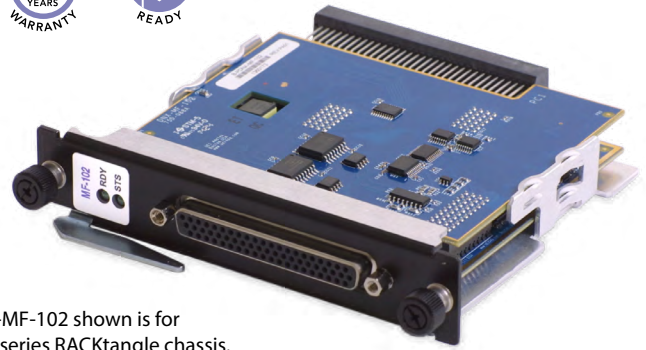


DNA/DNR/DNF-MF-102

Multifunction analog and digital I/O board

- DNA/DNR/DNF-MF-102 for use in Cube, RACKtangle® and FLATRACK™ I/O chassis
- 16 SE/8 Differential 18-bit analog input channels
- ± 80 V to ± 0.156 V analog input ranges
- 2 16-bit ± 10 V or 0–20 mA analog output channels
- 16 digital I/O bits 0–55 VDC
- 500 mA Douts with 16-bit PWM resolution
- Dual 32-bit counters
- Up to 2 kHz update rates
- Dual CAN 2.0 ports
- 1 RS-232/422/485 port
- 350 Vrms Isolation



DNR-MF-102 shown is for DNR series RACKtangle chassis. Also available for DNA (Cube) and DNF (FLATRACK) chassis.

General Description:

The DNA/DNR/DNF-MF-102 are multifunction analog and digital I/O boards for use in UEI's Cube/RACKtangle/FLATRACK I/O chassis respectively. The board offers a powerful combination of I/O including 16 single-ended/8 differential analog inputs, 2 analog outputs, 16 bits of digital I/O, two CAN ports and one RS-232/422/485 port.

The board offers 8 software selectable A/D ranges from ± 80 V to ± 0.156 V with 18-bit resolution. The ± 80 V range makes the DNx-MF-102 an ideal measurement solution in a host of automotive, aerospace and power generation applications where many DAQ products' 10 V maximum input range cannot be used without external signal conditioning. The "high voltage" and "low voltage" configurations are programmable on a per-channel basis. Programmable gains combined with the board's 18-bit A/D converter provides resolution as low as 1.19 μ V. The DNx-MF-102 provides sample rates as high as 2000 sample per second on each channel (16 k/s aggregate). Two ± 10 voltage or current (e.g. 4-20 mA) 16-bit analog outputs are also provided.

The board offers 16 bits of industrial voltage DIO where each bit may be independently set as input or output. The DIO bits have a wide operating range from 3.3V to 55 VDC. The digital inputs have programmable pull up/down resistors that allow inputs to monitor contacts connected to a supply voltage or ground. Inputs are sensed with an A/D converter so high and low voltage thresholds are programmable and allowing change of state detection with 5 μ s resolution. The digital outputs can be set as current sourcing (a switch between Vcc and the output), current sinking (a switch between Gnd and the output), push-pull (connect to Vcc or Gnd but not at the same time) or can act as a simple switch to Vcc or Gnd. Digital outputs can also be configured as flexible controllers with PWM and 16-bit pulse width resolution or softstart. The PWM/softstart parameters are selectable on a per-channel basis. The outputs are protected with 1.25 A fast-blow fuses.

Analog input, industrial digital input (including digital in, analog values and change of state), serial and CAN data may be streamed to their own FIFOs of a single combined FIFO with timestamps. Ain/Din time stamps are generated at the start of the scan, while each byte of serial/CAN data received is time stamped upon receipt.

Two 32-bit counters are provided. The counter inputs can be connected to any digital input pin, while the counter outputs can be used to drive two dedicated industrial outputs.

The MF-102 board includes three communications ports. The first is an RS-232/422/485 that can be set for any baud rate from 300 baud to 2 Mbaud with 0.01% frequency accuracy. The board also offers two CAN 2.0 ports which support Standard, Fast and Fast+ baud rates.

The DNx-MF-102 offers 350 Vrms of isolation between itself and other I/O boards as well as between the I/O connections and the chassis. The

Technical Specifications: (typical at 25°C $\pm 5^\circ$ C unless otherwise stated)

Analog Inputs		
Number of channels	16 single-ended or 8 fully differential	
Input configuration	Multiplexed	
ADC resolution	18 bits	
Sampling rate	2000 samples/second per channel	
High voltage mode	Resolution	Accuracy (at 25°C)
± 80 V	610 μ V	± 24 mV
± 20 V	153 μ V	± 6 mV
± 5 V	38.1 μ V	± 2.5 mV
± 1.25 V	9.54 μ V	± 700 μ V
Input impedance	> 1.13 M Ω Diff / 565 k Ω SE	
Input offset current	< 72 μ A	
Overvoltage protection	± 100 Vdc	
Low voltage mode	Resolution	Accuracy (at 25°C)
± 10 V	76.3 μ V	± 2.5 mV
± 2.5 V	19.1 μ V	± 300 μ V
± 0.625 V	4.77 μ V	± 170 μ V
± 0.156 V	1.19 μ V	± 115 μ V
Input impedance	> 10 M Ω	
Input offset current	± 1 nA max, ± 0.5 nA typical	
Overvoltage protection	± 100 Vdc	
Common mode rejection	100 dB typical (differential mode)	
Isolation	350 Vrms (analog in and out share one gnd)	

analog and digital sections of this board are also isolated. Like all UEI I/O boards, the board offers operation in extreme environments and has been tested to 5g vibration, 100g shock, from -40 to +85 °C temperatures and will function at altitudes up to 70,000 feet.

The board is supported by a variety of cable and screw terminal options certain to meet the needs of almost all users (please see page 4 for details). For those wishing to create their own cables, all connections are through a standard 62-pin "D" connector allowing OEM users to build custom cabling systems with standard, readily available components.

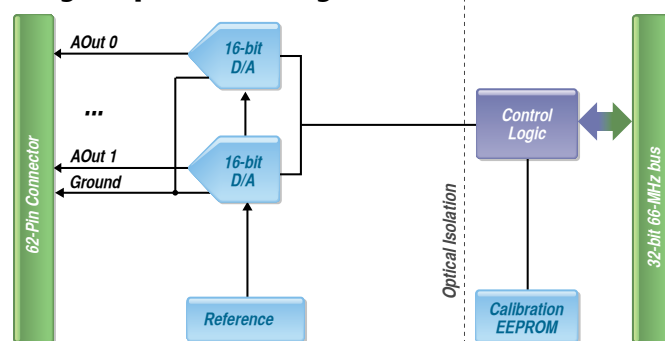
The DNx-MF-102 is supported by a complete software suite including support for Windows, Linux and all popular RTOS. Windows support is provided by the UEIDAQ Framework which includes a powerful software interface to Windows programming languages and DAQ applications including LabVIEW and MATLAB. An extensive factory written software suite is also provided for all popular "non-Windows" operating systems, including Linux, VXworks, QNX, RTX, INtime and more. All software support includes extensive example programs that make it easy to cut-and-paste the I/O software into your applications.

Technical Specifications: (typical at 25°C ±5° C unless otherwise stated)

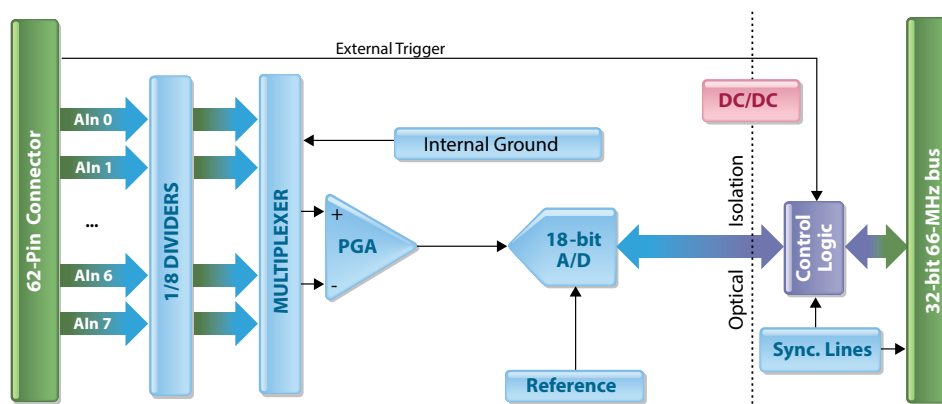
Analog Output	
Channels / resolution	2 channels / 16-bit resolution
Voltage Output mode	
Voltage output ranges	±10 V, ±5 V at ±5 mA
Output accuracy	tempco: 3 ppm/°C typical, 10 ppm/°C max
±10 V	±3 mV
±5 V	±1.5 mV
Output impedance	< 0.1 Ω not including any cables
Current Output mode	
Current output ranges	0–20 mA, 4–20 mA, -1–22 mA
Output accuracy	tempco: 3 ppm/°C typical, 10 ppm/°C max
0–20 mA	±3 µA
4–20 mA	±2.6 µA
-1–22 mA	±3.5 µA
Current outputs	0.02% of FSR (25°C), 0.07% of FSR (over temp)
Maximum load resistance	750 Ω
Update rate : Settling time	2000 update/sec max: 100 µS to 0.03%
Isolation	350 Vrms (analog in and out share one gnd)
Industrial Digital I/O	
Channels / direction	16 bits independently selectable as input or output
Digital Input specifications	
Input range	0–55 VDC
Input high/low voltage	Programmable from 0–55 VDC
Input impedance	>1.1 MΩ
Input open circuit state	98 kΩ Pull-up or pull-down resistors are software enabled
Input protection	±100 VDC
Guardian input accuracy	Tempco: 15 ppm/°C
0–55 V	275 mV
Input throughput	1 kHz max
Digital Output specifications	
Configurations	Current sink/source, Ground/open or Vcc/open (Vcc is user provided in banks of 4 bits)
Output drive	500 mA per channel, continuous
Output protection	1.25 Amp fast-blow fuse on each output
Output voltage drop	< 600 mV at 500 mA (Incl std 3' cable)
Output Off impedance	>1.1 MΩ
Output Off leakage current	< 50 µA (with 55V input)
Output throughput	1000 updates per second, max
PWM output	0 to 100% in 0.0015% increments (16-bit resolution)
PWM cycle rate	up to 10 kHz

CAN 2.0B	
Ports	2
Maximum data rate	1 Mbps
FIFO buffers	TX: 128 messages RX: 256 messages
Serial Port	
Configuration	1 port, software selectable RS-232, 422 or 485
Max baud rate	RS-232: 256 kb/s, RS-422/485: 2 Mb/s
Baud rate selection	300 to 2 Mbaud, 0.01% or better accuracy
RS-232/485 transceiver	MAX3160E with fail-safe RS-485 RX term
FIFO size	2048 words
General and Environmental	
Isolation	350 Vrms of isolation is provided between the MF-102 and other I/O boards as well as between the I/O connections and the chassis. Separate isolation zones and grounds are provided for each of the following signal types: Analog I/O (inputs and outputs have separate grounds) Industrial DIO TTL/Serial CAN 0 CAN 1
Power Consumption	< 5 W (not including output loads)
Operating Temp. (tested)	-40 °C to +85 °C
Operating Humidity	95%, non-condensing
Vibration IEC 60068-2-6	5 g, 10–500 Hz, sinusoidal
IEC 60068-2-64	5 g (rms), 10–500 Hz, broad-band 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
MTBF	140,000 hours

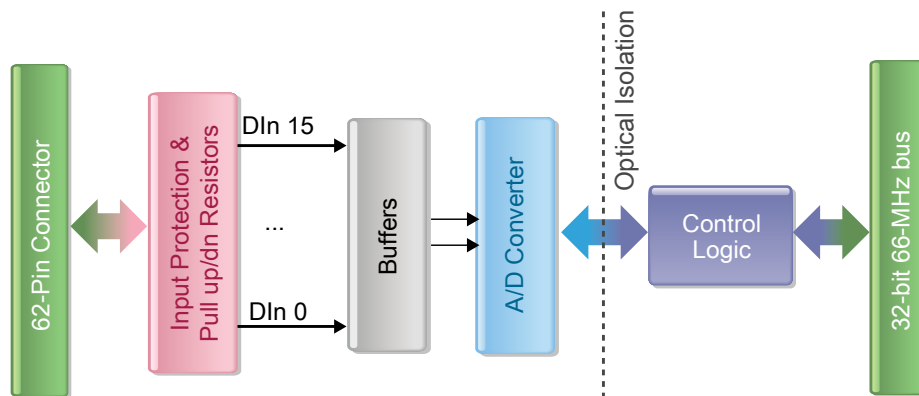
Analog Output Block Diagram:



Analog Input Block Diagram:

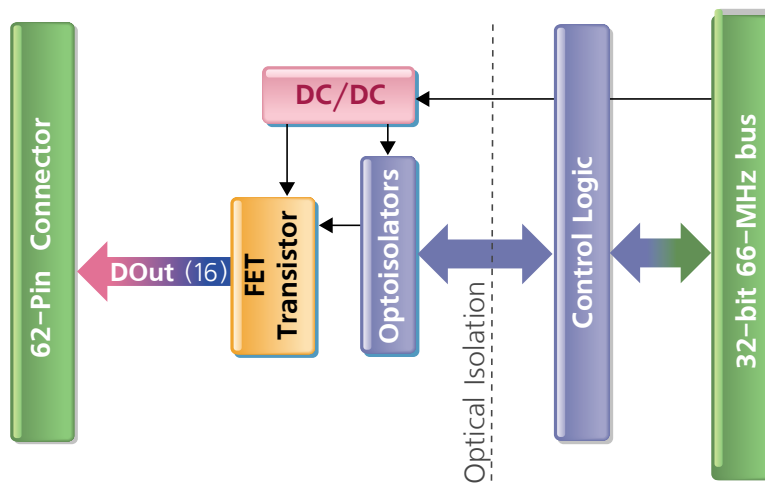


Digital Input Block Diagram:

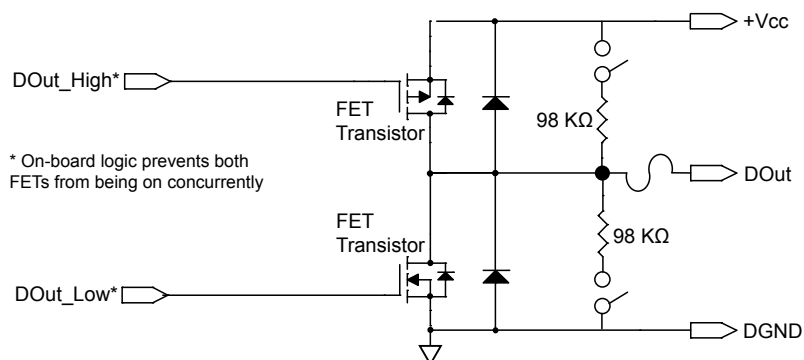


Notes: Dout and DIn share the same pin on the I/O connector. Vcc is provided in blocks of 4 channels. To provide proper output functionality with Vcc left open, a 2 MΩ resistor is connected to an internal 60 V power supply. With neither pull-up/down resistors enabled and the output off, a DMM measurement of the Vcc pin will read approximately +60V. This will not impact functionality with pull-up/down resistors.

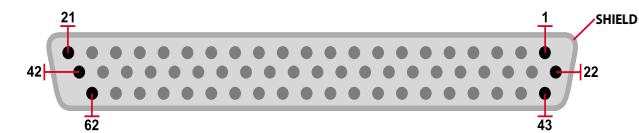
Digital Output Block Diagram:



Notes: Dout and DIn share the same pin on the I/O connector. Vcc is provided in blocks of 4 channels. DIO-0 through DIO-3 share a Vcc connection as do DIO-4 to DIO-7, DIO-8 to DIO-11 and DIO 12- DIO-15. To provide functionality with Vcc left open, a 2 MΩ resistor is connected to an internal 60 V power supply.



Pinout Diagram: DB-62 (female)



Pin	Signal	Pin	Signal	Pin	Signal
1	RTS232/TX485+	22	TX232/TX485-	43	CTS232/RX485-
2	TTL DOut 1	23	TTL/RS Gnd	44	RX232/RX485+
3	TTL DIIn 1	24	+5V-TTL	45	TTL DOut 0
4	DIO-02	25	DGnd	46	TTL DIIn 0
5	DIO-00	26	DV 0-3	47	DIO-03
6	DIO-06	27	DGnd	48	DIO-01
7	DIO-04	28	DV 4-7	49	DIO-07
8	DIO-10	29	DGnd	50	DIO-05
9	DIO-08	30	DV 8-11	51	DIO-11
10	DIO-14	31	DGnd	52	DIO-09
11	DIO-12	32	DV 12-15	53	DIO-15
12	CAN-L1	33	CAN1 Gnd	54	DIO-13
13	CAN-H1	34	CAN0 Gnd	55	CAN-L0
14	AGnd 1	35	AOut 1	56	CAN-H0
15	AGnd 0	36	AOut 0	57	Aln 3/1-
16	Aln 1/0-	37	Aln 0/0+	58	Aln 2/1+
17	Aln 5/2-	38	Aln 4/2+	59	AGnd
18	Aln 7/3-	39	Aln 6/3+	60	AGnd
19	Aln 9/4-	40	Aln 8/4+	61	Aln 11/5-
20	Aln 13/6-	41	Aln 12/6+	62	Aln 10/5+
21	Aln 15/7-	42	Aln 14/7+		

Notes

Signals are isolated in five groups:

1.) Analog I/O (in blue) is referenced to AGnd. All AGnd and AGnd 0/1 pins are connected together on the PCB. However, AGnd 0/1 grounds are matched to the Analog outputs on the PCB. Use AGnd for all analog inputs and AGnd 0/1 for AOut 0/1 respectively.

Aln n/m+ and Aln n/m is for Single Ended analog input channel n or for Differential analog input channel m.

2.) Industrial DIO (in red) is referenced to DGnd. Use DGnd as the return for DIO-n and DV n-m.

DV n-m is the user-supplied Vcc for industrial DO channels n-m. The digital outputs are divided into 4 groups of 4. If you desire to provide a Vcc for the digital output to switch on/off, you have the option of using more than one drive voltage.

3.) TTL and Serial (in black) are referenced to TTL/RS Gnd.

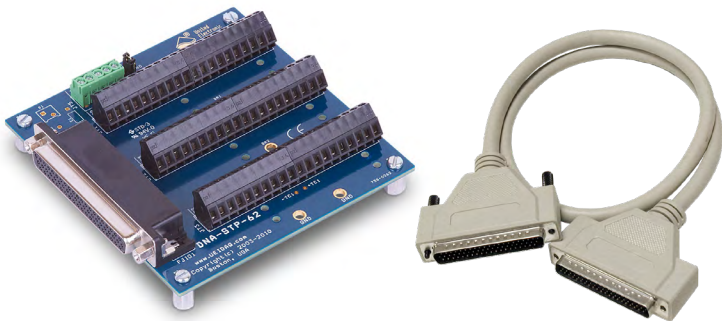
4.) CAN0 (in green) is referenced to CAN0 Gnd.

5.) CAN1 (in purple) is referenced to CAN1 Gnd.

Connectivity options:



The DNA-CBL-MF-1M is a 1 meter 62 conductor shielded cable.



The DNA-MF-102 is also compatible with UEI's popular DNA-CBL-62, 62-pin cable and DNA-STP-62 screw terminal boards. This may be an attractive alternative when space is at a premium and/or your application is not switching high frequency and/or high power digital signals.

Ordering Information

Product	Description
DNx-MF-102	Multifunction I/O board with 16 A/D, 2 D/A, 20 DIO and one RS-232/422/485 port
DNA-CBL-MF-1M	1 Meter 62 conductor shielded cable
DNA-CBL-62	Standard 62-pin cable
DNA-STP-62	Standard 62-terminal screw terminal board
Extended Warranty	Option to purchase UEI's extended 10 year warranty is available