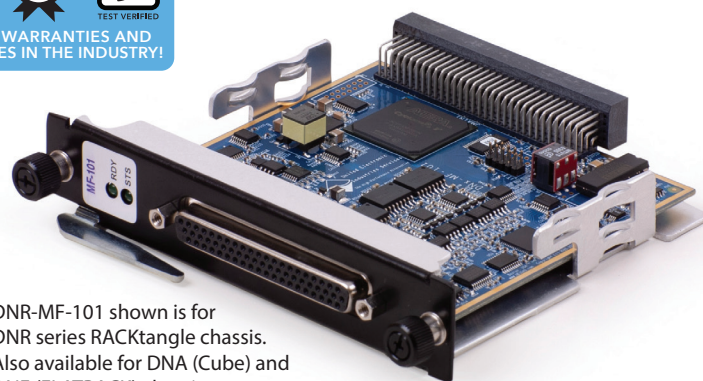


DNA/DNR/DNF-MF-101

Multifunction analog and digital I/O board

- DNA/DNR/DNF-MF-101 for use in "Cube", RACKangle® 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, 4 logic level DIO
- 500 mA Douts with 16-bit PWM resolution
- Dual 32-bit counters
- up to 2 kHz update rates
- Trigger input and output
- 1 RS-232/422/485 port, 1 I²C port
- 350 Vrms Isolation



DNR-MF-101 shown is for DNR series RACKangle chassis. Also available for DNA (Cube) and DNF (FLATRACK) chassis.

General Description:

The DNA/DNR/DNF-MF-101 are multifunction analog and digital I/O boards for use in UEI's Cube/RACKangle/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, 20 bits of digital I/O, one I²C port 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 Volt range makes the DNX-MF-101 an ideal measurement solution in a host of automotive, aerospace and power generation applications where many DAQ products' 10 volts 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 microvolts. The DNX-MF-101 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 20 bits of digital input/output broken into 16 bits of industrial voltages where each bit may be independently set as input or output. Four bits of TTL level DIO are also provided (programmed as I/O in banks of two). Industrial inputs and outputs have a wide operating range from 3.3V to 55 VDC. The industrial range (not logic-level) 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 200 kHz A/D converter so high and low voltage thresholds are programmable and allowing change of state detection with 5 μ s resolution. The industrial range (not logic-level) 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. Industrial 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 Amp fast-blow fuses.

Analog input, industrial digital input (including digital in, analog values and change of state), serial and I²C 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 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-101 board includes two 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 second communications port is an I²C port that fully supports the UM10204 specification and supports Standard, Fast and Fast+ baud rates. The I²C port supports both master and slave concurrently allowing loopback testing and bus monitoring. SDA/SCL have +5V pull-ups, but are also 3.3 V compliant.

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 | ± 12 mV |
| ± 20 V | 153 μ V | ± 3 mV |
| ± 5 V | 38.1 μ V | ± 1.25 mV |
| ± 1.25 V | 9.54 μ V | ± 350 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 | ± 750 μ V |
| ± 2.5 V | 19.1 μ V | ± 200 μ V |
| ± 0.625 V | 4.77 μ V | ± 113 μ V |
| ± 0.156 V | 1.19 μ V | ± 57 μ V |
| Input impedance | > 10 Meg 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) | |

The DNX-MF-101 offers 350 Vrms of isolation between itself and other I/O boards as well as between the I/O connections and the chassis. The 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.

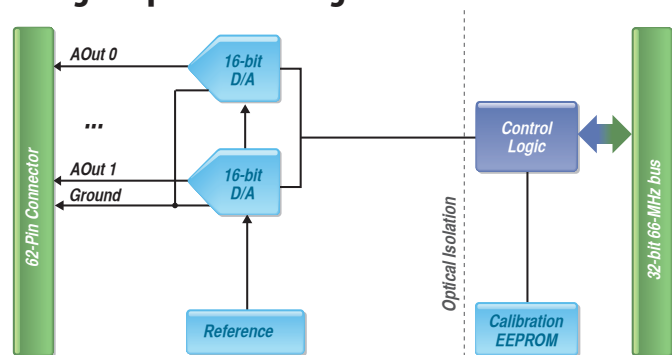
The DNX-MF-101 is supported by a complete software "suite" including support for Windows, Linux and all popular RTOS. Windows support is provided by the UEIDAQ Framework which includes a powerful software interface to Windows programming languages and DAQ applications including LabVIEW and MATLAB. An 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)

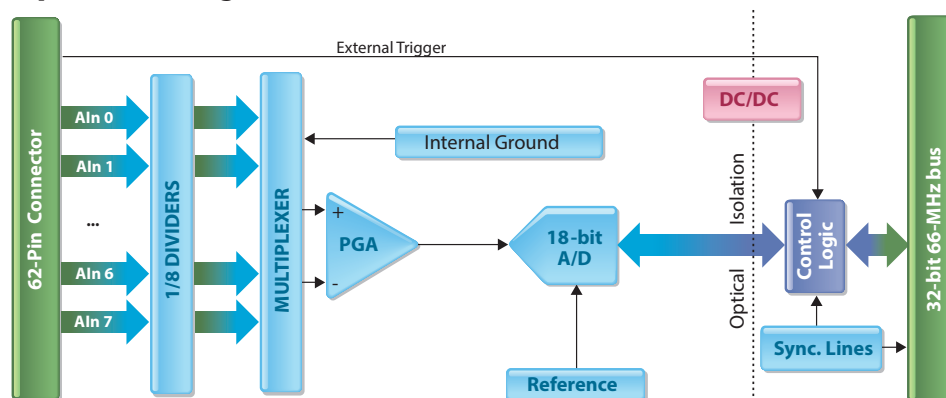
| Analog Output | |
|-------------------------------|--|
| Channels / resolution | 2 channels / 16-bit resolution |
| Voltage Output mode | |
| Voltage output ranges | ±10 V, ±5 V at ±5 mA |
| Output accuracy | tempco: 3 ppm/°C typical, 10 ppm/°C max |
| ±10 V | ±3 mV |
| ±5 V | ±1.5 mV |
| Output impedance | < 0.1 Ω not including any cables |
| Current Output mode | |
| Current outputs | 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 | 1 kΩ |
| 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 |

| Logic-Level Digital I/O | |
|---------------------------|---|
| Bits | 4 (direction set in groups of 2) |
| Logic level | 5 V logic |
| 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 |
| I ² C Port | |
| Ports | 1, Master, Slave or Bus Monitor capability |
| Interface specification | Complies with UM10204 |
| Max SCL speed | 1 Mbit/S (compliant with SM: 100kb, FM: 400 kb and FM+: 1Mb) |
| Logic Level | 5V / 3.3 V compatible |
| Baud rate base clock | 66 MHz, 24 MHz or PLL Based |
| FIFO size | Master Mode: 1k / 1k input/output Slave Mode: 512 / 512 input/output |
| General and Environmental | |
| Isolation | 350 Vrms All analog signals share one ground All digital/communications signals share one ground All analog and digital signals are isolated from the chassis and all other I/O boards |
| Power Consumption | < tbd W |
| 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 | TBD |

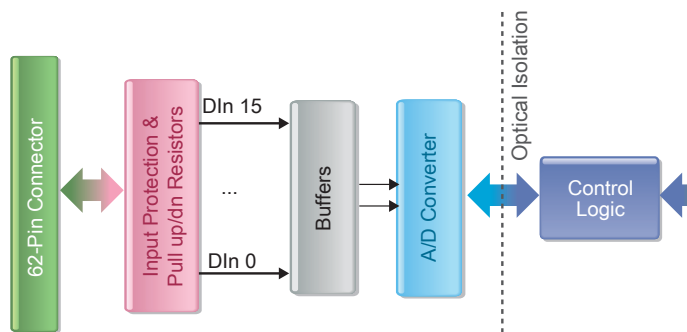
Analog Output Block Diagram:



Analog Input Block Diagram:

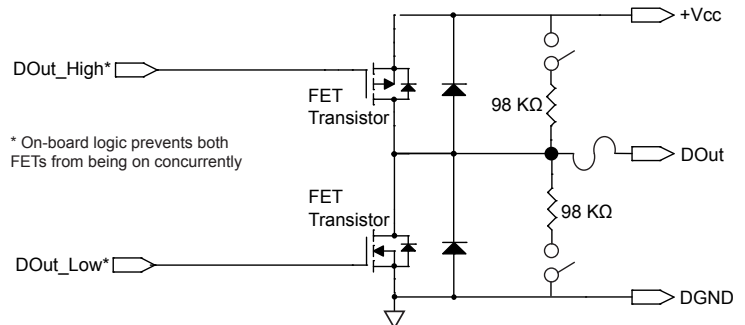
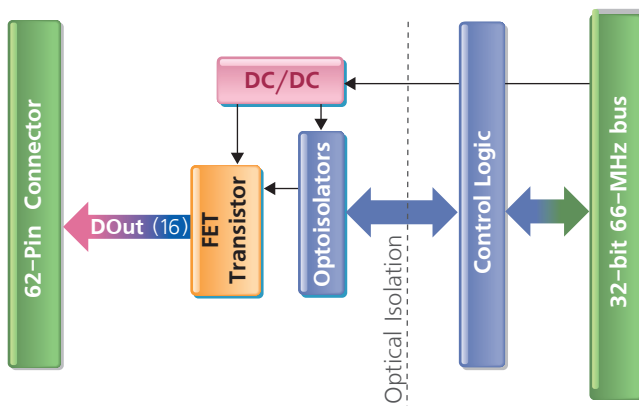


Digital Input Block Diagram:



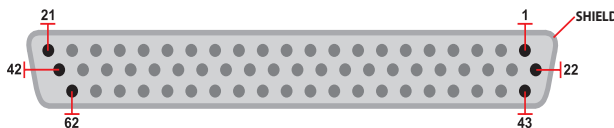
Notes: DOut and DIn share the same pin on the I/O connector. Vcc is provided in blocks of 4 channels. To provide proper output functionality with Vcc left open, a 2 MΩ resistor is connected to an internal 60 V power supply. With neither pull-up/down resistors enabled and the output off, a DMM measurement 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 | I2C SCL | 23 | Gnd | 44 | RX232/RX485+ |
| 3 | I2C SDA | 24 | +5V-TTL | 45 | Trig Out |
| 4 | DIO-02 | 25 | DGnd | 46 | Trig In |
| 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 | TTL 0 | 33 | Gnd | 54 | DIO-13 |
| 13 | TTL 2 | 34 | Gnd | 55 | TTL 1 |
| 14 | AGnd 1 | 35 | AOut 1 | 56 | TTL 3 |
| 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:

AGnd 0/1: All analog inputs and outputs share the same ground. However, AGnd 0/1 grounds are matched to the Analog outputs on the PCB. Using AGnd 0/1 (pins 15, 14) for AOut 0/1 respectively will minimize output noise and voltage drop on the outputs due to PCB resistance.

AGnd: This is the ground for all analog inputs. All AGnd (and AGnd 0/1) pins are connected together on the PCB.

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

DGnd: This is the return for industrial DIO-00 through DIO-15.

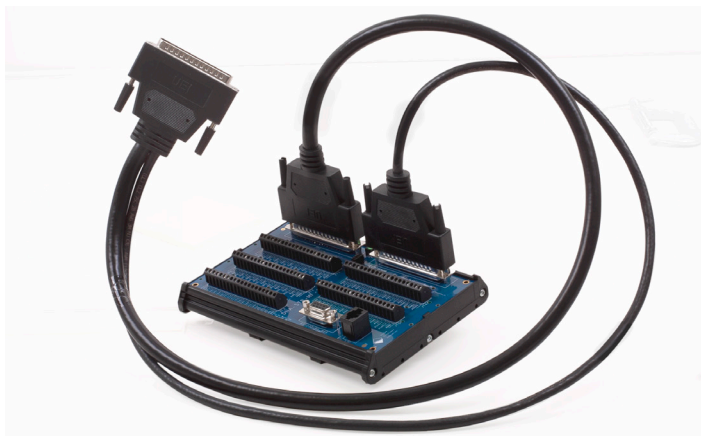
Gnd: This is the return for TTL logic-level signals: TTL 0-3, Trig Out/In, +5V, RS232/485, and I²C.

DV n-m: 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.

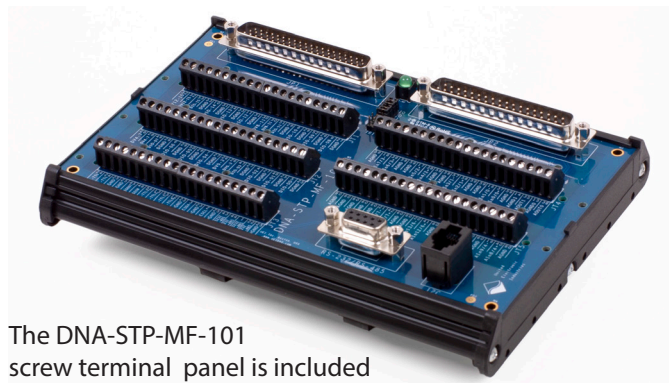
Connectivity options:

The DNA-MF-CBL-STP is the ideal way to connect your field wiring to the DNx-MF-101 board. It provides both the cable and the screw terminal board in one easy-to-order part number. The screw terminal board is designed for intuitive connections where all signal names are shown on the silk screen and all signal types are brought out to the in groups. A 62-pin connector attaches to the DNx-MF-101 board. That cable splits out into separate 37-pin and 62-pin connectors which are plugged into the screw terminal board. The 37/62 pin split cable separates analog signals (37-pin) from digital signals (62-pin). Splitting the analog and digital signals into separate cables ensures good noise performance on the analog signals even when the digital I/O section might be switching high frequencies or currents.

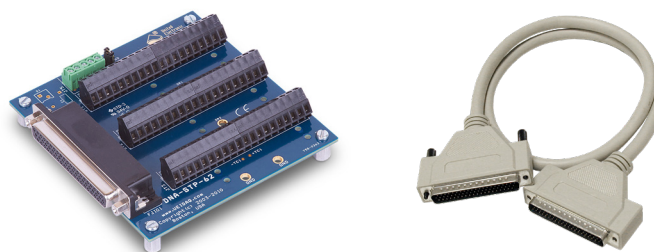
The DNA-MF-CBL-STP contains two pieces. The DNA-CBL-MF-1M cable provides the 62-pin connector for the MF-101 board as the 37/62 pin cables that connect to the DNA-STP-MF-101 screw terminal board. The cable and screw terminal may be ordered separate if desired. This allows you to order spares, but perhaps most importantly, it allows you to hardwire screw terminal boards into more than one system and allows you to move the DNx-MF-101 board between applications without disrupting existing field wiring.



The DNA-CBL-MF-1M is included in the DNA-MF-CBL-STP kit. It provides the connection between the DNx-MF-101 I/O board and the DNA-MF-STP-101 screw terminal board.



The DNA-STP-MF-101 screw terminal panel is included in the DNA-MF-CBL-STP kit. It provides easy connection to all field wiring as all signal names are shown on the board's silk screen.



The DNA-MF-101 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-101 | Multifunction I/O board with 16 A/D, 2 D/A, 20 DIO, one I ² C and one RS-232/422/485 port |
| DNA-MF-CBL-STP | Cable and Screw terminal kit that provides simple connections to all MF-101 signals. Signal names are silk screened onto the screw terminal board. |
| DNA-CBL-MF-1M | 1 Meter 62 conductor shielded cable that connects to DNA-STP-MF-101. (Included with DNA-MF-CBL-STP) |
| DNA-STP-MF-101 | Screw terminal panel specially designed for MF-101 board. Signal names are silkscreened on board. (Included with DNA-MF-CBL-STP) |
| DNA-CBL-62 | Standard 62-pin cable |
| DNA-STP-62 | Standard 62-terminal screw terminal board |