AMCI
ADVANCED MICRO CONTROLS INC.

AnyNET-I/O
PROFIBUS-DP
Network
Interface

User Manual

PROFI
PROCESS FIELD BUS
BUS
®

AMCI AnyNET-I/O Control Products

GENERAL INFORMATION

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24 Hour technical support is available on this product. If you have internet access, start at www.amci.com. Product documentation and FAQ's are available on the site that answer most common questions.

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Manuals at AMCI are constantly evolving entities. Your questions and comments on this manual are both welcomed and necessary if this manual is to be improved. Please direct all comments to: Technical Documentation, AMCI, 20 Gear Drive, Terryville CT 06786, or fax us at (860) 584-1973. You can also e-mail your questions and comments to *techsupport@amci.com*

ADVANCED MICRO CONTROLS INC.

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AnyNET-I/O PROFIBUS INTERFACE

> **This manual is designed to get the PROFIBUS-DP connection on your AnyNET-I/O module up and running quickly. As such, it assumes you have some basic knowledge of PROFIBUS-DP networking. If these standards are new to you, we're here to help. AMCI has a great deal of information on our website and we are adding more all the time. If you can't find what you're looking for at http:/// www.amci.com, send us an e-mail or call us. We're here to support you with all of our knowledge and experience.**

Audience

This manual explains the set-up, installation, and operation of the RS-485, PROFIBUS-DP interface available on the modules in the AnyNET-I/O product line from AMCI. It is written for the engineer responsible for incorporating these modules into a design, as well as the engineer or technician responsible for their actual installation.

Applicable Units

This manual applies to all AnyNET-I/O modules that have a built-in PROFIBUS interface. Generally, if the model number of the AnyNET-I/O module ends in "P", such as "ANG1P" or "ANR2P", this module has an integral PROFIBUS interface. This interface allows the module to connect itself, and up to five other modules, to an PROFIBUS network.

NOTE ▷ This manual only covers how to set-up, install and use the PROFIBUS interface on an AnyNET-I/O module. It does not cover any other functionality of the module. For a complete description of the functionality of your module, please refer to the appropriate user manual found on our website, *www.amci.com*.

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Revision Record

This manual, 940-0A060, is the first revision of this manual. It was first released January 29th, 2013.

Revision History

940-0A060   Initial Release.

Navigating this Manual

This manual is designed to be used in both printed and on-line formats. Its on-line form is a PDF document, which requires Adobe Acrobat Reader version 7.0+ to open it. The manual is laid out with an even number of pages in each chapter. This makes it easier to print a chapter to a duplex (double sided) printer.

Bookmarks of all the chapter names, section headings, and sub-headings were created in the PDF file to help navigate it. The bookmarks should have appeared when you opened the file. If they didn't, press the F5 key on Windows platforms to bring them up.

Throughout this manual you will also find *blue text that functions as a hyperlink* in HTML documents. Clicking on the text will immediately jump you to the referenced section of the manual. If you are reading a printed manual, most links include page numbers.

The PDF file is password protected to prevent changes to the document. You are allowed to select and copy sections for use in other documents and, if you own Adobe Acrobat version 7.0 or later, you are allowed to add notes and annotations.

Manual Conventions

Three icons are used to highlight important information in the manual:

NOTE   **NOTES** highlight important concepts, decisions you must make, or the implications of those decisions.

CAUTION   **CAUTIONS** tell you when equipment may be damaged if the procedure is not followed properly.

WARNING   **WARNINGS** tell you when people may be hurt or equipment may be damaged if the procedure is not followed properly.

The following table shows the text formatting conventions:

Format	Description
Normal Font	Font used throughout this manual.
Emphasis Font	Font used the first time a new term is introduced.
Cross Reference	When viewing the PDF version of the manual, clicking on the cross reference text jumps you to referenced section.
URL Reference	When viewing the PDF version of the manual, clicking on the URL Reference text opens the referenced document.

AnyNET-I/O

AnyNET-I/O is a growing product line from AMCI. The concept is simple: specialty and/or high speed I/O that can be attached to any popular industrial network; hence the name *AnyNET-I/O*.

AnyNet-I/O is designed for a broad range of applications, from small machines with a single control enclosure, to large machines that extensively use distributed I/O to minimize wiring costs.

What makes the AnyNET-I/O line different is that all of the modules are available with or without a network interface. Eliminating the need for a separate networking module lowers the total cost of ownership for all applications, but especially for the cost sensitive small machines that only require one or two sophisticated functions.

Like many low cost controllers, AnyNet-I/O modules are designed to be DIN rail mounted. Up to six AnyNET-I/O modules can be stacked together and accessed over a single network interface. "Stacking" is accomplished through a small backplane connector that snaps into the DIN rail before the AnyNET-I/O modules are installed. These connectors allow the AnyNET-I/O modules to communicate with each other. To the network, the stack of modules appear as one continuous block of I/O words.

Figure 1.1 AnyNET-I/O Module Stack

PROFIBUS Interface

➤ Protocol Reference: Profibus Specification Ed. 1.0, PNO Order No. 0.032

➤ Physical Interface: Galvanically isolated RS-485 driver, per Profibus-DP 2.0 standard. (DIN19245 part 3)

➤ Protocol Interface: AnyNET-I/O Stack functions as a communications adapter to the PROFIBUS Master.

Location

AnyNET-I/O modules are suitable for use in an industrial environment that meet the following criteria:

➤ Only non-conductive pollutants normally exist in the environment, but an occasional temporary conductivity caused by condensation is expected.

➤ Transient voltages are controlled and do not exceed the impulse voltage capability of the product's insulation.

Note that these criteria apply to the system as a whole. These criteria are equivalent to the *Pollution Degree 2* and *Over Voltage Category II* designations of the International Electrotechnical Commission (IEC). The AnyNET-I/O unit itself has an environmental rating of IP20.

Safe Handling Guidelines

Prevent Electrostatic Damage

⚠ CAUTION Electrostatic discharge can damage an AnyNET-I/O module if you touch the rear bus connector pins. Follow these guidelines when handling the module.

1) Touch a grounded object to discharge static potential before handling the module.

2) Work in a static-safe environment whenever possible.

3) Wear an approved wrist-strap grounding device.

4) Do not touch the pins of the bus connector or I/O connector.

5) Do not disassemble the module

6) Store the module in its anti-static bag and shipping box when it is not in use.

Prevent Debris From Entering the Module

⚠ WARNING During DIN rail mounting of all devices, be sure that all debris (metal chips, wire strands, tapping liquids, etc.) is prevented from falling into the module. Debris may cause damage to the module or unintended machine operation with possible personal injury. The DIN rail for the modules should be securely installed and grounded before the modules are mounted on it.

Remove Power Before Servicing in a Hazardous Environment

⚠ WARNING Remove power before removing or installing any modules in a hazardous environment.

Mounting

Module Dimensions

Figure 2.1 lists the dimensions of the AnyNET-I/O modules with a PROFIBUS interface.

I/O Mating Connector

0.89"
(22.6)

4.47"
(113.5)

3.90"
(99.1)

4.55"
(115.6)

0.26"
(6.6)

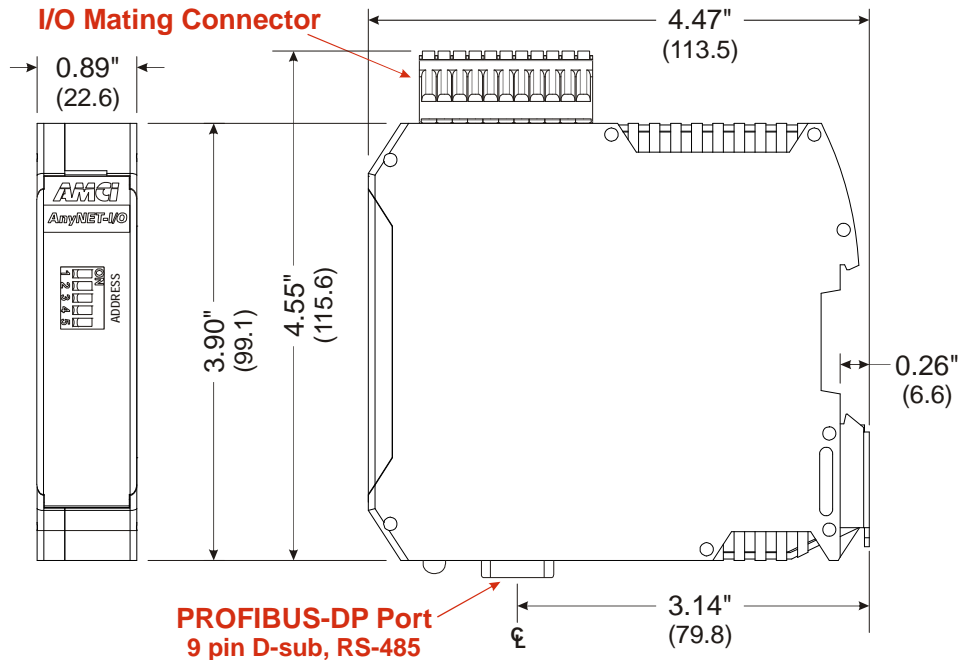**PROFIBUS-DP Port**
9 pin D-sub, RS-485

3.14"
(79.8)

Figure 2.1 PROFIBUS AnyNET-I/O Module Dimensions

Minimum Spacing

As shown in figure 2.2, you must maintain a minimum spacing of 2 inches (50.8 millimeters) from enclosure walls, wireways, adjacent equipment, etc. for adequate system ventilation.

Also note that the AnyNET-I/O modules must be mounted in the orientation shown in the figure. Mounting the system in any other orientation will decrease the efficiency of the ventilation slots on the top and bottom of each module which may lead to system overheating and malfunction.

When you use an AnyNET-I/O module that has high power outputs, such as the ANG1 Stepper Indexer Driver, it is possible for the module to overheat. It is difficult to calculate when this can occur because it is based on not only the current and duty cycle of outputs, but also such variables

Minimum Spacing (All dimensions)
2.0 inches / 50.8 mm

Figure 2.2 Ventilation Spacing

as enclosure size and ambient temperature. If overheating does occur, you have two choices. You can install a cooling fan beneath the stack to force additional air up through the modules or you can install an addition IC-5 connector between each module to space them out. Information on installing the IC-5 connectors can be found in the *Mounting* section of this manual starting on page 9.
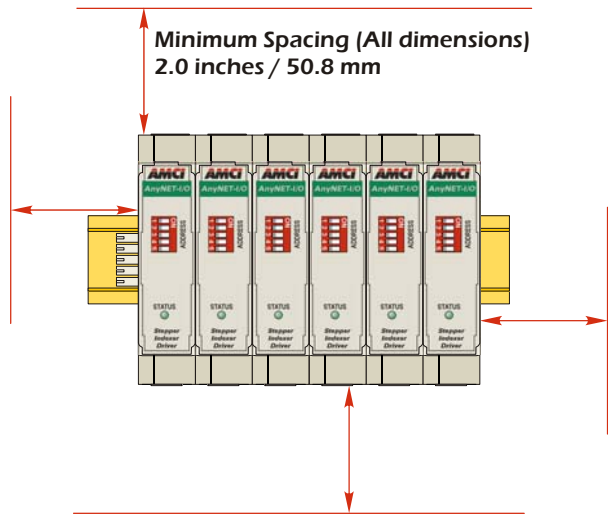
Mounting (continued)

DIN Rail Installation

AnyNET-I/O modules can be mounted on following DIN Rail

➤ EN 05 022 - 35 x 7.5 (35 x 7.5 mm)

If you are only installing one AnyNET-I/O module instead of an interconnected stack, then you can also use the following DIN rail.

➤ EN 05 022 - 35 x 15   (35 x 15 mm)

> **NOTE ▷** The EN 05 022 - 35 x 15 DIN rail is unacceptable when installing multiple AnyNET-I/O modules as a stack. The IC-5 connector that is used to inter-connect the modules requires the EN 05 022 - 35 x 7.5 DIN rail for proper operation.

The DIN Rail must be securely mounted to a panel and solidly grounded before the modules are installed. Grounding is usually accomplished through the mounting hardware, by first removing any paint or other material from all surfaces that may interfere with proper grounding. Another option is to install a heavy gauge wire from the DIN rail to your system's ground bus.
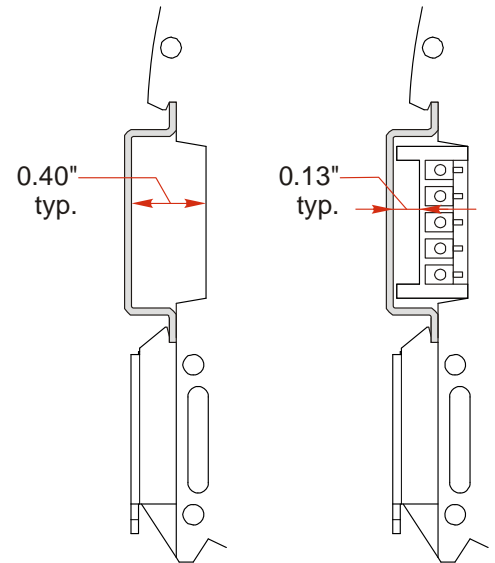

Figure 2.3 7.5 mm DIN Rail Installation

Figure 2.3 shows the amount of clearance space available for either a bolt head or a washer and nut when installing the 7.5mm deep DIN rail. The left side of the figure shows the clearance when installing a single AnyNET-I/O module and the right side of the figure shows the clearance when using the IC-5 connector to interconnect multiple modules in an AnyNET-I/O Stack. When installing a single module on 15mm deep rail, the clearance is 0.70 inches.

Installing IC-5 Connectors (as needed)

If you are installing a stack of AnyNET-I/O modules instead of a single unit, then you need to install the IC-5 connectors on the DIN rail to allow the modules in the stack to communicate. Figure 2.4 shows how to install the IC-5 connectors in the DIN rail.
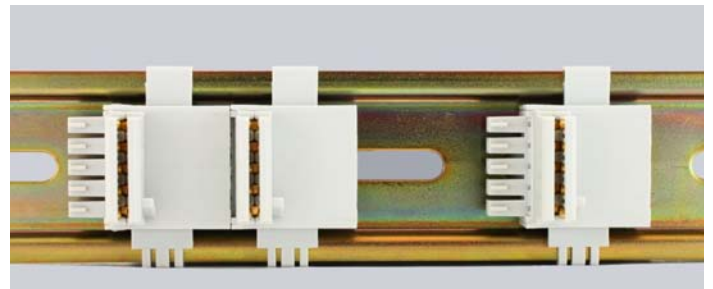
> **NOTE ▷** 1) EN 05 022 - 35 x 7.5 DIN rail must be used. The IC-5 connectors are not properly supported in EN 05 022 - 35 x 15 DIN Rail

2) Note the orientation of the IC-5 connectors when installing them. The module key goes towards the bottom of the DIN rail.

Figure 2.4 IC-5 Connector Installation

Mounting (continued)

Mounting the AnyNET-I/O Modules

Mounting an AnyNET-I/O module is a very simple process thanks to the design of the enclosure. If you are using the IC-5 connectors, then you will have to partially engage the connector in to the enclosure. Once that is done, engage the top clip in the enclosure with the top of the DIN rail and rotate the module down until the metal bracket on the module snaps on to the DIN Rail.

Once all of your modules are installed, it is strongly suggested to use the end caps from Phoenix Contact with the part number of 271 37 80 to secure the modules on the DIN Rail. These end caps prevent the module from sliding along the DIN rail if it is subjected to shock or vibration during machine operation.

Addressing

AnyNet-I/O Stack Addressing

Each module in the AnyNET-I/O Stack needs to be given an address before the system will operate correctly. Note that this is the address within the Stack, not the PROFIBUS-DP node address. The address is set with the five position DIP switch on the front of each module.

NOTE ►

1) Only a single switch should be in the "ON" position when setting the address.

2) The module that has an address of zero must have a network interface and it is the only module in the stack that can have a direct connection to the network.

3) If a module with a network interface has a non-zero address, then its network interface is disabled. This allows two modules with network interfaces to work in a single stack.
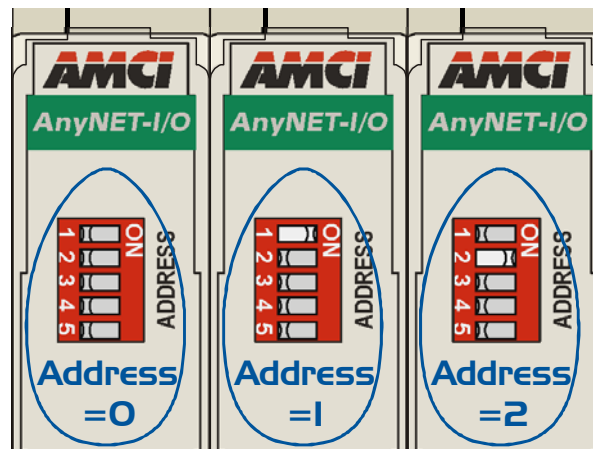
Figure 2.5 Addressing Example

Figure 2.5 is a close up of three modules in an AnyNET-I/O Stack. The module on the left is an unit with a network interface, and has an address of zero (All DIP switches off.) This module has the active network interface and connects the stack to the network. Reading left to right, the remaining modules have addresses of one and two respectively. These modules can be any AnyNET-I/O modules. If they have network interfaces, these interfaces are disabled.

Addressing (continued)

PROFIBUS Network Addressing

The node address of the AnyNET-I/O Stack on the PROFIBUS network is set with two rotary switches that are behind the front panel door. The address can be set to any value between 02 and 99. The top switch, which is closer to the DIP switches, sets the first digit of the address, and the bottom switch sets the second digit. As shown in figure 2.6, the rotary knob has a slot for a small flat head screwdriver and part of the shaft is cut away to indicate the number selected by the switch. The figure shows a PROFIBUS network address of 08. Note that every device on the PROFIBUS network must have a different address.

The figure also shows the AnyNet-I/O module address of zero. This is the proper setting for an AnyNET-I/O module that acts as the stack's network interface.

NOTE ▷ The PROFIBUS address is set exclusively by the rotary switches. Any change in address sent by a PROFIBUS Master will be ignored.
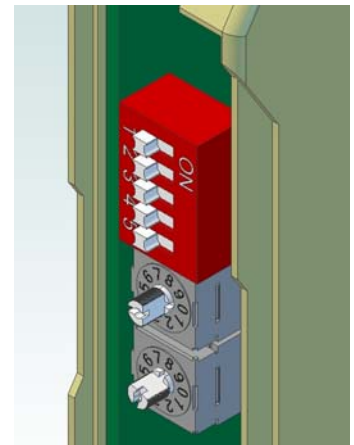
Figure 2.6 Modbus Addressing

PROFIBUS-DP Port

The PROFIBUS-DP port is located on the bottom of your AnyNET-I/O module. The connector is a standard female, nine pin, D-sub connector. It can be used with widely available connectors and cordsets. BUS_VDC and BUS_GND connections are available for termination resistors.
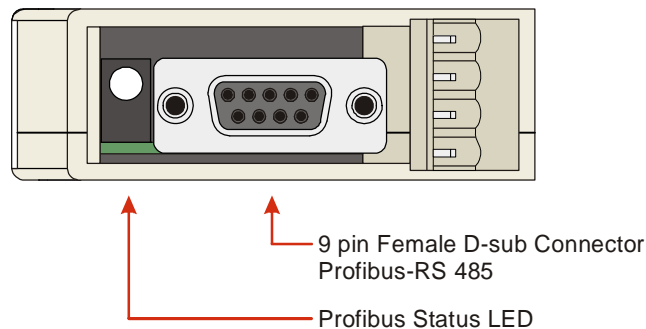
AnyNET-I/O Module Bottom View (Partial)

9 pin Female D-sub Connector
Profibus-RS 485

Profibus Status LED

Figure 2.7 PROFIBUS-DP Connector Location

PROFIBUS-DP Port (continued)

Port Pinout

Table 2.1lists the pins available on the PROFIBUS-DP port. Note that the BUS_VDC and BUS_GND connections should only be used for termination resistors.

Pin #	Function
1	Not Connected
2	Not Connected
3	RxD/TxD-P Data line+ (B-line) {Red Conductor typically}
4	Not Connected
5	BUS_GND (Data Ground for termination resistors that is electrically isolated from the rest of the AnyNET-I/O module.)
6	BUS_VDC (+ 5Vdc for termination resistors that is electrically isolated from the rest of the AnyNET-I/O module.)
7	Not Connected
8	RxD/TxD-N Data line– (A-line) {Green Conductor typically}
9	Not Connected

Table 2.1 PROFIBUS-DP Port Pinout

PROFIBUS Cabling

There are many suppliers of PROFIBUS connectors and cables, including pre-assembled and tested cordsets. is the most common way to wire a Profibus system. A small sampling of companies is given below.

➤ Phoenix Contact: http://www.phoenixcontact.com
➤ Turck Inc.: http://www.turck.com or http://www.turck-usa.com
➤ Lumberg Automation: http://www.lumberg-automationusa.com
➤ Belden Inc. http://www.belden.com (Belden part # 3079A or 3079E are suggested)

NOTE ▶ Many connector manufacturers have a ninety degree version in addition to a straight version. All of the ninety degree connectors reviewed by AMCI point towards the rear of the module when they are installed. Closely review the connector spacing, including the minimum bend radius of your cable, before using one of these connectors. The spacing from the center of the PROFIBUS-DP port and the back of the EN 05 022 - 35 x 7.5 DIN rail is approximately 3.18 inches.

PROFIBUS Status LED

The PROFIBUS status LED is a bi-color (red/green) LED that indicate the health of the network connection between the AnyNET-I/O module and its host. It is located on the bottom of the module next to the PROFI-BUS-DP port. Table 2.2 lists the meaning of the various blink codes.

PROFIBUS Status LED State	Definition
Off	No Power
Flashing Green	Communications over USB port.
On Green	Normal Operation / Data Exchange Mode
On Red	1) No communications 2) AnyNET-I/O module has not received data for an extended period of time. Possible bus line interruption.
Flashing Red (1 second, 1 Hz)	Parameter or Configuration Error. Invalid data or incorrect data length was received by the AnyNET-I/O module.
Flashing Red (3 seconds, 1/3 Hz)	1) Incorrect module address selected with rotary switches. Valid range of 02 to 99. 2) Fatal Internal Error. Cycle power to the module. If the error persists, unit must be returned to AMCI for repairs.

Table 2.2 PROFIBUS Status LED

Every AnyNET-I/O module also has one or more Status LED's on the front of the unit as well. These Status LED's indicates the state of the module itself. Information on their blink codes is available in the user's manual for the module itself.

Notes

> **This chapter covers how to connect to an AnyNET-I/O module with a PROFIBUS interface using the AMCI NET software. With this software, it is possible to communicate and configure all of the modules in the AnyNET-I/O stack. This chapter only gives a brief introduction to the AMCI NET software. Check our website for additional information that may be available.**

USB Connection

AnyNET-I/O modules with the PROFIBUS interface have a micro USB connector behind the front panel door. When connected to a computer, this USB connection acts as a serial port and allows you to connect to every module in your AnyNET-I/O stack. You may require a windows driver when you use the USB connection for the first time. The software and driver are both available as free downloads from the AMCI website using the following address: *http://www.amci.com/product-software.asp*. Once on the page, click on the appropriate links to download the software.

Installing the AMCI NET Software

Because many corporate firewalls prevent their users from downloading executable files, the install program exists as a ZIP file from our website. Installation is straight forward.

1) Download the software from *http://www.amci.com/product-software.asp*.

2) Extract the ZIP file to your computer. The resulting file is a simple install file.

3) Run the install program. When you do this, the following changes are made to your computer:

> ➤ An AMCI folder is created in your programs folder. This is typically located at \Program Files\AMCI on XP systems, and \Program Files (x86)\AMCI on Windows 7 systems.

> ➤ The AMCI NET program and the USB driver files are placed in this directory

> ➤ A shortcut to the AMCI NET program is created on the desktop and a program listing is created that will display the program off of the Start Menu.

NOTE ⮞ No changes are made to the registry. The AMCI NET program can be easily un-installed by deleting the AMCI directory in the programs folder and the desktop and Start Menu shortcuts.

USB Driver Installation

After the AMCI NET program is installed, apply power to your AnyNET-I/O PROFIBUS module and plug in a USB cable between the module and your computer.

At this point, your system may notify you that an unknown device has been plugged into the computer and the system will start to look for the required driver. AMCI uses a popular USB to serial chipset so the required drivers may already exist on your computer. If the drivers are on your system, they will install automatically. If the "Found New Hardware Wizard" opens on your system, and it asks "Can Windows connect to Windows Update to search for software?" you can click on the radio button that selects "Yes, this time only" and click on the [Next >] button. Your system should be able to locate the required driver.

Alternately, you can click on the "No, not at this time" radio button and click the [Next >] button. On the next screen, select the "Install from a list or specific location" radio button and click the [Next >] button. Now select the "Search for the best driver in these locations" radio button, un-check the "Search removable media" check box, check the "Include this location in the search" check box, and click on the [Browse] button. Browse to the folder that was created when you installed the program, typically \Program Files\AMCI on XP systems or \Program Files (x86)\AMCI on Windows 7 systems, and click the [OK] button. Click the [Next >] button, and your system should install the required driver.

The process may repeat to install a USB serial port.

Using the AMCI NET Software

To start the program, click on the desktop icon or navigate from the start button to the program listing and click on the icon there. The program will present a screen similar to figure 3.1 below.
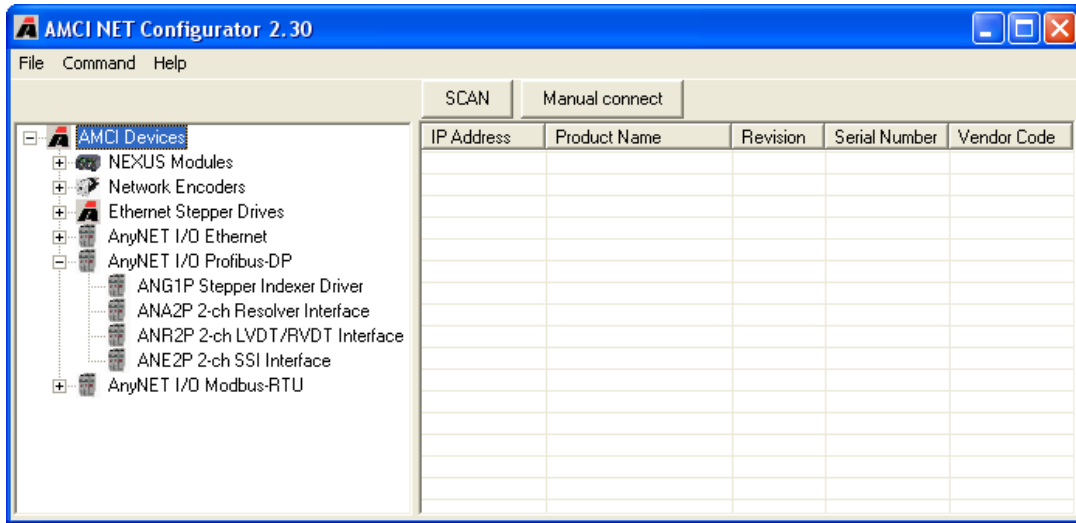

Figure 3.1 AMCI NET System software

Connect to the AnyNET-I/O Stack

The first step is to either click on the [Manual connect] button or double click on the name of the module in the device tree on the left of the screen. Either way, a "Device Properties" window will open that allows you to connect to your module. If you clicked on the [Manual connect] button you now have to click on the drop down menu and change the choice from "TCP/IP" to "USB". Click on the [Connect] button to connect to your PROFIBUS module.
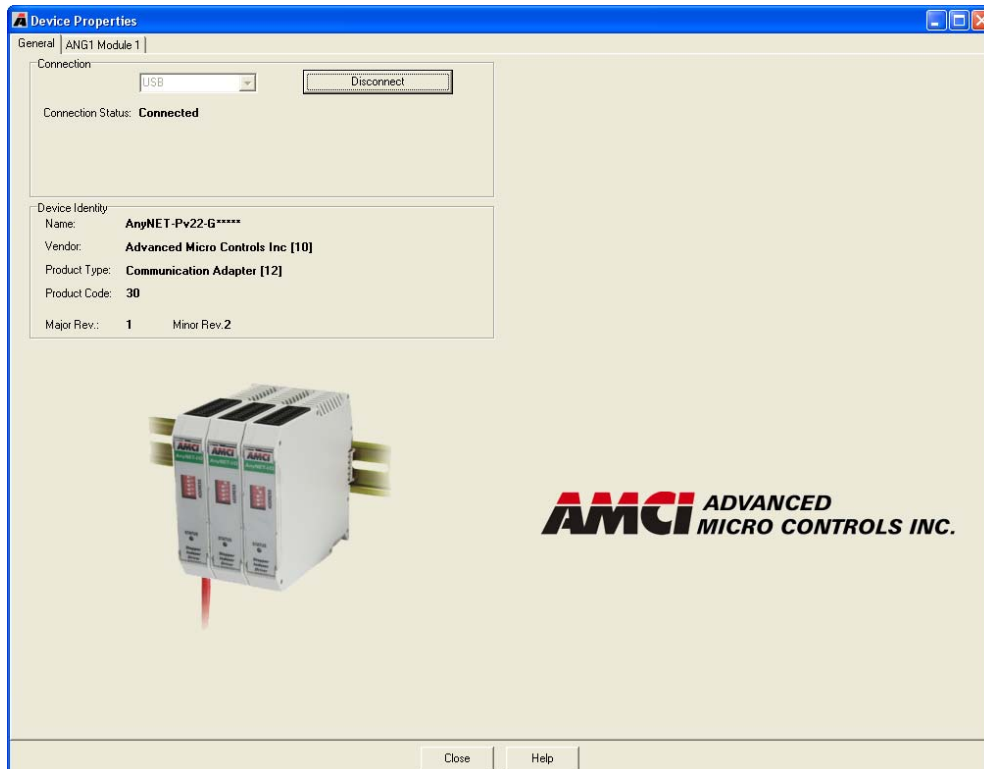

Figure 3.2 PROFIBUS Module Device Properties

Using the AMCI NET Software (continued)

The Meaning of the Product Name

Once you successfully connect to your AnyNET-I/O Stack, the Product Name will show up in the General tab of the Device Properties windows. The Product Name gives you clues to the configuration of your AnyNET-I/O Stack. As shown in figure 3.3 below, the Product Name is broken down into four parts.

<div align="center">

AnyNET-Pv22-G*****

</div>

Fixed ───
"P" = Profibus-DP Protocol ───
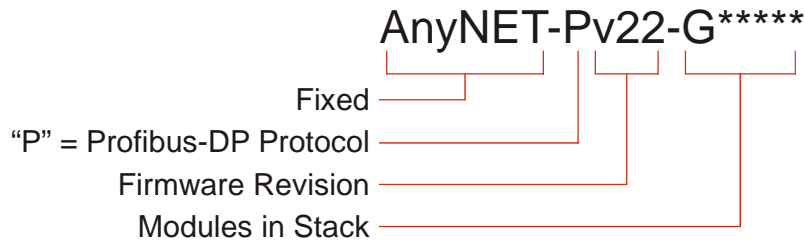Firmware Revision ───
Modules in Stack ───

Figure 3.3 Product Name Description

The AnyNET-I/O system allows you to stack up to six AnyNET-I/O modules together and attach them to a single network connection. The last section of the product name lists all of the modules in the stack as individual letters. The figure above shows a single module in the stack, and it is an ANG1 module. Generally, the third letter of the product name is used as the module code. An "*" is used as a place holder when no module is present. The modules are ordered by their address settings, not their physical location in the stack. For simplicity's sake, AMCI strongly suggests using consecutive address settings and place them in numeric order in their physical stack.

Using the AMCI NET Software (continued)

Configuring an AnyNET-I/O Module (optional)

The remaining tab(s) in the Device Properties window allow you to configure the modules in the AnyNet-I/O stack. These tabs are typically used for bench testing as they can help you determine the correct configuration and command data to use in your host controller's program. As an example, figure 3.4 below shows the configuration and command window for an ANG1.
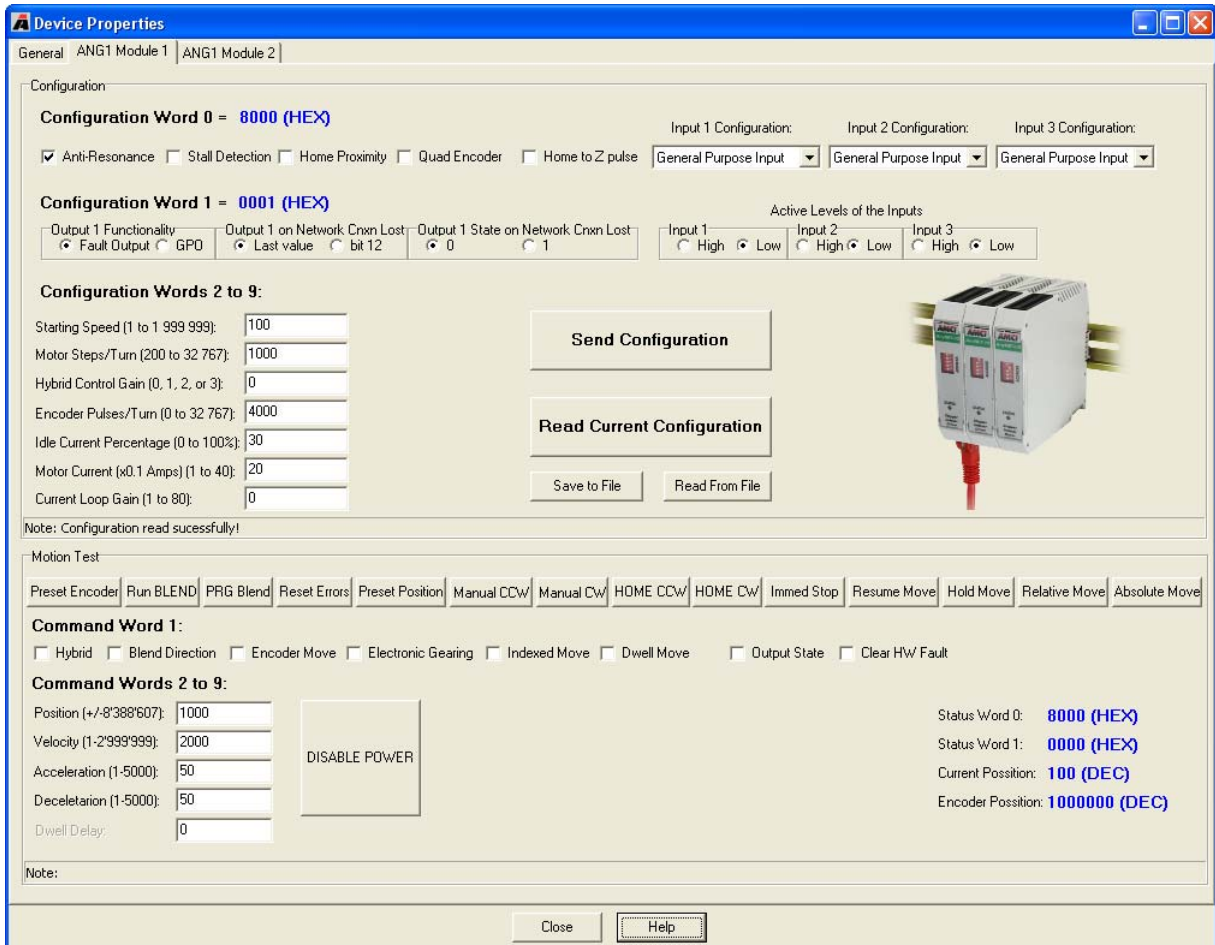

Figure 3.4 Configuration and Command Screen

> This chapter gives an overview of communications with the AnyNET-I/O Stack over PROFIBUS.

GSD File

The first step in commissioning a PROFIBUS AnyNET-I/O Stack is registering the GSD file with your PRO-FIBUS Master software. Please refer to the documentation for your PROFIBUS Master software to determine how to accomplish this. The GSD file lists the capabilities of the AnyNET-I/O PROFIBUS interface for your PROFIBUS Master and allows you to easily choose the number of modules in your stack. The GSD file is available on our website at:

➤ *http://www.amci.com/gsd-files/AMCI_AnyNET-IO_profibus.zip*

Addressing the AnyNET-I/O Stack

Every device attached to a PROFIBUS master must have its own unique address. The PROFIBUS address of the AnyNET-I/O module is set with rotary switches that are located behind the front panel door. The valid address range for the AnyNET-I/O Stack is 02 through 99. Please refer to *PROFIBUS Network Addressing* on page 11 for information on setting these rotary switches.

Configuring the AnyNET-I/O Stack Size

Once the GSD file is registered and the PROFIBUS address of the AnyNET-I/O Stack is set, use the software of your PROFIBUS Master to set the number of modules in your stack. By doing this, you are commanding the PROFIBUS Master to set aside ten I/O words for each module in the stack. This value is written down to the AnyNET-I/O PROFIBUS module at system startup using the *DDLM_Set_Prm* communication function. A typical configuration screen is shown in figure 4.1.
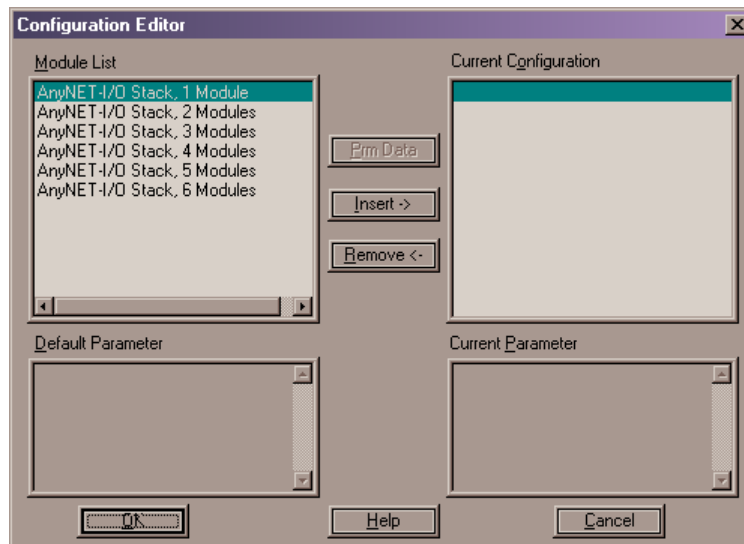

Figure 4.1 Selecting the AnyNET-I/O Stack Size

Once this parameter is written down to the module, the stack will enter its normal mode of operation. Data transferred in this mode is explained in the next section.

Data Transfer

This section describes the data transferred to and from the AnyNET-I/O Stack when using the *DDLM_Data_Exchange* communications function.

Identifier Bytes

Identifier bytes are used to determine the number of I/O words assigned to each AnyNET-I/O module. Each module has a single $F9_{16}$ Identifier byte assigned to it. This sets aside ten input words and ten outputs words for each module.

Data Format

An AnyNET-I/O Stack appears as a Communications Adapter to the PROFIBUS Master. Therefore, the I/O Words assigned to the stack appear as general purpose I/O instead of specific data values. Each AnyNET-I/O module uses the I/O words assigned to it differently. Refer to the user's manual for your module to determine its data format. Manuals for the AnyNET-I/O modules can be found on the ***AMCI User Manual*** page of our website.

Diagnostic Information

This section describes the data transferred to and from the AnyNET-I/O Stack when using the *DDLM_Slave_Diag* communications function.

Diagnostic Length

An AnyNET-I/O Stack that is attached to a PROFIBUS network will transmit Standard Diagnostics information that is six bytes long. Note that this information pertains to the status of the PROFIBUS communications, it is not diagnostic data for each of the modules. Each module has its own set of status bits that is transmitted as part of its Network Input Data. Refer to the user's manual for your module to determine the locations and use of the module's status bits.

Standard Diagnostics Format

Function	Data Type	Octet (Byte)	Typical Value	Description
Station Status 1	Bit	1	Determined by PROFIBUS-DP Specification	
Station Status 2	Bit	2		
Station Status 3	Bit	3		
Diagnostic Master Address	Bit	4		
PNO Identification Number	Bit	5-6	0x0D:7E	AMCI's ID assigned by PNO

Table 4.1 Standard Diagnostics Format

Notes

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