United Electronic Industries

The High-Performance Alternative

DNx-DIO-430

—

User Manual

30-Channel Solid-state Relay Output Interface for the PowerDNA Cube and RACK series chassis

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PN Man-DNx-DIO-430

CE

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Table of Contents

List of Figures

Chapter 1 Introduction

This document outlines the feature set of the DNx-DIO-430 board and its use in solid-state relay applications.

The following sections are provided in this chapter:

- Organization of Manual (Section 1.1)
- DIO-430 Board Overview (Section 1.2)
- Features (Section 1.3)
- Specification (Section 1.4)
- Device Architecture (Section 1.5)
- Indicators (Section 1.6)
- Wiring and Connectors (pinout) (Section 1.7)

For comparison, see the DNx-DIO-470, a 10-channel, high-current, electromechanical relay board.

1.1 Organization of Manual

This DNx-DIO-430 User Manual is organized as follows:

- **Introduction**
  Chapter 1 provides an overview of DNx-DIO-430 analog input board features, device architecture, connectivity, and logic.
- **Programming with the High-Level API**
  Chapter 2 provides an overview of the how to create a session, configure the session, and interpret results with the Framework API.
- **Programming with the Low-Level API**
  Chapter 3 is an overview of low-level API commands for configuring and using the DIO-430 series board.
- **Appendix A - Accessories**
  This appendix provides a list of accessories available for use with the DNx-DIO-430 board.
- **Index**
  This is an alphabetical listing of the topics covered in this manual.

NOTE: A glossary of terms used with the PowerDNA Cube/RACK and I/O boards can be viewed or downloaded from www.ueidaq.com.

Manual Conventions

To help you get the most out of this manual and our products, please note that we use the following conventions:

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

NOTE: Notes alert you to important information.

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

Text formatted in **bold** typeface generally represents text that should be entered verbatim. For instance, it can represent a command, as in the following example: “You can instruct users how to run setup using a command such as **setup.exe**.”

Bold typeface will also represent field or button names, as in “Click **Scan Network**.”

Text formatted in `fixed` typeface generally represents source code or other text that should be entered verbatim into the source code, initialization, or other file.

Examples of Manual Conventions

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

Usage of Terms

Throughout this manual, the term “Cube” refers to either a PowerDNA Cube product or to a RACKtangle™ rack mounted system, whichever is applicable. The term DNR- is a specific reference to the RACKtangle, DNA- to the PowerDNA I/O Cube, and DNx- to refer to both.

1.2 DIO-430 Board Overview

The DNx-DIO-430 is a 30-channel, solid state relay board for use with UEI's Cube and RACK series chassis.

DNA-DIO-430, DNR-DIO-430, and DNF-DIO-430 boards are compatible with the UEI Cube, RACKtangle, and FLATRACK chassis respectively. These board versions are electronically identical and only differ in the mounting hardware. The DNA version is designed to stack in a Cube chassis. The DNR/F versions are designed to plug into the backplane of a RACK chassis.

1.2.1 Relay Operating Overview

The DIO-430 boards are designed for use in a wide variety of switching and digital control applications. Each channel is configured as a standard Form A (SPST) relay and switches voltages up to ±55 VDC or AC waveforms with peaks less than ±55 VDC. Each channel is rated for continuous operation at 400 mA DC or AC rms with a switch resistance of less than 1.5 Ohm (not including external cables).

All relays default to "OFF" on power up/reset. Switching rates up to 1000 Hz are supported. Each board provides 350 VDC isolation between channels, as well as between the board, chassis and other installed I/O boards. Outputs are protected against transients by SMAJ60CA TVS diodes and against over-current with a 1 Amp, fast blow fuse.

1.2.2 Accessories

All connections are made through a convenient 62-pin D connector ensuring no problems obtaining mating cables or connectors. Users may also connect the DNx-DIO-430 boards to UEI's DNA-STP-62 screw terminal panel via the DNA-CBL-62 cables. Cables are fully shielded and are available in 1, 3, 10 and 20 foot lengths.

1.2.3 Software Support

The DNx-DIO-430 series includes software drivers supporting all popular operating systems including: Windows, Linux, QNX, VXWorks, RTX, and other popular Real-Time Operating Systems. Windows users may take advantage or the powerful UEIDAQ Framework which provides a simple and complete software interface to all popular Windows programming languages and data acquisition and control applications (e.g. LabVIEW and MATLAB).

1.3 Features

The DNx-DIO-430 offers the following features:

- 30 independent Form A (SPST) solid state relays
- ±55 VDC (maximum operating voltage)
- 1.5 Ohm resistance (not including cabling)
- 400 mA continuous load current rating
- 2 A peak current (<10 mS)
- 1000 Hz update rate
- Weight of 150 g or 5.3 oz for DNA-DIO-430; 162g or 5.7 oz for DNR
- UEI Framework Software API may be used with all popular Windows programming languages and most real time operating systems such as RT Linux, RTX, or QNX and graphical applications such as LabVIEW, MATLAB and any application supporting ActiveX or OPC.

1.4 Specification

The technical specification for DNx-DIO-430 is provided in the table below:

Table 1-1 . DNx-DIO-430 Technical Specifications

Output specifications	
Rated Load (continuous)	400 mA (-40 to +85°C) 600 mA (-40 to +55°C)
Rated Load (peak)	2 A <10 mS, 1.5 A <100 mS, 1 A <1 second
Max Operating Voltage	55 VDC, 55 V peak in AC waveforms
Contact Material	Solid State
Contact ON impedance	1.5 Ohm max (at the I/O connector)
Contact OFF impedance	>100 MOhm
Off Leakage Current	< 1 µA
Turn-On/Off Time	< 1 mS / < 1 mS
Output Protection	Transient protection via SMAJ60CA TVS diode
	1A fast-blow fuse (Littlefuse 0453001.MR or equivalent)
Power up / reboot state	Off
Power dissipation	< 5 W not including output switches
Isolation	350 Vrms
Operating Temp. Range	Tested -40 to +85 °C
Operating Humidity	95%, non-condensing
Vibration *IEC 60068-2-6* *IEC 60068-2-64*	5 g, 10-500 Hz, sinusoidal 5 g (rms), 10-500 Hz, broad-band random
Shock *IEC 60068-2-27*	50 g, 3 ms half sine, 18 shocks @ 6 orientations 30 g, 11 ms half sine, 18 shocks @ 6 orientations
MTBF	hours

1.5 Device Architecture

This section outlines the hardware used in the DNx-DIO-430 board.

The DIO-430 block diagram is shown below in **Figure 1-1**.

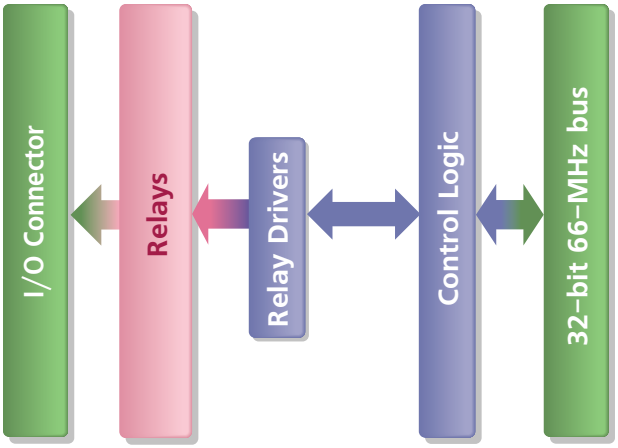


Figure 1-1 DIO-430 Logic Block Diagram

The board has 30 SPST (Form A) relay outputs.

Each output is protected by a 1 A fast-blow fuse, and transient protection is provided by SMAJ60CA TVS diodes on each output.

1.6 Indicators

The DNx-DIO-430 indicators are described in **Table 1-2** and illustrated in **Figure 1-2**.

Table 1-2 DIO-430 Indicators

LED Name	Description
RDY	Indicates board is powered up and operational
STS	Indicates which mode the board is running in: • **OFF**: Configuration mode, (e.g., configuring channels, running in point-by-point mode) • **ON**: Operation mode

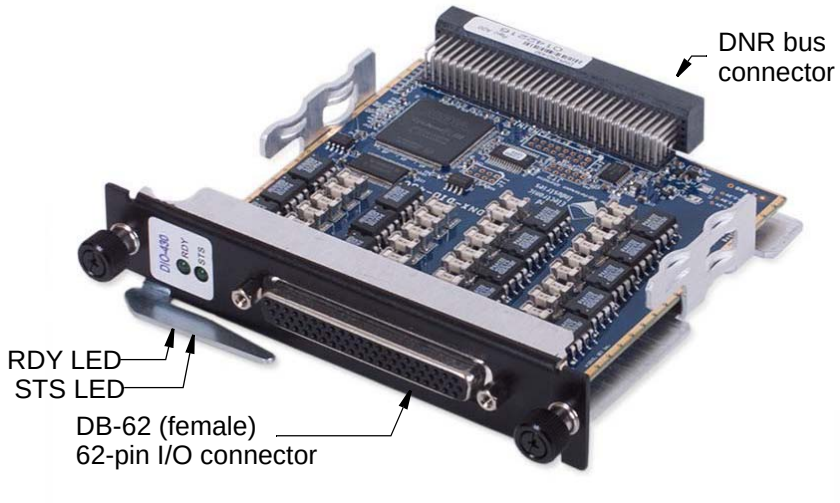


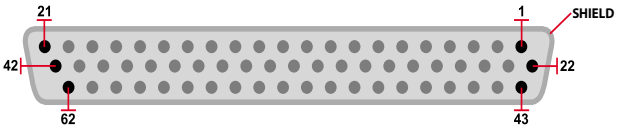
Figure 1-2 Photo of DNR-DIO-430 Board

1.7 Wiring and Connectors (pinout)

Figure 1-3 below illustrates the pinout of the DIO-430.

The DIO-430 uses a 62-pin D-sub connector. The following signals are located at the connector:

- Relay A and Relay B: the input and output of one of the 30 relays
- Rsvd - do not connect to these pins



Pin	*Signal*	*Pin*	*Signal*	*Pin*	*Signal*
1	Rsvd-do not use	22	Rsvd-do not use	43	Relay 28-B
2	Relay 29-A	23	Relay 29-B	44	Relay 28-A
3	Relay 27-A	24	Relay 27-B	45	Relay 25-B
4	Relay 26-A	25	Relay 26-B	46	Relay 25-A
5	Relay 24-A	26	Relay 24-B	47	Relay 22-B
6	Relay 23-A	27	Relay 23-B	48	Relay 22-A
7	Relay 21-A	28	Relay 21-B	49	Relay 19-B
8	Relay 20-A	29	Relay 20-B	50	Relay 19-A
9	Relay 18-A	30	Relay 18-B	51	Relay 16-B
10	Relay 17-A	31	Relay 17-B	52	Relay 16-A
11	Relay 15-A	32	Relay 15-B	53	Relay 13-B
12	Relay 14-A	33	Relay 14-B	54	Relay 13-A
13	Relay 12-A	34	Relay 12-B	55	Relay 10-B
14	Relay 11-A	35	Relay 11-B	56	Relay 10-A
15	Relay 9-A	36	Relay 9-B	57	Relay 7-B
16	Relay 8-A	37	Relay 8-B	58	Relay 7-A
17	Relay 6-A	38	Relay 6-B	59	Relay 4-B
18	Relay 5-A	39	Relay 5-B	60	Relay 4-A
19	Relay 3-A	40	Relay 3-B	61	Relay 1-B
20	Relay 2-A	41	Relay 2-B	62	Relay 1-A
21	Relay 0-A	42	Relay 0-B		

Figure 1-3 Pinout Diagram of the DIO-430

Chapter 2 Programming with the High-level API

This chapter provides the following information about using the UeiDaq high-level Framework API to program the DNx-DIO-430:

- About the High-Level Framework (Section 2.1)
- Creating a Session (Section 2.2)
- Configuring the Resource String (Section 2.3)
- Configuring for Digital I/O (Section 2.4)
- Configuring the Timing (Section 2.5)
- Updating Digital Outputs (Section 2.6)
- Cleaning-up the Session (Section 2.7)

2.1 About the High-Level Framework

UeiDaq Framework is object oriented and its objects can be manipulated in the same manner from different development environments, such as Visual C++, Visual Basic, or LabVIEW.

UeiDaq Framework is bundled with examples for supported programming languages. Examples are located under the UEI programs group in:

- *Start » Programs » UEI » Framework » Examples*

The following sections focus on the C++ API, but the concept is the same no matter which programming language you use.

Please refer to the UeiDaq Framework User Manual for more information on use of other programming languages.

2.2 Creating a Session

The Session object controls all operations on your PowerDNx device. Therefore, the first task is to create a session object:

```
// create a session object
                    CUeiSession session;
```

2.3 Configuring the Resource String

UeiDaq Framework uses resource strings to select which device, subsystem and channels to use within a session. The resource string syntax is similar to a web URL:

```
<device class>://<IP address>/<Device Id>/<Subsystem><Channel list>
```

For PowerDNA Cubes and RACKs, the device class is **pdna**.
Note that the Framework API groups the DIO-430's thirty DO lines into one port.

For example, the following resource string selects digital output port 0 on device 1 at IP address 192.168.100.2: "pdna://192.168.100.2/Dev1/Do0"

2.4 Configuring for Digital I/O

The DIO-430 can be configured for digital output with all of the digital outputs configured as one 32-bit port in Framework.

NOTE: In Framework, a digital channel corresponds to a physical port on the device. You cannot configure a session only to access a subset of lines within a digital port.

NOTE: Sessions are unidirectional. The DIO-430 is also unidirectional and you only need to configure one session for output.

The following snippet configures the digital port of a DIO-430 set as device 1:

```
// Configure session to write to port 0 on device 1
session.CreateDOChannel("pdna://192.168.100.2/Dev1/Do0");
```

2.5 Configuring the Timing

You can configure the DIO-430 to run in simple mode (point by point). Use of ACB mode is not currently supported.

In simple mode, the delay between samples is determined by software on the host computer.

The following sample shows how to configure the simple mode. Please refer to the UeiDaq Framework User's Manual to learn how to use other timing modes.

```
// configure timing for point-by-point (simple mode)
session.ConfigureTimingForSimpleIO();
```

2.6 Updating Digital Outputs

Writing data is done using a writer object.

The following sample shows how to create a writer object and write data:

```
// create a writer and link it to the session's stream
CUeiDigitalWriter writer(session.GetDataStream());
// to write a value, the buffer must contain one value per channel
uInt32 data = 0x0000;
// write one scan, the buffer must contain one value per channel
writer.WriteSingleScan(&data);
```

2.7 Cleaning-up the Session

The session object will clean itself up when it goes out of scope or when it is destroyed. To reuse the object with a different set of channels or parameters, you can manually clean up the session as follows:

```
// clean up the session
session.CleanUp();
```

Chapter 3 Programming with the Low-level API

This chapter provides the following information about programming the DIO-430 using the low-level API:

- About the Low-level API (Section 3.1)
- Low-level Functions (Section 3.2)
- Low-level Programming Techniques (Section 3.3)

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, however, we recommend that you use the UeiDaq high-level Framework API (see **Chapter 2**). The Framework extends the low-level API with additional functionality that makes programming easier, faster, and less error-prone.

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

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

3.2 Low-level Functions

Table 3-1 provides a summary of DIO-430-specific functions. All low-level functions are described in detail in the PowerDNA API Reference Manual.

Table 3-1 Summary of Low-level API Functions for DNx-DIO-430

Function	Description
`DqAdv40xWrite`	Write the open/close state of the relays of a 430/470 board.
`DqAdv40xReadLastWrite`	Read the last written state of the relays of a 430/470 board.

3.3 Low-level Programming Techniques

Application developers are encouraged to explore the existing source code examples. Sample code provided with the installation is self-documented and serves as a good starting point.

Code examples are located in the following directories:

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

Sample code with “402” or “40x” in the name can be used as a reference for DIO-430 boards.

DIO-430 boards can be configured to run in simple mode (point by point) or Real-time Data Map (RtDMap) data acquisition mode. Data acquisition modes are described in the PowerDNA API Reference Manual and PowerDNx Protocol Manual.

Appendix

A.1 Accessories

The following cables and STP boards are available for the DIO-430 boards.

DNA-CBL-62

This is a 62-conductor round shielded cable with 62-pin male D-sub connectors on both ends. It is made with round, heavy-shielded cable; 2.5 ft (75 cm) long, weight of 9.49 ounces or 269 grams; up to 10ft (305cm) and 20ft (610cm).

DNA-STP-62

The STP-62 is a Screw Terminal Panel with three 20-position terminal blocks (JT1, JT2, and JT3) plus one 3-position terminal block (J2). The dimensions of the STP-62 board are 4w x 3.8d x1.2h inch or 10.2 x 9.7 x 3 cm (with standoffs). The weight of the STP-62 board is 3.89 ounces or 110 grams.

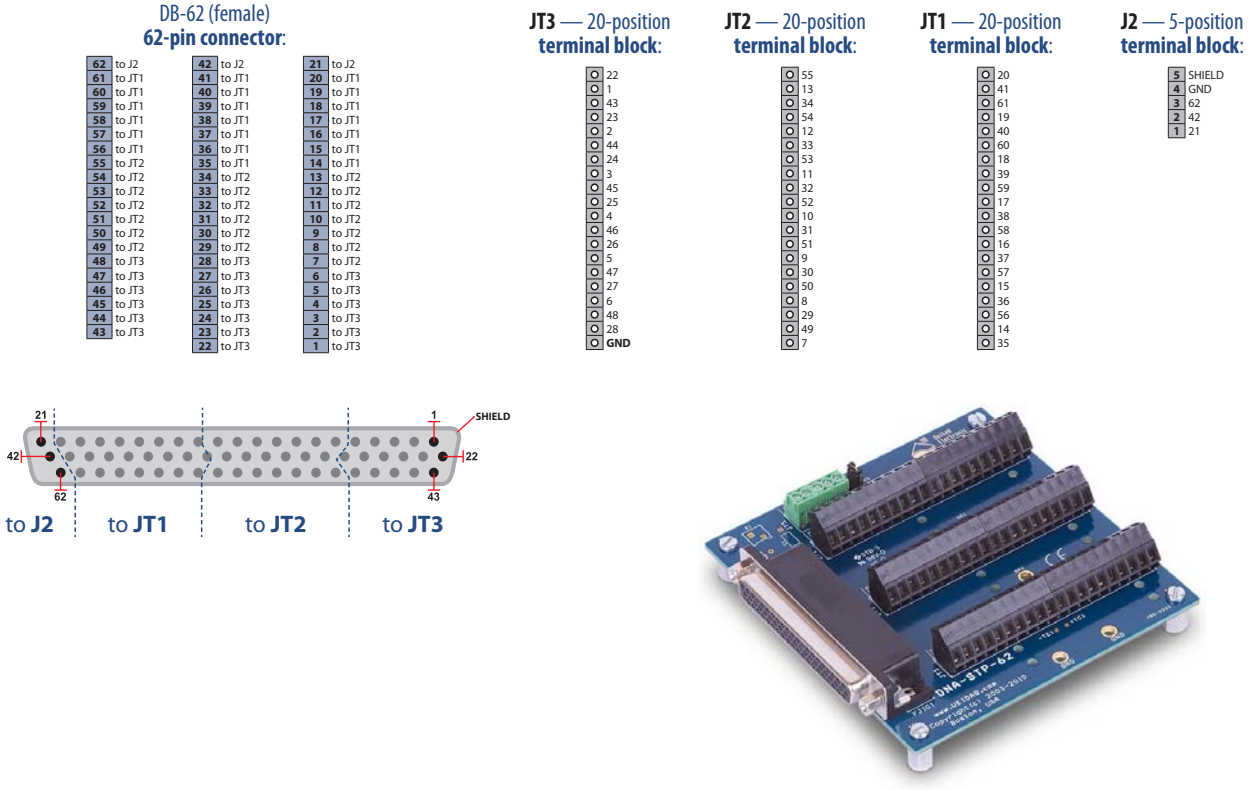


Figure A-1 Pinout and Photo of DNA-STP-62 Screw Terminal Panel

Index