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Centaurus Prime

CENTAURUS PRIME

Integrations, Custom Programming, Consulting

Staefa Smart II Gateway Guide

INTEGRATIONS, CUSTOM PROGRAMMING, AND CONSULTING

Staefa Smart II Gateway Guide

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Chapter 1

Smart-II 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 or BACnet/IP, Annex J) that communicates using the industry-standard Modbus RTU or BACnet protocols 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 BACnet/IP network is a 10-Mbaud Ethernet, only. The Modbus RTU Network connects to the "P1" Gateway via either (a) a 10-Mbaud Ethernet, (b) an RS-422 serial link (a four-wire, full-duplex connection), an RS-485 serial link (a two-wire, half-duplex connection), or an (c) RS-232 serial link (a three-wire, full-duplex connection). The RS-485 or RS-422 connections may 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. It is manufactured 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 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 handshakie/RS-485 half duplex, COM2, address 0x2F8, IRQ 3 115200 baud max
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 :	3 - 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)

This computer is programmed to automatically boot into the gateway application, and memory is retained so that the gateway comes up from its last state. The configuration that you do on the first installation will never need to be redone (unless significant changes, such as additions of new Staefa Smart-II controllers are made).

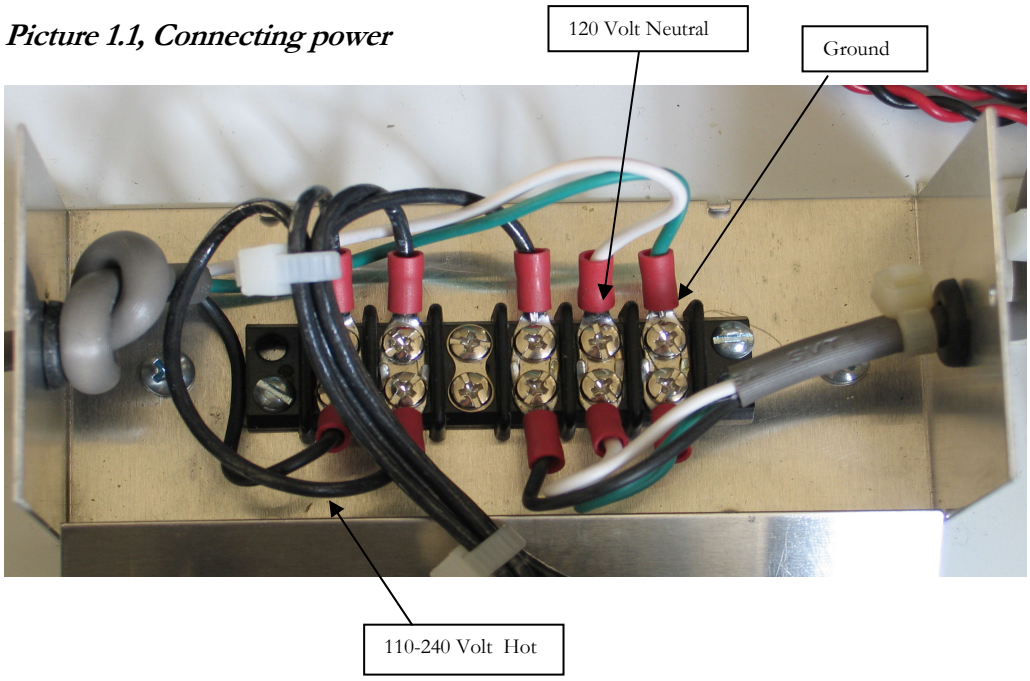
Connecting Power to the Gateway

The first thing that you have to do, of course, is mount the cabinet on a wall where you want it. The mounting brackets for the NEMA 4/12/13 thermoplastic enclosure are included inside the cabinet. Be sure to mount it properly and solidly.

There are three connections you have to make: Power (120 volts in the USA, but the power supply works on all voltages 110-240 VAC, either 50 or 60 Hertz), Ethernet (to your "host" system), and the field connections to the Staefa trunks.

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

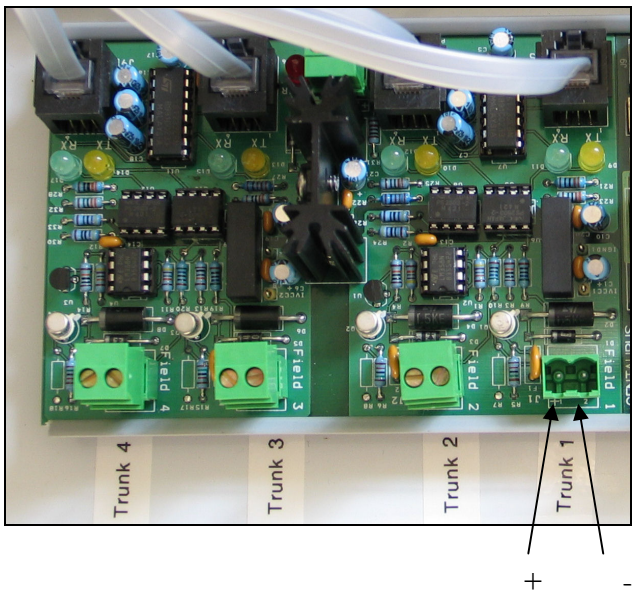
Picture 1.1, Connecting power



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 Smart-II 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:

Picture 1.2, Staefa Trunk Layout 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 GATEWAY.INI 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 19200 baud (19200 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:

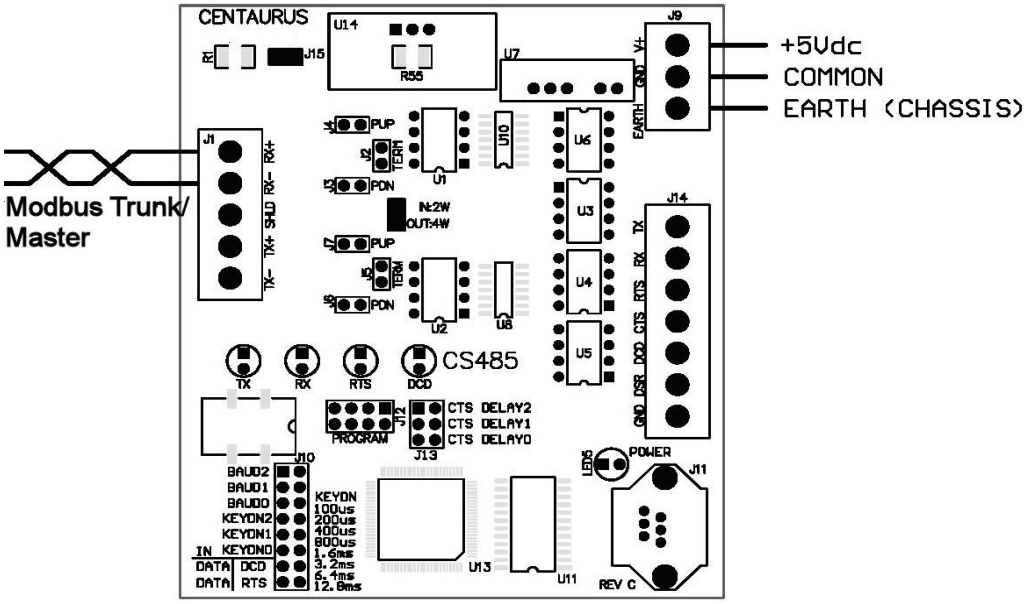
RS-485 RX and TX Jumpers

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

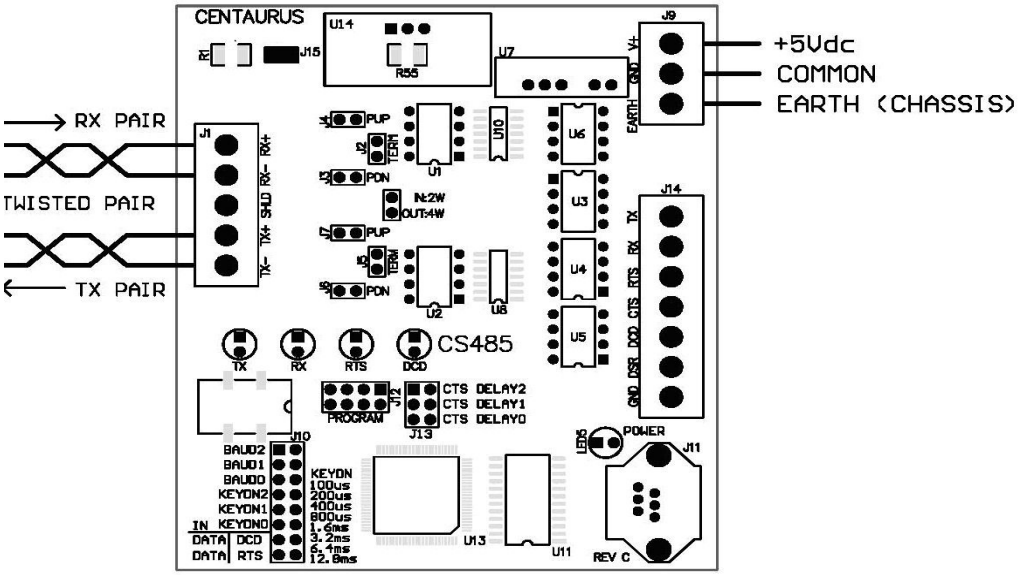
J15 Connects isolated RS-485 common to bleed resistor and filter cap

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)

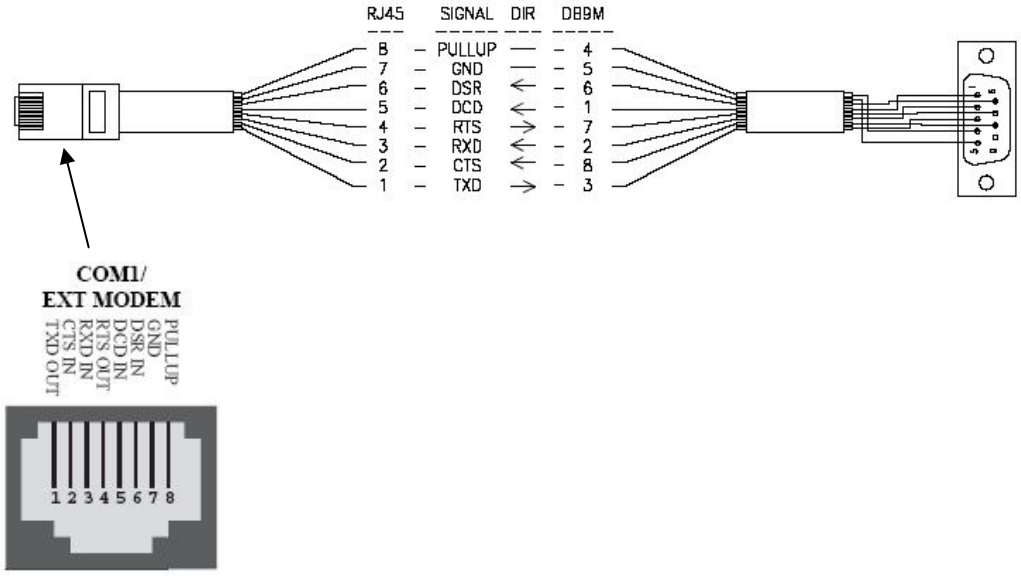
RS422 Communications:



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 GATEWAY.INI file, described in the following section. The same IP address must also be used in the SOCKET.CFG file, which is also described later. There are several parameters (BACnet network, the BACnet device "offset", and the override priority for physical I/O) that you will need to think about for your system, also, and modify the GATEWAY.INI file as appropriate.

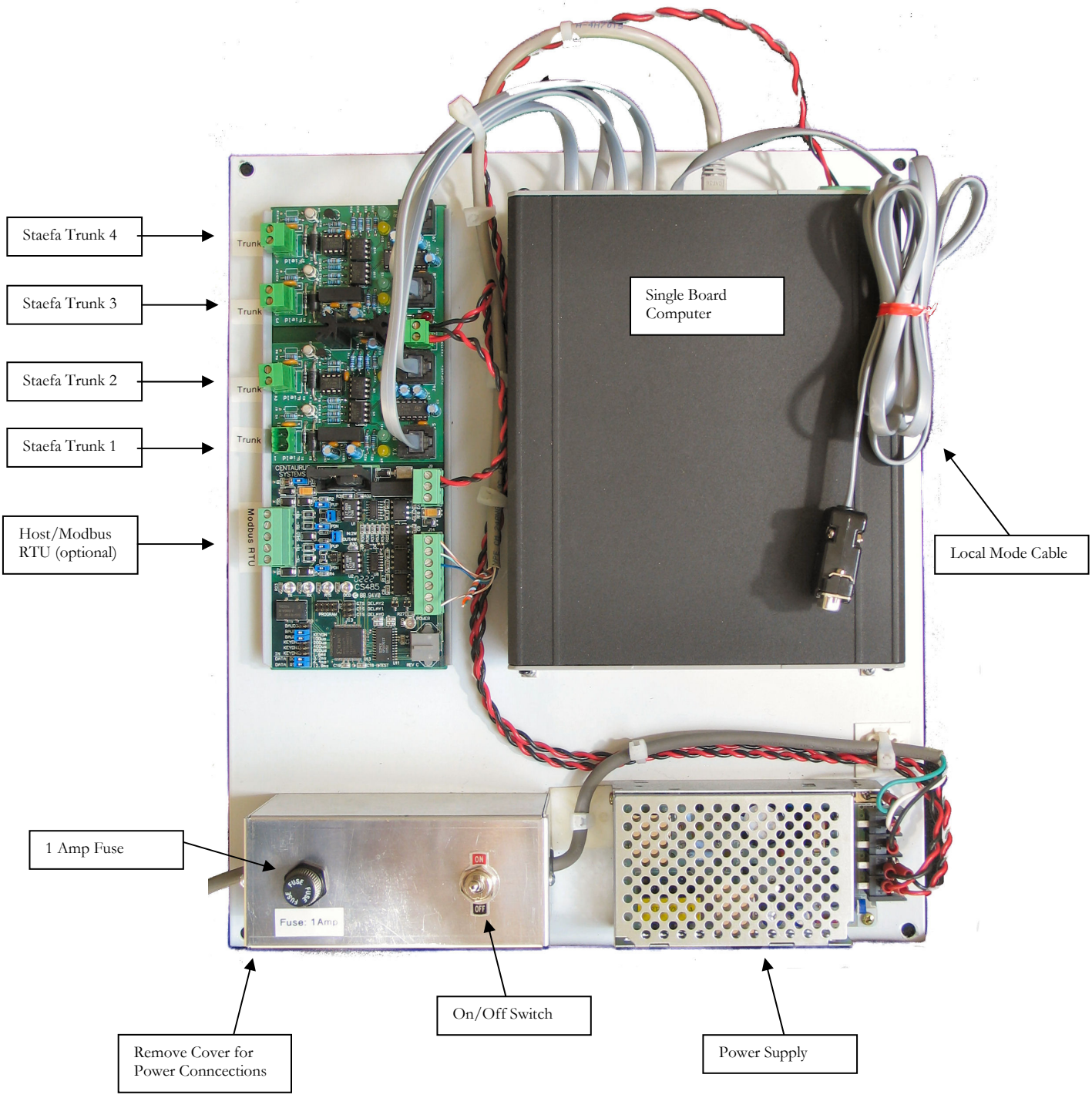
The BACnet options in the GATEWAY.INI that you select will determine how the Gateway operates on a BACnet network. Some are simple: What BACnet "network number" you will use, what the offset is for these devices (i.e., a number to "add" to the gateway's internal device numbers to yield the device numbers that a BACnet system sees), whether the BACnet system requires NPDU and APDU identifiers to match, what BACnet port number to use (if not the standard 47808, hex "BAC0"), and optionally, what BACnet priority you want to distinguish FORCE versus RELEASE for physical I/O points. Take care in designing your system and know what your host BACnet system requires!

Gateway Overview and Identification

The picture on the following page shows the Smart-II Gateway, with its major components labeled. The power box on the bottom left is where a 120 Volt AC connection is made. It has a fuse (1 amp) and a switch. The power supply is at the lower right hand corner of the backplate. The upper right is entirely taken up by the single-board computer that is the heart of the gateway. The two electronic boards on the left-hand side are the quad TTL-to-RS232 converter (upper board.) and optional CS-485 converter for Modbus-RTU operations (lower board.)

This picture shows an older Gateway (pre-2012), which uses a smaller power box. A larger power box has an EMI line filter, to block electromagnetic interference being impressed on the AC power line. This is required for Europe's CE-Mark compliance.

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" (but the very new "Smart-II-Plus can communicate at 9600 Baud). Remember that ALL the devices on the trunk must communicate at the same rate—so even if you have one older Smart-II that can talk at a maximum of 1200 baud, you must keep the entire trunk at 1200 baud (the lowest common denominator that all the Smart-II's can use). If you have unused Staefa trunks, then the baud rate should be set to "0" as seen in the example below for 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! Note the trailing "/24" at the end of this line in the example, below. This is IP-shorthand for a subnet mask of 24-bits-set (that is 255.255.255.0). If you have split subnets, or wider subnet making, you may have to change the "/24", accordingly.

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). 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 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.

For host systems that are compliant with the BACnet Addendum "al", where the Gateway must be a "router-to-network", add the following line: "MAKE_ROUTER_DEVICE, TRUE". This will undoubtedly be a requirement in the future, but some older systems may not recognize this feature. If you want the Gateway's response to the "Who_Is" command to go to all devices on the subnet that it is on (using it's subnet mask), then add the following line: "I_AM_FULL_SUBNET, TRUE". Since 2008, it has been a requirement to send the "I-Am" responses directed, to the sending device, but this will allow older systems 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.

if you include the "OVERRIDE_PRI", then the gateway will use the BACnet priorities (from Priority 1, called "Manual Life Safety" to this priority setting to "force" the physical I/O points only (that is, DO-0 through DO-5, AO-6, and AO-7). Below that priority, up to BACnet priority #16, the physical I/O points will go to "automatic" control. If you do NOT have this line in your INI file, then the system expects you to use BO points 51 through 58 as command points, to set the particular I/O point into either forced- or automatic-mode, before you do your actual control adjustment.

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 line FLOW_CONSTANT, 10.4784 (metric, LPS) will override the usual default Flow_constants of 22.2 (American, CFM) in flow calculations on AI points 95 and 96, the Primary and Aux air flow computed values, respectively.

```
C:\>type gateway.ini
//
// 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 -- 98% of Smart-IIs in the world
//                         2400 – Newer SMVU's can be at this higher baud-rate
//                         9600 -- New "Smart-II-plus" can go 9600 (rare)
//                            0 -- <means that nothing is on that trunk>
BAUD1, 1200
BAUD2, 1200
BAUD3, 1200
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
//
// "MAKE_BACNET_DEVICE" is used to make the device conform to BACnet Annex "al"
//
MAKE_BACNET_DEVICE, TRUE
//
// "OVERRIDE_PRI" = maximum priority used for PHYSICAL I/O "Force" (o/w "Auto")
//
OVERRIDE_PRI = 8
//
// This sets up the Gateway to use Metric units (Deg C, LPS, etc.)
//
UNITS, METRIC
//
```

```
// This is what is used by the Gateway for flow calculations (note: 22.2 for CFMs)
//
FLOW_CONSTANT, 10.4784
//
```

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 192.168.0.204

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. The gateway "assumes" that the subnet mask is 255.255.255.0, which is what you will normally encounter in a building. If this will NOT be your subnet mask, you will have to modify the "ip address" line to give it the subnet mask information. Please contact Centaurus Prime for further information about this; it is not what you might expect.

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

SM2 #  2 Discovered on Trunk #1  <DDC>  Version 1.2; Date: 1/88

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
```

```
SM2 #  6 Discovered on Trunk #1  <VAV>  Version 4.0; Date: 9/92

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

          ….etc.., for all 239 possible Smart-II addresses…

State: "AutoDiscovery" on Trunk: 1,  SM-II Device #239

End of AutoDiscovery!
```

When Auto Discover is invoked the Gateway will scan for all device addresses (1-239) on the requested trunk. At 1200 baud, this takes a LONG time (enough time for a double espresso, or a power nap).

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. A VAV was found at address #6, and a DDC device was discovered at address #2.

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 up to 20 minutes per trunk on a 1200 baud Staefa Trunk

- Note 2: If a controller is dead, unplugged, or not communicating when the 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
PERSIST.LOG	- Permanent changes made to the database after the "defaults" created
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
TPLn_xxx	- Templates (generally just for DDC or MUX devices)

```
 (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 #2;  Trunk #1;  Type = 3;  Rev: "Version 1.2; Date: 1/88"
Merging, SM2 unit #4;  Trunk #1;  Type = 1;  Rev: "Version 4.3; Date: 6/93"
Merging, SM2 unit #6;  Trunk #1;  Type = 0;  Rev: "Version 4.0; Date: 9/92"
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 CONFIG.TXT. When the Gateway is rebooted, the new CONFIG.TXT file is used (with any templates you download—see a later section), to create a "Database" file that is initialized. Then, with this configuration known, communications to the field devices will commence.

The Save Discovery option automatically assigns Modbus device numbers (slave addresses) or BACnet device numbers to the Smart II devices it found. First, devices on trunk #1 are assigned, in order of Modbus slave devices (or BADnet 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 that 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). Note that this would mean, in the example above, that Devices #1, #2, and #3 on trunk 1 are the Staefa devices at addresses 2, 4, and 6. You can always edit the CONFIG.TXT file. For example, this file, after the save would have its first few lines read:

```
//    Configuration file created from merge at 9:15:35 AM on 12 Sept, 2006
//
//    "DEVICE", TRUNK, SM2-NUMBER, SM2-TYPE, MB-UNIT, NAME
//
DEVICE, 1, 2, 3,  1, "SM-II #2, Trunk 1 (#1)"
DEVICE, 1, 4, 2,  2, "SM-II #4, Trunk 1 (#2)"
DEVICE, 1, 6, 0,  3, "SM-II #6, Trunk 1 (#3)"
```

You might want to make Staefa Address #2 be Device #2, not number 1; same for the rest of the gizmos. To do this, you would modify the CONFIG.TXT file in the following fashion (changes are in RED):

DEVICE, 1, 2, 3, 2, "SM-II #2, Trunk 1 (#2)"
DEVICE, 1, 4, 2, 4, "SM-II #4, Trunk 1 (#4)"
DEVICE, 1, 6, 0, 6, "SM-II #6, Trunk 1 (#6)"

This makes Staefa address #2 be device #2; #4 is #4, #6 is #6. We recommend that you do this if there are gaps (such as in our example), for ease of servicing in the future.

"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 ON-LINE & RELIABLE
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. 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. Usually, there are no controls to do (because any controls that are sent by the host are done BEFORE any scanning takes place!). But in the off chance you catch the interface right before it has issued a command it will show up.

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

Internal Global Controls Queue: Head = 987 Tail = 987;  Controls Today = 1529

  *** 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 1/0/1
 *** "PO #7 Action" is UNRELIABLE
 *** "PO #6 Action" is UNRELIABLE
 *** "COOLING Control" is UNRELIABLE
 *** "HEATING Control" is UNRELIABLE

DEVICE #17 is field device/subdevice/type 17/0/3
*** "Generic AI #2" 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. This is just a summary of the current status of all devices. In the following example, Devices #1, #2, and #61 are OK; but devices #121 and #122 have failed:

```
DEV: (S)elect, (A)ll, (D)etail, (O)ff-line, (C)omm Stats, (X)-it :A
TagID: "FCU #1, TRUNK 1 (MB #1)" is ON-LINE & RELIABLE
TagID: "DDC #2, TRUNK 1 (MB #2)" is ON-LINE & RELIABLE
TagID: "FCU #4, TRUNK 2 (MB #61)" is ON-LINE & RELIABLE
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. This allows you to work with ONE device, rather than them all. This is the FIRST thing you do when you want to look at one point, on one device, or control a point. First, you select the device, then go to the POINT menu, to select the point. (And if you want to control it, then go to the CONTROL menu, and issue controls to it)

Here's how you would select device #2 (the second device on trunk #1):

```
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 #2 is field device/subdevice/type 2/0/1 Device Name:  VAV #2 -- Farmers
Device Description:  VAV #2 in Farmers Insurance Company
Location: West Conference Room VAV
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, 2006
Device has 54 objects under it.  First Record =54
```

(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

# 61TagID: "P1 #1, TRUNK 2" is OFF-LINE! <MUST INIT> (SlowScan)
```

(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:   101902
      RX Errors Today: 9   % Error: 0.009
      TX Errors Today: 50   % Error: 0.049
      Last Comm at:  17:13:26 on Mar 28, 2006
```

"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 :A

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 a display, in "BACnet" format:

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

DEVICE #1 is field device/subdevice/type 1/0/0
TagID: "VAV #1 Trunk 1 (BACnet 1)", has 91 objects under it, 1st one at: 91
--BACnet ID   1 (AI) "             Zone Temperature"  Fld:   39 ==>   39.00
--BACnet ID   2 (AI) "               Setpoint / AI1"  Fld:  255 ==>   -1.00
--BACnet ID   3 (AI) "                  Generic AI2"  Fld:   53 ==>   53.00
--BACnet ID   4 (AI) "                  Generic AI3"  Fld:    0 ==>    0.00
--BACnet ID   5 (AI) "                  Generic AI4"  Fld:   61 ==>   61.00
--BACnet ID   6 (AI) "                  Generic AI5"  Fld:    0 ==>    0.00
--BACnet ID   7 (AI) "                  Generic AI6"  Fld:  255 ==>  255.00
--BACnet ID   8 (AI) "                  Generic AI7"  Fld:  255 ==>  255.00
--BACnet ID 109 (AO) "          Prop. #0 Output CTL"  Fld:    0 ==>    0.00
--BACnet ID   9 (AI) "           Prop. #0 Output FB"  Fld:    0 ==>    0.00
--BACnet ID 110 (AO) "          Prop. #1 Output CTL"  Fld:    0 ==>    0.00
--BACnet ID  10 (AI) "           Prop. #1 Output FB"  Fld:    0 ==>    0.00
--BACnet ID  14 (AI) "                Cooling Load"  Fld:    0 ==>    0.00
--BACnet ID  15 (AI) "                Heating Load"  Fld:  100 ==>   39.22
--BACnet ID 116 (AO) "       Pri. Duct Position CTL"  Fld:    0 ==>    0.00
--BACnet ID  16 (AI) "        Pri. Duct Position FB"  Fld:    0 ==>    0.00
--BACnet ID 117 (AO) "       Aux. Duct Position CTL"  Fld:  103 ==>   40.39
--BACnet ID  17 (AI) "        Aux. Duct Position FB"  Fld:  103 ==>   40.39
--BACnet ID 118 (AO) "        Override Time-Set CTL"  Fld:   60 ==>   60.00
--BACnet ID  18 (AI) "     Override Time Setting FB"  Fld:   60 ==>   60.00
--BACnet ID  19 (AI) "      Override Time Remaining"  Fld:    0 ==>    0.00
--BACnet ID 120 (AO) "      OCC. Cooling Setpnt CTL"  Fld:   74 ==>   74.00
--BACnet ID  20 (AI) "       OCC. Cooling Setpnt FB"  Fld:   74 ==>   74.00
--BACnet ID 121 (AO) "      OCC. Heating Setpnt CTL"  Fld:   70 ==>   70.00
--BACnet ID  21 (AI) "       OCC. Heating Setpnt FB"  Fld:   70 ==>   70.00
--BACnet ID 122 (AO) "  Pri Duct DeadBand Vol. CTL"  Fld:   31 ==>   31.00
--BACnet ID  22 (AI) "   Pri Duct DeadBand Vol. FB"  Fld:   31 ==>   31.00
--BACnet ID 123 (AO) "      Pri Duct Max. Vol. CTL"  Fld:   69 ==>   69.00
--BACnet ID  23 (AI) "       Pri Duct Max. Vol. FB"  Fld:   69 ==>   69.00
--BACnet ID 124 (AO) "      Pri Duct Acc. Vol. CTL"  Fld:    0 ==>    0.00
--BACnet ID  24 (AI) "       Pri Duct Acc. Vol. FB"  Fld:    0 ==>    0.00
--BACnet ID 125 (AO) "   Aux/Term Deadband Vol CTL"  Fld:   10 ==>   10.00
--BACnet ID  25 (AI) "    Aux/Term Deadband Vol FB"  Fld:   10 ==>   10.00
--BACnet ID 126 (AO) "    Aux/Term Cooling Vol CTL"  Fld:    0 ==>    0.00
--BACnet ID  26 (AI) "     Aux/Term Cooling Vol FB"  Fld:    0 ==>    0.00
--BACnet ID 127 (AO) "    UnOcc Cooling Setpnt CTL"  Fld:   93 ==>   88.00
--BACnet ID  27 (AI) "     UnOcc Cooling Setpnt FB"  Fld:   93 ==>   88.00
--BACnet ID 128 (AO) "    UnOcc Heating Setpnt CTL"  Fld:   93 ==>   55.00
```

```
--BACnet ID  28 (AI) "     UnOcc Heating Setpnt FB"  Fld:   93 ==>   55.00
--BACnet ID 129 (AO) "      Cooling Prop. Band CTL"  Fld:  222 ==>  140.00
--BACnet ID  29 (AI) "       Cooling Prop. Band FB"  Fld:  222 ==>  140.00
--BACnet ID 130 (AO) "    Cooling Integ. Rate CTL"  Fld:  222 ==>   13.00
--BACnet ID  30 (AI) "     Cooling Integ. Rate FB"  Fld:  222 ==>   13.00
--BACnet ID 131 (AO) "     Heating Prop. Band CTL"  Fld:  222 ==>  140.00
--BACnet ID  31 (AI) "      Heating Prop. Band FB"  Fld:  222 ==>  140.00
--BACnet ID 132 (AO) "    Heating Integ. Rate CTL"  Fld:  222 ==>   13.00
--BACnet ID  32 (AI) "     Heating Integ. Rate FB"  Fld:  222 ==>   13.00
--BACnet ID 138 (AO) "       Aux/Term Max Vol CTL"  Fld:  103 ==>  103.00
--BACnet ID  38 (AI) "        Aux/Term Max Vol FB"  Fld:  103 ==>  103.00
--BACnet ID 139 (AO) "       Fan Energize Spt CTL"  Fld:    0 ==>    0.00
--BACnet ID  39 (AI) "        Fan Energize Spt FB"  Fld:    0 ==>    0.00
--BACnet ID 401 (BO) "        Generic DO0 Control"  Fld:    0 ==> OFF
--BACnet ID 301 (BI) "         Generic DO0 Status"  Fld:    0 ==> OFF
--BACnet ID 402 (BO) "        Generic DO1 Control"  Fld:    1 ==> ON
--BACnet ID 302 (BI) "         Generic DO1 Status"  Fld:    1 ==> ON
--BACnet ID 403 (BO) "        Generic DO2 Control"  Fld:    1 ==> ON
--BACnet ID 303 (BI) "         Generic DO2 Status"  Fld:    1 ==> ON
--BACnet ID 404 (BO) "        Generic DO3 Control"  Fld:    0 ==> OFF
--BACnet ID 304 (BI) "         Generic DO3 Status"  Fld:    0 ==> OFF
--BACnet ID 405 (BO) "        Generic DO4 Control"  Fld:    1 ==> ON
--BACnet ID 305 (BI) "         Generic DO4 Status"  Fld:    1 ==> ON
--BACnet ID 406 (BO) "        Generic DO5 Control"  Fld:    0 ==> OFF
--BACnet ID 306 (BI) "         Generic DO5 Status"  Fld:    0 ==> OFF
--BACnet ID 407 (BO) "          Occupancy Control"  Fld:    1 ==> UN-OCC
--BACnet ID 307 (BI) "           Occupancy Status"  Fld:    1 ==> UN-OCC
--BACnet ID 408 (BO) "            Standby Control"  Fld:    0 ==> Normal
--BACnet ID 308 (BI) "             Standby Status"  Fld:    0 ==> Normal
--BACnet ID 409 (BO) "             Warmup Control"  Fld:    0 ==> Normal
--BACnet ID 309 (BI) "              Warmup Status"  Fld:    0 ==> Normal
--BACnet ID 411 (BO) "         HEATING PI Control"  Fld:    0 ==> AUTO
--BACnet ID 311 (BI) "            HEATING PI Mode"  Fld:    0 ==> AUTO
--BACnet ID 412 (BO) "         COOLING PI Control"  Fld:    0 ==> AUTO
--BACnet ID 312 (BI) "            COOLING PI Mode"  Fld:    0 ==> AUTO
--BACnet ID 413 (BO) "            HEATING Control"  Fld:    1 ==> HEAT-O
--BACnet ID 313 (BI) "             HEATING Status"  Fld:    1 ==> HEAT-O
--BACnet ID 414 (BO) "            COOLING Control"  Fld:    1 ==> COOL-O
--BACnet ID 314 (BI) "             COOLING Status"  Fld:    0 ==> OFF
--BACnet ID 315 (BI) "          FAN CONTROL Status"  Fld:    0 ==> OFF
--BACnet ID 316 (BI) "             FAN MODE Status"  Fld:    1 ==> FORCED
--BACnet ID 317 (BI) "         Primary Air Heating"  Fld:    0 ==> OFF
--BACnet ID 318 (BI) "         Primary Air Cooling"  Fld:    0 ==> OFF
--BACnet ID 319 (BI) "             Aux Air Cooling"  Fld:    1 ==> COOLIN
--BACnet ID 320 (BI) "             Aux Air Heating"  Fld:    0 ==> OFF
--BACnet ID 321 (BI) "             Setpoint Switch"  Fld:    0 ==> Normal
--BACnet ID 322 (BI) "                PO #6 Action"  Fld:    0 ==> DIRECT
--BACnet ID 323 (BI) "                PO #7 Action"  Fld:    0 ==> DIRECT
--BACnet ID 201 (AV) "       Analog Value 1 (user)"  Fld:    0 ==>    0.00
--BACnet ID 202 (AV) "       Analog Value 2 (user)"  Fld:    0 ==>    0.00
--BACnet ID 203 (AV) "       K-Packets TX/RX Today"  Fld:    0 ==>    0.01
--BACnet ID 204 (AV) "                TX Error Rate"  Fld:    0 ==>    0.00
--BACnet ID 205 (AV) "                RX Error Rate"  Fld:    0 ==>    0.00
```

(S)elect: With Select, you can target a specific point for the Device that you have targeted using the "Devices" menu. This, along with the DEVICE that you have selected, now uniquely defines a point of interest to you. Here is what the MODBUS version of select looks like:

```
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.
```

The BACnet version is slightly different. You have to select the object TYPE and ID for BACnet, to uniquely specify an object. Here is what the BACnet version of select looks like:

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

PNT:  You may select an OBJECT ID to target into.
     Enter an existing BACnet Object TYPE/ID (0 to 4, 1 to 1000) : 0, 17

The object with TYPE 0 and Object ID #17 is now selected.
```

You have to remember that BACnet types are an "enumerated value" (in BACnet-speak). These are, for those who don't remember such minutae:

- 0 = AI
- 1 = AO
- 2 = AV
- 3 = BI
- 4 = BO

(D)etail: will display details associated with the selected point. For a Modbus system, the display might look like this:

```
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 :    67 /    0    Field Value :   67.000
  Field  Lo / Hi Range :  0.000 /   255.000
  Eng. Units: Deg F.
```

The display details associated with a selected point, for BACnet systems, is in a format like this (note that for output points, any controls in the BACnet "priority array" are shown):

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

  BACnet Object ID = 112,  Type = AO
  Object Name: "RM STPT MAX"
  Description: "Room Setpoint Maximum"
…No elements in priority/control array
…BACnet Relinquish Default Value: NULL
  Field Unit / Subunit :    42 /    0    Field Address :40012
  Object Flags / Errors :    3   /  0
  Field In / Out Counts :    124 /    0    Field Value :   79.000
  Field Lo / Hi Range :    0.000 /   255.000
  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 4).

(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
```

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 use only!
2	Automatic Life-Safety	Critical! (Programmatic; no mins)
3	Miscellaneous	
4	Miscellaneous	
5	Critical Equipment Control	Commonly: Demand Limiting
6	Minimum On/Off	Commonly: "Minimum on/off"
7	Custom Programming—High	Custom Programming—High Pri.
8	Manual Operator	Standard "Operator Control"
9	VAV Air Systems	Commonly: VAV "group" control
10	Chiller Plant Control	Usually Chiller Plant Control
11	Area Control	Usually: Area Control (non-VAV)
12	Manual Operator—Low	Infrequently used
13	Miscellaneous	
14	Timed-Override	Overrides a "standard" schedule
15	Time-of-Day Scheduling	Time-of-Day Scheduling
16	Custom Programming—Low	Custom Programming—Low Pri.
N/A	Relinquish Default	Relinquish Default

Note in the "Comments" we have given what the majority of control systems use for their "Default" was for the priorities in question. This is informational only, but might help.

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.

The local-mode terminal, when you issue a command, does so at a specific BACnet priority. You can use the (P)riority: (BACnet ONLY) command to set this priority up. 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
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 :   69 /   0   Field Value :   69.000
 Field Lo / Hi Range : 0.000 /   255.000
 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 :           90  /   0   Field Value :   90.000
  Field Lo / Hi Range : 0.000 /   255.000
  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
    AI   1           Zone Temperature  Counts:      71 =     71.00
    AI   2             Setpoint / AI1  Counts:     255 =     -1.00
    AI   3                Generic AI2  Counts:      53 =     53.00
    AI   4                Generic AI3  Counts:       0 =      0.00
    AI   5                Generic AI4  Counts:      61 =     61.00
    AI   6                Generic AI5  Counts:       0 =      0.00
    AI   7                Generic AI6  Counts:     255 =    255.00
    AI   8                Generic AI7  Counts:     255 =    255.00
    AO 109         Prop. #0 Output CTL  Counts:       0 =      0.00
    AI   9          Prop. #0 Output FB  Counts:       0 =      0.00
    AO 110         Prop. #1 Output CTL  Counts:       0 =      0.00
    AI  10          Prop. #1 Output FB  Counts:       0 =      0.00
    AI  14                Cooling Load  Counts:       0 =      0.00
    AI  15                Heating Load  Counts:     100 =     39.22
    AO 116      Pri. Duct Position CTL  Counts:       0 =      0.00
    AI  16       Pri. Duct Position FB  Counts:       0 =      0.00
    AO 117      Aux. Duct Position CTL  Counts:     103 =     40.39
    AI  17       Aux. Duct Position FB  Counts:     103 =     40.39
    AO 118       Override Time-Set CTL  Counts:      60 =     60.00
    AI  18   Override Time Setting FB  Counts:      60 =     60.00
    AI  19    Override Time Remaining  Counts:       0 =      0.00
    DO 401         Generic DO0 Control  Counts:  22 (.0) =      OFF
    DI 301          Generic DO0 Status  Counts:  22 (.0) =      OFF
    DO 402         Generic DO1 Control  Counts:  22 (.1) =       ON
    DI 302          Generic DO1 Status  Counts:  22 (.1) =       ON
    DO 403         Generic DO2 Control  Counts:  22 (.2) =       ON
    DI 303          Generic DO2 Status  Counts:  22 (.2) =       ON
    DO 404         Generic DO3 Control  Counts:  22 (.3) =      OFF
    DI 304          Generic DO3 Status  Counts:  22 (.3) =      OFF
    DO 405         Generic DO4 Control  Counts:  22 (.4) =       ON
    DI 305          Generic DO4 Status  Counts:  22 (.4) =       ON
    DO 406         Generic DO5 Control  Counts:  22 (.5) =      OFF
    DI 306          Generic DO5 Status  Counts:  22 (.5) =      OFF
    DO 407           Occupancy Control  Counts:   1 (.0) =   UN-OCC
    DI 307            Occupancy Status  Counts:   1 (.0) =   UN-OCC
    DO 408             Standby Control  Counts:   0 (.0) =   Normal
    DI 308              Standby Status  Counts:   0 (.0) =   Normal
    DO 409             Warmup Control  Counts:   1 (.5) =   Normal
    DI 309              Warmup Status  Counts:   1 (.5) =   Normal
    DO 411          HEATING PI Control  Counts:   0 (.5) =     AUTO
    DI 311             HEATING PI Mode  Counts:   0 (.5) =     AUTO
    DO 412          COOLING PI Control  Counts:   0 (.4) =     AUTO
    DI 312             COOLING PI Mode  Counts:   0 (.4) =     AUTO
    DO 413             HEATING Control  Counts:   1 (.0) =   HEAT-O
```

```
    DI 313            HEATING Status  Counts:   1 (.0) =   HEAT-O
    DO 414           COOLING Control  Counts:   1 (.0) =   COOL-O
    DI 314            COOLING Status  Counts:   0 (.0) =      OFF
    DI 315         FAN CONTROL Status  Counts:   0 (.0) =      OFF
    DI 316            FAN MODE Status  Counts:   1 (.0) =   FORCED
    DI 317       Primary Air Heating  Counts:   0 (.0) =      OFF
    DI 318       Primary Air Cooling  Counts:   0 (.0) =      OFF
    DI 319           Aux Air Cooling  Counts:   1 (.0) =   COOLIN
    DI 320           Aux Air Heating  Counts:   0 (.0) =      OFF
    DI 321           Setpoint Switch  Counts:   0 (.0) =   Normal
```

(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 #1, Operation #1
 -- Read MEM command, Trunk #1, to SM2 #1
--TO Trunk 1: 01 01 80 19 20 BB
-FRM Trunk 1: 02 01 19 20 47 FF 35 00 3D 00 FF FF 00 16 00 00 01 00 08 00 00 64 00
67 00 3C 30 0A 13 45 <Valid>
    AI   1          Zone Temperature  Counts:      71 =     71.00
    AI   2            Setpoint / AI1  Counts:     255 =     -1.00
    AI   3               Generic AI2  Counts:      53 =     53.00
…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 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

This is something that you will probably want to do if you have DDC or MUX devices on your system. You also might want to make a template for VAV, FanCoil, or HeatPump devices if you want to "trim" unnecessary points out of the system, or change names to those that your users are familiar with. In these cases, you will download various "TPLx_yyy.CSV" files to the gateway. More on this, later.

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 receive 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.

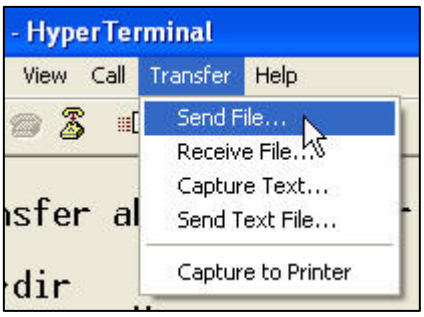
Sending a file to the Gateway (uploading):

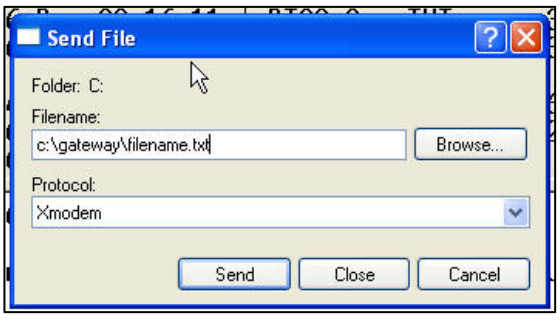
From the dos prompt, you must type "UP filename" (filename being the name of the file to send with extension). The response will look like the following.

```
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.





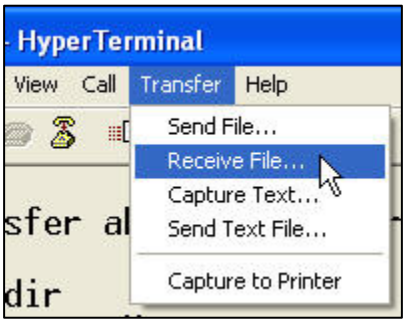
Receiving a file from the Gateway (downloading):

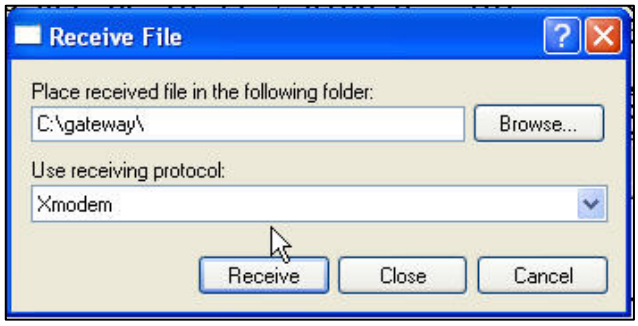
From the dos prompt, you must type "DOWN filename" (filename being the name of the file to receive with extension). The response will look like the following.

```
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 (Note 1)
MAXIMUM number of input registers read at once (CMD #4) is 32   (Note 1)
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)
```

Note 1: We suggest that 16 be used as a maximum if there are quality issues with communications (e.g., radio links), to keep the packet size down.

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.

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 suggestion!

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.

A Few Words About Controls

The Staefa Smart-II devices are not state-of-the-art: they were designed in the early 1980's. As such, their controls 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 Smart-II controller, but that value is also written to EPROM. This is "safe", because the last thing you wrote to a Smart-II it remembers, and that value is what is used when it has a power-bump or failure and reboots. But, the EPROM used in this design 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. 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 Fan mode for a VAV is really a 6-state digital: AUTO, Forced ON, Forced OFF, Forced to DeadBand, Forced to Heating, and Forced to Cooling. You have several "force" BO points (On, Off, Deadband, Heating, Cooling), and if it is in NONE of the "force" modes, then it is in AUTOMATIC. This is very important to remember: Staefa 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 Smart-II 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 the Smart-II's, but it has been known to cause them to reset.

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.

So how to do this force/auto? In MODBUS systems, there are eight "force/auto" points (coils 51 through 58, for DO-0 through DO-5, AO-6, and AO-7, respectively) that you must set to 1 to set the physical I/O point into "forced" mode. Then you can do your controls to the control points (coils 1 through 6, and output register 40009 and 40010, respectively). When you are done, and want to go back to automatic, then set coils 51 to 58 back to 0, and the point(s) will go back to automatic mode. Now, in BACnet systems, this is the default operation, also. But some people may want to use the BACnet priority system, so that there are no "extra" points. If so, the GATEWAY.INI file should be modified to have the "OVERRIDE_PRI" line added, and set it to the lowest BACnet priority value that you will allow to do "forced" controls. This means that any command from the host system with a priority from 1 to this value will give the I/O point a "force" before doing the actual control. And, any command from the host system that has a BACnet priority lower than this (up to priority 16), will put the point in "auto"—so that the "local controls" then take over (if any are attached to that I/O point).

A Few Words About VAV Flows

The Staefa Smart-II VAV device has two pressure sensor inputs (velocity probe "hi" and "lo"), and that raw data is returned to any requestor (the old NCRS, the Hand-Held, PC-Tool, or this Gateway). There is a setup parameter in the VAV box for the "area" of the ductwork. The Smart-II VAV controller does NOT compute the flow, in engineering units, from these sensors and parameters. The NCRS, hand-held device, PC-Tool, and now, this Gateway, do that computation.

There are actually two flows that are computed. One is the "primary duct" flowrate, the second is the "secondary duct" flowrate (usually not used). These are computed by the gateway and are available as AI object #95 and AI object #96, respectively. These two points are in CFM, and require that the VAV box have the correct area set up in the Duct Area parameters in the VAV box itself (these are at locations 70 and 71, respectively). Note that, if the parameter for the auxiliary flow is not set up in the Smart-II VAV device, the primary duct parameter is used.

You may use AI #95 for the primary flow, in CFM, just as if it were a "real point", for the primary air flow rate. If there is a secondary velocity probe, then you may use AI#96 for that computed value.

TEMPLATE Files

There are five kinds of Staefa Smart-II's: VAVs, Fan Coils, Heat Pumps, "DDC", and "MUX". The first three have a standard "point map". The last two are semi-custom. You most certainly will want to download a custom template for DDC and MUX devices, simply because of the custom ranges that each device can have.

For VAV, Fan Coil, and Heat Pump devices, you might want to use the "default" templates that are generated by the gateway, since the gateway generates the point with proper ranges and units. What the gateway can not do is to generate "names" for the input and output points (it generates names like "Generic AI #4", and "Digital Output #2"; you probably want these things to be named meaningful things like "Corridor Temperature" and "Room #422 Lighting".

VAV Template example

Let's take a look at what a template would be for a VAV box, which is the most common Staefa Smart-II device you will encounter. The "standard points" which are made by the gateway (as defaults) are as follows (taken from a "Watch" trunk capture):

```
--BACnet ID   1 (AI) "            Zone Temperature"  Fld:   82 ==>   82.00
--BACnet ID   2 (AI) "              Setpoint / AI1"  Fld:  255 ==>   -1.00
--BACnet ID   3 (AI) "                 Generic AI2"  Fld:   98 ==>   98.00
--BACnet ID   4 (AI) "                 Generic AI3"  Fld:    4 ==>    4.00
--BACnet ID   5 (AI) "                 Generic AI4"  Fld:  255 ==>  255.00
--BACnet ID   6 (AI) "                 Generic AI5"  Fld:  255 ==>  255.00
--BACnet ID   7 (AI) "                 Generic AI6"  Fld:  255 ==>  255.00
--BACnet ID   8 (AI) "                 Generic AI7"  Fld:  255 ==>  255.00
--BACnet ID 109 (AO) "          Prop. #0 Output CTL"  Fld:    0 ==>    0.00
--BACnet ID   9 (AI) "           Prop. #0 Output FB"  Fld:    0 ==>    0.00
--BACnet ID 110 (AO) "          Prop. #1 Output CTL"  Fld:    0 ==>    0.00
--BACnet ID  10 (AI) "           Prop. #1 Output FB"  Fld:    0 ==>    0.00
--BACnet ID  14 (AI) "                 Cooling Load"  Fld:  100 ==>  100.00
--BACnet ID  15 (AI) "                 Heating Load"  Fld:    0 ==>    0.00
--BACnet ID 116 (AO) "       Pri. Duct Position CTL"  Fld:   84 ==>   84.00
--BACnet ID  16 (AI) "        Pri. Duct Position FB"  Fld:   84 ==>   84.00
--BACnet ID 117 (AO) "       Aux. Duct Position CTL"  Fld:    0 ==>    0.00
--BACnet ID  17 (AI) "        Aux. Duct Position FB"  Fld:    0 ==>    0.00
--BACnet ID 118 (AO) "        Override Time-Set CTL"  Fld:   60 ==>   60.00
--BACnet ID  18 (AI) "     Override Time Setting FB"  Fld:   60 ==>   60.00
--BACnet ID  19 (AI) "      Override Time Remaining"  Fld:    0 ==>    0.00
--BACnet ID 120 (AO) "      OCC. Cooling Setpnt CTL"  Fld:   74 ==>   74.00
```

```
--BACnet ID  20 (AI) "      OCC. Cooling Setpnt FB"  Fld:    74 ==>   74.00
--BACnet ID 121 (AO) "     OCC. Heating Setpnt CTL"  Fld:    70 ==>   70.00
--BACnet ID  21 (AI) "      OCC. Heating Setpnt FB"  Fld:    70 ==>   70.00
--BACnet ID 122 (AO) "  Pri Duct DeadBand Vol. CTL"  Fld:     4 ==>    4.00
--BACnet ID  22 (AI) "   Pri Duct DeadBand Vol. FB"  Fld:     4 ==>    4.00
--BACnet ID 123 (AO) "      Pri Duct Max. Vol. CTL"  Fld:    84 ==>   84.00
--BACnet ID  23 (AI) "       Pri Duct Max. Vol. FB"  Fld:    84 ==>   84.00
--BACnet ID 124 (AO) "      Pri Duct Acc. Vol. CTL"  Fld:     4 ==>    4.00
--BACnet ID  24 (AI) "       Pri Duct Acc. Vol. FB"  Fld:     4 ==>    4.00
--BACnet ID 125 (AO) "   Aux/Term Deadband Vol CTL"  Fld:     8 ==>    8.00
--BACnet ID  25 (AI) "    Aux/Term Deadband Vol FB"  Fld:     8 ==>    8.00
--BACnet ID 126 (AO) "    Aux/Term Cooling Vol CTL"  Fld:     0 ==>    0.00
--BACnet ID  26 (AI) "     Aux/Term Cooling Vol FB"  Fld:     0 ==>    0.00
--BACnet ID 127 (AO) "    UnOcc Cooling Setpnt CTL"  Fld:    10 ==>   85.00
--BACnet ID  27 (AI) "     UnOcc Cooling Setpnt FB"  Fld:    10 ==>   85.00
--BACnet ID 128 (AO) "    UnOcc Heating Setpnt CTL"  Fld:    10 ==>   50.00
--BACnet ID  28 (AI) "     UnOcc Heating Setpnt FB"  Fld:    10 ==>   50.00
--BACnet ID 129 (AO) "      Cooling Prop. Band CTL"  Fld:   222 ==>  140.00
--BACnet ID  29 (AI) "       Cooling Prop. Band FB"  Fld:   222 ==>  140.00
--BACnet ID 130 (AO) "     Cooling Integ. Rate CTL"  Fld:   222 ==>   13.00
--BACnet ID  30 (AI) "      Cooling Integ. Rate FB"  Fld:   222 ==>   13.00
--BACnet ID 131 (AO) "      Heating Prop. Band CTL"  Fld:   222 ==>  140.00
--BACnet ID  31 (AI) "       Heating Prop. Band FB"  Fld:   222 ==>  140.00
--BACnet ID 132 (AO) "     Heating Integ. Rate CTL"  Fld:   222 ==>   13.00
--BACnet ID  32 (AI) "      Heating Integ. Rate FB"  Fld:   222 ==>   13.00
--BACnet ID 138 (AO) "        Aux/Term Max Vol CTL"  Fld:    54 ==>   54.00
--BACnet ID  38 (AI) "         Aux/Term Max Vol FB"  Fld:    54 ==>   54.00
--BACnet ID 139 (AO) "        Fan Energize Spt CTL"  Fld:     0 ==>    0.00
--BACnet ID  39 (AI) "         Fan Energize Spt FB"  Fld:     0 ==>    0.00
--BACnet ID 401 (BO) "         Generic DO0 Control"  Fld:     1 ==> ON
--BACnet ID 301 (BI) "          Generic DO0 Status"  Fld:     1 ==> ON
--BACnet ID 402 (BO) "         Generic DO1 Control"  Fld:     0 ==> OFF
--BACnet ID 302 (BI) "          Generic DO1 Status"  Fld:     0 ==> OFF
--BACnet ID 403 (BO) "         Generic DO2 Control"  Fld:     0 ==> OFF
--BACnet ID 303 (BI) "          Generic DO2 Status"  Fld:     0 ==> OFF
--BACnet ID 404 (BO) "         Generic DO3 Control"  Fld:     0 ==> OFF
--BACnet ID 304 (BI) "          Generic DO3 Status"  Fld:     0 ==> OFF
--BACnet ID 405 (BO) "         Generic DO4 Control"  Fld:     0 ==> OFF
--BACnet ID 305 (BI) "          Generic DO4 Status"  Fld:     0 ==> OFF
--BACnet ID 406 (BO) "         Generic DO5 Control"  Fld:     0 ==> OFF
--BACnet ID 306 (BI) "          Generic DO5 Status"  Fld:     0 ==> OFF
--BACnet ID 407 (BO) "           Occupancy Control"  Fld:     1 ==> UN-OCC
--BACnet ID 307 (BI) "            Occupancy Status"  Fld:     1 ==> UN-OCC
--BACnet ID 408 (BO) "              Standby Control"  Fld:     0 ==> Normal
--BACnet ID 308 (BI) "               Standby Status"  Fld:     0 ==> Normal
--BACnet ID 409 (BO) "              Warmup Control"  Fld:     0 ==> Normal
--BACnet ID 309 (BI) "               Warmup Status"  Fld:     0 ==> Normal
--BACnet ID 411 (BO) "          HEATING PI Control"  Fld:     0 ==> AUTO
--BACnet ID 311 (BI) "             HEATING PI Mode"  Fld:     0 ==> AUTO
--BACnet ID 412 (BO) "          COOLING PI Control"  Fld:     0 ==> AUTO
--BACnet ID 312 (BI) "             COOLING PI Mode"  Fld:     0 ==> AUTO
--BACnet ID 413 (BO) "             HEATING Control"  Fld:     0 ==> OFF
--BACnet ID 313 (BI) "              HEATING Status"  Fld:     0 ==> OFF
--BACnet ID 414 (BO) "             COOLING Control"  Fld:     0 ==> OFF
--BACnet ID 314 (BI) "              COOLING Status"  Fld:     1 ==> COOL-O
--BACnet ID 315 (BI) "          FAN CONTROL Status"  Fld:     0 ==> OFF
--BACnet ID 316 (BI) "             FAN MODE Status"  Fld:     1 ==> FORCED
--BACnet ID 317 (BI) "         Primary Air Heating"  Fld:     0 ==> OFF
--BACnet ID 318 (BI) "         Primary Air Cooling"  Fld:     0 ==> OFF
--BACnet ID 319 (BI) "             Aux Air Cooling"  Fld:     0 ==> OFF
--BACnet ID 320 (BI) "             Aux Air Heating"  Fld:     1 ==> COOLIN
--BACnet ID 321 (BI) "             Setpoint Switch"  Fld:     0 ==> Normal
--BACnet ID 322 (BI) "                PO #6 Action"  Fld:     0 ==> DIRECT
--BACnet ID 323 (BI) "                PO #7 Action"  Fld:     0 ==> DIRECT
--BACnet ID 201 (AV) "       Analog Value 1 (user)"  Fld:     0 ==>    0.00
--BACnet ID 202 (AV) "       Analog Value 2 (user)"  Fld:     0 ==>    0.00
--BACnet ID 203 (AV) "       K-Packets TX/RX Today"  Fld:     0 ==>    0.05
--BACnet ID 204 (AV) "               TX Error Rate"  Fld:     0 ==>    0.00
```

```
--BACnet ID 205 (AV) "              RX Error Rate"  Fld:    0 ==>    0.00
```

This is all the POSSIBLE points on the VAV controller (no matter what kind). Many points will not be used for one type of VAV, and so the default is "overkill". Plus it has "generic" names. Many people don't want extraneous I/O, and that drives them to create templates; the choice is yours.

Note that the above display shows ALL the valid points that can come from this particular VAV device. That does not mean that ALL these points are used, nor does it mean that you should map ALL the points. Some can never (or should never change), such as points #321 and #322 (the direct/reverse action of the pulse output points), etc. There are perhaps calibration-only points that SHOULD not change (and if they do, it is because the hardware has changed)--it is recommended that you NOT put these points in the database, so that the user is not tempted to try to mess with them from their control room La-Z-Boy recliner. It is our recommendation to trim any unnecessary and unused points out of the templates.

Let's use a real-world example:

Say that this is a single-duct fan-powered terminal VAV with hot-water reheat. From the Staefa documentation on VAV controllers, you know that Input #0 is the zone temperature, input #1 is unused (the thermostat does not have a setpoint dial), and input #3 is the velocity probe. From this documentation, you know that Output #2 is the fan, output #6 is for modulating terminal reheat, and outputs #0 and #1 are the open and close signals (respectively) for the primary cooling damper. It also tells you that Loop #0 is for cooling, and Loop #1 is for heating. You know from the drawings of the project that there is only a primary duct (no secondary duct), and that this VAV box is installed in Room 422. Additionally, there are two extra sensors wired in to this device: input #2 is a humidity sensor; all other inputs are unused. You could define a "template" for this device, which would make all the necessary points for you and none of the unused points, plus it would have the correct names. An example might be:

```
// VAV Template (example)
//
// Maintain the ORDER of these lines.  Line Deletions are OK; Additions are NOT recommended
//
NA, Room 422 VAV box, Room 422 VVV-type Controller
//
BO, 18, Pri. Air Cooling, OFF, COOLIN,  , Primary Air Cooling
BO, 17, Pri. Air Heating, OFF, HEATIN,  , Primary Air Heating
BO, 16, Fan Mode, AUTO, MANUAL,  , Fan Mode Status
BO, 15, Fan Status, OFF, ON,  , Fan Status
BO, 14, Cooling State, OFF, COOLIN,  , Cooling State
BO, 13, Heating State, OFF, HEATIN,  , Heating State
BO, 12, Cooling Mode, AUTO, MANUAL,  , Cooling Loop; Auto/Manual Mode
BO, 11, Heating Mode, AUTO, MANUAL,  , Heating Loop; Auto/Manual Mode
BO, 9, Morning Warm-up, Normal, WARMUP,  , Morning Warm-up
BO, 8, Standby, Normal, STNDBY,  , Zone Standby
BO, 7, OCCUPANCY, OCC, Un-Occ,  , Zone Occupancy
BO, 3, Fan, OFF, ON,  , Fan Output
BO, 2, Damper Closed, OFF, CLOSE,  , Damper Close Output
BO, 1, Damper Open, OFF, OPEN,  , Damper Open Output
//
AI, 95, Primary Air Flow, 0.000, 10000.00, CFM, Computed Air Flow
AO, 74, Loop #2 Prop Band, 0.000, 0.000, %, Loop/Block #2; Proportional Band
AO, 73, Loop #1 Prop Band, 0.000, 0.000, %, Loop/Block #1; Proportional Band
AO, 72, Loop #0 Prop Band, 39.000, 100.710, degF, Loop/Block #0; Proportional Band
```

```
AO, 39, Fan Energize Setpoint, 0.000, 255.000, deg F, Fan Energization Setpoint
AO, 32, Heating Integ. Rate, 0.000, 255.000, mins, Heating Integration Rate
AO, 31, Heating Prop. Band, 0.000, 255.000, %, Heating Proportional Band
AO, 30, Cooling Integ. Rate, 0.000, 255.000, mins, Cooling Integration Rate
AO, 29, Cooling Prop. Band, 0.000, 255.000, %, Cooling Proportional Band
AO, 28, UnOcc. Heating Setpoint, 0.000, 255.000, deg F, Un-Occupied Heating Setpoint
AO, 27, UnOcc. Cooling Setpoint, 0.000, 255.000, deg F, Un-Occupied Cooling Setpoint
AO, 24, Pri Duct Acc Volume, 0.000, 0.000, %, Primary Duct Accessory Volume
AO, 23, Pri Duct Max Volume, 0.000, 0.000, %, Primary Duct Maximum Volume
AO, 22, Pri Duct DB Volume, 0.000, 0.000, %, Primary Duct Deadband Volume
AO, 21, Occ. Heating Setpoint, 0.000, 255.000, deg F, Occupied Heating Setpoint
AO, 20, Occ. Cooling Setpoint, 0.000, 255.000, deg F, Occupied Cooling Setpoint
AO, 18, Override Time, 0.000, 255.000, Mins, Override Time Remaining
AO, 16, Primary Duct, 0.000, 255.000, %, Primary Duct
AO, 15, Heating Load,0.000, 255.000, %, Heating Load
AO, 14, Cooling Load, 0.000, 255.000, %, Cooling Load
AO, 9, Reheat Output #6, 0.000, 255.000, %, Room 422 Reheat; PO #6 Output
AI, 4, Velocity Flow, 0.000, 0.000, %, Room 422 Velocity
AI, 3, Room Humidity, 0.000, 0.000, %, Room 422 Humidity
AI, 1, Zone Temperature, 39.000, 100.710, deg F, Room 422 Zone Temperature
```

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

1. It is for ONE VAV device only, so it will have a unique TPL name (e.g., TPL1_22.CSV, if it was Device #22 on trunk #1).

2. It does NOT do anything for unused inputs (2, 5, 6, or 7) or outputs (DO 3, 4, 5, and PO 7).

3. It does NOT create any points for a secondary damper (output, control setpoints, etc.) since there is none.

4. 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).

5. All "AO" and "BO" lines in the template file end up generating TWO points in the gateway: the control point itself (the "AO" or "BO"), and the feedback point ("AI" or "BI") with the exact same address. This is important to remember, and may affect how you program your host. An output point will always read back the true and current value; but some systems rely on feedback from an AI or BI for verification of control—you must be aware of how your host system works in the fashion of control verification and alarming.

6. The "NA" line is active in this template, so the device will be named as such. This is not usually used, as most people retrieve the CONFIG.TXT file from the Gateway after the autodiscover(s) have been done and saved, and edit the names of the devices in that file.

Centaurus Prime supplies some generic templates you can use for VAV, Fan Coil, and Heat Pump devices. Contact us and we can e-mail you these "basic" templates; you can then edit them to specify the exact point names, engineering units, and whatever else you wish to modify.

DDC Device Example

The DDC devices are much more complicated, since they have three generic "loops" (called "blocks" in a MUX device, by the way). These control loops are generic and general purpose—they can be used for everything from AHU control to clean-room control. The big difference is that the DDC blocks are "scaled" using real-number parameters in the *SCALING E2PROM* (rather than the diabolical "range blocks" of VAV/HP/FC devices). Because of this, there are many more possible points in the DDC template. For example, there is a "Base" (or zero) and a "Gain", (or multiplier) for each possible input, and each output has maximum/minimum values and start/stop percentages. You will use relatively few of these, really. As an assist in figuring out what to use and what points are meaningful to include (and what are not!) we have developed a program, described in the next chapter, to translate the Staefa "listings" of DDC and MUX definitions into these template files.

Downloading Templates

You may need to download to the Gateway any of these "custom" templates that will be used in your building. Say that you had a system with a couple Fan Coil devices and many DDCs. You would most certainly want to create a template for each DDC device, and do it with the Template Generator that is described in the next chapter. The Fan Coil units you may wish to leave automatically generated, but for consistency, you may wish to also use templates for them, too.

You would, after creating them, have to download the following templates to the Gateway. The templates are named automatically by the Template Generator program, but have a simple format:

TPLx_yyy.CSV where "x" is the trunk number, "yyy" is the controller number.

This means that Staefa DDC device #23 on trunk #4 has a template file called TPL4_23.CSV.

Note the extension: CSV is short for "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.

Centaurus Prime supplies default TEMPLATE files as "samples" for VAV, FC, and HP devices. We have several DDC and MUX "samples" that may assist you, too. You can obtain them by contacting us, either by e-mail or telephone, and we will e-mail any that you need back to you.

We'd like to leave you with our own philosophy about templates:

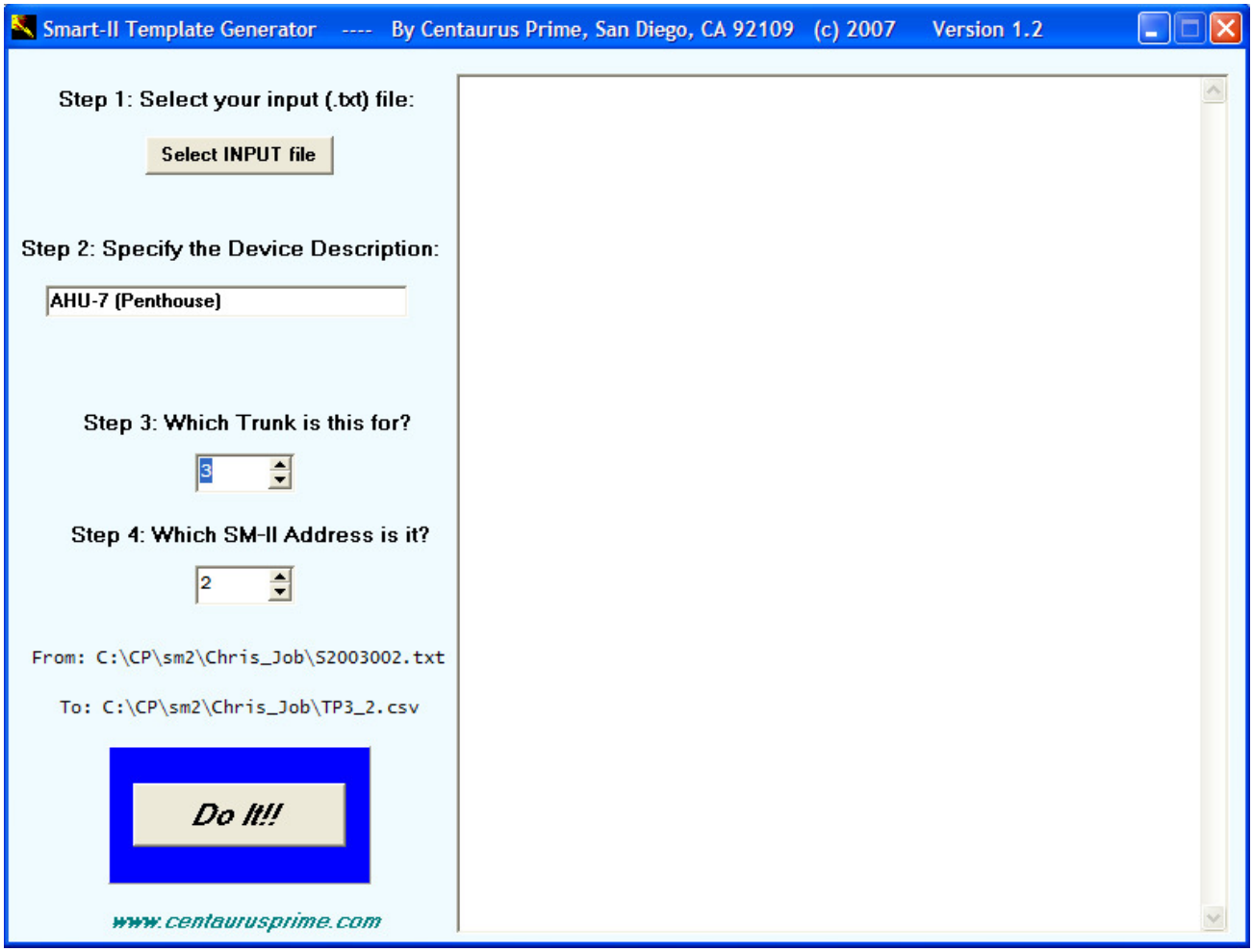
One philosophy is to put all points in the Gateway (i.e., keep these files just as they are and download them to the Gateway), and just NOT map the ones that you don't want. The other philosophy is to DELETE the points you will never want to expose from these template files, before you download them 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.

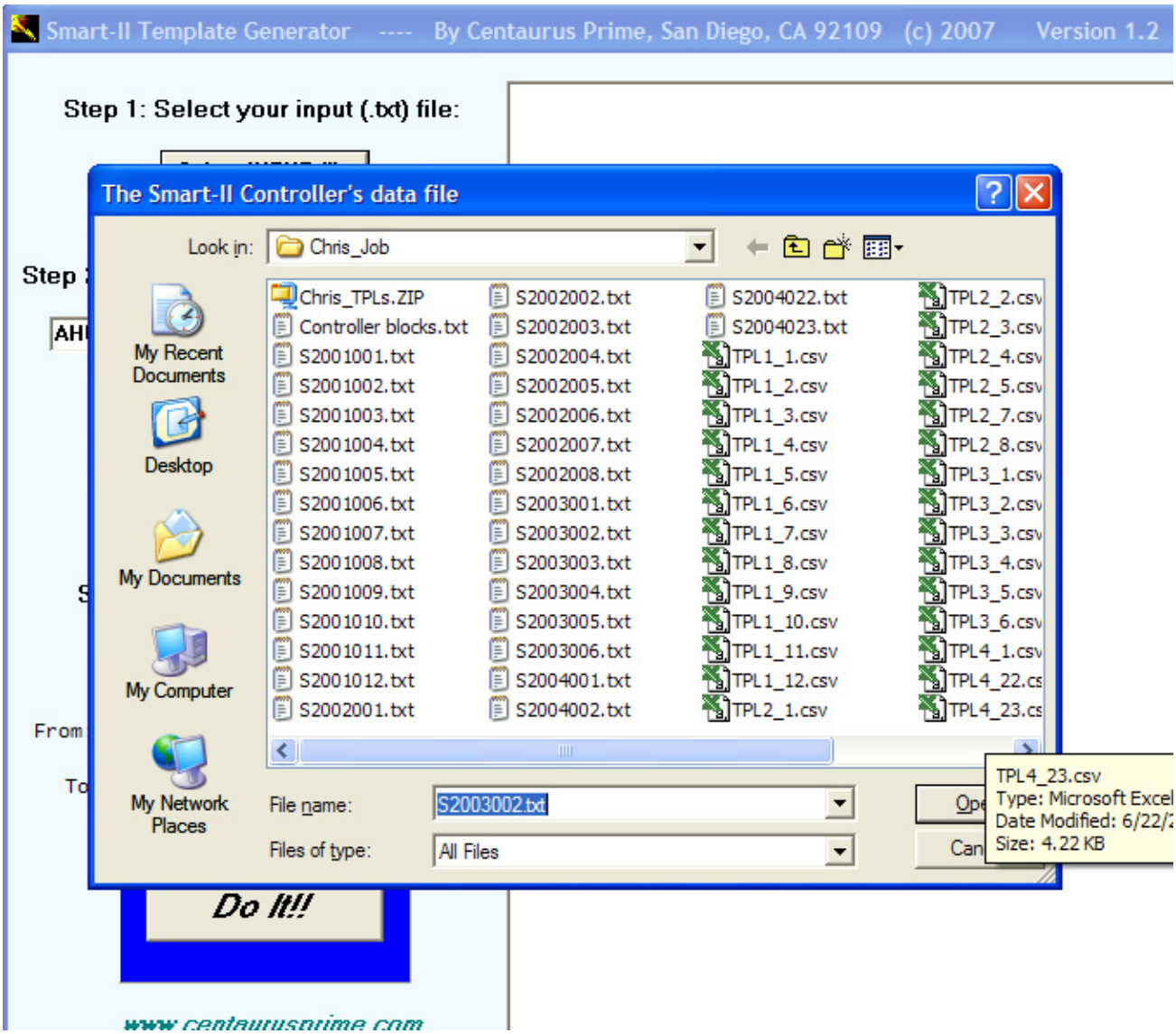
Chapter 3

Template Generator Program

The Template Generator Program is a Windows™ program that allows you to take a "list" or "text" file from a Staefa system and create a template, automatically! Its main screen looks like this:



The program does "lead you by the hand". Step 1 is a "button" that you press. When you press it, the following screen pops up to allow you to select the Staefa listing file that you will use for the template that you want to create:



Input Files (example)

These files created by the Staefa system are usually "*.lst" files (that is, they have the extension ".lst"). They have also been created as "*.txt" files. In this example, the files from the Staefa system are things like "S2001007.txt", which is System 2, Trunk #1, and Device #7. An example of what one of these files might look like is the following:

```
File Name: C:\MS2000\CONDO\S2002007.lst
Site Name: 100 East Huron
Controller Type: SMART II DDC controller
Data Type: EEPROM values
Date: 5/16/2007
Time: 11:54:45
```

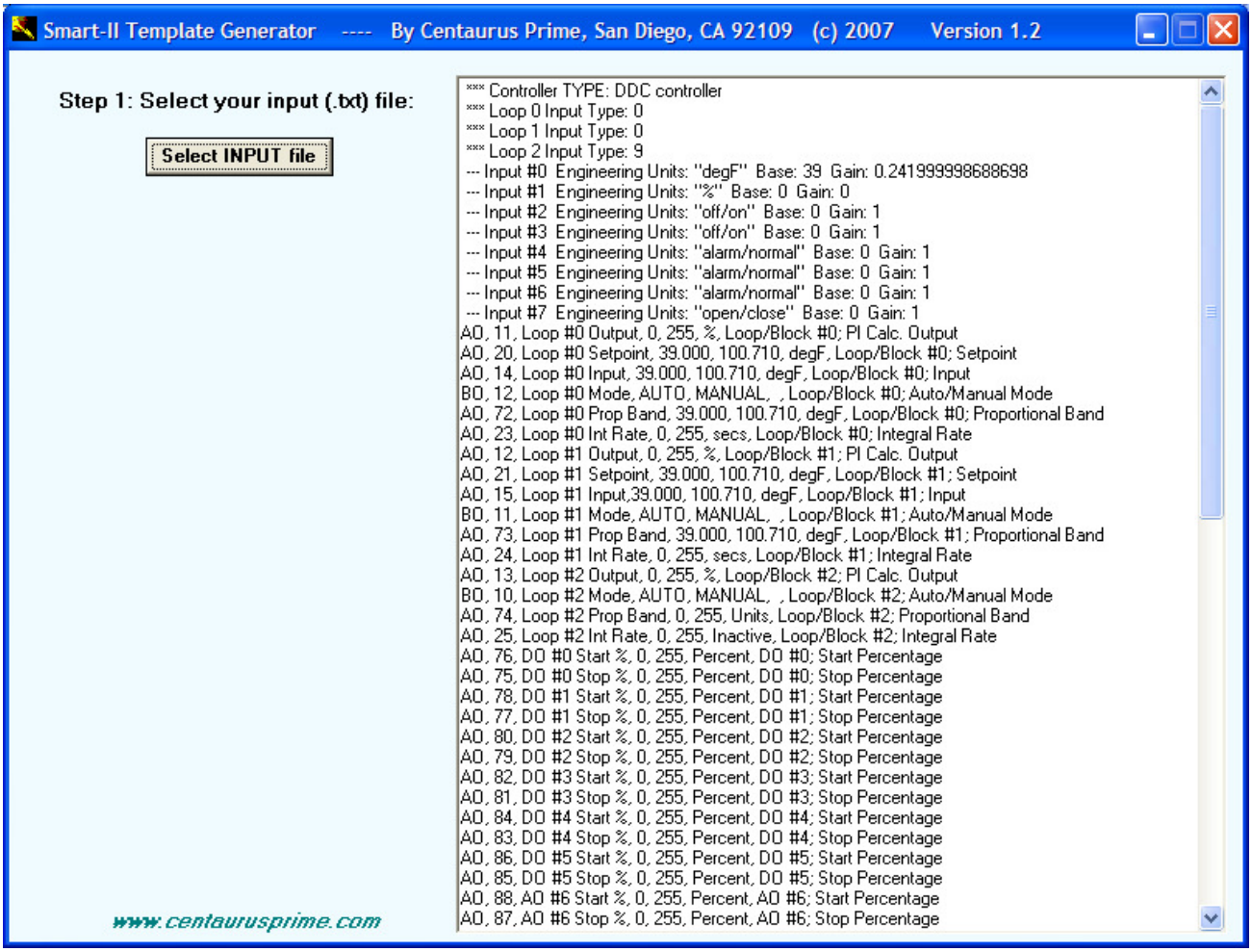
```
     Node Number: 0
     Trunk Number: 2
     Address: 7

Loop 0
     20 - Loop 0 PI calc               0.0        %
     21 - Loop 0 setpoint              1.009      iwc
     22 - Loop 0 input                 0.0        iwc
     23 - Loop 0 auto/manual           Automatic
     24 - Loop 0 band select           1.256 -24.99  iwc
     25 - Loop 0 prop band             4.806      iwc
     26 - Loop 0 int rate              60         secs
     27 - Loop 0 stpnt type            Host       1.009  iwc
     28 - Loop 0 input type            Input #7
     29 - Loop 0 action                Reverse
Loop 1
     30 - Loop 1 PI calc               0.0        %
     31 - Loop 1 setpoint              Not Defined
     32 - Loop 1 input                 Not Defined
     33 - Loop 1 auto/manual           Automatic
     34 - Loop 1 band select           Pass through
     35 - Loop 1 prop band             Pass through
     36 - Loop 1 int rate              Inactive
     37 - Loop 1 stpnt type            Not Defined
     38 - Loop 1 input type            Not Defined
     39 - Loop 1 action                Direct
Loop 2
     40 - Loop 2 PI calc               0.0        %
     41 - Loop 2 setpoint              Not Defined
     42 - Loop 2 input                 Not Defined
     43 - Loop 2 auto/manual           Automatic
     44 - Loop 2 band select           Pass through
     45 - Loop 2 prop band             Pass through
     46 - Loop 2 int rate              Inactive
     47 - Loop 2 stpnt type            Not Defined
     48 - Loop 2 input type            Not Defined
     49 - Loop 2 action                Direct
On-Off Automatic
     50 - DO 0                         Automatic
     51 - DO 1                         Automatic
     52 - DO 2                         Automatic
     53 - DO 3                         Automatic
     54 - DO 4                         Automatic
     55 - DO 5                         Automatic
     56 - PO 6                         Automatic
     57 - PO 7                         Automatic
     58 - Application Status           Automatic
DO 0-1 Definition
     60 - DO 0 type                    On/Off
     61 - DO 0 loop asgnmt             Not Defined
     62 - DO 0 start %                 20 %
     63 - DO 0 stop %                  10 %
     64 - DO 0 pulse rate              10 sec
     65 - DO 1 type                    On/Off
     66 - DO 1 loop asgnmt             Not Defined
     67 - DO 1 start %                 70 %
     68 - DO 1 stop %                  60 %
     69 - DO 1 pulse rate              10 sec
DO 2-3 Definition
     70 - DO 2 type                    On/Off
     71 - DO 2 loop asgnmt             Not Defined
     72 - DO 2 start %                 20 %
     73 - DO 2 stop %                  10 %
     74 - DO 2 pulse rate              10 sec
     75 - DO 3 type                    On/Off
     76 - DO 3 loop asgnmt             Not Defined
```

```
     77 - DO 3 start %                10 %
     78 - DO 3 stop %                 20 %
     79 - DO 3 pulse rate             10 sec
DO 4-5 Definition
     80 - DO 4 type                   On/Off
     81 - DO 4 loop asgnmt            Not Defined
     82 - DO 4 start %                70 %
     83 - DO 4 stop %                 60 %
     84 - DO 4 pulse rate             10 sec
     85 - DO 5 type                   On/Off
     86 - DO 5 loop asgnmt            Not Defined
     87 - DO 5 start %                0 %
     88 - DO 5 stop %                 0 %
     89 - DO 5 pulse rate             10 sec
PO #6-7 Definition
     90 - PO 6 loop asgnmt            0
     91 - PO 6 start %                0 %
     92 - PO 6 stop %                 100 %
     93 - PO 6 min voltage            10 %
     94 - PO 6 max voltage            100 %
     95 - PO 7 loop asgnmt            Not Defined
     96 - PO 7 start %                0 %
     97 - PO 7 stop %                 0 %
     98 - PO 7 min voltage            0 %
     99 - PO 7 max voltage            100 %
Input Action
     A0 - Input 0 action              Reverse
     A1 - Input 1 action              Reverse
     A2 - Input 2 action              Direct
     A3 - Input 3 action              Reverse
     A4 - Input 4 action              Direct
     A5 - Input 5 action              Direct
     A6 - Input 6 action              Direct
     A7 - Input 7 action              Direct
     A8 - PO 6 action                 Direct, Linear
     A9 - PO 7 action                 Direct, Linear
Configuration
     B0 - Controller addr             7
     B1 - Baud rate                   1200
     B2 - Model firmware              Entire File 2.0 04/10/91
     B3 - Control group               240
     B4 - Offline timer               Inactive
     B5 - Shutdown                    Active
     B6 - Integral timer              1-255 secs
     B7 - Loop 0 limit                Disable
     B8 - Loop 0 low limit            Disabled
     B9 - Loop 0 high limit           Disabled
Input Bases
     C0 - Input #0 base               0.0
     C1 - Input #1 base               0.0
     C2 - Input #2 base               0.0
     C3 - Input #3 base               0.0
     C4 - Input #4 base               0.0
     C5 - Input #5 base               0.0
     C6 - Input #6 base               0.0
     C7 - Input #7 base               0.0
Input Gains
     D0 - Input #0 gain               1.000
     D1 - Input #1 gain               0.0
     D2 - Input #2 gain               1.000
     D3 - Input #3 gain               1.000
     D4 - Input #4 gain               1.000
     D5 - Input #5 gain               1.000
     D6 - Input #6 gain               1.000
     D7 - Input #7 gain               0.010
Input Units
     E0 - Input #0 units
```

```
E1 - Input #1 units
E2 - Input #2 units                normal/alarm
E3 - Input #3 units                on/off
E4 - Input #4 units                normal/alarm
E5 - Input #5 units
E6 - Input #6 units                open/close
E7 - Input #7 units                iwc
```

Output Files (example)

The "finale" of the Template Generator Program gives you an output like this:



Note the the large "memo" field on the right is the points that it found in the input file, and it created them. Of course, they are written to the output "CSV" file in the proper order (not in the the order that they were found), that is, in reverse-address order.

The example file shown previously, from the DDC controller on trunk #2, would yield a "template file" called "TPL2_7.CSV", like this:

```
// File created on 6/22/2007 2:09:03 PM  For Smart-II Device #2 on Trunk #7
//
// Maintain the ORDER of these lines.  Line Deletions are OK; Additions are NOT
recommended
//
NA, F21, << Description of the Device >>
BI, 36, Generic BI #6, open, close, , Generic AI #6; Used as BI
BI, 34, Generic BI #4, normal, alarm, , Generic AI #4; Used as BI
BI, 33, Generic BI #3, on, off, , Generic AI #3; Used as BI
BI, 32, Generic BI #2, normal, alarm, , Generic AI #2; Used as BI
BO, 12, Loop #0 Mode, AUTO, MANUAL,  , Loop/Block #0; Auto/Manual Mode
BO, 11, Loop #1 Mode, AUTO, MANUAL,  , Loop/Block #1; Auto/Manual Mode
BO, 10, Loop #2 Mode, AUTO, MANUAL,  , Loop/Block #2; Auto/Manual Mode
BO, 6, DO #5 Output, OFF, ON,  , DO #5 Output
BO, 5, DO #3 Output, OFF, ON,  , DO #4 Output
BO, 4, DO #3 Output, OFF, ON,  , DO #3 Output
BO, 3, DO #2 Output, OFF, ON,  , DO #2 Output
BO, 2, DO #1 Output, OFF, ON,  , DO #1 Output
BO, 1, DO #0 Output, OFF, ON,  , DO #0 Output
//
AO, 94, AO #7 Max Voltage, 0, 255, Percent, AO #7; Maximum Voltage Output
AO, 93, AO #7 Min Voltage, 0, 255, Percent, AO #7; Minimum Voltage Output
AO, 92, AO #6 Max Voltage, 0, 255, Percent, AO #6; Maximum Voltage Output
AO, 91, AO #6 Min Voltage, 0, 255, Percent, AO #6; Minimum Voltage Output
AO, 90, AO #7 Start %, 0, 255, Percent, AO #7; Start Percentage
AO, 89, AO #7 Stop %, 0, 255, Percent, AO #7; Stop Percentage
AO, 88, AO #6 Start %, 0, 255, Percent, AO #6; Start Percentage
AO, 87, AO #6 Stop %, 0, 255, Percent, AO #6; Stop Percentage
AO, 86, DO #5 Start %, 0, 255, Percent, DO #5; Start Percentage
AO, 85, DO #5 Stop %, 0, 255, Percent, DO #5; Stop Percentage
AO, 84, DO #4 Start %, 0, 255, Percent, DO #4; Start Percentage
AO, 83, DO #4 Stop %, 0, 255, Percent, DO #4; Stop Percentage
AO, 82, DO #3 Start %, 0, 255, Percent, DO #3; Start Percentage
AO, 81, DO #3 Stop %, 0, 255, Percent, DO #3; Stop Percentage
AO, 80, DO #2 Start %, 0, 255, Percent, DO #2; Start Percentage
AO, 79, DO #2 Stop %, 0, 255, Percent, DO #2; Stop Percentage
AO, 78, DO #1 Start %, 0, 255, Percent, DO #1; Start Percentage
AO, 77, DO #1 Stop %, 0, 255, Percent, DO #1; Stop Percentage
AO, 76, DO #0 Start %, 0, 255, Percent, DO #0; Start Percentage
AO, 75, DO #0 Stop %, 0, 255, Percent, DO #0; Stop Percentage
AO, 74, Loop #2 Prop Band, 0, 255, Units, Loop/Block #2; Proportional Band
AO, 73, Loop #1 Prop Band, 0, 255, Units, Loop/Block #1; Proportional Band
AO, 72, Loop #0 Prop Band, 0.000, 2.550, iwc, Loop/Block #0; Proportional Band
AI, 70, Base; Input #7, 0, 255, %, Base for Input #7
AI, 68, Gain; Input #7, 0, 255, %, Gain for Input #7
AI, 66, Base; Input #6, 0, 255, %, Base for Input #6
AI, 64, Gain; Input #6, 0, 255, %, Gain for Input #6
AI, 62, Base; Input #5, 0, 255, %, Base for Input #5
AI, 60, Gain; Input #5, 0, 255, %, Gain for Input #5
AI, 58, Base; Input #4, 0, 255, %, Base for Input #4
AI, 56, Gain; Input #4, 0, 255, %, Gain for Input #4
AI, 54, Base; Input #3, 0, 255, %, Base for Input #3
AI, 52, Gain; Input #3, 0, 255, %, Gain for Input #3
AI, 50, Base; Input #3, 0, 255, %, Base for Input #2
AI, 48, Gain; Input #2, 0, 255, %, Gain for Input #2
AI, 46, Base; Input #1, 0, 255, %, Base for Input #1
AI, 44, Gain; Input #1, 0, 255, %, Gain for Input #1
AI, 42, Base; Input #0, 0, 255, %, Base for Input #0
AI, 40, Gain; Input #0, 0, 255, %, Gain for Input #0
AO, 25, Loop #2 Int Rate, 0, 255, Inactive, Loop/Block #2; Integral Rate
```

```
AO, 24, Loop #1 Int Rate, 0, 255, Inactive, Loop/Block #1; Integral Rate
AO, 23, Loop #0 Int Rate, 0, 255, secs, Loop/Block #0; Integral Rate
AO, 20, Loop #0 Setpoint, 0.000, 2.550, iwc, Loop/Block #0; Setpoint
AO, 14, Loop #0 Input, 0.000, 2.550, iwc, Loop/Block #0; Input
AO, 13, Loop #2 Output, 0, 255, %, Loop/Block #2; PI Calc. Output
AO, 12, Loop #1 Output, 0, 255, %, Loop/Block #1; PI Calc. Output
AO, 11, Loop #0 Output, 0, 255, %, Loop/Block #0; PI Calc. Output
AO, 10, PO #7 Output, 0, 255, Units, PO #7 Output
AO, 9, PO #6 Output, 0, 255, Units, PO #6 Output
AI, 8, Generic AI #7, 0.000, 2.550, iwc, Generic AI #7; Used as AI
AI, 6, Generic AI #5, 0.000, 255.000, %, Generic AI #5; Used as AI
AI, 2, Generic AI #1, 0.000, 0.000, %, Generic AI #1; Used as AI
AI, 1, Generic AI #0, 0.000, 255.000, %, Generic AI #0; Used as AI
```

In particular, note that the Staefa "input units" has been used, along with the gain and base, for each input. The inputs are used in the loops and those engineering units carry through to the appropriate loop points (e.g., the setpoints are also in the units of the input).

It is unfortunate that the Staefa files have no information on the USAGE of the points or loops. You should edit the template files that are created by the Template Generator Program to reflect what the input and output points really mean, and what the loops are used for. For example:

- You might want to change point #7 to be "static pressure", rather than "Generic AI #7".
- Similarly, the other inputs and outputs should be named to reflect their actual use.
- You might want to change loop #0 to be "pressure control loop", since that is its function
- All the DO start/stop percentage points are created; delete the unused ones.

The edited file should then be downloaded into the Gateway. You will then have a sensible and easily worked with device.

Chapter 4

Hand-Held Template Generator Program

In Chapter 3, we described a program that will allow you to import files from the old Staefa "Host" system, and create templates. But what if the "host" is dead (or died a few years before…and nobody even has a backup copy of the hard disk)? Well, this actually happened at Altus Air Force Base. Things looked grim, since everything would have to be hand-created. The ONLY thing that the Air Force had was the "hand-held" tool (a small device that plugs into the wall stat or the motherboard on Smart-II devices). Eventually, they also obtained the "PC-Tool", a program that runs on (ancient) laptops which emulates the functions of the "hand-held" tool. Well, at least it was something—better than nothing!

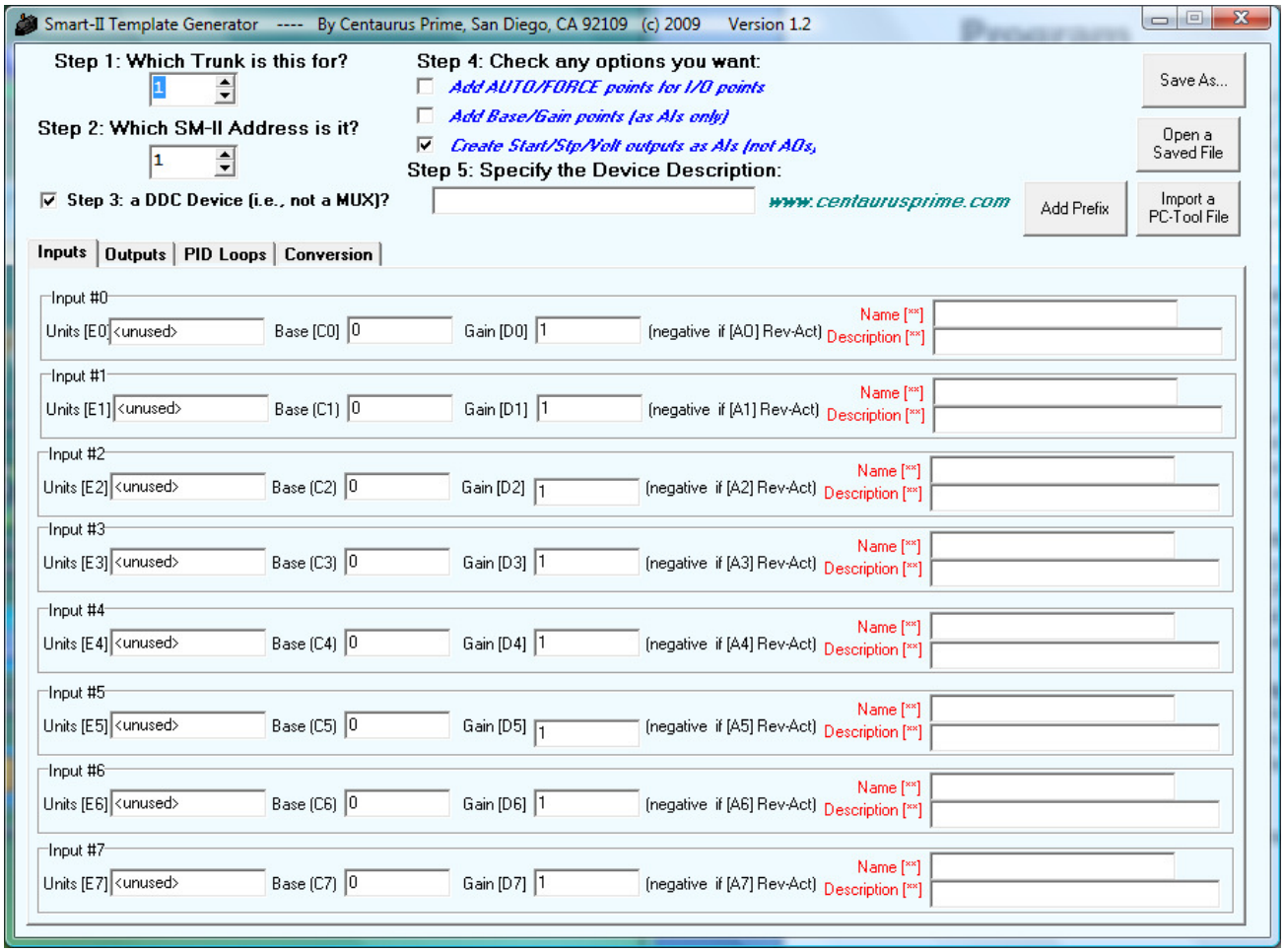
The ***Hand-Held Template Generator Program*** is a Windows™ program that allows you to simply and painlessly key in data from the "hand-held" tool, or to import a file from the "PC-Tool" program. While not as optimal as having the "host" files available to you, it makes template generation moderately painless for DDC devices (the Smart-II gizmos that really require templates). This program was created with the invaluable assistance of Doug Izer, Greg Goodfellow, and Rod Godfrey.

The situation is different if you just have the hand-held tool, and much more typing is involved. We therefore recommend that you use the PC-based "PC-Tool" program supplied by Staefa; but some sites do not have it. It is not a current program, either—we have reports that PC-Tool will NOT run on either the Windows™ XP or Vista operating systems (but does run on Windows™ 98 or 2000).

What follows is a description of the ***Hand-Held Template Generator Program***, and the functions it has (especially the "tabs"). Then, a step-by-step procedure is given for how to build DDC Templates using either (a) the hand-held tool only, or (b) the PC-Tool program. As these are both Staefa Control Systems products, it is not the purpose of this manual to document their usage—you should use the Staefa manuals to comprehend the operation of the hand-held device or the PC-Tool program.

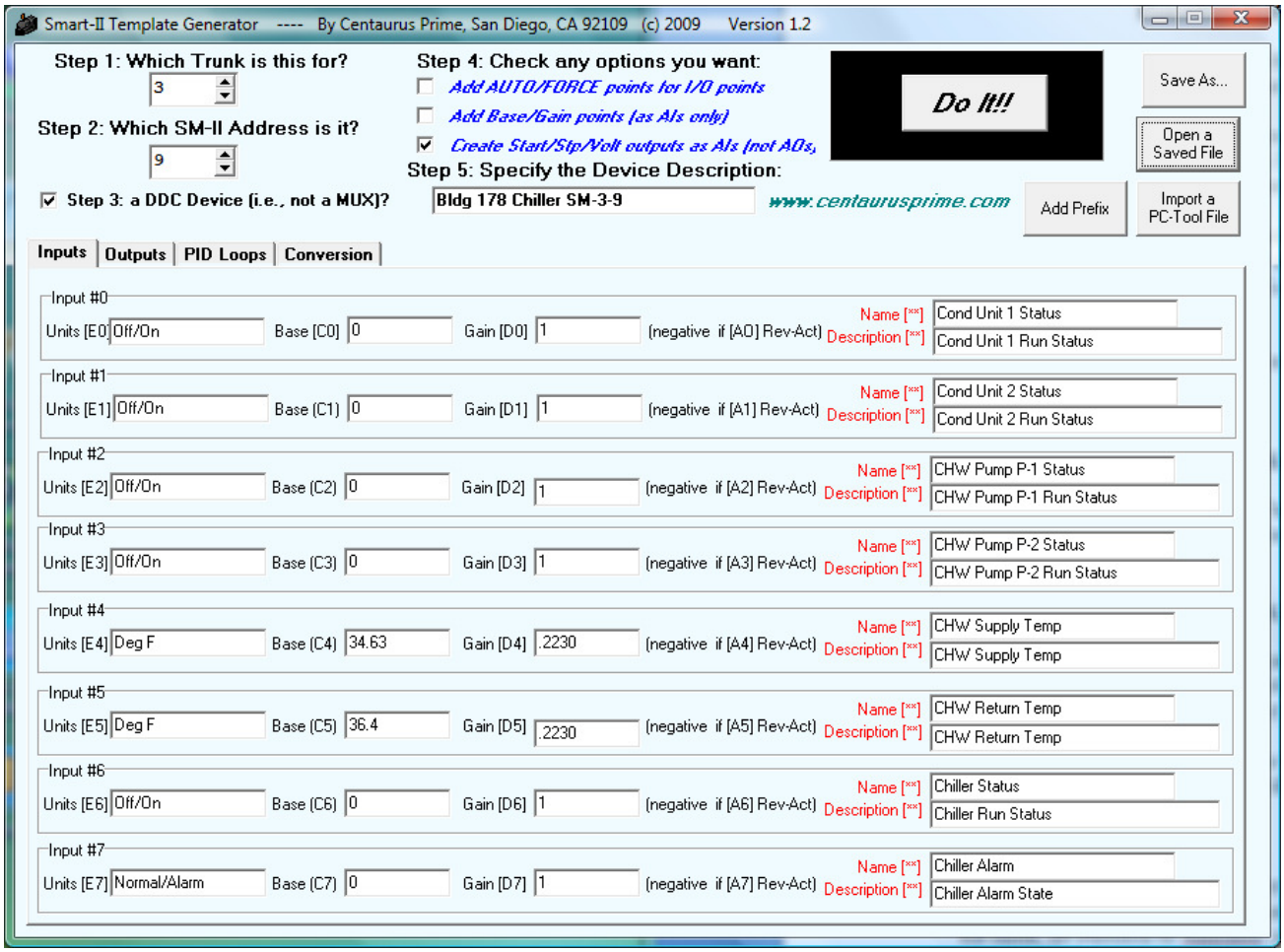
Please not that the ***Hand-Held Template Generator Program*** is designed for DDC and MUX devices, but there were no MUX devices at Altus AFB. The program has not been tested with PC-Tool files from a "real" job site (just from MUX devices at the Centaurus Prime home-office "wall of shame"), so we must give a caveat here about MUX devices. The MUX devices are relatively rare, and so simple, it is unlikely that there will be an issue.

The ***Hand-Held Template Generator Program*** main screen looks like this when it first is launched:



Here's the nutshell version of what you do: First, fill in the top of the screen (telling the program what the trunk number and address of the Smart-II device is, what options you want, and the "Device Description". Then, you will either have to use the hand-held tool and gather data from the appropriate registers in the Smart-II device (the numbers in each data field's description, like "E0", "C0", etc. on the screen correspond to the registers in the hand-held), or import a PC-tool file. Clearly, importing a PC-tool file involves much less typing! Then, you have to do some typing for the NAMES of each point you will actually use (and also type in description text, if you want them to be different from the names). Then SAVE your work!

Let's first talk about Steps 1 through 5 at the top of the screen. Here is a sample created from a real building at Altus AFB:



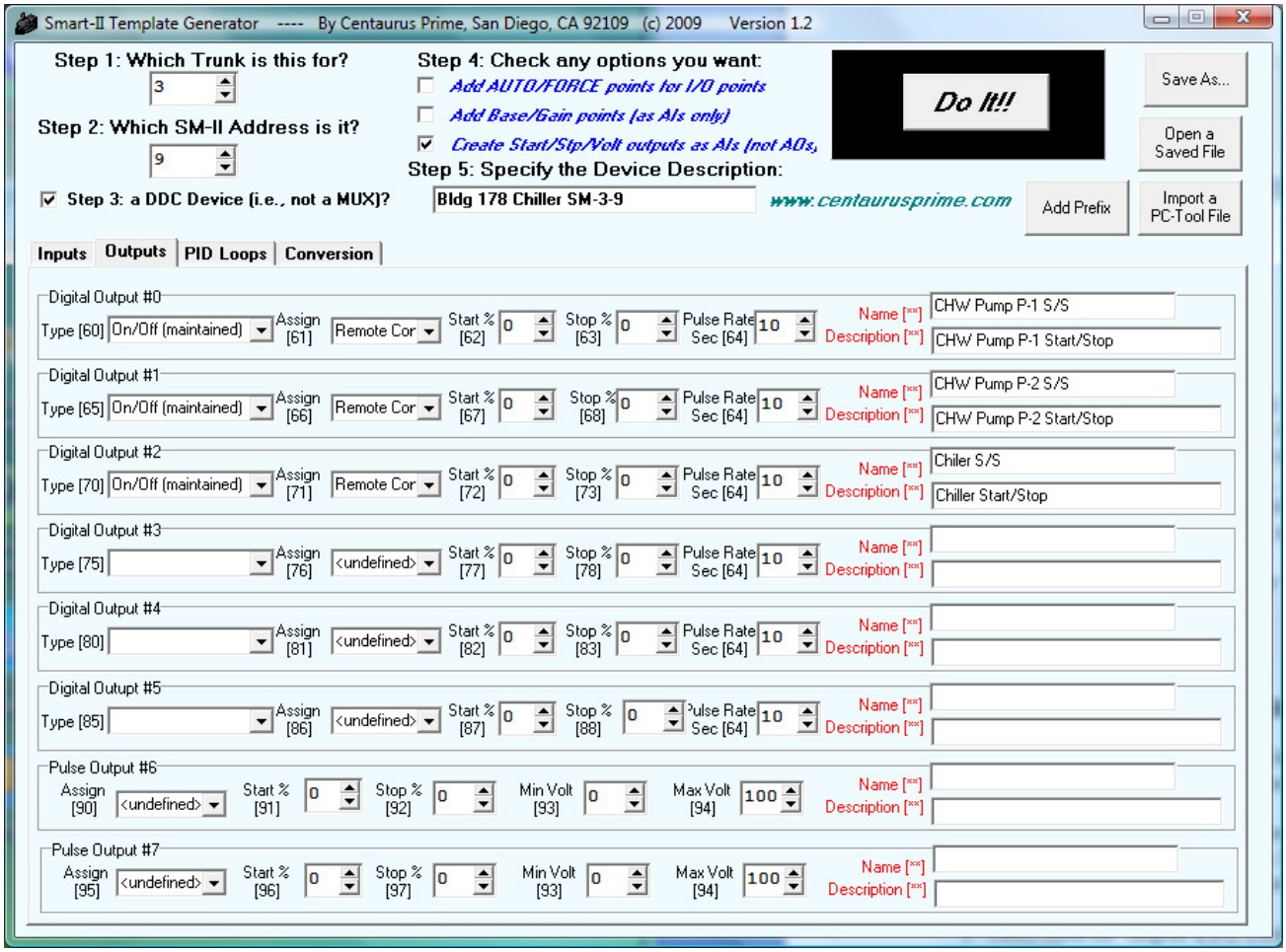
Start with Step 1: This is what TRUNK NUMBER the Smart-II controller in question is attached to on the Gateway. Next, Step 2: This is the ADDRESS of the Smart-II controller itself. The default for Step 3 is "DDC" device (checked); you would "uncheck" this if the controller was a MUX device. Step 4 has some options, the most common options are the defaults. If you are using Modbus, you probably will want to check the "Add AUTO/FORCE points for all I/O points" checkbox, but for BACnet, you will probably want to use the Gateway's 16-level "BACnet priority array". In the unlikely event that you really want "data diarrhea", you might want to check the "Add Base/Gain points" so that the ranging of every analog point becomes visible from the host Modbus or BACnet system. If you want to cut down on data poop even more than the default, you can "uncheck" the "Create Start/Stop/Volt outputs as AIs). This will "hide" the start percentage, stop percentage, min/max voltage, and pulse-rate points from being visible to the host Modbus or BACnet system. Alas, some people really like this stuff to be displayed…

Note the four "tabs" in the tabbed-notebook at the bottom of the screen. You will have to fill in the first three (***Inputs***, ***Outputs***, and ***PID Loops***). The last tab shows you what is happening when you hit the bit "Do It!!" button. Your job is to enter data that the hand-held device shows you (or import it from a PC-Tool-generated file) into the ***Inputs***, ***Outputs***, and ***PID Loops*** tabs.

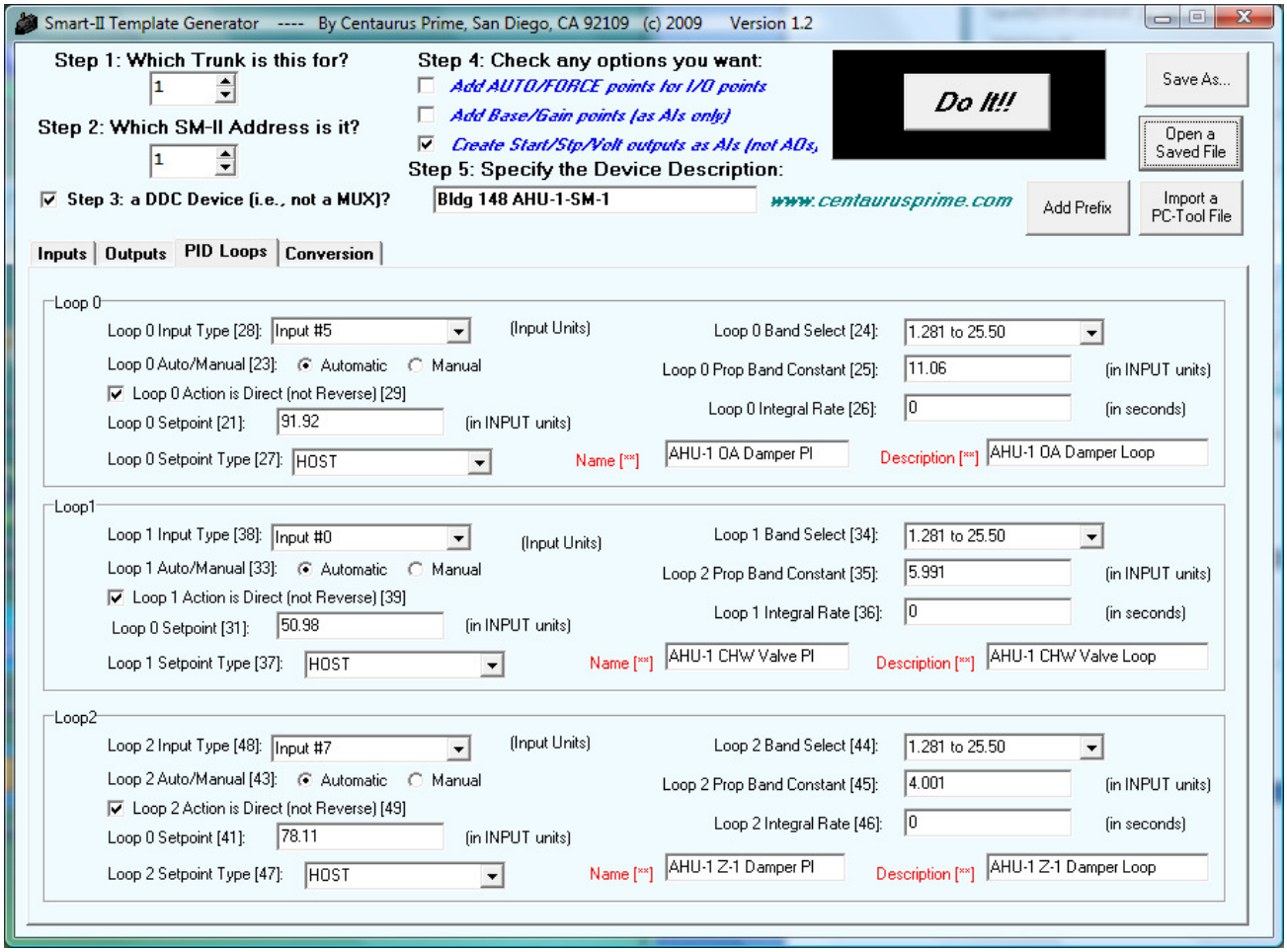
You also have to create the NAMES for each point (the red fields on the above screen). If you are OK with the BACnet "description" field being the same as the "name" field, you may leave the Descriptions blank. But the names MUST be keyed in. Note that there is a "Add prefix" button. If you want every point to have a certain prefix (e.g., "Bldg52" or "AHU-14", or "DHW", you can hit that button and enter characters into the prefix text-box. Then the program will pre-pend what you types to every NAME and DESCRIPTION field (all the "red" data).

Note that the hand-held device and the PC-Tool program no nothing about names of objects. For that, you really must know HOW the inputs, outputs, and PID loops are used. Usually, there are drawings for a job that shows what is physically hooked up to Input-0, Digital-Out-3, Pulse-Out-6, etc. It is imperative that the ACTUAL physical hook-up is used. Be careful of "old" drawings or as-builts that do not show field modifications or historical changes to the real-world equipment!

The second tab, ***Outputs***, looks like this:



The third tab, ***PID Loops***, looks like this:



There are several things to note about these pages:

(1) The three PID loops reference Input points (for their engineering units, setpoint units, etc.). However, the Outputs page is where the PID loops are referenced (the "assignment" fields). The PC-Tool file import does this for you automatically, but if you only have the hand-held tool, be careful!

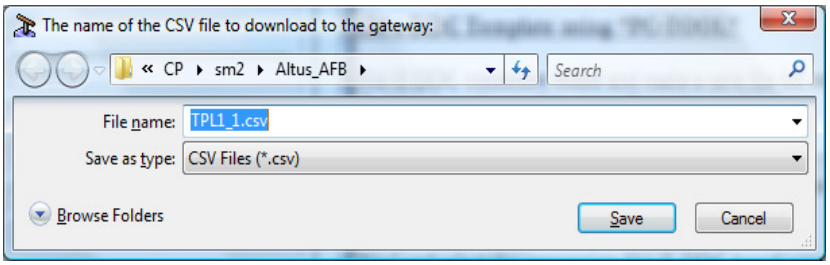
(2) It is unlikely that any PID setpoint type will be any other than "HOST", and undoubtedly they will always be "Automatic" (not manual).

(3) These actually are "P-I-squared" loops, according to the Staefa literature. That is only because the software was too stupid to do any derivative control. In fact, the integral control was pretty poor, too, so you will find that most PID loops are P-loops only (that is, proportional control only; the integral rate field is zero—as shown in the above real-world example).

(4) The "band select" is not used by the gateway, but it is important to know, and that is why it is included in the PID Loops data tab.

OK…what if you get interrupted while doing all this (it takes awhile). Duty calls! The boss asks you into his office! The Roach Coach rolls by and honks! Your girlfriend wants you NOW! Forget this program, for sure! But before you do, hit the "Save As" button and save the work you have done in a file, so you can go back to it later. When the duty/boss/dysentery/girlfriend interruption is over, just bring up the program and hit the "Open a Saved File" and select the file you saved. You will be right back where you were before doo-doo happened.

When you are FINALLY done, there is one big button that says "Do It!!" You will hit that button and a small dialog box appears (which looks different on Win2K, XP, and Vista; this is the Vista version):



The default is the NAME that the gateway expects that particular device on a specific trunk to have. That's probably what you should keep, but you might want to create separate folders for each building/gateway that you do this for.

The screen switches to the "Conversions" tab and hopefully shows no errors (you might have names too long, or something you forgot—the program will tell you what's wrong and give an English message about what you need to do to fix the problem. If you do have a problem, fix the issue, and hit the "Do It!!" button again. When you have no errors, then you are done!

What follows is the simplified version of what you need to do, based on whether you have "PC-Tool" or just the Staefa Hand-Held device (we profusely thank Doug Izer for his help in determining these procedures):

Procedure to Build a DDC Template using "PC-TOOL"

1. Use "PC-Tool" to connect to each SM-II DDC controller board and make a save file for each controller. In addition, the SM-II handheld tool can be used to manually retrieve point data.

2. Run the Hand-Held Template Generator program (it has a "TNT" icon if you install it on your desktop) and follow the steps 1 thru 5 listed at the top of the program. Be sure to keep the naming convention the same for all equipment.

3. Double-check whether you are importing a DDC device (default) or a MUX (checkbox in Step 3). Then, Click on "Import a PC-Tool File" and select the appropriate SM-II DDC board save file (.LST file). You now have the tedious work done (but you have NO names of any objects).

4. Use the control drawings to name all input and output points (all point names are 28 characters long). Follow the output points reference to name the PID Loops. Once complete click on the "Do It" button. This creates a TPL file in .CSV format, ready to download to the gateway.

5. Click on "Save As" button for a text file save of the template that was just created. This is primarily used for record keeping.

Procedure to Build a DDC Template using the "Hand-Held" tool

1. Connect to a DDC controller. The SM-II handheld tool can be used to manually retrieve point data, parameters, and setup information from the Staefa Smart-II controller.

2. Run the Hand-Held Template Generator program (it has a "TNT" icon if you install it on your desktop) and follow the steps 1 thru 5 listed at the top of the program. Be sure to keep the naming convention the same for all equipment.

3. Use the Hand-Held tool and step through the menus to the relevant data. For example, for the Engineering Units for Input #0, location "E0" says "Deg F", "PSI" or some such text. Key it into the "Units (E0)" text-box what you find out from the Hand-Held. Do this for EVERY field that is used in the Smart-II controller.

4. Use the control drawings to name all input and output points (all point names are 28 characters long). Follow the output points reference to name the PID Loops. Once complete click on the "Do It" button. This creates a TPL file in .CSV format, ready to download to the gateway.

5. Click on "Save As" button for a text file save of the template that was just created. This is primarily used for record keeping.

PC-Tool Output File (example)

The PC-Tool program creates a file that is imported into this program. Just for your edification, here is an example from Altus AFB:

```
     File Name: B179-ddc2
     Controller Type: SMART II DDC controller
     Data Type: RAM values
     Date: May 28, 2009
     Time: 18:08:45

Loop 0
     20 - Loop 0 PI calc                 0.0        %
     21 - Loop 0 setpoint                -73.75     fpm
```

```
     22 - Loop 0 input                  97.75      fpm
     23 - Loop 0 auto/manual            Automatic
     24 - Loop 0 band select            1570  -31237  fpm
     25 - Loop 0 prop band              1570       fpm
     26 - Loop 0 int rate               2.000      secs
     27 - Loop 0 stpnt type             Input #5   -73.50 fpm
     28 - Loop 0 input type             Input #6
     29 - Loop 0 action                 Reverse
Loop 1
     30 - Loop 1 PI calc                50.20      %
     31 - Loop 1 setpoint               Not Defined
     32 - Loop 1 input                  Not Defined
     33 - Loop 1 auto/manual            Automatic
     34 - Loop 1 band select            0.5 - 10%
     35 - Loop 1 prop band              10.00      %
     36 - Loop 1 int rate               Inactive
     37 - Loop 1 stpnt type             Not Defined
     38 - Loop 1 input type             Not Defined
     39 - Loop 1 action                 Direct
Loop 2
     40 - Loop 2 PI calc                49.02      %
     41 - Loop 2 setpoint               1.004      iwc
     42 - Loop 2 input                  1.004      iwc
     43 - Loop 2 auto/manual            Automatic
     44 - Loop 2 band select            0.314 -6.247  iwc
     45 - Loop 2 prop band              6.247      iwc
     46 - Loop 2 int rate               24.00      secs
     47 - Loop 2 stpnt type             Host       1.004  iwc
     48 - Loop 2 input type             Input #4
     49 - Loop 2 action                 Reverse
On-Off Automatic
     50 - DO 0                          Automatic
     51 - DO 1                          Automatic
     52 - DO 2                          Automatic
     53 - DO 3                          Automatic
     54 - DO 4                          Automatic
     55 - DO 5                          Automatic
     56 - PO 6                          Automatic
     57 - PO 7                          Automatic
     58 - Application Status            Automatic
DO 0-1 Definition
     60 - DO 0 type                     On/Off
     61 - DO 0 loop asgnmt              Not Defined
     62 - DO 0 start %                  0 %
     63 - DO 0 stop %                   0 %
     64 - DO 0 pulse rate               10 sec
     65 - DO 1 type                     On/Off
     66 - DO 1 loop asgnmt              Not Defined
     67 - DO 1 start %                  0 %
     68 - DO 1 stop %                   0 %
     69 - DO 1 pulse rate               10 sec
DO 2-3 Definition
     70 - DO 2 type                     On/Off
```

```
     71 - DO 2 loop asgnmt              Not Defined
     72 - DO 2 start %                  0 %
     73 - DO 2 stop %                   0 %
     74 - DO 2 pulse rate               10 sec
     75 - DO 3 type                     On/Off
     76 - DO 3 loop asgnmt              Not Defined
     77 - DO 3 start %                  0 %
     78 - DO 3 stop %                   0 %
     79 - DO 3 pulse rate               10 sec
DO 4-5 Definition
     80 - DO 4 type                     On/Off
     81 - DO 4 loop asgnmt              Not Defined
     82 - DO 4 start %                  0 %
     83 - DO 4 stop %                   0 %
     84 - DO 4 pulse rate               10 sec
     85 - DO 5 type                     On/Off
     86 - DO 5 loop asgnmt              Not Defined
     87 - DO 5 start %                  0 %
     88 - DO 5 stop %                   0 %
     89 - DO 5 pulse rate               10 sec
PO 6-7 Definition
     90 - PO 6 loop asgnmt              2
     91 - PO 6 start %                  10 %
     92 - PO 6 stop %                   90 %
     93 - PO 6 min voltage              20 %
     94 - PO 6 max voltage              100 %
     95 - PO 7 loop asgnmt              0
     96 - PO 7 start %                  10 %
     97 - PO 7 stop %                   80 %
     98 - PO 7 min voltage              0 %
     99 - PO 7 max voltage              50 %
Input Action
     A0 - Input 0 action                Reverse
     A1 - Input 1 action                Reverse
     A2 - Input 2 action                Reverse
     A3 - Input 3 action                Reverse
     A4 - Input 4 action                Direct
     A5 - Input 5 action                Direct
     A6 - Input 6 action                Direct
     A7 - Input 7 action                Reverse
     A8 - PO 6 action                   Direct, Linear
     A9 - PO 7 action                   Direct, Linear
Configuration
     B0 - Controller addr               2
     B1 - Baud rate                     1200
     B2 - Model firmware                DDC 2.2 04/20/94
     B3 - Control group                 241
     B4 - Offline timer                 Active
     B5 - Shutdown                      Active
     B6 - Integral timer                0.2-51.0 secs
     B7 - Loop 0 limit                  Disable
     B8 - Loop 0 low limit              Disabled
     B9 - Loop 0 high limit             Disabled
```

```
Input Bases
     C0 - Input #0 base                    Not Defined
     C1 - Input #1 base                    -44.40
     C2 - Input #2 base                    -52.20
     C3 - Input #3 base                    0.0
     C4 - Input #4 base                    -1.250
     C5 - Input #5 base                    -625.0
     C6 - Input #6 base                    -625.0
     C7 - Input #7 base                    0.0
Input Gains
     D0 - Input #0 gain                    Not Defined
     D1 - Input #1 gain                    0.863
     D2 - Input #2 gain                    0.863
     D3 - Input #3 gain                    0.020
     D4 - Input #4 gain                    0.024
     D5 - Input #5 gain                    12.25
     D6 - Input #6 gain                    12.25
     D7 - Input #7 gain                    0.020
Input Units
     E0 - Input #0 units                   normal/dirty
     E1 - Input #1 units                   degF
     E2 - Input #2 units                   degF
     E3 - Input #3 units                   off/on
     E4 - Input #4 units                   iwc
     E5 - Input #5 units                   fpm
     E6 - Input #6 units                   fpm
     E7 - Input #7 units                   VDC
```

Chapter 5

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
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	Primary Duct Deadband Vol.	Disc. Air Low Limit	Disc. Air Low Limit	Range: Note 6	0x62
30023	40023	Primary Duct Maximum Volume	Disc. Air High Limit	Disc. Air High Limit	Range: Note 6	0x63
30024	40024	Primary Duct Accessory Volume	Disc. Air Tmp SPT	Disc. Air Tmp SPT	Range: Note 6	0x64
30025	40025	Aux./Terminal Maximum Vol.	Disc. Air Cooling P-Band	Disc. Air Cooling P-Band	Range: Note 6	0x65
30026	40026	Aux/Terminal Heating Volume	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 Band	Cooling Prop Band	Cooling Prop Band	0 to 100 percent	0x6C.0-3
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
30038	40038	Aux Duct Max Volume	Compressor Delay	Discharge Air Heating P-Band	0 to 100 percent	66
30039	40039	Fan Energize Setpoint	(unused)	Economizer OSA Low Limit Setpnt	0 to 255 Deg F.	68
30095		Computed Pri. Flow			CFM (LPM, metric)	(Calc)

30096		Computed Aux. Flow			CFM (LPM, metric)	(Calc)
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	15	Fan Ctl Status	Fan Ctl Status	Fan Ctl Status	0=NoForce; 1= Forced ON	0x2E.4-7
10016	16	Fan Mode Status	Fan Mode Status	Fan Mode Status	0=MANUAL; 1=AUTO	0x2E.4-7
10017	17	Primary Air HEAT	(unused)	Fan change HEAT	0=NoForce; 1=Forced to HEAT	0x2E.0-1
10018	18	Primary Air COOL	Compr. in Cooling	Fan change COOL	0=NoForce; 1=Forced to COOL	0x2E.0-1
10019	19	Aux. Air COOL	(unused)	Chg'over in Manual	Units; Note 4	0x2E.2-3
10020	20	Aux. Air HEAT	(unused)	(unused)	0=NoForce; 1=Forced to 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	24	(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
10047	47	Fan: Forced OFF	Fan: Forced OFF	Fan: Forced OFF	0=NoForce; 1=ForceOFF	0x2E.4-7
10048	48	Fan: Force DeadBand Mode	(unused)	Fan: Forced to MAX Speed	0=NoForce; 1=ForceDB	0x2E.4-7
10049	49	Fan: Force Cooling Mode	(unused)	Fan: Forced to MIN Speed	0=NoForce; 1=ForceCool	0x2E.4-7
10050	50	Fan: Force Heating Mode	(unused)	(unused)	0=NoForce; 1=ForceHeat	0x2E.4-7
10051	51	DO 0 Auto-Manual	DO 0 Auto-Manual	DO 0 Auto-Manual	0 = Auto; 1 = Forced	28.0
10052	52	DO 1 Auto-Manual	DO 1 Auto-Manual	DO 1 Auto-Manual	0 = Auto; 1 = Forced	28.1
10053	53	DO 2 Auto-Manual	DO 2 Auto-Manual	DO 2 Auto-Manual	0 = Auto; 1 = Forced	28.2
10054	54	DO 3 Auto-Manual	DO 3 Auto-Manual	DO 3 Auto-Manual	0 = Auto; 1 = Forced	28.3
10055	55	DO 4 Auto-Manual	DO 4 Auto-Manual	DO 4 Auto-Manual	0 = Auto; 1 = Forced	28.4
10056	56	DO 5 Auto-Manual	DO 5 Auto-Manual	DO 5 Auto-Manual	0 = Auto; 1 = Forced	28.5
10057	57	AO 6 Auto-Manual	AO 6 Auto-Manual	AO 6 Auto-Manual	0 = Auto; 1 = Forced	28.6
10058	58	AO 7 Auto-Manual	AO 7 Auto-Manual	AO 7 Auto-Manual	0 = Auto; 1 = Forced	28.7
10059	59	PRI Dmpr Mode/Ctl	OSA Duct Mode/Ctl	OSA Duct Mode/Ctl	0=MANUAL; 1=AUTO	0x2d.0-3

10060	60	PRI Dmpr Force OPEN	OSA Dmpr Force OPEN	OSA Dmpr Force OPEN	0 = Auto; 1 = OPEN	0x2d.0-3
10061	61	PRI Dmpr Force CLOS	OSA Dmpr Force CLOSE	OSA Dmpr Force CLOSE	0 = Auto; 1 = CLOSE	0x2d.0-3
10062	62	PRI Dmpr Force MIN	OSA Dmpr Force MIN	OSA Dmpr Force MIN	0 = Auto; 1 = MIN	0x2d.0-3
10063	63	PRI Dmpr Force MAX	OSA Dmpr Force MAX	OSA Dmpr Force MAX	0 = Auto; 1 = MAX	0x2d.0-3
10064	64	PRI DmprForce HEAT	OSA Dmpr Force HEAT	OSA Dmpr Force HEAT	0 = Auto; 1 = HEAT	0x2d.0-3
10065	65	AUX Dmpr Mode/Ctl			0=MANUAL; 1=AUTO	0x2d.4-7
10066	66	AUX Dmpr ForceOPEN			0 = Auto; 1 = OPEN	0x2d.4-7
10067	67	AUX Dmpr ForceCLOS			0 = Auto; 1 = CLOSE	0x2d.4-7
10068	68	AUX Dmpr Force MIN			0 = Auto; 1 = MIN	0x2d.4-7
10069	69	AUX Dmpr Force MAX			0 = Auto; 1 = MAX	0x2d.4-7
10070	70	AUX Dmpr ForceHEAT			0 = Auto; 1 = HEAT	0x2d.4-7
	71	SM2-Reset	SM2-Reset	SM2-Reset	Toggle ON to RESET the SM2 Device	0x2F.7

Notes:

See below next section for all notes

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
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
30033	40033	(unused)	AO 7 Default	0 to 100 percent	Ext 0x2Da
30034	40034	(unused)	AO 6 Default	0 to 100 percent	Ext 0x3Db
30035	40035	(unused)	Block 0 Default	No-host output	Ext 0x3Ea
30036	40036	(unused)	Block 1 Default	No-host output	Ext 0x3Fa
30037	40037	(unused)	Block 2 Default	No-host output	Ext 0x3Fb
30040		Gain 0	Gain 0	Real number	E2(10-11)
30042		Base 0	Base 0	Real number	E2(12-13)
30044		Gain 1	Gain 1	Real number	E2(14-15)
30046		Base 1	Base 1	Real number	E2(16-17)
30048		Gain 2	Gain 2	Real number	E2(18-19)
30050		Base 2	Base 2	Real number	E2(20-21)
30052		Gain 3	Gain 3	Real number	E2(22-23)
30054		Base 3	Base 3	Real number	E2(24-25)
30056		Gain 4	Gain 4	Real number	E2(26-27)
30058		Base 4	Base 4	Real number	E2(28-29)
30060		Gain 5	Gain 5	Real number	E2(30-31)
30062		Base 5	Base 5	Real number	E2(32-33)
30064		Gain 6	Gain 6	Real number	E2(34-35)
30066		Base 6	Base 6	Real number	E2(36-37)
30068		Gain 7	Gain 7	Real number	E2(38-39)
30070		Base 7	Base 7	Real number	E2(40-41)
30072	40072	Loop 0 P-Band	(unused)	0 to 100 percent	0x66
30073	40073	Loop 1 P-Band	(unused)	0 to 100 percent	0x67
30074	40074	Loop 2 P-Band	(unused)	0 to 100 percent	0x68
30075	40075	DO 0 Stop Value	DO 0 Stop Value	0 to 100%, in 10% increments	Ext 6C.0-3
30076	40076	DO 0 Start Value	DO 0 Start Value	0 to 100%, in 10% increments	Ext 6C.4-7
30077	40077	DO 1 Stop Value	DO 1 Stop Value	0 to 100%, in 10% increments	Ext 6D.0-3
30078	40078	DO 1 Start Value	DO 1 Start Value	0 to 100%, in 10% increments	Ext 6D.4-7
30079	40079	DO 2 Stop Value	DO 2 Stop Value	0 to 100%, in 10% increments	Ext 6E.0-3
30080	40080	DO 2 Start Value	DO 2 Start Value	0 to 100%, in 10% increments	Ext 6E.4-7
30081	40081	DO 3 Stop Value	DO 3 Stop Value	0 to 100%, in 10% increments	Ext 6F.0-3
30082	40082	DO 3 Start Value	DO 3 Start Value	0 to 100%, in 10% increments	Ext 6F.4-7
30083	40083	DO 4 Stop Value	DO 4 Stop Value	0 to 100%, in 10% increments	Ext 70.0-3
30084	40084	DO 4 Start Value	DO 4 Start Value	0 to 100%, in 10% increments	Ext 70.4-7
30085	40085	DO 5 Stop Value	DO 5 Stop Value	0 to 100%, in 10% increments	Ext 71.0-3
30086	40086	DO 5 Start Value	DO 5 Start Value	0 to 100%, in 10% increments	Ext 71.4-7
30087	40087	AO 6 Stop Value	DO 8 Stop Value	0 to 100%, in 10% increments	Ext 72.0-3
30088	40088	AO 6 Start Value	DO 6 Start Value	0 to 100%, in 10% increments	Ext 72.4-7

30089	40089	AO 7 Stop Value	DO 7 Stop Value	0 to 100%, in 10% increments	Ext 73.0-3
30090	40090	AO 7 Start Value	DO 7 Start Value	0 to 100%, in 10% increments	Ext 73.4-7
30091	40091	AO 6 Min Output	AO 6 Min Output	0 to 100%, in 10% increments	Ext 74.0-3
30092	40092	AO 6 Max Output	AO 6 Min Output	0 to 100%, in 10% increments	Ext 74.4-7
30093	40093	AO 7 Min Output	AO 7 Min Output	0 to 100%, in 10% increments	Ext 75.0-3
30094	40094	AO 7 Max Output	AO 7 Min Output	0 to 100%, in 10% increments	Ext 75.4-7
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
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
10030		DI 0	DI 0	0=Off; 1= On	0x20.5
10031		DI 1	DI 1	0=Off; 1= On	0x21.5
10032		DI 2	DI 2	0=Off; 1= On	0x22.5
10033		DI 3	DI 3	0=Off; 1= On	0x23.5
10034		DI 4	DI 4	0=Off; 1= On	0x24.5
10035		DI 5	DI 5	0=Off; 1= On	0x25.5
10036		DI 6	DI 6	0=Off; 1= On	0x26.5
10037		DI 7	DI 7	0=Off; 1= On	0x27.5
10038	38	(unused)	DO 0 Default (No host)	0=Off; 1= On	Ex 0x2Eb0
10039	39	(unused)	DO 1 Default (No host)	0=Off; 1= On	Ex 0x2Eb1
10040	40	(unused)	DO 2 Default (No host)	0=Off; 1= On	Ex 0x2Eb2
10041	41	(unused)	DO 3 Default (No host)	0=Off; 1= On	Ex 0x2Eb3
10042	42	(unused)	DO 4 Default (No host)	0=Off; 1= On	Ex 0x2Eb4
10043	43	(unused)	DO 5 Default (No host)	0=Off; 1= On	Ex 0x2Eb5
10044	44	Loop 0 Action	(unused)	0=Direct; 1=Reverse	7F.4
10045	45	Loop 1 Action	(unused)	0=Direct; 1=Reverse	7F.5
10046	46	Loop 2 Action	(unused)	0=Direct; 1=Reverse	7F.6
10051	51	DO 0 Auto-Manual	DO 0 Auto-Manual	0=Auto; 1= Forced	28.0
10052	52	DO 1 Auto-Manual	DO 1 Auto-Manual	0=Auto; 1= Forced	28.1
10053	53	DO 2 Auto-Manual	DO 2 Auto-Manual	0=Auto; 1= Forced	28.2
10054	54	DO 3 Auto-Manual	DO 3 Auto-Manual	0=Auto; 1= Forced	28.3
10055	55	DO 4 Auto-Manual	DO 4 Auto-Manual	0=Auto; 1= Forced	28.4
10056	56	DO 5 Auto-Manual	DO 5 Auto-Manual	0=Auto; 1= Forced	28.5
10057	57	AO 6 Auto-Manual	AO 6 Auto-Manual	0=Auto; 1= Forced	28.6
10058	58	AO 7 Auto-Manual	AO 7 Auto-Manual	0=Auto; 1= Forced	28.7
	71	SM2 Reset	SM2 Reset	Toggle ON to RESET the SM2 Device	0x2F.7

Units: Note 1:

For DDC units, this is the control mode for Loop #2. 0 = AUTO; 1 = MANUAL

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 = AUTO; 1 = MANUAL

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

Units: Note 4:

For FC units, this is the “changeover” point. 0 = MANUAL; 1 = AUTO

For VAV units, this is used for a force of the HEATING mode on the auxiliary air system. (0 = No Force; 1 = Forced to HEAT)

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. For DDC and MUX inputs, the scaling must be done by the host to match the 0 to 255 counts range, using the exact EEPROM ranges (points 30040 to 30070)

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 to 255 counts, and scaling must be done in the host, using the matching EEPROM Ranging values. For Remote Temperatures, use range of 0-255 (this number is an integer, in degrees F.)

Range: Note 6:

For temperature setpoints, this is in degrees (VAV/FC/HP). For the VAVs only, where these are VOLUME setpoints, the units are CFM. For the DDC, the setpoint is in the same units as the control (integer, 0-255, scales as per the matching EEPROM range and gain values). If this is used as an offset for Loops in DDC devices, this is a signed value (-127 to +128).

Range: (Base and Gains)

Real Number; in standard "IEEE" format (32-bit, excess-128 exponent; 24-bit mantissa)
ROM order is: Byte 1, Byte 0 (1st Modbus "word"), followed by Byte 3, Byte 2 (2nd Modbus "word")
In BACnet, only one address is used, since floating-point values are direct (e.g. AI-40 is Loop 0 Gain). Hence, the second address is unused (e.g., there is no AI 41).

Range: (DO 0-5, AO6-7 Start/Stop values)

These start/stop and limit values are 0-100%, in nearest 10ths. (e.g., a value of 42% is "4" in this 4-bit value)

For MODBUS or BACnet, the value you see and set is 0-100%. Translation is done by the gateway. Feedback will always be to the nearest 10%, since the granularity of this value is 10%.

Range: (Prop-Band value)

The multiplier is two bits: 00 ==> Multiplier = 100; 01 ==> Multiplier = 1000; 10 = Multiplier = 100000; 11 ==> pass-thru. The P-band is six bits: P-Band = ((Multiplier / 3) * value) + 10
But if "pass thru", P-Band = value. The Gateway manipulates the six-bits of the P-band value, but does NOT change the multiplier bits.

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.

Chapter

6

What's in a (BACnet) Name?

Option 1: Prefix names for Every Point:

Whether you use the "defaults" or a generic template, all the points of the same Smart-II type have the same names. That is, if there are fifty VAV boxes attached to a SM2-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., 2, 11
FT-003., 2, 22
FT-125., 3, 1
FT-126., 3, 2
FT-127., 3, 3
FT-128., 3, 4
FT-124., 3, 5
FT-123., 3, 6
FT-122., 3, 7
FT-120., 3, 8
FT-119., 3, 9
FT-105., 3, 10
```

Etc…

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

This is saying that Staefa 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 to 4). Finally, third is the Staefa Smart-II device number (1 to 239). 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!

Option 2: Unique Names (Object ID) and Descriptions for each device:

The name of the device can come from three places: (1) The default name from the "Autodiscovery" file, which is merely a description of the device type, unit #, and trunk, and what BACnet device it maps to; (2) a specific name from the "NA" line in a device-specific template (TPLx_y.csv) file; or (3) an edited name and (optional) description from the CONFIG.TXT file that you edit. Most people will want to use the features of option #3.

To do this, you would auto-discover all the trunks, and SAVE that database, using the local-mode menu, described previously. Then, reboot the Gateway, stop it from booting, and DOWN (download to your PC) the CONFIG.TXT file. You can then change the name of the device, and optionally, add a full description, for each device. Let's use an example:

For a simple system, we end up with a CONFIG.TXT that finds just a few devices on two trunks:

```
//  Auto-Discovery Files were Merged at 14:40:28, on Nov 28, 2012.
//
//    "DEVICE", TRNK, SM2-UNIT, SM2-TYPE, MB-UNIT, NAME
//
DEVICE, 1, 1, 0,  1, "VAV #1, Trunk 1 (BACnet 1)"
DEVICE, 1, 2, 3,  2, "VAV #2, Trunk 1 (BACnet 2)"
DEVICE, 1, 3, 3,  3, "DDC #3, Trunk 1 (BACnet 3)"
DEVICE, 2, 1, 0,  61, "VAV #1, Trunk 2 (BACnet 61)"
DEVICE, 2, 2, 3,  62, "VAV #2, Trunk 2 (BACnet 62)"
```

Just leaving this file the way it is gives you devics named "VAV #1, Trunk 1 (BACnet 1)", and the description being the same. Say we edited this file in this way (with the things edited shown in RED):

```
//  Auto-Discovery Files were Merged at 14:40:28, on Nov 28, 2012..  EDITED ON 1 Dec 2012 (BC)
//
//    "DEVICE", TRNK, SM2-UNIT, SM2-TYPE, MB-UNIT, NAME
//
DEVICE, 1, 1, 0,  1, "Room 123 VAV", "Room 123 VAV3 (#1 on Trunk 1)"
```

DEVICE, 1, 2, 3, 2, "Room 124 VAV", "Room 124 VAV3 (#2 on Trunk 1)"
DEVICE, 1, 3, 3, 3, "AHU-1", "AHU-1 DDC (#3 on Trunk 1)"
DEVICE, 2, 1, 0, 61, "Room 201 VAV", "Room 201 VAV3 (#1 on Trunk 2)"
DEVICE, 2, 2, 3, 62, "Room 202 VAV", "Room 202 VAV3 (#1 on Trunk 2)"

Then, the name (BACnet Object-ID) would be things like "Room 123 VAV", with descriptions (BACnet) like "Room 123 VAV3 (#1 on Trunk 1)". You get the picture. Or you pet the gicture…

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