet connection, this text file is irrelevant, and can be ignored and left as it comes from the factory.

ONLY ONE LINE SHOULD BE CHANGED—the line that begins with "ip address". Here is an example (the line to change is highlighted in RED):

```
C:\>type socket.cfg
# SOCKET.CFG is the configuration file to be executed by SOCKETP.EXE

ip address 192.168.0.72/24

interface pdr if0 dix 1500 10 0x60

# The following line will just display the info for easy verification:
ip address
# The following lines set TCP/IP parameters (commented out in this case):
#ip ttl 15
#tcp mss 1460
#tcp window 2920
```

The "**ip address 192.168.0.72**" line should be modified to be whatever ***static*** IP address that the Barber-Colman Gateway will have. Note that DHCP is not an option; this device requires a static, fixed, IP address.

Also note the "**/24**" after the ip address. This is the number of bits in the subnet mask (that is, in this example, there are 24 "1"'s, so the subnet mask is 255.255.255.0. If you had a subnet mask of 255.255.255.128, then you'd add "/25" after the ip address. Or a weirder subnet of 255.255.255.224 (which has 27 "one" bit) would be "/27". This is not important for Class C subnets (which have 255.255.255.0 as the default), but if you happen to be on a Class A network, for example, and omit the "/24", then global broadcast commands will be too wide (e.g., 255.0.0.0).

If a "gateway" IP address is wanted, unlikely, but it might be required by some IT wonks at your establishment, you will have to add the following line, right after the "ip address" line in your SOCKET.CFG file:

route add default if0 10.139.60.1 (of course, your gateway IP would differ)

Frankly, this is totally unnecessary (as the Gateway doesn't want to yap on the World Wide Web, and you probably don't want it to, either). But some IT departments are requiring this, lately, even though it is needless. But the ***IT Gods*** must be appeased…

Local Mode Menu Options

Once connected via the local mode port you may press <enter> at any time to display this top level menu:

```
(H)elp, (S)ummary, (D)evice, (P)oint, (C)ontrol, (W)atch, (A)utoDisc, (X)-it
```

When you type "H" <enter> you will get the following:

```
Hit a single key to get to a submenu.  Your Options are:
  H (for Help),    which gives you this screen.
  S (for Summary), which allows you to get various status summaries.
  D (for Devices), which allows you to manage and get data on devices.
  P (for Points),  which allows you to manage and get data on points.
  C (for Control), which allows you to control various field objects.
  W (for Watch),   which allows you to watch protocol streams.
  A (for AutoDisc),which allows you to auto-discover trunks.
  X (for "X-it"),  which exits this gateway program.

(H)elp, (S)ummary, (D)evice, (P)oint, (C)ontrol, (W)atch, (A)utoDisc, (X)-it :
```

🗁 ***X – will always take you back to the top level menu options***

Auto Discovery and Database Generation

Before you can use any of the other menu options you must first create your database by using the (A) option, which will give you something similar to the following text:

```
AUT:  (A)uto-Discovery, (S)ave Discovery,  (X)-it :A

AUTODISCOVERY:  You may select a TRUNK to auto-discover.
       Enter a TRUNK NUMBER  (1 through 4) : 1

Trunk #1 will now be auto-discovered...
AUT:  (A)uto-Discovery, (S)ave Discovery,  (X)-it :

State: "AutoDiscovery" on Trunk: 1,  Device #1
State: "AutoDiscovery" on Trunk: 1,  Device #2
    MicroFlo-II Device Discovered at Address #2
State: "AutoDiscovery" on Trunk: 1,  Device #3
State: "AutoDiscovery" on Trunk: 1,  Device #4
State: "AutoDiscovery" on Trunk: 1,  Device #5
     MicroZone-II Device Discovered at Address #5
State: "AutoDiscovery" on Trunk: 1,  Device #6
State: "AutoDiscovery" on Trunk: 1,  Device #7

…etc… this continues for all 250 possible addresses on a trunk!  So…it takes awhile…
```

When Auto Discover is invoked the Gateway will scan for all ASD bus devices, at every addresses possible on the requested trunk.

As you can see in the example above, ASD Device address #2 was discovered, which was a MicroFlo-II type device, and ASD Device #4 was discovered to be a MicroZone-II device..

This process should be completed for all trunks that have ASD bus devices. When all trunks have been Auto Discovered, you can then use the (S)ave Discovery option.

- Note 1: This is a lengthy process, taking 20 to 30 minutes per trunk, even on a 19200-baud trunk; it has to give commands to EVERY possible address (1 to 250), for EVERY possible device type.

- Note 2: If a controller is dead, unplugged, or not communicating when Auto-Discover is done, you can manually add the controller to the discovered data file. You must download the data file to your PC, edit it to add a line about the missing controller, and then upload the modified file back into the Gateway. **See "Uploading and Downloading files to the Gateway"**

- The auto-discover process creates two files, DISC_1.TXT and DISC_2.TXT, which specify the devices that the auto-discover process found on those trunks. Then, when you SAVE the auto-discovery (see below), the CONFIG.TXT file is created in the Gateway.

- Just for completeness, and for your edification, here is a list of the files that are in the Gateway on drive C:, and their purpose, are (discovery files highlighted):

STARTUP .BAT	- Startup Batch file
GATEWAY.INI	- Sets all baud rates, IP Address, BACnet parameters
SOCKET.CFG	- IP Configuration file
SOCKETP .EXE	- TCP/IP Socket stack
NE2000.COM	- Ethernet Driver
BC_GWAY.EXE	- Does all the magic
DATABASE.DAT	- Database that is created from Save Discovery
DISC_1 .TXT	***- Trunk #1 Auto Disc File***
DISC_2 .TXT	***- Trunk #2 Auto Disc File***
CONFIG .TXT	***- Device configuration file created when the Auto-Discovery files are merged***
XPING.EXE	- Test program to verify Ethernet connectivity

```
(H)elp, (S)ummary, (D)evice, (P)oint, (C)ontrol, (W)atch, (A)utoDisc, (X)-it :A

AUT:  (A)uto-Discovery, (S)ave Discovery,  (X)-it :S

AUTODISCOVERY:   You may SAVE and MERGE all trunk auto-discovery maps.
    ARE YOU SURE?  If so, enter "Y" for YES; and then the ENTER key.
```

```
    (or any other keys if you do NOT want to merge the maps :Y

Discovery File Merging, trunk #1
Merging, MicroFlo-II unit #2;  Trunk #1;  Type = 0
Merging, MicroZone-II unit #5;  Trunk #1;  Type = 1
Merging, PEM unit #9;  Trunk #1;  Type = 2
Discovery File Merging, trunk #2
Merging, MNET-VAV unit #1;  Trunk #2;  Type = 3
Merging, MNET-VAV unit #2;  Trunk #2;  Type = 3
Merging, MNET-VAV unit #2;  Trunk #2;  Type = 3
```

This option will merge all of the discovery files for each trunk thereby giving you a completed database for the Barber-Colman devices on all trunks.

After the merge is complete, the Gateway will have created a file called CONFIG.TXT. This is a summary of the ASD devices, used the next (and subsequent) time the Gateway is rebooted. Upon reboot, another file is created on a "virtual" RAM disk, called DATABASE.DAT. So, when the Gateway is rebooted, this saved configuration in CONFIG.TXT is used to create a new Database file, which will be initialized and communications to the field devices will commence.

The Save Discovery option automatically assigns BACnet or Modbus device numbers (slave addresses) to the Barber-Colman devices it found. First, devices on trunk #1 are assigned, in order of Modbus slave devices 1 through 120 (note that there are a maximum of 120 ASD devices for one trunk – this is because many installations either used repeaters or simply violated the "rules" about only having 32 devices on one trunk. We accommodate systems that have more). Similarly, the Barber-Colman devices found on Trunk #2 are assigned (in the order that they are discovered) to BACnet or Modbus slave devices 121 through 240.

"Summary" Menu Options

```
SUM:  (D)evices,  (A)larms,  (C)ontrolled,  (U)nreliable,  (X)-it :
```

After the (S)ave Discovery has been completed, you can then reboot and the Gateway will begin to poll the discovered devices. The summary menu option will display further options detailed below.

(D)evices : Devices will display all the statuses of all devices configured for the Gateway.

```
SUM:  (D)evices,  (A)larms,  (C)ontrolled,  (U)nreliable,  (X)-it :D

TagID: "MZ-II #4, TRUNK 1 (MB #1)" is ON-LINE & RELIABLE
TagID: "MF-II #1, TRUNK 1 (MB #2)" is OFF-LINE! <Must INIT> (SlowScan)
TagID: "MF-II #4, TRUNK 2 (MB #121)" is ON-LINE & RELIABLE
TagID: "MF-II #5, TRUNK 2 (MB #122)" is ON-LINE & RELIABLE
TagID: "PEM #6, TRUNK 2 (MB #123)" is ON-LINE & RELIABLE
```

(A)larms: Not available with Modbus (does not support alarm states). With BACnet, this does have meaning, but only for points that have alarm states or limits (intrinsic alarms) defined. At the present time, the Centaurus Prime gateways do NOT support BACnet alarming, either "intrinsic" or "algorithmic".

(C)ontrolled: This command will display all controlled points for all Modbus or BACnet devices.

```
SUM: (D)evices, (A)larms, (C)ontrolled, (U)nreliable, (X)-it :C

DEVICE #1 is field device/subdevice/type 1/0/1
  *** Gateway has NO controls to do! ***
DEVICE #2 is field device/subdevice/type 2/0/0
  *** Gateway has NO controls to do! ***
DEVICE #121 is field device/subdevice/type 4/0/0
  *** Gateway has NO controls to do! ***
DEVICE #122 is field device/subdevice/type 5/0/0
  *** Gateway has NO controls to do! ***
DEVICE #123 is field device/subdevice/type 6/0/2
  *** Gateway has NO controls to do! ***
```

(U)nreliable: This will display all unreliable points for all devices.

```
SUM: (D)evices, (A)larms, (C)ontrolled, (U)nreliable, (X)-it :U

DEVICE #2 is field device/subdevice/type 2/0/1
 *** "COOLING SETPOINT Control" is UNRELIABLE
 *** "HEATING SETPOINT Control" is UNRELIABLE
```

"Devices" Menu Options

The Devices menu is used to display all of the configured devices (A) or to "target" a specific device and get data about it.

(A)ll: View all configured devices.

```
DEV: (S)elect, (A)ll, (D)etail, (O)ff-line, (C)omm Stats, (X)-it :A

TagID: "MZ-II #1, TRUNK 1 (MB #1)" is ON-LINE & RELIABLE
TagID: "MF-II #2, TRUNK 1 (MB #2)" is OFF-LINE! <Must INIT> (SlowScan)
TagID: "MZ-II #4, TRUNK 2 (MB #121)" is ON-LINE & RELIABLE
TagID: "MZ-II #5, TRUNK 2 (MB #122)" is ON-LINE & RELIABLE
TagID: "MZ-II #6, TRUNK 2 (MB #123)" is ON-LINE & RELIABLE
```

(S)elect: Target a specific device.

```
DEV:  (S)elect,  (A)ll,  (D)etail,  (O)ff-line,  (C)omm Stats,  (X)-it :S

DEV:  You may select a DEVICE to target into.
     Enter a DEVICE number (1..240 or 0 for all): 2

Device #2 is now the targeted device.
```

(D)etail: Will display the following details of selected device.

```
DEV:  (S)elect,  (A)ll,  (D)etail,  (O)ff-line,  (C)omm Stats,  (X)-it :D

DEVICE #121 is field device/subdevice/type 4/0/1
Device Name:  MF-II #4, Insurance Company
Device Description: West Conference Room VAV
TagID: "MF-II #4, TRUNK 2 (MB #121)" is ON-LINE & RELIABLE
I/O Trunk: 1, had last COMM at 17:13:12 on Dec 28, 2004
Scan time (secs):  14.  Device has 34 objects under it.  First link =34
```

(O)ffline: This will display the Offline status of devices. Hopefully none are, but if any are, they will be displayed in a list.

```
DEV:  (S)elect,  (A)ll,  (D)etail,  (O)ff-line,  (C)omm Stats,  (X)-it :O

TagID: "MF-II #2, TRUNK 1 (MB #2)" is OFF-LINE!
```

(C)omm Stats: This will display communication statistics of the selected device.

```
DEV:  (S)elect,  (A)ll,  (D)etail,  (O)ff-line,  (C)omm Stats,  (X)-it :C

TagID: "MZ-II #1, TRNK 1 (BACnet #1)" statistics:
      Packets Today:   4563
      RX Errors Today: 0   % Error: 0.000
      TX Errors Today: 4   % Error: 0.087
      Last Comm at:  17:13:26 on Dec 28, 2004
…and so on…5 lines per device…
```

"Point" Menu Options

The "Point" menu has three options, Select, All, and Detail.

```
PNT:  (S)elect,  (A)ll,  (D)etail,  (X)-it :
```

(A)ll: This will display all points and their current values for the targeted device. What follows below is an example from a Modbus gateway. A BACnet gateway will display the BACnet object type and Instance number in the first part of each line, rather than the Modbus register number). Data is the same for both gateway "flavors", it is just the object mapping which is different in the two protocol systems (register addresses versus object type/instances).

```
PNT:  (S)elect,  (A)ll,  (D)etail,  (X)-it :A

DEVICE #1 is field device/subdevice/type 4/0/1
  TagID: "MF-II #15, TRUNK 1 (MB #15)", has 54 objects under it, 1st one at: 54
 MB Reg  30001  (AI) "Zone Temperature           "   Fld:   7245 ==>      72.45
 MB Reg  30002  (AI) "Duct Temperature           "   Fld:   7031 ==>      70.31
 MB Reg  30003  (AI) "Flow                       "   Fld:   1292 ==>    1292.00
 MB Reg  30004  (AI) "Damper Position            "   Fld:   3419 ==>      34.19
 MB Reg  30005  (AI) "HtgValve/Aux Position      "   Fld:      0 ==>       0.00
 MB Reg  30006  (AI) "Thermostat Thumbwheel "   Fld:   7145 ==>      71.45
 MB Reg  30007  (AI) "Cooling Setpoint FB        "   Fld:   7500 ==>      75.00
 MB Reg  30008  (AI) "Heating Setpoint FB        "   Fld:   6650 ==>      66.50
 MB Reg  30009  (AI) "Analog Output AO1 FB       "   Fld:   1006 ==>      10.06
 MB Reg  30010  (AI) "Min Position/Flow FB       "   Fld:   1000 ==>      10.00
 MB Reg  30011  (AI) "Max Position/Flow FB       "   Fld:  10000 ==>     100.00
 MB Reg  30012  (AI) "Parallel Fan Setpoint FB   "   Fld:   6500 ==>      65.00
 MB Reg  40007  (AO) "Cooling Setpoint CTL       "   Fld:   7500 ==>      75.00
 MB Reg  40008  (AO) "Heating Setpoint CTL       "   Fld:   6650 ==>      66.50
 MB Reg  40009  (AO) "Analog Output AO1 CTL"   Fld:   1006 ==>      10.06
 MB Reg  40010  (AO) "Min Position/Flow CTL      "   Fld:   1000 ==>      10.00
 MB Reg  40011  (AO) "Max Position/Flow CTL      "   Fld:  10000 ==>     100.00
 MB Reg  40012  (AO) "Parallel Fan Setpoint CTL"   Fld:   6500 ==>      65.00
 MB Reg  10021  (DI) "OCC/UNOCC Mode FB      "   Fld:      1   OCCUPIED (1-state)
 MB Reg  10022  (DI) "Digital Output #1 FB       "   Fld:      1   ON (1-state)
 MB Reg  10023  (DI) "Digital Output #2 FB       "   Fld:      1   ON (1-state)
 MB Reg  10024  (DI) "Digital Output #3 FB       "   Fld:      0   Off (0-state)
 MB Reg  10025  (DI) "Digital Output #4 FB       "   Fld:      0   Off (0-state)
 MB Reg  10026  (DI) "Damper Forced Open FB      "   Fld:      0   NORMAL (0-state)
 MB Reg  10027  (DI) "Damper Forced Closed FB"   Fld:      0   NORMAL (0-state)
 MB Reg  10028  (DI) "Max Setpoint Forced        "   Fld:      0   NORMAL (0-state)
 MB Reg  10029  (DI) "Temp/Flow Mode FB    v     "   Fld:     64   TEMP (1-state)
 MB Reg:    21  (DO) "OCC/UNOCC Mode CTL     "   Fld:      1   OCCUPIED (1-state)
 MB Reg     22  (DO) "Digital Output #1 CTL       "   Fld:      1   ON (1-state)
 MB Reg     23  (DO) "Digital Output #2 CTL       "   Fld:      1   ON (1-state)
 MB Reg     24  (DO) "Digital Output #3 CTL       "   Fld:      0   Off (0-state)
 MB Reg     25  (DO) "Digital Output #4 CTL       "   Fld:      0   Off (0-state)
 MB Reg:    26  (DO) "Damper Forced Open CTL "   Fld:      0   OFF (0-state)
 MB Reg:    27  (DO) "Damper Forced Close CTL "   Fld:      0   OFF (0-state)

…etc…
```

The display is slightly different for the BACnet flavor of this gateway, because BACnet uses Object Type/Instances rather than registers. The order is slightly different, but the data is identical. Here is the same display, in "BAC-yap" format:

```
PNT: (S)elect, (A)ll, (D)etail, (X)-it :A

DEVICE #1 is field device/subdevice/type 4/0/1
  TagID: "VAV #15, TRUNK 1 (Dev #15)", has 54 objects under it, 1st one at: 54
 BACnet ID    1  (AI) "Zone Temperature          "  Fld:   7245 ==>     72.45
 BACnet ID    2  (AI) "Duct Temperature          "  Fld:   7031 ==>     70.31
 BACnet ID    3  (AI) "Flow                      "  Fld:   1292 ==>   1292.00
 BACnet ID    4  (AI) "Damper Position           "  Fld:   3419 ==>     34.19
 BACnet ID    5  (AI) "HtgValve/Aux Position     "  Fld:      0 ==>      0.00
 BACnet ID    6  (AI) "Thermostat Thumbwheel "  Fld:   7145 ==>     71.45
 BACnet ID    7  (AI) "Cooling Setpoint FB       "  Fld:   7500 ==>     75.00
 BACnet ID    8  (AI) "Heating Setpoint FB       "  Fld:   6650 ==>     66.50
 BACnet ID    9  (AI) "Analog Output AO1 FB      "  Fld:   1006 ==>     10.06
 BACnet ID   10  (AI) "Min Position/Flow FB      "  Fld:   1000 ==>     10.00
 BACnet ID   11  (AI) "Max Position/Flow FB      "  Fld:  10000 ==>    100.00
 BACnet ID   12  (AI) "Parallel Fan Setpoint FB  "  Fld:   6500 ==>     65.00
 BACnet ID   107  (AO) "Cooling Setpoint CTL     "  Fld:   7500 ==>     75.00
 BACnet ID   108  (AO) "Heating Setpoint CTL     "  Fld:   6650 ==>     66.50
 BACnet ID   109  (AO) "Analog Output AO1 CTL"  Fld:   1006 ==>     10.06
 BACnet ID   110  (AO) "Min Position/Flow CTL  "  Fld:   1000 ==>     10.00
 BACnet ID   111  (AO) "Max Position/Flow CTL  "  Fld:  10000 ==>   100.00
 BACnet ID   112  (AO) "Parallel Fan Setpoint CTL"  Fld:   6500 ==>     65.00
 BACnet ID   201 (AV)  "Analog Value 1 (User)    "  Fld:   22 ==>    22.00
 BACnet ID   202 (AV)  "Analog Value 2 (User)    "  Fld:   10 ==>    10.00
 BACnet ID   203 (AV)  "K-Packets TX/RX Today"  Fld:   27 ==>    27.00
 BACnet ID   204 (AV)  "TX Error Rate            "  Fld:    1 ==>    .51
 BACnet ID   205 (AV)  "RX Error Rate            "  Fld:    0 ==>    0.00
 BACnet ID   321  (DI) "OCC/UNOCC Mode FB    "  Fld:     1   OCCUPIED (1-state)
 BACnet ID   322  (DI) "Digital Output #1 FB       "  Fld:     1   ON (1-state)
 BACnet ID   323  (DI) "Digital Output #2 FB       "  Fld:     1   ON (1-state)
 BACnet ID   324  (DI) "Digital Output #3 FB       "  Fld:     0   Off (0-state)
 BACnet ID   325  (DI) "Digital Output #4 FB       "  Fld:     0   Off (0-state)
 BACnet ID   326  (DI) "Damper Forced Open FB  "  Fld:     0   NORMAL (0-state)
 BACnet ID   327  (DI) "Damper Forced Closed FB"  Fld:     0   NORMAL (0-state)
 BACnet ID   328  (DI) "Max Setpoint Forced      "  Fld:     0   NORMAL (0-state)
 BACnet ID   329  (DI) "Temp/Flow Mode FB   v  "  Fld:    64   TEMP (1-state)
 BACnet ID    21  (DO) "OCC/UNOCC Mode CTL  "  Fld:     1   OCCUPIED (1-state)
 BACnet ID    22  (DO) "Digital Output #1 CTL       "  Fld:     1   ON (1-state)
 BACnet ID    23  (DO) "Digital Output #2 CTL       "  Fld:     1   ON (1-state)
 BACnet ID    24  (DO) "Digital Output #3 CTL       "  Fld:     0   Off (0-state)
 BACnet ID    25  (DO) "Digital Output #4 CTL       "  Fld:     0   Off (0-state)
 BACnet ID    26  (DO) "Damper Forced Open CTL "  Fld:     0   OFF (0-state)
 BACnet ID    27  (DO) "Damper Forced Close CTL "  Fld:     0   OFF (0-state)

…etc…
```

(E)very: Sometimes you might want to see ALL the zone temperatures that the Gateway is seeing, or review what the setpoints are, for all devices. Simple! Just (S)elect a point (e.g. #1 is always the zone temp), and when you hit "E" for "Every", the Gateway will show you the above one-line summary, for ***every device*** in the Gateway. Very easy to use, and good for system-wide trouble-shooting. Try it, you'll like it!

(S)elect: With Select, you can target a specific point for the Device that you have targeted using the "Devices" menu.

```
PNT:  (S)elect,  (A)ll,  (D)etail,  (X)-it :S

PNT:  You may select an OBJECT ID to target into.
     Enter a valid, existing, Object ID (1 to 49999) : 30001

The object at ID #30001 is now selected.
```

(D)etail: will display details associated with the selected point, for MODBUS points:

```
PNT:  (S)elect,  (A)ll,  (D)etail,  (X)-it :D

 MB Address: 30001,  Type = AI, "Zone Temperature"
 Field Unit / Subunit :    1   /    0    Field Address :30001
 Object Flags / Errors :    0   /  0
 Field In / Out Counts :    9256 /    0          Field Value :   72.310
 Field Lo / Hi Range :     0.000 /   256.000
 Eng. Units : Deg F.
```

(D)etail: will display details associated with the selected point, for BACnet points, in a format like this:

```
PNT:  (S)elect,  (A)ll,  (D)etail,  (X)-it :D

 BACnet Object ID = 12,  Type = AI
 Object Name: "Zone Temperature"
 Object Description: "West wall temp sensor, 1st floor Conf. Room"
 Field Unit / Subunit :    4 /    0    Field Address :30001
 Object Flags / Errors :    0    /  0
 Field In / Out Counts :    9013 /    0         Field Value :   70.453
 Field Lo / Hi Range :    0.000 /   256.000
 Eng. Units : Deg F.
```

"Control" Menu Options

This is slightly different for Modbus and BACnet. In BACnet, you control things at sixteen different priority levels, and you can "release" control from any particular level.

Let's consider the simpler, Modbus case first. Control just "happens" when you select a point and give it a new value. No priorities at all. The last control to a point "wins", and stays until some other control is given to that point.

Now, before you can control a point object you must first have selected a device number and point number (see Modbus point map, Chapter 3).

(S)elect: Use this to select a valid point. Here is the Modbus variant:

```
CTL:  (S)elect,  (C)ontrol,  (D)etail,  (X)-it :S

CTL:  You may select an OBJECT ID to target into.
     Enter a valid, existing, Object ID (0 to 49999) : 11

The object at ID #1 is now selected.
```

And, here is the BACnet variation on the same theme:

```
CTL:  (S)elect, (P)riority, (C)ontrol,  (R)elease, (D)etail,  (X)-it :S

 CTL:  You may select an OBJECT ID to target into.
     Enter a valid, existing, BACnet Object TYPE/ID (0 to 4), (1 to 16000): 1,114

The object with Type 1 and  Instance #114 is now selected.
```

(C)ontrol: (MODBUS version). This option will let you control the selected point. Here is a simple MODBUS example of a digital point control to "off" (zero):

```
CTL:  (S)elect,  (C)ontrol,  (D)etail,  (X)-it :C

CTL:  You may enter a new value to set the selected object to.
     Enter a field value (0 or 1 for digitals; valid number for analogs) : 0

The new value of the object will be : 0
Adding to Control Queue, at #2.   MB #1, Register: 1
Queued Control;  Trunk #1,  MB #1, Register: 1 -- to:    0.000
```

OK…so much for simple. Now let's talk about BACnet (alias BADnet). There are sixteen priorities. These are given below:

Priority	BACnet Default	Comments
1	Manual Life-Safety	User-Emergency
2	Automatic Life-Safety	Critical! (Programmatic; no mins)
3	Minimum On/Off Time	Custom Programming: Serious Issue!
4	Miscellaneous / High-user	Generally "User-High"
5	Critical Equipment Control	Custom Programming: High-High
6	Miscellaneous (User High)	Equip must meet min on/off times

7	Demand Limiting	Custom Programming—High Priority
8	Manual Operator	Generic Operator Overrides
9	VAV Air Systems	Normal VAV Control loops
10	Chiller Plant Control	Chiller Plant or other main units
11	Area Control	Sometimes called "Group Control"
12	Manual Operator—Low	Generally "User-Low Priority"
13	Miscellaneous (User-Low)	Miscellaneous
14	Timed-Override	For Overrides of Normal Time Scheds
15	Time-of-Day Scheduling	Routine, Time-Schedules
16	Custom Programming—Low	Custom Programming—Low Priority
N/A	Relinquish Default	Relinquish Default

Each controllable point in BACnet (that is, an AO or a BO) has a "priority array" which is generally sparsely populated. Nothing in a particular priority level is specified by "Null", which means that priority level is unused.

As an example, consider a warehouse exhaust fan which is turned on and off by a time schedule at priority 15. In a demand-limiting situation, this point may also have control at priority 7 (shut down ancillary systems in energy peak situations). But programmatically, a logic block that detects a fire might want to override everything and keep the fan on in order to pressurize an area and keep the fire from spreading, so that might be at priority 2. When control is "released" from the higher levels, the next lowest control is issued. Hence, after the fire is over, the fan that was overridden ON might go OFF from its priority 7 demand-limiting shutdown. But if that priority 7 control had been released, then the control descends to the priority 15 time-schedule control. You have to know what your plant's priority system is, and what each point's capabilities and control options are—this is not a trivial control philosophy!

The "Relinquish Default" value, if any is specified, is the control that is given out to a point if there is NOTHING in this priority array (that is, all 16 levels of control have been released). If there is no "Relinquish Default" value, then the point just sits there, at it's last control.

Now, before you can control a point object you must first have selected a device number, a point type/instance, and a priority. Then you can set the control value, and that value will go into the object's priority-array. That does NOT mean that control will be issued, remember, since you may be at a lower priority level than what is controlling the point right now.

Here's the meat of the Control Menu Options:

(P)riority: (BACnet ONLY) Use this to select the priority that you will issue subsequent control and release operations at.

```
CTL: (S)elect, (P)riority, (C)ontrol, (R)elease, (D)etail, (X)-it :P

PRI: Enter a PRIORITY to do your controls at (1 to 16): 4
```

```
Control and Release Operations will now be done at Priority 4.
```

(C)ontrol: (BACnet version) This option will let you control the selected point, at whatever priority level you are currently at.

```
CTL:  (S)elect,  (P)riority,  (C)ontrol,  (R)elease,  (D)etail,  (X)-it :C

CTL:  You may enter a new value to set the selected object to.
      Enter a field value (0 or 1 for digitals; valid number for analogs) : 70

The new value of the object will be : 0
Adding to Control Queue, at #2.   Device #6, AO #114
Queued Control;  Trunk #1,  Device #6, AO #114 -- to:    70.000  pri = 4
```

(R)elease: This option will let you release control for the selected point at your selected priority level (valid for the BACnet variant of the Gateway, only!):

```
CTL:  (S)elect,  (P)riority,  (C)ontrol,  (R)elease,  (D)etail,  (X)-it :R

RLS:  Are you sure that you want to RELEASE this object?
        ARE YOU SURE?  If so, enter Y for Yes, and then the ENTER key.
        (or any other keys if you do NOT want to RELEASE the object) : Y

The object AO #114 has been released from Priority #4.
```

(D)etail: will display details associated with the selected point.. Let's first look at a Modbus version of an object's detail:

```
CTL:  (S)elect,  (P)riority,  (C)ontrol,  (R)elease,  (D)etail,  (X)-it :D

   MB Address: 30001,  Type = AO, "Heating Setpoint"
  Field Unit / Subunit :    4 /    0    Field Address :40007
  Object Flags (bits) :       0    Error Counter : 0
  Field In / Out Counts :    9472  /    9472    Field Value :   74.000
  Field Hi / Lo Range :  256.000 /   0.000    Eng. Units : Deg F.
  No elements in priority/control array
```

And this is what is displayed for an example BACnet controllable object that has been released from all controls (note the line that says "No elements in priority/control array":

```
CTL:  (S)elect,  (P)riority,  (C)ontrol,  (R)elease,  (D)etail,  (X)-it :D

BACnet Obj_ID 113,  Type = AO, "Max Flow/Position Ctl"
  No elements in priority/control array
```

```
Field Unit / Subunit :      4  /   0   Field Address :40012
Object Flags / Errors :          0  /   0
Field In / Out Counts :    11520  /  11520   Field Value :   90.000
Field Hi / Lo Range : 256.000 /   0.000
Engineering Units :     Percnt
```

Had any priorities have controls in them, it would have displayed the priority and the control value, for EACH priority level.

"Watch" Menu Options

The "Watch" menu will let you select various methods for monitoring the real time data from the field.

(Q)uiet: Use the (Q) key to halt any of the following monitoring options. *REMEMBER THIS!*

"Enter **(1)** or **(2)** to Watch Trunks" means this: Enter a trunk number of the Barber-Colman ASD-Bus trunk to monitor. This will display the field scan of all Trunk devices and the status of their points in real time. What is displayed below is the Modbus variant (it shows the register numbers in the second column); the BACnet variation is the same except it shows the BACnet object instances in the second column:

```
WCH:  (Q)uiet, (1) or (2) to watch trunks; (V)erbose, (M)odbus, (X)-it :1

*** TRUNK 1 is now being MONITORED ***
-- SCAN: Trunk #1, MZ-II #4  Device # 1  Type: 0
AI  30001      Zone Temperature Counts:    72 =    72.00
AI  30002 Active Heating SP Used Counts:    71 =    71.00
AI  30003 Active Cooling SP Used Counts:    76 =    76.00
AI  30003 Active Cooling SP Used Counts:    76 =    76.00
AO  40004   OCCUPIED Heating SPT Counts:    71 =    71.00
AI  30004     OCC Heating Value Counts:    71 =    71.00
AO  40005   OCCUPIED Cooling SPT Counts:    76 =    76.00
AI  30005     OCC Cooling Value Counts:    76 =    76.00
AO  40006 UNOCCUPIED Heating SPT Counts:    67 =    67.00
AI  30006    UNOCC Heating Value Counts:    67 =    67.00
AO  40007 UNOCCUPIED Cooling SPT Counts:    80 =    80.00
AI  30007    UNOCC Cooling Value Counts:    80 =    80.00
AI  30008      Damper/Valve Pos Counts:    24 =    24.00
AI  30009    Maximum Flow (Size) Counts:    16 =  1100.00
AI  30010      Present CFM Flow Counts:     0 =     0.00
AO  40011   Max Heating Flow SPT Counts:    16 =    16.00
AI  30011      Max Heating Flow Counts:    16 =    16.00
AO  40012   Min Heating Flow SPT Counts:    15 =    15.00
AI  30012      Min Heating Flow Counts:    15 =    15.00
AO  40013   Max Cooling Flow SPT Counts:    90 =    90.00
AI  30013      Max Cooling Flow Counts:    90 =    90.00
```

```
AO  40014   Min Cooling Flow SPT Counts:    25 =    25.00
AI  30014      Min Cooling Flow Counts:    90 =    90.00
AO  40015    Fan Ctl Offset SPT Counts:     3 =     3.00
AI  30015   Fan Ctl Offset Value Counts:     3 =     3.00
DI  10001    Current Fan Status Raw Value:   8 ==> OFF
DI  10002   Control Mode Status Raw Value:   0 ==> COOL
DI  10003       Heating Status Raw Value:   8 ==> OFF
DO    10  Damper Force Open CTL Raw Value:   0 ==> NORMAL
...etc…
```

(V)erbose: When (V) is pressed while in monitor mode, the full protocol data packets will be displayed as well for each scanned device.

```
*** Now in VERBOSE MODE (full packets) for monitored trunks
 -- SCAN: Trunk #1, MZ-2 #4  Device # 1  Type: 0
 --TO Trunk 1:  00 04 01 00 1C AA 3D
 -- Set up TIMEOUT, Trunk #1, to be 6153193,  TMO @baud = 100
-FRM Trunk 1: <Incomplete>
TIMEOUT" on Trunk: 1, error count = 0
--TO Trunk 1: 00 04 01 00 1C AA 3D
--FRM Trunk 1:00 84 01 00 1C 08 00 11 01 1C  00 00 00 18 00 19 47 4C
47 4C
              19 5A 0F 03 43 50 00 00 10 40  AA AA 3D 85 0F <Valid>
AI  30001       Zone Temperature Counts:     72 =     72.00
AI  30002 Active Heating SP Used Counts:     71 =     71.00
AI  30003 Active Cooling SP Used Counts:     76 =     76.00
AI  30003 Active Cooling SP Used Counts:     76 =     76.00
AO  40004   OCCUPIED Heating SPT Counts:     71 =     71.00
AI  30004      OCC Heating Value Counts:     71 =     71.00
AO  40005   OCCUPIED Cooling SPT Counts:     76 =     76.00
AI  30005      OCC Cooling Value Counts:     76 =     76.00

…etc…
```

(M)odbus: When (M) is pressed while in monitor mode, the full Modbus RTU data packets will be displayed as well for each scanned device (Modbus version only).

(B)ACnet: When (B) is pressed while in monitor mode, the full BACnet protocol data packets (addressed globally or to this gateway only) will be displayed in real-time. ***Note that this significantly slows down the BACnet channel, and we recommend that this mode NOT be utilized for any length of time.***

Uploading and Downloading files to the Gateway

In order to upload/download files to the Gateway, you will need to use a VT-100 Terminal emulator (Hyperterminal or the like). We like "Tera Term", which is easy to use (and a free download!). As an aside, some people (ex-hippies who did UNIX in the 70's and a lot of weed), use a thing called "Putty". We feel that should be used to patch holes in walls, not talk to computers. Call us up and say "I'm using putty…" and the line will mysteriously fade out. FYI.

You will need to set it up to use a Comm Port (Comm1 typically) and use the following settings**: Baud=9600, Databits=8, Stop bits=1, Parity=None,** and **No Flow Control.**

The Gateway has two utilities for transferring files. **UP.COM** is used to send files to the Gateway from your computer and **DOWN.COM** is used to receive files from the gateway to your PC.

When you are connected to the gateway in local mode, hit X-it once or twice and you will be asked to type "YES" to quit the program which will take you to DOS prompt.

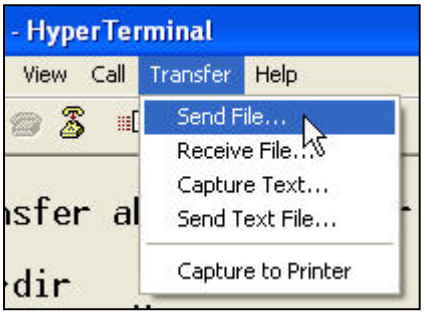
Sending a file to the Gateway (uploading)

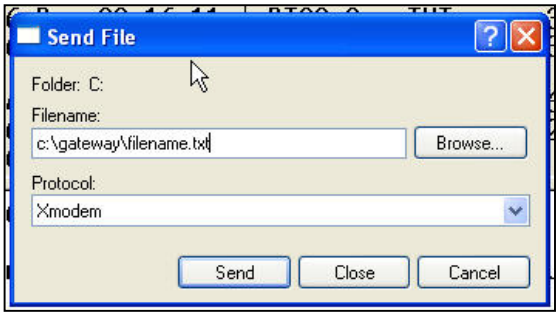
From the dos prompt, you must type "UP filename" (filename being the name of the file to send with extension). The response will look like the following.

```
C:\>up test.txt
Ready, start X-modem upload now,
 Press CNTL-C to abort...
……
```

In Hyperterminal, start the file transfer by selecting Transfer/Send and follow the following sequence below.

Click Transfer > Send File: Browse for file to send and make sure that Xmodem is selected. Click the send button and the file will be sent to the Gateway.



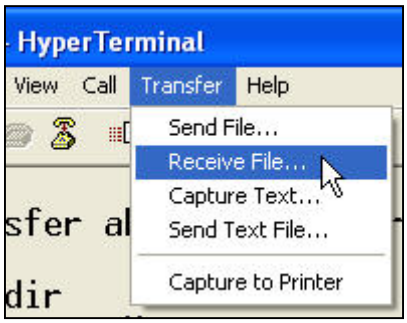


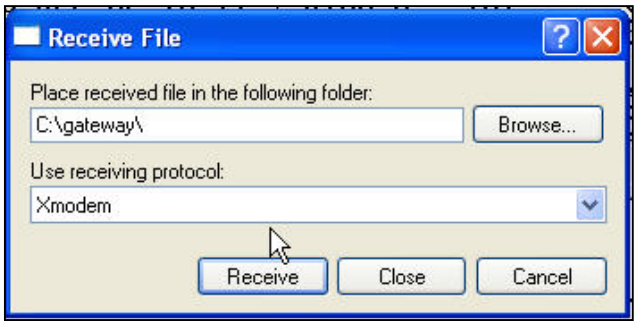
Receiving a file from the Gateway (downloading)

From the dos prompt, you must type "DOWN filename" (filename being the name of the file to receive with extension). The response will look like the following.

```
C:\>down disc_1.txt
Ready, start X-modem download now...
```

In Hyperterminal, start the file transfer by selecting Transfer/Send and follow the following sequence below.





Click Transfer > Receive File: Enter the location to save the file and make sure that Xmodem is selected and then click the Receive button. The next dialog box will ask you to specify a filename and when you click "OK" the file will be received from the Gateway.

Setting up the Modbus Driver

After the Gateway is ready to go and you have your database configured, one of the last steps is to make sure that you have the Modbus driver settings for the Host/Master setup correctly. The following information should be kept in mind when configuring the driver

Modbus commands that are accepted by the Gateway are:

1 - Read Coils	(0000's)
2 - Read Discretes	(10000's)
3 - Read Holding Registers	(40000's)
4 - Read Input Registers	(30000's)
5 - Force Single Coil	
6 - Preset Single Register	

7 - Read Exception Status (Status is 0 if OK; o/w internal error-code)
15 - Force Multiple Coils
16 - Preset Multiple Registers
17 - Report Slave ID (Emulates Modicon Micro-84)

Most Modbus drivers have many setup options and each vendor is different. Following are some limits with the Modbus Gateway that you need to consider when setting up your driver.

```
MAXIMUM number of coils read at once (CMD #1) is 64
MAXIMUM number of discretes read at once (CMD #2) is 64
MAXIMUM number of holding registers read at once (CMD #3) is 32
MAXIMUM number of input registers read at once (CMD #4) is 32
MAXIMUM number of coils forced at once (CMD #15) is 4
MAXIMUM number of registers preset at once (CMD #16) is 4

TIMEOUT for a command should be a minimum of 350 milliseconds (500 ms
recommended)

TIME BETWEEN commands should be a minimum of 50 milliseconds (100 ms
recommended)

NUMBER OF TIMEOUTS before "slow polling" should be a minimum of 3 (3
recommended)
```

We recommend that multiple-force commands (Commands #15 and #16) NOT be used, as there is no error-return on these commands if a single point has a failure. We believe that, since it is possible to return an error-code for single point force commands (Commands #5 and #6), that those be used with Modbus drivers that can then present the failure mode to the user in a rational, natural language mode (rather than "codes"). This is, of course, up to the implementer, but we have our opinions.

Setting up the BACnet System

After the Gateway is ready to go and you have your database configured, one of the most important steps is to make sure that you have your BACnet system configured properly to communicate with the Centaurus Prime Gateway.

The most important parameter that some BACnet systems need to know is whether a device supports READ-MULTIPLE and WRITE-MULTIPLE services. The Centaurus Prime Gateways only support READ-MULTIPLE, not WRITE-MULTIPLE services. All Centaurus Prime Gateways conform to the BACnet "PICS" statement published and available on our web site, www.CentaurusPrime.com.

There is some difference in the way many host systems work. Some require our gateway to be on a separate network number (e.g., ALC); some prefer the gateway to be on the same network (e.g., Alerton), and some don't care (most). In the GATEWAY.INI you should change the parameter "BACNET_NETWORK" to an appropriate value. The 2017 BACnet Addendum ***al*** ("Gateway Best Practices") does REQUIRE that all gateways have **UNIQUE BACnet network numbers.** For "future proofing" your site, we HIGHLY RECOMMEND a unique network number!

Typically, installers have chosen the BACNET_NETWORK to be a certain number, and then made the BACNET_OFFSET to be 1000 times that number; so that the BACnet instance numbers of the devices are all prefixed by the network number. As an example, if you set the BACNET_NETWORK number to 333 and the BACNET_OFFSET to 333000, then you would end up with BACnet device numbers 333001, 333002, 333003, etc., on network #333. Makes it simple, no? Just a suggestion1

DO NOT over-tax the BACnet network! At about 30 BACnet/IP packets per second directed ***TO THE GATEWAY***, the Gateway will saturate; any more packets than that, and they are lost. Any more than that will cause retries and actually SLOW DOWN the BACnet system! This is because BACnet/IP is a "connectionless" system—the requestor sends a packet to the Gateway, and the network gives it a "best effort" to deliver it. If the network is saturated, and our Gateway does not receive the packet, the requestor has to time-out, and then retries its request packet. This may mean that control logic will "stall" (depending upon the software implementation in the controller) until that retry occurs.

What's in a (BACnet) Name?

Whether you use the "defaults" or a generic template, all the points of the same BC Device type have the same names. That is, if there are fifty VAV boxes attached to a BC-Gateway, then there will be fifty points called "Room Temperature". Of course, they're on different devices, and hence, for BACnet, they are unique. But that doesn't make it that much easier for the users of some systems (e.g., Trane), who often have to 'dig' to find the device name or number. Nor is it nice for systems (e.g., Honeywell) that want to "post-pend" something to the end of the same. Most people think in terms of "Room 1234 Zone Temp", not "Zone Temp Room 1234". Wouldn't it be nice to give each and every point in every device a unique name, prefixed to every point in a device? That was what Ron Powell at Warner Brothers wanted to do, and we came up with an elegant solution for him. Perhaps you will want to do it, too.

All it takes is making a "***prefixs.txt***" file, specifying for each device in the gateway, the name that would go in FRONT of every point in a device when it is defined (that is, at bootup). This file has a simple format:

```
FT-001., 1, 1
FT-002., 1, 11
FT-003., 1, 22
FT-125., 2, 1
FT-126., 2, 2
FT-127., 2, 3
FT-128., 2, 4
FT-124., 2, 5
FT-123., 2, 6
FT-122., 2, 7
FT-120., 2, 8
FT-119., 2, 9
FT-105., 2, 10
```

Etc…

The format is simple: Three columns. The name to prefix, the trunk, and the ASD-bus device number. It is a CSV formatted file (CSV is "comma-separated variable", remember).

This is saying that ASD-bus device #1 on Trunk #1 is "FT-001.". This name is what is pre-pended onto every point in that device. So, there will be points named "FT-001.Room_Temp", "FT001.Unocc_Heat_SPT", "FT001.Fan", and so on.
Also, Staefa device #11 on Trunk #2 has the prefix "FT-002.". So it will have "FT-002.Room_Temp", "FT-002.Fan", and the like. Very simple, indeed.

So, if you want to use this feature, just create a file, like the one above, with one device per line. The "name" you want prefixed for every point should be first. Then, the second parameter is the trunk number (1 or 2). Finally, third is the Barber-Coleman ASD-bus device number (1 to 128). Name this file "prefixs.txt", and then download it to the gateway.

Upon the next reboot, you will see the new names (shown as each device is being defined) at the end of the line about each device. Voila!

A Few Words About Controls

The Barber-Colman devices are not state-of-the-art: they were designed in the 1980's and 1990's. Older VAV (MicroFlo-II) device are slow, but the newer MicroNet devices are even slower, as the MicroNet Integrator is "in the way" and as such slows things down.

As such, controls to any Barber-Colman gizmo are "leisurely" and have several limitations. We want you to be aware of these limits when you design your logic and controls in your front-end system.

First, you should NOT just continuously write output values to the controllers. Most of the parameters you WRITE (that is, AO and BO points) are not only changing things within the RAM of the controller, but that value is also written to EPROM. This is "safe", because the last thing you wrote to a Barber-Colman device it remembers (usually), and that value is what is used when it has a power-bump or failure and reboots. But, the EPROM used in some of the Tdevice designs was never designed to take more than 100,000 writes (but they would usually last 250,000 to 500,000). Now, if you write to a parameter once per minute, that is 1440 times per day, or 525,600 times per year. Ooops…it's easy to see that continuously bumping a setpoint is a bad idea: the EPROM can fail in less than a year or two. We think that you should write to EPROM only on a "significant" change, and only when really necessary.

Second, many of the parameters are "modes", and are mapped as several BI/BO points. For example, the Occupied and Unoccupied modes for a VAV is really controlling the fan, modulating dampers, turning heating and cooling ON as needed, etc. There are several "force" BO points (Damper forced open, Damper forced closed, Minimum Setpoint forced, Maximum Setpoint forced, etc.), and if the Barber-Colman device is in NONE of the "force" modes, then it is in AUTOMATIC. This is very important to remember: these devices have "automatic" as

their default control mode. Note also that if you try to FORCE it into several of these "force" modes at once, the results are nonsense (actually, the last command wins). We also have noted that there is some time-lag between telling the device to go to a mode and it actually happening. Further, controls should be written so that the "force" points are taken off (which means that it goes into AUTO mode), then, after a minimum of one minute, you can "force" it into another mode. Too-fast operations changing modes may possibly not only confuse these old field devices, but it has been known to cause them to reset or fail.

Third, there is a way to override any physical I/O point, independent of what "mode" the controller is in. You can "force" a physical I/O point, via one of two mechanisms. From then on, all controls and adjustments that you do to that physical I/O point will go straight out, and any automatic controls that would otherwise control the point are thwarted. Then, you can set that physical I/O point back into "auto", and the automatic controls, as computed by the controller, will then go out.

Speed of Controls is of enormous interest when designing your controls. Controls are the FIRST priority of the Gateway, ahead of scanning. We have implemented a queue of 1000 controls (yes, one thousand!). But you need to be aware that all controls in the queue have to be done before scanning will re-commence. There will usually be a lot of controls from your host system (sending initial controls upon re-connection to each device). But DO NOT program your system to re-control anything on a regular basis (e.g., every five minutes). Say you control a half-dozen points in 100 VAV field devices (setting modes, some setpoints, etc). That is 500 controls. As the Gateway can do about 1 to 3 controls per second (remember, these are slow serial-trunks!) It may take several minutes (if we use a rate of 2 controls per second, that would be 250 seconds; over four minutes). It would mean that all your controls are preventing the Gateway from scanning, 90% of the time. Bad news! Over-control of points is the most common problem with the implementation of these Gateways. Beware!!!!

Now, in BACnet systems, we have implemented the full 16-level priority scheme of BACnet. This allows you to control a point at various priorities (higher priorities, closer to 1 for critical controls like emergency shutdowns). As you RELEASE the controls at various priorities, the Gateway will "walk down" the list of controls, and do the next-lower priority control.

Now, two BIG WORDS about the BACnet "Relinquish Default" for analog output objects: IMPLEMENT THEM. The way BACnet works, you send a command to an AO point at a certain priority (say, operator, priority 8), and perhaps some logic controls it to another value, say a time schedule at priority 12). Release from 8, and the control at priority 12 is sent. Release from ALL control priority, and the BACnet Relinquish Default" value is sent out. But what if your system never had a Relinquish Default value for an analog output point? Then "Null" is the value sent out to the real world, which could be a VERY bad thing. Of course, the same issue applies to Binary Output points.. This is just standard BACnet operations, so become familiar with this operation!

However, we have implemented a "catch" for this BACnet issue. When all controls have been released, but there is no Relinquish Default value (i.e., it is "Null") we just leave the object where it is at (that is, we do no controls to it). Better to stay put than go to some weird value!

TEMPLATE Files

Centaurus Prime Gateways allow serious customization. You can to download to the Gateway and "regular" and "custom" templates that will be used in your building. Maybe you don't like the set of standard points that are created for your MicroFlo-II VAV box. Maybe you have so many devices that you run over the 10,000 point limit in the Gateway (yikes!). Maybe you hate the names we made up. Maybe you want to make each gizmo have different names for their points. You can do all this, and more, by creating your own templates and downloading them to the Gateway.

If you just want to replace the "standard" set of points that the Gateway creates upon startup, create a template for a device type, and download it. The templates are named as follows, and MUST use these names:

1. MicroFlo-II VAV boxes: TPL_MF2.CSV
2. MicroZone-II Controllers: (No default)
3. PEM Controllers (half-size MZ-II): (No default)
4. Micronet-2000 VAV boxes: TPL_MNFL.CSV
5. Micronet-200 Heat Pump/Fan Coil devices: TPL_MNHP.CSV

We will give an example for a MicroFlo-II (TPL_MF2.CSV) template file, but the concept is the same for all the other devices. This example CSV file shows you all the points that WOULD be created, and those that are not desired are "commented out" by putting a double-slash ("//") at the beginning of the line. Here it is (displayed in a sort-of Excel cell format):

// MicroFlo-II Template -- Maintain the ORDER of these lines. Line Deletions are OK; Additions are NOT recommended
//
// NOTE: This file is for 'English units'; not sensible Metric units!
//

// Type	Point#	Short Name	0-Units/Ana-Min	1-Units/Ana-Max	Ana-Units	Description/Long Name
//						
BO	40	EMS Mode CTL	LOCAL	HOST		EMS (Host) Mode CTL
BI	40	EMS Mode FB	LOCAL	HOST		EMS (Host) Mode FB
BI	32	Digitial Input #1	OFF	ON		Digital Input #1 Status
BO	31	Valve Action CTL	NORMAL	REVERSE		Valve Action (Mode) CTL
BI	31	Valve Action FB	NORMAL	REVERSE		Valve Action (Mode) FB
BO	30	ForceMornWarmUp CTL	NORMAL	FORCED		Force Morning Warm-Up CTL
BI	30	ForceMornWarmUp FB	NORMAL	FORCED		Force Morning Warm-Up FB
BO	29	ForceMaxFlow Spt CTL	NORMAL	FORCED		Force Max Flow Setpoint CTL
BI	29	ForceMaxFlow Spt FB	NORMAL	FORCED		Force Max Flow Setpoint FB
BO	28	ForceMinFlow Spt CTL	NORMAL	FORCED		Force Min Flow Setpoint CTL
BI	28	ForceMinFlow Spt FB	NORMAL	FORCED		Force Min Flow Setpoint FB
BO	27	Dmpr ForceClose CTL	NORMAL	FORCED		Damper Force-Close CTL
BI	27	Dmpr ForceClose FB	NORMAL	FORCED		Damper Force-Close FB
BO	26	Dmpr ForceOpen CTL	NORMAL	FORCED		Damper Force-Open CTL
BI	26	Dmpr ForceOpen FB	NORMAL	FORCED		Damper Force-Open FB
BO	25	DigOut #4 CTL	OFF	ON		Digital Output #4 CTL
BI	25	DigOut #4 FB	OFF	ON		Digital Output #4 FB
BO	24	DigOut #3 CTL	OFF	ON		Digital Output #3 CTL
BI	24	DigOut #3 FB	OFF	ON		Digital Output #3 FB

BO	23	DigOut #2 CTL	OFF	ON			Digital Output #2 CTL
BI	23	DigOut #2 FB	OFF	ON			Digital Output #2 FB
BO	22	DigOut #1 CTL	OFF	ON			Digital Output #1 CTL
BI	22	DigOut #1 FB	OFF	ON			Digital Output #1 FB
BO	21	OCC/UNOCC Mode CTL	UNOCC	OCC			Occupancy Mode CTL
BI	21	OCC/UNOCC Mode FB	UNOCC	OCC			Occupancy Mode FB
//							
AI	63	Reheat Max Flow		0	10000	CFM	Local Reheat Maxinum Flow
AI	62	Reheat Min Flow		0	10000	CFM	Local Reheat Mininum Flow
AI	61	Flow Calibration		0	10000	CFM	VAV Box Flow Calibration
AI	20	Local Max Flow		0	12800	CFM	Local Maxinum Flow
AI	19	Local Min Flow		0	12800	CFM	Local Mininum Flow
AI	18	Max Heating Spt FB		0	100	Deg F	Maximum Heating Spt FB
AI	17	Min Heatling Spt FB		0	100	Deg F	Minimum Heating Spt FB
AI	16	Max Cooling Spt FB		0	100	Deg F	Maximum Cooling Spt FB
AI	15	Min Cooling Spt FB		0	100	Deg F	Minimum Cooling Spt FB
AI	14	Control Status Code		0	255	CODE	Control Status CODE
AI	13	Diagnostics Code		0	255	CODE	Diagnostics CODE
AO	12	Paral Fan Spt CTL		0	12800	CF	Parallel Fan Flow Spt CTL
AI	12	Paral Fan Spt FB		0	12800	CFM	Parallel Fan Flow Spt FB
AO	11	Max Flow SPT		0	12800	CFM	Maximum Flow SPT CTL
AI	11	Max Flow FB		0	12800	CFM	Maximum Flow SPT FB
AO	10	Min Flow SPT		0	12800	CFM	Minimim Flow SPT CTL
AI	10	Min Flow FB		0	12800	CFM	MininumFlow SPT FB
AO	9	AO1 Output CTL		0	100	Percnt	AO1 Output CTL
AI	9	AO1 Output FB		0	100	Percnt	AO1 Output FB
AO	8	Heating Spt CTL		0	100	Deg F	Heating Setpoint CTL
AI	8	Heating Spt FB		0	100	Deg F	Heating Setpoint FB
AO	7	Cooling Spt CTL		0	100	Deg F	Cooling Setpoint CTL
AI	7	Cooling Spt FB		0	100	Deg F	Cooling Setpoint FB
AI	6	T'Stat Setting		0	100	Deg F	Thermostat Temperature
AI	5	Heat/AUX Position		0	100	Percnt	Heat Valve Position
AI	4	Damper Position		0	100	Percnt	Damper Position
AI	3	Flow		0	12800	CFM	Flow (Actual)
AI	2	Duct Temp		0	100	Deg F	Aux/Duct Temperature
AI	1	Zone Temp		0	100	Deg F	Zone Temperature

Things to note in this example:

Let's take a look at a few features of this template file:

1. This is for ALL the MicroFlo-II VAV devices. If you want one (or more) to be special, you can create a unique template file for it -- and so that template file will have a unique TPL name (e.g., TPL1_22.CSV, if it was Device #22 on trunk #1).

2. The UNITS ARE ALWAYS BRITISH/AMERICAN! The Barber-Colman devices all "think" in Deg F., CFM, Square feet, and other such nonsense. The data returned is all in these units, and the controls must be done in these units. The METRIC_UNITS line that you put in the GATEWAY.INI file tells the Gateway to convert every odd unit to sensible metric ones.

3. The order of the points in the template file is "reversed" (lowest number at the end). This is important to maintain the correct order on the diagnostic displays (which is lowest number first).

4. The "NA" line is not used in this template, so the device will use the names from the CONFIG.TXT file (created when you SAVED the AUTODISCOVERY files from the four trunks). You of course fiddled with that file so that the device names would be more

meaningful than "VAV1 #31 on Trunk #2", right? You can use the NA line to make a unique name, if this is for a UNIQUE TPL (see note 1).

5. Note what points are commented out: Feedback for some of the control points; perhaps the calibration points. You should work with your owner/users to decide what they will really want, without being redundant and just "data-spew". Make sure that what you are getting out of each device is reasonable and interesting; not displayed "just because you can".

Note the extension: CSV means "comma separated variable", which is a standard text-type spreadsheet file. Because it is a text file, you can edit these files with either a simple text editor or a spreadsheet program. If you do edit it with a spreadsheet, some spreadsheets (like Excel) will give you the option to save the file in their own internal format (e.g., .XLS format). DO NOT DO THIS! ***Keep the file in text format (.CSV),*** so that it is transferable and readable by the Gateway. Otherwise, you will have a lot of "quadruple" quotes you have to make into mere "double" quotes. *Caveat Spreadsheet!*

Centaurus Prime can help: We can give you some example TEMPLATE files (like the one above) or help you create your own. You can contact us, either by e-mail or telephone, and we will e-mail any that you need back to you.

One philosophy is to put <u>most</u> points in the Gateway, and just NOT map the ones that you don't want. The other philosophy is to DELETE the points you will never want to expose from these template files, before you download them to the Gateways. The good point of the first philosophy is that all the points are there, if you ever want to map them later; the bad news is that the Gateway has to scan these points, and that affects performance in a bad way. The good point of the second philosophy is that the scan is quicker, and you are only getting the data you want; the bad news is that if you want to add points in the future, you will need to download modified TEMPLATE files to the Gateway in order to add those points. Our personal opinion is that the speed improvement far outweighs the minor inconvenience of downloading new templates, if ever they are needed.

MicroZone and PEM Templates MUST be unique; there is no default (since they have "Universal Inputs", which may be digital, or analog, and ranged any which way.) The programming in these controllers dictates what you will define. Let's give concrete, real-world examples (courtesy of Unity Hospital in Minneapolis). This is for Micro-Zone #126 on Trunk #2; so, it's file name is "TPL_2_126.CSV":

// Application: Waiting Area/Reception: MZ-126
//

//Type	Point#	Short Name	0-Units/Ana-Min	1-Units/Ana-Max	Ana-Units	Full Name	Comments
//							
AI	1	Waiting Area Temp	0	100	Deg F	Waiting Area Temp	Analog Value for UI1
AI	2	Waiting Area Temp SPT	0	100	Deg F	Waiting Area Temp SPT	Analog Value for UI2
AI	3	Reception Temp	0	100	Deg F	Reception Temp	Analog Value for UI3
AI	4	Reception Temp SPT	0	100	Deg F	Reception Temp SPT	Analog Value for UI4
AO	9	Waiting Area Valve CTL	0	100	Percnt	Waiting Area Valve CTL	Analog-Out-1
AO	10	Reception Valve CTL	0	100	Percnt	Reception Valve CTL	Analog-Out-2
AO	10	Reception Valve CTL	0	100	Percnt	Reception Valve CTL	Analog-Out-2
AI	10	Reception Valve FB	0	100	Percnt	Reception Valve FB	AO-2 Feedback
BO	13	Recep/Wait Elec Stage 1	OFF	ON		Recep/Wait Elec Stage 1	Digital-Out-1

BO	14	Recep/Wait Elec Stage2	OFF	ON		Recep/Wait Elec Stage2	Digital-Out-2
BI	13	Recep/Wait Stage 1 FB	OFF	ON		Recep/Wait Stage 1 FB	DO-1 Feedback
BI	14	Recep/Wait Stage2 FB	OFF	ON		Recep/Wait Stage2 FB	DO-2 Feedback

This little MicroZone-II is programmed to keep the reception area and waiting room comfy by modulating cooling valves and turning on electric strip (baseboard) heating stages. Pretty simple.

A slightly more complex MicroZone-II handles four DRH areas in the hospital. Notice that it uses all the UI points as analog inputs (discharge air and return air temps for each of these four areas). Note that the EMS and WINDOW points are used in this MZ-II. The EMS points are sent to the MZ-II for the return-air setpoint controls. The WINDOW points are coming up from the MZ-II, and indicate the AO valve positions that the MZ-II wants.

This is for Micro-Zone #14 on Trunk #2; so, it's file name is "TPL_2_14.CSV":

// Application: Rheats 15-16-17-14; MZ-14
//
//

Type	Point#	Short Name	0-Units/Ana-Min	1-Units/Ana-Max	Ana-Units	Full Name	Comments
//							
AI	1	DRH-15 Disc Air Temp	0	100	Deg F	DRH-15 Disc Air Temp	Analog Value for UI1
AI	2	DRH-16 Disc Air Temp	0	100	Deg F	DRH-16 Disc Air Temp	Analog Value for UI2
AI	3	DRH-17 Disc Air Temp	0	100	Deg F	DRH-17 Disc Air Temp	Analog Value for UI3
AI	4	DRH-14 Disc Air Temp	0	100	Deg F	DRH-14 Disc Air Temp	Analog Value for UI4
AI	5	DRH-15 Return Air Temp	0	100	Deg F	DRH-15 Return Air Temp	Analog Value for UI5
AI	6	DRH-16 Return Air Temp	0	100	Deg F	DRH-16 Return Air Temp	Analog Value for UI6
AI	7	DRH-17 Return Air Temp	0	100	Deg F	DRH-17 Return Air Temp	Analog Value for UI7
AI	8	DRH-14 Return Air Temp	0	100	Deg F	DRH-14 Return Air Temp	Analog Value for UI8
AO	61	DRH-15 RAT SPT Ctl	0	100	Deg F	DRH-15 RAT SPT Ctl	EMS AV1
AO	62	DRH-16 RAT SPT Ctl	0	100	Deg F	DRH-16 RAT SPT Ctl	EMS AV2
AO	63	DRH-17 RAT SPT Ctl	0	100	Deg F	DRH-17 RAT SPT Ctl	EMS AV3
AO	64	DRH-14 RAT SPT Ctl	0	100	Deg F	DRH-14 RAT SPT Ctl	EMS AV4
AI	61	DRH-15 RAT SPT FB	0	100	Deg F	DRH-15 RAT SPT FB	EMS AV1 FB
AI	62	DRH-16 RAT SPT FB	0	100	Deg F	DRH-16 RAT SPT FB	EMS AV2 FB
AI	63	DRH-17 RAT SPT FB	0	100	Deg F	DRH-17 RAT SPT FB	EMS AV3 FB
AI	64	DRH-14 RAT SPT FB	0	100	Deg F	DRH-14 RAT SPT FB	EMS AV4 FB
AI	93	DRH-15 Valve Pos	0	100	% Closed	DRH-15 Valve Pos	Window AV1
AI	94	DRH-16 Valve Pos	0	100	% Closed	DRH-16 Valve Pos	Window AV2
AI	95	DRH-17 Valve Pos	0	100	% Closed	DRH-17 Valve Pos	Window AV3
AI	96	DRH-14 Valve Pos	0	100	% Closed	DRH-14 Valve Pos	Window AV4

Chapter

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Modbus & BACnet Point Mapping

In the first two columns, the first part is the Modbus Register number and he second part is the BACnet object instance number. The second column is the point description and/or how the object is used. The fourth column is the analog range (either fixed, or the default), or the 0-state and 1-state descriptors. Note that the analog range for BACnet systems is mostly informational, but must be carefully studied for MODBUS systems, since your host driver needs to know the engineering units range and the counts range for every point. The last column is for any notes or comments.

A. Device Point Mapping for MicroFlo-II Devices:

Monitor Reg # / Inst. #	Control Reg # / Inst. #	Point Name and Usage	Range (Analog) State Descriptions (Digital)	Notes & Comments
30001 / 1		Zone Temperature	0-100 Deg F. (fixed)	Range Note 1
30002 / 2		Duct Temperature	0-100 Deg F. (fixed)	Range Note 1
30003 / 3		Flow	0-10000 CFM (fixed)	Range Note 2
30004 / 4		Damper Position	0-100 % (fixed)	Range Note 1
30005 / 5		Heating Valve/AUX Position	0-100 % (fixed)	Range Note 1
30006 / 6		Thermostat Thumbwheel	0-100 Deg F. (fixed)	Range Note 1
30007 / 7	40007 / 107	Cooling Setpoint	0-100 Deg F. (fixed)	Range Note 1
30008 / 8	40008 / 108	Heating Setpoint	0-100 Deg F. (fixed)	Range Note 1
30009 / 9	40009 / 109	Analog Output AO1	0-100 % (fixed)	Range Note 1
30010 / 10	40010 / 110	Minimum Flow	0-12800 CFM (fixed)	Range Note 1
30011 / 11	40011 / 111	Maximum Flow	0-12800 CFM (fixed)	Range Note 1
30012 / 12	40012 / 112	Parallel Fan Setpoint	0-10000 CFM (fixed)	Range Note 1
30013 / 13		Diagnostics (Code)	0-255 (bitmap)	See MF-II Manual
30014 / 14		Control Status (Code)	0-255 (enumerated)	Range Note 1
30015 / 15		MIN Cooling Setpoint	0-100 Deg F. (fixed)	Range Note 1
30016 / 16		MAX Cooling Setpoint	0-100 Deg F. (fixed)	Range Note 1
30017 / 17		MIN Heating Setpoint	0-100 Deg F. (fixed)	Range Note 1
30018 / 18		MAX Healing Setpoint	0-100 Deg F. (fixed)	Range Note 1
30019 / 19		Local MIN Flow (or Pos)	0-10000 CFM. (fixed)	Range Note 1
30020 / 20		Local MAX Flow (or Pos)	0-10000 CFM. (fixed)	Range Note 1
10021 / 321	21 / 421	OCC/UNOCC Mode	0 = UNOCC; 1 = OCC	

10022 / 322	22 / 422	Digital Output #1	0 = Off; 1 = ON	
10023 / 323	23 / 423	Digital Output #2	0 = Off; 1 = ON	
10024 / 324	24 / 424	Digital Output #3	0 = Off; 1 = ON	
10025 / 325	25 / 425	Digital Output #4	0 = Off; 1 = ON	
10026 / 326	26 / 426	Damper Forced Open	0 = Off; 1 = FORCED	
10027 / 327	27 / 427	Damper Forced Closed	0 = Off; 1 = FORCED	
10028 / 328	28 / 428	Force to Maximum Flow	0 = Off; 1 = FORCED	
10029 / 329	29 / 429	Force to Minimum Flow	0 = Off; 1 = FORCED	
10030 / 330	30 / 430	Morning Warm-Up Mode	0 = Off; 1 = MORNING	
10031 / 331	31 / 431	Normal/Reverse Action	0 = Normal; 1 = Reverse	
10032 / 332		Digital Input #1	0 = Off; 1 = ON	
10040 / 340	40 / 440	EMS (Host) Control Mode	0 = Local; 1 = HOST CTL	Control Note 1
30061 / 61		Box Flow Calibration	0-10000 CFM. (fixed)	Range Note 1
30062 / 62		Local ReHeat MIN Flow	0-10000 CFM. (fixed)	Range Note 1
30063/ 63		Local ReHeat MAX Flow	0-10000 CFM. (fixed)	Range Note 1

B. Device Point Mapping for MicroZone-II Devices:

Monitor Reg # / Inst. #	Control Reg # / Inst. #	Point Name and Usage	Range (Analog) State Descriptions (Digital)	Notes & Comments
30001 / 1		Universal Input #1 (analog)	ANY (0-100 Deg F. default)	Range Note 4
30002 / 2		Universal Input #2 (analog)	ANY (0-100 Deg F. default)	Range Note 4
30003 / 3		Universal Input #3 (analog)	ANY (0-100 Deg F. default)	Range Note 4
30004 / 4		Universal Input #4 (analog)	ANY (0-100 Deg F. default)	Range Note 4
30005 / 5		Universal Input #5 (analog)	ANY (0-100 Deg F. default)	Range Note 4
30006 / 6		Universal Input #6 (analog)	ANY (0-100 Deg F. default)	Range Note 4
30007 / 7		Universal Input #7 (analog)	ANY (0-100 Deg F. default)	Range Note 4
30008 / 8		Universal Input #8 (analog)	ANY (0-100 Deg F. default)	Range Note 4
30009 / 9	40009 / 109	Analog Output #1	ANY (0-100 % default)	Range Note 4
30010 / 10	40010 / 110	Analog Output #2	ANY (0-100 % default)	Range Note 4
30011 / 11	40011 / 111	Analog Output #3	ANY (0-100 % default)	Range Note 4
30012 / 12	40012 / 112	Analog Output #4	ANY (0-100 % default)	Range Note 4
10013 / 313	13 / 413	Digital Output #1	0 = Off; 1 = ON	Range Note 4
10014 / 314	14 / 414	Digital Output #2	0 = Off; 1 = ON	Range Note 4
10015 / 315	15 / 415	Digital Output #3	0 = Off; 1 = ON	Range Note 4
10016 / 316	16 / 416	Digital Output #4	0 = Off; 1 = ON	Range Note 4
10017 / 317	17 / 417	Digital Output #5	0 = Off; 1 = ON	Range Note 4
10018 / 318	18 / 418	Digital Output #6	0 = Off; 1 = ON	Range Note 4
10019/ / 319	19 / 419	Digital Output #7	0 = Off; 1 = ON	Range Note 4
10020 / 320	20 / 420	Digital Output #8	0 = Off; 1 = ON	Range Note 4
10021 / 321		Universal Input #1 (binary)	0 = Off; 1 = ON	If used as BI
10022 / 322		Universal Input #2 (binary)	0 = Off; 1 = ON	If used as BI
10023 / 323		Universal Input #3 (binary)	0 = Off; 1 = ON	If used as BI
10024 / 324		Universal Input #4 (binary)	0 = Off; 1 = ON	If used as BI
10025 / 325		Universal Input #4 (binary)	0 = Off; 1 = ON	If used as BI
10026 / 326		Universal Input #6 (binary)	0 = Off; 1 = ON	If used as BI
10027 / 327		Universal Input #7 (binary)	0 = Off; 1 = ON	If used as BI
10028 / 328		Universal Input #8 (binary)	0 = Off; 1 = ON	If used as BI
10040 / 340	40 / 440	EMS (Host) Control Mode	0 = Local; 1 = HOST CTL	Control Note 1

10041 / 341	41 / 441	EMS Binary #1	0 = Off; 1 = ON	If EMS1 used as BO
10042 / 342	42 / 442	EMS Binary #2	0 = Off; 1 = ON	If EMS2 used as BO
10043 / 343	43 / 443	EMS Binary #3	0 = Off; 1 = ON	If EMS3 used as BO
10044 / 344	44 / 444	EMS Binary #4	0 = Off; 1 = ON	If EMS4 used as BO
10045 / 345	45 / 445	EMS Binary #5	0 = Off; 1 = ON	If EMS5 used as BO
10046 / 346	46 / 446	EMS Binary #6	0 = Off; 1 = ON	If EMS6 used as BO
10047 / 347	47 / 447	EMS Binary #7	0 = Off; 1 = ON	If EMS7 used as BO
10048 / 348	48 / 448	EMS Binary #8	0 = Off; 1 = ON	If EMS8 used as BO
30061 / 61	40061 / 161	EMS Analog #1	0-100 Units (default)	Range Note 3
30062 / 62	40062 / 162	EMS Analog #2	0-100 Units (default)	Range Note 3
30063 / 63	40063 / 163	EMS Analog #3	0-100 Units (default)	Range Note 3
30064 / 64	40064 / 164	EMS Analog #4	0-100 Units (default)	Range Note 3
30065 / 65	40065 / 165	EMS Analog #5	0-100 Units (default)	Range Note 3
30066 / 66	40066 / 166	EMS Analog #6	0-100 Units (default)	Range Note 3
30067 / 67	40067 / 167	EMS Analog #7	0-100 Units (default)	Range Note 3
30068 / 68	40068 / 168	EMS Analog #8	0-100 Units (default)	Range Note 3
10081 / 381		WINDOW Binary #1	0 = Off; 1 = ON	Window1 Used as BI
10082 / 382		WINDOW Binary #2	0 = Off; 1 = ON	Window2 Used as BI
10083 / 383		WINDOW Binary #3	0 = Off; 1 = ON	Window3 Used as BI
10084 / 384		WINDOW Binary #4	0 = Off; 1 = ON	Window4 Used as BI
10085 / 385		WINDOW Binary #5	0 = Off; 1 = ON	Window5 Used as BI
10086 / 386		WINDOW Binary #6	0 = Off; 1 = ON	Window6 Used as BI
10087 / 387		WINDOW Binary #7	0 = Off; 1 = ON	Window7 Used as BI
10088 / 388		WINDOW Binary #8	0 = Off; 1 = ON	Window8 Used as BI
30093 / 93		WINDOW Analog #1	0-100 Units (default)	Range Note 3
30094 / 94		WINDOW Analog #2	0-100 Units (default)	Range Note 3
30095 / 95		WINDOW Analog #3	0-100 Units (default)	Range Note 3
30096 / 96		WINDOW Analog #4	0-100 Units (default)	Range Note 3
30097 / 97		WINDOW Analog #5	0-100 Units (default)	Range Note 3
30098 / 98		WINDOW Analog #6	0-100 Units (default)	Range Note 3
30099 / 99		WINDOW Analog #7	0-100 Units (default)	Range Note 3
30100 / 100		WINDOW Analog #8	0-100 Units (default)	Range Note 3

C. Device Point Mapping for PEM Devices:

Monitor Reg # / Inst. #	Control Reg # / Inst. #	Point Name and Usage	Range (Analog) State Descriptions (Digital)	Notes & Comments
30001 / 1		Universal Input #1 (analog)	ANY (0-100 Deg F. default)	Range Note 4
30002 / 2		Universal Input #2 (analog)	ANY (0-100 Deg F. default)	Range Note 4
30003 / 3		Universal Input #3 (analog)	ANY (0-100 Deg F. default)	Range Note 4
30004 / 4		Universal Input #4 (analog)	ANY (0-100 Deg F. default)	Range Note 4
30009 / 9	40009 / 109	Analog Output #1	ANY (0-100 % default)	Range Note 4
30010 / 10	40010 / 110	Analog Output #2	ANY (0-100 % default)	Range Note 4
10013 / 13	13 / 413	Digital Output #1	0 = Off; 1 = ON	Range Note 4
10014 / 14	14 / 414	Digital Output #2	0 = Off; 1 = ON	Range Note 4
10015 / 15	15 / 415	Digital Output #3	0 = Off; 1 = ON	Range Note 4
10016 / 16	16 / 416	Digital Output #4	0 = Off; 1 = ON	Range Note 4
10021 / 321		Universal Input #1 (binary)	0 = Off; 1 = ON	If used as BI
10022 / 322		Universal Input #2 (binary)	0 = Off; 1 = ON	If used as BI

10023 / 323		Universal Input #3 (binary)	0 = Off; 1 = ON	If used as BI
10024 / 324		Universal Input #4 (binary)	0 = Off; 1 = ON	If used as BI
10040 / 340	40 / 440	EMS (Host) Control Mode	0 = Local; 1 = HOST CTL	Control Note 1
10041 / 341	41 / 441	EMS Binary #1	0 = Off; 1 = ON	If EMS1 used as BO
10042 / 342	42 / 442	EMS Binary #2	0 = Off; 1 = ON	If EMS2 used as BO
10043 / 343	43 / 443	EMS Binary #3	0 = Off; 1 = ON	If EMS3 used as BO
10044 / 344	44 / 444	EMS Binary #4	0 = Off; 1 = ON	If EMS4 used as BO
30061 / 61	40061 / 161	EMS Analog #1	0-100 Units (default)	Range Note 3
30062 / 62	40062 / 162	EMS Analog #2	0-100 Units (default)	Range Note 3
30063 / 63	40063 / 163	EMS Analog #3	0-100 Units (default)	Range Note 3
30064 / 64	40064 / 164	EMS Analog #4	0-100 Units (default)	Range Note 3
30065 / 65	40065 / 165	EMS Analog #5	0-100 Units (default)	Range Note 3
30066 / 66	40066 / 166	EMS Analog #6	0-100 Units (default)	Range Note 3
30067 / 67	40067 / 167	EMS Analog #7	0-100 Units (default)	Range Note 3
30068 / 68	40068 / 168	EMS Analog #8	0-100 Units (default)	Range Note 3
30069 / 69	40069 / 169	EMS Analog #9	0-100 Units (default)	Range Note 3
30070 / 70	40070 / 170	EMS Analog #10	0-100 Units (default)	Range Note 3
30071 / 71	40071 / 171	EMS Analog #11	0-100 Units (default)	Range Note 3
30072 / 72	40072 / 172	EMS Analog #12	0-100 Units (default)	Range Note 3
30073 / 73	40073 / 173	EMS Analog #13	0-100 Units (default)	Range Note 3
30074 / 74	40074 / 174	EMS Analog #14	0-100 Units (default)	Range Note 3
30075 / 75	40075 / 175	EMS Analog #15	0-100 Units (default)	Range Note 3
30076 / 76	40076 / 176	EMS Analog #16	0-100 Units (default)	Range Note 3
10081 / 381		WINDOW Binary #1	0 = Off; 1 = ON	Window1 Used as BI
10082 / 382		WINDOW Binary #2	0 = Off; 1 = ON	Window2 Used as BI
30093 / 93		WINDOW Analog #1	0-100 Units (default)	Range Note 3
30094 / 94		WINDOW Analog #2	0-100 Units (default)	Range Note 3
30095 / 95		WINDOW Analog #3	0-100 Units (default)	Range Note 3
30096 / 96		WINDOW Analog #4	0-100 Units (default)	Range Note 3

D. Device Point Mapping for MicroNet-FLO (VAV) Devices:

Monitor Reg # / Inst. #	Control Reg # / Inst. #	Point Name and Usage	Range (Analog) State Descriptions (Digital)	Notes & Comments
30001 / 1		Zone Temperature	0-100 Deg F. (fixed)	Range Note 1
30002 / 2		Aux/Duct Temperature	0-100 Deg F. (fixed)	Range Note 1
30003 / 3		OverRide Timer Value	0-100 Minutes (fixed)	Range Note 2
30004 / 4		Velocity Pressure	0-1.0 Inch (fixed)	Range Note 2
30005 / 5		Cooling Output	0-100 % (fixed)	Range Note 1
30006 / 6		Heating Output	0-100 % (fixed)	Range Note 1
30007 / 7	40007 / 107	Cooling Setpoint	0-100 Deg F. (fixed)	Range Note 1
30008 / 8	40008 / 108	Heating Setpoint	0-100 Deg F. (fixed)	Range Note 1
30009 / 9		Flow Setpoint (actual)	0-10000 CFM (fixed)	Range Note 2
30010 / 10		Flow	0-10000 CFM (fixed)	Range Note 2
30011 / 11	40011 / 111	UnOcc Heating Setpoint	0-100 Deg F. (fixed)	Range Note 1
30012 / 12	40012 / 112	Maximum Flow Setpoint	0-10000 CFM (fixed)	Range Note 2
30013 / 13	40013 / 113	Minimum Flow Setpoint	0-10000 CFM (fixed)	Range Note 2
30014 / 14	40014 / 114	Reheat Max Flow Setpoint	0-10000 CFM (fixed)	Range Note 2
30015 / 15	40015 / 115	UnOcc Min Flow Setpoint	0-10000 CFM (fixed)	Range Note 2
30016 / 16		Computed % Damper Pos	0-100% (fixed)	Internal Computation

10021 / 321	21 / 421	OCC/UNOCC Mode	0 = UNOCC; 1 = OCC	
10022 / 322	22 / 422	Digital Output #1	0 = Off; 1 = ON	ONLY on FLO3's
10023 / 323	23 / 423	Digital Output #2	0 = Off; 1 = ON	ONLY on FLO3's
10024 / 324	24 / 424	Digital Output #3	0 = Off; 1 = ON	ONLY on FLO3's
10025 / 325		Forced Condition	0 = Off; 1 = ON	
10026 / 326	26 / 426	Damper Forced Open	0 = Off; 1 = FORCED	
10027 / 327	27 / 427	Damper Forced Closed	0 = Off; 1 = FORCED	
10028 / 328	28 / 428	Force to MAX-Flow Mode	0 = Off; 1 = FORCED	
10029 / 329	29 / 429	Force to MIN-Flow Mode	0 = Off; 1 = FORCED	
10030 / 330	30 / 430	Morning Warm-Up Mode	0 = Off; 1 = MORNING	
10031 / 331		Diagnostic Mode	0 = Off; 1 = DIAGNOSE	
10032 / 332		In Ventilation Mode	0 = Off; 1 = VENT	
10033 / 333		In Heating Mode	0 = Off; 1 = HEAT	
10034 / 334		In Cooling Mode	0 = Off; 1 = COOL	
10035 / 335	35 / 435	Force to Reheat Minimum	0 = Off; 1 =RHT-MIN	
10036 / 336	36 / 436	Reheat Disable Mode	0 = Off; 1 = RHT-DIS	
10037 / 337	37 / 437	Heat Disable Mode	0 = Off; 1 = HT-DIS	
10040 / 340	40 / 440	EMS (Host) Control Mode	0 = Local; 1 = HOST CTL	Control Note 1
10041 / 341		DO1-Status	0 = Off, 1 = ON	FLO-3 (usually Heat 1)
10042 / 342		DO2-Status	0 = Off, 1 = ON	FLO-3 (usually Heat 2)
10043 / 343		DO3-Status	0 = Off, 1 = ON	FLO-3 (usually fan)

E. Device Point Mapping for MicroNet HP/FC Devices (Prelim):

Monitor Reg # / Inst. #	Control Reg # / Inst. #	Point Name and Usage	Range (Analog) State Descriptions (Digital)	Notes & Comments
30001 / 1		Zone Temperature	0-100 Deg F. (fixed)	Range Note 1
30003 / 3		OverRide Timer Value	0-100 Minutes (fixed)	Range Note 2
30003 / 3		Flow	0-10000 CFM (fixed)	Range Note 2
30005 / 5		Cooling Output	0-100 % (fixed)	Range Note 1
30006 / 6		Heating Output	0-100 % (fixed)	Range Note 1
30007 / 7	40007 / 107	OCC Cooling Setpoint	0-100 Deg F. (fixed)	Range Note 1
30008 / 8	40008 / 108	OCC Heating Setpoint	0-100 Deg F. (fixed)	Range Note 1
30009 / 9	40009 / 109	UNOCC Cooling Setpoint	0-100 Deg F. (fixed)	Range Note 2
30010 / 10	40010 / 110	UNOCC Heating Setpoint	0-100 Deg F. (fixed)	Range Note 2
10021 / 321	21 / 421	OCC/UNOCC Mode	0 = UNOCC; 1 = OCC	
10022 / 322	22 / 422	Digital Output #1	0 = Off; 1 = ON	
10023 / 323	23 / 423	Digital Output #2	0 = Off; 1 = ON	
10024 / 324	24 / 424	Digital Output #3	0 = Off; 1 = ON	
10028 / 328	28 / 428	Force to Heating Mode	0 = Off; 1 = FORCED	NOT IMPLEMENTED
10029 / 329	29 / 429	Force to Cooling Mode	0 = Off; 1 = FORCED	NOT IMPLEMENTED
10032 / 332		In Ventilation Mode	0 = Off; 1 = VENT	
10033 / 333		In Heating Mode	0 = Off; 1 = HEAT	
10034 / 334		In Cooling Mode	0 = Off; 1 = COOL	
10040 / 340	40 / 440	EMS (Host) Control Mode	0 = Local; 1 = HOST CTL	Control Note 1

Range Note 1: The data has a FIXED range. The response from the Barber-Colman equipment is 0 to 12800 counts, in fixed-float format (7 bits for units, 7 bits for decimal fraction. The Fahrenheit scale, or percentage is always used in these devices. This corresponds to a $1/128^{th}$ degree/percent accuracy, and a full scale of 0 to 100 degrees F or percent. MODBUS systems should use 0 to 100 as the EUN range, and 0 to 12800 as the counts range.

Range Note 2: The data has a FIXED range. The response from the Barber-Colman equipment is also 0 to 12800 counts, in fixed-float format (7 bits for units, 7 bits for decimal fraction), but is ranged as "times 100". Units are always CFM. Hence, MODBUS systems should use 0 to 10,000 as the EUN range, with 0 to 12800 as the counts range.

Range Note 3: For EMS and WINDOW points that are used as analogs: The data does not have a fixed range. It depends upon how the Barber-Colman equipment was programmed. You must supply the same range as was programmed into the controller (see the section on "defining ranges"). However, the usual range is 0-100 (no units—this is a "unitless" value). Since that is the most likely range, it is the default, and if you don't need to change it, this range is used. This is a "quasi-real" number (fixed point), rather than a counts value, however, for MODBUS systems we range it as 0 to 12800 counts, within the user-programmable range (or 0-100, if you leave the default).

Range Note 4: The field data is for "Universal Input" points, that have a user-programmable range (non-fixed). You must supply the same range as was programmed into the controller (see the section on "defining ranges"). However, the usual range is 0-100 (no units—this is a "unitless" value). The response from the Barber-Colman equipment is also 0 to 12800 counts, ranged to whatever the "physical range" of the sensor is (done in software, in the Barber-Colman controller). Hence, MODBUS systems should use the Barber-Colman EUN range, with 0 to 12800 as the counts range.

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