FlightSafety
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Simulation

&

United Electronic Industries

®

High Performance Real-Time I/O and Control

Sim*I/O*

**Made possible with the new PowerDNR RACKtangle™ from UEI**

Version 3.0

Increased up-time: The RACKtangle based SimI/O series was designed from the start to provide unprecedented "up time" and reliability. The I/O is mounted directly on the simulator rather than an off-sim cabinet. This eliminates over 80% of the waterfall wiring and dramatically reduces the likelihood of a cable failure. The system also includes a complex level of system diagnostics that identifies pending and/or existing system faults before they impact training schedules.

Higher Performance: The new system is based entirely upon Gigabit Ethernet technology, ensuring the communications between the host computer system and the simulator is extremely fast. The tight coupling of the hardware and real-time operating system software allowed by using a single API and driver also enhances system speed. Having the I/O onboard increases the signal-to-noise ratio due to the proximity of the data acquisition electronics to the signal source. These factors combined allow SimI/O simulators to be operated at 2000 updates per second.

Faster repairs and maintenence: The SimI/O offers incredible reliability, but no system offers 100% reliability. Once a failure is noted, the key is quick fault identification and repair. Every output in the system can be independently monitored. All inputs can be connected to a test signal. This allows faults to be automatically detected and the system informs the repair technician via wireless notepad exactly where the problem lies and how to correct it. In the time it takes for the instructor and trainees to grab a cup of coffee, the sim is often back on-line.

Secure COTS source: When FSI realized VME product obsolescence could someday adversely impact their ability to build and maintain their simulators, they made the choice to seek out an I/O partner rather than simply select new products from multiple vendors. The partnership formed with UEI ensures a totally secure source of product. Not that supplying OEMs with a continuous source of products is new to UEI. The company still supplies OEM customers with ISA-bus boards designed over 20 years ago!

Additional benefits: The SimI/O requires less time to install and reduces "off-simulator" cabinet size by 50%. The tight integration of I/O and the simulator will also reduce the time and effort required to develop simulators for new aircraft.
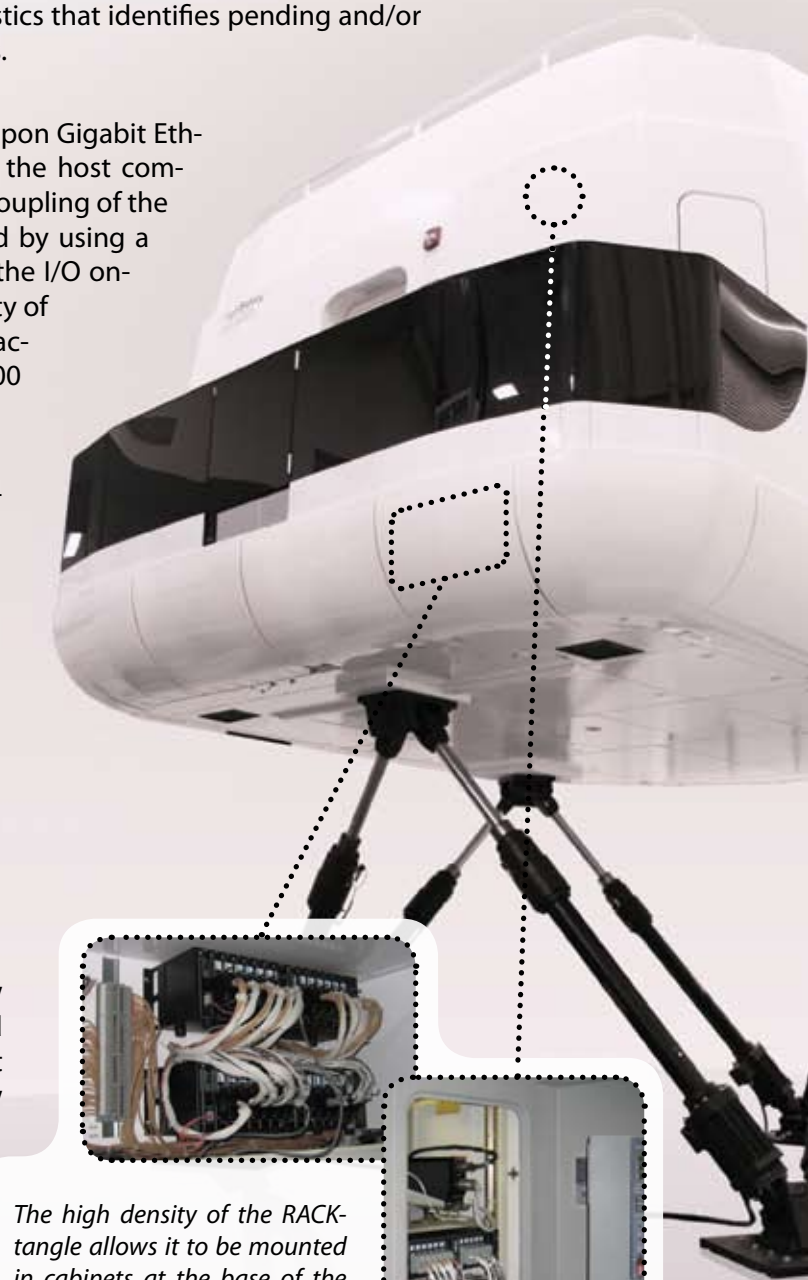
The high density of the RACKtangle allows it to be mounted in cabinets at the base of the simulator (above) or in racks within the simulator (right) rather than in "off-sim" racks.

For more information please download our white paper at: ***www.ueidaq.com/FSI-RACKtangle***

UEI's RACKtangle I/O series provides the entire interface between the host computer and the simulator, including; control/loading/motion, controlling and monitoring all flight deck I/O and providing a direct interface to all avionics.

Features *(with numbered callouts)***:**

I/O Board Slots (1)

The DNR rack provides 12 I/O slots. All combinations of DNR-series I/O boards are allowed offering over literally trillions of possible configurations. DNR series I/O boards are fully plug-and-play. There is no hardware configuration required. Empty slots are covered with blank panels to maintain air flow, reduce EMI and protect the system from dust accumulation. Your signals may be connected directly to the I/O boards via your custom cabling or take advantage of our wide variety of easy-to-use, external screw terminal panels.

CPU and Gigabit Ethernet NIC Module (2)

The DNR series controller and NIC interface are provided in the center slot. This configuration maximizes system noise immunity by reducing the maximum distance an I/O board may be from the CPU. In addition to providing the CPU, this module provides the two Network/Ethernet ports, the two USB 2.0 ports, the serial configuration port, the recessed reset button, the inter-rack sync interface and the SD Card slot.

Passive Backplane

The backplane of the DNR rack contains no active components. This means the DNR chassis itself offers an almost unlimited MTBF. All active components in a DNR system are on easily replaced boards. The DNR-Buffer module provides the interface between the CPU and the various I/O boards. Placing the drive circuitry on a removable board rather than on the backplane ensures the backplane remains totally passive.

Flexible Mounting (3)

The DNR-series racks include industrial quality rubber feet for table-top applications. The DNR-Bracket kit allows the rack to be mounted on an flat wall or surface or in a standard 19" rack (requires 3U spacing).

Power Supply Module (4)

Power-In, 9-36V DC either from the DNA-PSU-24 (included with the rack), or a user-supplied source. All power supplies are monitored. Power supply status supplied to the CPU module as well as displayed on annunciator LEDs (see layout below).

Protected On/Off Switch (5)

The On/off switch is mounted within two metal shields which ensure the switch will not be inadvertently turned on or off.

Diagnostics & System Health Monitoring

The RACKtangle I/O systems provide significant diagnostic and health monitoring capability including: Current and voltage monitoring on digital outputs, Analog voltage monitoring on digital inputs, Built-in chassis temperature monitoring and more. This allows the system to diagnose and sometimes predict failures before they cause major problems. All functions are fully supported by the supplied API.

Rugged and Industrial

All aluminum construction ensures excellent immunity to shock and vibration. Operationally tested from -40°C to +70° C and rated for use up to 70,000 feet. The RACKtangle I/O chassis is fully CE certified.
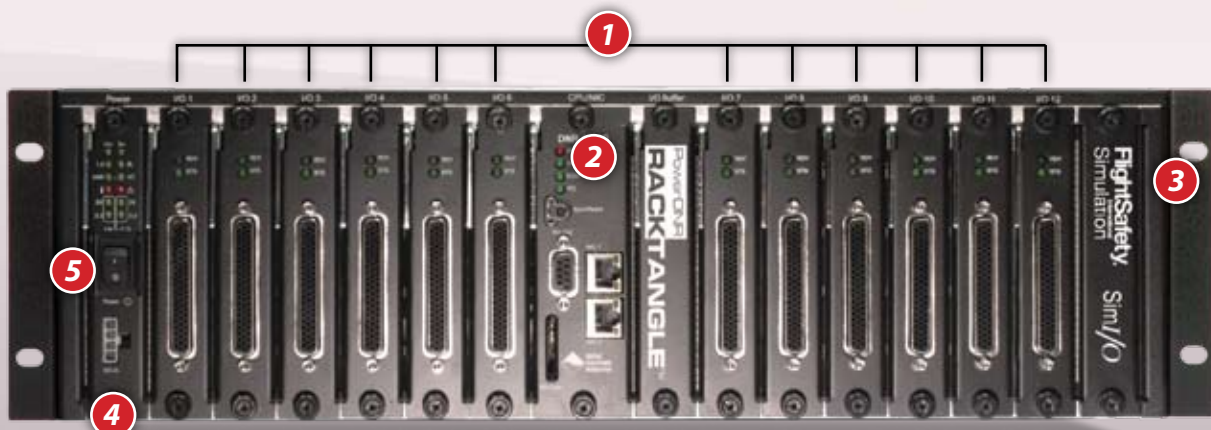
RACKtangle 3U Ethernet I/O Chassis

DNR-12-1G
RACKtangle™ Ethernet I/O Chassis

- Allows the installation of up to 12 I/O boards
- Over 30 different I/O boards available
- Front-loading I/O boards for rapid reconfiguration or repair
- Two independent 1000Base-T Gigabit Ethernet Interfaces
  (One primary port and one diagnostics port)
- Powerful built-in diagnostics and software monitoring
- Dual USB 2.0 ports (one controller and one slave)
- Inter RACK Sync Interface
- Compact : 5.25" × 6.2" × 17.5" (3U) provides 12 I/O slots
- Up to 300 A/D, 576 DIO, 384 D/A, 144 ARINC-429 channels per rack
- Rugged: 3 g Vibration, 50 g Shock, -40°C to +70°C
- Real-time: 1000 I/O scans in < 1 millisecond
- Complete Windows, Linux and RT OS support
- LabVIEW™, MATLAB®, DASYLab™ support and more

DNR-12-1G includes rack/chassis, dual channel NIC, CPU, dual USB 2.0 ports, buffer board, power supply, software, flange brackets and slot covers for empty slots.

The powerful diagnostics software shown above monitors all system power supplies, temperatures and fan operation.

General Description:

The DNR-12-1G RACKtangle is a compact (3U), rugged Ethernet I/O rack. Though the I/O electronics are identical to our popular PowerDNA "Cube" series, the *RACK*tangle DNR series provides two Gigabit Ethernet interfaces and slots for 12 I/O boards. The front-loading configuration allows the I/O boards to be quickly and easily installed into and removed from the rack. These capabilities dramatically increase performance and simplify system reconfiguration. The backplane within the rack contains no active electronic components, ensuring the rack itself has an almost unlimited MTBF. It also means all active components are on easily replaceable I/O modules, offering an extremely short MTTR in critical applications.

The RACKtangle is an excellent, modern alternative to VME based systems. As more and more VME vendors are "end-of-lifing" boards, particularly data acquisition and control I/O boards, many customers are being forced to consider alternative platforms. The DNR series is not only new, ensuring long-term availability, its 3U chassis has the distinct advantage of offering equivalent performance in one half the rack space of a typical 6U VME rack.

Another key advantage of the RACKtangle is its ability to work in conjunction with UEI's popular PowerDNA cube in "mixed"
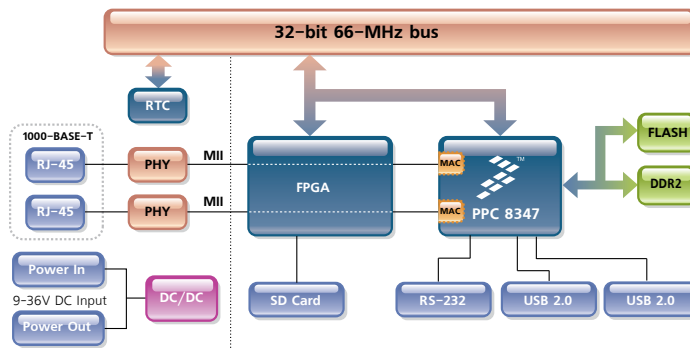
applications. Distributed systems frequently have requirements for a high number of I/O points at a few locations, while requiring smaller numbers at more remote spots. The RACKtangle is the ideal solution on the "main" rack, while the cubes provide the perfect balance of small footprint, ruggedness and performance required at the remote sites.

DNR series I/O boards are electronically identical to the DNA boards developed for use in UEI's I/O Cubes. The DNR-12-1G is supported by a rapidly growing complement of I/O boards, currently numbering greater than 30. The DNR RACKtangle chassis is ideally suited for a wide variety of industrial, aerospace, automotive, and laboratory data acquisition and control applications.

The DNR-12-1G chassis provides an 8347 PowerPC CPU, two Ethernet Network Interfaces, a USB 2.0 controller port, a USB 2.0 slave port, indicator lights, timing/trigger interface, configuration ports, backplane buffer and power supply. The bulk of the rack is dedicated to the 12 I/O slots. These slots are populated with I/O boards selected to match your application. With over 30 different I/O boards available, we're sure to have just what your application requires. We currently offer: Analog input boards (with up to 24-bit resolution) to

Controller Block Diagram:

Block diagram elements:
- 32-bit 66-MHz bus
- RTC
- 1000-BASE-T: RJ-45, PHY, MII
- RJ-45, PHY, MII
- Power In, 9-36V DC Input, Power Out
- DC/DC
- FPGA
- SD Card
- PPC 8347, MAC, MAC
- FLASH
- DDR2
- RS-232, USB 2.0, USB 2.0

General Description: (continued)

measure voltage, current, strain gages, thermocouples and more, Analog output boards with output ranges up to ±40V or ±50 mA, Digital I/O interfaces for logic and "real-world" signal levels, counters and timers, quadrature encoder inputs, and Communications interfaces for ARINC-429, MIL-STD-1553, RS-232/422/485 and the CAN bus.

A variety of Ethernet based communication "modes" provide the interface between the host PC and the DNR rack. Largely transparent to the user and fully compliant with standard Ethernet operation, these communication modes have been optimized for certain application types. The first is simple, single point, programmed I/O. This mode is simple and is suitable for most systems where high speed or precise sample timing are not required. The second mode is the ACB (Advanced Circular Buffer). In ACB mode, data is written to and from buffers on the I/O boards rather than directly to the Ethernet port. ACB mode is preferred for high speed acquisition/control or where precise timing is required, as the buffers are large enough to ensure data is not lost due to Ethernet timing latencies. The third mode is DMAP. In DMAP mode, cubes use our patented DAQBIOS Ethernet protocol to ensure deterministic real-time performance and achieve sub-millisecond response times across more than 1000 I/O (analog and/or digital) points. Finally, there are two high speed messaging modes that allow real-time performance when transferring data to and from any of the communications I/O boards (e.g., the ARINC-429 or CAN-bus interface).

No system is complete without software. The DNR-12 rack is supported by all the popular operating systems including Windows, Vista and Linux. The RACKtangle also has exceptional support for the QNX, VXWorks, RTX, RT Linux and RTAI Linux Real-time operating systems. The UEIDAQ Framework included with the rack provides a simple and universal API and supports all common programming languages as well as OPC and ActiveX applications. The rack is fully supported by all popular application packages such as LabVIEW, MATLAB, DASYLab and more.

The DNR-12 rack offers a wide variety of mounting options. The standard 3U rack is provided with rubber feet, which make the DNR-12 ideal for desk or table top applications. Flange brackets mounted on the rear of the chassis allow the RACKtangle to be mounted directly on a wall, on the back of a NEMA enclosure, or on any flat surface. Installation of the brackets on the front of the rack allows the RACKtangle to be installed in any standard 19" rack (3U height).

DNR Series Advantages:

Easy to Configure and Deploy
- Over 30 different I/O boards available
- Over 5 quadrillion possible configurations
- Built-in signal conditioning
- Gigabit Ethernet based
- Bracket kit for mounting to wall or in 19" racks
- Industrial quality rubber feet for solid table-top mounting
- Passive backplane ensures extremely high MTBF
- Standard "Off-the-shelf" products and delivery

True Real-time Performance
- 1 msec updates guaranteed with 1000 I/O
- Up to 6 million samples per second
- Use QNX, RTX, RT Linux, RTAI Linux, VXworks

Extensive Built-in Diagnositcs
- Two independent Ethernet ports. One for primary control and one purely for diagnostic support
- Built-in temperature monitoring
- Built-in power supply voltage and current monitoring
- Guardian series I/O boards provide extensive diagnostic monitoring

Flexible Connectivity
- 10/100/1000Base-T with Cat-5 cable
- Supports WIFI / GSM / Cell networks
- Built-in USB 2.0 slave and controller ports

Compact Size:
- Standard 3U Rack mount
- 300 analog inputs, 384 analog outputs, 576 digital I/O bits, 96 counter/quadrature channels, 144 ARINC-429 channels, 48 RS-232/422/485 ports per rack

Low Power:
- Less than 15 watts per typical rack (not including I/O)
- AC, 9-36 VDC, or battery powered.

Rugged and Industrial:
- Solid aluminum construction
- Operation tested from -40°C to +70°C
- Vibration tested to 3 g, (operating)
- Shock tested to 50 g (operating)
- All I/O isolated from rack and host PC.

Outstanding Software Support
- Windows, Linux, RT Linux, Windows RT, RTX , VXWorks and QNX operating systems
- VB, VB .NET, C, C#, C++, J#
- MATLAB, LabVIEW, DASYLab, OPC, ActiveX support

CPU and NIC Interface

Status LEDs

LEDs display the status of internally monitored parameters including: Internal temperature, system self-test status, bus activity, SD card activity and provide confirmation that required CPU/NIC power supply voltages are within specifications. The USR LED is controlled by the application program allowing a service technician to confirm he/she is working on the correct rack in multiple rack installations.

Sync Connector

High-speed Cube-to-Cube synchronization connector. This connector allows triggers or clocks to be shared among racks. Two racks may be connected together directly or larger systems may take advantage of the DNA-SYNC interface to share timing signals among many racks.

SD Card Slot

Secure Digital (SD) Card slot for onboard data storage. The SD Card is used as the data storage media in the UEILogger series. It also stores both data and Linux embedded programs deployed on the rack using the soon to be released embedded toolkit. Supports FAT12, FAT16 and FAT32 file systems.

Serial Port

The serial port is used primarily for system setup and configuration. The rack may be configured from any serial terminal running in 57,600 baud/8 data bits/no parity/1 stop bit. From a terminal program you can, for instance, change the IP address from the default. You also download updated firmware through the serial port. The serial port is usable for RS-232 communications. For users without a convenient serial port, a USB to serial converter provides a simple and inexpensive interface.

Reset Button

 Recessed to prevent accidental activation, this button resets the CPU layer for activities such as downloading and installing new firmware for the DNR rack. It may also be used to start/stop logging when the rack is configured as a UEILogger 1200R.

Network Connectors

Each NIC interface includes two independent Gigabit Ethernet ports. The 1000Base-T interface allows the rack to be installed up to 100 Meters from your host PC.

Power Supply Annunciator LEDs:

Spec:	ON / OFF		Spec:	ON / OFF
Vin:	OK / Error		Input I:	OK / Overcurrent
1.5V	OK / Error		Fans:	On / Off
User controlled, default is off			One flash per second heartbeat	
Temp:	Over / OK		System:	Error / OK
24 V*:	OK / Error		24 V**:	OK / Error
3.3 V*	OK / Error		3.3 V**	OK / Error
*24 V & 3.3 V for slots 1 - 6			**24 V & 3.3 V for slots 7 - 12	
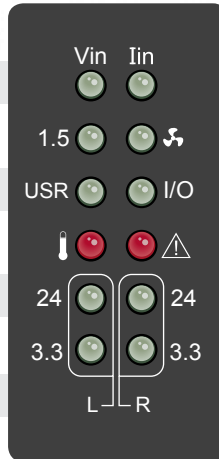
Technical Specifications:

Standard Interfaces	
To Host Computer	Two independent 10/100/1000Base-T Gigabit Ethernet ports via RJ-45 connector. One port is designated as Control and the other Diagnostic
Distance from host	100 meters, max
Config/General	RS-232, 9-pin "D"
Sync	Custom cable to sync multiple racks
I/O Slots Available	
DNR-12-1G	12 slots
Data transfer and communication rates	
Ethernet data transfer rate	20 megabytes per second
Analog data transfer rate	Up to 6 megasamples per sec (16-bit samples)
DMAP I/O mode	Update 1000 I/O channels (analog and/or digital) in < 1 millisecond, guaranteed
Processor/Memory	
CPU	Freescale 8347, 400 MHz, 32-bit
Memory	128 MB
Status LEDs	Power Supplies within spec, system heart-beat, Attn, Read/Write, Power, Communications. Active

Environmental	
Temp (operating)	Tested to -40°C to 70°C
Temp (storage)	-40°C to 85°C
Humidity	0 to 95%, non-condensing
Vibration	
(IEC 60068-2-64)	10–500 Hz, 3 g (rms), Broad-band random
(IEC 60068-2-6)	10–500 Hz, 3 g, Sinusoidal
Shock	
(IEC 60068-2-27)	50 g, 3 ms half sine, 18 shocks at 6 orientations; 50 g, 11 ms half sine, 18 shocks at 6 orientations
Physical Dimensions	
DNR-12 series	5.25" × 6.2" × 17.5" (3U in a 19" rack)
Power Requirements	
Voltage	9 - 36 VDC (AC adaptor included)
Fuse	Internal 10 A
Power Dissipation	13 W at 24 VDC (not inc. I/O boards)
Power Monitoring	
I/O board power	All power supplies monitored to ±1% accuracy and may be read by host. LED annunciators indicate out of range
Input current	May be monitored by host, LED indicates overcurent condition

Popular RACKtangle™ I/O modules

DNR-AI-205
- 4 A/D channels
- 18-bit resolution
- Chan to chan isolation

DNR-AI-207
- 16 A/D channels
- 18-bit resolution
- 12 input ranges

DNR-AI-225
- 25 A/D channels
- 24-bit resolution
- ±1.25 V input range

DNR-AI-254
- 4 LVDT/RVDT channels
- 16-bit resolution
- Provides all excitation

DNR-AI-255
- 2 Synchro/resolver inputs
- 16-bit resolution
- Programmable excitation

DNR-DIO-432
- 32 digital outputs (sink)
- 600 mA output
- Monitors Vout and Iout

DNR-DIO-433
- 32 digital outputs (source)
- 600 mA output
- Monitors Vout and Iout

DNR-DIO-448
- 48 digital inputs
- Programmable input range
- A/D monitor actual input V

DNR-SL-508
- 8 RS-232/422/485 ports
- Full port-port isolation
- Independent channel settings

DNR-429-566
- 6 ARINC-429 RX channels
- 6 ARINC-429 TX channels
- Hardware label filter/scheduler

DNR-1553-553
- 2 dual redundant MIL 1553 channels
- BC, RT or MT/BM operation
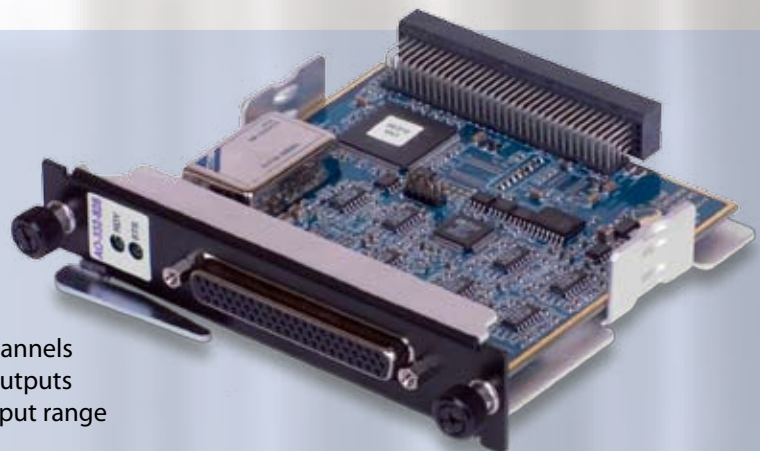- Multiple RT simulation

DNR-DIO-403
- 48 digital I/O
- 5 V logic levels
- 16 mA outputs

DNR-DIO-406
- 24 DIO channels (12 in, 12 out)
- 1 Amp outputs
- 100 kHz updates

DNR-AO-308-353
- 8 analog outputs
- Output voltages up to ±40 VDC
- Low output glitch energy

DNR-AO-332
- 32 D/A channels
- ±10 mA outputs
- ±10 V output range

DNR-CT-601
- 8 counter/timer channels
- 32-bit counters
- 8 counting modes

DNR-QUAD-604
- 4 Quadrature encoder inputs
- Buffered or single point readings
- x1, x2 and x4 input modes

DNR-CAN-503
- 4 CAN-bus ports
- Per-port isolation
- 1 Mb/s max xfer rate

Many additional I/O modules are available. Visit www.ueidaq.com for additional details.

The RACKtangle™ versus Legacy and Custom I/O solutions

Specification	Sim I/O	Legacy I/O	Custom I/O	Critical Comments
COTS availability	✓	some		Many commercial operators prefer COTS, while military groups are beginning to demand it!
Guaranteed 10+ year availability	✓			Legacy products are getting End-of-Life'd every day. Custom I/O is very difficult to maintain as component obsolescense issues must be addressed for very small production requirements
Minimal panel wear and tear	✓	✓		Accessing Custom I/O devices requires the removal and re-installation of various simulator panels and these panels will show wear and tear after repeated access.
Soft-start lamp drivers	✓			Reduces filament thermal shock and extends indicator bulb life
Common I/O for CLM, Avionics and Flight Deck I/O	✓	some		Reduces requirements for spares, technician training, documentation and cables
Internal RACK temp. monitoring	✓			Identifies potential problems before failures occur, allowing correction during scheduled, routine maintenance
All I/O fits onboard the simulator	✓	some	✓	Eliminating the need for most "waterfall" cabling increases reliability, reduces scheduled maintenance and dramatically speeds up installation or relocation efforts
I/O distributed around simulator	✓		✓	Reduces signal wiring length, though signal fidelity is seldom an issue in simulator applications
Easy to service I/O	✓	✓		Not only reduces MTTR, the ability to easily service I/O electronics greatly simplifies future upgrades and modifications
Automatic support for new avionics buses or instruments	✓			Legacy devices will never support new technology. Keeping the in-house engineering team required to address new technology is exceedingly expensive.
Gigabit Ethernet design	✓	some		Perfect blend of high performance and stability
Front panel status indicators	✓			Helps technicians quickly identify and correct issues
Gigabit diagnostic port	✓			Allows system testing without disconnecting the primary communications link
Uniform spares	✓	✓		Custom I/O solutions include many more devices and mounting configurations, greatly increasing the effort required to keep spares available.
Software diagnostics	✓			Enhanced diagnostics increases up-time, simplifies maintenance and reduces mean-time-to-repair (MTTR)
Passive backplane configuration	✓			Ensures almost infinite MTBF on non plug-in electronics
Easy access to hardware	✓	✓		Sim I/O racks are easily accessed while Custom I/O devices are often mounted behind cockpit panels and are difficult to access.
Guaranteed software support for new computer systems and/or operating systems	✓			Computer technology changes rapidly. Whether replacing a failed host computer or upgrading to a newer architecture, support for the latest technology is critical
Redundant real-time monitoring	✓			Allows system testing and monitoring even while the simulator is in operation

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