

MATRIXPNC USER MANUAL



MatrixPNC User Manual

Part Number - 1E-01-00-0065

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- . Initial Product Release

This manual describes the operation and configuration of MatrixPNC.

This document is divided into the following sections:

- . One: *Overview*, describing the product platform.
- . Two: *Device Setup*, describing the setup and configuration of device and communications.
- . Three: *Using the PNC*, describing general programming of the MatrixPNC, application network theory, and other items essential to successful setup and configuration.

This document contains certain style and formatting conventions for conveying information in a clear and concise manner:

- . Menu commands appear with a ">" symbol between levels. For example: File>Open.
- . *Italics* indicate options within software.

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SECTION 1: OVERVIEW

This section provides general information regarding the MatrixPNC. This section provides a general discussion regarding the system architecture use of the MatrixPNC, product mounting and hardware layout, communication connections, and product specifications.

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1.1 OVERVIEW: WHY THE PNC?

It has been three years since the advent of AAM's AspectFT line of products. Since that time there have been several options available to migrate legacy sites from SageMAX and Auto-Pilot architectures to the new AspectFT-based web server paradigm. The MatrixPNC is the third such option - an option that makes migrating from a SageMAX to an AspectFT front end far faster, far simpler and far more economical than any other solution.

Prior to the MatrixPNC, the “cleanest” migration option has been for Solution Integrators to remove the SageMAX completely and replace all SageMAX based SPL programs with newly created JavaScript or graphical component-based programming. With this approach the controllers on the EIA-485 networks are all left in place but the graphics and the SPL programs, the “guts” of the SageMAX, have been re-engineered to run on the new platform.

The other option has been to keep the SageMAX in place as part of the system architecture but move the graphics, data aggregation and scheduling to the AspectFT front end. This involves the use of an SDP (Sage Datagram Protocol) driver for AspectFT to communicate with the SageMAX's on site. This approach has proven to be faster to deploy because the SPL programs do not have to be scrapped and replaced as they do in the other method. The drawback with this method is that in the end the system is a hybrid in that it still relies on the on site SageMAX despite also having more advanced AspectFT devices on site.

The MatrixPNC or “PUP Network Controller” is the third and latest option available to Solution Integrators as they try to migrate to the more powerful front-end that AspectFT provides. At its core the MatrixPNC is a PUP router that can be used to physically replace a SageMAX. This is because the MatrixPNC allows an AspectFT front end to speak directly to the PUP devices that are connected to its EIA-485 PUP ports. This in itself is not different from what a Matrix/Nexus area controller can accomplish, but there is one major difference- the MatrixPNC can also run SPL programs that have been pulled from the existing SageMAX that they have replaced.

Each MatrixPNC has the ability to connect to two physical EIA-485 ports/trunks and also contains 98 regions suitable for SPL programs. SPL programs in the MatrixPNC can access points in locally attached devices as well as those in other EIA-485 trunks attached to other MatrixPNC controllers or AspectFT devices. Replacing a fully loaded SageMAX with 8 trunks of controllers can now be accomplished with 4 MatrixPNC controllers, each running SPL programs that can access not only directly (locally) attached controllers but also controllers attached to other MatrixPNC devices, all without any additional drivers or licenses needed.

1.2 MATRIXPNC SYSTEM ARCHITECTURE OVERVIEW

The MatrixPNC device is both a PUP controller and a PUP router. Technically, the MatrixPNC is an FTNet device which means that it can be used anywhere in the system architecture where EIA-485-based PUP controllers need to be connected to the broader network. By attaching a MatrixPNC to new or existing PUP networks, all of the PUP controllers on those networks can be interrogated by the AspectFT front end, SoloPro or other MatrixPNC devices on the IP network.

In addition to routing, each MatrixPNC also allows up to 98 SPL programs to run concurrently. These programs can access data on any controller downstream (e.g. connected directly to the MatrixPNC via EIA-485) of the MatrixPNC but they can also communicate with any other PUP controller in the LAN.

As an example, let's look at replacing a fully loaded SageMAX. Assuming that the SageMAX used all eight of its EIA-485 ports, 4 dual-port routing devices will be needed to connect each of the EIA-485 networks. Of these 4 devices, at least one needs to be a MatrixPNC to run SPL programs but the rest of the devices can be any other FTNet device such as an AspectFT Matrix or Nexus.

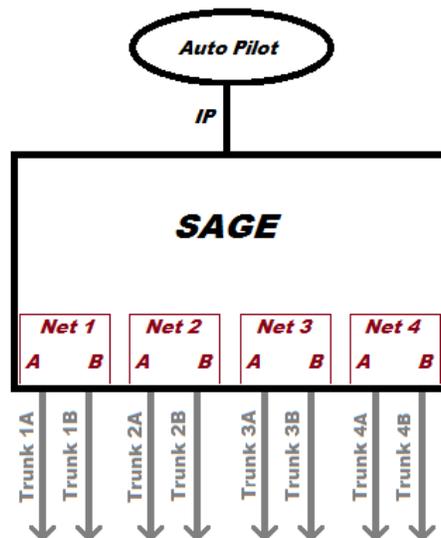


Figure 1-1 - Classic Auto-Pilot/SageMAX Architecture Example

The number of FTNet devices that are MatrixPNC's should be chosen carefully. If there is a desire to run more than 98 concurrent SPL programs, additional MatrixPNC's will be needed. With 4 MatrixPNC's attached to the 8 EIA-485 trunks, a maximum of 392 programs can be run concurrently. But what is even more important is the network addressing that was used on the original SageMAX.

The SageMAX technically only has 4 networks, each of which has two trunks, trunk A and trunk B. This is a **very important point** for several reasons. On a SageMAX, controller ID's have to be unique on both trunks of a network but they may be repeated on other local networks. The only rules at the time were that no two controllers with the same ID can be on the same network. This is important because the SageMAX didn't differentiate between trunks in its addressing scheme. If a SageMAX's "point.bob" file provided a link to controller 500 on port 1, the SageMAX didn't technically care if it was on 1A or 1B, it communicated with both ports and returned the answer from the correct port. There could easily be additional units sharing the

same ID of 500 on any of the other EIA-485 networks, it's just that no more than 4 could have existed on the SageMAX at one time.

In order to take this addressing into account, the MatrixPNC is equipped with a feature called "Compatibility Mode." This feature is turned on by default and allows the MatrixPNC to act like a SageMAX with respect to downstream controllers. Using Compatibility Mode, other devices, software like SoloPro, as well as the MatrixPNC itself will allow communications with controllers on either of its EIA-485 ports without the need to specify on which trunk the controller is physically located.

1.2.1 CHOOSING THE NUMBER OF MATRIXPNC'S

Below are two methods of replacing a fully loaded SageMAX, one using 4 MatrixPNC's and one using 1 MatrixPNC and 3 other FTNet devices.

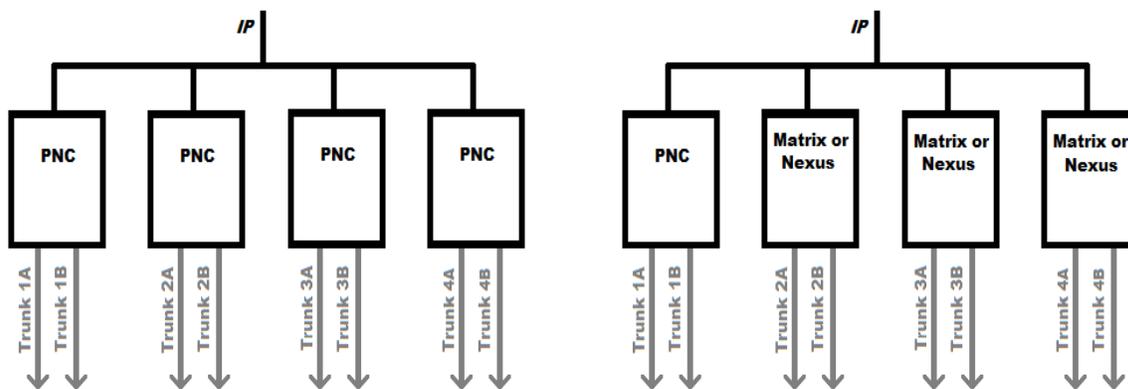


Figure 1-2 - Replacement Methods

The two figures above each show appropriate methods of replacing a SageMAX. However, the figure on the left, showing 4 MatrixPNC's is the fastest and easiest way to replace a SageMAX. This method allows for 394 SPL programs to run concurrently across the 4 MatrixPNC's and it allows the "point.bob" file to be converted automatically without having to locate and document each and every controller on the network to determine if they are on trunk A or trunk B of their declared SageMAX Net.

The figure on the right shows an alternative method of SageMAX replacement. In this example only one MatrixPNC is used, and the other three devices are either Matrix or Nexus devices. Using this method, only 98 SPL programs can be run since only one MatrixPNC is on the network to support SPL. In addition, because there is no "Compatibility Mode" option on non-MatrixPNC devices, the "point.bob" file will need to be modified to specify to which trunk each controller is attached. The process of modifying the "point.bob" (or more specifically, the "point.csv") file is addressed in a later section of this document.

Other advantages of using multiple MatrixPNC's in the project is that the SPL programs that they run can be moved between controllers to allow load leveling and redundancy. Because the SPL programs reference ASCII names for the controllers (specifically names tied to each object in each controller) the path to find that controller is set up in the network channels in each PNC. As long as the networks are labeled correctly, an SPL program can be pulled from one MatrixPNC and dropped into another one without having to recompile or modify it in any way.

1.2.2 SAFETY PRECAUTIONS

NOTE

All equipment must be installed in accordance with NEC and local codes. For more information on local codes, please check state/local regulations in your area.

CAUTION

To prevent damage to any of the electrical components of this product and to ensure that it continually operates, do not attempt to alter any componentry.

1.2.3 STATIC DISCHARGE PRECAUTIONS

WARNING

Follow the precautions provided specific to static discharge.

Static discharge can produce voltages high enough to damage electronic circuits and components. The microprocessor and associated circuitry are sensitive to static discharge. Follow these precautions while working with the product during service and installation:

- . Work in a static free environments
- . Discharge any static electricity you may have accumulated by touching a known, securely grounded object.
- . Do not handle the printed circuit board (PCB) without proper protection against static discharge. Users should handle PCB components while wearing a ground bracelet or strap (connected to Earth ground).

1.2.4 MISCELLANEOUS PRECAUTIONS

NOTE

Do not apply this product to aerospace systems, mainline communication systems, nuclear power control systems or medical equipment involved in life support that require high reliability and safety, as it is not intended for such use or application.

NOTE

This device complies with Part 15 of the FCC rules. Operation of this equipment is subject to the following conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

1.3 PRODUCT MOUNTING

The MatrixPNC ships with an approved enclosure consistent with most electrical standards and regulations. It is intended for indoor applications only and should be installed in a location that is dry, away from direct sunlight and free from excessive dust, vibration, and electrical interference. Mount the product in a location that allows clearance for ease of wiring and service. Use the two keyhole-style screw holes located on the back of the enclosure for assistance with mounting.

1.3.1 ENCLOSURE COVER

The enclosure cover of the product is designed to be removed for servicing the device. The cover is removed by unscrewing the 4 hex head screws in the cover then sliding the cover vertically before pulling it away from the base. Care should be taken when removing the cover on a mounted unit to prevent it from being dropped and damaging the cover or harming the user.

1.4 HARDWARE LAYOUT

Below is an illustration of the hardware layout of the product. The device includes connection ports for Main Power, EIA-485 network connectivity and Ethernet connectivity. Depending on the application it may involve using one of the or both EIA-485 network ports.

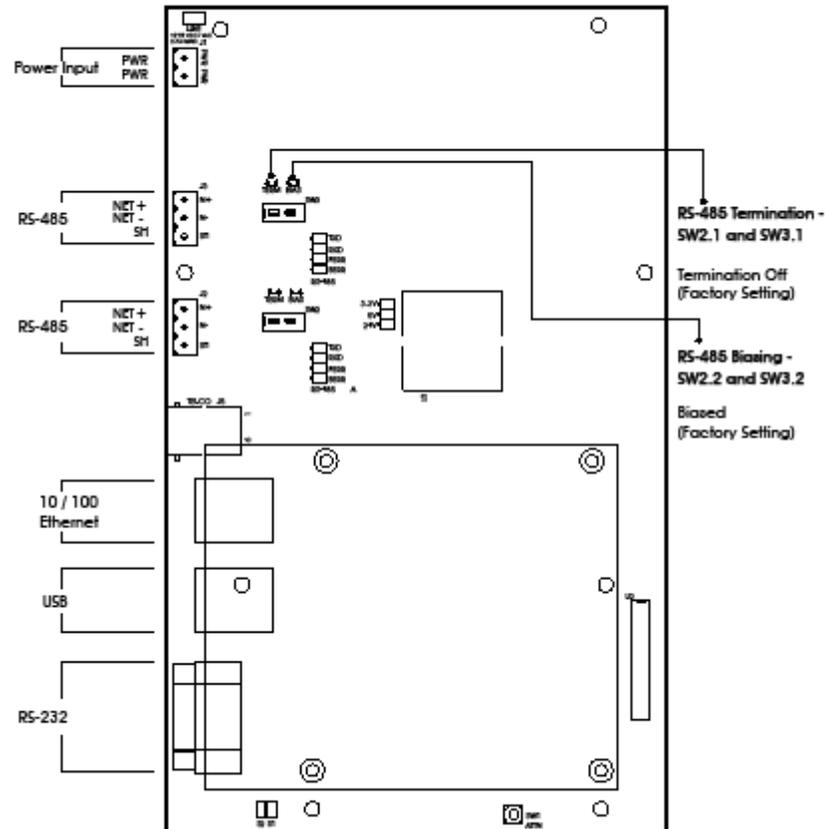


Figure 1-3 - MatrixPNC Board Layout

1.4.1 UNUSED PORTS

The MatrixPNC contains an RS-232 port, as well as dual USB ports. These ports currently contain no functionality relative to the product itself, but are reserved for future use and applications.

1.4.2 POWER REQUIREMENTS

This product requires a transformer capable of providing 24VAC power to the product. Use a UL listed 24VAC transformer.

To connect power, use the supplied two-position terminal plug. The output leads from the transformer should be connected to the terminal plug. The terminal plug is then connected into the socket marked *J1* on the PCB. American Auto-Matrix recommends using 18AWG cable for power wiring.

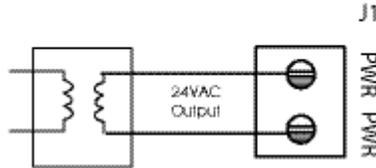


Figure 1-4 - Connecting Power to MatrixPNC

WARNING
<i>Do not share the power source for MatrixPNC with other devices. Damage to the product as a result of improper power and wiring will void product warranty.</i>

1.4.2.1 LED INDICATION

The PCB of the product includes diagnostic LEDs, providing user feedback when power has been connected to the device. When power is connected, all three of the LEDs should be illuminated. The power diagnostic LEDs is located near the unused modem socket on the PCB.

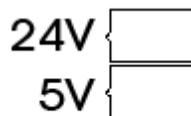


Figure 1-5 - Power LEDs on MatrixPNC PCB

1.5 COMMUNICATION CONNECTIONS

Communication connections should be made with care. To avoid conflicts with existing networks, it is recommended all communication configuration of the product be performed prior to connecting physical media from the building automation system.

CAUTION

It is recommended that all software configuration be performed prior to physically connecting this product to any associated communication networks.

1.5.1 ETHERNET NETWORK

Ethernet is a high-speed network layer widely used in commercial buildings. This product includes an on-board Ethernet adapter, allowing users communicate with the device for product setup, as well as for building automation routines and applications. The Ethernet network interface is located on the single board computer card.

The on-board Ethernet network interface supports 10Base-T (10Mbps) and 100Base-T (100Mbps) Ethernet connections. The product will automatically switch to 100Base-T operations if other devices and cabling connected to the same subnetwork support this

1.5.1.1 CABLE TYPE AND LENGTH

Use an approved Category 5 (CAT5) Ethernet patch cable with RJ-45 plugs to connect the product to an Ethernet switch or hub. Use professionally manufactured cables to assure reliable transmission rates and connectivity between devices. Category 5 wiring is typically limited to about 100 meters (320 feet).

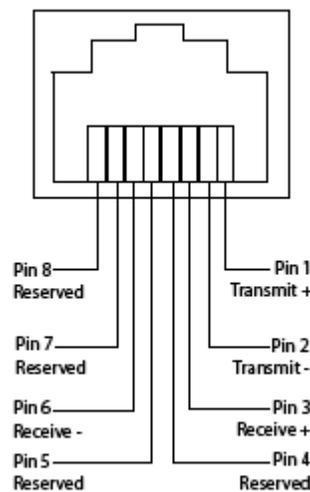


Figure 1-6 - Standard Ethernet Connection Pinout

1.5.2 EIA-485 NETWORK

The EIA-485 network ports are used to accommodate connections to the American Auto-Matrix PUP protocol network. Terminals for EIA-485 network connections are located on the left side of the controller board and are labeled J2 and J3. Each terminal has a connection for Network Positive (N+), Network

Negative (*N-*), and Source High Reference Wire (*SH*, commonly used for serial networks that utilize a reference wire for electrical stability).

The MatrixPNC should be installed at an electrical end of the EIA-485 network. Avoid network topologies where the network is “t-tapped” or “starred”.

1.5.2.1 CONNECTING EIA-485 NETWORKS

Connect the serial network to the determined EIA-485 port. Be sure to maintain network polarity at all times. Failure to do so can result in loss of network communications. For protection against ground loops or noise, connect the drain wire of the 485 network wire to one of the supplied enclosure studs located within the enclosure panel.

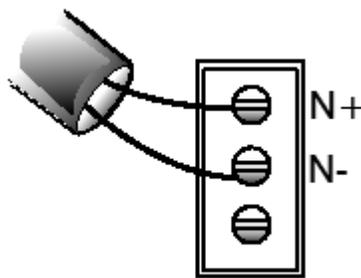


Figure 1-7 - PUP Network Connection

1.5.2.2 NETWORK TERMINATION AND BIASING

Adjacent to each EIA-485 port is a two-position switch block, which applies termination and biasing to your 485 network. To enable either termination (*TERM*) or biasing (*BIAS*), configure the respective switch towards the ON (Up) position.

When applying termination, be certain that it is applied at both ends of your EIA-485 network at the two end devices. In termination applications, biasing should also be enabled to ensure proper idle state voltage.

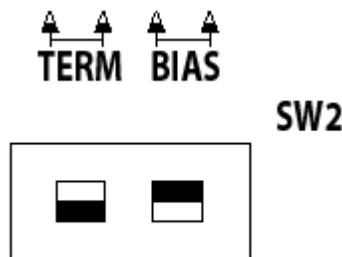


Figure 1-8 - Termination and Biasing Switches and LED Indicators

1.5.2.3 LED INDICATION

Located below the network termination and biasing switches is a set of diagnostic LEDs that can be useful for troubleshooting network communication problems.

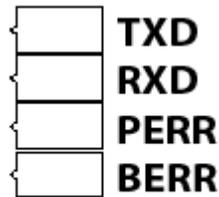


Figure 1-9 - Network Diagnostic LEDs

Table 1-1: EIA-485 LED Diagnostics

LED Position	Notes
TXD	This LED will flash anytime data is transmitted by the MatrixPNC to the field bus network. On an active network, this light should flash anytime the device passes a network token to another device or routes a request made by another device.
RXD	This LED will flash anytime data is received by the MatrixPNC from the field bus network. On an active network, this light should flash anytime there is activity on the network.
PERR	This LED will flash upon the event a parity error occurs on the network. A parity error is caused by a mismatch between the calculated checksum and value received with the packet. The most common reason for a packet error is if more than one unit is attempting to communicate on the network at once, indicating the presence of a duplicate token or duplicate address.
BERR	This LED will flash upon the event a byte error occurs on the field bus network. A byte error is caused when information is lost during network communications, and is detected in the start, stop, or data bit timings. The most common reason for a byte error is due to devices attempting to communicate on the network at different baud rates.

NOTE

This product utilizes native EIA-485 communication drivers. Therefore, all network communications to field-devices should occur over specified network media as outlined in American Auto-Matrix product documentation. The use of media converters (such as Serial-to-Ethernet modems) not certified or sold by AAM is discouraged.

1.6 SPECIFICATIONS

1.6.1 POWER REQUIREMENTS

- . **connection:** 2 position, 5.08mm Eurostyle
- . NEC Class 2 transformer
- . 11-29 VAC, 50/60Hz, 2.7A max
- . PTC Protection

1.6.2 ETHERNET CONNECTION

- . **termination count:** 1 connection
- . **connection type:** RJ-45, female

1.6.3 EIA-485 CONNECTION

- . **termination count:** 2 connections
- . **connection type:** 3 position
- . **data isolation:** GMR Data Isolation
- . **termination:** 249ohm, switch selectable
- . **biasing:** 3.32k, switch selectable
- . **led:** indication for TXD, RXD, Byte-Error, Parity-Error
- . **network load:** supports up to 64 field devices per port - license enforced

1.6.4 CPU

- . **processor:** ARM9 with embedded Linux OS
- . **memory:** 128MB DRAM and 128MB Flash

1.6.5 OPERATING ENVIRONMENT

- . **temperature range:** 32-122 F (0-50 C) ambient
- . **humidity range:** 0-80% RH, non-condensing
- . **altitude:** up to 2000m

1.6.6 DIMENSIONS

- . base module: 5.4 x 9.0" (13.72 x 22.86 cm)
- . enclosure: 11.0 x 11.0 x 3.50" (27.94 x 27.94 x 8.89 cm)

1.6.7 BROWSER SUPPORT

- . Microsoft Windows Internet Explorer 7.0 or later
- . Mozilla Firefox v3.0 or later
- . Apple Safari v1.0 or later
- . Google Chrome v1.0 or later
- . Opera v1.0 or later

1.6.8 AGENCY APPROVALS

- . CE Approved
- . FCC, Class A Computing Device; Part 15
- . UL Listed 916, Management Equipment, Energy
- . UL Listed 873, Component Temperature-Indicating and Regulating Equipment
- . UL Listed, CComponent Temperature-Indicating and Regulating Equipment for Canada

SECTION 2: SOFTWARE CONFIGURATION

The following provides instructions relative to the base software configuration settings of the MatrixPNC. Base software configuration settings are performed using a standard web-browser and an Ethernet connection to the MatrixPNC. Please read through this section carefully before beginning the installation procedure.

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2.1 INTRODUCTION

The following provides details on the software configuration of the MatrixPNC hardware. Please follow the steps contained within this document for proper setup and configuration.

2.1.1 TOOLS REQUIRED

The following tools will be required for proper configuration of the system:

- . PC/Laptop
- . Ethernet cross-over cable, or other network connection to your MatrixPNC
- . Standard web-browser such as Windows Internet Explorer, Mozilla Firefox, Apple Safari, or other.
- . MatrixPNC License

2.2 CONNECTING TO THE MATRIXPNC

The MatrixPNC is shipped with a default IP address and subnet mask. Please refer to the product sticker on the inside door panel of the MatrixPNC for the default IP address (192.168.1.250) and subnet mask (255.255.255.0). Your computer's network card must be configured in a manner where it may access this IP network setting. Refer to your operating system documentation for details on how to configure your network card.

2.3 LOG-IN

To log-in to the MatrixPNC:

1. With your PC's network card configured, open any standard web browser.
2. Browse to the default IP address (192.168.1.250) of your MatrixPNC.
3. If your connection is successful, you should be greeted with the main page of the PNC, requiring user-name and password entry.
4. Enter the case-sensitive default username (*aamuser*) and password (*default*) into the fields provided.
5. Click the *Log In* button.

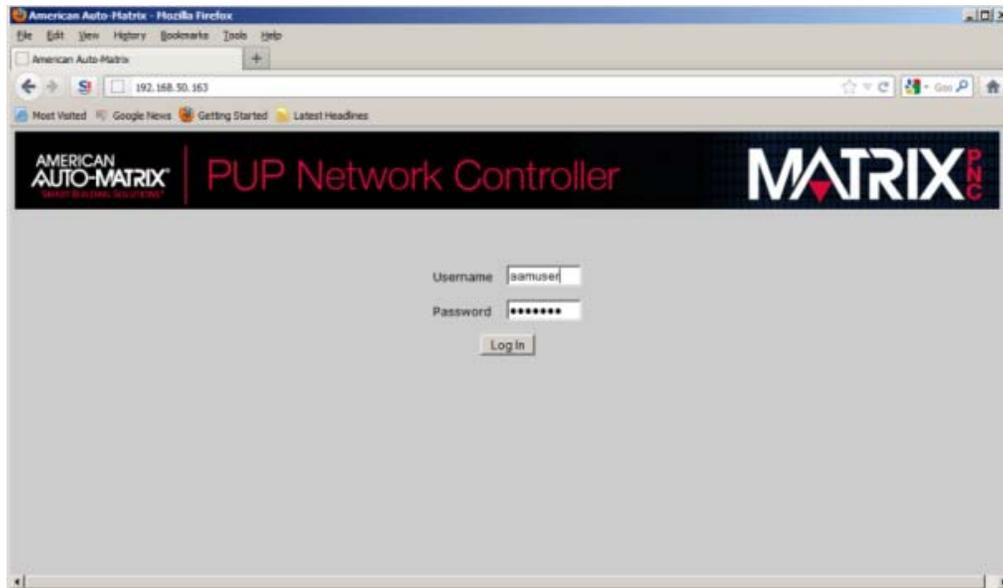


Figure 2-1 - Matrix PNC Log-In

2.4 CONTROL PANEL

When you successfully log-in, you will be directed to the Control Panel. The Control Panel contains a navigation tree to the left of the web user interface; allowing users to select different configuration areas of the product.

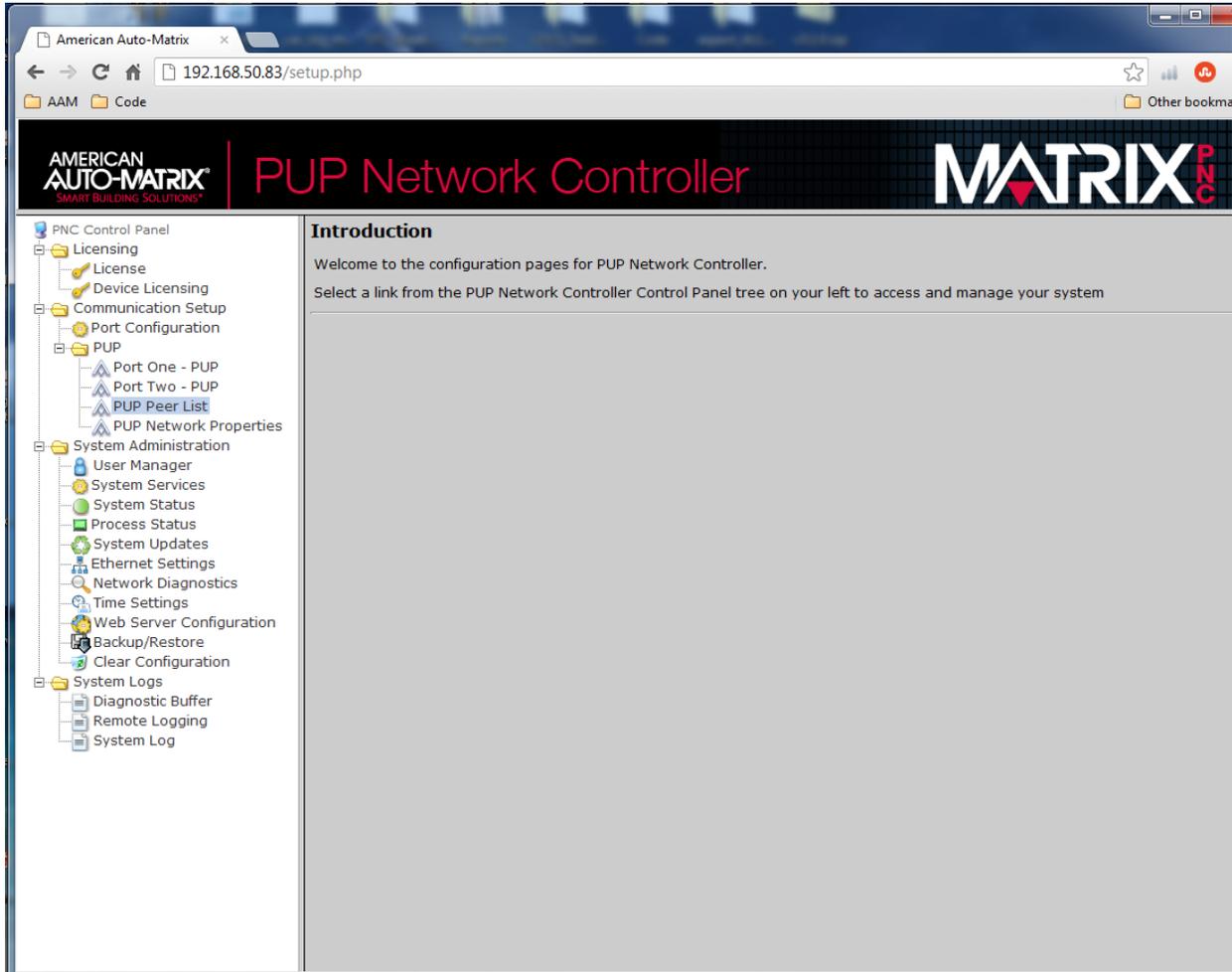


Figure 2-2 - Control Panel Overview

2.5 LICENSING

The licensing tab has two sub-pages. The top one, “License” is where you can upload a new license file or view or download the currently installed file. This file is human readable but can only be generated or modified by AAM.

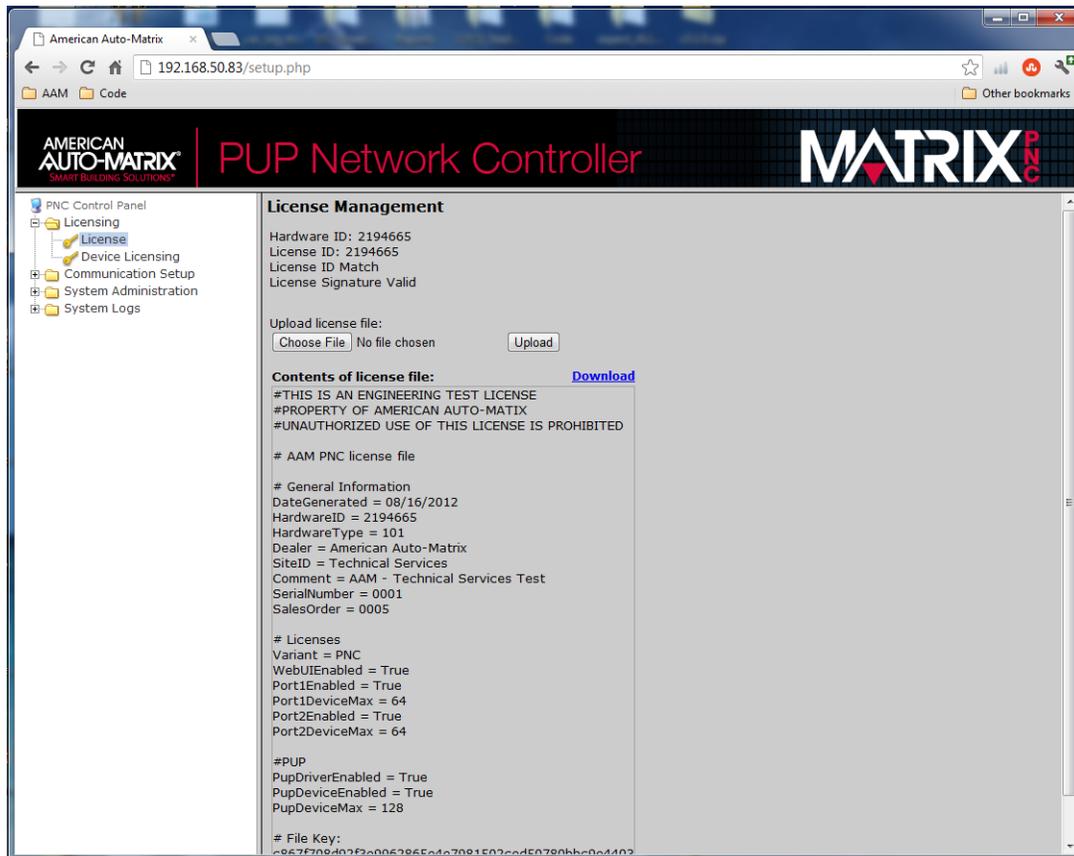


Figure 2-3 - MatrixPNC license page

2.6 COMMUNICATION SETUP

The communication setup page allows administrators the ability to configure the PUP network properties for the MatrixPNC controller.

2.6.1 PORT CONFIGURATION

The first sub-tab in the “Communication tab” is “Port Configuration.” Unlike other Matrix-based AAM products, the PUP Network Controller is only able to “speak” the PUP protocol, so this tab only allows you to select “PUP” or “Not Assigned” for each of the two local EIA-485 ports. These ports come defaulted to the “PUP” option but they should be verified to ensure a smooth and fast deployment of the product.

2.6.2 PUP

The second sub-tab in the “Communication tab” is simply titled “PUP.” This contains 4 different pages, one for each port, one for the peer lists associated with either port and one that defines the network timing details.

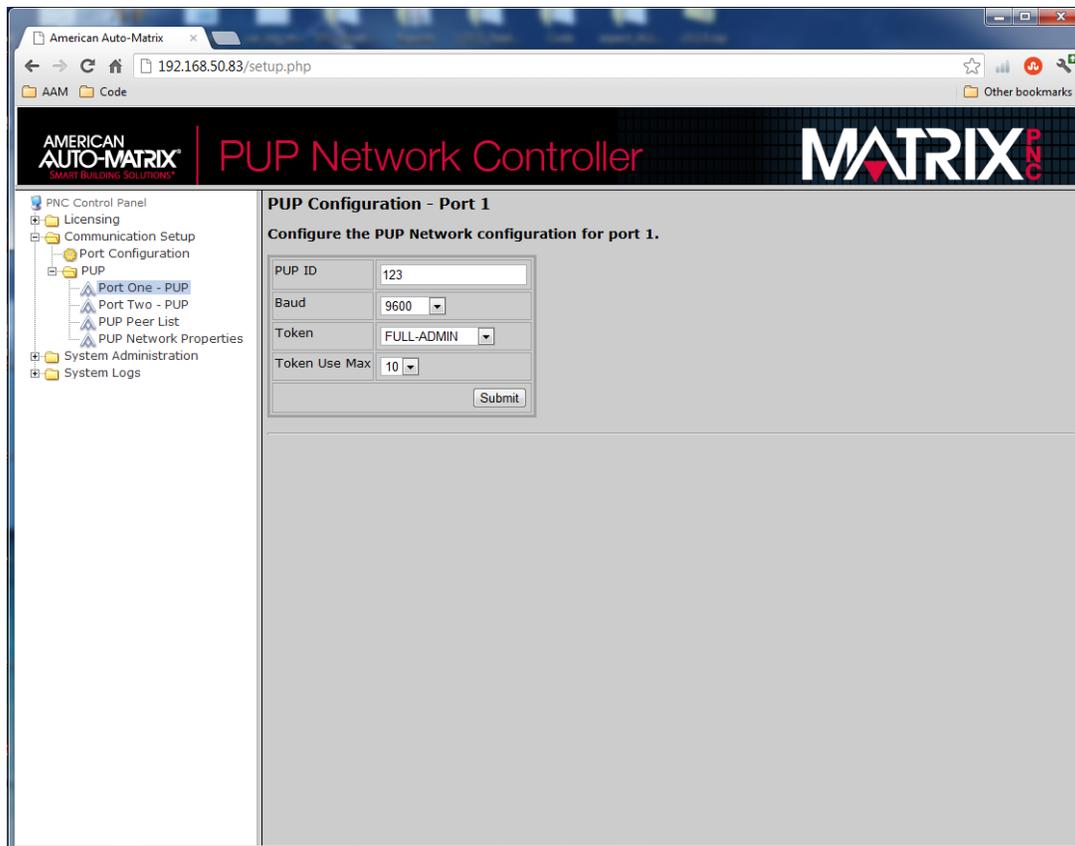


Figure 2-4 - PUP Port Configuration

2.6.2.1 PUP ID

This is the actual ID of the MatrixPNC on this port. It is strongly suggested that you keep the ID the same for both ports, as that will facilitate the network configuration, and greatly simplify any network troubleshooting that may take place in the future.

2.6.2.2 BAUD

This is where the baud rate for each trunk is set. Make sure that this rate matches the baud rate of the network to which the MatrixPNC will be attached. The MatrixPNC can be set for any of the following baud rates:

- . 1200 bps
- . 2400 bps
- . 4800 bps
- . 9600 bps (This is the default rate)
- . 19200 bps
- . 38400 bps
- . 57600 bps
- . 115200 bps
- .

2.6.2.3 TOKEN

The MatrixPNC can operate in two different token-passing modes, “Sole Master” and “Full Admin.” When in sole master mode, the MatrixPNC will not generate or pass any tokens but it will remain “in charge” of the network. This allows for the fastest network throughput since there is no time spent passing or waiting for tokens.

If devices on the network also need the token for alarm management, or to share broadcast data or other points, then the MatrixPNC should be put into “Full Admin” mode. In this mode, each of the controllers specified in the MatrixPNC’s token list will be passed a token on a regular basis.

2.6.2.4 TOKEN USE MAX

This variable can be set from 1 to 10 and indicates the number of transactions the MatrixPNC will perform before passing the token (if it is in a token passing mode). It is presumed that the default value of 10 will provide for the most robust network as the MatrixPNC will have the ability to initiate between 0 and 10 transactions every time the token is received.

2.6.3 PUP PEER LIST

The PUP Peer list is the next tab inside the “PUP” sub-tab. This is where any units requiring a token are granted token access. To pass a token to a PUP controller, simply specify the port, the unit ID and under the “Peer” column choose the “Yes” drop-down option.

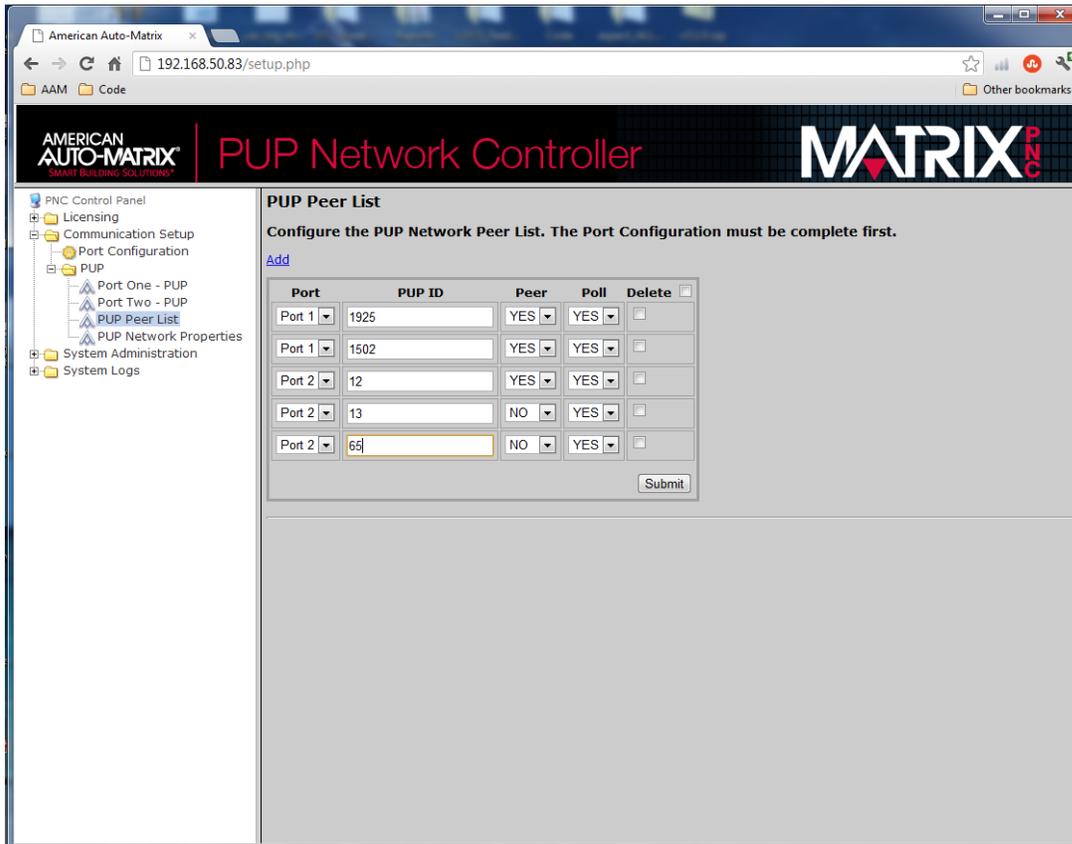


Figure 2-5 - PUP Peer List

2.6.4 PUP NETWORK PROPERTIES

The "PUP Network Properties" page is the last page in the Communication Setup tab. This is where the router-specific network details of the MatrixPNC are set.

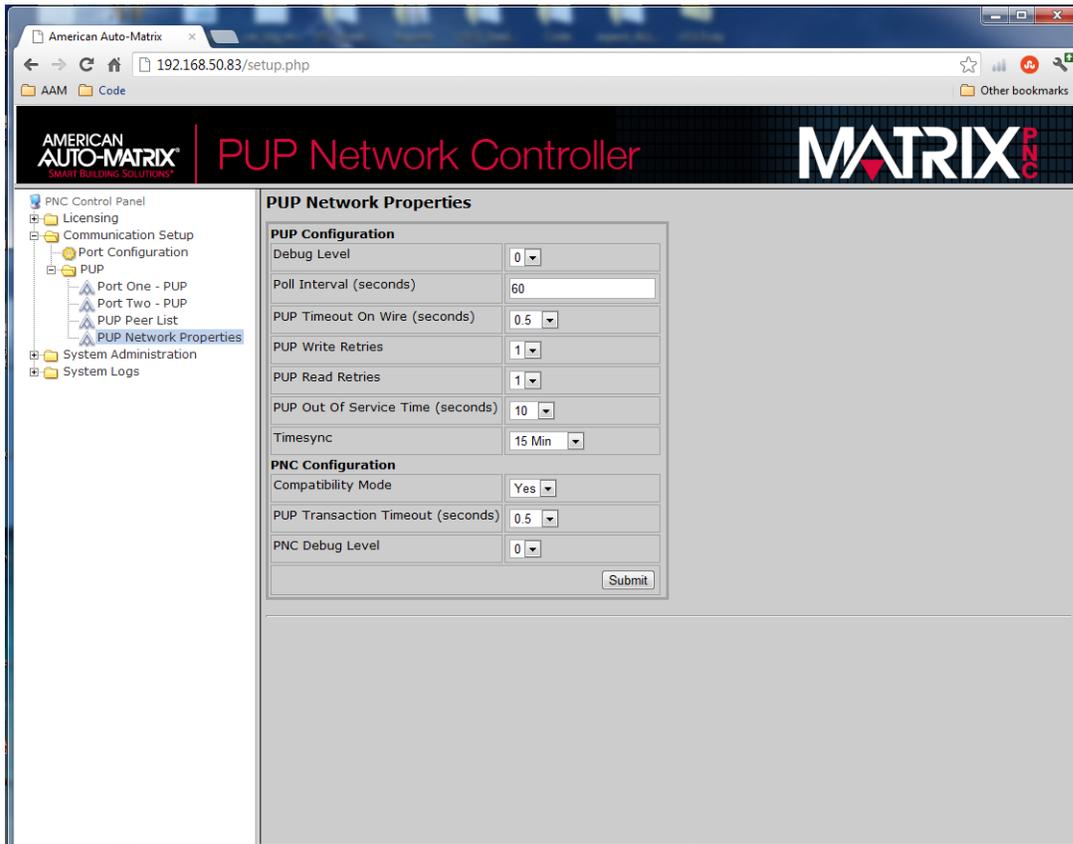


Figure 2-6 - PUP Network Properties

2.6.4.1 DEBUG LEVEL

This number specifies the type and quantity of messages logged in the MatrixPNC's various feedback buffers. Raising this to a higher number may provide AAM Technical Services with greater visibility into your site if you are experiencing difficulties. Raising this number also slightly slows down the MatrixPNC so it is suggested that it remain at or below 2 unless otherwise directed by tech support.

2.6.4.2 POLL INTERVAL

If units have been set up to be polled (asked if they are online and awake) by the PNC, this interval (in seconds) specifies how often the polls are sent out. This feature is not widely used in the MatrixPNC paradigm.

2.6.4.3 PUP TIMEOUT ON WIRE

This is the time (in seconds) that the MatrixPNC will wait for a response from a unit on its downstream EIA-485 controllers. If controllers are not found to be responding within a second this number can be increased but doing so will cause longer timeouts on the wire meaning that the network influence of an offline or missing controller will increase very rapidly with this number.

2.6.4.4 PUP READ/WRITE RETRIES

These values are used to specify if retries are automatically attempted by the PNC. It is likely that one would want to leave these numbers at 0 or 1 as traditionally retries have been taken into account in SPL with the manual use of "OnError" commands.

2.6.4.5 PUP OUT OF SERVICE TIME

If the MatrixPNC is passing the token to another device, this is the method used to periodically hold off on passing it the token if the unit is powered down or removed from the system. Setting this to a value of 1 minute means that every minute the MatrixPNC will attempt to pass the token to the device, then once it has exhausted its retries it will wait another minute before trying once more.

2.6.4.6 TIMESYNC

The MatrixPNC is automatically set up to broadcast a Timesync command on both EIA-485 networks at regular intervals. This can be set as often as every 15 minutes or as infrequently as once a day.

2.6.4.7 COMPATIBILITY MODE

This is where the MatrixPNC's Compatibility mode can be turned on and off. It is strongly recommended that this feature be left on so that the PNC can automatically route packets to PUP devices without having to specify the port (or more specifically, while ignoring the specified port). A restart is required after changing this value.

2.6.4.8 PUP TRANSACTION TIMEOUT

This is where the timeout (in seconds) is set for getting data back from PUP devices not local to the PNC. Specifically, if a program on a MatrixPNC needs to read or write to a controller that is attached to another PNC or AspectFT device, this is the timeout that must expire before the program moves on. It is important to set this value to be higher on networks with token passing as the target PUP device might be on a network where the PNC/Matrix/Nexus is waiting long periods of time for a token.

2.6.4.9 PNC DEBUG LEVEL

This is another feedback setting that changes what messages are logged in the various message buffers. This can be set higher at the request of AAM's Tech Support personnel.

2.7 SYSTEM ADMINISTRATION

The System Administration page is used to configure system-wide properties.

2.7.1 SYSTEM SERVICES

This is where the MatrixPNC can be rebooted to allow changes to take effect. The drop down options are:

- . Ethernet – Restart
- . Services – Restart
- . System – Restart (This takes the longest but restarts the entire PNC)
- . Web Server – Restart

2.7.2 SYSTEM STATUS

This screen provides feedback on the MatrixPNC from the Operating System level. In it you can view the amount of free memory, the current revision of MatrixPNC firmware that is running and other useful details.

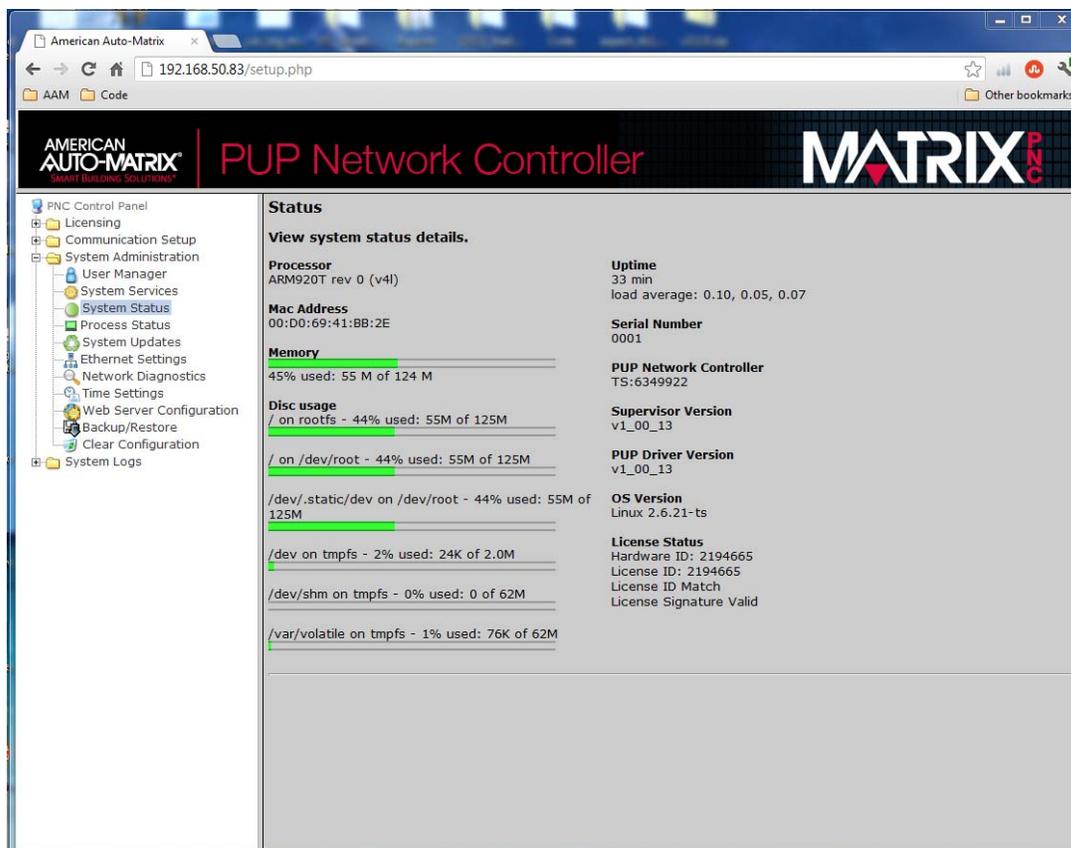


Figure 2-7 - MatrixPNC System Status

2.7.3 PROCESS STATUS

This screen provides detailed Operating System level feedback.

2.7.4 SYSTEM UPDATES

This screen is where the MatrixPNC's firmware can be updated. If you have been provided with a newer revision of the firmware the ".AAM" file can be uploaded to the MatrixPNC through this screen. A full system reboot will be required to commit to the changes and restart the PNC.

2.7.5 ETHERNET SETTINGS

This screen is where the Ethernet settings are located for the PNC. You may choose to obtain the address automatically from your network's DHCP server or you can specify it here. Note that if you rely on a DHCP server to obtain the address you will need to have a static IP assigned to this device. Failure to assign a static IP can allow the MatrixPNC to boot into a different IP address each time it is powered on which will nullify any network mapping you have specified in your related MatrixPNC or AspectFT devices.

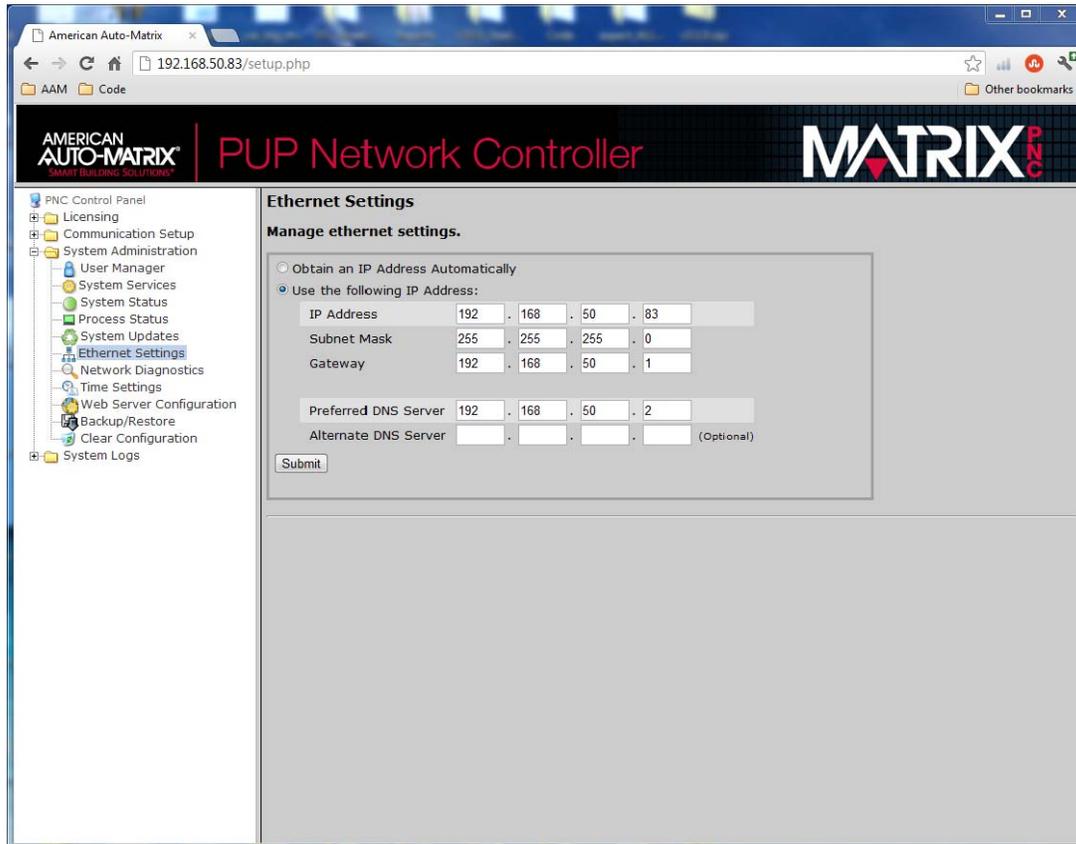


Figure 2-8 - PNC Ethernet Settings

2.7.6 NETWORK DIAGNOSTICS

This page has been provided to allow a remotely logged in user to ping other devices on the LAN for troubleshooting purposes.

2.7.7 TIME SETTINGS

This page is where one specifies the time server that will feed the time to the PNC.

- . System Time - specified in military time
- . System Date - specified in MM/DD/YYYY
- . TimeZone/Region - specified in one of many configurable options
- . Time Server Synchronization - specified through use of an NTP time server on the Internet. Refer to pool.ntp.org for information relative to other available NTP servers available.

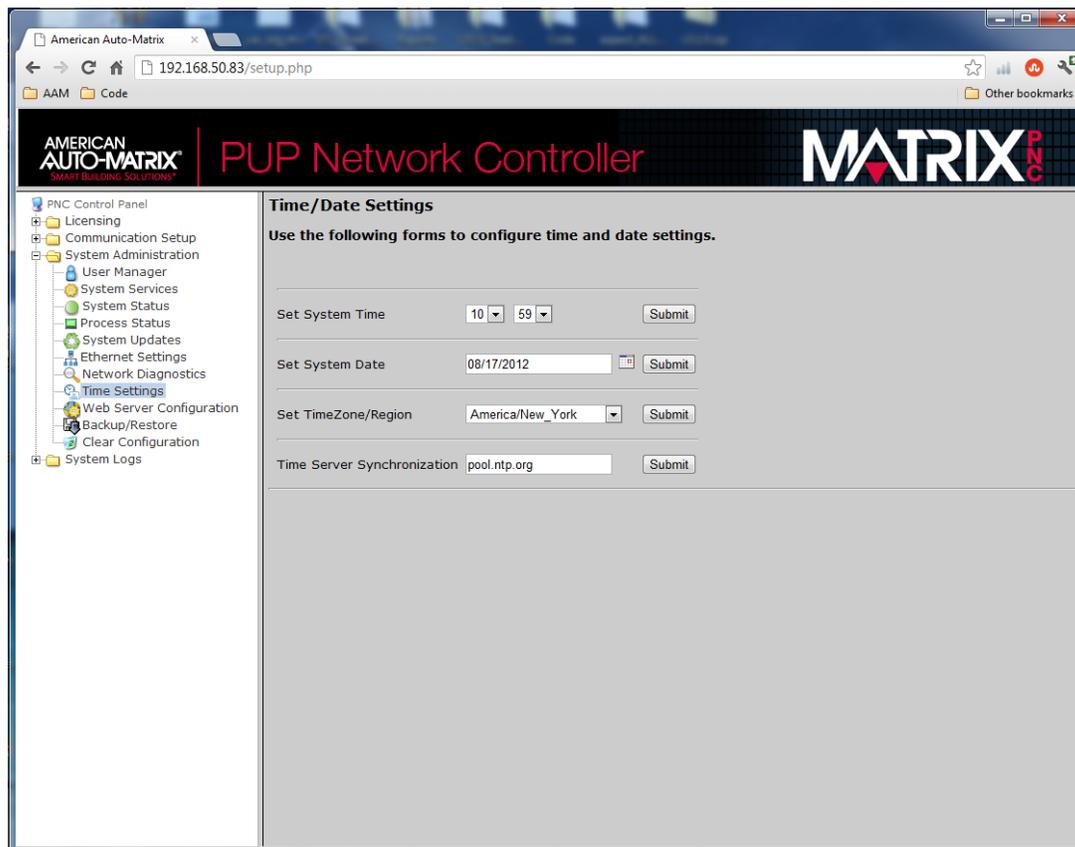


Figure 2-9 - Time Settings

2.7.8 WEB SERVER CONFIGURATION

This page allows the installer to specify which port is used to serve the Web UI on the PNC. By default it is set to 80 which allows one to view the web pages without specifying the port. If the port were to be changed from the default then the new number will have to be specified at the end of the URL to specify the non-default port.

As an example, if you are currently logged onto the unit at the default port of 80, the URL might look like this:

192.168.1.250/setup.php

If you were to specify a different port, say port 8080, the MatrixPNC's web pages could only be accessed by putting this into your browser's URL:

192.168.1.250:8080/setup.php

2.7.9 BACKUP/RESTORE

This page allows you to save and restore all of the MatrixPNC's relevant parameters including the channels, attributes, SPL files, and network and comm. port settings. It is suggested that once a PNC has

been configured it be backed up in case a need arises to replace it. Backing up the PNC requires only one step- pressing the “download” button on the backup/restore page.

The backup and restore feature is only guaranteed to work properly if the firmware is of the same revision between the initial backup and the eventual restore. If one is to upgrade the firmware on the PNC it is suggested that a precautionary capture file be made with SoloPro in addition to the backup file made from the backup/restore web page.

It is also suggested that a new backup file is created after any firmware upgrades to ensure that any new features are also backed up properly.

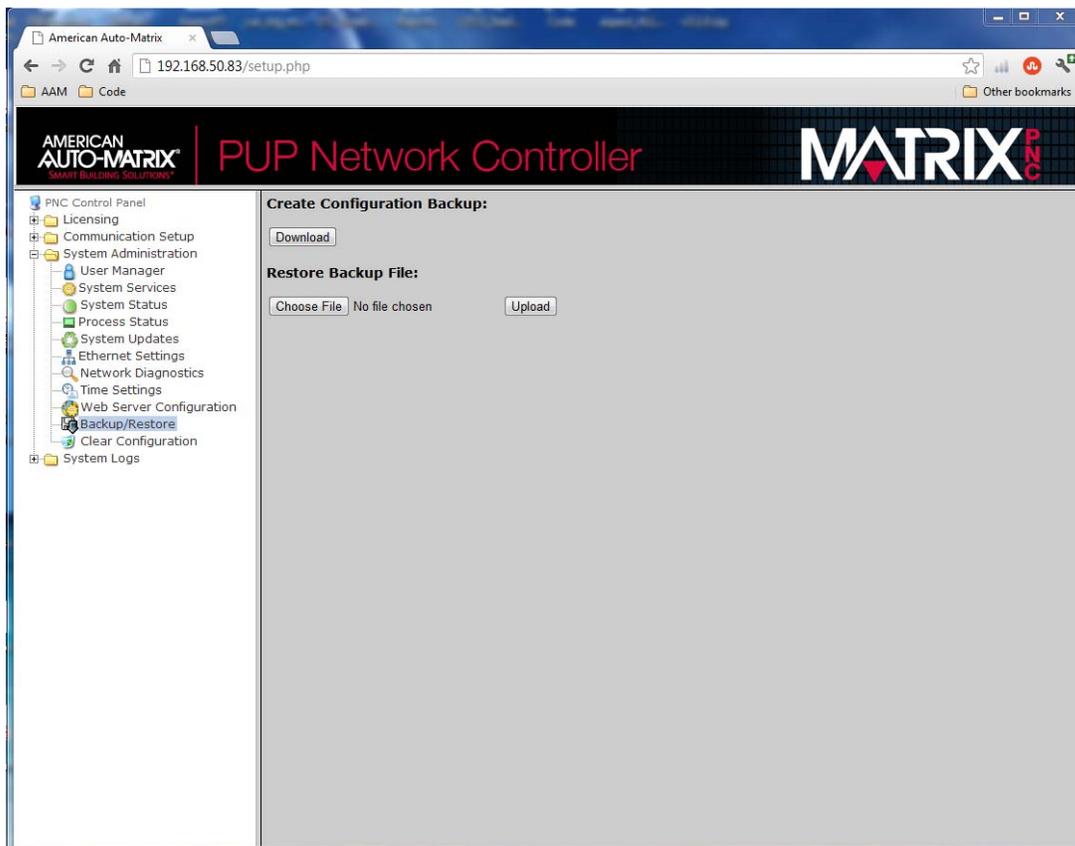


Figure 2-10 - Backup/Restore

2.7.10 CLEAR CONFIGURATION

The button on this page is used to wipe and default the PUP points and program regions on the PNC. This feature allows you to accomplish a “Default Enable” cycle on the MatrixPNC without using SoloPro to write to the “;DE” variable in the system channel.

Please note that after defaulting the PNC, you will likely want to restart the MatrixPNC cleanly by issuing a “System – Restart” command in the “System Services” sub-tab.

2.8 SYSTEM LOGS

There are three sub-tabs in this section of the UI. They are the Diagnostic Buffer, Remote Logging and the System Log file. Configuring and interpreting these logging features can be accomplished at the request of AAM's Tech Services if the need should arise.

2.8.1 DIAGNOSTIC BUFFER

Provides kernel operating system output for the MatrixPNC. The information shown here is for diagnostic purposes and may be referenced during troubleshooting sessions with AAM Technical Services. No configurable properties or values are present in this area.

2.8.2 REMOTE LOGGING

The remote logging page is used to allow or disallow centralized syslog messaging. All AspectFT targets support the ability to send their log information to a centralized AspectFT target or IT-supported syslog server.

2.8.3 SYSTEM LOG

This log contains information processed by the sub-level operating system outside of AspectFT.

SECTION 3: USING THE MATRIXPNC

This section describes overall programming and usage of the MatrixPNC. Configuration within this portion is achieved using the latest revision of SoloPro.

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3.1 USING THE PNC - PROCESS OVERVIEW

The MatrixPNC can be added to any PUP network simply to act as a PUP router or a place to run SPL programs. But the real power of the MatrixPNC comes when they are used to replace existing SageMAX units as sites move from AutoPilot-based front ends to AspectFT-based front ends.

Converting a SageMAX and AutoPilot site to a modern AspectFT site involves 5 basic steps:

1. Define the Network Addressing of all new devices.
2. Convert the POINT.BOB file from a SageMAX to a new easily editable file called "point.csv".
3. Convert the "#SAGE" SPL programs to "#PNC" SPL programs.
4. Create/modify the AspectFT front end that will replace AutoPilot.
5. Deploy the PNC/AspectFT devices on the network.

3.2 DEFINING THE NETWORK ADDRESSING

The following sections discuss network addressing within the MatrixPNC.

3.2.1 THEORY

In PUP, network numbers are not system wide, they are device-local only. This means that if you have two PUP ports on a MatrixPNC (or a Nexus or a Matrix), you may refer to those networks as anything you wish. By following this simple guideline you can be assured that the network number assignments don't become confusing to you or to the next tech to work on your project.

Unlike in the BACnet paradigm, network ID numbers are not automatically broadcasted out in the network using special descriptor packets. In PUP these network numbers are only defined in the device making the read or write request to controllers attached on these ports. The actual PUP data is routed via the IPv4 address.

As an example, let's say that you have 3 MatrixPNC's on a site at IP addresses 192.168.0.100, 192.168.0.101 and 192.168.0.102 respectively. (These MatrixPNC units will be referenced as units 100, 101 and 102 in this example which is the last entry in their IP addresses.) Each MatrixPNC can have 2 EIA-485 PUP ports on them, and each of these logical ports can be assigned network numbers.

Let's drill farther into the example above. If an SPL program in the MatrixPNC device at address 100 wants to read or write to a device attached through Port 2 of the MatrixPNC 101, that network will need to be defined in one of MatrixPNC 100's Network channels. Below is a screenshot of where I have made such an entry:

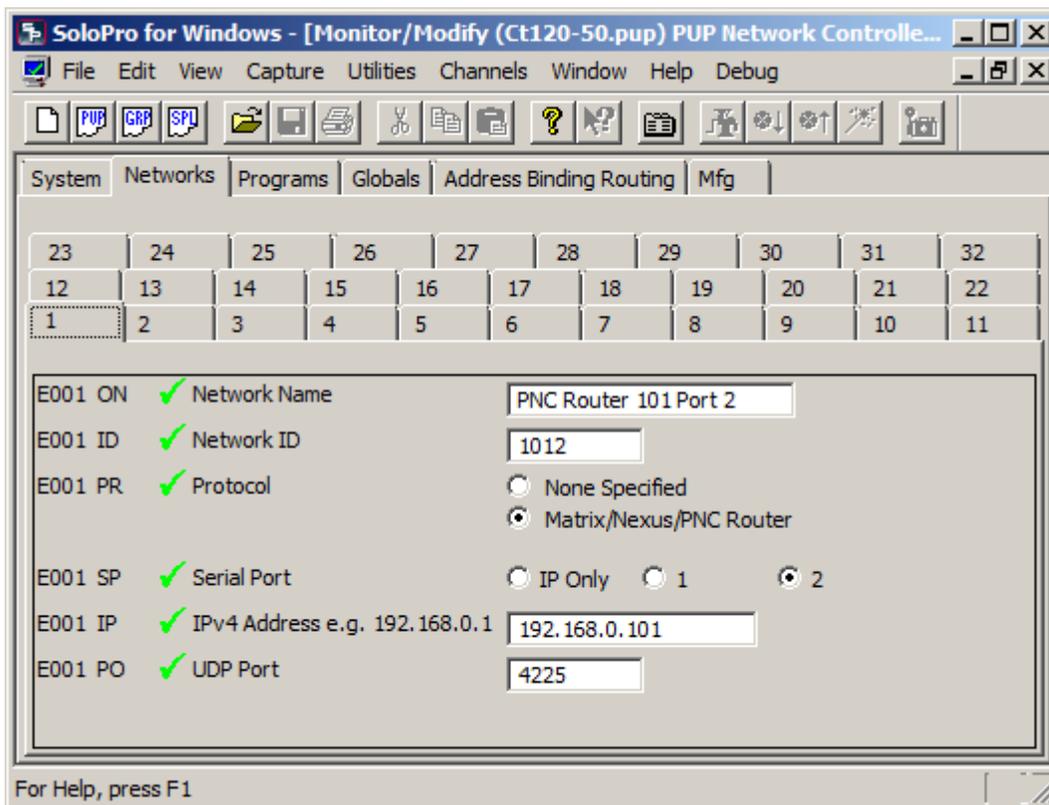


Figure 3-1 - PNC Network Channel

As one can see, here in device 100 we defined PUP port 2 in device 101 to be network #1012. That number was chosen because the port is physically located at the second EIA-485 port on the unit with an IP address ending in 101. By combining those two pieces of data I decided to name the port number 101-2, or 1012.

The reason this is so important is that the designation of that particular EIA-485 trunk as network 1012 only exists inside of the MatrixPNC where we just made a network entry for it. Now wherever the SPL programs reference a CSV entry that calls out a channel on a device on port 1012, the MatrixPNC will know exactly where to read and write that data.

Inside device 102 one could make a network entry for the same physical trunk, but one isn't required to call it the same thing:

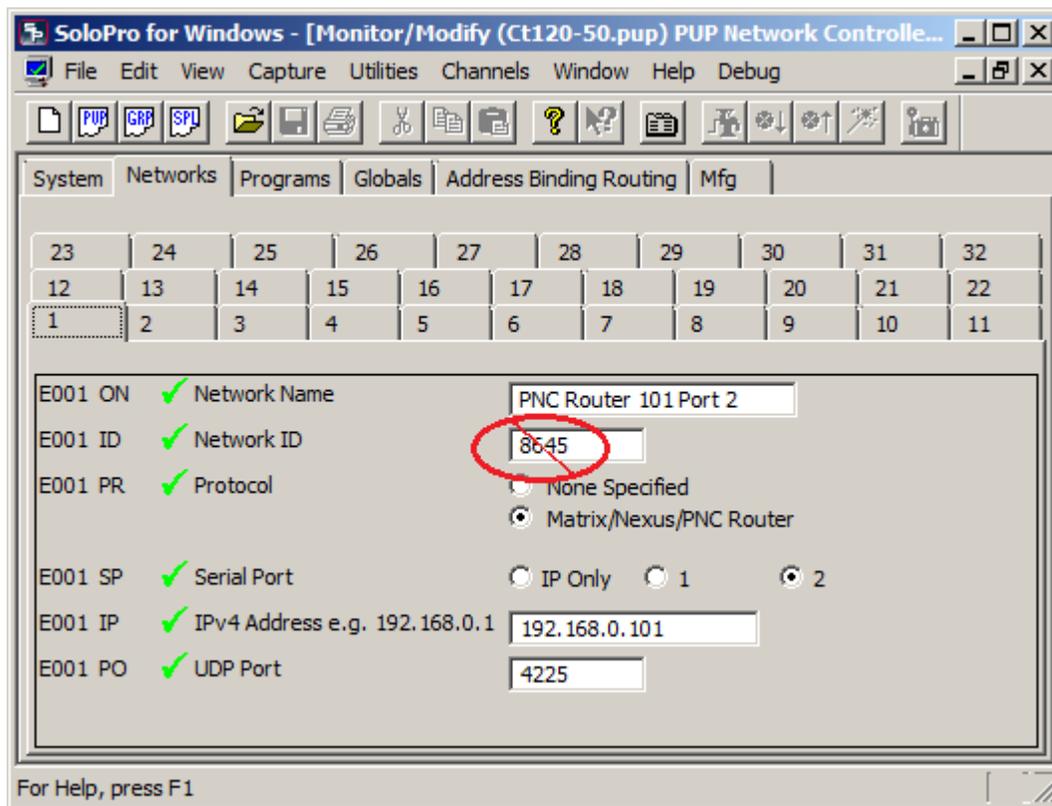


Figure 3-2 - PNC Network ID

As you can see, any CSV files in device 102 would have to refer to network 8645 to access the same points that from device 100 are declared to be on network 1012. This would not only be confusing, it could seriously slow down the deployment and troubleshooting of a project.

One last compelling reason to always use this network number naming convention is that if you have the same CSV file in multiple MatrixPNC's, an SPL program can be moved from any MatrixPNC to any other MatrixPNC and it will still work, regardless of where the controllers are that it is managing.

3.2.2 PRACTICE

First determine how many MatrixPNC's, and how many Matrix/Nexus devices are going to replace the SageMAX. After choosing what their IP addresses are going to be fill out the following form to help keep this information at your fingertips:

Sage Information		New Controller Information			
Sage Net	Sage Trunk	IP Address Of Controller	Local Port Number	Compatibility Mode Enabled?	New Network Number
1	A				
	B				
2	A				
	B				
3	A				
	B				
4	A				
	B				

Figure 3-3 - Sample Form

Let's assume that we are using 4 MatrixPNC's. Because they are using compatibility mode, you do not need to specify which SageMAX trunk a controller is on, only the port. A typical example is shown below.

Sage Information		New Controller Information			
Sage Net	Sage Trunk	IP Address Of Controller	Local Port Number	Compatibility Mode Enabled?	New Network Number
1	A	192.168.23.100	1	Yes	100
	B	192.168.23.100	2	Yes	100
2	A	192.168.23.105	1	Yes	105
	B	192.168.23.105	2	Yes	105
3	A	192.168.23.110	1	Yes	110
	B	192.168.23.110	2	Yes	110
4	A	192.168.23.125	1	Yes	125
	B	192.168.20.125	2	Yes	125

Figure 3-4 - Sample Form All MatrixPNC Products

As this example shows, the network numbers are shared on each MatrixPNC since compatibility mode is turned on. That means that if a controller is attached to either EIA-485 network on the MatrixPNC communicating with it does not require specifying which port it is on- the MatrixPNC will take care of that automatically.

By contrast, this next form has been filled out to show one MatrixPNC and 3 AspectFT Matrix or Nexus devices:

Sage Information		New Controller Information			
Sage Net	Sage Trunk	IP Address Of Controller	Local Port Number	Compatibility Mode Enabled?	New Network Number
1	A	192.168.23.100	1	Yes	100
	B	192.168.23.100	2	Yes	100
2	A	192.168.23.105	1	No	1051
	B	192.168.23.105	2	No	1052
3	A	192.168.23.110	1	No	1101
	B	192.168.23.110	2	No	1102
4	A	192.168.23.125	1	No	1251
	B	192.168.20.125	2	No	1252

Figure 3-5 - Sample Form 1 MatrixPNC & 3 AspectFT-Matrix or AspectFT-Nexus

The green numbers with dark cell shading indicate the MatrixPNC device with compatibility mode turned on whereas the red numbers in the cells with light shading indicate EIA-485 networks that are not attached to a PNC. As one can see, unlike the PNC, the other controllers need to be aware of just which port each device is actually on. For that reason, those numbers are 4 digits long and not three as the port number is the last digit.

Now that the networks have been mapped out, they can be entered into the Network Channels (E001 through E032) on any and all MatrixPNC's on site. Below is an example of how to enter one of these networks:

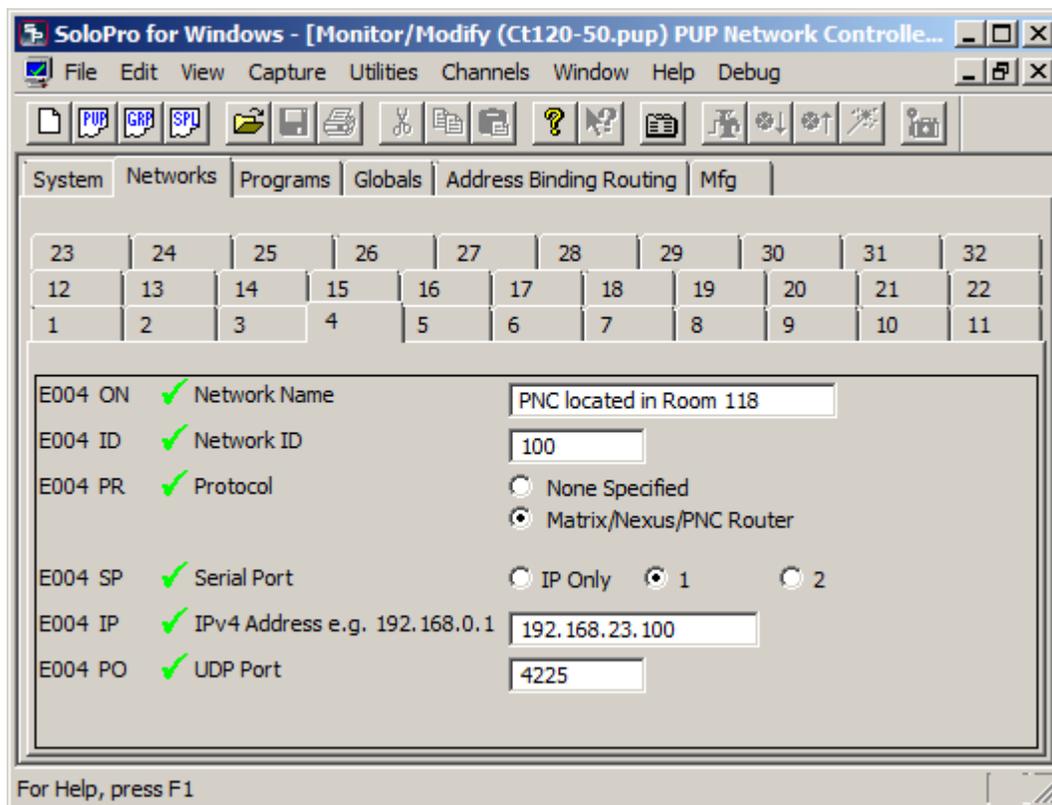


Figure 3-6 - PNC Network Configuration

3.2.3 ABOUT THE NETWORK CHANNEL

The Networks channel contains the following configurable attributes.

- . **Network Name** - This text is not used for any purpose except to make it easier to debug and troubleshoot. A location description is probably the most useful use of this field.
- . **Network ID** - This is the ID that you chose in the far right field of the spreadsheet you build in the previous step.
- . **Protocol** - Setting this to "Matrix/Nexus/MatrixPNC Router" does nothing more than stuff the number 4225 into the Port variable below. Port 4225 is the default port for PUP communications on AAM's devices.
- . **Serial Port** - This variable is ignored when the device in question is a MatrixPNC with compatibility mode turned on. If this was a non MatrixPNC device, you would want to specify the port # listed in the 4th column of the spreadsheet. The "IP Only" port is applicable only if you want to talk to another MatrixPNC's hosted PUP points directly and that MatrixPNC has had compatibility mode turned off for various other reasons.
- . **UDP Port** - This is the port over which the PUP protocol is passed. It is assumed that the default of 4225 is almost always used.

Note that the location of where the port is declared in the MatrixPNC is of no consequence. A typical MatrixPNC will communicate with up to 8 different ports (the same eight EIA-485 networks that the SageMAX originally used). Each of these ports should be defined in the Network Channels of each PNC, even the local ports. That way an SPL program can operate on any MatrixPNC without having to modify the ports or the "point.csv" file.

Even though there are likely only 8 networks, each MatrixPNC can specify up to 32 individual networks on the site. This means that your SPL programs are not bound by the constraints of the original SageMAX. Instead, they can communicate or control devices in other parts of the system. Using all of these 32 available port bindings a MatrixPNC can talk to up to 2048 different controllers (assuming all 32 EIA-485 networks have 64 attached devices).

3.3 CONVERTING THE POINT.BOB FILE

The following section discusses converting the POINT.BOB file from a SageMAX for use within the MatrixPNC.

3.3.1 THEORY

SageMAX controllers run SPL programs that can read and write points on up to 512 different controllers. Despite this fact, the SageMAX doesn't act as a PUP controller itself- it does not serve any PUP points that can be read from any other PUP controllers. Instead, SPL programs running in the SageMAX are used to read and write points on the downstream controllers attached to its EIA-485 ports.

The way that SageMAX controllers references these points was via text references. Inside the SPL program there would be a statement like the following:

```
D = [Unit 1234s System Channel;ID]
```

It was then the job of the "point.bob" file to take the text string "Unit 1234s System Channel" and associate that with a channel on a unit on one of the 4 networks attached to the SageMAX. In this example, let's say that the channel being referenced is the system channel on device #1234 located on one of the two trunks called Network 3.

In order to make the binary "point.bob" file easier to view and modify it has been replaced in the MatrixPNC with a comma separated file (CSV). This point.csv file has one line for each text reference and each of these lines follows the following format:

Text Reference, Trunk#, Unit ID, Channel #

So in order to reference the channel that is called out by the text string "Unit 1234s System Channel" the point.csv file needs to contain this line:

	A	B	C	D	E
1	Unit 1234s System Channel	3	1234	65280	
2					
3					
4					
5					
6					

Figure 3-7 - CSV Reference

Note that the last column shows up as decimal in Excel, but 65280 in decimal is the same number as FF00 in hex which is the way that channels are generally described. To switch back and forth between decimal

and hexadecimal in excel you can use the built in functions, dec2hex() and hex2dec(). These helpful references should be deleted before saving and deploying the CSV file so that it still conforms to the 4 column standard that the MatrixPNC is expecting.

3.3.2 PRACTICE

SoloPro now contains a utility to convert a “point.bob” file into a “point.csv” file. This utility can be found under the path “Utilities->Convert BOB File”.

Once the utility has been launched the following screen will pop up:

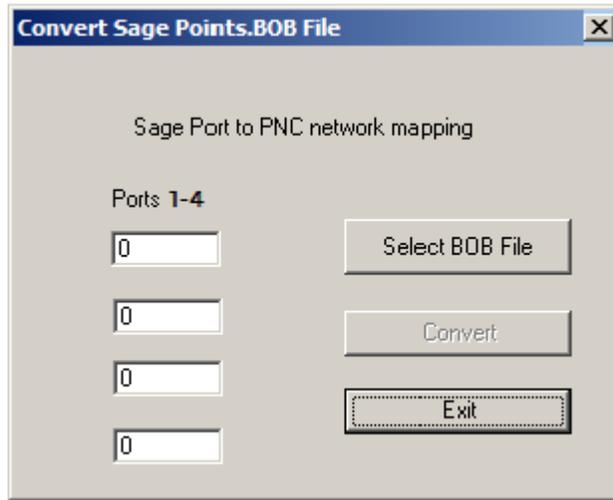


Figure 3-8 - Converting POINT.BOB

First you will need to select the bob file from your hard drive or network. The next step is to specify what the PUP network ID's will be for each of the MatrixPNC's that will replace the SageMAX.

As indicated in the previous section, these network numbers are only indexes but they should be respected system-wide to eliminate confusion. Enter your chosen network numbers that have been selected for each SageMAX network that is being replaced.

After running the conversion process you will have created a new comma separated volume (CSV) file. This file can be opened and modified in most spreadsheet programs including but not limited to Microsoft Excel, OpenOffice, LibreOffice and others. Opening this file you can see all of the data that has been converted from the original point.bob file in a format similar to this:

	A	B	C	D	E
1	VAV_17_xyz	100	17	64017	
2	VAV_12_xyz	100	12	65026	
3	VAV_14_xyz	105	14	65280	
4	VAV_16_xyz	110	16	65027	
5	VAV_17_xyz	105	17	65025	
6	VAV_5_xyz	110	5	65026	
7	VAV_19_xyz	125	19	65028	
8	VAV_27_xyz	100	27	65030	
9	VAV_11_xyz	125	11	65031	
10	VAV_26_xyz	125	26	65041	
11	VAV_99_xyz	100	99	65042	

Figure 3-9 - POINT.BOB Converted to MatrixPNC

If non MatrixPNC's are being used on this network, there is now an additional step to be performed. As described above, the SageMAX was interested only in which SageMAX Net each device was on, it did not differentiate between trunks A and B on each SageMAX Net. Note- If you are using MatrixPNC's for the entire project you may skip this portion of this step.

	A	B	C	D	E
1	VAV_17_xyz	100	17	64017	
2	VAV_12_xyz	100	12	65026	
3	VAV_14_xyz	1051	14	65280	
4	VAV_16_xyz	1102	16	65027	
5	VAV_17_xyz	1052	17	65025	
6	VAV_5_xyz	1102	5	65026	
7	VAV_19_xyz	1252	19	65028	
8	VAV_27_xyz	100	27	65030	
9	VAV_11_xyz	1251	11	65031	
10	VAV_26_xyz	1252	26	65041	
11	VAV_99_xyz	100	99	65042	
12	VAV_104_xyz	1052	104	65043	

Figure 3-10 - Converted-Non MatrixPNC's

Each controller on EIA-485 trunks attached to non MatrixPNC's will have to be manually entered to the spreadsheet. Once a controller is determined to be on one trunk or another, column B (containing the network number) will need to be manually edited. In the screenshot above you can see how pup units on devices 105, 110 and 125 have been updated to specify on which actual port they will be connected.

Once the point.csv file has been finalized, it can be deployed to each of the MatrixPNC's that are going to be on the project. This involves sending the file to the MatrixPNC via the file transfer service in SoloPro. Unlike the SPL programs themselves, the CSV files are automatically sent to region 1 on the PNC. In this way there can be only one CSV file in use at a time on the PNC.

3.4 CONVERTING “#SAGE” SPL TO “#PNC” SPL

The following section discusses converting SPL programs developed for the #SAGE platform for use in the MatrixPNC.

3.4.1 THEORY

Just because a program compiles and runs does not mean that it is still relevant for the new system. AAM believes strongly that all #PNC file conversions should be performed by someone who understands the system being upgraded. Blindly compiling and redeploying any SPL programs without viewing and verifying their contents is a practice that AAM does not condone.

Once the new system layout has been selected and the BOB file has been converted and uploaded, the next step is to prepare the SPL programs for use in the MatrixPNC. Although the MatrixPNC is able to run SageMAX SPL files, it is required that they be recompiled using a different hash tag to allow the MatrixPNC to verify that they have been vetted for proper use.

The reason for recompiling is simple, a small subset of commands that were available to the SageMAX are no longer available to the PNC. These include references to local line-printer references, local SageMAX schedules and trending databases. Scheduling and Trending features are best handled via the AspectFT front end and should be built concurrently with the design of the web server. To ensure that no unsupported function references are missed, the SPL compiler will show compiler errors when they are encountered. By addressing the compiler's issues you will be immediately drawn to the parts of functions that need to be addressed in the new system.

3.4.2 PRACTICE

Launch the SPL editor included in your SoloPro distribution. By default, SPL programs are compiled for use in a SageMAX. This means that some SageMAX-based SPL programs include the hash tag “#SAGE” while others have no hash tag at all. These tags are generally located at the very top of the SageMAX. If the declaration #SAGE is found in the file, delete it, then add the directive “#PNC” in its place. This will tell the compiler to allow only the commands that are supported in the MatrixPNC.

To compile the SPL program, click on the compile button (which appears as a small meat-grinder icon at the top of the screen) or choose the “Compile” option in the Utilities Tab.

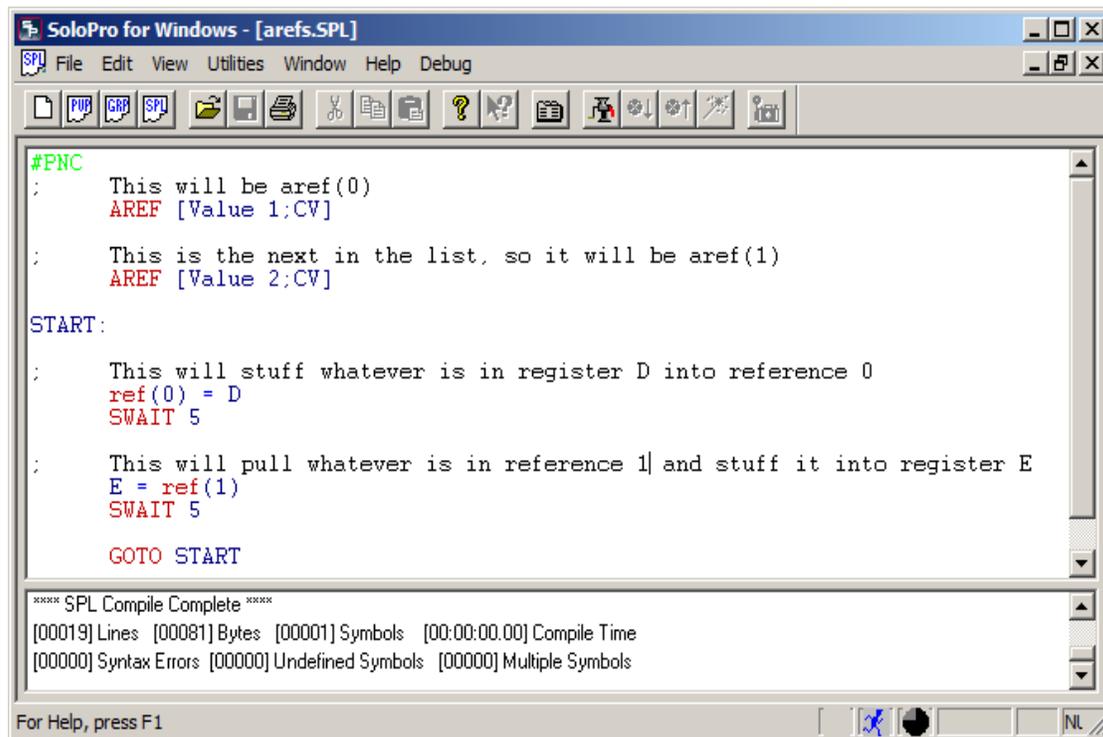


Figure 3-11 - Compiling SPL Programs

Once the program has been compiled it can be deployed on any MatrixPNC in the project. Please note that there can be only one “point.csv” in each PNC and it automatically takes over the first region. This leaves regions 2 through 99 for SPL programs.

For further instructions on uploading programs, please consult the SoloPro manual.

3.5 CREATE/MODIFY ASPECTFT TO REPLACE AUTO PILOT

3.5.1 THEORY & PRACTICE

This manual will not go into great detail in covering the creation or deployment of AspectFT products. However it is important to mention the features of SageMAX-based SPL programs that are best ported to the AspectFT product that is serving as the front-end to the system.

Unlike the SageMAX-Autopilot method of controlling a building, the AspectFT method is far more powerful with respect to the functions of alarming, trending and scheduling. For this reason, the SPL features that facilitated alarming, trending and scheduling should be moved to the AspectFT front end to take advantage of the improved features.

3.6 NEW FEATURES

There are some features that are unique to the PNC and not found in other new or legacy AAM products. These features are discussed in greater detail below.

3.6.1 LOCAL PUP CHANNELS & ATTRIBUTES

The SageMAX was designed to be an area controller, but it was not a native PUP device. Unlike all other devices that spoke PUP, it was unable to serve PUP points that could be read by other controllers on the network or by the front end. The MatrixPNC differs from this paradigm by enabling PUP client features.

SoloPro can be used to read and write to the MatrixPNC just as it would an SBC-GPC. You can choose to connect to the MatrixPNC by attaching SoloPro through a serial port or through the IP side of the PNC.

SoloPro can be attached directly to either trunk of the MatrixPNC. Simply add SoloPro to the peer list on the PNC and it will be passed a token allowing it to communicate on the wire. Then by searching for the ID of the PNC you can bring up all of its channels and attributes just as you would any other controller.

To view a MatrixPNC's Channels and Attributes in SoloPro using the IP connection, navigate to the "Preferences Tab" and choose the "Router" option instead of the Serial Port option. Next, type in the IP address of the PNC in question. The "Port" option can be left on either Port 1 or Port 2 since the PNC itself exists on both ports as well as the IP layer.

When connecting to the MatrixPNC via IP, SoloPro is able to simultaneously talk to any controller on either trunk as well as the PNC itself. If compatibility mode is turned off then only one trunk and the MatrixPNC itself can be accessed by SoloPro at a time. The MatrixPNC's channels and attributes will be available to SoloPro regardless of the specified Port.

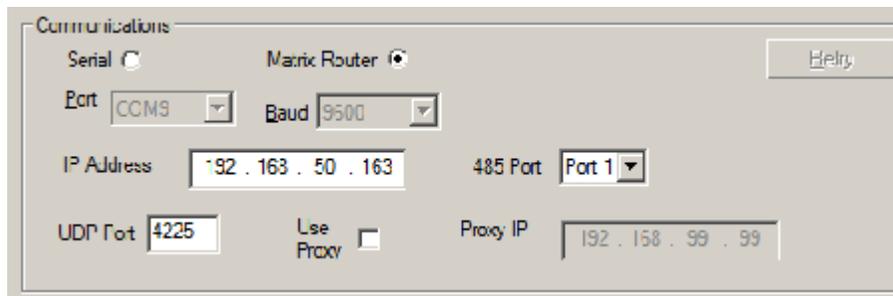


Figure 3-12 Solo Pro Configuration

3.6.2 THE AREF COMMAND

When SPL is running in a GPC, there is a command that allows a variable to be passed as an index pointer to a list of attributes. The GPC paradigm of specifying where a point exists does not work on the PNC as the PNC is able to see controllers on up to 32 different networks and the GPC is limited to only talking to units that share the same trunk.

"DREF" was a powerful feature on the GPC's and it has been modified and added to the PNC project to facilitate similar program scenarios. This new feature is called an "Advanced Reference" or "AREF" point.

To declare an AREF in SPL, simply make a list of all of the properties that you want to be able to toggle between in your code. As an example, the following program has 10 AREFS and by passing a pointer to the "ref()" command you can access any of the points without having to take each into consideration in the code.

The following is a code snippet of a program that will reboot 10 remote controllers every 10 minutes.

```
#PNC
;   This will be aref(0) through aref(9)
AREF [Controller 1's Device Object;RS]
AREF [Controller 17's Device Object;RS]
AREF [Controller 64's Device Object;RS]
AREF [Controller 1156's Device Object;RS]
AREF [Controller 145's Device Object;RS]
AREF [Controller 8's Device Object;RS]
AREF [Controller 67's Device Object;RS]
AREF [Controller 15's Device Object;RS]
AREF [Controller 100's Device Object;RS]
AREF [Controller 1630's Device Object;RS]

START:
;   When this program runs it will restart all 10 controllers
;   Every 10 minutes.

;   A will be the number of times through the LOOP
A = 10

AREF_Loop:

;   B will be the first index used each time through this LOOP
B = 0

;   This sends out the reset command.
ref(B) = 1

;   Increment B
B = B + 1

;   This is where the loop is executed 10 times.
LOOP A, AREF_Loop

MWAIT 10

GOTO START
```

Figure 3-13 - SPL Example Using the AREF Command

3.6.3 COMPATIBILITY MODE

This is the mode that allows the MatrixPNC to automatically route packets to controllers on either trunk without needing to specify which trunk the units are on. This mode is crucial for SageMAX replacement because SageMAX controllers were also unaware of which trunk a controller was on, it knew only if it was on Network 1-4.

When compatibility mode is on (which is the default mode for a PNC), the PNC will clear its tables at every boot. Then once data is to be routed to a controller, the PNC finds the controller by searching both ports, then routes the message through automatically. Feedback on which controllers have been located and which ports they are on can be read from the “Address Binding Routing” Channels in the MatrixPNC.

3.7 GLOSSARY

AspectFT – The embedded or enterprise level web server and app-server that provides access and control of PUP, BACnet, and Modbus projects across the Internet.

AutoPilot – The program that was used on SageMAX-based sites to access data across the LAN and or internet.

MatrixPNC (or PNC) – PUP Network Controller. This is a Matrix device that runs PUP SPL to facilitate the replacement of Legacy SageMAX Area Controllers.

SageMAX – An AAM product that has the ability to “speak” to 512 controllers concurrently.

SPL- SageMAX Programming Language. SPL is currently used in many other platforms as well.

SoloPro – A software utility that can read and write to PUP devices on a deployed network. A valid licensed copy of SoloPro v2.x is required to compile or deploy SPL programs for the MatrixPNC.

APPENDIX A: CHANNELS & ATTRIBUTES

The following tables contain listings of the channel and attribute assignments for the MatrixPNC.

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SYSTEM CHANNEL, FF00

Attribute	Data Type	Access	Description
ON	DF	RW	Object Name defines the name of this MatrixPNC
ID	FE	RW	Unit Number (ID) specifies the controller's identification number. The value of ID defaults to 123.
SN	FE	RO	Serial Number the factory-set serial number.
CT	FE	RO	Controller Type factory-set controller type number for the controller. This value is always set to 120.
FT	FE	RO	Firmware Type indicates which firmware is installed on the controller. This value will always indicate 50 for MatrixPNC.
FV	DF	RO	Firmware Version indicates the current revision of firmware for the MatrixPNC.
SR	FE	RO	Flash Release Code the release code of the firmware currently flashed on the controller, used primarily for technical support purposes.
PD	FE	RW	Power-Up Delay time delay (in seconds) that must elapse after the controller is reset before it begins control and alarming functions. Valid ranges for this value are from 5 to 6,000 (number of seconds)
DE	FE	RW	Default Enable used to return all attributes in the controller to their default values. 0=Normal operation 197=set attributes to their default values.
RS	FE	RW	Reset the Controller? used to reset the controller. Setting RS to 1 resets the controller. 0=No 1=Yes
TM	E6	RO	Current Time indicates the current time in the form HH:MM.
DT	E4	RO	Current Date indicates the current date displayed as MM/DD/YYYY
DA	FE	RO	Day of Week the current day of the week 0=Monday 1=Tuesday 2=Wednesday 3=Thursday 4=Friday 5=Saturday 6=Sunday

NETWORK CHANNELS, E001- E020

Attribute	Data Type	Access	Description
ON	DF	RW	Channel Name identifier name for the channels.
ID	FE	RW	Network ID The network information in this channel can be referenced in the point.csv file by specifying this unique number.
PR	FE	RW	Protocol By specifying option #2(Matrix/Nexus/MatrixPNC Router) the UDP port will automatically be set to 4225 in the "PO" variable below.
SP	FE	RW	Serial Port specifies which port to be used in communications 0=IP only 1=Port1 2=Port2
IP	DF	RW	IPv4 Address the IPv4 Internet address of the unit or router in question.
PO	FE	RW	UDP Port The UDP port used to communicate with the controller or router in question. By default PUP used port# 4225.

DEVICE ADDRESS BINDING FEEDBACK, 8001-8002

Attribute	Data Type	Access	Description
ON	DF	RW	Channel Name identifier for the channel
NA	DF	RO	Network Address Defines the network address for this port.
CM	E9	RO	Compatibility Mode This is feedback only, putting the MatrixPNC in and out of compatibility mode is accomplished via the Web UI.
01-64	DF	RO	Device # List of PUP controllers known to exist on each port of the PNC. This list is created new each boot and only references controllers that have been accessed for reads or writes since boot.

GLOBAL/PERSISTED VALUE CHANNELS, F601 - F6FF

Attribute	Data Type	Access	Description
ON	DF	RW	Channel Name identifier for the channel name
CV	DT variable	RW	Current Value specifies the current value of the attribute.
DT	FE	RW	PUP Data Type for CV specifies the data type used for the "CV" attribute
BC	FE	RW	Clear Data At Boot? specifies whether the data in the channels should be cleared or retained. 0= No (Retain data) 1=Yes (Clear data upon Boot)

PROGRAM SUMMARY CHANNEL, F200

Attribute	Data Type	Access	Description
ON	DF	RW	Channel Name indicates the name of the channel.
01	FE	RO	CSV File Status specifies whether the CSV file has been loaded 0=Unloaded 1=Loaded
02-99	FE	RO	Region <i>n</i> Program Status indicates the program status for the program regions. 0=Stop 1=Run 2=Unloaded 3=Abort 4=Wait for Time 5=Restart 6=Load 7=Unload Request 8=Abort Request 9=Wait For Fetch

PROGRAMS 1-99, F201 - F263

Attribute	Data Type	Access	Description
ON	DF	RW	Program Name specifies a user definable string that is used to help identify the channel or its function.
\$\$	FE	RO	Current Status indicates the current status of the resident SPL program. 0=Stop 1=Run 2=Unloaded 3=Abort 4=Wait for Time 5=Restart 6=Load 7=Unload Request 8=Abort Request 9=Wait for Fetch
\$A	FE	RW	Region Action (Change) Permits the ability to start or stop a program easily. 0 = No Change 1 = Run 2 = Halt 3 = Restart
\$L	FE	RW	Manually Load Program Each Boot? Specifies whether or not the program needs to be manually loaded on a controller boot. The default setting is No (0) indicating that the program will automatically load when the controller boots.
\$D	FE	RW	Delay Time Remaining specifies the number of seconds remaining when an SWAIT or MWAIT statement is encountered in the SPL program.
\$E	FE	RO	Error Code indicates the SPL error code that is returned when the program aborts.
\$T	FE	RO	Error Text provides text feedback on the abort cause
\$S	FE	RO	Section Number indicates the current section number as determined by the SECTION statements in the SPL code.
\$C	FE	RO	Program Counter indicates the hexadecimal memory location of the next program statement to be executed.
\$W	FE	RO	Trappable Error Action specifies how the SPL program should handle trappable errors. 0=Abort on Error 1=Wait on Error
\$1	FE	RW	Enable Single-Step Mode? specifies whether the single-step, line by line debugging mode is enabled. 0=No 1=Yes
%A-%P	Variable	RW	Register A - P These are local, flexible data type variables that are used as needed in SPL programs.

Attribute	Data Type	Access	Description
Variable	Variable	RW	Variable (using ATTR command) Each SPL Program can create up to 255 additional self-declared local variables using the ATTR statement. These can be any two-letter combination (NOTE - custom ATTR variables cannot begin with the \$ or % character).

MANUFACTURING CHANNEL, 8000

Attribute	Data Type	Access	Description
ON	DF	RW	Channel Name specifies the channel name
SN	FE	RO	Serial Number The unique serial number for the PNC
DM	FE	RO	Date of Manufacture This indicates when the MatrixPNC was built. MM/YY as the format
NA	DF	RO	Network Address This is the IPv4 address of the PNC. It is provided as reference only as changing the IP address is accomplished via the Web UI
UT	FE	RO	Uptime This is the time in seconds since the MatrixPNC powered up or was rebooted/restarted

