



DNA-PC-921-D User Manual

**Power Supply Conditioning Board
for the PowerDNA Cube chassis**

February 2021

PN Man-DNA-PC-921-D

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Chapter 1 Introduction

This manual outlines the feature set and use of the DNA-PC-921-D, a power conditioning board designed for use in UEI's Cube series chassis.

The following sections are provided in this chapter:

- Organization of this Manual (Section 1.1)
- Manual Conventions (Section 1.2)
- Before You Begin (Section 1.3)
- Related Resources (Section 1.4)
- DNA-PC-921-D Features (Section 1.5)
- Technical Specification (Section 1.6)
- Device Architecture (Section 1.7)
- Indicators (Section 1.8)
- Board Position in Cube (Section 1.9)
- Pinout (Section 1.10)
- Diagnostic Monitoring (Section 1.11)

1.1 Organization of this Manual

This DNA-PC-921-D User Manual is organized as follows:

- **Introduction**
Chapter 1 describes the features, specification, and connectivity of the DNA-PC-921-D.
- **Programming with High-level API**
Chapter 2 shows how to create a session, configure the session, and read data with the Framework API.
- **Programming with Low-level API**
Chapter 3 provides an overview of low-level programming functions for the DNA-PC-921-D.
- **Appendix A - Accessories**
This appendix provides a list of accessories available for the DNA-PC-921-D.



1.2 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	<code>session.CleanUp()</code>
<brackets>	placeholder for user-defined text	<code>pdna://<IP address></code>
<i>italics</i>	path to a file or directory	<i>C:/Program Files</i>

1.3 Before You Begin

No Hot Swapping!



Before plugging any I/O connector into the Cube, be sure to remove power from all field wiring. Failure to do so may cause severe damage to the equipment.

Check Your Firmware



Ensure that the firmware installed on the Cube CPU matches the UEI software version installed on your PC. The IOM is shipped with pre-installed firmware and a matching software installation. If you upgrade your software installation, you must also update the firmware on your Cube CPU. Instructions for updating firmware are provided in the UEI chassis user manuals.

1.4 Related Resources

This manual only covers functionality specific to the DNA-PC-921-D. To get started with the UEI IOM, please see the documentation included with the software installation. On Windows, these resources can be found from the desktop by clicking **Start » All Program » 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.



1.5 DNA-PC-921-D Features

The DNA-PC-921-D power conditioning board is designed to add MIL-STD-1275 and MIL-STD-704 to a UEI Cube. Hold-up circuitry provides temporary power in case of external power loss. Features include:

- Brown-out and surge protection
- Power failure detection, which allows for file closure or emergency shut-down prior to CPU power loss
- Installs in the bottom two slots of any Cube (except for UEINet)
- Diagnostic readback of input voltage, input current, and hold-up capacitor voltage

1.5.1 Software Support

The DNA-PC-921-D does not require any software to function, though an easy to use API does provide the user access to the various diagnostics available.

The included software suite supports Windows, Linux, QNX, VXWorks, RTX, and most other popular real-time operating systems. Windows users may use the UEIDAQ Framework, which provides a simple and complete software interface to Windows programming languages and DAQ applications (e.g., LabVIEW, MATLAB). All software support includes extensive example programs that make it easy to cut-and-paste the I/O software into your applications.

1.6 Technical Specification

Table 1-1 lists the technical specifications for the DNA-PC-921-D board. All specifications are for a temperature of 25°C unless otherwise stated.

Table 1-1 Technical Specification for DNA-PC-921-D

Input voltage	9 - 36V DC
Power supply rating	Designed to meet MIL-STD-1275 and MIL-STD-704
Output voltage hold-up	> 200 milliseconds at 15 Watts (see Figure 1-1)
Output enable/disable	Software controlled. Default is ON.
Input fuse protection	10 A (Littleton 0453 010 or equivalent)
Diagnostic voltage readback accuracy	±100 mV
Power consumption	2.0 W (plus up to 0.5 A while charging)
Environmental	
Temp (operating & storage)	-40 °C to +85 °C
Operating Humidity	0% to 95%, non-condensing
Vibration	
IEC 60068-2-6	5 g, 10-500 Hz, sinusoidal
IEC 60068-2-64	5 g (rms), 10-500 Hz, broadband random
Shock	
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
MTBF	>100,000 hours



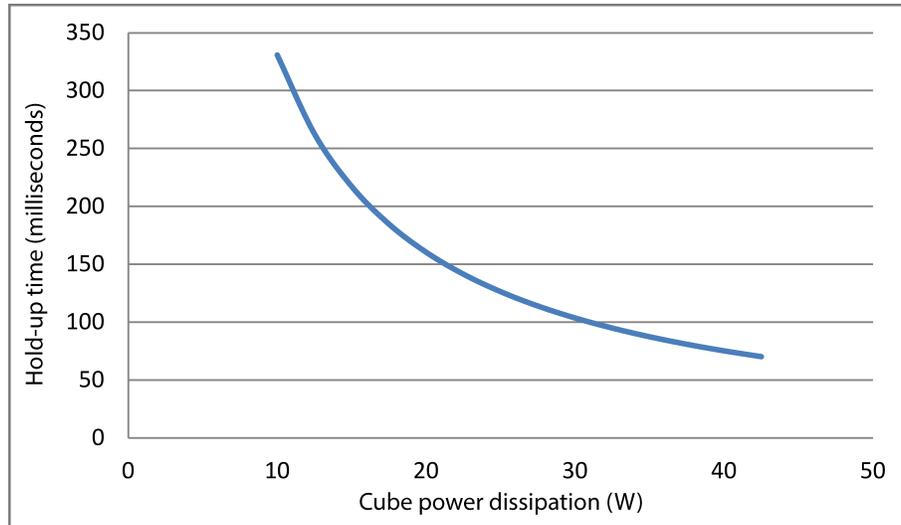


Figure 1-1 Power loss hold-up duration

The total Cube power dissipation includes the Cube chassis, I/O boards, plus 2.5W used by the DNA-PC-921-D.

1.7 Device Architecture

As shown in **Figure 1-2**, the DNA-PC-921-D places hold-up circuitry between the external power supply and the Cube’s DC/DC converter. Input voltage spikes and transients are suppressed by a voltage pre-regulator. The hold-up module supplies power to the Cube and charges a bank of 5 capacitors (totaling 6000 μ F) at 38V. If the input voltage drops below 9V, a power failure signal is activated and energy is drawn from the hold-up capacitors. A “capacitor discharged” signal is sent when the capacitors have discharged to a minimum of 9.4V. In addition to monitoring status signals from the hold-up module, the logic also reads diagnostics from the on-board ADC and can turn on/off power to the Cube.

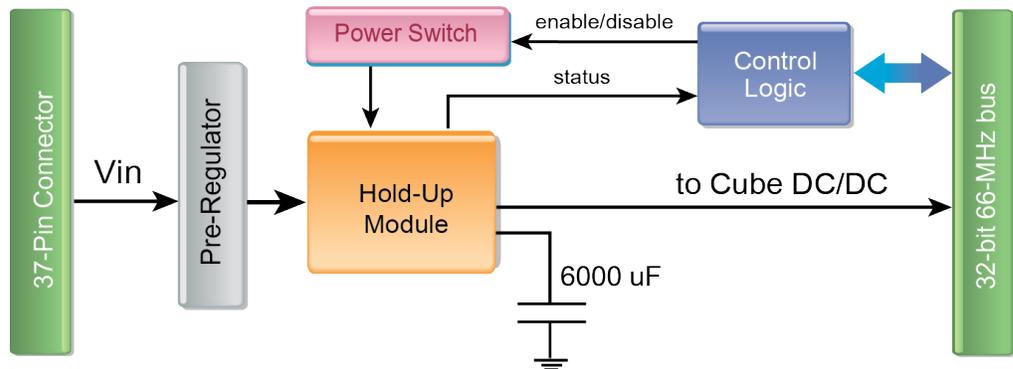


Figure 1-2 Simplified Block Diagram of DNA-PC-921-D



1.8 Indicators

The DNA-PC-921-D LED indicators are described in **Table 1-2** and illustrated in Figure 1-3.

Table 1-2 DNA-PC-921-D LED Indicators

LED Name	Description
PWR	ON when power is applied to the board
STS	reserved

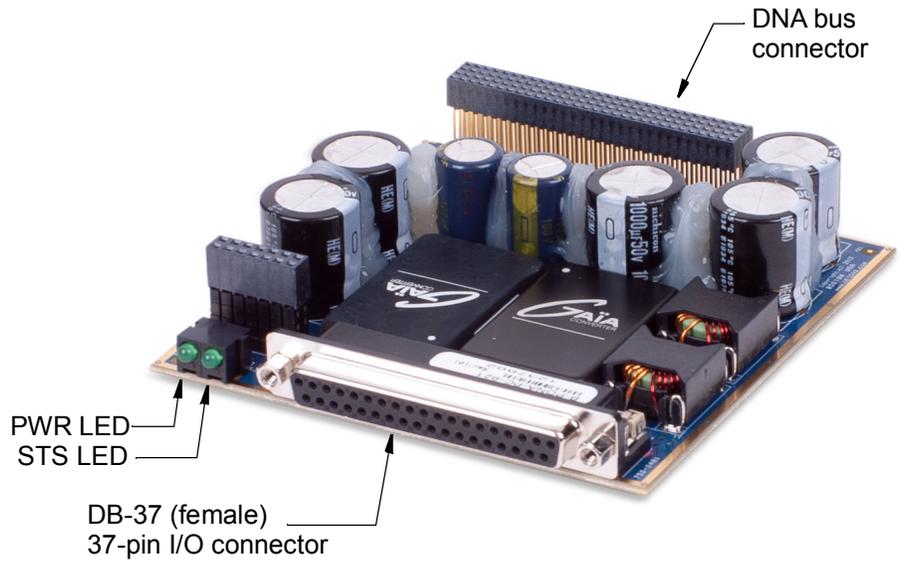


Figure 1-3 Photo of DNA-PC-921-D Board

1.9 Board Position in Cube

The DNA-PC-921-D board fits into two adjacent slots within a Cube chassis, as shown in **Figure 1-4**. It should be placed at the bottom of the Cube, below all other I/O boards in the stack. It is fine to have empty slots below the DNA-PC-921-D.

Note that the board is compatible with all UEI Cubes except for UEINET, since UEINET only has one slot.



Figure 1-4 DNA-PC-921-D in Cube

1.10 Pinout

Figure 1-5 illustrates the pin configuration for the DNA-PC-921-D board. Input voltage from an external source is connected through a standard DB-37 female connector on the front panel. Connections should be made only to the -Vin and +Vin pins. All other pins are reserved.

rsvd	1	20	-Vin
-Vin	2	21	-Vin
-Vin	3	22	-Vin
rsvd	4	23	+Vin
+Vin	5	24	+Vin
+Vin	6	25	+Vin
rsvd	7	26	rsvd
rsvd	8	27	rsvd
rsvd	9	28	rsvd
rsvd	10	29	rsvd
rsvd	11	30	rsvd
rsvd	12	31	rsvd
rsvd	13	32	rsvd
rsvd	14	33	rsvd
rsvd	15	34	rsvd
rsvd	16	35	rsvd
rsvd	17	36	rsvd
rsvd	18	37	rsvd
rsvd	19		

Figure 1-5 Pinout Diagram for DNA-PC-921-D

NOTE: Please do not use the Molex or dSub power connector near the top of the Cube. No damage will occur if both the power connector and the PC-921-D are powered at the same time, but this connection will eliminate the protection offered by the PC-921-D.



1.11 Diagnostic Monitoring

The DNA-PC-921-D is equipped with diagnostic capabilities, providing users the ability to read back voltage levels, current, temperature, and other status information. The available diagnostic data is listed in Table 1-3 and Table 1-4.

Table 1-3 Analog Diagnostic Channels

Channel #	Description	Units
0	Voltage on hold-up capacitors (typically 38V)	V
1	Input current (supplied to Cube by external source)	A
2	Input voltage on DB-37 connector (supplied to Cube by external source)	V
3	Internal 3.3V power supply	V
4	Temperature inside the ADC IC	°C

Table 1-4 Digital Status Bits

Bit #	Description
6	=0: power failure is detected
5	reserved
4	reserved
3	reserved
2	reserved
1	=0: hold-up capacitor is charged
0	=0: hold-up capacitor is discharged

See Chapter 2, "Programming with High-level API" for information about reading diagnostic values using high-level API. Chapter 3, "Programming with Low-level API" provides an introduction to the low-level API.



Chapter 2 Programming with High-level API

This chapter provides the following information about programming the DNA-PC-921-D using the UeiDaq Framework API:

- About the High-level API (Section 2.1)
- Sample Code (Section 2.2)
- Create a Session (Section 2.3)
- Assemble the Resource String (Section 2.4)
- Configure the Timing (Section 2.5)
- Start the Session (Section 2.6)
- Analog Input Session (Section 2.7)
- Digital Input Session (Section 2.8)
- Stop the Session (Section 2.9)

2.1 About the High-level API

UeiDaq Framework is object oriented and its objects can be manipulated in the same manner from different development environments, such as Visual C++, MATLAB, LabVIEW, and more. The Framework is supported in Windows 7 and up. It is generally simpler to use compared to the low-level API, and it includes a generic simulation device to assist in software development. Therefore, we recommend that Windows users use the high-level API unless unconventional functionality is required. Users programming in Linux or a real-time operating system should instead use the low-level API (Chapter 3).

For more detail regarding the Framework's architecture, please see the "UeiDaq Framework User Manual" located under:

Start » All Programs » UEI » Framework » Documentation

2.2 Sample Code

UeiDaq Framework is bundled with examples for supported programming languages. The sample code is located under:

Start » All Programs » UEI » Framework » Examples

Unlike the low-level samples, Framework samples are board-agnostic, e.g., the "AnalogInSingle" sample works across all UEI analog input layers which support Point-by-Point data acquisition mode.

Each high-level sample follows the same basic structure:

1. Create a session.
2. Configure the session for a particular device and subsystem.
3. Configure the timing.
4. Start the session.
5. Read or write data.
6. Stop the session.



This chapter presents examples using C++ API, but the concepts are the same no matter which programming language you use. The “UeiDaq Framework User Manual” provides additional information about programming in other languages.

2.3 Create a Session

The session object manages all communications with the DNA-PC-921-D. Therefore, the first step is always to create a new session.

```
//create a session object  
CUEiSession mySession;
```

NOTE: If you want to use multiple subsystems on the DNA-PC-921-D (for example simultaneous analog input and digital input), you will need to create a new session for each subsystem. Therefore, the subsystem-specific sessions discussed later in the chapter will be given unique names.

2.4 Assemble the Resource String

Each session is dedicated to a specific subsystem within the device. Framework uses a resource string to link the session to the hardware. The resource string syntax is similar to a web URL; it should not have any spaces and is case insensitive.

“<device class>://<IP address>/<device number>/<subsystem><channel list>”

- *<device class>* - By default, Framework samples open with a generic simulated device. To use the DNA-PC-921-D, set the device class to *pdna*.
- *<IP address>* - IP address of the Cube.
- *<device number>* - position of the DNA-PC-921-D within the Cube, relative to the other I/O boards.
- *<subsystem>* - one of the following DNA-PC-921-D subsystems:
 - *Ai*: analog input session to read voltage, current, and temperature (Section 2.7)
 - *Di*: digital input session to read status bits (Section 2.8)
- *<channel list>* - desired lines or ports within the selected subsystem, either as a comma-separated list of numbers or a range. If the subsystem name ends in a number, separate the subsystem and channel list with a forward slash.

Example:

Here are two valid resource strings for selecting analog input channel 0,1,2,3 on device 1 at IP address 192.168.100.2:

- “pdna://192.168.100.2/Dev1/Ai0,1,2,3”
- “pdna://192.168.100.2/Dev1/Ai0:3”



- 2.5 Configure the Timing** Only Point-by-Point data acquisition mode can be used to communicate with the DNA-PC-921-D. Other modes are not supported. Point-by-Point mode transfers one sample at a time to/from each configured channel. The delay between samples is controlled by the host application (e.g. by using a Sleep function), thus limiting the data transfer rate to a maximum of 100 Hz. This mode is also known as immediate mode or simple mode.

```
//configure session to use Point-by-Point DAQ mode  
mySession.ConfigureTimingForSimpleIO();
```

- 2.6 Start the Session** After the session is configured, you can start the session manually:

```
//Start the session.  
mySession.Start();
```

If you don't explicitly start the session, it will start automatically the first time you try to transfer data.

- 2.7 Analog Input Session** The session may be configured to read back voltage, current, and temperature from the Ai subsystem.

- 2.7.1 Add Input Channels** To access the measurements, configure the channel list using the session object's `CreateAIChannel()` method. See **Table 1-3** for a description of the channels.

```
//Configure session to read Channels 0-4.  
aiSession.CreateAIChannel("pdna://192.168.100.2/Dev1/Ai0:4",  
-10, 10, UeiAIChannelInputModeSingleEnded);
```

The input range and input mode settings are not used on the DNA-PC-921-D.

- 2.7.2 Read Data** Reading data is done using a reader object. An Analog Raw Reader returns the calibrated binary data and an Analog Scaled Reader returns the data converted to SI units. The following sample code shows how to create a scaled reader object and read samples.

```
//Create a reader object and link it to the session's data stream.  
CUeiAnalogScaledReader aiReader(aiSession.GetDataStream());  
  
//Read one sample from all 5 channels.  
  
double data[5];  
aiReader.ReadSingleScan(data);
```



2.8 Digital Input Session The session may be configured to read digital status information from the Di subsystem.

2.8.1 Add Input Port The DNA-PC-921-D has only one digital port, so the resource string should specify port 0 as shown in the code below. The entire port is added to one channel.

```
//Configure session to read digital status bits.  
diSession.CreateDIChannel("pdna://192.168.100.2/Dev1/Di0");
```

2.8.2 Read Data Reading data is done using a reader object. Digital data is stored in a 32-bit integer buffer, but only the bits in **Table 1-4** are used.

```
//Create a reader object and link it to the session's data stream.  
CUeiDigitalReader diReader(diSession.GetDataStream());  
  
//Read state of all status bits.  
uInt32 data[1];  
diReader.ReadSingleScan(data);
```

2.9 Stop the Session The session will automatically stop and clean itself up when the session object goes out of scope or when it is destroyed. To manually stop the session:

```
//Stop the session.  
mySession.Stop();
```

To reuse the object with a different set of channels or parameters, you can manually clean up the session as follows:

```
//clean up session and free resources  
mySession.CleanUp();
```



Chapter 3 Programming with Low-level API

This chapter provides the following information about programming the DNA-PC-921-D using low-level API:

- About the Low-level API (Section 3.1)
- Sample Code (Section 3.2)
- Data Acquisition Modes (Section 3.3)
- Low-level Functions (Section 3.4)

3.1 About the Low-level API

The low-level API provides direct access to the DAQBIOS protocol structure and registers in C. The low-level API is intended for speed-optimization, when programming unconventional functionality, or when programming under Linux or real-time operating systems.

When programming in Windows OS, we recommend that you use the UeiDaq high-level Framework API (see Chapter 2). The Framework simplifies the low-level API, making programming easier and faster while still providing access to the majority of low-level API features. Additionally the Framework supports a variety of programming languages and the use of scientific software packages such as LabVIEW and MATLAB.

For additional information regarding low-level programming, refer to the “PowerDNA API Reference Manual” located in the following directories:

- On Linux: `<PowerDNA-x.y.z>/docs`
- On Windows: **Start » All Programs » UEI » PowerDNA » Documentation**

NOTE: The DNA-PC-921-D is supported in PowerDNA version 4.10.0.49+. If you're unsure if your version supports the board, please contact Technical Support at support@ueidaq.com

3.2 Sample Code

Application developers are encouraged to explore the self-documented source code examples to get started programming UEI products. The sample code is located in the following directories:

- On Linux: `<PowerDNA-x.y.z>/src/DAQLib_Samples`
- On Windows: **Start » All Programs » UEI » PowerDNA » Examples**

The I/O board number is embedded in the name of the sample code. For example, the Sample921 folder contains sample code specific to the DNA-PC-921-D. The sample code should run out of the box after inputting the IOM's IP address and the board's Device Number (DEVN).

3.3 Data Acquisition Modes

Data is transferred to/from the DNA-PC-921-D using Point-by-Point data acquisition mode. Also known as immediate mode or simple mode, this mode transfers one data point at a time to/from each configured channel of a single board. Timing is controlled by the user application, which limits the transfer rate to 100 Hz.



3.4 Low-level Functions

Table 3-1 summarizes the low-level API used to configure and read from the DNA-PC-921-D. Functions and their parameters are described in more detail in the "PowerDNA API Reference Manual".

Table 3-1 Low-level API for DNA-PC-921-D

Function	Description
DqAdv921Read	Read diagnostic ADC data and status bits
DqAdv921SetConfig	Enable or disable power (default = enabled).



Appendix A

Accessories

A.1 Cables and STP Boards

The following cables and STP boards are available for the DNA-PC-921-D.

DNA-CBL-37

This is a 37-conductor flat ribbon cable with 37-pin male D-sub connectors on both ends. The length is 3ft and the weight is 3.4 ounces or 98 grams.

DNA-CBL-37S

This is a 37-conductor round shielded cable with 37-pin male D-sub connectors on both ends. It is made with round, heavy-shielded cable; 3 ft (90 cm) long, weight of 10 ounces or 282 grams; also available in 10ft and 20ft lengths.

DNA-STP-37

The DNA-STP-37 provides easy screw terminal connections for all DNx series I/O boards using the 37-pin connector scheme. The DNA-STP-37 is connected to the I/O board via either DNA-CBL-37 or DNA-CBL-37S cable. The dimensions of the STP-37 board are 4.2w x 2.8d x 1.0h inch or 10.6 x 7.1 x 7.6 cm (with standoffs). The weight of the STP-37 board is 2.4 ounces or 69 grams.

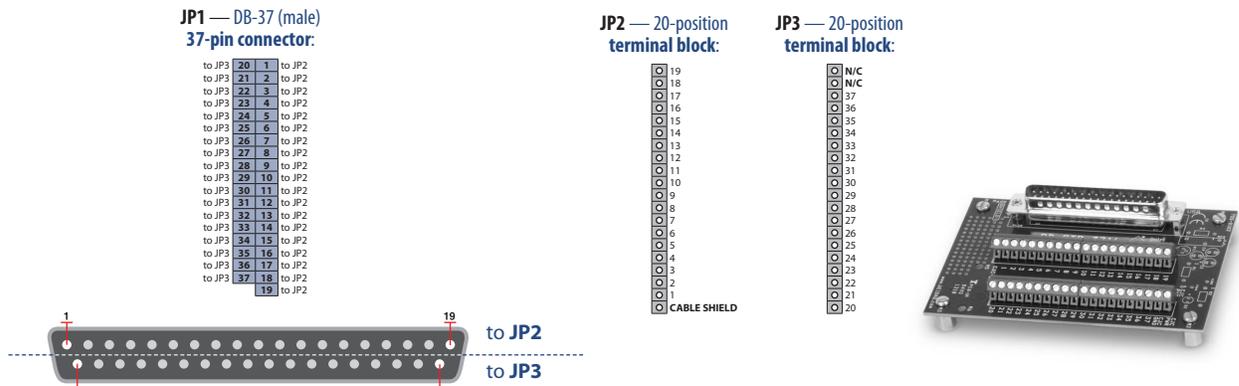


Figure A-1 Pinout and Photo of DNA-STP-37 Screw Terminal Panel

