UEI GCIA TSN I/O Adaptor System

Compact 4-Slot Military-Grade I/O Chassis

DNR-MIL-4-34-00-PA-TN

- Military/Rugged 38999 connectivity
- 100% COTS solution
- 5 g vibration, 100 g shock, sealed to IP66
- Dual GigE ports
- Designed for MIL-STD-461/810/1275 compliance
- TSN Deterministic Redundant Ethernet
- Up to 64 Analog Inputs, 8 analog outputs, 64 discrete I/O, 8 CAN ports, 4 RS-232/485 ports all on one chassis
- Fully compatible with UEI's new Cybersecurity products

GENERAL DESCRIPTION

The GCIA TSN I/O Adapter System is the latest deployment of UEI's rugged DNR-MIL-4 unit featuring a powerful quad-core Zynq processor and four I/O board slots. Designed for use in the toughest environments, the DNR-MIL-4 is ideal for military ground vehicle and aerospace deployments as well as a huge assortment of commercial applications. All connectivity is through ROHS compliant 38999 connectors.

This unit includes four I/O boards selected specifically to match critical military applications and that offer an incredibly high channel count.

SYSTEM OVERVIEW

Total Number of Channels Per GCIA TSN I/O System)

- 16 Analog Inputs 80 V
- 2 Analog Outputs +/10 V, 0–20 mA
- 16 Discrete I/O 55 V 500 mA
- 48 Digital Inputs 150 V AC/DC

Ports & Power

- 2 CAN 2.0 Ports
- 9 RS-232/422/485
- 1 24 V 1.6 A Power Out

Reconfigurable System — Breadth of I/O to meet application needs.

Popular configurations include 3 MF-102 boards with CAN and 1 PC-912 power conversion board.

INDIVIDUAL BOARD OVERVIEW

Multifunction Analog and Digital I/O Board with Dual CAN Ports (DNR-MF-102):

- 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
- Dual CAN 2.0 ports
- 1 RS-232/422/485 port
- 350 Vrms Isolation

8-Port RS-232/422/485 serial communications board (DNR-SL-508)

- 8 independent ports
- Each port is software-configurable as RS-232 or RS-422/485
- Maximum speed of 256Kbit/s for RS-232 and 1Mbit/s for RS-422/485
- Completely independent bit rate settings for every port
- 350V isolation between ports, ports and circuitry; 15kV ESD

High Voltage 48-Channel Digital Input Board (DNR-DIO-449)

- ±150 VDC/150 VAC input range
- Sample rate of 1 kS/sec
- Programmable input transition levels & hysteresis
- Change of state detection with 200 µS accuracy
- 350 VAC isolation

- Monitors contacts without external components
- Programmable debounce intervals

Guardian Series Diagnostics

- Analog voltage measurement on each channel
- Internal test signal injection for self-test

+ 24V power conversion board (DNR-PC-912)

- Supplies +24V @1.6A to external devices
- Isolated DC/DC converter
- Overload protection
- Overtemperature shutdown
- Software controlled on/off switch
- Read status of lines: voltage in limits, overload

POWERFUL CPU

The system is equipped with Xilinx Zynq® UltraScale+™ MPSoCs (ZU4EG) processor. Includes quad-core ARM Cortex -A53 MPCore CPU, 4 GB RAM, 8 GB Flash, plus a Xilinx FPGA with 192k logic cells, 176k CLB Flip-Flops, 88k CLB LUTS.

RUGGED & COMPACT DESIGN

The new DNR-MIL-4 is designed to meet the most commonly required elements of MIL-STD-461 and -810 specifications, plus is sealed to at least IP66/NEMA6 standards. All this is housed in a compact, 9.5" W x 7.1" D x 4.3" H chassis, weighing less than 10 pounds and typically consuming less than 30 W. Heat transfer from the internal electronics to the external chassis is designed such that no fans or rotary cooling is required. All internal printed circuit boards are conformal coated to ensure the highest reliability.

TECHNICAL SPECIFICATIONS

Computer Interface	MIL Series Ruggedized Chassis
Primary Ethernet Port	10/100/1000Base-T, 38999 connector
Diagnostic Port	10/100/1000Base-T, 38999 connector—alternatively can be teamed/bonded with primary port
Configuration/Serial Port	RS-232, 38999 connector
Synchronization Options	1. IEEE-1588/TSN 802.1AS 2. DNR-SYNC-1G series cables and boards provide both clock and trigger sync signals 3. DNR-IRIG-650 board provides IRIG and GPS time synchronization
I/O Board Support	
Series supported	All DNR-series boards
TSN Support	
Zynq CPU series	Redundant (FRER). Profiles supported include: 802.1Qbv, 802.1Qbu/802.3br, 802.1AS, 802.1Q, 802.1Qav, 802.1CB.
Software/Operating System	
Embedded OS	Linux, kernel 5.4.x
Real-time support	Linux RT
Development Language	C/C++, Eclipse IDE support
Development Environments	Linux PC or Cygwin Windows environment
SNMP Library	Yes
OS royalties	None
Processor/System	
CPU	Xilinx Zynq® UltraScale+TM SoC quad-core ARM; Integrated FPGA; ZU4EG Series at 1.2 GHz clock speed
Memory (RAM)	4 GByte
Solid State Hard Drive	Optional 42-22, 60-22 NVMe M.2 cards up to 320 GByte
USB drive interface	Standard USB 3.0 port
Memory (Flash)	8 GByte eMMC
Host Communications (DNR-MIL-4 Only)	
Distance from host	100 meters maximum, CAT5/6 cable
Ethernet data transfer rate	20 MB/s
Analog data transfer rate	>6 MS/s. Capable of sustained transfer in any RACKtangle configuration
DMAP/VMAP real-time I/O mode	Update >1,000 I/O channels at 4 kHz, guaranteed
Physical Dimensions/Weight	
4 I/O slots	9.5" W x 7.1" D x 4.3" H, 10 lbs. including I/O boards
Environmental	
Electrical Isolation	350 Vrms
Temperature (operating)	-40 °C to 70 °C
Temperature (storage)	-40 °C to 70 °C
Humidity	0 to 95%, non-condensing
Vibration (IEC 60068-2-64) (IEC 60068-2-6)	MIL-STD-810 G plus the IEC standards below 10–500 Hz, 5 g (rms), broadband random 10–500 Hz, 5 g, sinusoidal
Shock (IEC 60068-2-27)	MIL-STD-810G plus the IEC standards below 100 g, 3 ms half sine, 18 shocks at 6 orientations 30 g, 11 ms half sine, 18 shocks at 6 orientations
Altitude	70,000 feet, maximum
EMI / RFI	Designed to meet MIL-STD-461
Sealing	Default unit sealed to IP 66 or better. Pressure relief valves support continuous altitude changes of 5000 fpm. Units can be configured with bottom weep holes if desired.
Power Requirements	
Voltage	9 – 36 VDC (115/220 VAC adaptor available)
Power	12 W (not including I/O boards)
Power Quality requirement	Designed to meet MIL-STD-704/1275
Reliability	
MTBF	100,000 hours

CABLES, CONNECTORS & SCREW-TERMINAL PANELS

CONNECTORS

All connections to the DNR-MIL-4 are made through standard, COTS, nickel plated 38999 connectors. I/O board connections are made through 128-pin connectors where each I/O board utilizes up to 62 of the 128 pins. The Ethernet, USB, diagnostic Serial, Sync, and hardware reset connections are via 37-pin connectors. Power supply and an auxiliary synch bus connections are through a 13-pin connector. Optional keying is available on the 128 pin, I/O connectors. For keying order:

DNA-38999-KEY: Clocked/keyed I/O connectors (N, A keys)

CABLES

Though most customers will design custom cables for their deployed systems, customers working on prototypes and/or those building "one off" systems may desire the ability to connect to the DNR-MIL-4 using more traditional, commercial connections (e.g. RJ-45 for the Ethernet ports).

For these customers, UEI offers a complete array of cables and screw terminal panels that will provide direct access to all signals routed in and out of the chassis.

LAN/Power Cables

■ **DNA-CBL-LAN-06** Communications cable
6 foot cable connecting the 37-pin LAN/COM/USB port connector to standard commercial connectors. Ethernet ports come out to RJ-45, the serial port to a DB-9 and the USB ports to standard USB jacks.

■ **DNA-CBL-1315-03** Power supply cable
Connects the 13-pin power/sync connector to a standard female DB-15 connector.

I/O board cables

Each 128 pin I/O 38999 connector provides the I/O connectivity for two I/O slots within the DNR-MIL-4. UEI I/O boards utilize either 37- or 62-pin D connectors, and these connectors are mapped as follows.

I/O slots one and three map to pins 65–126 on the 38999 connectors (please see diagram below). I/O slots two and four map to pins 1–62 on the 38999s. Note that the 37-pin based boards simply do not use pins 38–62. For this reason, most applications can standardize on 62-pin cables and screw terminal panels and simply ignore "no connection" pins. The exception to this is the STP boards that have been specifically designed for use with 37-pin boards (e.g. DNA-STP-207TC). For these boards 37-pin are also available. Also, as some I/O slots

may not be utilized in a given application, cables with a single 37-pin or 62-pin D connector are also available.

The following cables provide the same I/O connectivity as the standard, commercial DNA-CBL-37S and DNA-CBL-62 series cables.

■ **DNA-CBL-12862-5** 5 ft male 128-pin 38999 to 2x DB-62M

■ **DNA-CBL-12837-5** 5 ft male 128-pin 38999 to 2x DB-37F

■ **DNA-CBL-6237M-3** 3 ft male RoHS 128-pin 38999 to 1x DB-37F and 1x DB-62M

■ **DNA-CBL-62M-03** 3 ft male 128-pin 38999 to 1x DB-62M

■ **DNA-CBL-37M-03** 3 ft male 128-pin 38999 to 1x DB-37F

SCREW TERMINAL PANELS

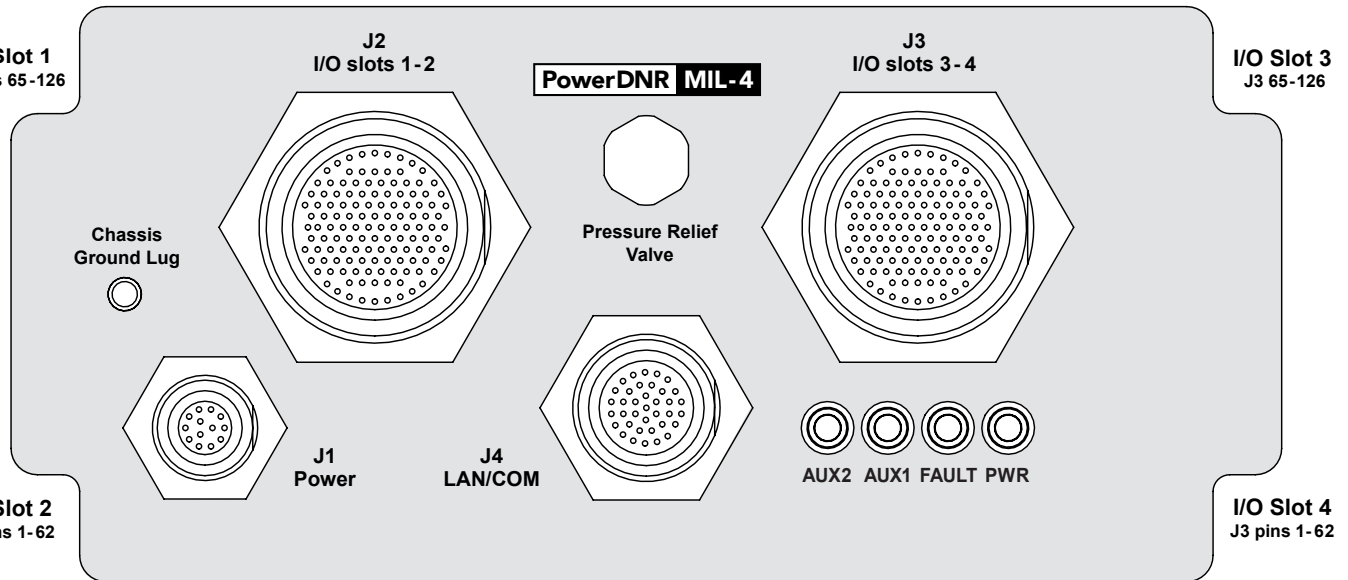■ **DNA-STP-37**
Standard 37-pin screw terminal panel, suitable for use with all 37-pin I/O boards and cables.

■ **DNA-STP-62**
Standard 62-pin screw terminal panel, suitable for use with all 62-pin I/O boards and cables.
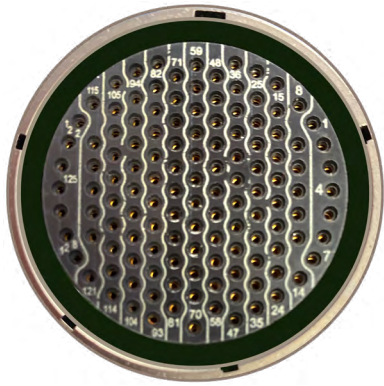
■ **DNA-STP-3762**
Standard 37-pin screw terminal panel, providing both 37- and 62-pin connectors and suitable for use with any combination of I/O board.

FRONT PANEL LAYOUT

38999 CONNECTOR PINOUTS

128-pin I/O

Pin #	I/O slot	Board Pin
1	2 / 4	1
2	2 / 4	2
3	2 / 4	3
4	2 / 4	4
5	2 / 4	5
6	2 / 4	6
7	2 / 4	7
8	2 / 4	8
9	2 / 4	9
10	2 / 4	10
11	2 / 4	11
12	2 / 4	12
13	2 / 4	13
14	2 / 4	14
15	2 / 4	15
16	2 / 4	16
17	2 / 4	17
18	2 / 4	18
19	2 / 4	19
20	2 / 4	20
21	2 / 4	21
22	2 / 4	22
23	2 / 4	23

Pin #	I/O slot	Board Pin
24	2 / 4	24
25	2 / 4	25
26	2 / 4	26
27	2 / 4	27
28	2 / 4	28
29	2 / 4	29
30	2 / 4	30
31	2 / 4	31
32	2 / 4	32
33	2 / 4	33
34	2 / 4	34
35	2 / 4	35
36	2 / 4	36
37	2 / 4	37
38*	2 / 4	38
39	2 / 4	39
40	2 / 4	40
41	2 / 4	41
42	2 / 4	42
43	2 / 4	43
44	2 / 4	44
45	2 / 4	45
46	2 / 4	46

Pin #	I/O slot	Board Pin
47	2 / 4	47
48	2 / 4	48
49	2 / 4	49
50	2 / 4	50
51	2 / 4	51
52	2 / 4	52
53	2 / 4	53
54	2 / 4	54
55	2 / 4	55
56	2 / 4	56
57	2 / 4	57
58	2 / 4	58
59	2 / 4	59
60	2 / 4	60
61	2 / 4	61
62	2 / 4	62
63	n/a	n/a
64	n/a	n/a
65	1 / 3	1
66	1 / 3	2
67	1 / 3	3
68	1 / 3	4
69	1 / 3	5
70	1 / 3	6
71	1 / 3	7
72	1 / 3	8
73	1 / 3	9
74	1 / 3	10
75	1 / 3	11
76	1 / 3	12
77	1 / 3	13
78	1 / 3	14
79	1 / 3	15
80	1 / 3	16
81	1 / 3	17
82	1 / 3	18
83	1 / 3	19
84	1 / 3	20
85	1 / 3	21
86	1 / 3	22
87	1 / 3	23

Pin #	I/O slot	Board Pin
88	1 / 3	24
89	1 / 3	25
90	1 / 3	26
91	1 / 3	27
92	1 / 3	28
93	1 / 3	29
94	1 / 3	30
95	1 / 3	31
96	1 / 3	32
97	1 / 3	33
98	1 / 3	34
99	1 / 3	35
100	1 / 3	36
101	1 / 3	37
102	1 / 3	38
103	1 / 3	39
104	1 / 3	40
105	1 / 3	41
106	1 / 3	42
107	1 / 3	43
108	1 / 3	44
109	1 / 3	45
110	1 / 3	46
111	1 / 3	47
112	1 / 3	48
113	1 / 3	49
114	1 / 3	50
115	1 / 3	51
116	1 / 3	52
117	1 / 3	53
118	1 / 3	54
119	1 / 3	55
120	1 / 3	56
121	1 / 3	57
122	1 / 3	58
123	1 / 3	59
124	1 / 3	60
125	1 / 3	61
126	1 / 3	62
127	-	n/a
128	-	n/a

Pins 38–62 are not applicable if I/O slot 1 contains a 37-pin board

## 37-pin LAN / COM port—mating connector required: D38999/26WD35PN
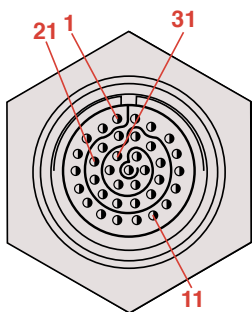
Pin number	Pin designation
1	LAN0 TX+ / DA+
2	LAN0 RX+ / DB+
3	LAN0 nc / DC-
4	LAN0 nc / DD+
5	Shield
6	Lan1 TX+ / DA+
7	LAN1 RX+ / DB+
8	LAN1 nc / DC-
9	LAN1 nc / DD+
10	Shield
11	Misc In
12	USB1 P+
13	USB1 D+

Pin number	Pin designation
14	USB2 P+
15	USB2 P-
16	USB2 D+
17	USB2 D-
18	LAN0 TX- / DA-
19	LAN0 nc / DC+
20	LAN0 RX- / DB-
21	LAN0 nc / DD-
22	LAN1 TX- / DA-
23	LAN1 nc / DC+
24	LAN1 RX- / DB-
25	LAN1 nc / DD-
26	Misc Out

Pin number	Pin designation
27	USB1 P-
28	USB1 D-
29	Sync Clock Out
30	Sync Trig Out
31	RS232 TX
32	RS232 RX
33	RS232 GND
34	Sync Clock In
35	Sync Trig In
36	Sync +5V
37	Sync Gnd

13-pin power connector—
mating connector required: D38999/26FB35PN
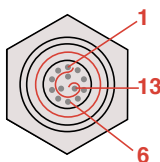
Pin #	Pin Designation
1	GND
2	GND
3	GND
4	Vcc (9-36 VDC)
5	Vcc (9-36 VDC)
6	Vcc (9-36 VDC)
7	Sync In2 / reset
8	Sync In0
9	Sync In1
10	Sync Gnd
11	Sync Out1
12	Sync +5V
13	Sync Out0