United Electronic Industries

The High-Performance Alternative

PowerDNA® for SoloX Cube & RACK™ Data Acquisition Systems

—

User Manual

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PN Man-PowerDNA-SoloX

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Chapter 1 Introduction

This document describes the features, specifications, and operating functions of the PowerDNA® for SoloX Cube and RACK data acquisition systems. Each system contains a SoloX CPU/Power core module and is designed for use with a Gigabit Ethernet 1000Base-T communication network. Cube and RACK versions differ in their form factor and the number of I/O boards supported.

This chapter provides the following information:

- Organization of this Manual (Section 1.1)
- Product Versions Described in This Manual (Section 1.2)
- Manual Conventions (Section 1.3)
- Related Resources (Section 1.4)

1.1 Organization of this Manual

This "PowerDNA for SoloX Cube & RACK Data Acquisition Systems User Manual" is organized as follows:

- **Introduction**
  Chapter 1 describes the organization of the document and the conventions used throughout the manual.
- **PowerDNA SoloX RACK System**
  Chapter 2 provides an overview of hardware for PowerDNA SoloX systems in a RACK, HalfRACK, and FLATRACK chassis.
- **PowerDNA SoloX Cube System**
  Chapter 3 provides an overview of hardware for PowerDNA SoloX systems in a Cube chassis.
- **Installation and Configuration**
  Chapter 4 summarizes the recommended procedures for installing, configuring, starting up, and troubleshooting a SoloX Cube/Rack.
- **PowerDNA Explorer**
  Chapter 5 provides a general description of the capabilities of UEI's GUI-based communication application, PowerDNA Explorer, when used with a SoloX Cube/Rack.
- **Programming CPU Parameters**
  Chapter 6 describes the SoloX CPU/Power core module(s) within a SoloX Cube/Rack.
- **SoloX Accessories**
  Appendix A provides a list of cable and screw terminal panel accessories available for interacting with the SoloX CPU core module.
- **Network Interface Card Configuration**
  Appendix B describes procedures for installing and configuring Ethernet cards for use with Windows operating systems.
- **Field Replacement of Fuses**
  Appendix C describes procedures for replacing fuses on DNA and DNR boards.

1.2 Product Versions Described in This Manual

This manual provides information for the following products:

- PowerDNA SoloX Cube systems
  (referred to collectively as “DNA-PPCx-1G-11”):
  - **UEINet-11** supports 1 I/O board
  - **DNA-PPC5-1G-11** supports up to 3 I/O boards
  - **DNA-PPC8-1G-11** supports up to 6 I/O boards
  - **DNA-PPC9-1G-11** supports up to 7 I/O boards
- PowerDNA SoloX RACK™ systems
  (referred to collectively as “DNR-x-1G-11”):
  - **DNF-4-1G-11** FLATRACK™ supports up to 4 I/O boards
  - **DNR-6-1G-11** HalfRACK™ supports up to 6 I/O boards
  - **DNR-12-1G-11** RACKtangle™ supports up to 12 I/O boards

1.2.1 Comparison with Other Product Versions

Table 1-1 compares the PowerDNA SoloX Cube/Rack system with earlier generations of the PowerDNA Cube/Rack.

Earlier generations are indicated by option numbers -00/-01, -02, or -03 (e.g., DNR-12-1G, DNR-12-1G-02, or DNR-12-1G-03). SoloX products are indicated by option number -11 as shown in the list above (e.g., DNR-12-1G-11).

For users transitioning between the two, the SoloX version simply swaps out the CPU/Power core module on the 8347-based version. The chassis, software, I/O boards, and all other system components are identical.

Table 1-1 Summary of DNA-PPCx-1G and DNR-x-1G Product Versions

Option No.	Processor	Summary of Features
-00/-01 -02 -03	8347	• Freescale MPC8347 PowerPC CPU @400MHz • 10/100/1000Base-T Ethernet interface • 1PPS and IEEE-1588 synchronization support[1] • Up to 256 MB RAM[2] • Up to 128 MB flash memory[2] • RS-232 interface through DSUB-9 • All I/O boards supported
-11	SoloX	• NXP i.MX6 SoloX Series ARM dual-core CPU: Cortex-A9 @1GHz and Cortex-M4 @200MHz • 10/100/1000Base-T Ethernet interface • 1PPS and IEEE-1588 synchronization support[1] • 1 GB RAM[2] • 8 GB flash memory (& U-boot QSPI flash)[2] • Dual RS-232 interface (one per CPU core) through DSUB-15 • All I/O boards supported

1. 1PPS and IEEE-1588 synchronization support is described in the “PowerDNx 1PPS Sync Interface Manual”.

2. RAM and flash memory are not user-accessible on PowerDNA (hosted) deployments. Portions of RAM and flash are available on UEIPAC, UEISIM, UEIModbus, and UEIOPC-UA (stand-alone) deployments.

PowerDNA Cube/RACK hardware may be upgraded to one of UEI’s stand-alone systems:

- UEIPAC XXX-1G - Programmable Automation Controller
- UEISIM XXX-1G - Simulink / Simulink Coder Target
- UEIModbus XXX-1G - Modbus TCP-based Controller
- UEIOPCUA XXX-1G - OPC-UA Server, accessed by any OPC-UA client

1.3 Manual Conventions

The following conventions are used throughout this manual:

Tips are designed to highlight quick ways to get the job done or to reveal good ideas you might not discover on your own.

CAUTION! advises you of precautions to take to avoid injury, data loss, and damage to your boards or a system crash.

NOTE: Notes alert you to important information.

Typeface	Description	Example
bold	field or button names	Click **Scan Network**
»	hierarchy to get to a specific menu item	**File » New**
`fixed`	source code to be entered verbatim	`session.CleanUp()`
<brackets>	placeholder for user-defined text	`pdna://<IP address>`
italics	path to a file or directory	*C:\Program Files*

1.4 Related Resources

Additional documentation is included with the PowerDNA software installation. On Windows, these resources can be found from the desktop by clicking **Start » All Programs » UEI**

UEI's website includes other user resources such as application notes, FAQs, tutorials, and videos. In particular, the glossary of terms may be helpful when reading through this manual: https://www.ueidaq.com/glossary

Additional questions? Please email UEI Support at support@ueidaq.com or call 508-921-4600.

Chapter 2 PowerDNA SoloX RACK System

This chapter provides the following information about PowerDNA SoloX RACK system hardware (DNR-x-1G-11):

- SoloX RACK Overview (Section 2.1)
- Specifications (Section 2.2)
- Key Features (Section 2.3)
- RACK Enclosures (Section 2.4)
- CPU/POWER Module (Section 2.5)
- DNR/DNF Power Module (Section 2.6)
- DNR-Buffer Module (Section 2.7)
- RACK I/O Boards (Section 2.8)

2.1 SoloX RACK Overview

The PowerDNA SoloX RACK is a Gigabit Ethernet-based data acquisition system housed in a rack-mounted chassis.

PowerDNA SoloX RACK versions differ in the number of supported I/O boards:

- **DNF-4-1G-11** FLATRACK™ accepts up to 4 user-selected I/O boards
- **DNR-6-1G-11** HalfRACK™ accepts up to 6 user-selected I/O boards
- **DNR-12-1G-11** RACKtangle™ accepts up to 12 user-selected I/O boards

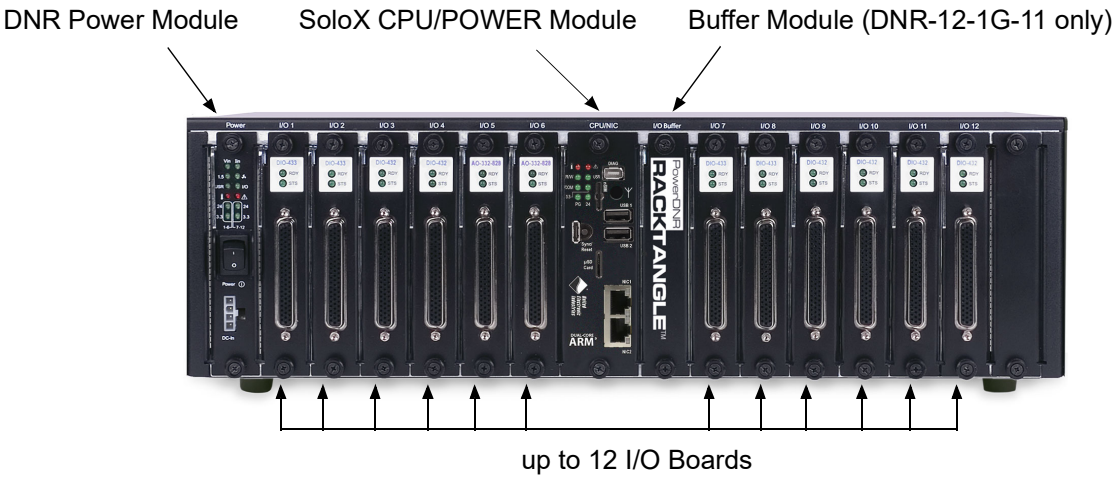


Figure 2-1 DNR-12-1G-11 RACKtangle System

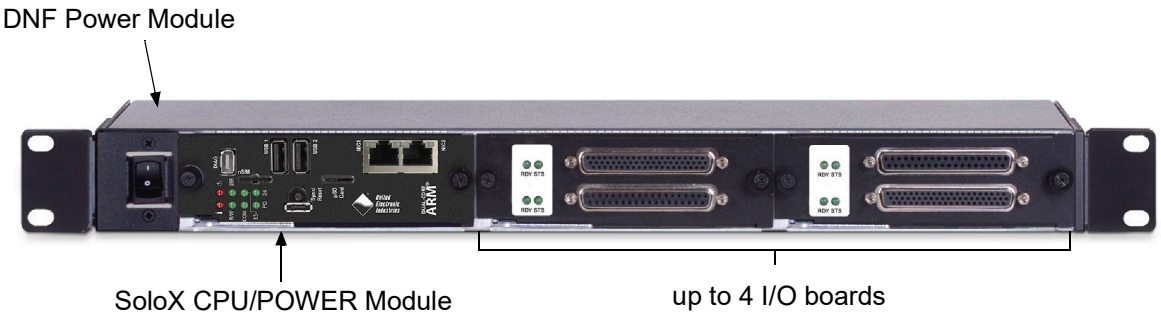


Figure 2-2 DNF-4-1G-11 FLATRACK System

2.1.1 RACK System Components

A standard PowerDNA SoloX RACK system consists of the following modules:

Table 2-1 PowerDNA SoloX RACK Components

QTY	Item	Refer to Section
1	RACKtangle, HalfRACK, or FLATRACK enclosure	Section 2.4
1	SoloX CPU/POWER module	
1	DNR/DNF Power module	
1	Buffer Module (only used with RACKtangle chassis)	
up to 12	Your selection of DNR- or DNF- series I/O boards	
optional	Blank filler panels, one for each unused I/O slot **Note:** Slot covers are optional and not included in the price of the RACK.	
1	DNA-PSU-180 180-Watt, 120/230 VAC to +24 VDC external power supply with cable and Molex connector	

Module locations are shown in **Figure 2-1** and **Figure 2-2**.

The SoloX CPU/POWER module controls the unit's operations and supervises the activity of the I/O boards. System power is managed by the CPU/POWER module as well as a separate DNR/DNF Power module. DNR-12-1G RACKtangle systems also include a Buffer module to guard against data loss between the I/O boards and CPU.

The remaining slots in the RACK are dedicated to user-selected I/O boards. To configure a complete data acquisition system, specify up to 4 DNF I/O boards for installation into a FLATRACK, up to 6 DNR boards or a HalfRACK, or up to 12 DNR boards for a full RACKtangle.

For module part numbers, refer to **Table 2-4**.

For detailed descriptions of all I/O boards and accessories available for the PowerDNA SoloX RACK, refer to www.ueidaq.com.

2.2 Specifications

Table 2-2 lists the technical specifications for the PowerDNA SoloX RACK:

Table 2-2 PowerDNA SoloX RACK Specifications

Computer Interface	
Primary Ethernet port	10/100/1000Base-T, RJ-45 connector
Diagnostic port	10/100/1000Base-T, RJ-45 connector
Config/Serial port	Dual RS-232 ports, one per CPU core
Synchronization options	1. DNA-SYNC-1G series cables and boards provide both clock and trigger signals 2. DNA-IRIG-650 board for IRIG and GPS sync 3. IEEE-1588 sync
I/O Slots and Dimensions[1]	
DNF-4-1G-11	4 slots (1.75” x 7.8” x 16”, Std 1U)
DNR-6-1G-11	6 slots (5.25” x 6.2” x 10.5”)
DNR-12-1G-11	12 slots (5.25” x 6.2” x 17.5”, Std 3U)
Host Communications	
Distance from host	100 meters max, CAT5+ cable
Ethernet data transfer rate	20 megabytes per second
Processor	
CPU	SoloX i.MX6 series dual core ARM processor Cortex A9 core @ 1GHz, Cortex M4 @ 200 MHz
Memory	1 GByte RAM[1]
FLASH memory	8 GByte[1]
Solid-state hard drive	not supported on PowerDNA deployments[2]
µSD card interface	not supported on PowerDNA deployments[2]
USB port	not supported on PowerDNA deployments[2]
Environmental	
Electrical Isolation	350 Vrms
Temp (operating)	-40 °C to +70 °C
Temp (storage)	-40 °C to +85 °C
Humidity	0% to 95%, non-condensing
Vibration[3] IEC 60068-2-6 IEC 60068-2-64	3 g, 10-500 Hz, sinusoidal 3 g (rms), 10-500 Hz, broadband random
Shock[3] IEC 60068-2-27	100 g, 3 ms half sine, 18 shocks @ 6 orientations 30 g, 11 ms half sine, 18 shocks @ 6 orientations
Altitude	70,000 feet, maximum
Power Requirements	
Voltage	9-36 VDC (115/220 VAC adaptor included)
Power	10 Watts (not including I/O boards)
Reliability	
MTBF	>130,000 / 160,000 hours for DNR-12 / DNR-6

1. Dimensions are given as $length_{base}$ × $width_{base}$ × height.
2. Only user-accessible on UEIPAC stand-alone deployments
3. Shock and vibration specifications assume appropriate mounting/installation.

2.3 Key Features

The following table is a list of key features of the PowerDNA SoloX RACK system.

Table 2-3 PowerDNA SoloX RACK Features

Easy to Configure and Deploy	Flexible Connectivity
• Over 80 different I/O boards available • Built-in signal conditioning • Bracket kit for mounting to wall or in 19” racks • Industrial quality rubber feet for solid table-top mounting • Passive backplane ensures extremely low MTTR • Standard “Off-the-shelf” products and delivery	• Dual 1000Base-T Gigabit Ethernet ports with independent IPs (100/10Base-T compatible) • RS-232 interface
High Channel Density	**Rugged and Industrial**
A RACK with 12 I/O boards supports: • Analog Inputs: up to 300 channels • ICP/IEPE: up to 48 channels • Analog Outputs: up to 384 channels • Digital I/O: up to 576 channels • ARINC-429: up to 192 channels • Counter/Timer: up to 96 channels • CAN-bus: up to 48 ports • RVDT/LVDT: up to 48 channels • RS-232/422/485: up to 96 ports • Synchro/Resolver: up to 48 channels • MIL-1553: up to 24 redundant ports	• All Aluminum construction • Operation tested from -40°C to 70°C • Vibration tested to 3 g (operating) • Shock tested to 100 g (operating) • All I/O isolated from Cube and host PC • Operation to 70,000 feet • Fans included
True Real-time Performance	**Outstanding Software Support**
• 1 millisecond updates guaranteed with 1000 I/O • Up to 6 million samples per second • Use QNX, RTX, VxWorks	• Windows, Linux, RTX, VxWorks, and QNX operating systems • VB, VB.NET, C, C#, C++, Python • MATLAB, LabVIEW, OPC, ActiveX support

2.4 RACK Enclosures

The RACK enclosures are rigid mechanical structures with complete EMI shielding (see **Figure 2-3**, **Figure 2-4**, and **Figure 2-5** below). The enclosure houses the following components:

Table 2-4 Modules in PowerDNA SoloX RACK Enclosure

Item	Part No.	Description
Power board	DNR-POWER-DC	**DNR-12 and DNR-6:** Isolated DC/DC Power Module/Power Monitor with status indicators, a local on/off switch, and 4-pin Molex Power-In connector.
	DNF-POWER-DC or DNF-POWER-AC	**DNF-4, DC**: Mounting plate & connecting hardware or **DNF-4, AC**: Mounting plate, connecting hardware, and 9-36 VDC power supply for use with -AC
CPU / POWER module	DNR-CPU-1G-11 DNF-CPU-1G-11	One dual-slot CPU / POWER module
Buffer board	DNR-BUFFER (RACKtangle only)	**DNR-12:** One for buffering address/control/clock lines (not currently addressable). **Not applicable for DNR-6 and DNF-4**
I/O boards	DNR- / DNF-	RACK I/O boards designed for front removal and installation.
Enclosure	DNR-BP-6 DNR-BP-6 DNF-4-ENCL	One backplane/assembly with temperature sensors
Filler panels	DNR-IO-FILLER DNF-IO-FILLER	Blank filler panels for all unused slots (Note that this item is optional / not included in price of rack)
Fans		8-volt cooling fans mounted in enclosure

2.4.1 DNR-12-1G Enclosure

The exploded view of a DNR-12-1G RACKtangle enclosure is shown below in **Figure 2-3**. A parts list is provided in **Table 2-5** on the next page.

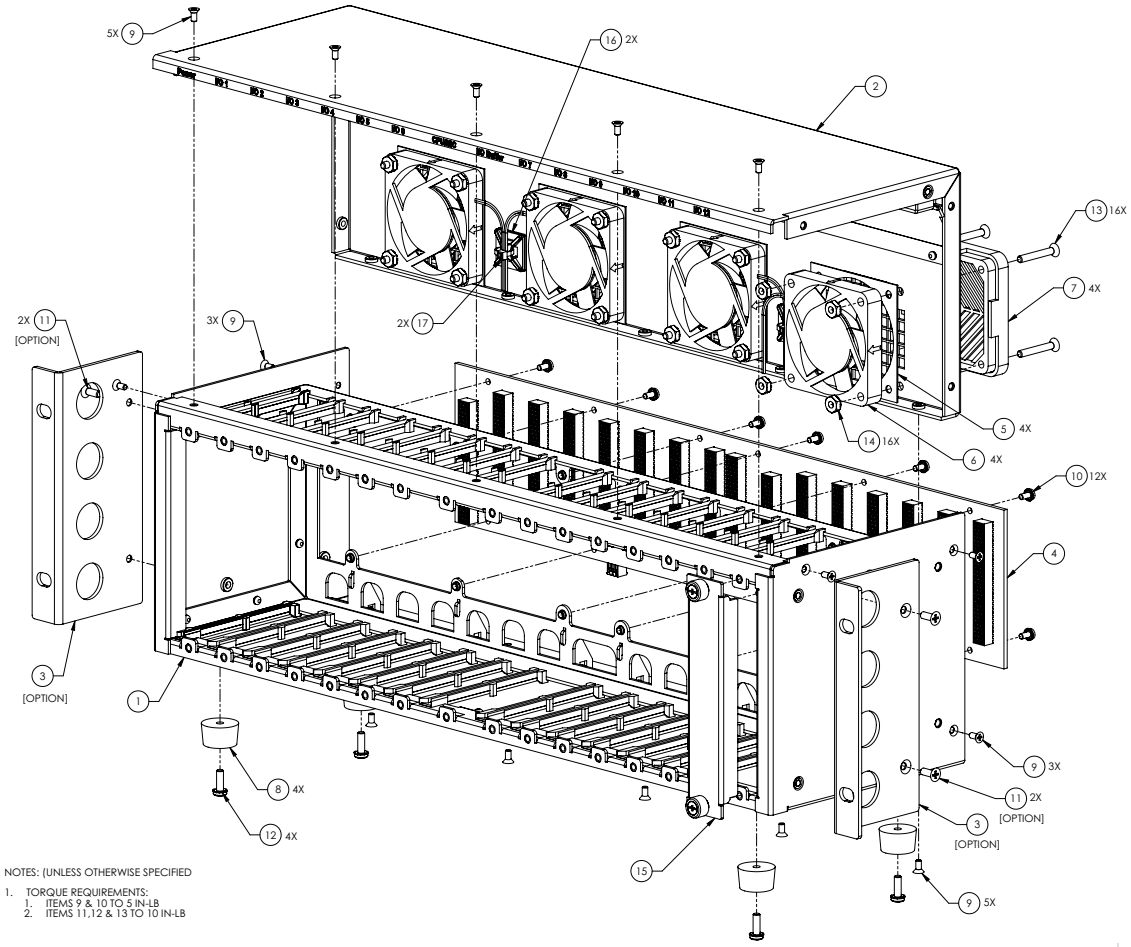


Figure 2-3 Typical RACKtangle Enclosure (Exploded View)

NOTE: The rightmost module (I/O board slot 12) is 2-slots wide to accommodate future designs and/or custom modules.

The enclosure has reversible mounting flanges designed for rack or surface mounting. Rubber feet are supplied for desktop or tabletop mounting. Refer to Section 4.8 on page 61 for more information about mounting options and field connections.

Table 2-5 DNR-12-1G RACKtangle Enclosure Part List (see Figure 2-3)

Item No.	Quantity	Description
1	1	Enclosure, UEIPAC 1200R 2000-241A
2	1	Rear Panel, UEIPAC 1200R 2000-242A
3	2	Bracket, MOUNTING, STEEL, DNR-12 2000-0033 X
4	1	Assembly, PCB, BACKPLANE, DNR-12 DNR-12BP
5	4	Spacer, FAN, 60MM 2004-6060
6	4	Fan, AXIAL, 60x10mm, 12VDC . DNR-FAN
7	4	Filter Assembly, 60mm, 45PPI 806-5023
8	4	Bumper, RECESSED, 3/4DIA, 7/16H 1000-728
9	16	Screw, #4-40x¼,82° FH,PHIL,SST,BLK OXIDE 1001-082
10	12	Screw, #4-40x.250,PAN HD,PH,SEMS,SQ CONE 1001-028
11	4	Screw, #6-32x.375,100D FH,PHIL,SST,BLK OXIDE 1001-375 X
12	4	Screw, #6-32x.437,PAN HD,PHIL,SEMS,EXT 1001-437
13	16	Screw, #6-32x1.00,82° FH,PHIL 1001-635
14	16	Nut, HEX, KEPS, #6-32 1001-634
15	1	IO Filler, DNR-12 2000-0101
16	2	Mount, CABLE TIE 1000-214
17	2	Cable Tie 1000-213

2.4.2 DNR-6-1G Enclosure

The exploded view of a DNR-6-1G HalfRACK system is shown below in **Figure 2-4**. A parts list is provided in **Table 2-6** on the next page.

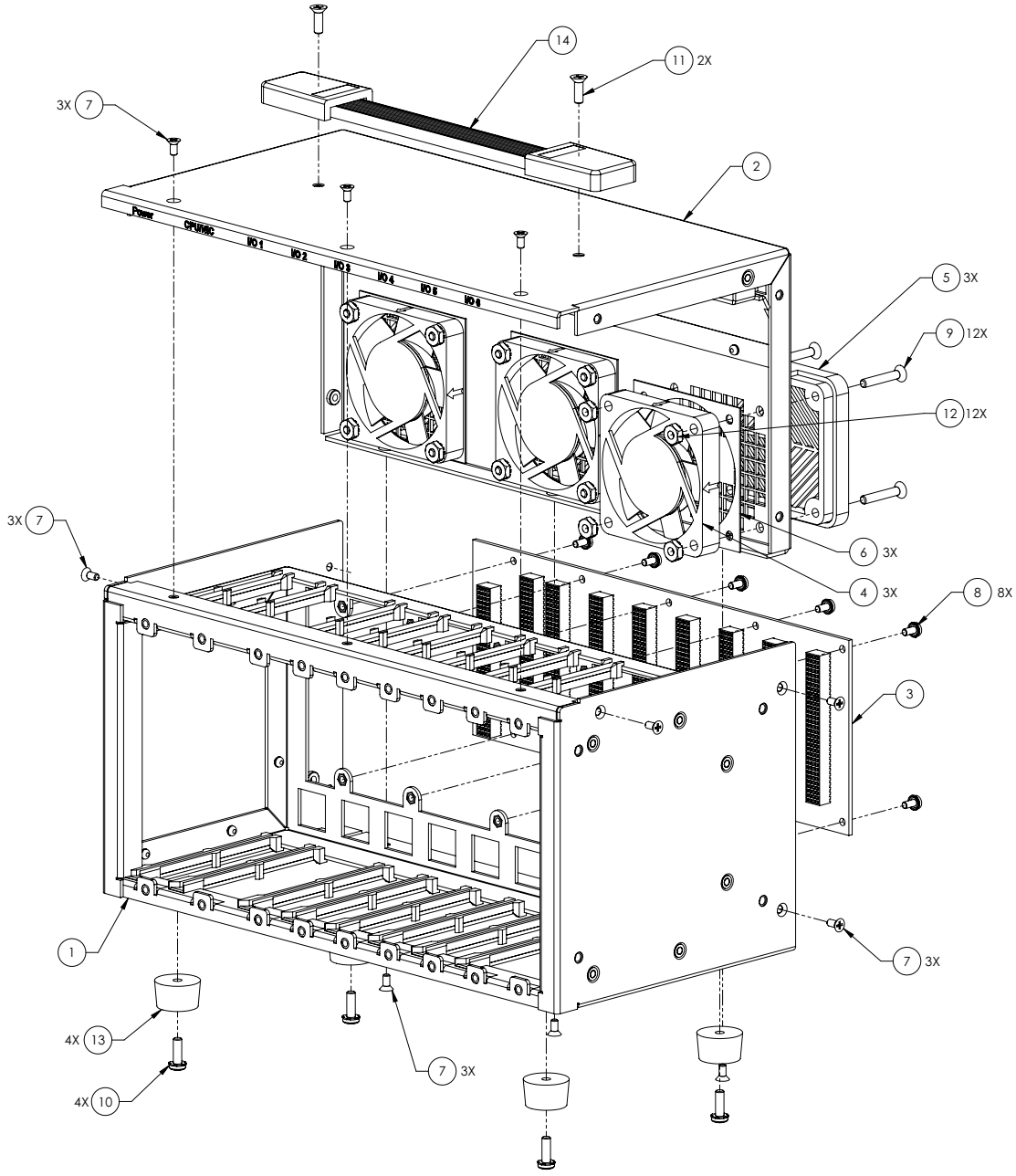


Figure 2-4 Typical HalfRACK Enclosure (Exploded View)

NOTE: The rightmost module (I/O board slot 6) is 2-slots wide to accommodate future designs and/or custom modules.

Rubber feet are supplied for desktop or tabletop mounting. Refer to Section 4.8 on page 61 for more information about mounting options and field connections.

Table 2-6 DNR-6-1G HalfRACK Enclosure Parts List (see Figure 2-4)

Item No.	Quantity	Description
1	1	Enclosure, UEIPAC 600R Base
2	1	Rear panel, UEIPAC 600R
3	1	Assembly, PCB, BACKPLANE, DNR-6
5	3	Filter Assembly for Fans, 60mm, 30PPI QUALTEK
6	3	Spacer, FAN, 60MM
7	12	Screw, #4-40x¼,82D FH,PHIL,SST,BLK OXIDE
8	10	Screw, #4-40x.250,PAN HD,PH,SEMS,SQ CONE
9	12	Screw, #6-32x.875,82D FH,PHIL
10	4	Screw, #6-32x.437,PAN HD,PHIL,SEMS,EXT
11	2	Screw, #6-32x.437,82D FH,PHIL
12	12	Nut, HEX, KEPS, #6-32
13	4	Bumper, RECESSED, 3/4DIA, 7/16H
14	1	Handle, FLAT

2.4.3 DNF-4-1G Enclosure

The exploded view of a DNF-4-1G FLATRACK system is shown below in **Figure 2-5**. A parts list is provided in **Table 2-7** on the next page.

The FLATRACK is available in AC or DC powered versions. The DC version requires a DC power source between 9 and 36 Volts. The AC unit operates from 100 to 240 VAC, from 50 to 60 Hz. The power module provides output voltages of 24, 3.3, 2.5, 1.5, and 1.2 VDC for the logic/CPU and 8 VDC to power 3 cooling fans.

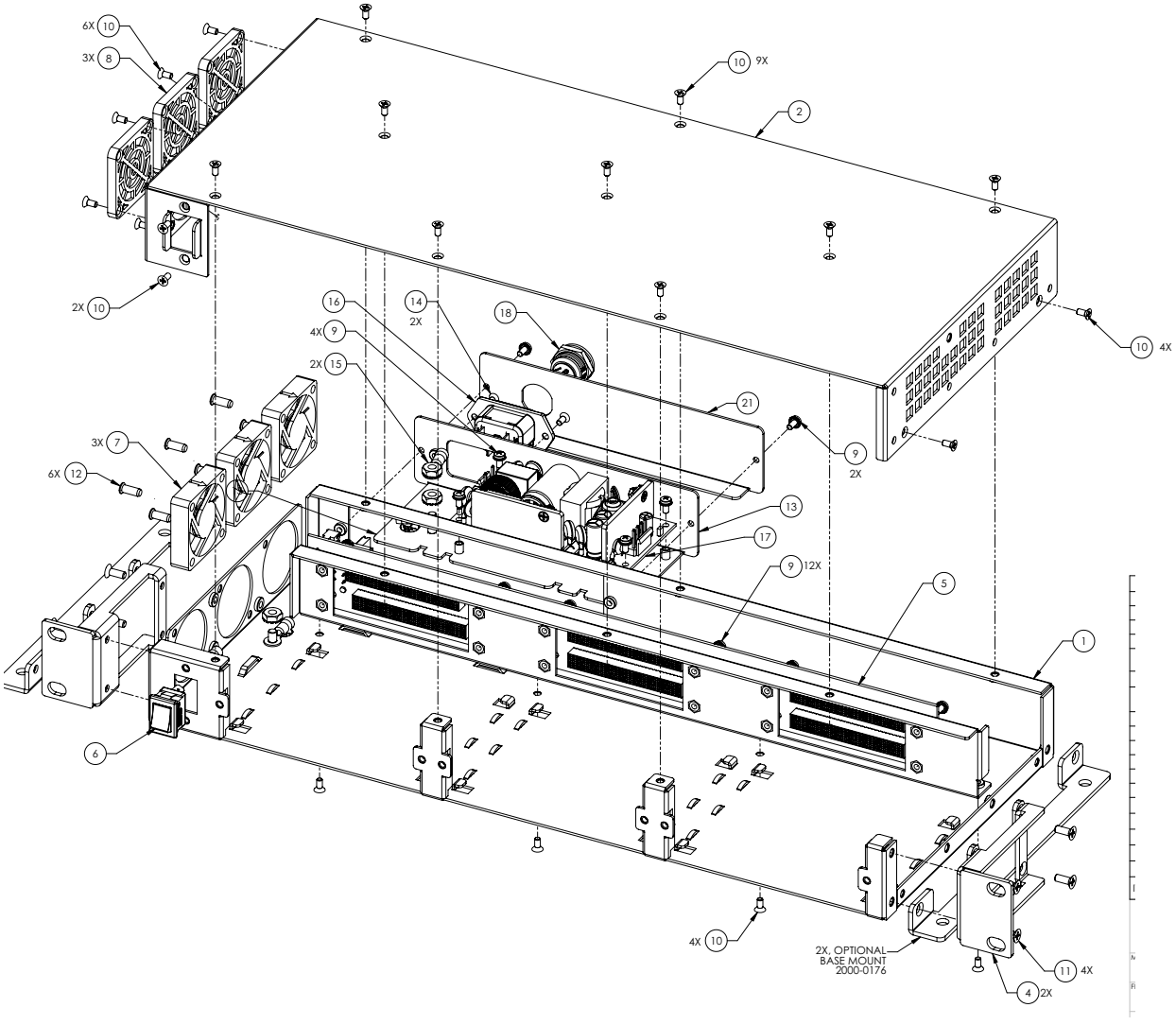


Figure 2-5 Typical FLATRACK Enclosure (Exploded View)

Table 2-7 DNF-4-1G FLATRACK Enclosure Parts List (see Figure 2-5)

Item No.	Quantity (AC version)	Quantity (DC version)	Description (Vendor/Vendor Part No.)
1	1	1	Chassis, DNF-4-1G Base
2	1	1	Chassis, DNF-4-1G Cover
3	1	1	Support, DNF-4-1G Backplane
4	2	2	Bracket, Mounting, 19" RACK, DNF-4-1G
5	1	1	Backplane Assembly, PCB, DNFBP4-RA DNFBP4-RA
6	1	1	Power Switch, Rocker, SNAP-IN, 2A 250VAC ITT DA102J12S215PQF
7	3	3	Fan, Axial, 40x10mm
8	3	3	Filter Assembly, 40MM FAN QUALTEK 09150-F/30PPI
9	18	14	Screw, #4-40x.250, PAN HD, PH, SEMS, SQ CONE 1001-028
10	25	25	Screw, #4-40x¼,82° FH,PHIL,SST,BLK OXIDE 1001-082
11	8	8	Screw, #6-32x.375,100D FH,PHIL,SST,BLK OXIDE 1001-375
12	6	6	Screw, M3.9x1.2 x 10.5mm, FH, PHIL, FAN MOUNT PENCOM M3.9 X 10.5mmPHFL-FAN-NI
13	1	NA	Plate, Mounting, CUI POWER SUPPLY 2000-0178
14	2	NA	Screw, Oval Head, #4-40 X .250, SLT/Z MCMASTERCARR 91802A106
15	3	NA	Nut, Hex, KEPS, #8-32
16	1	NA	Connector, AC Inlet, IEC 320 SCHURTER 6100-3300
17	1	NA	Power Supply, 60W, 24VDC, 2"X4" CUI INC VMS-60-24
18	NA	1	Connector, RCPT, MINI CIRC DIN, 4P CUI SD-40LS
21	NA	1	Plate, Mounting, CUI POWER SUPPLY 2000-0184

2.4.4 Filler Panel & Mounting Bracket

The following section provides drawings for the DNR-IO-FILLER and DNR-BRACKET.

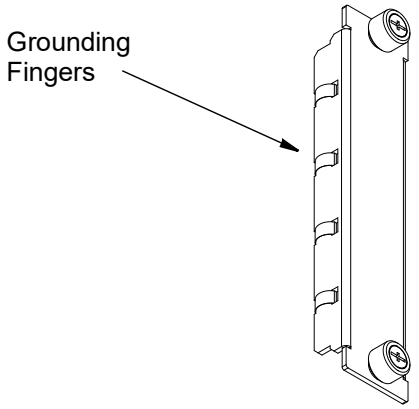


Figure 2-6 Optional DNR-IO-Filler Panel for Empty Slots

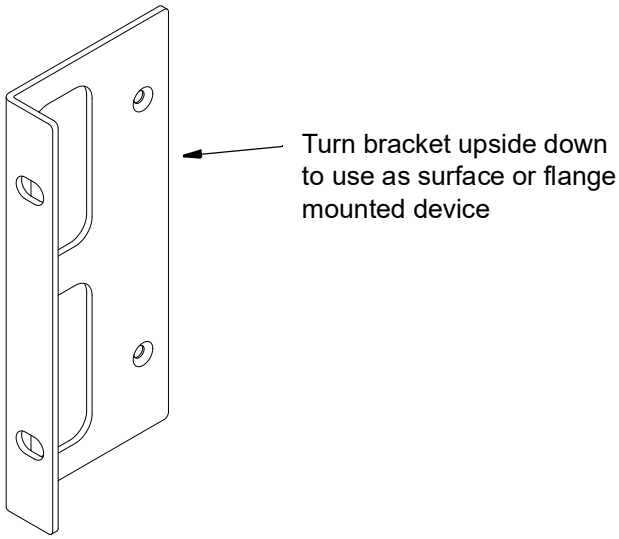


Figure 2-7 DNR-BRACKET Reversible Mounting Bracket

2.4.5 RACK Air Flow

As shown below in **Figure 2-8**, cooling air is drawn into the rear of the enclosure via fans, routed forward over the electronic circuit boards, up to the top of the enclosure, and then out the top rear of the enclosure. The system is designed to maintain positive pressure cooling within the enclosure at all times.

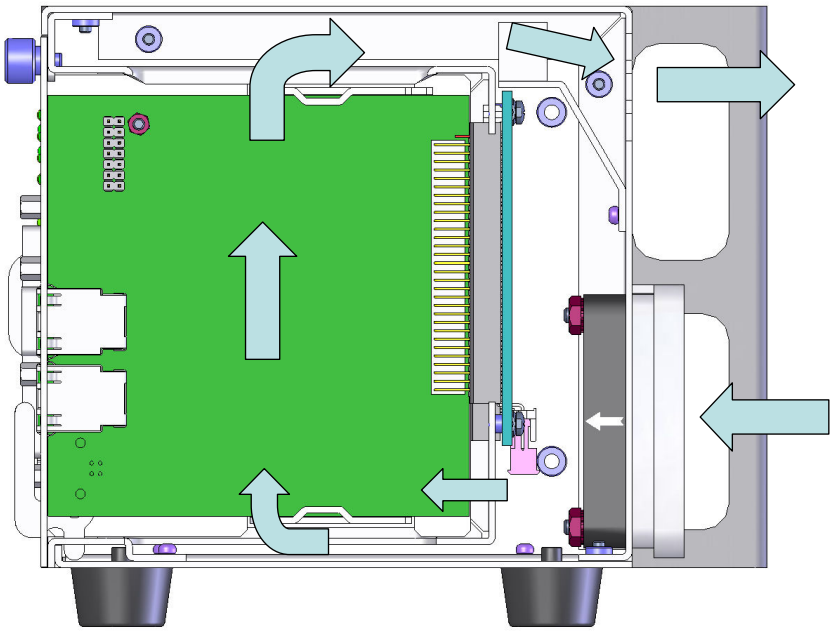


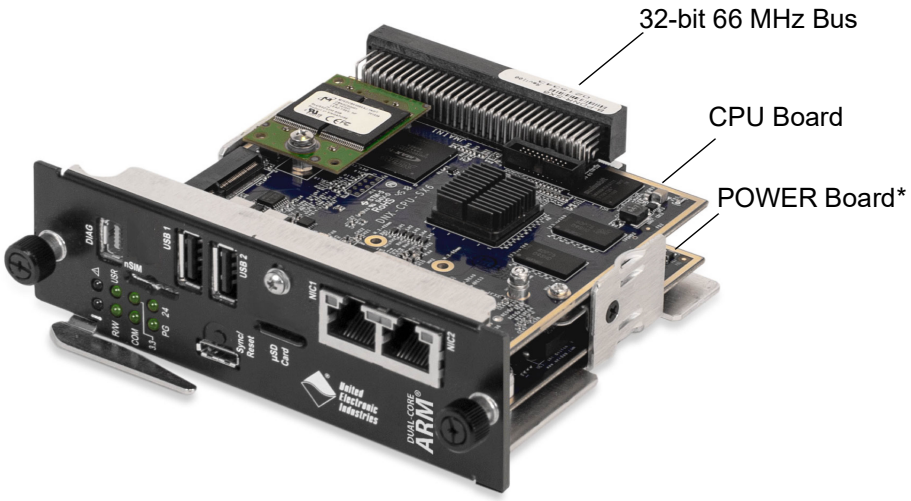
Figure 2-8 Example of DNR-12-1G RACKtangle Air Flow

Two sensors mounted on the backplane over the Power Module and over the CPU board continuously monitor internal temperatures, turning fans on if the internal temperature exceeds 45°C, off if it falls below 45°C, and shutting down power if a high limit is exceeded.

2.5 CPU/POWER Module

The core module on the PowerDNA SoloX RACK is a 2-board CPU/POWER module (DNR-CPU-1G-11). One board is dedicated to CPU functions and the other is dedicated to power management.

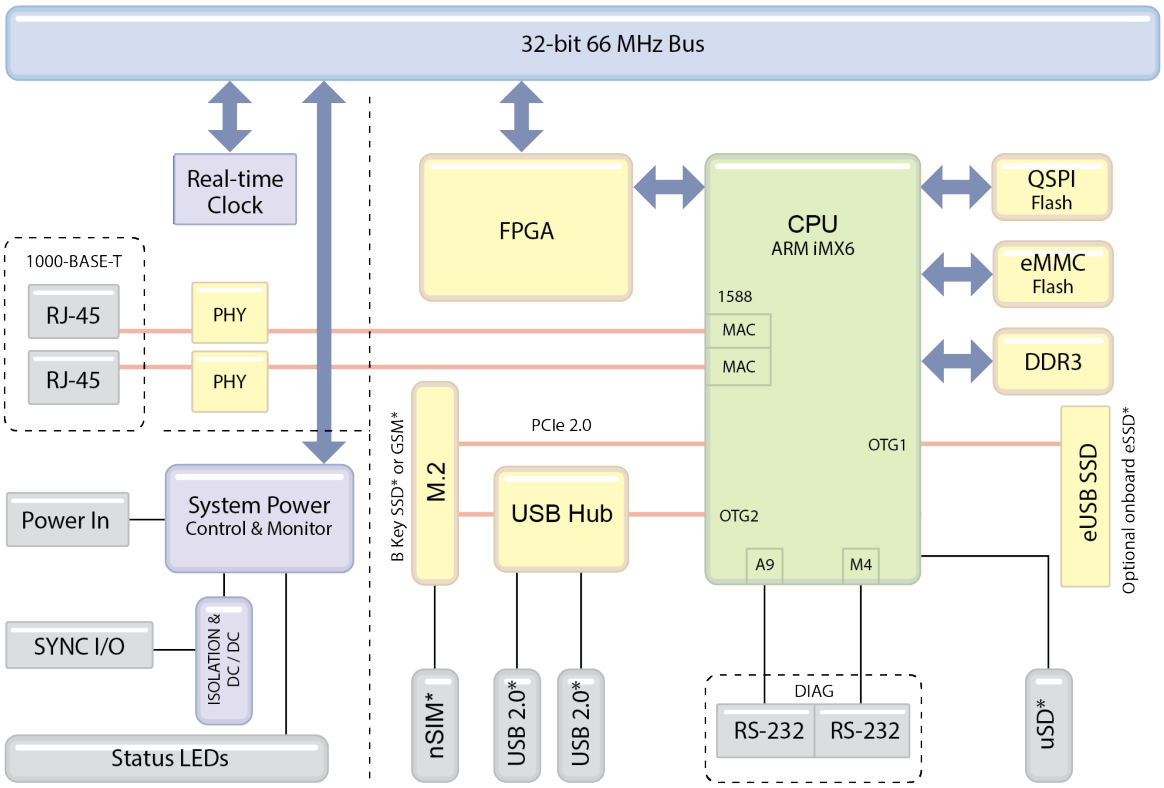
- The CPU board is based on the NXP i.MX6 SoloX processor. It uses an Altera/Intel FPGA to communicate with the I/O boards in the chassis.
- The POWER board is a dedicated DC/DC source and control system. For RACK-based systems, there is an additional power module located in slot 1 of the DNR-6-1G and DNR-12-1G RACKtangle enclosure or at the rear of the DNR-4-1G FLATRACK enclosure.



**RACK-based systems include an additional power module (DNx-POWER), which is not shown.*

Figure 2-9 SoloX CPU/POWER Module (DNR-CPU-1G-11)

CPU/POWER module components are shown in the functional block diagram in **Figure 2-10** and described in Section 2.5.1 through Section 2.5.9.



* Only supported on UEIPAC stand-alone deployments

Figure 2-10 Block Diagram of SoloX CPU Module (DNx-CPU-1G-11)

2.5.1 CPU Processor

The CPU module centers around an NXP i.MX6 SoloX processor, which is a low-power, dual-core ARM® processor composed of the Cortex®-A9 and Cortex®-M4 cores.

The Cortex®-A9 core runs at a maximum of 1 GHz while the Cortex®-M4 core runs at a maximum of 200 MHz. The more powerful A9 core is available for user programs. The M4 core utilizes a RTOS and runs UEI-specific firmware.

2.5.2 FPGA

The CPU module uses the Altera / Intel® MAX® 10 FPGA to communicate with the I/O boards via the 32-bit 66 MHz bus.

2.5.3 Memory and Storage

Table 2-8 lists the memory and storage hardware on the CPU/POWER module.

NOTE: Memory and storage components are not user-accessible in PowerDNA mode, except when updating firmware.

Table 2-8 Memory and Storage Components in PowerDNA SoloX Cube/Rack

Item	Description
RAM (DDR3)	1 GB of SDRAM *(not user-accessible in PowerDNA mode)*
eMMC Flash	8 GB flash *(not user-accessible in PowerDNA mode)*
QSPI Boot Flash	16 MB of flash Stores U-boot image, UEI environment variables, UEI initialization values, µC/OS firmware.
Solid State Hard Drive	Optional internal SSDs installed on M.2 connector or 10-pin header *(UEIPAC only)*
USB 2.0 Dual Ports	External USB 1 and USB 2 ports connect to the CPU via a USB hub *(UEIPAC only)*
µSD Card	Optional micro Secure Digital card (up to 128 GB) *(UEIPAC only)*

2.5.4 Ethernet Ports

Two Ethernet ports are provided:

- NIC1 provides communication between the PowerDNA SoloX RACK system and the host PC/primary LAN network.
- NIC2 is designed as a diagnostic port for monitoring system health during operation. It may be assigned as the primary Ethernet port if NIC1 is not available for use.

Each port features a Physical Layer transceiver that supports 10BASE-Te, 100BASE-TX and 1000BASE-T Ethernet protocols for implementation of 10/100/1000 Mbps Ethernet LANs.

The Ethernet connection additionally supports precision clock synchronization and provides IEEE 1588 hardware time stamp support. Refer to the “PowerDNx 1PPS Sync Interface Manual” for more information about synchronization support.

2.5.5 Real-time Clock

The real-time clock (RTC) is the hardware clock for the PowerDNA SoloX RACK system, which stores persistent date and time information. The RTC chip is the Dallis-Maxim DS1390 with a battery backup (Panasonic CR2032 coin).

2.5.6 RS-232 Ports (DIAG)

The 10-pin DIAG connector provides access to the A9 and M4 CPU cores through two separate RS-232 serial interfaces. Refer to **Figure 4-16** for pinout. The serial interface can be used to program CPU parameters and read diagnostics. Serial connections run at: 57600 bps, 8 bits, no parity, 1 stop.

Alternatively, you can communicate with the SoloX core module through the Ethernet port using UEI's PowerDNA Explorer. PowerDNA Explorer is a GUI-based application which can display diagnostic CPU module data, change the IP address, update firmware, and more. See Chapter 5 for more information about Explorer.

2.5.6.1 DIAG Accessories

The following UEI accessories are available for purchase:

- DIAG to COM DB-9 connector cable to access the A9 core over a serial connection (CBL-SX6-DIAG).
- CBL-SX6-SYNC cable and STP-SX6-DIAG board, which provide access to both A9 and M4 serial interfaces.

See Appendix A for more information about accessories.

2.5.7 Sync Port

The "Sync" port connection consists of 2 TTL input lines (CLK and TRIGGER) and 2 TTL output lines (CLK and TRIGGER), along with +5 V power and isolated ground. Refer to **Figure 4-16** for pinout.

The Sync port is used for 1PPS synchronization, which synchronizes multiple systems to an external pulse-per-second reference signal. Two systems may be directly connected together, and larger groups may use UEI's SYNC STP panel to share triggers and clocks among many chassis and systems.

- Trigger and clock inputs accept TTL signals in (3.3 V to 5 V). The inputs also have internal pull-up resistors to an internal 5 V supply, making the inputs also compatible with a low-side drive open-collector outputs.
- Trigger and clock outputs use 5 V logic levels. The sync connector's ground and 5 V power connections are provided by its own isolated DC-DC converter.

For more information, refer to the "PowerDNx 1PPS Sync Interface Manual," which also describes IEEE-1588 PTP synchronization available through the Ethernet port.

2.5.8 System Power Control & Monitoring

The DNR-POWER-1G board comprises an FPGA and other hardware to control and monitor system power, perform power conditioning, control diagnostic LED states, isolate and direct synchronization I/O to the CPU board, and control fan operation. The DNR-POWER-1G board is located at the bottom of the CPU/POWER core module shown in **Figure 2-9**.

The POWER board uses a 24-bit ADC to monitor:

- V_{in} (9-36 VDC), I_{in}
- 24 V source, I_{24V}
- 3.3 V source, $I_{3.3V}$
- 2.5 V source (derived from 3.3V source)
- 1.5 V source, $I_{1.5V}$
- 1.2 V source, $I_{1.2V}$
- 8 V FAN source
- System temperature

NOTE: On RACK-based systems, V_{in} connects through a separate dedicated power module (DNR-POWER-DC, DNF-POWER-DC, or DNF-POWER-AC). See Section 2.6 for more information.

2.5.9 CPU/POWER Module Ports & LEDs

The PowerDNA SoloX RACK CPU/POWER module front panel is illustrated below in **Figure 2-11** and described in **Table 2-9**.

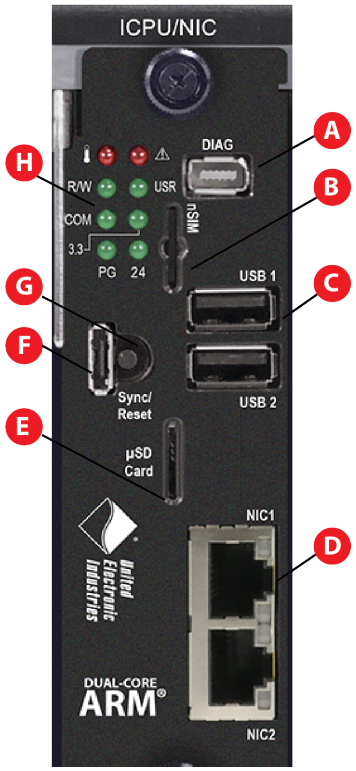


Figure 2-11 CPU/POWER Module Front Panel (Rack)

Table 2-9 CPU/POWER Module Front Panel Descriptions (Rack)

No.	Name	Description	Section
A	DIAG	Diagnostic port. Provides serial comminication port to Cortex-A9 core and Cortex-M4 core. Serial connections run at 57600 bps, 8 bits, no parity, 1 stop	Section 2.5.6
B	nSIM card slot	Optional slot for nano SIM card.	Section 2.5.3
C	USB 1, USB 2	USB 2.0 ports	Section 2.5.3
D	NIC1, NIC2	Ethernet ports: 1000/100/10Base-T connection. RJ-45 connector for NIC1 (eth0) and NIC2 (eth1)	Section 2.5.4
E	µSD card slot	Slot for optional µSD card up to 128 GB.	Section 2.5.3
F	Sync port	High-speed, chassis-to-chassis connector for synchronizing multiple UEI systems.	Section 2.5.7
G	Reset	Recessed reset button.	n/a
H	Status LEDs	See **Figure 2-12** and **Table 2-10** for LED descriptions.	n/a

The Power In connector is on the DNx-POWER module located in slot 1 of the DNR-12-1G RACKtangle and DNR-6-1G HalfRACK or at the rear of the DNR-4-1G FLATRACK.

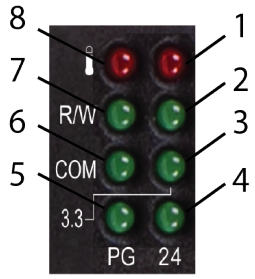


Figure 2-12 CPU/POWER Module LEDs (Rack)

Table 2-10 CPU/POWER Module LED Descriptions (Rack)

No.	Name	Description
1	ATT	Indicates system needs attention due to overrange condition: Error when red LED is ON
2	USR	Optionally controlled by user application[1]: OFF is default
3	3.3	Indicates status of internal 3.3 V supply: LED ON (OK) / OFF (ERROR)
4	24	Indicates status of internal 24 V supply: LED ON (OK) / OFF (ERROR)
5	PG	Indicates the presence of a valid power input: LED ON (OK) / OFF (ERROR)
6	COM	Indicates I/O communication active: Flashes once/second when communicating / OFF when not
7	R/W	Indicates bus activity: Flashes when bus is active / OFF when not
8	OverTemp	Indicates high temperature condition in module: LED ON (high temp) / OFF when not

1. For more information about how to read or set LEDs, please refer to `DqAdvDnxpSetConfig()` API described in the *PowerDNA API Reference Manual* and/or `SampleDiagnostics.c` sample code included with your SDK installation.

For DNR-12-1G RACKtangle and DNR-6-1G HalfRACK systems only, additional LEDs are located on the DNR-POWER-DC module (refer to Section 2.6.2).

2.6 DNR/DNF Power Module

In addition to the power hardware included in the DNx-CPU/POWER module, RACK-based systems include a separate power module:

- **DNF-4-1G:** The power module in a FLATRACK chassis is available in AC or DC powered versions. The DC version requires a DC power source between 9 and 36 Volts. The AC unit operates from 100 to 240 VAC, from 50 to 60 Hz.
  Power is connected via a Mini-Con-X connector at the rear of the FLATRACK chassis. See **Figure 4-16** for pinout.
- **DNR-6-1G and DNR-12-1G**: The power module in a RACKtangle and HalfRACK chassis is the DNR-POWER-DC, which is always installed in slot 1 of the chassis.
  Power is connected via a Molex connector on the DNR-POWER-DC. Ports and LEDs on the DNR-POWER-DC module are shown in **Figure 2-13** and described in **Table 2-11**.

2.6.1 Power Management Features

Features of the RACK power management system include:

- Input power — 9-36 VDC 80 W maximum, protected by resettable fuses and EMI chokes
- Power supply on/off switch (with guard)
- Output power sources (all with greater than 90% efficiency)
  - 24 V, 1 A (24 W)
  - 3.3 V, 5 A (16.5 W, including the 2.5 V derived voltage)
  - 2.5 V, 3 A (derived from 3.3 V source)
  - 1.5 V, 5 A, (7.5 W, including the 1.2 V derived voltage)
  - 8 V, 0.5 A (4 W for fans)
- DC/DC for 24 V, 3.3 V, and 1.5 V are synchronized from the single spread- spectrum clock source in the CPU/NIC Core Module for low EMI noise level
- Fan control (Forced ON) and status ON/OFF
- Monitoring and LED indicators (1% accuracy, 0.25Hz update rate) for
  - All output voltages
  - Input current for the 9-36 VDC for the DNR enclosure
  - All voltages from the NIC/Power Module (24 V, 3.3 V, 2.5 V)
  - Temperature of the DNR backplane
- Provides 9-36 VDC for all modules from an external power source

2.6.2 DNR Power Module Ports & LEDs

For DNR-12-1G and DNR-6-1G RACKtangle-based systems only, additional LEDs are installed on a DNR-POWER-DC module.

The ports and LEDs of the DNR-POWER-DC module are illustrated in **Figure 2-13** and described in **Table 2-11**.

For information about the ports and LEDs on the CPU module, refer to

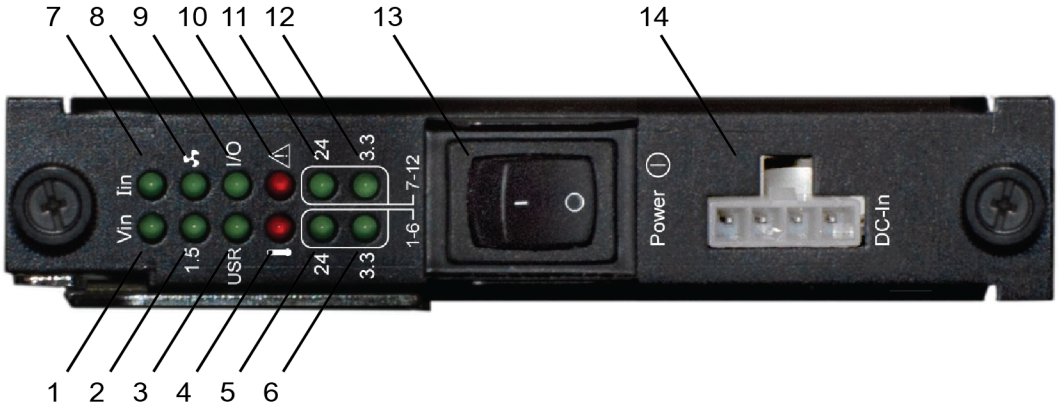


Figure 2-13 DNR-POWER-DC Front Panel (HalfRACK and RACKtangle only)

Table 2-11 DNR-POWER-DC Front Panel Descriptions (HalfRACK and RACKtangle only

No.	Name	Description
1	Vin LED	Indicates status of input voltage: LED ON (OK) / OFF (ERROR)
2	1.5 LED	Indicates status of 1.5 V onboard supply: LED ON (OK) / OFF (ERROR)
3	USR LED	Optionally controlled by user application[1]: OFF is default
4	Temperature LED	Indicates high temperature condition in module: LED ON (high temp) / OFF when not
5	24 LED	Indicates status of 24 V onboard supply for I/O boards 1 - 6: LED ON (OK) / OFF (ERROR)
6	3.3 LED	Indicates status of 3.3 V onboard supply for I/O boards 1 - 6: LED ON (OK) / OFF (ERROR)
7	Iin LED	Indicates status of input current: LED ON (OK) / OFF (ERROR)
8	Fans LED	Indicates state of fans: LED ON (ON) / OFF (OFF)
9	I/O LED	Indicates I/O circuitry operation: LED flashes 1/second
10	ATTN LED	Indicates system needs attention due to overrange condition: Error when red LED is ON
11	24 LED	Indicates status of 24 V onboard supply for I/O boards 7 - 12: LED ON (OK) / OFF (ERROR)

Table 2-11 DNR-POWER-DC Front Panel Descriptions (HalfRACK and RACKtangle only

No.	Name	Description
12	3.3 LED	Indicates status of 3.3 V onboard supply for I/O boards 7 - 12: LED ON (OK) / OFF (ERROR)
13	Power	Chassis ON / OFF switch.
14	DC In	DC In 4-pin molex connector: 9-36 VDC (DNA-PSU adapter included). See **Figure 4-16** for pinout.

1. For more information about how to read or set LEDs, please refer to `DqAdvDnxpSetConfig()` API described in the PowerDNA API Reference Manual and/or `SampleDiagnostics.c` sample code included with your SDK installation.

2.6.3 DC Power Thresholds

Table 2-12 lists the DC power threshold specifications for RACK systems.

Table 2-12 DC Power Thresholds for PowerDNA SoloX RACK

	Backplane Power Rail Voltages	Turn-on Voltage, V[1]	Reset Voltage, V[2]	Turn-off Voltage, V[3]	Notes
Logic power supply	+3.3V, +2.5V, +1.5V, +1.2V	7.5	7.2	7.0	Supplies power to all CPUs and FPGAs
Analog power supply	+24V	8.5	-	7.8	Analog power supply is used as a regulated source for on-layer DC/DCs on most boards
Fan power supply	+12V	8.5	-	8.4	
On-layer DC/DCs that use input power	+VIn	7.8-8.8	-	7.5-8.5	Varies with I/O board type

1. Turn-on Voltage: The value of Vin at which the corresponding DC/DCs are turned on.
2. Reset Voltage: When Vin is below 7.2 V, a voltage reset puts all boards into reset mode.
3. Turn-off Voltage: The value of Vin at which the corresponding DC/DCs are turned off.

NOTE: The CPU/POWER module consumes 70 mW when Vin is below 7 V.

2.7 DNR-Buffer Module

The DNR-12-1G RACKtangle includes a DNR-BUFFER module, which buffers address/control/clock signals between the CPU and I/O board. The buffer board is not included or required for HalfRACK and FLATRACK systems.

Refer to Figure 2-1 on page 5 for location of buffer board in the RACKtangle chassis.

2.8 RACK I/O Boards

All standard UEI I/O boards are available for PowerDNA SoloX RACK systems.

- Cube systems use a DNA- prefix, e.g. DNA-AI-207.
- RACKTangle and HalfRACK systems use a DNR- prefix, e.g. DNR-AI-207.
- FLATRACK systems use a DNF- prefix, e.g. DNF-AI-207.

These boards are electronically identical. The only difference between DNA-, DNR-, and DNF- I/O boards is the physical mounting arrangement for installation in the different chassis types.

I/O boards are populated into your chassis in the order you specify.

NOTE: Refer to the I/O board datasheets and user manuals for detailed electrical specifications, functional descriptions, pinouts, and programming instructions. These documents are available on the UEI website at www.ueidaq.com.

Chapter 3 PowerDNA SoloX Cube System

This chapter provides the following information about PowerDNA SoloX Cube system hardware (DNA-PPCx-1G-11 and UEINet-11):

- SoloX Cube Overview (Section 3.1)
- Specifications (Section 3.2)
- Key Features (Section 3.3)
- Cube Enclosure (Section 3.4)
- CPU/POWER Module (Section 3.5)
- Cube I/O Boards (Section 3.6)

3.1 SoloX Cube Overview

The PowerDNA SoloX Cube is a Gigabit Ethernet-based data acquisition system housed in a Cube chassis.

PowerDNA SoloX Cube versions differ in the number of supported I/O boards:

- **UEINet-11** accepts 1 user-selected I/O board
- **DNA-PPC5-1G-11** accepts up to 3 user-selected I/O boards
- **DNA-PPC8-1G-11** accepts up to 6 user-selected I/O boards
- **DNA-PPC9-1G-11** accepts up to 7 user-selected I/O boards

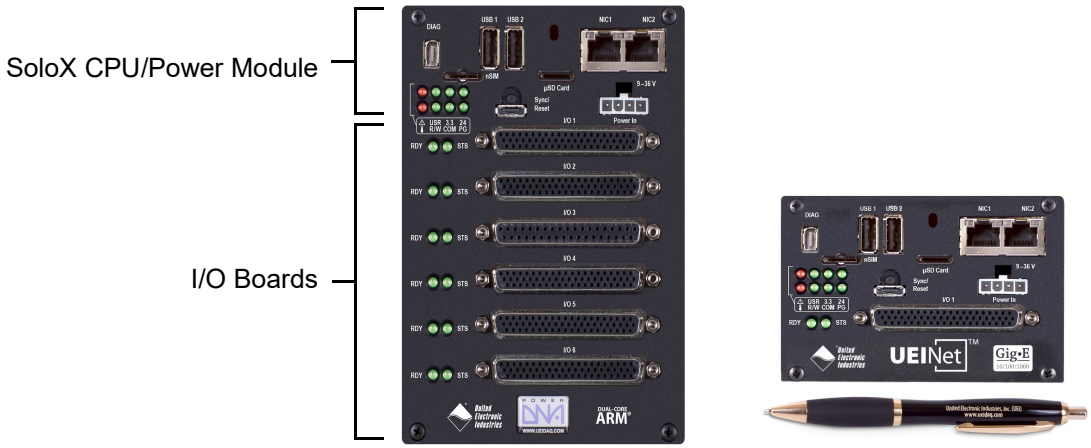


Figure 3-1 DNA-PPC8-1G-11 and UEINet-11 Systems

NOTE: As an option for rackmount solutions, up to 4 Cube systems can be mounted in UEI's DNA-19RACKW accessory assembly.

3.1.1 Cube System Components

A standard PowerDNA SoloX Cube system consists of the following modules:

Table 3-1 PowerDNA SoloX Cube Components

QTY	Item	Refer to Section
1	Cube enclosure	Section 3.4
1	SoloX CPU/POWER module	Section 3.5
up to 7	Your selection of DNR-series I/O boards	Section 3.6
1 per unused slot	Blank filler panels for unused slots	
1	DNA-PSU-24-100 100-Watt, 120/230 VAC to +24 VDC external power supply with cable and Molex connector	

As shown in **Figure 3-1**, the SoloX CPU/POWER 2-board module occupies the top portion of the Cube. It controls the unit's operations, supervises the activity of the I/O boards, and manages system power.

The remaining slots in the Cube are dedicated to user-selected I/O boards. To configure a complete data acquisition system, specify up to 7 DNA I/O boards for installation into your Cube enclosure. I/O boards may be specified in any combination of UEI's DNA I/O boards.

For detailed descriptions of all I/O boards and accessories available for the PowerDNA SoloX Cube, refer to www.ueidaq.com.

3.2 Specifications

Table 3-2 lists the technical specifications for the PowerDNA SoloX Cube:

Table 3-2 PowerDNA SoloX Cube Specifications

Computer Interface	
Primary Ethernet port	10/100/1000Base-T, RJ-45 connector
Diagnostic port	10/100/1000Base-T, RJ-45 connector
Config/Serial port	Dual RS-232 ports, one per CPU core
Synchronization options	1. DNA-SYNC-1G series cables and boards provide both clock and trigger signals 2. DNA-IRIG-650 board for IRIG and GPS sync 3. IEEE-1588 sync
I/O Slots and Dimensions[1]	
UEINet	1 slot (4.0” x 4.1” x 2.7”)
DNA-PPC5-1G	3 slots (4.0” x 4.1” x 4.0”)
DNA-PPC8-1G	6 slots (4.0” x 4.1” x 5.8”)
DNA-PPC9-1G	7 slots (4.0” x 4.1” x 6.6”)
Host Communications	
Distance from host	100 meters max, CAT5+ cable
Ethernet data transfer rate	20 megabytes per second
Processor	
CPU	SoloX i.MX6 series dual core ARM processor Cortex A9 core @ 1GHz, Cortex M4 @ 200 MHz
Memory	1 GByte RAM[1]
FLASH memory	8 GByte[1]
Solid-state hard drive	not supported on PowerDNA deployments[2]
µSD card interface	not supported on PowerDNA deployments[2]
USB port	not supported on PowerDNA deployments[2]
Environmental	
Electrical Isolation	350 Vrms
Temp (operating)	-40 °C to +70 °C
Temp (storage)	-40 °C to +85 °C
Humidity	0% to 95%, non-condensing
Vibration[3] IEC 60068-2-6 IEC 60068-2-64	3 g, 10-500 Hz, sinusoidal 3 g (rms), 10-500 Hz, broadband random
Shock[3] IEC 60068-2-27	100 g, 3 ms half sine, 18 shocks @ 6 orientations 30 g, 11 ms half sine, 18 shocks @ 6 orientations
Altitude	70,000 feet, maximum
Power Requirements	
Voltage	9-36 VDC (115/220 VAC adaptor included)
Power	7 Watts (not including I/O boards)
Reliability	
MTBF	>160,000 hours

1. Dimensions are given as $length_{base}$ × $width_{base}$ × height.
2. Only user-accessible on UEIPAC stand-alone deployments
3. Shock and vibration specifications assume appropriate mounting/installation.

3.3 Key Features

The following table is a list of key features of the PowerDNA SoloX Cube system.

Table 3-3 PowerDNA SoloX Cube Features

Easy to Configure and Deploy • Over 80 different I/O boards available • Built-in signal conditioning • Flange kit for mounting to wall/flat surface • DIN rail and Rack Mount kits • Standard “Off-the-shelf” products and delivery	**Flexible Connectivity** • Dual 1000Base-T Gigabit Ethernet ports with independent IPs (100/10Base-T compatible) • RS-232 interface
High Channel Density A Cube with 7 I/O boards supports: • Analog Inputs: up to 175 channels • ICP/IEPE: up to 28 channels • Analog Outputs: up to 224 channels • Digital I/O: up to 336 channels • ARINC-429: up to 112 channels • Counter/Timer: up to 56 channels • CAN-bus: up to 28 ports • RVDT/LVDT: up to 28 channels • RS-232/422/485: up to 56 ports • Synchro/Resolver: up to 28 channels • MIL-1553: up to 14 redundant ports	**Compact Size** • 4.1” x 4” x 6.6” Cube holds 7 I/O boards • 4.1” x 4” x 5.8” Cube holds 6 I/O boards • 4.1” x 4” x 4.0” Cube holds 3 I/O boards • 4.1” x 4” x 2.7” Cube holds 1 I/O board
True Real-time Performance • 1 millisecond updates guaranteed with 1000 I/O • Up to 6 million samples per second • Use QNX, RTX, VxWorks	**Outstanding Software Support** • Windows, Linux, RTX, VxWorks, and QNX operating systems • VB, VB.NET, C, C#, C++, Python • MATLAB, LabVIEW, OPC, ActiveX support
Rugged and Industrial • All Aluminum construction • Operation tested from -40°C to 70°C • Vibration tested to 3 g (operating) • Shock tested to 100 g (operating) • All I/O isolated from Cube and host PC • Operation to 70,000 feet • Fans included	

3.4 Cube Enclosure

The PowerDNA SoloX Cube enclosure is a rigid, extruded aluminum box with complete EMI shielding.The enclosure houses the following components:

- One DNA-CPU-1G-11 CPU/POWER module, which consists of:
  - DNA-CPU-SX6 CPU board (slot 1)
  - DNA-POWER-1GB DC/DC power board (slot 2)
- DNA- I/O boards (slot 3 through up to slot 9, where the number of supported boards depends on the product version)
- DNA-IO-FILLER blank filler panels for unused slots
- Up to two 8-volt fans mounted on the rear cover of the cube

The CPU, Power, and I/O boards are stacked together and positioned on grooved guides behind the faceplate.

The Power module provides output voltages of 24, 3.3, 2.5, 1.5, and 1.2 VDC for the logic/CPU and 8 VDC to power the fans.

3.4.1 Fans & Air Flow

Figure 3-2 shows a representation of air flow through the PowerDNA cube.

Air is drawn into the rear of the enclosure, routed forward over the electronic circuit boards, up to the top of the enclosure, and then out the top rear of the enclosure. The system is designed to maintain positive pressure cooling within the enclosure at all times.

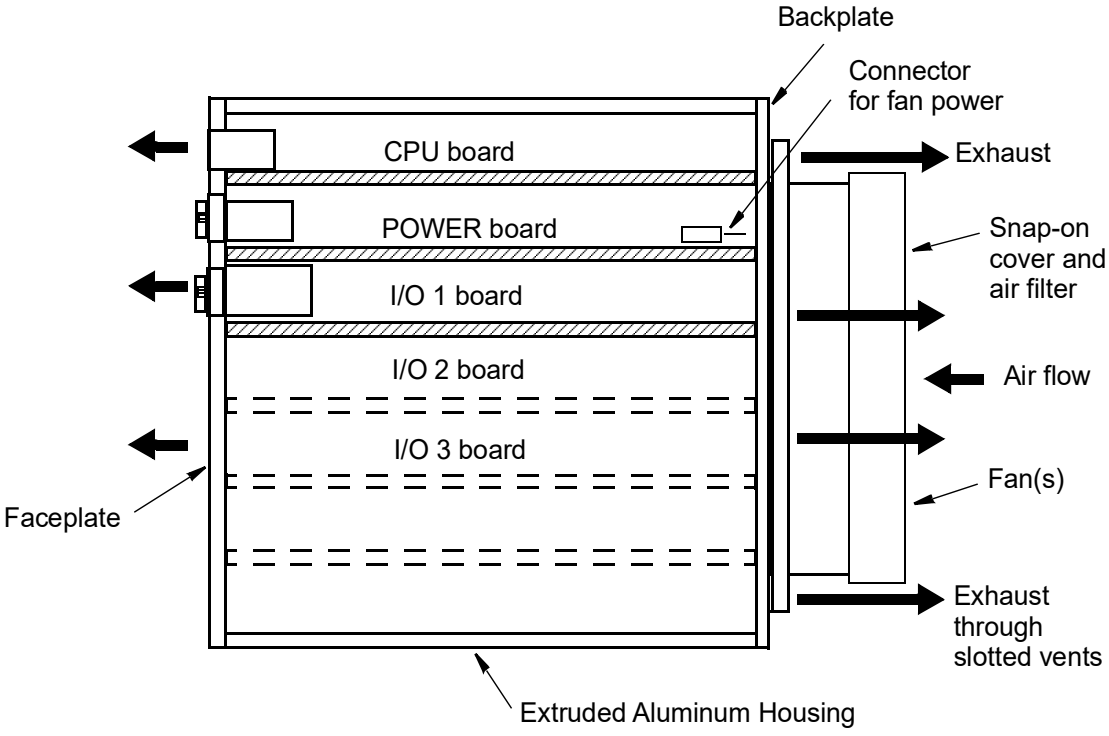


Figure 3-2 Air Flow through a Cube Chassis

A temperature sensor mounted on the POWER board above the CPU monitors temperature within the cube. The system turns on the fan(s) if the temperature exceeds 45° C and shuts down power to the cube if a high limit is exceeded.

3.5 CPU/POWER Module

The core module on the PowerDNA SoloX Cube is a 2-board CPU/POWER module (DNA-CPU-1G-11):

- The CPU board is based on the NXP i.MX6 SoloX processor. It uses an Altera/Intel FPGA to communicate with the I/O boards in the chassis.
- The POWER board is a dedicated DC/DC source and control system.

See **Figure 2-9** on page 18 for a representative photo of the CPU/POWER core module. The core module on the Cube is the same as the core module on the Rack, except that power management on the Cube is handled exclusively by core module's POWER board.

A block diagram of the CPU/POWER module is shown in **Figure 2-10**.

3.5.1 CPU Processor

Refer to Section 2.5.1.

3.5.2 FPGA

Refer to Section 2.5.2.

3.5.3 Memory and Storage

Refer to Section 2.5.3.

3.5.4 Ethernet Ports

Refer to Section 2.5.4.

3.5.5 Real-time Clock

Refer to Section 2.5.5.

3.5.6 RS-232 Ports (DIAG)

Refer to Section 2.5.6.

3.5.7 Sync Port

Refer to Section 2.5.7.

3.5.8 Ports & LEDs

The PowerDNA SoloX Cube CPU/POWER module front panel is illustrated below in **Figure 3-3** and described in **Table 3-4**.

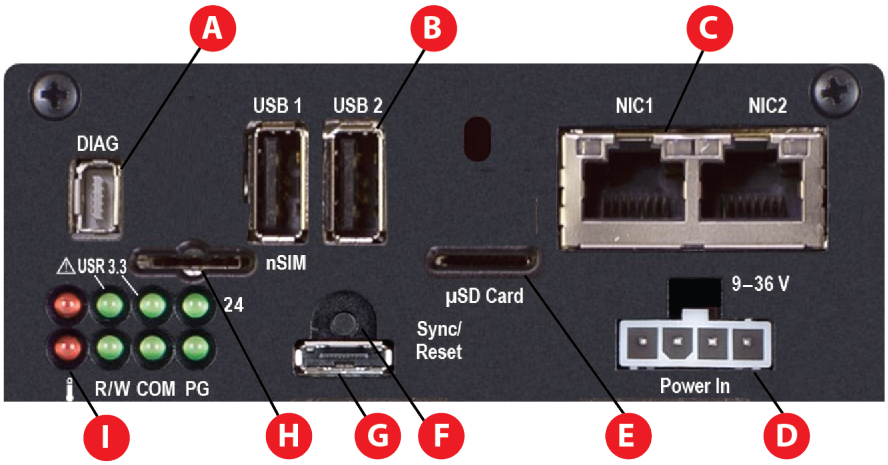


Figure 3-3 CPU/POWER Module Front Panel (Cube)

Table 3-4 CPU/POWER Module Front Panel Descriptions (Cube)

No.	Name	Description	Section
A	DIAG	Diagnostic port. Provides serial comminication port to Cortex-A9 core and Cortex-M4 core. Serial connections run at 57600 bps, 8 bits, no parity, 1 stop	Section 3.5.6
B	USB 1, USB 2	USB 2.0 ports	Section 3.5.3
C	NIC1, NIC2	Ethernet ports: 1000/100/10Base-T connection. RJ-45 connector for NIC1 (eth0) and NIC2 (eth1)	Section 3.5.4
D	Power In	External power connects in through 4-pin Molex. 9-36VDC, DNA-PSU adapter included	Section 3.5.9
E	µSD card slot	Slot for optional µSD card up to 128 GB.	Section 3.5.3
F	Reset	Recessed reset button.	n/a
G	Sync port	High-speed, chassis-to-chassis connector for synchronizing multiple UEI systems.	Section 3.5.7
H	nSIM card slot	Optional slot for nano SIM card.	Section 3.5.3
I	Status LEDs	See **Figure 3-4** and **Table 3-5** for LED descriptions.	n/a

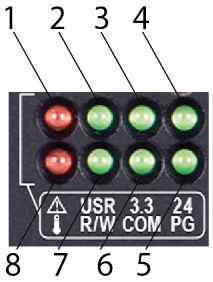


Figure 3-4 CPU/POWER Module LEDs (Cube)

Table 3-5 CPU/POWER Module LED Descriptions (Cube)

No.	Name	Description
1	ATT	Indicates system needs attention due to overrange condition: Error when red LED is ON
2	USR	Optionally controlled by user application[1]: OFF is default
3	3.3	Indicates status of internal 3.3 V supply: LED ON (OK) / OFF (ERROR)
4	24	Indicates status of internal 24 V supply: LED ON (OK) / OFF (ERROR)
5	PG	Indicates the presence of a valid power input: LED ON (OK) / OFF (ERROR)
6	COM	Indicates I/O communication active: Flashes once/second when communicating / OFF when not
7	R/W	Indicates bus activity: Flashes when bus is active / OFF when not
8	OverTemp	Indicates high temperature condition in module: LED ON (high temp) / OFF when not

1. For more information about how to read or set LEDs, please refer to `DqAdvDnxpSetConfig()` API described in the *PowerDNA API Reference Manual* and/or `SampleDiagnostics.c` sample code included with your SDK installation.

3.5.9 System Power Control & Monitoring

All power management in a Cube chassis is provided by the DNA-POWER-1GB board. The DNR-POWER-1G board comprises an FPGA and other hardware to control and monitor system power, perform power conditioning, control diagnostic LED states, isolate and direct synchronization I/O to the CPU board, and control fan operation. The DNR-POWER-1G board is located at the bottom of the CPU/POWER core module shown in **Figure 2-9**.

3.5.9.1 Power Management Features

Features of the DNA-POWER-1GB board include:

- Input power — 9-36 VDC 80 W maximum, protected by resettable fuses and EMI chokes
- Output power sources (all with greater than 90% efficiency)
  - 24 V, 1 A (24 W)
  - 3.3 V, 5 A (16.5 W, including the 2.5 V derived voltage)
  - 2.5 V, 3 A (derived from 3.3 V source)
  - 1.5 V, 5 A, (7.5 W, including the 1.2 V derived voltage)
  - 8 V, 0.5 A (4 W for fans)
- DC/DC for 24 V, 3.3 V, and 1.5 V are synchronized from the single spread- spectrum clock source in the CPU/NIC Core Module for low EMI noise level
- Fan control (Forced ON) and status ON/OFF
- Monitoring with 24-bit ADC:
  - V_{in} (9-36 VDC), I_{in}
  - 24 V source, I_{24V}
  - 3.3 V source, $I_{3.3V}$
  - 2.5 V source (derived from 3.3V source)
  - 1.5 V source, $I_{1.5V}$
  - 1.2 V source, $I_{1.2V}$
  - 8 V FAN source
  - System temperature
- LED indicators (1% accuracy, 0.25Hz update rate) for status of V_{in}, 24 V source, 3.3 V source, and temperature.
- Provides 9-36 VDC for all modules from an external power source

3.5.9.2 DC Power Thresholds

Table 3-6 lists the DC power threshold specifications for Cube systems.

Table 3-6 DC Power Thresholds for PowerDNA SoloX Cube

	Backplane Power Rail Voltages	Turn-on Voltage, V[1]	Reset Voltage, V[2]	Turn-off Voltage, V[3]	Notes
Logic power supply	+3.3V, +2.5V, +1.5V, +1.2V	7.5	7.2	7.0	Supplies power to all CPUs and FPGAs
Analog power supply	+24V	8.5	-	7.8	Analog power supply is used as a regulated source for on-layer DC/DCs on most boards
Fan power supply	+12V	8.5	-	8.4	
On-layer DC/DCs that use input power	+VIn	7.8-8.8	-	7.5-8.5	Varies with I/O board type

1. Turn-on Voltage: The value of Vin at which the corresponding DC/DCs are turned on.
2. Reset Voltage: When Vin is below 7.2 V, a voltage reset puts all boards into reset mode.
3. Turn-off Voltage: The value of Vin at which the corresponding DC/DCs are turned off.

NOTE: The CPU/POWER module consumes 70 mW when Vin is below 7 V.

3.6 Cube I/O Boards

All standard UEI I/O boards are available for PowerDNA SoloX Cube systems.

- Cube systems use a DNA- prefix, e.g. DNA-AI-207.
- RACKTangle and HalfRACK systems use a DNR- prefix, e.g. DNR-AI-207.
- FLATRACK systems use a DNF- prefix, e.g. DNF-AI-207.

These boards are electronically identical. The only difference between DNA-, DNR-, and DNF- I/O boards is the physical mounting arrangement for installation in the different chassis types. I/O boards are populated into your chassis in the order you specify.

NOTE: Refer to the I/O board datasheets and user manuals for detailed electrical specifications, functional descriptions, pinouts, and programming instructions. These documents are available on the UEI website at www.ueidaq.com.

Chapter 4 Installation and Configuration

This chapter provides getting started instructions for working with your PowerDNA SoloX Cube/Rack. The following installation and configuration topics are included:

- Shipment Contents (Section 4.1)
- Installing Software (Section 4.2)
- Initial Bootup (Section 4.3)
- Updating IP Addresses (Section 4.4)
- Network Configuration (Section 4.5)
- Troubleshooting (Section 4.6)
- Updating Firmware (Section 4.7)
- Mounting & Field Connections (Section 4.8)
- Pinout Diagrams (Section 4.9)
- Wiring I/O Boards (Section 4.10)
- Repairing or Upgrading a Cube/RACK (Section 4.11)
- Disabling Writes to Flash/EEPROM (NVRAM) (Section 4.12)

4.1 Shipment Contents

The contents of the shipping package for a standard PowerDNA SoloX Cube/Rack system include the following:

- A Cube or Rack enclosure.
  Preinstalled with a CPU / POWER module, blank filler panels (if specified), plus your selection of I/O boards.
  - RACK-based systems also include a DNR-POWER module
  - DNR-12-1G systems also include a DNR-BUFFER module
- A DNA-PSU-XXX universal powerline brick and cable.
- Cat5e Ethernet cable, 7 ft.
- Removable USB media containing PowerDNA/DNR software

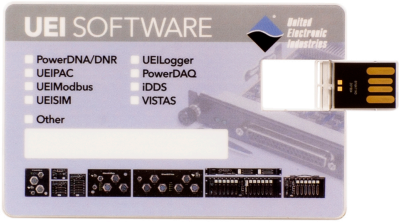


Figure 4-1 UEI Software USB Drive

4.2 Installing Software

This section describes how to load the PowerDNA software suite onto a Windows- or Linux-based computer (i.e. host PC) and run some initial tests.

4.2.1 Installing Software on Windows

The PowerDNA USB provides one installer that combines the UEI low-level driver and UEIDAQ Framework.

Be sure to install third-party applications (such as LabVIEW, MATLAB, or Visual Studio) ***before*** installing the PowerDNA Software Suite. The installer automatically searches for third-party IDE and testing suites, and adds them as tools to the suites found.

To install PowerDNA software, do the following:

STEP 1: Insert the provided UEI Software USB Drive (**Figure 4-1**) into your host PC.

Alternatively, you may download the latest software suite from www.ueidaq.com/downloads.

Launch the PowerDNA Software Suite installer as an administrator (Right-click *setup.exe* -> **Run As Administrator**).

The PowerDNA Welcome screen should appear:

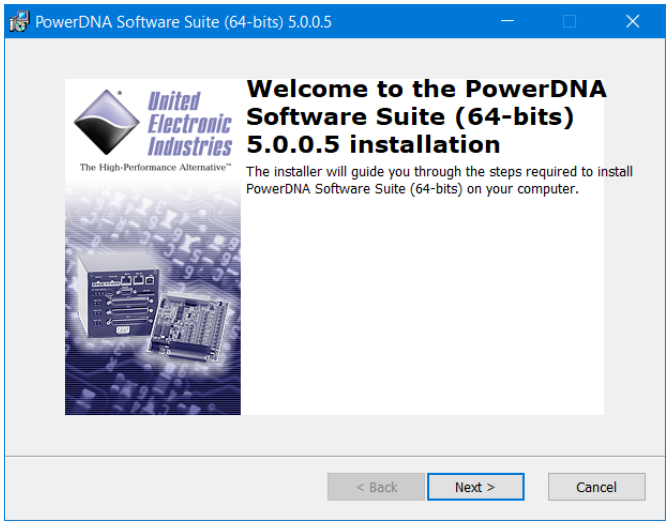


Figure 4-2 PowerDNA Installer: Welcome Screen

STEP 2: Click **Next >** to continue the installation process. The *End User License Agreement* window will open.

STEP 3: Read the license agreement, and click **Next** > to accept. The *Choose Setup Type* window will open.

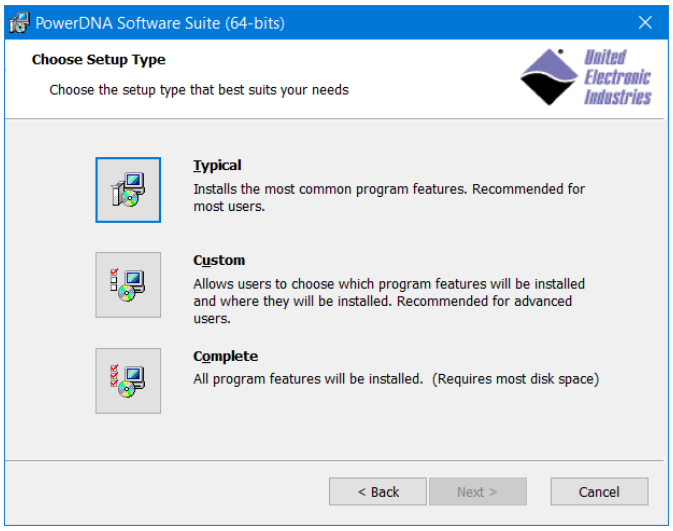


Figure 4-3 PowerDNA Installer: Choose Setup Type

You have three installation options:

- **Typical** installs the PowerDNA driver and core UEIDAQ Framework components (C/C++ support and Session configuration utility) and any required tools and plugins for detected software packages.
- **Custom** allows you to select which components will be installed. The custom install dialog shows detected software packages (LabView, MATLAB, etc.).
- **Complete** installs the full PowerDNA Software Suite.

STEP 4: Unless you are an expert user and have specific requirements, select **Typical** and accept the default configuration.

If 32-bit Java is not detected on the system, Java JRE 6 will automatically be installed for the PowerDNA Explorer application.

STEP 5: Click **Install** to proceed with the PowerDNA software installation and **Finish** to complete the installation.

NOTE: Because the installation process modifies your Windows registry, you should always install or uninstall the software using the appropriate utilities. Never remove PowerDNA software from your PC directly by deleting individual files; always use the Windows Control Panel Add/Remove Programs utility.

4.2.2 Installing Software on Linux

The PowerDNA_*.tgz file in the USB drive's Linux folder contains the software package for Linux. To extract the file to a local directory:

```
tar -xjvf <Path to file>/PowerDNA_*.tgz
```

Follow the instructions in the readme.txt file provided in the tar file.

4.3 Initial Bootup

You can connect to the Cube/Rack via the Ethernet port or via the serial port. Before proceeding, verify that the network adapter on your host PC is configured to detect the Cube/Rack's default IP address, 192.168.100.2 (see Appendix B).

4.3.1 Connecting to Cube/RACK via PowerDNA Explorer

PowerDNA Explorer is a GUI-based application which communicates with your Cube/RACK over an Ethernet connection.

Refer to Chapter 5 for how to open, set up, and use PowerDNA Explorer.

4.3.2 Connecting to Cube/RACK via Serial Port

The following provides instructions for connecting over the serial port:

STEP 1: Attach the CBL-SX6-DIAG serial cable between the DIAG port on the PowerDNA SoloX Cube/Rack and the serial port on your host PC (or to the USB-to-serial adapter on your host PC). Refer to **Figure 3-3** (Cube) or **Figure 2-11** (Rack) for the system's front panel layout.

STEP 2: Open the serial port on your host PC:

a.) Run a serial terminal-emulation program on your host PC. For example,

- Windows host: MTTTY (installed with the PowerDNA software suite), PuTTY, or any other terminal-emulation program except HyperTerminal.
- Linux host: minicom, kermit, or cu (part of uucp package).

b.) Select the COM port you are using and configure its settings to:

57600 baud, 8 bits, no parity, 1 stop bit

c.) Start the serial connection (e.g., by clicking **Connect** in MTTTY).

STEP 3: Connect power to the PowerDNA SoloX Cube/Rack:

Plug the 24 VDC power supply into the wall power outlet with the cable provided, and connect the 24 VDC 4-pin cable into the Power In connector on the Cube/Rack.

As soon as the system powers up, it runs through self-diagnostics and generates output text on the terminal program.

Once a connection is made, you will see a `DQ>` prompt. A typical readout is shown below.

```
PowerDNA (C) UEI, 2001-2021. Running PowerDNA Firmware on SX6 SoloX
Built on 08:36:43 Oct  1 2021
RAM size:1GB  FLASH size:16MB
Initialize uC/OS-II (Real-Time Kernel v.29300)
ARM 101 ARM 255 ARM 261 ARM 20 ARM 40 ARM 11 SX6 MX6SX detected
5 devices detected

 Address   Irq  Model Option  Phy/Virt  S/N    Pri DevN
-------------------------------------------------------
0x54000000   2    101    1    phys   1269599     10   0
0x54010000   2    255    1    phys   1249193     20   1
0x54020000   2    261    1    phys   1278460     30   2
0x540C0000   2     20    1    phys   1223814     40   3
0x540D0000   3     40    1    phys   1234567     50   4
0x540E0000   3     11    B     cpu   0224359      0  14
-------------------------------------------------------
Current time: 10:38:01 09/09/2021
Power DNA version 5.1.0 release build 165
Built on 08:36:43 Oct  1 2021
996MHz i.MX6SoloX uC/OS v.29300 is running

Enter 'help' for help.

DQ>
Two independent NICs
DQ>
```

STEP 4: You can use the `show` command at the `DQ>` serial prompt to display additional information about the system configuration:

```
DQ> show

        name: "IOM-224359"
       model: 4012
      serial: 0224359
      option: 000B
        fwct: 1.2.0.0
         mac: 00:0C:94:03:6C:67
         srv: 192.168.100.1
          ip: 192.168.100.2 (DOWN)
     gateway: 192.168.100.1
     netmask: 255.255.255.0
        mac2: 00:0C:94:F3:6C:67
        srv2: 192.168.101.1
         ip2: 192.168.101.2 (DOWN)
    gateway2: 192.168.101.1
    netmask2: 255.255.255.0
         udp: 6334
     license: ""
    Manufactured 10/1/2020
    Calibrated 10/15/2020

DQ>
```

Through the serial connection, all parameters can be changed, including the IP address, gateway, and subnet mask (netmask) system configuration.

The next section provides instructions for changing the IP address. Chapter 6: "Programming CPU Parameters" provides information about changing other parameters via the serial port.

4.4 Updating IP Addresses

The PowerDNA SoloX Cube/Rack ships with pre-configured factory default IP addresses for NIC1 and NIC2 in nonvolatile memory (usually 192.168.100.2 for NIC1 and 192.168.100.102 for NIC2). These are static IP addresses; a hosted Cube/Rack system never retrieves its IP address from a DHCP server.

Most users use the default addresses without issue. However, if you require a different IP address, you can change it by using PowerDNA Explorer or by using the serial port.

4.4.1 When Should You Change the IP Address?

You should change your IP address if you have multiple UEI chassis in your application or if your application has network addressing guidelines you must conform to.

Before connecting your PowerDNA SoloX Cube/Rack to a general-purpose (company domain) network, consider the following:

- High sampling rate measurements consume a lot of the available bandwidth.
- Some samples may be significantly delayed or entirely dropped (lost) due to network congestion, collisions or a slow switch.
- Whether a system will be accessed by multiple parties on a LAN.
- Whether multiple Cube/Rack systems will operate (and interact) on the same network.

Alternatively, if you plan to use the system for high-speed measurements where high reliability is necessary, a direct connection between the host PC and the Cube/Rack is recommended.

Refer to “Network Configuration” on page 46 for more information.

4.4.2 Updating IP Address via PowerDNA Explorer

PowerDNA Explorer is a GUI-based application which communicates with your Cube/RACK over an Ethernet connection.

NOTE: You can only change the NIC1 address using Explorer. To change the NIC2 address, see “Updating IP Address via Serial Port” on page 45.

STEP 1: Connect power to the PowerDNA SoloX Cube/Rack.

Plug the 24 VDC power supply into the wall power outlet with the cable provided, and connect the 24 VDC 4-pin cable into the Power In connector on the Cube/Rack.

STEP 2: Connect an Ethernet cable between your PC Ethernet port and the NIC 1 port on the Cube (NIC 2 is reserved for Diagnostics).

Verify that the two LEDs on the NIC 1 Ethernet port on the Cube are lit or flashing. (NIC cards limited to 10baseT only have the left LED flashing.) If the LEDs do not light, you may be using a “crossover” cable. Try a “straight-through” cable instead.

STEP 3: Launch PowerDNA Explorer.

- On Windows, access Explorer from the Start menu:
  Start » All Programs » UEI » PowerDNA » PowerDNA Explorer
- On Linux, access PowerDNA Explorer under the UEI installation directory (*<PowerDNA-x.y.z>/explorer*) by typing:

```
java -jar PowerDNAExplorer.jar
```

STEP 4: In the PowerDNA Explorer toolbar, click **Scan Network** (see **Figure 4-4**). A device name, IOM-#### (where #### is the Cube/Rack serial number), will appear.

STEP 5: In the left panel, click the Cube/Rack device that you want to update (e.g., IOM-####). The right panel will show the IP Addresses and other configuration information of your Cube/Rack.

STEP 6: Type the new IP Address in the **IP 1** field and press **Enter** on your keyboard.

STEP 7: Click the **Store Configuration** icon to make the changes persistent. If asked for a password, the default is `powerdna`.

STEP 8: Click **Network » Reset IOM...** in the PowerDNA Explorer menu to make changes take effect.

The new IP Address will be stored in non-volatile memory and display in PowerDNA Explorer.

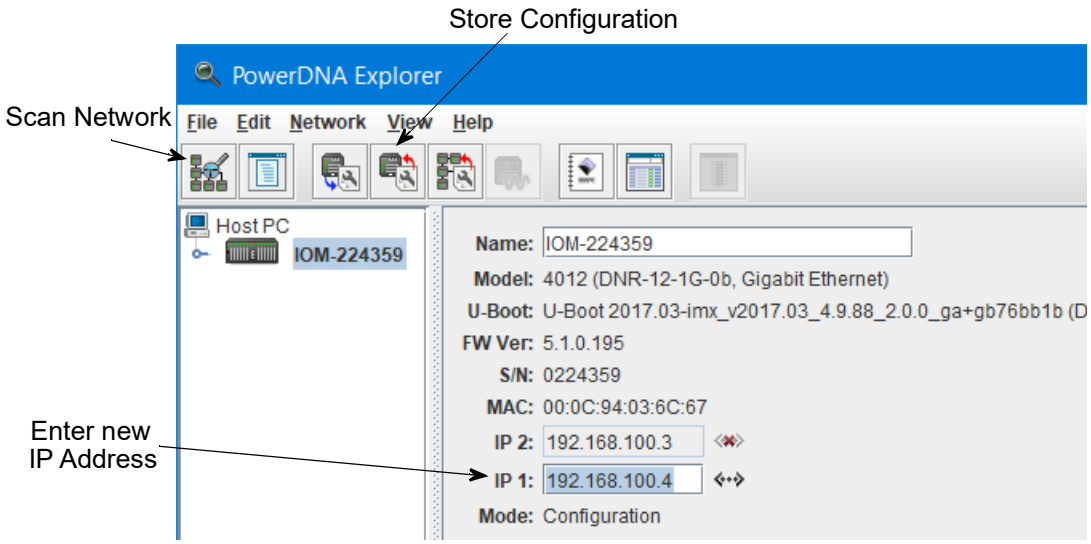


Figure 4-4. Using PowerDNA Explorer to Change IP Address

If needed, the gateway and network mask can be changed via the serial port. Refer to Section 6.3.3 on page 80 for instructions.

4.4.3 Updating IP Address via Serial Port

You can update NIC1 and/or NIC2 addresses on the Cube/Rack over a serial connection.

STEP 1: Remove power and Ethernet connections from the Cube/Rack.

STEP 2: Attach the CBL-SX6-DIAG serial cable between the DIAG port on the PowerDNA SoloX Cube/Rack and the serial port on your host PC (or to the USB-to-serial adapter on your host PC). Refer to **Figure 3-3** (Cube) or **Figure 2-11** (Rack) for the system's front panel layout.

STEP 3: Open the serial port on your host PC:

a.) Run a serial terminal-emulation program on your host PC. For example,

- Windows host: MTTTY (installed with the PowerDNA software suite), PuTTY, or any other terminal-emulation program except HyperTerminal.
- Linux host: minicom, kermit, or cu (part of uucp package).

b.) Select the COM port you are using and configure its settings to:

57600 baud, 8 bits, no parity, 1 stop bit

c.) Start the serial connection (e.g., by clicking **Connect** in MTTTY).

STEP 4: Connect power to the PowerDNA SoloX Cube/Rack:

Plug the 24 VDC power supply into the wall power outlet with the cable provided, and connect the 24 VDC 4-pin cable into the Power In connector on the Cube/Rack.

Once a connection is made, you will see a `DQ>` prompt.

STEP 5: To change the NIC1 address, type `set ip <new IP address>` in the MTTTY window at the DQ> prompt (**Figure 4-5**). When prompted for a password, type `powerdna`.

To change the NIC2 address, type: `set ip2 <new IP address>`

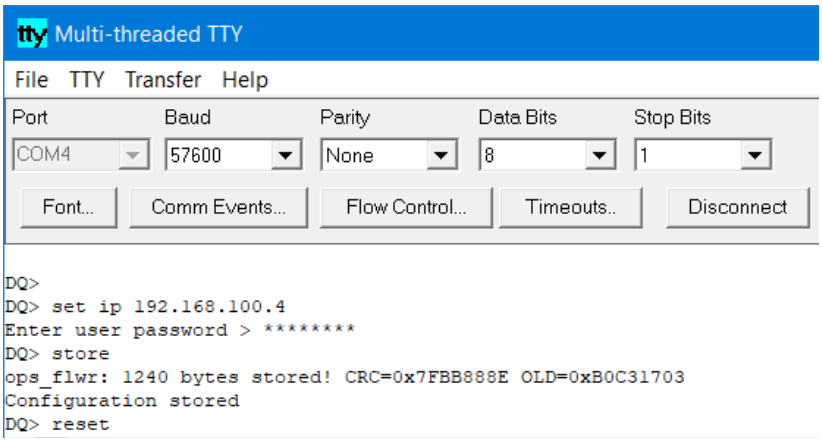


Figure 4-5 Updating Primary IP Address in MTTTY

STEP 6: Type `store` to make the changes persistent.

STEP 7: Type `reset` to make changes take effect.

STEP 8: Type `show` to verify updated network settings.

4.5 Network Configuration

If you do not need to connect to a company LAN and have only a single Cube/Rack in your system, you can connect it directly to your host as shown in **Figure 4-6** below. The PowerDNA SoloX Cube/Rack provides two NIC ports, but only one can be used for I/O operations at a time. You can use the other port to read diagnostics or serve as a backup in case the primary port fails.

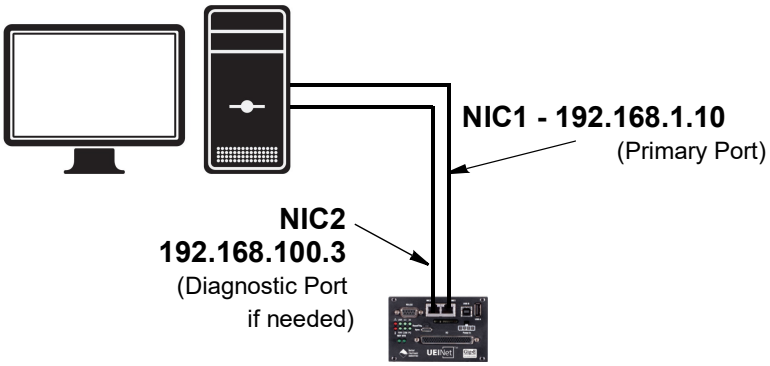


Figure 4-6 Single Cube/Rack Direct-Connected to Host without LAN Switch

When connecting to a network, to improve Cube/Rack network performance, we recommend that instead of connecting to a company-wide network, you use separate commercially available network interface controller (NIC) cards and, where possible, set up a single dedicated mini-network for cubes for both operation and diagnostics, as shown in **Figure 4-7** below.

Figure 4-7 shows a two-cube single network system with a LAN switch that performs both data acquisition and diagnostic functions.

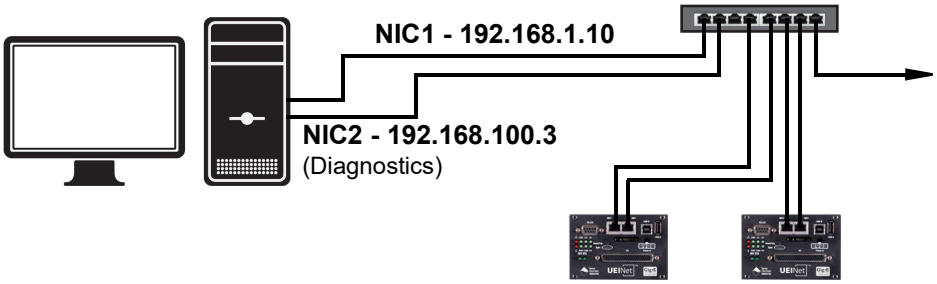


Figure 4-7 Single Network for Operation and Diagnostics Using Cubes and One LAN Switch

As an alternative, you can configure two separate networks, one for operation and one for diagnostic purposes, as shown in **Figure 4-8**.

Figure 4-8 shows a two-cube dual network system that performs both data acquisition and diagnostic functions and uses two LAN switches for routing.

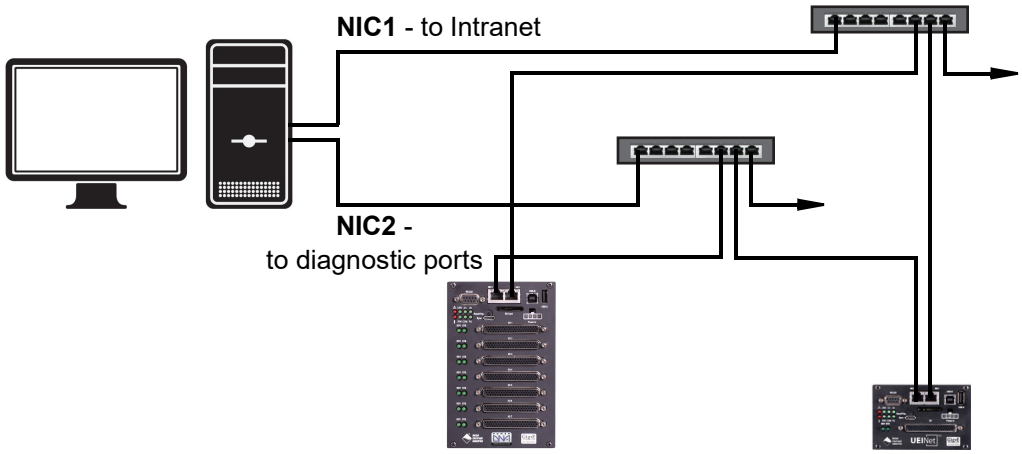


Figure 4-8 Separate Networks for Operation and Diagnostics: Two Cubes & Two Switches

4.5.1 Example of Configuring Network Settings

This section provides an example of configuring a separate network for diagnostics.

In this example, we assume that your office uses a Class C network (the class intended for small networks with fewer than 256 devices), and your host PC is configured with a static IP or via DHCH (Dynamic Host Configuration Protocol).

STEP 1: Obtain the networking configuration of your host PC:

- On Windows systems, open the command prompt and type `ipconfig` to display the configuration:
  Start >> Programs >> Windows System >> Command Prompt

```
C:\> ipconfig
Ethernet adapter Local Area Connection:
      Connection-specific DNS Suffix  . :
      IPv4 Address. . . . . . . . . . . : 192.168.1.10
      Subnet Mask . . . . . . . . . . . : 255.255.255.0
      Default Gateway . . . . . . . . . : 192.168.1.1
```

- On Linux systems, type `ifconfig` at the Linux prompt.

In the above example, the subnet mask of 255.255.255.0 uses the subnet range 192.168.1.0 through 192.168.1.255. Refer to the IP Addressing Side Note on the next page for more information about subnets.

IP Addressing Side Note:

The range of usable addresses is defined by the IP address and subnet mask.

- An IP address is a number that lies within the range of 0.0.0.0 and 255.255.255.255. In the `ipconfig` example shown in step 1, the IP address is 192.168.1.10.
- The subnet mask indicates where an address range starts and stops. For example, a subnet mask 255.255.255.240 has 15 usable addresses (255.255.255.255 – 255.255.255.240). In the `ipconfig` example shown in step 1, the subnet is 255.255.255.0, or 255 addresses.

The subnet limits from anything.anything.anything.0 up to the max.

- The usable range for 192.168.1.10/255.255.255.0 is 192.168.1.1 to 192.168.1.254 (192.168.1.0 and 192.168.1.255 are reserved for Router and Broadcast messages).
- The usable range for 192.168.100.2/255.255.255.0 is 192.168.100.1 to 192.168.100.254

Not every IP address from 0.0.0.0 to 255.255.255.255 is usable; however, these three ranges of IP addresses are guaranteed open for private use:

- 10.0.0.0 – 10.255.255.255
- 172.16.0.0 – 172.31.255.255
- 192.168.0.0 – 192.168.255.255

STEP 2: Install a secondary NIC card in your host PC, if needed.

STEP 3: Set up a secondary network that does not overlap the existing one:

In our example, the address space 192.168.1.0-192.168.1.255 is used by NIC1. The IP address block 192.168.100.1 to 192.168.100.255 is available and is in the private range.

We will choose 192.168.100.1-192.168.100.255 for the PC's secondary NIC and setup the port as follows:

```
IPv4 Address: 192.168.100.3
Subnet mask: 255.255.255.0
Default Gateway:192.168.100.3
```

a. On your host PC, open the Network and Internet settings in the control panel:

Start >> Programs >> Control Panel >> Network and Internet >> View network status and tasks

b. Click *Change adapter settings* in the left-sidebar, and then right-click the adapter to bring up the Properties window.

c. Open the TCP/IPv4 properties of the adapter and edit to the network settings noted above.

NOTE: Refer to Appendix B for step-by-step instructions and screenshots on how to set up TCP/IPv4 properties.

d. Open the Command Prompt:

Start >> Programs >> Windows System >> Command Prompt

e. Type `ipconfig` at the command prompt to confirm the network configuration on the host PC (unused adapter settings are not shown in this example*).*

```
C:\> ipconfig
Ethernet adapter Local Area Connection:
        Connection-specific DNS Suffix  . :
        IPv4 Address. . . . . . . . . . . : 192.168.1.10
        Subnet Mask . . . . . . . . . . . : 255.255.255.0
        Default Gateway . . . . . . . . . .: 192.168.1.1

Ethernet adapter Local Area Connection 2:
        Connection-specific DNS Suffix  . :
        IPv4 Address. . . . . . . . . . . : 192.168.100.3
        Subnet Mask . . . . . . . . . . . : 255.255.255.0
        Default Gateway . . . . . . . . . : 192.168.100.3
```

STEP 4: Use a serial terminal application (e.g. MTTTY) on the host to configure the Cube/Rack system to use the same subnet as the host PC. We'll set up the diagnostic port of the cube with the following:

```
Cube NIC2 IP: 192.168.100.2
Cube NIC2 Gateway:192.168.100.3
Cube NIC2 Netmask: 255.255.255.0
```

a. Attach a serial cable between the host PC and the RS-232 port on the front panel of the Cube/Rack.

b. Run a serial terminal-emulation program: MTTTY (installed with the PowerDNA software suite), PuTTY, or any other terminal-emulation program except HyperTermina

c. Verify that COM parameters are set at 57600 baud, 8 bits, no parity, 1 stop bit.

d. Click **Connect** in MTTTY, or use the commands on one of the other terminal-emulation programs to establish communication with the Cube/Rack system.

e. Enter the following commands when you see the DQ command prompt:

```
DQ> set ip2 192.168.100.2
DQ> set gateway2 192.168.100.3
DQ> set netmask2 255.255.255.0
DQ> store
DQ> reset
```

NOTE: The Cube/Rack NIC2 IP address in this example is changed to 192.168.100.2 in step 4 above (in the same subnet as your host PC's NIC2 at 192.168.100.3 which was set up in step 3). This example assumes NIC1 is already configured on your Cube/Rack system.

STEP 5: Connect the Cube/Rack to your PC's second NIC using a CAT5 cable. The green LEDs on the Cube/Rack NIC2 should light up.

STEP 6: Ping the Cube/Rack system from the command prompt on the host PC to make sure that it is alive (the following shows a successful response):

```
C:\> ping -n 1 192.168.100.2
Pinging 192.168.100.2 with 32 bytes of data:

Reply from 192.168.100.2: bytes=32 time<1ms TTL=128
Ping statistics for 192.168.100.2:
Packets: Sent = 1, Received = 1, Lost = 0 (0% loss),
```

NOTE: A "Request Timed Out" message indicates an error.

The system should now be configured as shown below.

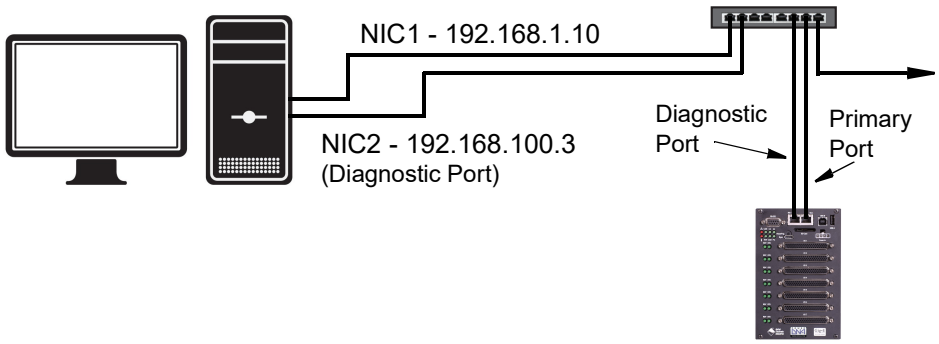


Figure 4-9 Typical Configuration for a Single Cube/Rack with a LAN Switch

You may now use PowerDNA Explorer to view system network settings and communicate with your cube. (Refer to Chapter 5: "PowerDNA Explorer" for more information about PowerDNA Explorer, if needed.)

4.6 Trouble-shooting

The following sections provide suggestions when troubleshooting your system.

4.6.1 Trouble-shooting System Communication

Use following checklist as a starting point.

☑ Verify the PG (Power Good) LED is ON:
This indicates power is applied to the chassis. Refer to **Figure 3-4** (Cube) or **Figure 2-12** (Rack) for LED locations.

☑ Verify the green LEDs on NIC ports are blinking:
This indicates the CAT5e cables are connected.

☑ Check communication over the Ethernet connection:
Use the command prompt to ping the Cube/Rack IP"
`ping 192.168.100.2`
If ping doesn't respond, check the following

- Disable the firewall (temporarily) on the NIC.

- Check the NIC's network settings.
- Check the system's network settings.

☑ Check communication over the serial connection:
Connect a serial cable between your host PC and your Cube/Rack chassis, open a serial communication program (e.g., MTTTY), and click **Connect**:

- Press [Enter] in the serial terminal window to display the `DQ>` prompt. (No prompt indicates that you are not connected).
- If you cannot connect over the serial port, check the following:
  - Verify the settings: 57600 baud, no parity, 8 data bits, 1 stop bit.
  - Check the device manager on your PC to see which com port you are using. Enter that com port in your serial communications program, (e.g., COM1, COM2, COM3), click Connect and press `<Enter>`.
- If you are able to connect over the serial port, check the following:
  - Type "`show`" the serial terminal window to verify the IP, Subnet Mask, and Gateway.
  - Note "`show`" results, and verify computers are on a valid subnet and have valid IPs.
- Reboot the Cube/Rack system. The start-up screen should display upon restart.

☑ If you have questions, contact UEI support at *support@ueidaq.com*.

4.6.2 Trouble-shooting Communication after Reset

After your Cube/Rack is set up and you reset the chassis, you may notice a situation where you can't see your Cube/Rack from a host computer immediately after reset. After up to two minutes, the connection shows up again.

This is caused by the operating system Address Resolution Protocol (ARP) implementation. When you try to contact an offline host that was previously online, the OS invalidates the Ethernet <-> IP address resolution protocol table until a timeout expires and it can be re-queried.

4.6.2.1 How to Find ARP Timeout Setting

To find how long the refresh timeout is on Windows machines, do the following:

STEP 1: Open a command window on your host computer.

STEP 2: Type `netsh interface ipv4 show interfaces` at the command prompt to find the index number of the interface connected to your cube, (e.g., 11 for the Local Area Connection):

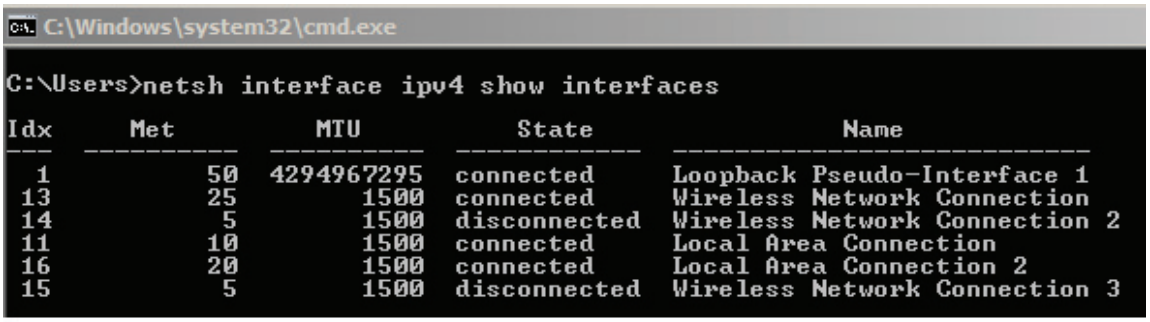


Figure 4-10 Show Interfaces

STEP 3: Type `netsh interface ipv4 show interface <Idx #>` to learn the timeout and other interface parameters of a connection:

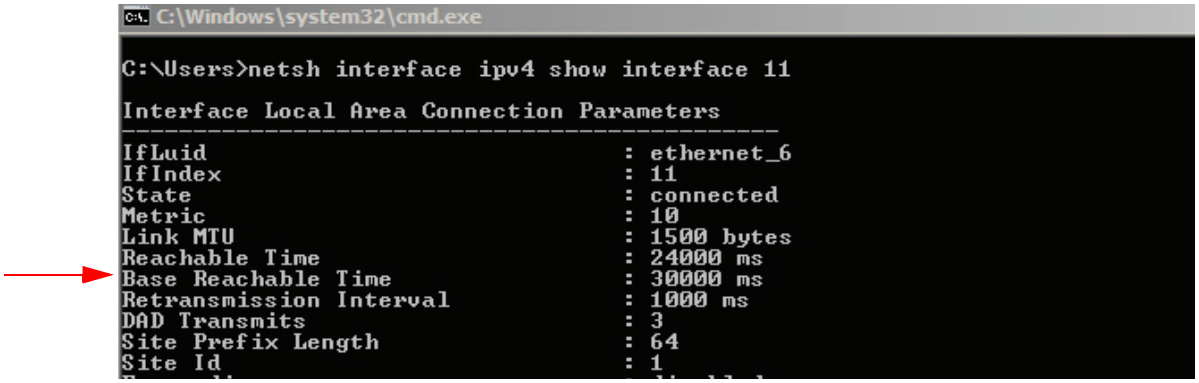


Figure 4-11 Show Interface Parameters

NOTE: In the above example, the timeout, or Base Reachable Time, is set to 30000 ms.

4.6.2.2 How to Speed Up ARP Timeout

To avoid waiting for the timeout, you can either force an immediate rebuild of the ARP cache or change the delay for subsequent timeout situations.

Both of the following must be entered as an administrator.

- To immediately reset, type the following at the command prompt:
  `arp -d *`
- To modify the Base Reachable Time, type the following to set the timeout to 5000 ms on interface 11:

```
netsh interface ipv4 set interface 11 basereachable=5000
```

4.7 Updating Firmware

This section provides instructions for updating firmware on a PowerDNA SoloX Cube/Rack. The CPU/POWER module stores the system firmware.

- Locating Firmware (Section 4.7.1)
- Determining Current Firmware Version (Section 4.7.2)
- Updating Firmware via PowerDNA Explorer (Section 4.7.3)
- Updating Firmware via USB and Serial (Section 4.7.4)

4.7.1 Locating Firmware

UEI periodically releases updated firmware to introduce new features and to improve the performance of existing features. Updated firmware releases are bundled with the full PowerDNA Software Suite, available for download at any time from www.ueidaq.com.

To locate the latest UEI firmware after installing the PowerDNA Software Suite, browse to the installation's Firmware directory, e.g.

C:\Program Files (x86)\UEI\PowerDNA\Firmware

The SoloX firmware is a `.bin` file located in the *Firmware_ARM_SOLOX* subdirectory.

4.7.2 Determining Current Firmware Version

To check the version of your firmware, you can use PowerDNA Explorer, a GUI-based application for communicating with your PowerDNA SoloX Cube/Rack system.

STEP 1: Connect power to the PowerDNA SoloX Cube/Rack:

Plug the 24 VDC power supply into the wall power outlet with the cable provided, and connect the 24 VDC 4-pin cable into the Power In connector on the Cube/Rack.

STEP 2: Connect an Ethernet cable between the NIC 1 port on the Cube/Rack and the host PC or network (e.g., host PC Ethernet port, switch).

STEP 3: Start PowerDNA Explorer:

- From the Windows desktop menu, navigate to:

  Start » Programs » UEI » PowerDNA » PowerDNA Explorer

- On Linux systems, access PowerDNA Explorer under the UEI installation directory (*<PowerDNA-x.y.z>/explorer*) and type:

  ```
  java -jar PowerDNAExplorer.jar
  ```

STEP 4: In the PowerDNA Explorer window, click **Network » Scan Network**.

STEP 5: Click the icon of the PowerDNA SoloX Cube/Rack you wish to query.

STEP 6: Note the version that is given in the **FW Ver** field (**Figure 4-12**).

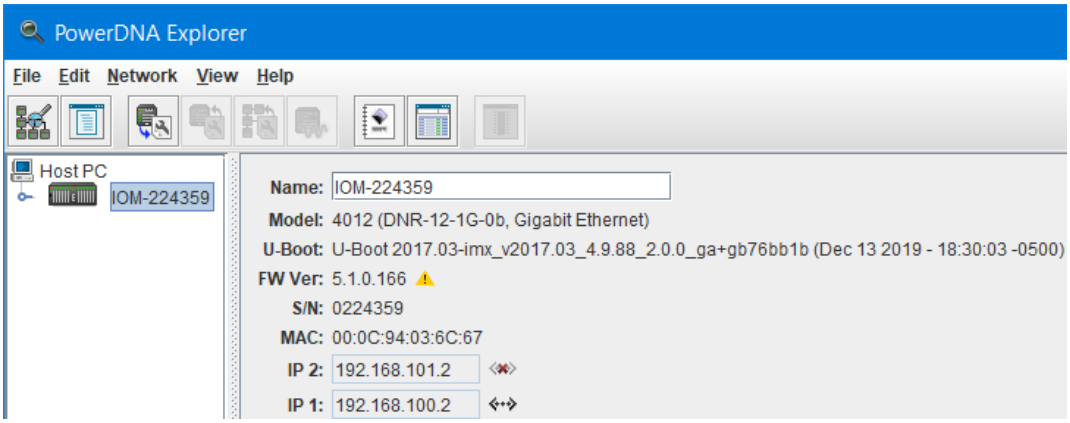


Figure 4-12 Displaying the Version of Your Firmware

If the **FW Ver** has a yellow triangle with an exclamation point next to it (see figure above), you have a mismatch between the firmware installed on your UEI chassis and the software version on your host PC. If you see this warning, UEI highly recommends that you update your firmware to match your software (or software to match your firmware). Firmware version mismatches can result in unexpected operation.

NOTE: The SoloX CPU supports **FW Ver** 5.0.0.20 and up.

4.7.3 Updating Firmware via PowerDNA Explorer

To update firmware with the PowerDNA Explorer application over Ethernet:

STEP 1: Connect power to the PowerDNA SoloX Cube/Rack:

Plug the 24 VDC power supply into the wall power outlet with the cable provided, and connect the 24 VDC 4-pin cable into the Power In connector on the Cube/Rack.

STEP 2: Connect an Ethernet cable between the NIC 1 port on the Cube/Rack and the host PC or network (e.g., host PC Ethernet port, switch).

STEP 3: Start PowerDNA Explorer:

- From the Windows desktop menu, navigate to:

  Start » Programs » UEI » PowerDNA » PowerDNA Explorer

- On Linux systems, access PowerDNA Explorer under the UEI installation directory (*<PowerDNA-x.y.z>/explorer*) and type:

  ```
  java -jar PowerDNAExplorer.jar
  ```

Be sure to use PowerDNA Explorer from the same release version as the new firmware.

STEP 4: In the PowerDNA Explorer window, click **Network » Scan Network**.

STEP 5: Click the icon of the PowerDNA SoloX Cube/Rack you wish to update.

STEP 6: Click **Network » Update Firmware...** from the menu.

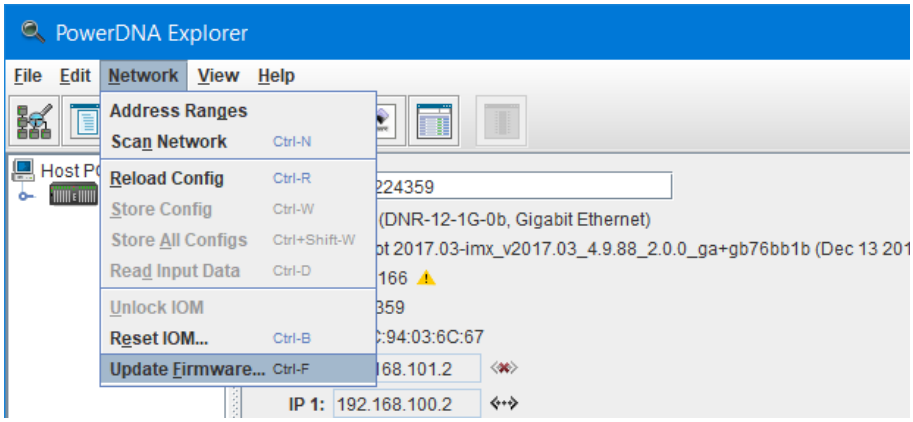


Figure 4-13 Update Firmware Menu Item

STEP 7: Click "Yes" when you see the prompt:

"Are you sure you want to update firmware…"

STEP 8: Verify you are in the *Firmware_ARM_SOLOX* directory, and double-click the **rom_arm_solox_X.X.X.bin** file (where X.X.X. is the version).

STEP 9: If asked, enter the password to continue. All UEI Cube and Rack systems come with the default password set to `powerdna`.

Figure 4-14 Password Dialog Box

STEP 10: Wait for the progress dialog to complete. The system will then be updated and running the new firmware.

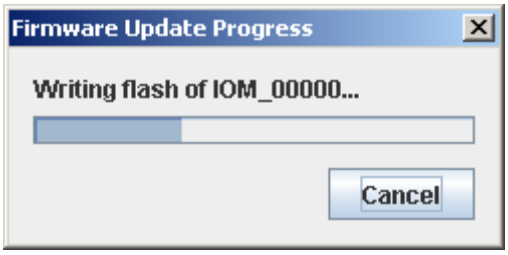


Figure 4-15 Firmware Update Progress Dialog Box

4.7.4 Updating Firmware via USB and Serial

Before you begin, you will need a removable USB drive (any size).

NOTE: The instructions below are for a Windows-formatted USB drive. Use of a Linux formatted drive is permitted; just substitute `fatls` with `ext4ls` in Step 8 and `fatload` with `ext4load` in Step 9.

STEP 1: Copy the firmware image file to the removable USB drive. The file is located in your UEI installation directory, e.g.

\Program Files (x86)\UEI\PowerDNA\Firmware\Firmware_ARM_SOLOX\rom_arm_solox_x.y.z.bin

STEP 2: Plug the removable USB drive into the PowerDNA SoloX Cube/Rack.

STEP 3: Attach the UEI-provided serial cable between the DIAG port on the PowerDNA SoloX Cube/Rack and the serial port on your host PC (or to the USB-to-serial adapter on your host PC).

a.) Install and run a serial terminal-emulation program on your host PC. For example,

- Windows host: MTTTY provided with the PowerDNA software suite), PuTTY, or any other terminal-emulation program except HyperTerminal.
- Linux host: minicom, kermit, or cu (part of uucp package).

b.) Select the COM port you are using and configure its settings to:

57600 baud, 8 bits, no parity, 1 stop bit

c.) Start the serial connection (e.g., by clicking **Connect** in MTTTY).

STEP 4: Connect power to the PowerDNA SoloX Cube/Rack:

Plug the 24 VDC power supply into the wall power outlet with the cable provided, and connect the 24 VDC 4-pin cable into the Power In connector on the Cube/Rack.

As soon as the Cube/Rack starts booting up, it runs through self-diagnostics and generates output text on the terminal program.

STEP 5: When you see the "`Enter password - autoboot in 5 seconds...`" prompt, enter `powerdna` (the password will not print to the screen as you are typing). When you successfully enter U-Boot space, the prompt becomes a `=>`.

```
U-Boot 2019.04-imx_v2019.84_4.19.35_1.1.0-uei+g4d377539a1 (Jun 26 2021 -
05:00:13 +0000)
CPU: Freescale i.MX6SX rev1.3 996 MHz (running at 792 MHz)
CPU: Extended Commercial temperature grade (-20C to 105C) at 320
Reset cause: POR
Model: UEI PDNX-CPU-SX6 Board
Board: UEI SOLOX
DRAM: 1 GiB
MMC: FSL_SDHC: 1, FSL_SDHC: 2
Loading Environment from SPI Flash... SF: Detected w25q128 with page size
256 Bytes, erase size 4 KiB, total 16 MiB
OK
Display: PDNASX6HDMI (1366x768)
Video: 1366x768x24
In: serial
Out: vga
Err: vga
USBO: USB EHCI 1.00
USB1: USB EHCI 1.00
scanning bus e for devices... 1 USB Device(s) found
scanning bus 1 for devices... 2 USB Device(s) found
scanning usb for storage devices... Storage Device(s) found
Net: CPU Net Initialization Failed
No ethernet found.
Enter password - autoboot in 5 seconds...
=>
```

If your device has already autobooted, you can type `reset` at the `DQ>` prompt to restart booting.

NOTE: Older versions of U-Boot do not ask for a password. Instead, you will see a "`Hit any key to stop autoboot`" prompt. To enter U-Boot space, continuously press the **Enter** key before the autoboot occurs.

STEP 6: Reset the USB:

```
=> usb reset
resetting USB...
USB0:   USB EHCI 1.00
scanning bus 0 for devices... 2 USB Device(s) found
USB1:   USB EHCI 1.00
scanning bus 1 for devices... 3 USB Device(s) found
       scanning usb for storage devices... 2 Storage Device(s) found
```

STEP 7: Determine the “Device #” and “Partition #” of the removable USB:

```
=> usb storage
  Device 0: Vendor: Virtium  Rev: 0428 Prod: TuffDrive
            Type: Hard Disk
            Capacity: 7632.1 MB = 7.4 GB (15630680 x 512)
  Device 1: Vendor: SanDisk  Rev: 1.26 Prod: Cruzer Glide
            Type: Removable Hard Disk
            Capacity: 15267.0 MB = 14.9 GB (31266816 x 512)
```

In the example shown above, the Device # is 1.

Windows-formatted USB drives typically contain only one partition; therefore, Partition # should be 1.

STEP 8: Verify the location of the firmware image by typing

`fatls usb <device#>:<partition#>`

where `<device#>` and `<partition#>` are replaced with the values from Step 7. For example:

```
=> fatls usb 1:1
            system volume information/
  2896592   rom_arm_solox_5_1_0_165.bin

1 file(s), 1 dir(s)
```

STEP 9: Upload firmware image from the USB:

```
=> fatload usb 1:1 $loadaddr rom_arm_solox_5_1_0_165.bin
reading rom_arm_solox_5_1_0_165.bin
2896592 bytes read in 249 ms (11.1 MiB/s)
```

STEP 10: Set the U-boot variables `ucos_bin_addr` and `ucos_bin_size`:

```
=> setenv ucos_bin_addr 0x200000
=> setenv ucos_bin_size $filesize
=> saveenv
```

STEP 11: Probe QSPI flash:

```
=> sf probe
SF: Detected w25q128bv with page size 256 Bytes, erase size 4 KiB, total
16 MiB
```

The following step erases blocks in QSPI flash. Use care when entering the erase range so that you don’t accidentally erase other system components.

STEP 12: Erase the old firmware image from QSPI flash. The firmware image partition starts at address offset 0x200000 and has size 0x800000. This command may take a minute or so to execute.

```
=> sf erase 0x200000 0x800000
SF: 8388608 bytes @ 0x200000 Erased: OK
```

STEP 13: Write the new firmware image to QSPI flash:

```
=> sf write $loadaddr $ucos_bin_addr $ucos_bin_size
device 0 offset 0x200000, size 0x2c32d0
SF: 2896592 bytes @ 0x200000 Written: OK
```

STEP 14: The firmware is now updated and you can eject the USB drive.

STEP 15: To run the new firmware, type `run ucosboot` in the serial terminal window (or reboot the Cube/Rack).

4.8 Mounting & Field Connections

This section provides mounting and field connection descriptions for each of the Cube/Rack chassis types:

DNA-PPCx-1G

The DNA-PPCx-1G (Cube) mounting options include the following:

- For horizontal surface mounting, use a flange accessory and secure the case directly to the surface.
- For mounting on a vertical wall surface, use a 19RACKW accessory with DIN rail and attach the assembly to a standard 19-inch rack with screws.

DNR-12-1G

The DNR-12-1G (RACKtangle) mounting options include the following.

- For horizontal surface mounting, use the rubber feet supplied with the standard enclosure or bolt the case directly to the surface.
- For mounting on a vertical wall surface, attach flanges to both ends of the enclosure with the flanges aligned flush with the rear of the enclosure; then fasten the flanges to the surface with screws or bolts.
- For mounting in a standard 19-inch rack, attach flanges to both ends of the enclosure with the flanges aligned flush with the front of the enclosure. Then attach the flanges to the rack with bolts.

Note that the flanges are included with the purchase of a PowerDNA SoloX Rack. If you need more clearance from the rack front panel, refer to the DNR-EXT-BRACKET-4 which provides 3.625 inches of clearance.

DNR-6-1G

The DNR-6-1G (HalfRACK) mounting options include the following:

- For horizontal surface mounting, use the rubber feet supplied with the standard enclosure or bolt the case directly to the surface.
- For mounting on a vertical wall surface, attach flanges to both ends of the enclosure with the flanges aligned flush with the rear of the enclosure; then fasten the flanges to the surface with screws or bolts.
- For mounting in a standard 19-inch rack, since the DNR-6-1G is not 19” wide, UEI recommends using a shelf for rack installations.

DNF-4-1G

The DNF-4-1G (FLATRACK) can be mounted in a standard 19-inch rack using the included rack mount brackets or on a horizontal surface using the base mount brackets.

- For mounting in a standard 19-inch rack, attach flanges to both ends of the enclosure with the flanges aligned flush with the front of the enclosure. Then attach the flanges to the rack with bolts.

If you need technical drawings, please contact UEI support at *support@ueidaq.com*.

4.8.1 Physical Dimensions

The housing used in each of the UEIPAC chassis types is as follows:

- DNA-PPCx-1G Cube consists of an extruded aluminum box with slotted guides plus a faceplate and rear cover.
- DNR-4-1G (FLATRACK) is compatible with Specification EIA-310-C for 19” Rack Mounting Equipment and is designed to occupy 1U unit of vertical space (where 1U is 1.75”).
- DNR-12-1G and DNR-6-1G (RACKtangle and HalfRACK) systems are also compatible with Specification EIA-310-C for 19” Rack Mounting Equipment and is designed to occupy 3U units of vertical space.

The physical dimensions of Cube/Rack versions are listed below:

Table 4-1 Cube/Rack Dimensions

Version	Dimensions[1]	I/O Slots
UEINet	4.1” x 4.0” x 2.7”	slots for 1 I/O board
DNA-PPC5-1G	4.1” x 5.0” x 4.0”	slots for up to 3 I/O boards
DNA-PPC8-1G	4.1” x 5.0” x 5.8”	slots for up to 6 I/O boards
DNA-PPC9-1G	4.1” x 5.0” x 6.6”	slots for up to 7 I/O boards
DNF-4-1G	16.75” x 7.2” x 1.75”	slots for up to 4 I/O boards
DNR-6-1G	10.5” x 6.2” x 5.25”	slots for up to 6 I/O boards
DNR-12-1G	17.5” x 6.2” x 5.25”	slots for up to 12 I/O boards

1. Dimensions are given as $\text{length}_{\text{base}} \times \text{width}_{\text{base}} \times$ height.

4.9 Pinout Diagrams

Pinout diagrams for the Power In, synchronization (SYNC) port, and DIAG port connectors are shown below in **Figure 4-16**.

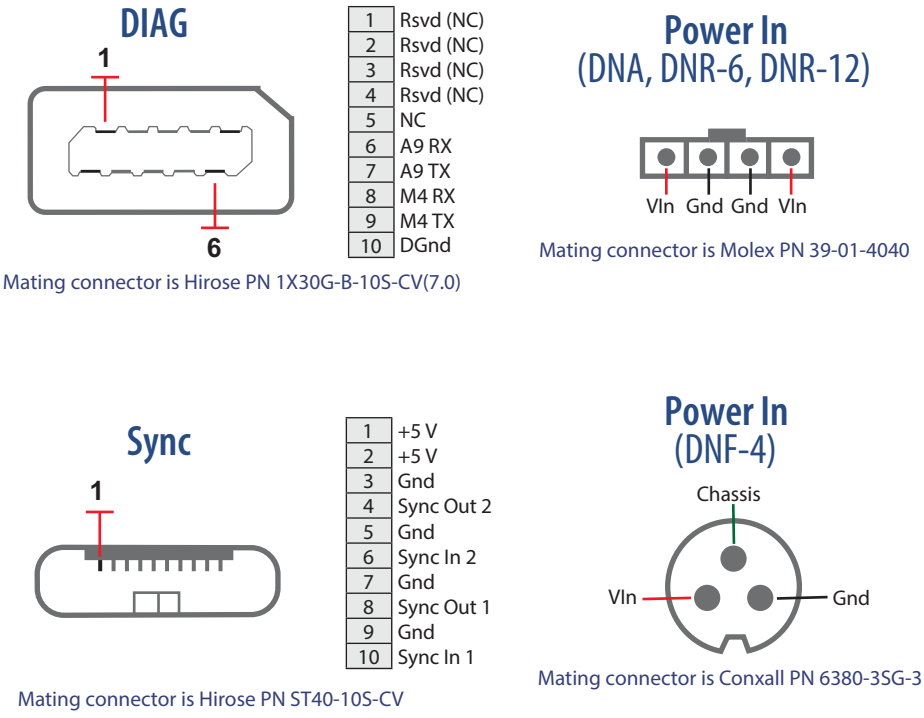


Figure 4-16 SoloX Cube/Rack Pinout

4.10 Wiring I/O Boards

Refer to the applicable I/O board manuals and datasheets for pinouts and proper wiring to boards.

Datasheets and manuals are provided on our website at www.ueidaq.com.

4.11 Repairing or Upgrading a Cube/RACK

PowerDNA SoloX Cube/Rack systems come from the factory calibrated and pre-configured with UEI drivers loaded in memory.

If you encounter a problem with your Cube/Rack, note that individual modules are designed for field replacement and are not suited for field repairs.

If you want to remove and replace individual boards or other system modules, you can do that in the field once you power down your system. You can also rearrange the locations of boards within the enclosure at any time; however, note that you may need to reprogram I/O board locations in your application. Refer to Section 4.11.1 for more information.

No Hot Swapping

Always turn POWER OFF before performing maintenance on a UEI system. Failure to observe this warning may result in damage to the equipment and possible injury to personnel.

If you want to enhance, repair, or otherwise modify a specific I/O board, you must send the module back to the factory or to your local distributor.

This process requires that you request an RMA number from UEI before shipping. To do so, contact support@ueidaq.com and provide the following information:

1. Model Number of the unit, (e.g. DNR-AI-217)
2. Serial Number of the unit
3. Reason for return, (e.g. faulty channel, needs calibration, etc.)

UEI will process the request and issue an RMA number.

4.11.1 Removing and Replacing I/O Boards

For all chassis types, individual boards can be removed and replaced in the field once power is removed from the chassis.

You can rearrange the locations of boards within the enclosure at any time; however, note that when installing I/O boards in a Cube chassis, you may need to move jumpers on the I/O board(s).

Removing and Replacing I/O Boards in a Cube Chassis

Each Cube I/O board includes a jumper block that identifies the physical position of the I/O board in the stack. If you change the order of your I/O boards in your Cube or install a new board, you may need to adjust corresponding hardware jumpers. This is only applicable in Cube systems (jumpers are not used in DNR or DNF I/O boards for installation in a DNR-12-1G, DNR-6-1G, or DNF-4-1G system.)

Refer to the *PowerDNA Field Installation Guide* for more information about installing I/O boards and setting jumper positions in Cubes.

NOTE: For additional maintenance procedures, please refer to the *DNA Maintenance Manual* for Cube-based chassis and the *DNR Maintenance Manual* for RACK-based chassis.

4.12 Disabling Writes to Flash/ EEPROM (NVRAM)

Writing non-volatile memory (NVRAM) can be disabled by installing a hardware jumper on the CPU board.

This hardware security feature ensures that no user data will be stored on the Cube/Rack after power is disconnected.

NOTE: Writes to the EEPROM on the DNx-AO-358 and DNx-AO-364 are not disabled by this process.
Applications that must disable all NVRAM writes should not include the DNx-AO-358 and DNx-AO-364 products in their system.

Installing the NVRAM protection jumper requires removal and replacement of the DNx-POWER-1GB board in the Cube/Rack chassis. In general UEI recommends that a Cube/Rack be returned to the factory for adding or replacing boards. UEI can install and remove jumpers as needed.

4.12.1 Disabling NVRAM Writes (Cube)

To disable writes to Flash/EEPROM on a Cube system, do the following:

STEP 1: Disconnect power to the Cube.

STEP 2: Attach a grounding strap to your wrist, and follow normal ESD procedures.

STEP 3: Disconnect all cables from the Cube.

If the Cube has a fan, remove the screws securing the rear cover to the housing. Lay the cover flat on the bench and disconnect the fan power cable from the board stack.

STEP 4: Remove the DNx-POWER-1GB board from the Cube chassis:

a. Using a 3/16-inch nut driver, unscrew all jack screws securing the 37- and 62-pin D-sub connectors to the faceplate.

b. Remove the four screws located on the corners of the faceplate. Use an appropriate screwdriver to avoid stripping the screws.

c. Remove the faceplate. Carefully push or pull the faceplate/board stack assembly out of the cube housing. Exercise caution to not bend or damage the pins on the last I/O board. Place the assembly onto an anti-static surface.

d. Identify the board labeled DNx-POWER-1GB in the stack (it is the second from the top and includes the Molex connector).

e. Carefully separate the I/O board stack so that the DNx-POWER-1GB board can be removed. Carefully pull boards apart and do NOT bend or damage any pins.

STEP 5: Locate the J1 jumper block on the DNx-POWER-1GB board, and insert a jumper between pins 13 and 15. Refer to **Figure 4-17** for pin locations.

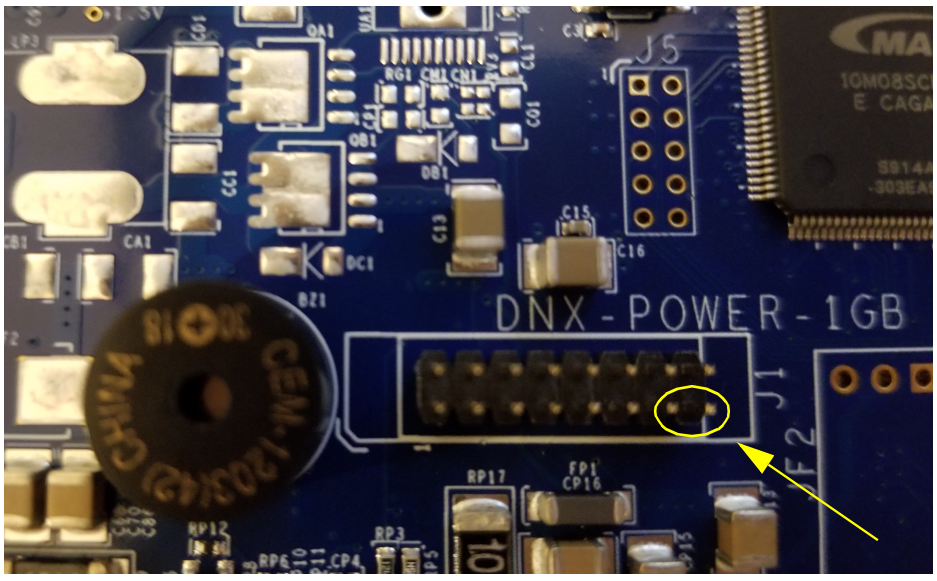


Figure 4-17 NVRAM Protection Jumper Pins

STEP 6: Reassemble the Cube:

a. Carefully align all pins and reassemble the stack of boards.

b. Verify that all boards are in the correct positions and then attach the faceplate to the stack using the jack screws previously removed. Use a 3/16-inch nut driver. Do not overtighten (5 lb-in. max torque).

NOTE: It may be helpful to power up the stack outside of the housing so that you can verify your assembly. Once verified, disconnect the power and proceed to Step c.

c. Insert the stack into the cube housing, carefully aligning all boards with the correct slots in the housing.

d. Slide the faceplate/stack assembly into the housing so that the faceplate is seated properly in the housing.

e. Reinsert the mounting screws for the faceplate and tighten securely. Do not overtighten. Check the DNx-POWER-1GB board LEDs, RESET button, and sync port at the front of the carrier. The RESET button should be free to move.

STEP 7: Reattach all cables to their respective connectors:

If the Cube has a fan, reattach the fan power cable and secure the rear cover to Cube.

STEP 8: Restore power to the system.

NOTE: If your Cube is repeatedly rebooting (i.e. all the CPU/POWER module LEDs stay on), check to ensure that the RESET pushbutton has not become stuck behind the faceplate.

4.12.2 Disabling NVRAM Writes (Rack)

To disable writes to Flash/EEPROM on a RACK, HalfRACK, or FLATRACK system, do the following:

STEP 1: Turn off power to the Rack.

STEP 2: Attach a grounding strap to your wrist, and follow normal ESD procedures.

STEP 3: Disconnect all cables from the SoloX CPU/POWER module (refer to **Figure 2-1** for location of CPU/POWER module).

STEP 4: Remove CPU/POWER module from the enclosure:

a. Using a torque screwdriver, loosen the thumbscrews securing the CPU/POWER module to the chassis.

b. Lift the insertion/extraction lever and slide out the module.

STEP 5: Remove the upper CPU board from its carrier (see **Figure 4-18**):

Care must be taken when removing PCB boards from a carrier. Over-tightening or forcing hardware can crack boards, damage components and/or leave the board inoperable.

Loosen 1 Phillips screw (4-40 x 1 inch) from the front of the carrier and 2 Phillips screws from the sides. Gently slide out the upper board.

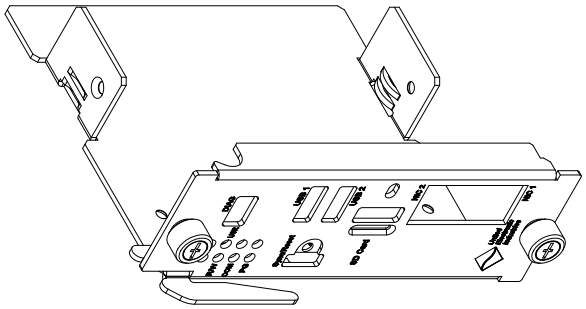


Figure 4-18 Isometric Diagram of CPU/POWER Module Carrier

STEP 6: Remove the lower DNx-POWER-1GB board from the carrier:

Loosen 2 Phillips screws (4-40 x 1 inch) from the bottom of the carrier using a 1/4” locknut driver and a Phillips screwdriver. Remove 2 screws, 4 plastic spacers, and 2 locknuts. Gently slide out the lower board.

STEP 7: Locate the J1 jumper block on the DNx-POWER-1GB board, and insert a jumper between pins 13 and 15.

Refer to **Figure 4-17** for pin locations.

STEP 8: Reinstall the lower DNx-POWER-1GB board into the carrier:

a. Gently slide the lower board into the carrier.

b. Align LEDs, RESET button, and sync connector with openings on carrier: Be sure the RESET button is free to move.

c. Slide and align one plastic spacer between the carrier and the lower board.

d. From the bottom of the carrier, insert the Phillips screw (4-40 x 1 inch) through the carrier, plastic spacer, and PCB board.

e. Slide a plastic spacer onto the Phillips screw and install locknut.

f. Gently tighten with 1/4” locknut driver and Phillips screwdriver, taking care not to over-tighten. Over-tightening can crack PCB boards.

STEP 9: Reinstall the upper CPU board into the carrier:

a. Gently slide the upper board into carrier. Care must be taken when sliding the board in; electrolytic capacitors on the lower board can get damaged if they scrape against the upper board.

b. Align CPU board connectors with openings on carrier.

c. Reinsert Phillips screw through the front of the carrier and two Phillips screws from the sides. Take care not to over-tighten.

STEP 10: Insert the CPU/POWER module into the enclosure:

a. Fully insert the module into the guides and use the insertion lever to seat the board into the backplane connector.

b. Using the torque screwdriver set to 5 in-lb, screw in the thumbscrews until the torque screwdriver clicks.

STEP 11: Reattach all cables to the CPU/POWER module.

STEP 12: Restore power to the system.

NOTE: If your Rack is repeatedly rebooting (i.e. all the CPU/POWER module LEDs stay on), check to ensure that the RESET pushbutton has not become stuck behind the faceplate.

Chapter 5 PowerDNA Explorer

PowerDNA Explorer is a GUI-based application for communicating with your UEI Cube/RACK systems. This chapter provides an overview of PowerDNA Explorer capabilities:

- Overview of PowerDNA Explorer (Section 5.1)
- Launching PowerDNA Explorer (Section 5.2)
- Connecting to the Cube/RACK (Section 5.3)
- Displaying CPU/POWER Module Diagnostics (Section 5.4)
- Obtaining a Hardware Report (Section 5.5)
- Viewing I/O Boards (Section 5.6)
- Setting Timeouts (Section 5.7)

5.1 Overview of PowerDNA Explorer

PowerDNA Explorer provides a platform for the following:

- Displays diagnostic data on CPU / Power module (temperatures, voltage supply measurements, error conditions)
- Reports serial numbers and version information about the CPU/Power module and I/O boards
- Provides hardware report for the CPU/Power module and all I/O boards
- Allows users to perform basic read, write, and configuration functionality on I/O boards for orientation and troubleshooting purposes
- Allows users to configure initial and shutdown output levels on supported boards
- Discovers and interacts with other UEI systems on a range of user-defined IP addresses on a network

5.2 Launching PowerDNA Explorer

PowerDNA Explorer can be used on Windows or Linux systems.

- On Windows systems, access PowerDNA Explorer from the Start menu: **Start » All Programs » UEI » PowerDNA » PowerDNA Explorer**
- On Linux systems, access PowerDNA Explorer under the UEI installation directory (<PowerDNA-x.y.z>/explorer) by typing:

```
java -jar PowerDNAExplorer.jar
```

UEI provides a PowerDNA Explorer DEMO with the installation that lets you safely explore the menus and I/O board screens without using actual hardware. The DEMO application is located in the same directory as the PowerDNA Explorer executable.

5.3 Connecting to the Cube/ RACK

To connect to your Cube/RACK system in PowerDNA Explorer:

STEP 1: Provide power to the Cube/Rack.

STEP 2: Connect an Ethernet cable between your PC Ethernet port and the NIC 1 port on the Cube/Rack (NIC 2 is reserved for Diagnostics.)

STEP 3: Launch PowerDNA Explorer and click the **Scan Network** button (**Figure 5-1**). All discovered UEI systems display to the left in the Device Tree panel. Each UEI system is named IOM-####, where #### is the serial number of the Cube/Rack.

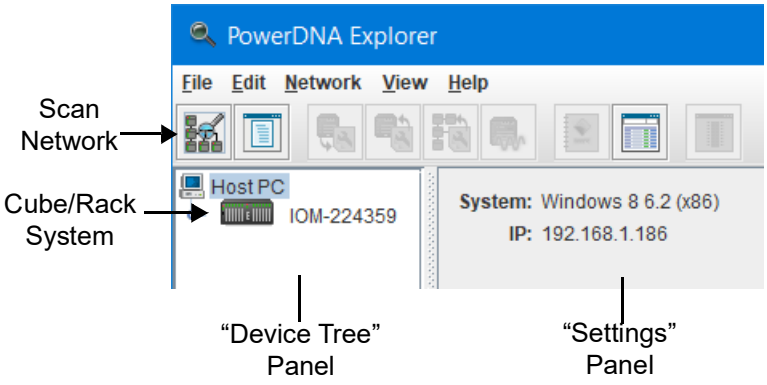


Figure 5-1 Initial Screen of PowerDNA Explorer

STEP 4: If your Cube/Rack was not found, check that the IP Address of your Cube/Rack is within the range scanned by PowerDNA Explorer:

a. Navigate to **Network » Address Ranges** in the PowerDNA Explorer menu (**Figure 5-2**).

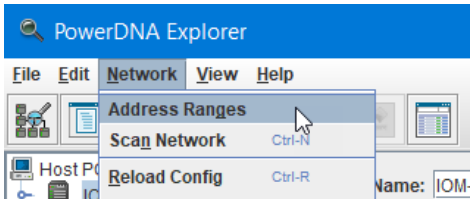


Figure 5-2 View Address Ranges

b. An Address Ranges window will open. If the IP address of your Cube/Rack is not in the listed range, click **Edit** to modify the existing range or click **Add** to add a new subnet or range (**Figure 5-3**).

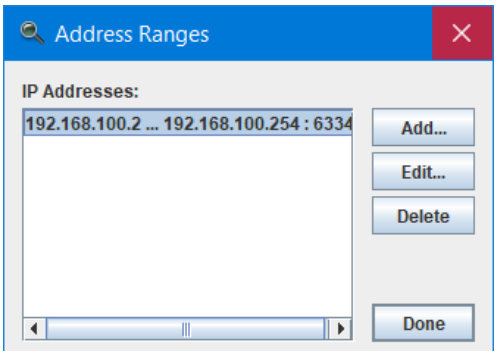


Figure 5-3 Address Ranges Window

c. Enter range information and click **OK** in the Edit Address Range dialog (**Figure 5-4**). Then click **Done** in the Address Ranges window.

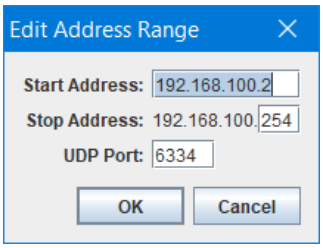


Figure 5-4 Edit Address Range Dialog

d. Scan the network for UEI systems in the newly specified range either by selecting **Network » Scan Network** or clicking the **Scan Network** button (see **Figure 5-1** on the previous page).

After a scan, the device tree is populated with all central controllers, UEI systems (Racks and Cubes), and I/O boards accessible from the network, as filtered through the range defined in the Address Ranges window.

5.4 Displaying CPU/POWER Module Diagnostics

When you click on an IOM name in the left-hand “Device Tree panel”, the right-hand “Settings” panel shows information about the system’s CPU and power boards.

The screenshot below shows example data for the SoloX CPU/POWER module:

Figure 5-5 CPU/POWER Module Panel (DNR-12-1G)

Table 5-1 CPU/POWER Settings Panel Descriptions

Field	Description
Name	Read/write UEI system name. To change: Edit field and then click **Network » Store Config**.
Model	Read the model number.
FW Ver	Read the version of the firmware installed on the system.
S/N	Read the serial number of the system.
MAC	Read the MAC address.
IP Address	“IP 1” displays the primary NIC1 address. “IP2” displays the diagnostic NIC2 address. Refer to Section 4.4 for instructions on changing IP addresses.
Mode	Displays the current mode of the system: *Initialization*, *Configuration*, *Operation*, or *Shutdown*.

The rest of the panel displays voltages, currents, temperatures and other diagnostic information. In **Figure 5-5**, the “CPU/NIC Layer” sub-panel shows data for the CPU/POWER 2-board module. For descriptions of “CPU/NIC Layer” LED states, refer to **Table 3-5** for the Cube or **Table 2-10** for the Rack.

The “Power Layer” sub-panel shows data for the DNR/DNF Power module, which is found on RACK-based systems only. Cube-based systems will not show the “Power Layer” display. For a description of “Power Layer” LED states, refer to **Table 2-11**.

5.5 Obtaining a Hardware Report

The hardware report provides diagnostic and status data, versioning, and more for your Cube/Rack system, CPU/POWER module, and all installed I/O boards.

To obtain a hardware report, select **View » Show Hardware Report**.

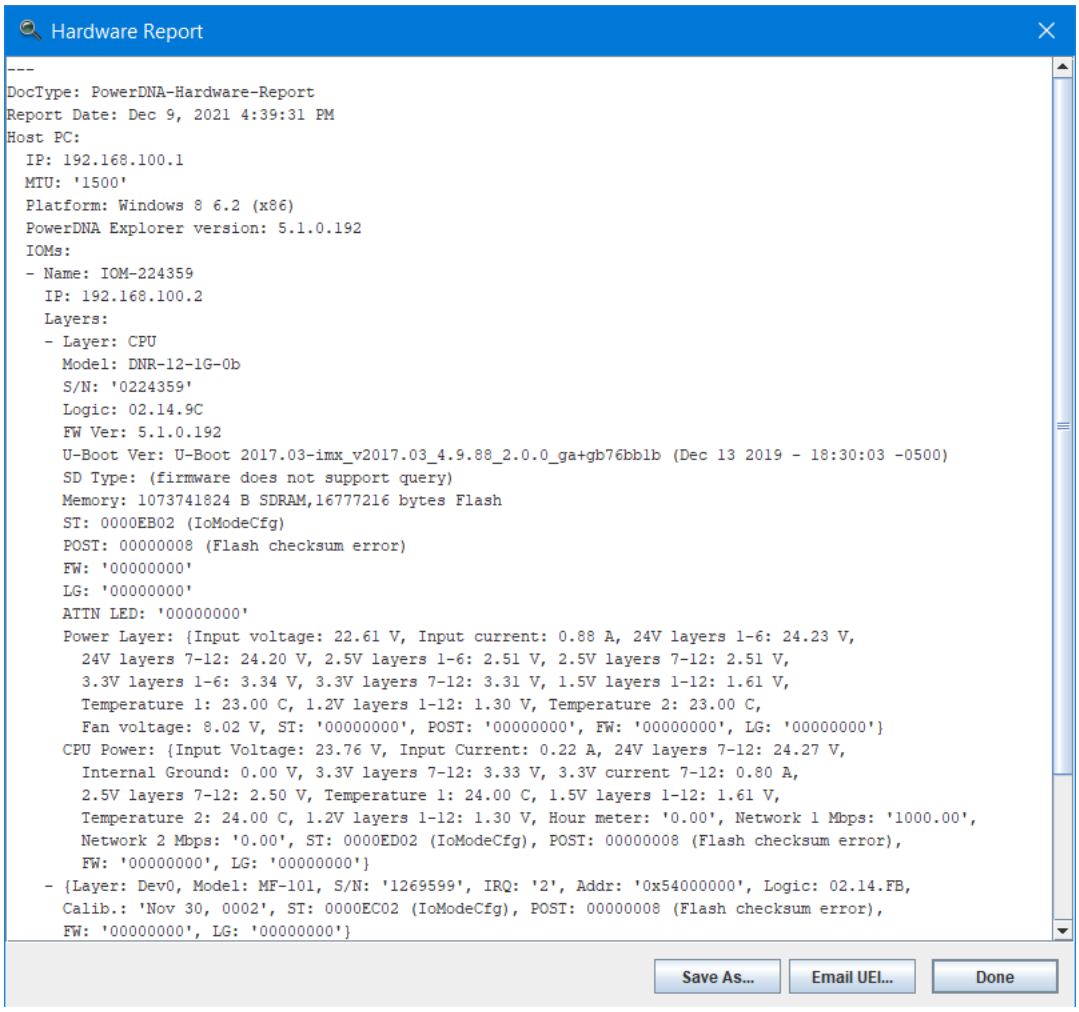


Figure 5-6 Example of a Hardware Report

5.6 Viewing I/O Boards

To view a list of installed I/O boards, double-click the name of your Cube/Rack (e.g., **IOM-####**) in the Device Tree panel. Click any available I/O board to display board details in the Settings panel (see **Figure 5-7**).

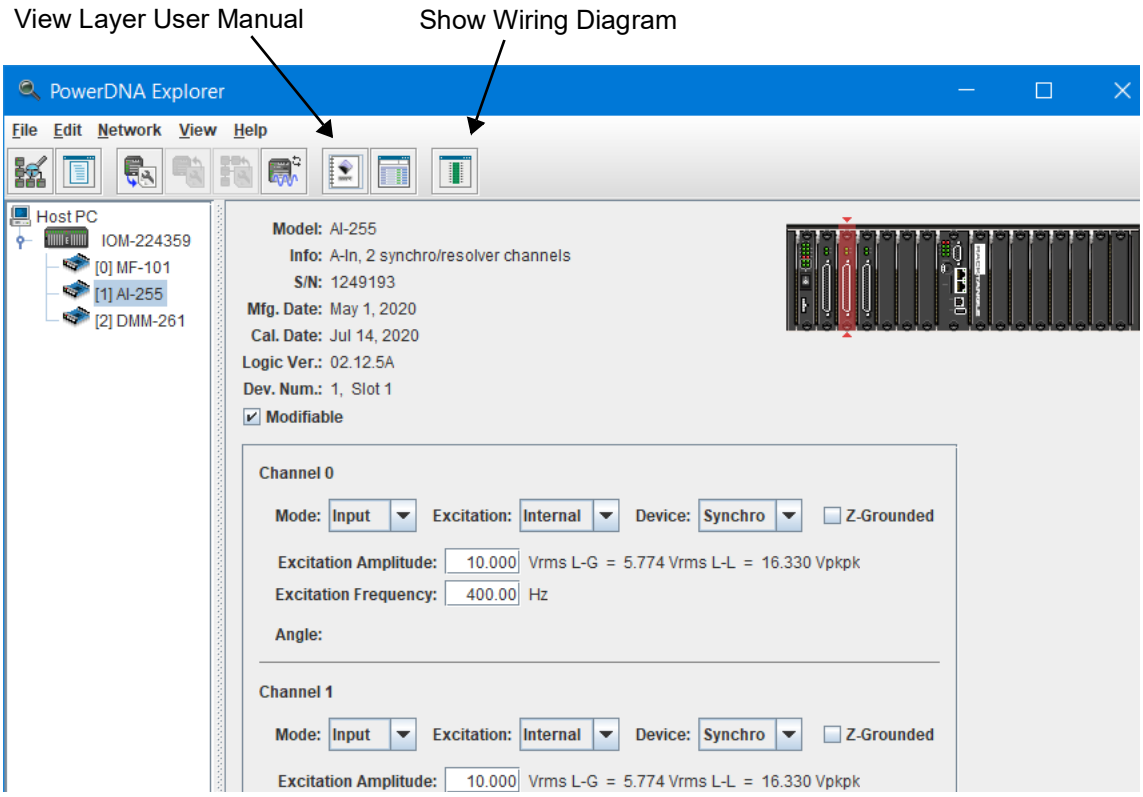


Figure 5-7 Viewing I/O Boards

Each I/O board has the following settings:

- **Model** shows the model number of the device.
- **Info** shows some key features of the device: A for analog, D for digital, In for input, Out for output, and a number of channels available.
- **S/N** shows the device serial number.
- **Mfg. Date** shows the manufacturing date.
- **Cal. Date** shows the date of the last calibration.
- **Logic Ver.** shows the logic version programmed on the board's FPGA.
- **Dev. Num.** is the device number (DEVN), which indicates the board's position in the chassis relative to other boards. The board's physical location is shown in the Cube/RACK image to the right.
- **Modifiable** is a checkbox which, when unchecked, prevents parameters from being changed.

Other I/O board settings vary on a per-board basis.

5.6.1 Interacting with I/O Boards

PowerDNA Explorer can be used to learn about the board's capabilities and to troubleshoot your application (e.g., isolating hardware vs programming issues). Typically, only a subset of I/O board settings are available through PowerDNA Explorer. More advanced features can be accessed through the high-level and/or low-level API.

Please refer to your I/O board's user manual for information about interacting with your board in Explorer.

To view the I/O board's user manual, click the **View Layer User Manual** button or visit its product page at www.ueidaq.com.

5.6.2 Displaying Pinout for I/O Boards

You can quickly view a wiring diagram for an I/O board by selecting **View » Show Wiring Diagram** (or click the **Show Wiring Diagram** button).

The same diagram is provided in the I/O board's user manual and datasheet. The user manual also includes pinout descriptions and wiring tips.

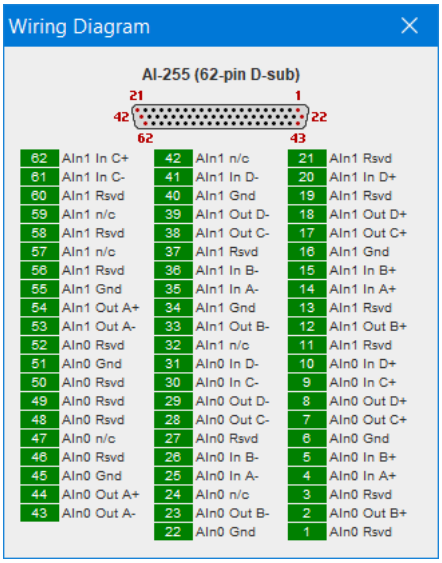


Figure 5-8 Example of a Wiring Diagram Display

5.7 Setting Timeouts

You can specify PowerDNA Explorer timeout intervals by opening the **File » Preferences** dialog (**Figure 5-9**).

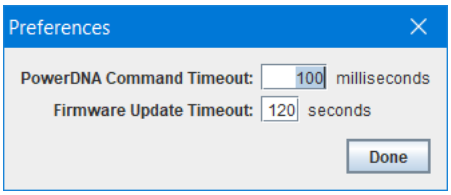


Figure 5-9 PowerDNA Explorer Timeout Preferences

The following timeout intervals can be changed:

- **PowerDNA Command Timeout** sets the length of time PowerDNA Explorer will wait for response from a CPU/NIC Core Module before giving up with an error. It defaults to 100 milliseconds.
- **Firmware Update Timeout** specifies the length of time PowerDNA Explorer will wait when updating firmware via **Network » Update Firmware...** The firmware timeout defaults to 120 seconds.

Chapter 6 Programming CPU Parameters

This chapter provides descriptions of configuration and diagnostic PowerDNA SoloX Cube/Rack CPU commands that can be issued over a serial terminal.

The following information is provided:

- Connecting to the CPU Module (Section 6.1)
- Startup Sequence (Section 6.2)
- Serial Interface Commands (Section 6.3)

To program your application, please refer to the example code and additional documentation that is provided with the installation (e.g., *Getting Started with your PowerDNA Application*, I/O board manuals, *PowerDNA API Reference Manual*).

6.1 Connecting to the CPU Module

There are two ways to set CPU Core Module parameters.

The first method is to use the serial interface and enter commands at the `DQ>` prompt. Refer to “Connecting to Cube/RACK via Serial Port” on page 42 for instructions on getting to the `DQ>` prompt.

The second method is the use of DAQBIOS calls by running an application on the host PC.

NOTE: The rest of this chapter provides descriptions of setting and reading CPU parameters using the serial interface. For more information about accessing CPU core parameters via your application, please refer to the *PowerDNA API Reference Manual.*

6.2 Startup Sequence

After the Cube/Rack is powered on or reset, the processor reads the boot-up sequence located at the U-Boot address shown below in **Table 6-1**. The U-boot monitor initializes the processor and the address map, retrieves information from the parameter sector of the flash memory and tests system memory and other system resources.

When the PowerDNA SoloX Cube/Rack starts booting, you have the option of interrupting the boot via a serial terminal connection between the PowerDNA SoloX Cube/Rack and a host PC. If the autoboot process is interrupted, the U-Boot monitor stops loading firmware into memory and instead brings up the U-Boot command prompt `=>` (to load new firmware, for example).

Otherwise, U-Boot reads the firmware from QSPI Flash and stores it in SDRAM at 0x80000000. U-Boot then executes the `bootcmd` command sequence, which is stored as a U-Boot environment parameter. The `bootcmd` sequence typically ends with `go 0x80000000`, which launches the firmware code located at address 0x80000000.

Table 6-1 Memory Map for PowerDNA SoloX Cube/Rack CPU (DNx-CPU-1G-11)

Device	Start Address	End Address	Size	Description
SDRAM	0x80000000	0xBFFFFFFF	1GB	SDRAM Address
QSPI Flash (U-Boot)	0x60000000	0x600DFFFF	896kB	QSPI HDR + U-Boot
QSPI Flash (U-Boot Env)	0x600E0000	0x600EFFFF	64 kB	U-Boot Environment params
QSPI Flash (PDNA Params)	0x600F0000	0x600FFFFF	64 kB	PowerDNA parameters
QSPI Flash (uC/OS FW)	0x60200000	0x600DFFFF	8 MB	PowerDNA SoloX firmware

6.3 Serial Interface Commands

The following CPU commands are executed via the serial interface. Refer to “Connecting to Cube/RACK via Serial Port” on page 42 for instructions on establishing a serial connection.

6.3.1 View Available Commands

The `help` command provides a list of available commands:

```
DQ> help

    help Display this help message      help
     set Set parameter                  set option value
    show Show parameters                show
   store Store parameters (flash)       store
    flrd Re-read flash (flash)          flrd
      mw Write wr <addr> <val> [width,b] mw
      mr Read rd <addr> [width,b] [size] mr
    time Show/Set time                  time [hh:mm:ss] [mm/dd/yyyy]
    pswd Set password                   pswd {user|su}
      ps Show process state #           ps [value]
    test Test something                 test [test number]
   simod System Init/Module Cal         simod [routine]
 default Default parameters             default
   reset Reset system                   reset
  dqping Send DQ_ECHO to <mac addr>     dqping
    mode Set current mode               mode {init|config|oper|shutdown} [ID]
     log Display log content            log [start [end]] -1 = clear
    logf Find entry in the log          logf marker [start [end]]
     ver Show firmware version          ver [all]
  devtbl Show all devices/layers        devtbl [logic|verbose|status]
 netstat Show network statistics        netstat
     pdj Print device object            pdj <devno> cl
    stat Display status                 stat [cpu]
     nif Display nif object             nif
   clear Clear terminal                 clear
```

6.3.2 Show System Parameters

The `show` command is one of the most frequently used commands. `show` provides a list of Cube/Rack system parameters:

```
DQ> show

        name: "IOM-224359"
       model: 4012
      serial: 0224359
      option: 000B
        fwct: 1.2.0.0
         mac: 00:0C:94:03:6C:67
         srv: 192.168.100.1
          ip: 192.168.100.2 (DOWN)
     gateway: 192.168.100.1
     netmask: 255.255.255.0
        mac2: 00:0C:94:F3:6C:67
        srv2: 192.168.101.1
         ip2: 192.168.101.2 (DOWN)
    gateway2: 192.168.101.1
    netmask2: 255.255.255.0
         udp: 6334
     license: ""
    Manufactured 10/1/2020
    Calibrated 10/15/2020
```

6.3.3 Change System Parameters

To view a list of parameters that can be changed, type set followed by the **Enter** key. The default user password is `powerdna`.

```
DQ> set
Enter user password > ********

Valid 'set' options:
        name: <Device name>
       model: <Model id>
      serial: <Serial #>
      option: <Option>
        fwct: <autorun.runtype.portnum.umports>
         mac: <ethernet address port 1>
         srv: <Default IP address port 1>
          ip: <IOM IP address port 1>
     gateway: <gateway IP address port 1>
     netmask: <netmask port 1>
        mac2: <ethernet address port 2>
        srv2: <Default IP address port 2>
         ip2: <diagnostic port IP address>
    gateway2: <diagnostic port gateway IP>
    netmask2: <diagnostic port netmask>
         udp: <udp port (dec)>
     license: license string
```

To change a parameter, type `set <parameter name> <value>`. Once parameters are set, you must store them into non-volatile flash memory with the `store` command. The following example sets the IP address of NIC2:

```
DQ> set ip2 192.168.100.3
DQ> store
ops_flwr: 1240 bytes stored! CRC=0x29140499 OLD=0x18AC7439
Configuration stored
```

Reset the system for the new parameters to take effect.

6.3.4 Reset System

The `reset` command performs a physical reset of the CPU and initiates the full startup sequence on the PowerDNA SoloX Cube/Rack system.

```
DQ> reset
Stopping DaqBIOS


U-Boot 2017.03-imx_v2017.03_4.9.88_2.0.0_ga+gb76bb1b (Dec 13 2019 - 18:30:03
-0500)
                        <...many U-boot messages deleted...>


DQ>
Two independent NICs
DQ>
```

6.3.5 Change Password

Some commands (such as `mr, mw, set,` and `store`) require entering a user password. Once the password is entered, these commands become enabled until the system is reset.

There are two levels of password protection available. The first is user level and the second is super-user level. Super-user level is currently used only for updating firmware over Ethernet.

- `DQ> pswd user` sets up a user level password.
  First, you'll be asked to enter your current password and then (if it matches) to enter the new password twice.
- `DQ> pswd su` sets up super-user level password.
  First, you'll be asked to enter your current super-user password and then (if it matches) to enter the new super-user password twice.

PowerDNA SoloX Cube/Rack systems come with both default passwords set to `powerdna`. If you need to reset your password, use the following

- `DQ> pswd reset`

Some DaqBIOS commands require entering a user or super-user password. Use `DqCmdSetPassword()` before calling these functions. The *PowerDNA API Reference Manual* notes which functions are password-protected.

6.3.6 Display I/O Boards

The `devtbl` command is a frequently used command. This command displays all boards (I/O, power, and CPU) installed and recognized by your system.

```
DQ> devtbl

 Address   Irq  Model Option  Phy/Virt  S/N    Pri DevN
-----------------------------------------------------
0x54000000   2    101    1    phys   1269599     10   0
0x54010000   2    255    1    phys   1249193     20   1
0x54020000   2    261    1    phys   1278460     30   2
0x540C0000   2     20    1    phys   1223814     40   3
0x540D0000   3     40    1    phys   1234567     50   4
0x540E0000   3     11    B     cpu   0224359      0  14
-----------------------------------------------------
```

where

- `Model` is the model number of the board
- `Option` indicates the version of the board. Option 1 corresponds to the base model.
- `S/N` is the serial number
- `DevN` is the device order in the chassis: 0 corresponds to the I/O board in the first position, etc. (CPU and power boards use DevNs after I/O). Use these device numbers in your user application to address I/O boards.

The other columns are for UEI internal use.

The `devtbl` command with the `logic` option added displays the logic version programmed on each board's FPGA:

```
DQ> devtbl logic
Logic information:
DevN Mod-opt Logic      CLI   CLO  LogOption
-----------------------------------------------
  0  101-001 02.14.FB  2048  2048  81008064
  1  255-001 02.12.5A     0     0   3008004
  2  261-001 02.15.07  4096   512  810824E0
  3  020-001 02.14.46     0     0   100800F
  4  040-001 02.14.BC     0     0  81000081
 14 4012-00B 02.14.9C     0     0    91FFC8
-----------------------------------------------
```

The `devtbl` command with the `verbose` option added displays additional detailed information about each installed board:

```
DQ> devtbl verbose
Logic capabilities:
Device:0 model:101-001
    - Sample counters are available
    - IS-->NIS selector is disabled in cli_sync module
    - Standard input channel list implementation used
    - Standard output channel list implementation used
    - Disabled NIS-->IS selector in cli_sync module

Device:1 model:255-001
    - Sample counters are available
    - IS-->NIS selector is disabled in cli_sync module
    - Disabled NIS-->IS selector in cli_sync module

Device:2 model:261-001
    - Sample counters are available
    - 16.5MHz serial isolation interface speed based on 66MHz system clock
    - 2-wire interface is used
    - PWM output enabled for the TMR0/TMR1 timers in SYNC module
    - Standard input channel list implementation used
    - Standard output channel list implementation used

Device:3 model:020-001
    - Sample counters are available
    - IS-->NIS selector is disabled in cli_sync module
    - Disabled triggering in cli_sync module
    - Disabled NIS-->IS selector in cli_sync module
    - Disabled SYNC lines part in cli_sync module
    - 8-bit output test port is unavailable

Device:4 model:040-001
    - Sample counters are available
    - PWM output enabled for the TMR0/TMR1 timers in SYNC module
    - 8-bit output test port is unavailable
```

6.3.7 Display Power Diagnostics

Typing `simod 5` at the serial prompt displays diagnostic information from the Cube/Rack power board(s).

In the example below, “DNR_PWR” is the dedicated DNR/DNF Power module and “DNR_PWR_1G” is the power board on the SoloX CPU/POWER module. Diagnostic information includes voltage readings on each of the 2.5 V, 24 V, 1.2 V, 3.3 V, and 1.5 V supplies, as well as temperature and current measurements.

```
DQ> simod 5

Periodic failures code: 0

DNR_PWR layer 20 diagnostics

   2.5DNR= 2.514*   2.5NIC= 2.509*   3.3DNR= 3.340*   3.3NIC= 3.312*
    24DNR=24.225*    24NIC=24.186*      Vin=22.604*   1.5DNR= 1.606*
   1.2DNR= 1.298*     Vfan= 8.017*      Iin= 0.863*    Temp1=24.580*
    Temp2=24.283*

DNR_PWR_1G layer diagnostics

   2.5DNx= 2.507*     GND1= 0.000*
   3.3DNx= 3.331*    U-Cap= 5.306*
    24DNx=24.263*      Vin=23.779*
   1.5DNx= 1.616*   1.2DNx= 1.303@
    VfanX= 0.025!
    I 3.3= 0.751*
    Temp1=27.882*    Temp2=27.912*
Unit logged 215033046.4 hours
```

6.3.8 Monitor CPU Buffer Usage

Typing `simod 15` at the serial prompt causes the CPU utilization percentage to continuously print to the serial console.

`simod 15` can be used to monitor the CPU load while your application is sending and receiving commands and data over Ethernet.

```
DQ> simod 15
Printing statistics
+cpu:0
+cpu:91
+cpu:2
+cpu:1
```

6.3.9 Change Date and Time

Enter `time` at the serial prompt to view the current date and time on the PowerDNA SoloX Cube/Rack system:

```
DQ> time
Current time: 06:23:57 09/10/2021
```

You can also use the `time` command to set a new date and time:

```
DQ> time 11/19/2021
DQ> time 15:48:00
```

Date and time are stored in the battery-backed real-time clock chip.

Appendix A

SoloX Accessories

A.1 Cables and STPs

The following cables and STP boards are designed for the SoloX CPU module.

CBL-SX6-DIAG

This is a 10-conductor cable with 10-pin multi-purpose plug connector on one end (Hirose IX30G-B-10S-CV(7.0)) and a DB-9 connector on the other.
It is made with round, heavy-shielded cable; 3.75 ft (114 cm) long, weight of 2.74 ounces or 77.6 grams.

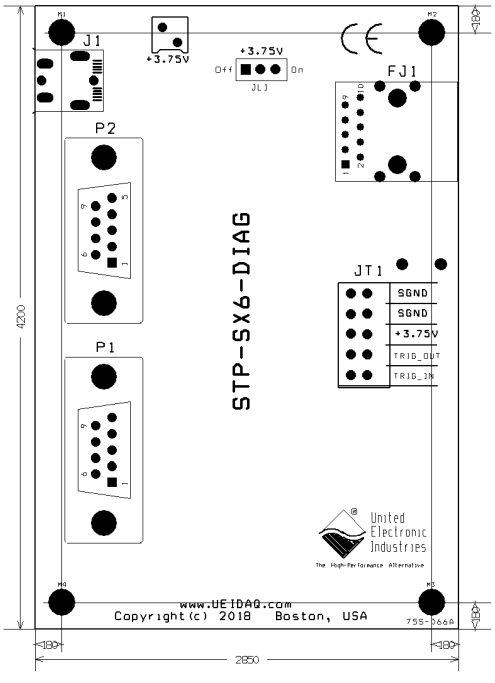
CBL-SX6-SYNC

This is a 10-conductor cable with 10-pin multi-purpose plug connectors on both ends (Hirose IX30G-B-10S-CV(7.0)). It is made with round, heavy-shielded cable; 3.75 ft (114 cm) long, weight of 2.50 ounces or 70.9 grams.

STP-SX6-DIAG

The STP-SX6-DIAG is a Screw Terminal Panel with one 10-pin multi-purpose plug connector (Hirose 1X61G-B-10P, which mates with IX30G-B-10S-CV(7.0)), 1 RJ-50 SYNC jack, 1 10-position terminal block (JT1) plus two DB-9 serial sockets (P1 for A9 and P2 for M4).

The dimensions of the STP-SX6-DIAG board are 2.85w x 4.2d x1.2h inch or 7.24 x 10.67 x 3 cm (with standoffs). The weight of the STP-62 board is 3.56 ounces or 100.79 grams.



NOTE:
P1: DB-9 connector for A9 processor
P2: DB-9 connector for M4 processor
FJ1, J1, JL1, JT1: Reserved

Figure A-1 Board Layout of STP-SX6-DIAG Screw Terminal Panel

Appendix B

Network Interface Card Configuration

B.1 Configuring an Ethernet Card on Windows

This section describes how to configure an Ethernet card on a Windows 10 host PC.

B.1.1 Install Ethernet Card

If you already have an Ethernet card installed, skip ahead to the next section, "Configure TCP/IPv4".

If you have just added an Ethernet card, install it by doing the following:

STEP 1: Click ***Start » Control Panel*** from the Windows menu.

STEP 2: Under "Hardware and Sound", click **Add a device** and follow the on-screen instructions.

NOTE: We recommend that you allow Windows to search for and install your Ethernet card automatically. If Windows does not find your Ethernet card, you will need to install it manually by following the manufacturer's instructions.

Once your Ethernet card has been installed, continue to the next section.

B.1.2 Configure TCP/IPv4

STEP 1: Click ***Start » Control Panel*** from the Windows menu.

STEP 2: In the *Control Panel* window, click **View network status and tasks** (Figure B-1).

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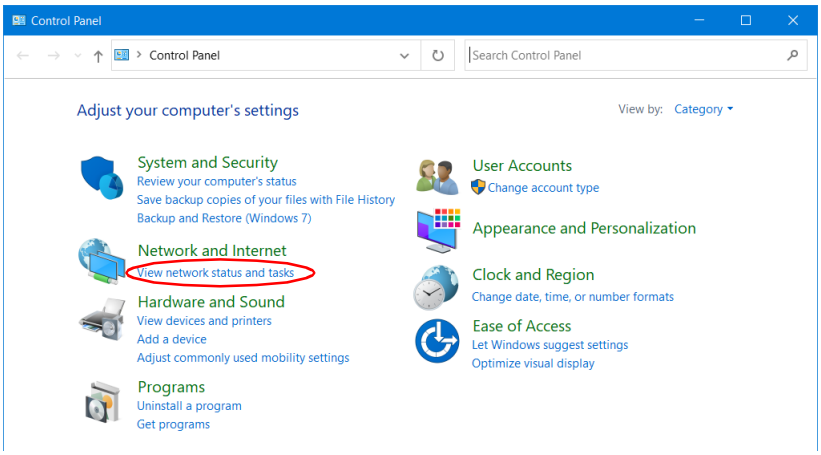

Figure B-1 Control Panel Window

STEP 3: In the left sidebar of the *Network and Sharing Center* window, click **Change adapter settings** *(*Figure B-2). The Ethernet port on your PC should not have a cable attached at this time.

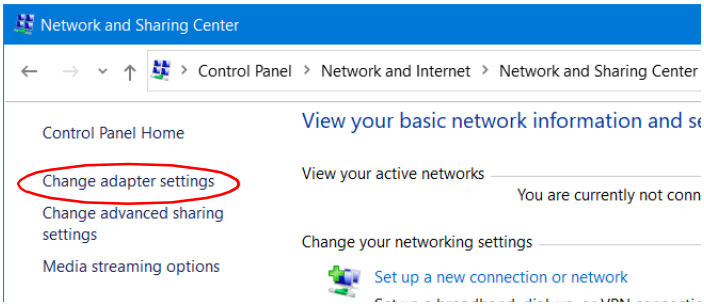

Figure B-2 Network and Sharing Center Window

STEP 4: In the *Network Connections* window, double-click the network interface you are connecting to the Cube/RACK. This will typically be labeled *Ethernet* (Figure B-3) or *Local Area Connection* if you are using your primary network interface card (NIC).

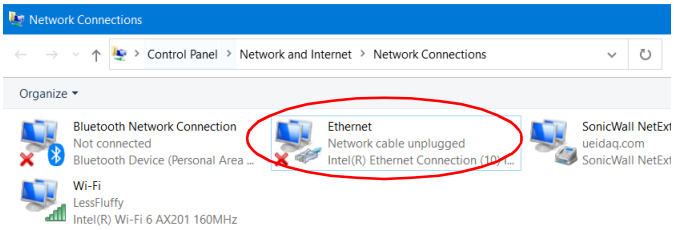

Figure B-3 Network Connections Window

STEP 5: In the *Ethernet Properties* window, verify the *Networking* tab is selected, and double-click **Internet Protocol Version 4 (TCP/IPv4)** (Figure B-4).

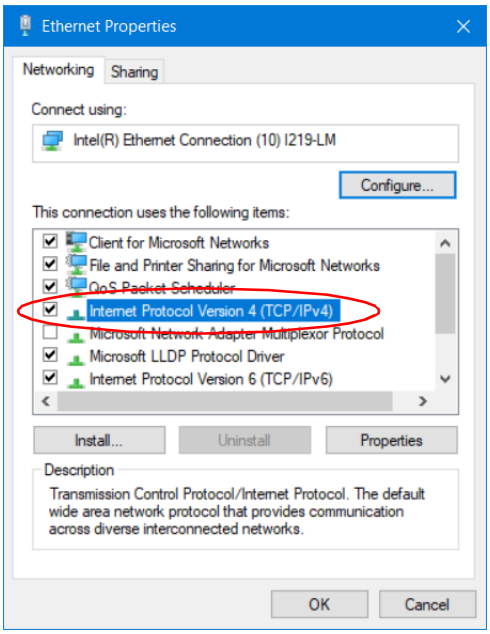

Figure B-4 Ethernet Properties Window

STEP 6: In the *Internet Protocol Version 4 (TCP/IPv4)* window, click the **Use the following IP address** button. Note any addresses listed in the *IP Address*, *Subnet Mask*, *Default Gateway*, *Preferred DNS Server* or *Alternate DNS Server* fields. You may want to re-enter them later to reconfigure your PC when you are done with the Cube/RACK.

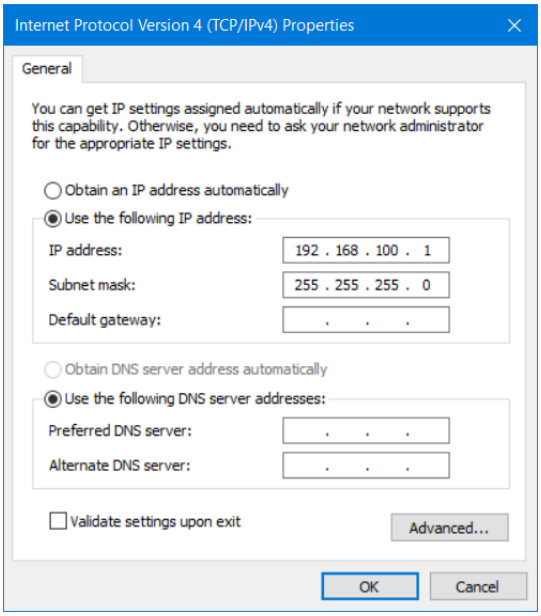

Figure B-5 Internet Protocol Version 4 (TCP/IPv4) Window

STEP 7: Enter the *IP Address* as 192.168.100.1 and the *Subnet mask* as 255.255.255.0 (Figure B-5).

Setting the host PC NIC address to 192.168.100.1 with a subnet mask of 255.255.255.0 allows the host PC to communicate with components with IP addresses from 192.168.100.2 through 192.168.100.254 via that NIC port. All UEI Cubes and RACKs on this network will need to have unique IP addresses in that range. (The default IP address of the Cube/RACK is 192.168.100.2, now within the required range.

STEP 8: Click **OK** and/or **Close** and close out of network setup windows.

For instructions on setting the IP address, subnet mask, and default gateway on the UEI chassis, refer to “Updating IP Addresses” on page 44.

Appendix C

Field Replacement of Fuses

C.1 Fuses on DNA and DNR Boards

Some boards used in UEI Cube and Rack systems require field replacement of fuses when unexpected overloads occur. Locations of these fuses are shown in **Figure C-1** through **Figure C-3**. Part numbers for the replacement fuses are listed **Table C-1**.

Table C-1 DNA/DNR Replacement Fuses

UEI Fuse ID (Board)	Rating	UEI Part No.	Description	Mfr.	Mfr P/N
F1	5A	925-5125	FUSE 5A 125V SLO SMD SILVER T/R	Littlefuse	0454005.MR
F2	5A	925-5125	FUSE 5A 125V SLO SMD SILVER T/R	Littlefuse	0454005.MR
F3 (DC)	5A	925-5125	FUSE 5A 125V SLO SMD SILVER T/R	Littlefuse	0454005.MR
F3 (1GB)	10A	925-1125	FUSE 10A 125V FAST NAN02 SMD	Littlefuse	0451010.MRL
F4	5A	925-5125	FUSE 5A 125V SLO SMD SILVER T/R	Littlefuse	0454005.MR

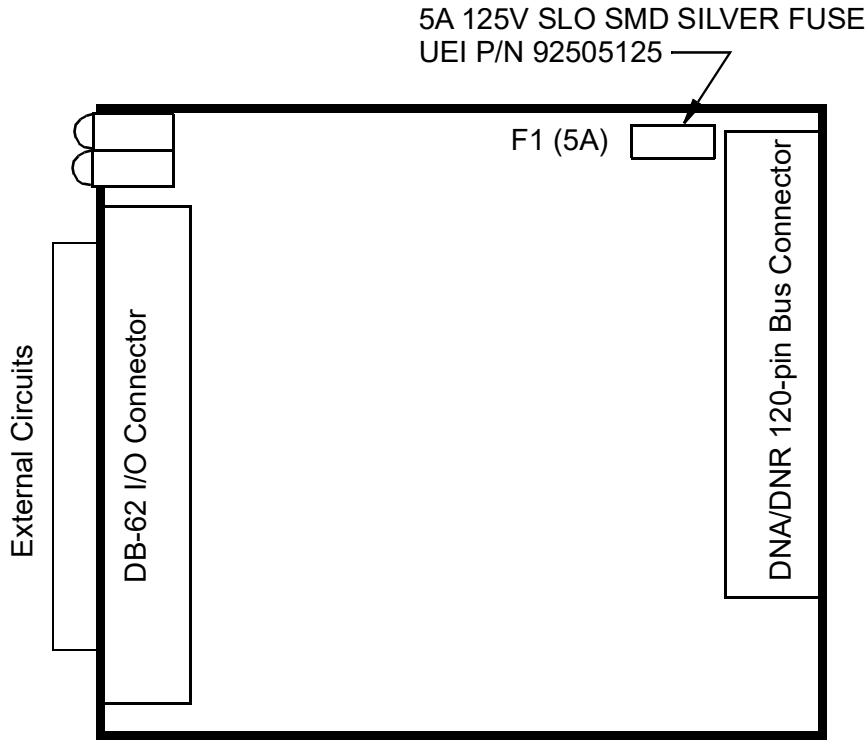

Figure C-1 Location of Fuse for I/O Boards Equipped with a Fuse

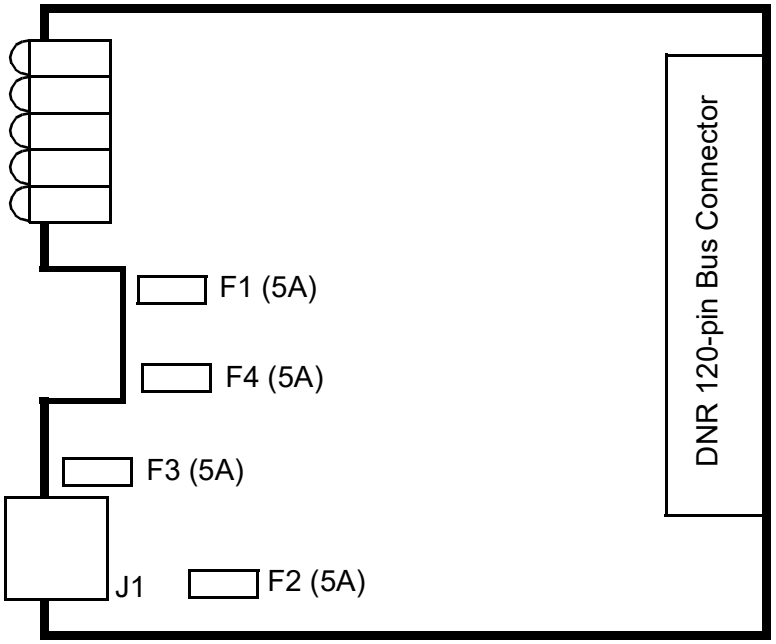

Figure C-2 Location of Fuses for DNR-POWER-DC Board

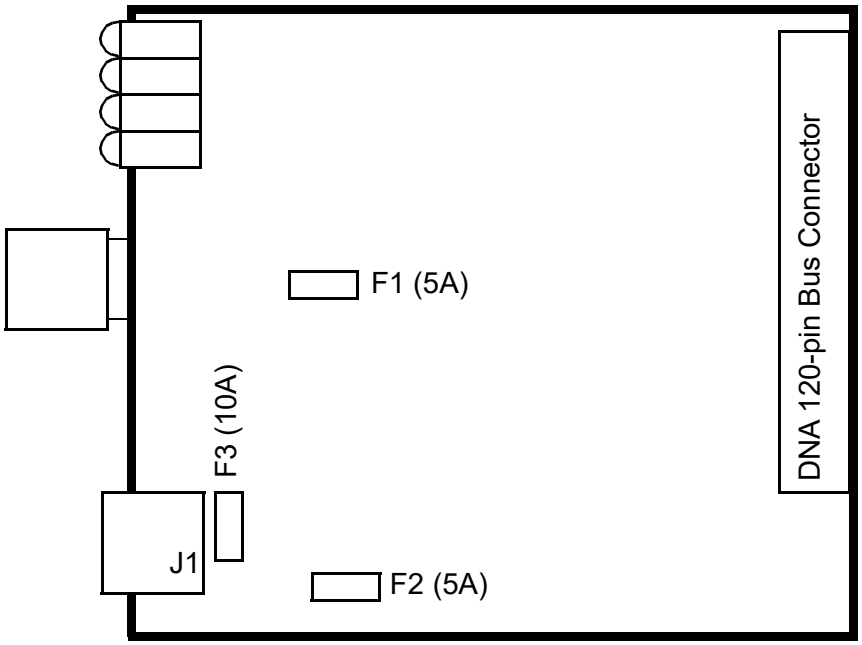

Figure C-3 Location of Fuses for DNx-POWER-1GB Board