1/2005 VERSION 1.1

Centaurus Prime

CENTAURUS PRIME

Integrations, Custom Programming, Consulting

Staefa Smart II Gateway Guide

1/2005 VERSION 1.1

INTEGRATIONS, CUSTOM PROGRAMMING, AND CONSULTING

Staefa Smart II 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 Smart II Gateway Panel. Detailed instructions are also provided later in this guide. The Centaurus Prime Smart II Gateway allows any front-end system (Modbus Master) that communicates using the industry-standard MODBUS RTU protocol to communicate to Staefa Smart II field equipment. The SMART II Field Devices will appear to the front-end system as a series of MODBUS SLAVE devices. Each Smart II Controller will map to one slave device. Real time point data from the Smart II panel is mapped to equivalent registers, coils, and bits on the MODBUS system. All operations are transparent to the user and the host computer.

ICON KEY

Valuable information

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

- Power Supply, 120 Volts AC (optionally, 220 or 240 Volts AC)
- Smart II Device Buss
- Modbus Network, RS-485
- Local Mode Port for commissioning via Laptop Computer

All hardware necessary to connect the Gateway to the Staefa Smart II devices is included in the 24" X 24" plastic cabinet which is easily mounted in a convenient location.

The Modbus RTU Network connects to the Smart II Gateway via an RS-422 serial link (a four-wire, full-duplex connection), an RS-485 serial link (a two-wire, half-duplex connection), or an RS-232 serial link (a three-wire, full-duplex connection). The RS485 or RS422 connections must be used in a multi-drop network configuration.

Single Board Computer Basics

The Single Board Computer used in Centaurus Prime Gateways is the Ether 6 manufactured by JK Microsystems.
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 40 Megabyte M-Systems DiskOnChip is added to the 32-pin DIP socket on the controller board. 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.

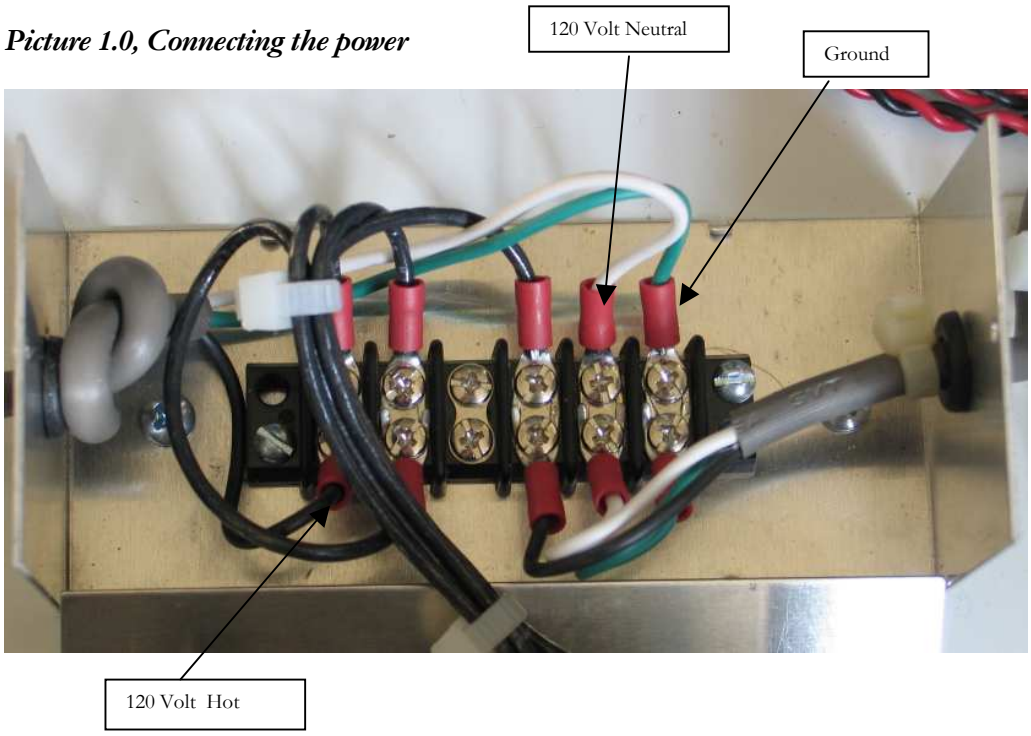
Specifications for the Ether 6 are:

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.

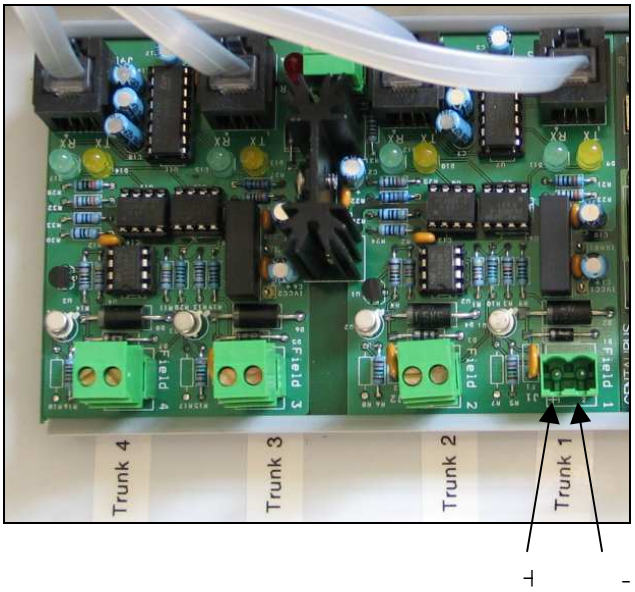
Picture 1.0, Connecting the power



Connecting Staefa Trunks to the Gateway

Typically, Staefa Smart II device trunks (up to four trunks) are connected to a Staefa Net Controller (Staefa NCRS). The Net Controller is then connected to a Staefa front-end computer. The Staefa Modbus Gateway will replace the Net Controller so the Staefa trunks will now land on the Staefa communication card in the Gateway Cabinet. The trunk connections are clearly marked and each trunk is only a two-wire connection. See Picture 1.2

Picture 1.2, Gateway Overview and Identification



Connecting to the Modbus Master

Connecting to the Modbus Master is done one of two ways:

(1) Ethernet:

If you have ordered the Staefa Smart II Gateway as the standard Modbus/IP configuration, then it is simple: You plug in an 8-pin Category 5 or 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 CONFIG.TXT file, described in the next chapter.

(2) Serial Link:

If you have ordered the Staefa Smart II Gateway with the Modbus/RTU protocol option, then the Modbus connection is made with the CS485 line driver included in the Gateway cabinet, if the product has been ordered with a Modbus-RTU front-end. The CS485 line driver is an RS-232 to RS-485 interface converter. It allows an RS-232 device to reliably transmit data over long distances (up to 4000 feet). The CS485 has many features not normally found in typical line drivers, and is intended for operation in harsh industrial environments.

You must also modify the BAUD.TXT file to specify the baud rate and parity of the Modbus/RTU connection. All Centaurus Prime Gateways act as a series of Modbus

slaves, and can be a large number of logical devices, but it acts as only one electrical device on the Modbus/RTU trunk. The Gateway can act at any baud rate from 4800 baud to 38400 baud (38400 baud is not recommended except for very short distances). Even, Odd, and None are the valid parity options.

The CS485 may be used in point-to-point applications as well as multi-drop applications using either 4-wire or 2-wire configurations. Up to 32 devices may be connected together on one communication line.

The CS485 has 1500-volt optical isolation between the RS-232 side and the RS-485 side. The RS-485 lines are protected with 2 stages of surge protection, and jumpers allow complete configuration of terminating and pull up/down functions.

Configuring the CS485

The full manual for the CS-485 is available on the Centaurus Prime web site (www.centaurusprime.com). While it is very lengthy and technical, we recommend that you download and review the full manual if you are using the Gateway in unusual applications (e.g., with radio modems, Ethernet converters, line-drivers with delays, etc.) The CS-485 allows for many options, and a unique "data mode" that no other RS-485 converter on the market has. It is extremely robust and adaptable.

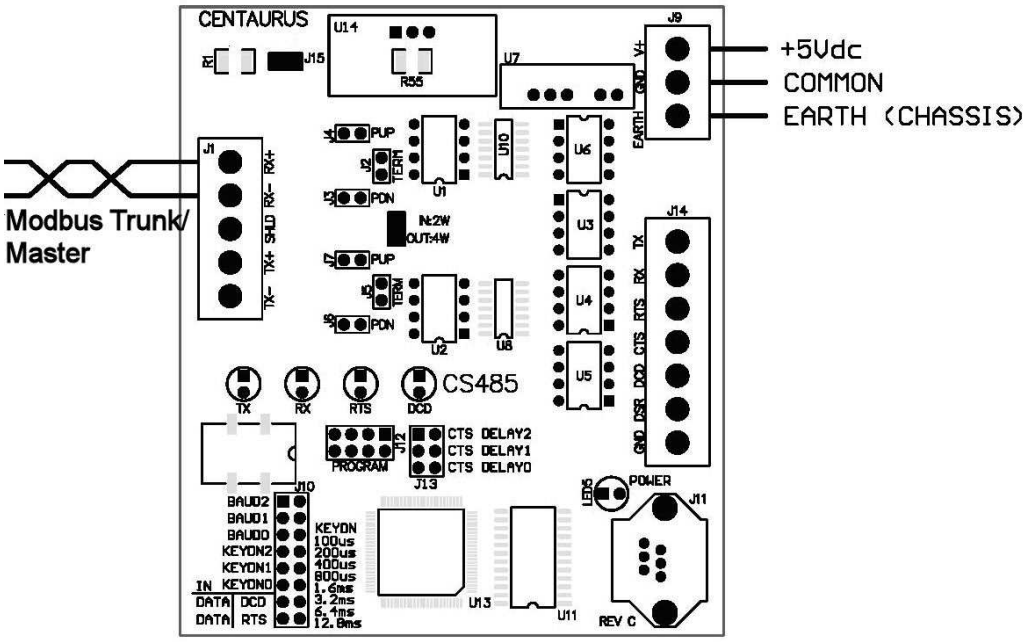
The CS485's default configuration is for 2-wire RS485. Following are setup parameters for RS485 (2 wire), RS422 (4 wire), and optionally, RS232:

RS-485 RX and TX Jumpers

J4 – Enable pull-up resistor for RX+ line
J3 – Enable pull-down resistor for RX- line
J2 – Terminate RX pair with 120-ohm resistor
J7 – Enable pull-up resistor for the TX+ line
J6 – Enable pull-down resistor for the TX- line
J5 – Terminate TX pair with 120-ohm resistor

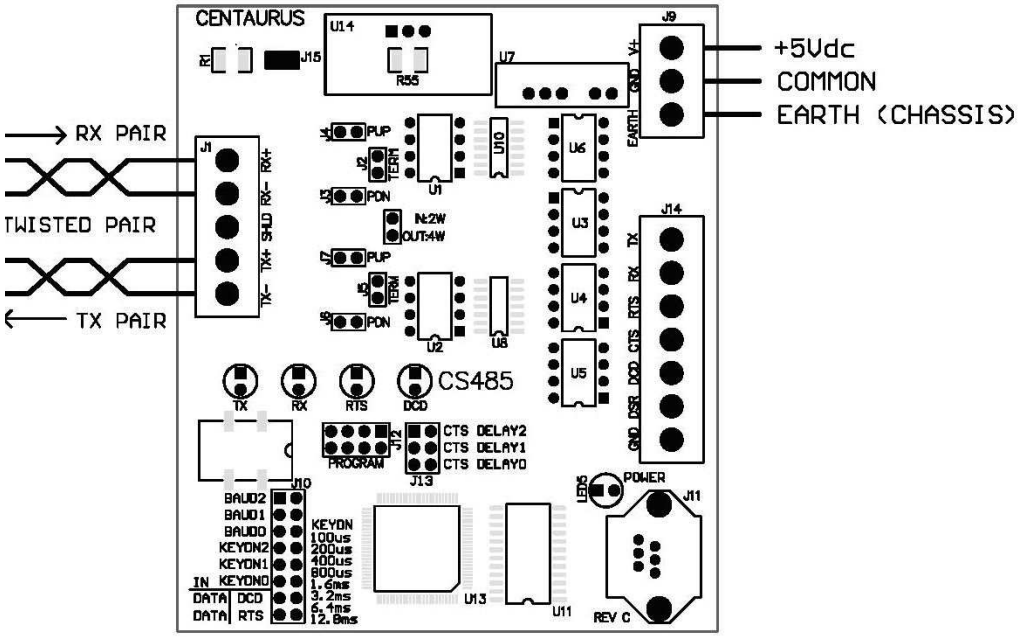
J8	IN	Enables 2-wire operation for both RX and TX pairs (Dual port operation)
	OUT	Enables 4-wire operation RX is receive pair TX is transmit pair
J15	Connects isolated RS-485 common to bleed resistor and filter cap	

RS485 Communications



Installed jumpers: 2W/4W, Baud0, Baud1, Data DCD, Data RTS, J2 (end of line only), J3 (end of line only), J4 (end of line only), and J15 (static bleed)

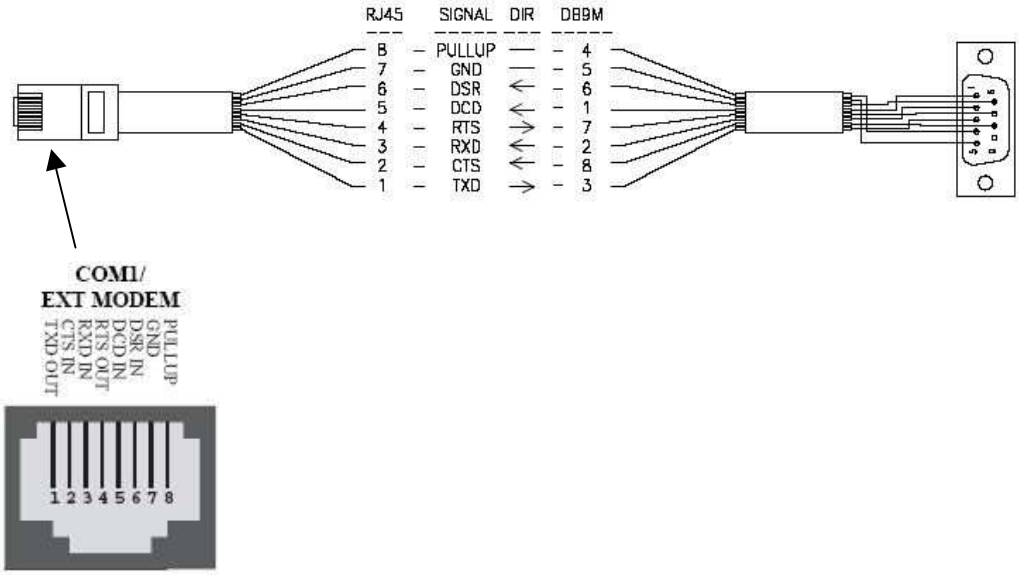
RS422 Communications



Installed jumpers: Baud0, Baud1, Data DCD, Data RTS, J2 (end of line only), J3 (end of line only), J4 (end of line only), J5 (end of line only), J7 (end of line only), and J15 (static bleed)

RS232 Communications

For RS232 communications, you will need to make a cable that will connect to Comm1 (RJ45) on the Single board Computer following the diagram below



NOTE about removing the CS-485:

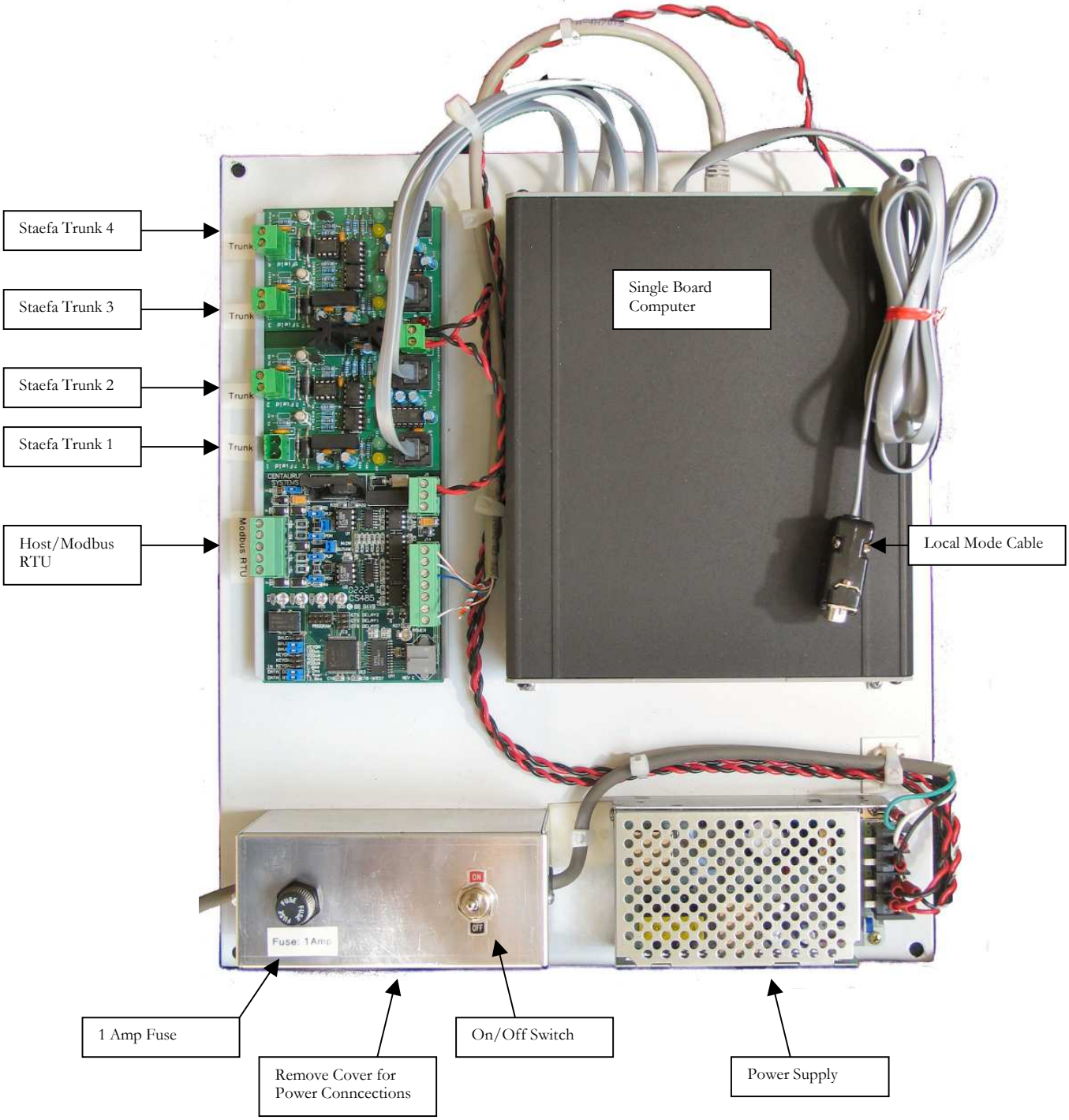
For RS-232 or Ethernet applications, the CS-485 module is not used, and may be removed. While many are tempted to do this (it can be used in other applications, of course), we recommend that you remove the wiring that powers the CS-485 also, if you do. "Wire nuts" or electrical tape on exposed wires are generally not approved by either the National Electrical Code, or local codes. As the Gateways are built to UL and CSA standards, we suggest you adhere to these standards, to avoid code issues.

Connecting to a BACnet/IP Network

This is quite simple: You plug in an 8-pin Category 5 or 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 CONFIG.TXT file, described in the following section.

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 four Staefa 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 "BAUD0, 9600,N" line may be modified for different Baud rates and parity for your Modbus/RTU connection. The valid baud rates you can use are only:

4800, 9600, 19200

The parity specification should only be "N, "O", or "E". This will set the Parity to **N**one, **O**dd, or **E**ven, if you are using the Modbus RTU protocol. If you are using Modbus/IP or BACnet/IP, then the "BAUD0" line is irrelevant.

The lines for BAUD1, BAUD2, BAUD3, and BAUD4 must be set for the respective Staefa Device baud rates which will almost always be "1200". If you have unused Staefa trunks, then the baud rate should be set to "0" as seen in the example below for BAUD3 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 60 on trunk 1; Devices 61 through 120 on trunk 2, Devices 121 through 180 on trunk 3, and Devices 181 through 240 on trunk 4. 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 #84 (the fourth gizmo on trunk #2), the BACnet system sees this device as Instance # 5084.

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).

```
C:\>type gateway.ini
// "BAUD0" is used for the HOST CHANNEL Baud Rate (the MODBUS RTU
//Protocol) and Parity settings N=None, O=Odd, E=Even
//
BAUD0, 9600,N
//
// ---------------------------------------------------------------------
//
// Required for 4 STAEFA ports: Set the baud rate (set to 0 if channel unused)
//
// Valid baud rates are:    300 -- Really old stuff (slow as a pooch!)
//                          1200 -- 95% of Smart-IIs in the world
//                          9600 -- New "Smart-II-plus" can go 9600 (rare)
//                               0 -- <means that nothing is on that trunk>
BAUD1, 1200
BAUD2, 1200
BAUD3, 0
BAUD4, 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
//
```

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:

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

ip address 192.168.0.72

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 Smart-II Gateway will have. Note that DHCP is not an option; this device requires a static, fixed, IP address.

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 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,  SM-II Device #1

State: "AutoDiscovery" on Trunk: 1,  SM-II Device #2

State: "AutoDiscovery" on Trunk: 1,  SM-II Device #3

State: "AutoDiscovery" on Trunk: 1,  SM-II Device #4
```

```
SM2 #  4 Discovered on Trunk #1  <FNC>  Version 4.3; Date: 6/93

State: "AutoDiscovery" on Trunk: 1,  SM-II Device #5

State: "AutoDiscovery" on Trunk: 1,  SM-II Device #6

State: "AutoDiscovery" on Trunk: 1,  SM-II Device #7
```

When Auto Discover is invoked the Gateway will scan for all device addresses (1-250) on the requested trunk.

As you can see in the example above, Smart II Device address #4 was discovered, which was a FanCoil with firmware version 4.3, dated 6/93.

This process should be completed for all trunks that have Smart II 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 20-25 minutes per trunk on a 1200 baud Staefa Trunk

- 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"**

- Files that are in the Gateway and their purpose:

STARTUP.BAT	- Auto-Execute (startup) Batch file
GATEWAY.INI	- Port /IP/Parameters configuration .INI file
SOCKET.CFG	- IP Configuration file
SOCKETP .EXE	- TCP/IP Socket stack
NE2000.COM	- Ethernet Driver
SM2_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
DISC_3 .TXT	- Trunk #3 Auto Disc File
DISC_4 .TXT	- Trunk #4 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, SM2 unit #4;  Trunk #1;  Type = 1;  Rev: "Version 4.3; Date: 6/93"
Discovery File Merging, trunk #2
Discovery File Merging, trunk #3
Merging, SM2 unit #4;  Trunk #3;  Type = 1;  Rev: "Version 4.3; Date: 6/93"
Merging, SM2 unit #6;  Trunk #3;  Type = 0;  Rev: "Version 4.1; Date: 2/93"
```

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

After the merge is complete, the Gateway will have created a file called DATABASE.DAT. When the Gateway is rebooted, the new Database file will be initialized and communications to the field devices will commence.

The Save Discovery option automatically assigns Modbus device numbers (slave addresses) to the Smart II devices it found. First, devices on trunk #1 are assigned, in order of Modbus slave devices 1 through 60 (note that there are a maximum of 60 Smart II's for one trunk – this is because many installations violated the Staefa "rules" about only having 40 Smart II's on one trunk. We accommodate systems which have more). Similarly, the Smart II devices found on Trunk #2 are assigned (in the order that they are discovered) to Modbus slave devices 61 through 120. And of course, Modbus slave addresses 121 to 180 are for the Smart II's found on Trunk #3, and finally Modbus slave addresses 181 to 240 are assigned to devices on Trunk #4 (in order of discovery).

"Summary" Menu Options

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

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 status of all devices configured for the Gateway.

```
SUM:  (D)evices,  (A)larms,  (C)ontrolled,  (U)nreliable,  (X)-it :dD
TagID: "FCU #4, TRUNK 1 (MB #1)" is ON-LINE & RELIABLE
TagID: "FCU #4, TRUNK 2 (MB #61)" is OFF-LINE! <MUST INIT> (SlowScan)
TagID: "FCU #4, TRUNK 3 (MB #121" is OFF-LINE! <MUST INIT> (SlowScan)
TagID: "VAV #6, TRUNK 3 (MB #122" is OFF-LINE! <MUST INIT> (SlowScan)
```

(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.

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

```
SUM: (D)evices, (A)larms, (C)ontrolled, (U)nreliable, (X)-it :C
DEVICE #1 is field device/subdevice/type 4/0/1
  *** Gateway has NO controls to do! ***
DEVICE #61 is field device/subdevice/type 4/0/1
  *** Gateway has NO controls to do! ***
DEVICE #121 is field device/subdevice/type 4/0/1
  *** Gateway has NO controls to do! ***
DEVICE #122 is field device/subdevice/type 6/0/0
  *** 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 #1 is field device/subdevice/type 4/0/1
 *** "PO #7 Action" is UNRELIABLE
 *** "PO #6 Action" is UNRELIABLE
 *** "COOLING Control" is UNRELIABLE
 *** "HEATING 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.

(A)ll: View all configured devices.

```
DEV: (S)elect, (A)ll, (D)etail, (O)ff-line, (C)omm Stats, (X)-it :A
TagID: "FCU #4, TRUNK 1 (MB #1)" is ON-LINE & RELIABLE
TagID: "FCU #4, TRUNK 2 (MB #61)" is OFF-LINE! <MUST INIT> (SlowScan)
TagID: "FCU #4, TRUNK 3 (MB #121" is OFF-LINE! <MUST INIT> (SlowScan)
TagID: "VAV #6, TRUNK 3 (MB #122" is OFF-LINE! <MUST INIT> (SlowScan)
```

(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..200 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 #1 is field device/subdevice/type 4/0/1
TagID: "FCU #4, TRUNK 1 (MB #1)" is ON-LINE & RELIABLE
I/O Trunk: 1, had last COMM at 17:13:12 on Dec 28, 2002
Device has 54 objects under it.  First Record =54
```

(O)ffline: This will display the Offline status of devices.

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

```
DEV:  (S)elect,  (A)ll,  (D)etail,  (O)ff-line,  (C)omm Stats,  (X)-it :C
TagID: "FCU #4, TRUNK 1 (MB #1)" statistics:
      Packets Today:   463
      RX Errors Today: 0   % Error: 0.000
      TX Errors Today: 4   % Error: 0.864
      Last Comm at:  17:13:26 on Dec 28, 2002
```

"Point" Menu Options

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

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

(A)ll: This will display all points and their current values for the targeted device. Below shows 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 :aA
DEVICE #1 is field device/subdevice/type 4/0/1
  TagID: "FCU #4, TRUNK 1 (MB #1)", has 54 objects under it, 1st one at: 54
 MB Reg: 10024 (DI) "       Economizer Mode" Fld:   0 OFF (0-state)
 MB Reg: 10023 (DI) "         PO #7 Action" Fld:   0 OFF (0-state)
 MB Reg: 10022 (DI) "         PO #6 Action" Fld:   0 OFF (0-state)
 MB Reg: 10021 (DI) "       Setpoint Switch" Fld:   0 OFF (0-state)
 MB Reg: 10019 (DI) " CHANGEOVER AUTO/MANUAL" Fld:   1 ON (1-
state)
 MB Reg: 10018 (DI) "      Fan Change - COOL" Fld:   0 OFF (0-state)
 MB Reg: 10017 (DI) "      Fan Change - HEAT" Fld:   1 ON (1-state)
 MB Reg: 30020 (AI) " Discharge Air Temp SPT" Fld:  69 ==>  69.00
 MB Reg:   14 (DO) "       COOLING Control" Fld:   0 OFF (0-state)
 MB Reg:   13 (DO) "       HEATING Control" Fld:   0 OFF (0-state)
 MB Reg:   12 (DO) "    COOLING PI Control" 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 a few lines of same display, in "BACnet" format:

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

DEVICE #1 is field device/subdevice/type 4/0/1
  TagID: "VAV #4, TRUNK 1 (Dev #1)", has 54 objects under it, 1st one at: 54
 BACnet ID  24 (DI) "       Economizer Mode" Fld:   0 OFF (0-state)
 BACnet ID  23 (DI) "         PO #7 Action" Fld:   0 OFF (0-state)
 BACnet ID  22 (DI) "         PO #6 Action" Fld:   0 OFF (0-state)
 BACnet ID  21 (DI) "       Setpoint Switch" Fld:   0 OFF (0-state)
Etc…
```

(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.

```
PNT:  (S)elect,  (A)ll,  (D)etail,  (X)-it :D
  MB Address: 30001,  Type = AI, "Zone Temperature"
 Field Unit / Subunit :    4 /    0    Field Address :30001
 Object Flags (bits) :       0    Error Counter :0
 Field In / Out Counts :    0 /    0    Field Value :   0.000
 Field Hi / Lo Range : 255.000 /   0.000    Eng. Units : Zero
```

"Control" Menu Options

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: This option will let you control the selected point. Let's look at the simple, Modbus case first:

```
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) : 00

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  pri = 16

CTL:  (S)elect,  (C)ontrol,  (D)etail,  (X)-it : Control (Q:3)  Trunk #1,  MB #1, Register:
1 -- to:    0.000  pri = 16

 Controlled object found!  Record #21
```

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 min on/off)
3	Miscellaneous	Very high (User, non-emergency)
4	Miscellaneous	Sometimes "safety"; many uses
5	Critical Equipment Control	Custom Programming—High Pri
6	Minimum On/Off	Minimum on/off times for equipment
7	Custom Programming—High	Lots of systems use Demand Limiting
8	Manual Operator	Generic "Operator Override"
9	VAV Air Systems	Really, any Air System
10	Chiller Plant Control	Chiller Plant Control
11	Area Control	Some systems have Area Control higher
12	Manual Operator—Low	Generic "Operator Control"
13	Miscellaneous	Schedule override for long periods
14	Timed-Override	Overriding a single schedule event
15	Time-of-Day Scheduling	Time-of-Day Scheduling
16	Custom Programming—Low	Custom Programming—Lowest Pri.
N/A	Relinquish Default	Relinquish Default

Note in the "Comments" we have given what some (or most) systems have as a "Default" was for the priorities in question. This is informational only, but might help some of you who are new to the "priority game" in BACnet.

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.

(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 = AI, "Zone Temperature"
  Field Unit / Subunit :    4 /    0    Field Address :30001
  Object Flags (bits) :       0    Error Counter :0
  Field In / Out Counts :    0 /    0    Field Value :   0.000
  Field Hi / Lo Range : 255.000 /   0.000    Eng. Units : Deg F.
```

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 Cooling Flow SPT"
  No elements in priority/control array
  Field Unit / Subunit :        4  /   0    Field Address :30001
  Object Flags / Errors :             0  /   0
  Field In / Out Counts :             0  /   0    Field Value :   0.000
  Field Hi / Lo Range : 10000.000 /   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.

(1),(2),(3),(4) to Watch Trunks: Enter a trunk to monitor. This will display the field scan of all Trunk devices and the status of their points in real time.

```
WCH:  (Q)uiet, (1),(2),(3),(4) to watch trunks; (V)erbose, (M)odbus, (X)-it :1
*** TRUNK 1 is now being MONITORED ***
 -- SCAN: Trunk #1, to SM2 #4, Operation #1
 -- DI  10024  Raw Value: 0 ==> 0 (Off)
 -- DI  10021  Raw Value: 0 ==> 0 (Off)
-- AI  30020   Counts:    69 =     69.00
 -- DO     12  Raw Value: 0 ==> 0 (Off)
 -- DO     11  Raw Value: 0 ==> 0 (Off)
 -- DO     10  Raw Value: 0 ==> 0 (Off)
 -- DO      9  Raw Value: 2 ==> 0 (Off)
 -- DO      8  Raw Value: 0 ==> 0 (Off)
 -- DO      7  Raw Value: 1 ==> 1 (ON)
 -- DI  10016  Raw Value: 1 ==> 1 (ON)
 -- DI  10015  Raw Value: 0 ==> 0 (Off)
 -- DI  10014  Raw Value: 0 ==> 0 (Off)
 -- DI  10013  Raw Value: 0 ==> 0 (Off)
 -- DI  10012  Raw Value: 0 ==> 0 (Off)
 -- DI  10011  Raw Value: 0 ==> 0 (Off)
 -- DI  10010  Raw Value: 0 ==> 0 (Off)
 -- DI  10009  Raw Value: 2 ==> 0 (Off)
 -- DI  10008  Raw Value: 0 ==> 0 (Off)
 -- DI  10007  Raw Value: 1 ==> 1 (ON)
```

(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, to SM2 #4, Operation #1
 -- Read MEM command, Trunk #1, to SM2 #4
--TO Trunk 1: 01 04 80 19 20 BE
 -- 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: 01 04 80 19 20 BE
```

```
-FRM Trunk 1: 02 04 19 20 46 01 00 47 CD 1B D6 84 00 01 64 00 02 00 0A 00 00 00
00 00 00 3C 45 76 05 7C <Valid>
 -- DI  10024  Raw Value: 0 ==> 0 (Off)
 -- DI  10021  Raw Value: 0 ==> 0 (Off)
 -- DI  10019  Raw Value: 1 ==> 1 (ON)
 -- DI  10018  Raw Value: 0 ==> 0 (Off)
```

(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 CHANNEL is now being MONITORED ***
 -- SCAN: Trunk #1, to SM2 #4, Operation #1
 -- Read MEM command, Trunk #1, to SM2 #4
--TO Trunk 1: 01 04 80 19 20 BE
 -- Set up TIMEOUT, Trunk #1, to be 6154675,  TMO @baud = 100
-FRM Trunk 1: <Incomplete>
TIMEOUT" on Trunk: 1, error count = 0
--TO Trunk 1: 01 04 80 19 20 BE
-FRM Trunk 1: 02 04 19 20 46 01 00 46 CD 1B D6 84 00 01 64 00 02 00 0A 00 00 00
00 00 00 3C 45 6D 08 75 <Valid>
-- DI  10019  Raw Value: 1 ==> 1 (ON)
…etc…
```

(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). 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 and DOWN.COM is used to received files from the gateway.

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.

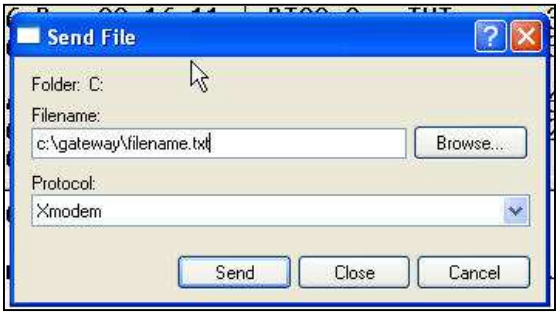
Sending a file to the Gateway (uploading)

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...
CCCCCCCCCCCCCCCCCCCCCCCCC
```

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.



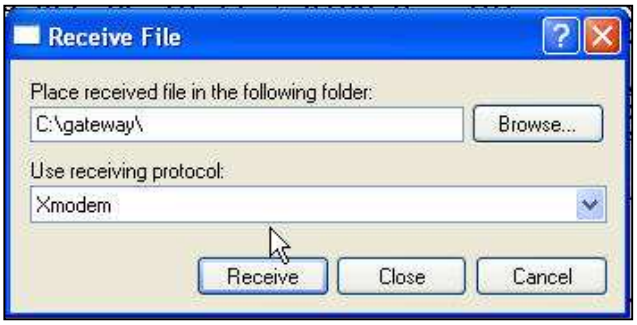
Receiving a file from the Gateway (downloading)

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 8
MAXIMUM number of registers preset at once (CMD #16) is 8

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)
```

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.

Chapter 3

Modbus and BACnet Point Mapping

Device Point Mapping for VAV's, HP's, and FC's

Monitor Address	Control Address	VAV Usage	HP Usage	FC Usage	Ranges & Notes	I/O Address
30001		Zone Temp	Zone Temp	Zone Temp	Range: Note 1	0x20
30002		Setpoint	Setpoint	Setpoint	Range: Note 2	0x21
30003		Generic AI2	Generic AI2	Generic AI2	Range: Note 2	0x22
30004		Generic AI3	Generic AI3	Generic AI3	Range: Note 2	0x23
30005		Generic AI4	Generic AI4	Generic AI4	Range: Note 2	0x24
30006		Generic AI5	Generic AI5	Generic AI5	Range: Note 2	0x25
30007		Generic AI6	Generic AI6	Generic AI6	Range: Note 2	0x26
30008		Generic AI7	Generic AI7	Generic AI7	Range: Note 2	0x27
30009	40009	Prop.Output 0	Prop.Output 0	Prop.Output 0	Range: Note 3	0x2A
30010	40010	Prop.Output 1	Prop.Output 1	Prop.Output 1	Range: Note 3	0x2B
30011	40011	(unused)	(unused)	(unused)	Range: Note 4	0x2C
30012	40012	(unused)	(unused)	(unused)	Range: Note 4	0x2D
30013	40013	(unused)	(unused)	(unused)	Range: Note 4	0x2E
30014	40014	Cooling Load	Cooling Load	Cooling Load	Range: Note 5	0x30
30015	40015	Heating Load	Heating Load	Heating Load	Range: Note 5	0x31
30016	40016	Pri Duct Control	OA Damper Ctl	OA Damper Ctl	Range: Note 5	0x32
30017	40017	Aux Duct Control	Remote OSA Tmp	Remote OSA Tmp	Range: Note 5	0x33
30018	40018	Override Time	Override Time	Override Time	0 to 255 minutes	0x35
30019		Override Mins Left	Override Mins Left	Override Mins Left	0 to 255 minutes	0x34
30020	40020	Occ. Cooling SPT	Occ. Cooling SPT	Occ. Cooling SPT	Range: Note 6	0x60
30021	40021	Occ. Heating SPT	Occ. Heating SPT	Occ. Heating SPT	Range: Note 6	0x61
30022	40022	(unused)	Disc. Air Low Limit	Disc. Air Low Limit	Range: Note 6	0x62
30023	40023	(unused)	Disc. Air High Limit	Disc. Air High Limit	Range: Note 6	0x63
30024	40024	(unused)	Disc. Air Tmp SPT	Disc. Air Tmp SPT	Range: Note 6	0x64
30025	40025	(unused)	(unused)	(unused)	Range: Note 6	0x65
30026	40026	(unused)	OSA Dmpr Min Pos	OSA Dmpr Min Pos	0 to 100 percent	0x67
30027	40027	Unocc Cooling SPT	Unocc Cooling SPT	Unocc Cooling SPT	0 to 255 Deg F.	0x69.0-3
30028	40028	Unocc Heating SPT	Unocc Heating SPT	Unocc Heating SPT	0 to 255 Deg F.	0x69.4-7
30029	40029	Cooling Prop	Cooling Prop	Cooling Prop	0 to 100 percent	0x6C.0-

		Band	Band	Band		3
30030	40030	Cooling Integ. Rate	Cooling Integ. Rate	Cooling Integ. Rate	(relative units)	0x6C.4-7
30031	40031	Heating Prop Band	Heating Prop Band	Heating Prop Band	0 to 100 percent	0x6D.0-3
30032	40032	Heating Integ. Rate	Heating Integ. Rate	Heating Integ. Rate	(relative units)	0x6D.4-7
10001	1	DO 0 Status/Ctl	DO 0 Status/Ctl	DO 0 Status/Ctl	0=Off; 1= On	0x29.0
10002	2	DO 1 Status/Ctl	DO 1 Status/Ctl	DO 1 Status/Ctl	0=Off; 1= On	0x29.1
10003	3	DO 2 Status/Ctl	DO 2 Status/Ctl	DO 2 Status/Ctl	0=Off; 1= On	0x29.2
10004	4	DO 3 Status/Ctl	DO 3 Status/Ctl	DO 3 Status/Ctl	0=Off; 1= On	0x29.3
10005	5	DO 4 Status/Ctl	DO 4 Status/Ctl	DO 4 Status/Ctl	0=Off; 1= On	0x29.4
10006	6	DO 5 Status/Ctl	DO 5 Status/Ctl	DO 5 Status/Ctl	0=Off; 1= On	0x29.5
10007	7	OCC Status/Ctl	OCC Status/Ctl	OCC Status/Ctl	0=OCC; 1=Unocc	0x2C.3-4
10008	8	STBY Status/Ctl	STBY Status/Ctl	STBY Status/Ctl	0=Normal; 1=STANDBY	0x2C.3-4
10009	9	WRM Status/Ctl	WRM Status/Ctl	WRM Status/Ctl	0=Normal; 1=WARMUP	0x2C.5
10010	10	(unused)	OAT Location	OAT Location	Units: Note 1	0x2F.6
10011	11	HEAT PI Mode	HEAT PI Mode	HEAT PI Mode	Units: Note 2	0x2F.5
10012	12	COOL PI Mode	COOL PI Mode	COOL PI Mode	Units: Note 3	0x2F.4
10013	13	HEAT Status/Ctl	HEAT Status/Ctl	HEAT Status/Ctl	0=Heat Off; 1=Heat ON	0x2C.0-1
10014	14	COOL Status/Ctl	COOL Status/Ctl	COOL Status/Ctl	0=Cool Off; 1=Cool ON	0x2C.0-1
10015		Fan Ctl Status	Fan Ctl Status	Fan Ctl Status	0=Off; 1= On	0x2E.4-7
10016		Fan Mode Status	Fan Mode Status	Fan Mode Status	0=AUTO; 1=FORCED	0x2E.4-7
10017		Primary Air HEAT	(unused)	Fan change HEAT	0=Off; 1=HEAT	0x2E.0-1
10018		Primary Air COOL	Compr. in Cooling	Fan change COOL	0=Off; 1=COOL	0x2E.0-1
10019		Aux. Air COOL	(unused)	Chg'over in Manual	0=Off; 1=HEAT	0x2E.2-3
10020		Aux. Air HEAT	(unused)	(unused)	0=Off; 1=COOL	0x2E.2-3
10021		Setpoint Switch	Setpoint Switch	Setpoint Switch	0=Normal; 1 = UNOCC	0x21.7
10022		PulseOut6 Action	PulseOut6 Action	PulseOut6 Action	0=Direct; 1=RevAction	0x7D.3
10023		PulseOut7 Action	PulseOut7 Action	PulseOut7 Action	0=Direct; 1=RevAction	0x7E.3
10024		(unused)	Economizer Mode	Economizer Mode	0=Off; 1=Economizing	0x2D.4
10025		(unused)	Defrost Cycle	(unused)	0=Off; 1=Defrosting	0x36.4
10026		(unused)	Compr. Cooling	(unused)	0=Normal; 1= Cooling	0x36.2-3
10027		(unused)	Compr. Heating	(unused)	0=Normal; 1=Heating	0x36.2-3
10028		(unused)	Rev. Valve COOL	(unused)	0=Normal; 1= Cooling	0x36.0-1
10029		(unused)	Rev. Valve HEAT	(unused)	0=Normal; 1=Heating	0x36.0-1
10030		(unused)	(unused)	(unused)	0=Off; 1= On	0x20.5
10031		(unused)	(unused)	(unused)	0=Off; 1= On	0x21.5
10032		(unused)	(unused)	(unused)	0=Off; 1= On	0x22.5
10033		(unused)	(unused)	(unused)	0=Off; 1= On	0x23.5
10034		(unused)	(unused)	(unused)	0=Off; 1= On	0x24.5
10035		(unused)	(unused)	(unused)	0=Off; 1= On	0x25.5
10036		(unused)	(unused)	(unused)	0=Off; 1= On	0x26.5
10037		(unused)	(unused)	(unused)	0=Off; 1= On	0x27.5

Units: Note 1:

For DDC units, this is the control mode for Loop #2. 0 = MANUAL; 1 = AUTO
For VAV, HP and FC, this is where the OAT is obtained. 0=internal;

1=downloaded

Units: Note 2:

For DDC units, this is the control mode for Loop #1. 0 = MANUAL; 1 = AUTO
For VAV, HP and FC, this is the MODE of the Heating PI Calculation.
0=AUTO; 1=MANUAL

Units: Note 3:

For DDC units, this is the control mode for Loop #0. 0 = MANUAL; 1 = AUTO
For VAV, HP and FC, this is the MODE of the Cooling PI Calculation.
0=AUTO; 1=MANUAL

Range: Note 1:

For VAV, HP, and FC, this is in degrees F (units). Low Range=0;
High Range=255 (byte value). For MUX and DDC types, this scales as per
Range: "Note 2"

Range: Note 2:

A scaling module is installed on the board for these type of inputs. Please
refer to the appropriate Staefa Manual for the Smart-II type. The 255 "count"
range of this input is scaled as the module dictates. However, for DDC types,
the top bit is unused, so only 127 counts are
available.

Range: Note 3:

For lineraized points, this is 0 to 100%
For non-linearized points, this is 0-255 counts (scaling must be done in the host)
In either case, use Low Range=0; High Range = 255

Range: Note 4:

Usage: Low Range=0; High Range = 100 (since 0-255 counts maps to 0 to 100%)

Range: Note 5:

Cooling/Heating/Duct/Damper Usage: Low Range=0; High Range = 100
(since 0-255 counts maps to 0 to 100%) For Loop Host Input Values, this is
0-255 counts (scaling must be done in the host)For Remote
Temperatures,
use range of 0-255 (this number is an integer, in degrees F.)

Range: Note 6:

For setpoints, this is in degrees (VAV/FC/HP). For the DDC, the setpoint is in
the units of control (integer, 0-255) If this is used as an offset for Loops in DDC
devices, this is a signed value (-127 to +128)

Device Point Mapping for DDC and MUX

Monitor Address	Control Address	DDC Usage	MUX Usage	Ranges & Notes	I/O Address
30001		Generic AI0	Generic AI0	Range: Note 1	0x20
30002		Generic AI1	Generic AI1	Range: Note 2	0x21
30003		Generic AI2	Generic AI2	Range: Note 2	0x22
30004		Generic AI3	Generic AI3	Range: Note 2	0x23
30005		Generic AI4	Generic AI4	Range: Note 2	0x24
30006		Generic AI5	Generic AI5	Range: Note 2	0x25
30007		Generic AI6	Generic AI6	Range: Note 2	0x26
30008		Generic AI7	Generic AI7	Range: Note 2	0x27
30009	40009	Prop.Output 0	Prop.Output 0	Range: Note 3	0x2A
30010	40010	Prop.Output 1	Prop.Output 1	Range: Note 3	0x2B

30011	40011	Loop 0 Out Value	Block 0 Out Value	Range: Note 4	0x2C
30012	40012	Loop 1 Out Value	Block 1 Out Value	Range: Note 4	0x2D
30013	40013	Loop 2 Out Value	Block 2 Out Value	Range: Note 4	0x2E
30014	40014	Loop 0 Host Input	(unused)	Range: Note 5	0x30
30015	40015	Loop 1 Host Input	(unused)	Range: Note 5	0x31
30016	40016	Loop 2 Host Input	(unused)	Range: Note 5	0x32
30017	40017	(unused)	(unused)	Range: Note 5	0x33
30018	40018	(unused)	(unused)	0 to 255 minutes	0x35
30019		(unused)	(unused)	0 to 255 minutes	0x34
30020	40020	Loop 0 Setpoint	(unused)	Range: Note 6	0x60
30021	40021	Loop 1 Setpoint	(unused)	Range: Note 6	0x61
30022	40022	Loop 2 Setpoint	(unused)	Range: Note 6	0x62
30023	40023	Loop 0 Integ. Rate	(unused)	Range: Note 6	0x63
30024	40024	Loop 1 Integ. Rate	(unused)	Range: Note 6	0x64
30025	40025	Loop 2 Integ. Rate	(unused)	Range: Note 6	0x65
30026	40026	(unused)	(unused)	0 to 100 percent	0x67
30027	40027	(unused)	(unused)	0 to 255 Deg F.	0x69.0-3
30028	40028	(unused)	(unused)	0 to 255 Deg F.	0x69.4-7
30029	40029	(unused)	(unused)	0 to 100 percent	0x6C.0-3
30030	40030	(unused)	(unused)	(relative units)	0x6C.4-7
30031	40031	(unused)	(unused)	0 to 100 percent	0x6D.0-3
30032	40032	(unused)	(unused)	(relative units)	0x6D.4-7
10001	1	DO 0 Status/Ctl	DO 0 Status/Ctl	0=Off; 1= On	0x29.0
10002	2	DO 1 Status/Ctl	DO 1 Status/Ctl	0=Off; 1= On	0x29.1
10003	3	DO 2 Status/Ctl	DO 2 Status/Ctl	0=Off; 1= On	0x29.2
10004	4	DO 3 Status/Ctl	DO 3 Status/Ctl	0=Off; 1= On	0x29.3
10005	5	DO 4 Status/Ctl	DO 4 Status/Ctl	0=Off; 1= On	0x29.4
10006	6	DO 5 Status/Ctl	DO 5 Status/Ctl	0=Off; 1= On	0x29.5
10007	7	(unused)	(unused)	0=OCC; 1=Unocc	0x2C.3-4
10008	8	(unused)	(unused)	0=Normal; 1=STANDBY	0x2C.3-4
10009	9	(unused)	(unused)	0=Normal; 1=WARMUP	0x2C.5
10010	10	Loop #2 Mode	(unused)	Units: Note 1	0x2F.6
10011	11	Loop #1 Mode	(unused)	Units: Note 2	0x2F.5
10012	12	Loop #0 Mode	(unused)	Units: Note 3	0x2F.4
10013	13	(unused)	(unused)	0=Heat Off; 1=Heat ON	0x2C.0-1
10014	14	(unused)	(unused)	0=Cool Off; 1=Cool	0x2C.0-1

			ON	
10015	(unused)	(unused)	0=Off; 1= On	0x2E.4-7
10016	(unused)	(unused)	0=AUTO; 1=FORCED	0x2E.4-7
10017	(unused)	(unused)	0=Off; 1=HEAT	0x2E.0-1
10018	(unused)	(unused)	0=Off; 1=COOL	0x2E.0-1
10019	(unused)	(unused)	0=Off; 1=HEAT	0x2E.2-3
10020	(unused)	(unused)	0=Off; 1=COOL	0x2E.2-3
10021	(unused)	unused)	0=Normal; 1 = UNOCC	0x21.7
10022	(unused)	(unused)	0=Direct; 1=RevAction	0x7D.3
10023	(unused)	(unused)	0=Direct; 1=RevAction	0x7E.3
10024	(unused)	(unused)	0=Off; 1=Economizing	0x2D.4
10025	(unused)	(unused)	0=Off; 1=Defrosting	0x36.4
10026	(unused)	(unused)	0=Normal; 1= Cooling	0x36.2-3
10027	(unused)	(unused)	0=Normal; 1=Heating	0x36.2-3
10028	(unused)	(unused)	0=Normal; 1= Cooling	0x36.0-1
10029	(unused)	(unused)	0=Normal; 1=Heating	0x36.0-1
10030	(unused)	DI 0	0=Off; 1= On	0x20.5
10031	(unused)	DI 1	0=Off; 1= On	0x21.5
10032	(unused)	DI 2	0=Off; 1= On	0x22.5
10033	(unused)	DI 3	0=Off; 1= On	0x23.5
10034	(unused)	DI 4	0=Off; 1= On	0x24.5
10035	(unused)	DI 5	0=Off; 1= On	0x25.5
10036	(unused)	DI 6	0=Off; 1= On	0x26.5
10037	(unused)	DI 7	0=Off; 1= On	0x27.5

Units: Note 1:

For DDC units, this is the control mode for Loop #2. 0 = MANUAL; 1 = AUTO
For VAV, HP and FC, this is where the OAT is obtained. 0=internal; 1=downloaded

Units: Note 2:

For DDC units, this is the control mode for Loop #1. 0 = MANUAL; 1 = AUTO
For VAV, HP and FC, this is the MODE of the Heating PI Calculation. 0=AUTO; 1=MANUAL

Units: Note 3:

For DDC units, this is the control mode for Loop #0. 0 = MANUAL; 1 = AUTO
For VAV, HP and FC, this is the MODE of the Cooling PI Calculation. 0=AUTO; 1=MANUAL

Range: Note 1:

For VAV, HP, and FC, this is in degrees F (units). Low Range=0; High Range=255 (byte value). For MUX and DDC types, this scales as per Range: "Note 2"

Range: Note 2:

A scaling module is installed on the board for these type of inputs. Please refer to the appropriate Staefa Manual for the Smart-II type. The 255 "count"

range of this input is scaled as the module dictates. However, for DDC types, the top bit is unused, so only 127 counts are available.

Range: Note 3:

For linearized points, this is 0 to 100%
For non-linearized points, this is 0-255 counts (scaling must be done in the host)
In either case, use Low Range=0; High Range = 255

Range: Note 4:

Usage: Low Range=0; High Range = 100 (since 0-255 counts maps to 0 to 100%)

Range: Note 5:

Cooling/Heating/Duct/Damper Usage: Low Range=0; High Range = 100 (since 0-255 counts maps to 0 to 100%) For Loop Host Input Values, this is 0-255 counts (scaling must be done in the host). For Remote Temperatures, use range of 0-255 (this number is an integer, in degrees F.)

Range: Note 6:

For setpoints, this is in degrees (VAV/FC/HP). For the DDC, the setpoint is in the units of control (integer, 0-255) If this is used as an offset for Loops in DDC devices, this is a signed value (-127 to +128)

Note that all these tables are for Modbus points (the first two columns specify the Modbus register numbers you will use. For BACnet, the objects have an "Object Type" and an "Instance Number". Well, it is very simple to translate from Modbus to BACnet—just use the following simple "secret decoder ring":

Modbus Register Set	BACnet Type/Instance #	Comments
XX (e.g. 24)	DO / XX	Modbus Coils are BACnet DOs
100XX (e.g. 10021)	DI / XX	ModbusBits are BACnet DIs
300XX (e.g., 30013)	AI / XX	Modbus Registers are BACnet AIs
400XX (e.g., 40011)	AO / XX	Modbus Holdings are BACnet AOs

For our examples here, we would have four BACnet points , with the following unique IDs: DO #24, DI #21, AI #13, and AO #11.

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