

# UEIPAC Cubes and RACKs

## Fourth Generation (G4) processor

### Programmable Automation Controllers

- Powerful stand-alone embedded controller
- Flexible, compact and rugged
- Powerful ARM processor
- HDMI video output (optional)
- Standard Linux Operating System
- IOT/MQTT ready (pre-installed Mosquitto application)
- DDS support w/ iDDS, ZeroMQ, OpenSplice or CoreDX
- EPICS CAS support included
- M2 slot for peripherals including Cell cards
- Web/HTML/HTML5 Web Socket interface support
- Flexible: Over 90 I/O boards available
- Solid-State Drive and/or SD Card-based storage\*
- Synchronization via IEEE-1588
- Real-Time Linux kernel-based real-time capability



The UEIPAC is available on all UEI's platforms!

## General Description:

The UEIPAC offers an unprecedented combination of flexibility, high performance, low cost and small controller. The unit is an ideal solution in a wide variety of measurement and control applications. The UEIPAC is also an ideal solution for embedded DAQ applications, allowing systems to operate without the cost or additional space required by an external host computer.

### Enhanced CPU performance

The Fourth Generation (G4) CPU is based upon a modern, low power G4 SoloX / i.MX6 series ARM processor. The new CPU joins the currently supported Freescale MPC5200/8347 based CPUs in the UEIPAC family and all three are covered by UEI's powerful 10-year availability guarantee. The G4's Cortex-A9 core runs up to 1 GHz and is fully available for user programs. The initial release will provide a Linux operating system on the A9 core. QNX support is expected in the future.

### New features of the G4 CPU (beyond CPU power)

- Built-in HDMI (1366 x 768) support (optional)
- 1 GByte RAM/8 GByte eMMC FLASH
- M.2 series I/O slot for SSD or other peripheral
- eUSB slot for additional SSD storage
- MicroSD card slot for removable data storage\*

### Other Key CPU features

- Dual GigE ports (control/diagnostic or teamed/bonded)
- Direct USB connection
- IEEE-1588 / PTP timing/synchronization interface
- Direct support of DNx series sync port
- Extensive diagnostics including power supply and temperature monitoring
- All standard UEI chassis environmental specifications
- 9-36 VDC power (universal AC adaptor also included)
- Low power <10W in most configurations

\* No SD and µSD available for MIL and BRICK chassis.

The A9 core provides approximately 2.5 to 5 times the CPU horsepower of the previous 8347 generation, depending on the application. The G4 will be compatible with all 8347-based chassis and deployments which includes all GigE based chassis.

### Linux Systems

- Uses Yocto Linux distribution: Yocto version 2.7 (Warrior), Linux kernel 4.9.88, PREEMPT\_RT patch for real-time support
- Program in standard C/C++
- Eclipse IDE support
- Develop on Linux PC or Windows PC / Cygwin environment

The UEIPAC is supported by all UEI DNA/DNR/DNF series chassis. There are currently over 90 different I/O boards available, including analog input (with up to 24 bit resolution), analog output, digital I/O, MIL-STD-1553, AFDX, ARINC 429/453/708, Serial and CAN communications, counter/timer, quadrature encoder input and more. With this many different I/O boards available, there is sure to be a configuration perfect for your application.

Generation 4 Cubes and RACKs provide dual Ethernet ports, each of which resides at a unique IP address. These are most commonly used to provide separate primary control and diagnostic ports, but can also function as teamed/bonded redundant interfaces. An M.2 PCIe slot on the CPU can be used for SS Drives or other M.2 peripherals including Cell or WIFI interfaces.

## Linux Programming:

Your application runs as a regular Linux process, giving you access to the standard POSIX API provided by the GNU C runtime library (glibc), as well as any other library that can be compiled for Linux (for example: libxml, libaudio file...).

New software provided with the UEIPAC includes an EPICS (Experimental Physics and Industrial Control System) Channel Access Server (CAS). Our new LibSharedData software allows easy connection of the UEIPAC to HTML/HTML5 browsers via Web Sockets or other PCs via TCP/IP Sockets.

Whether your application requires a few I/O channels or a few thousand, the UEIPAC is an ideal solution. The UEIPAC's unique combination of Linux operating system, real-time support, I/O flexibility, compact size, mechanical and electrical ruggedness, and ease of use is unparalleled.

## UEIPAC Linux TK-SX Programmer's Toolkit:

The Programmer's Toolkit provides the software tools necessary to create an embedded application targeting Linux on the UEIPAC's ARM processor. This includes most popular versions of Linux, such as Fedora and Suse. The development environment runs on a Linux PC or in the Cygwin environment on a Windows PC. The UEIPAC is also supported by the popular Eclipse IDE. Applications requiring hard real-time functionality are possible with the Real-Time Linux capability included in the 4.9.88 series kernel.

The UEIPAC development environment includes:

- GCC 7 based cross-compiler for applications targeting the UEIPAC ARM module
- GNU toolchain tools, such as make
- Standard Linux libraries, such as glibcV
- UEIPAC library for the various I/O boards/devices

The UEIPAC Linux TK-SX is not included with the UEIPAC and must be purchased as a separate item. *Only one Linux toolkit must be purchased, regardless of the number of UEIPAC deployed.*

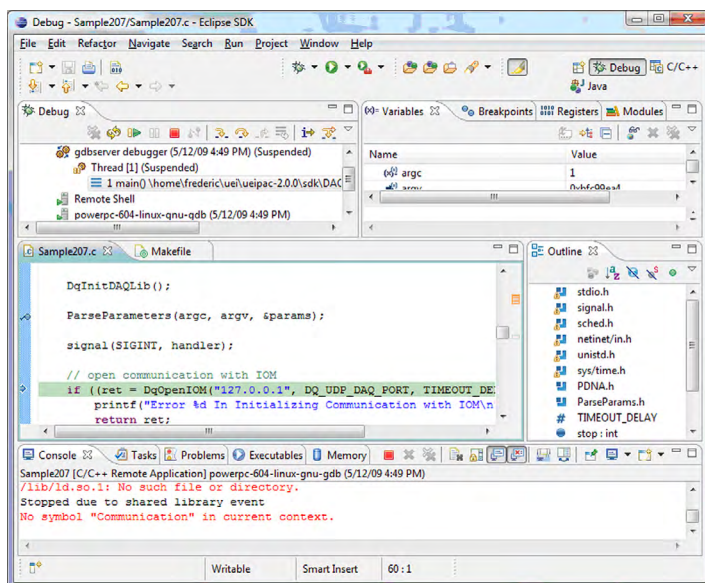
The toolkit uses the same API as our popular PowerDNA Cubes, allowing you to reuse existing programs that were designed to run with a PowerDNA Cube over the network. This allows you to develop your application on your desktop, working directly with a "slaved" PowerDNA Cube. Once you are satisfied with your system, you may port the programs to run directly on the UEIPAC Cube with few modifications. After the UEIPAC power-up, you have a ready to go Linux OS with FTP and web servers as well as a command line shell accessible from the serial port or SSH over the network.

## EPICS

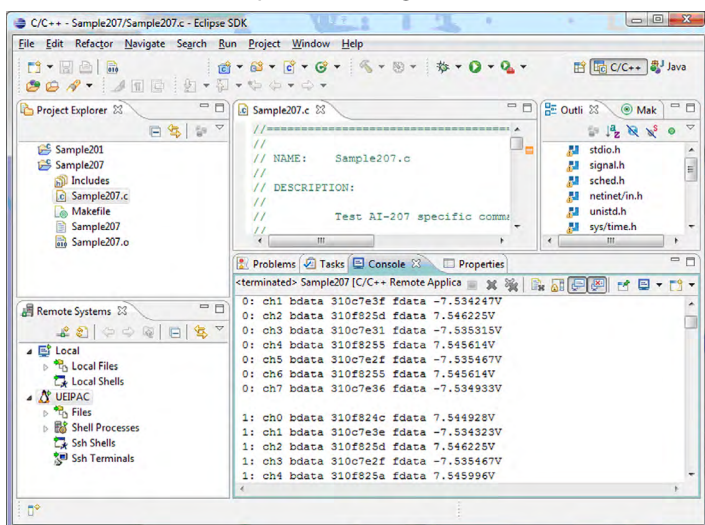
EPICS (Experimental Physics and Industrial Control System) is a popular standard in high-energy physics laboratories. Our new EPICS server provides the source code to set up the UEIPAC as an EPICS CAS (Channel Access Server), allowing you to configure any I/O input or output as a PV (Process Variable).

## Eclipse IDE support:

The UEIPAC is now supported by the Eclipse IDE. Programmers may now take advantage of the many powerful Eclipse tools to build their UEIPAC applications.



The Eclipse IDE debug screen.



A typical Eclipse IDE run-time screen.

## New Software Support:

**Web Browser Interface:** Our new LibSharedData API/library allows easy connection of the UEIPAC to HTML/HTML5 browsers via Web Sockets or other PCs via TCP/IP Sockets. The HTML5 interface is fully compatible with many mobile browsers including Safari for iOS and iPhones and iPads and the Android web browser. Of course the standard HTML interface is provided to interface to more general purpose web browsers.

## IOT

The UEIPAC comes with Mosquitto pre-installed. Mosquitto implements a broker and a C library to publish/subscribe MQTT messages. Examples and API documentation can be found at <http://mosquitto.org>. UEIPAC comes with the Sample DMAP\_MQTT example that can acquire and publish data from AI, DI or counter/timer layers. The example can also subscribe to external data and write it on AO and DO outputs.

# UEIPAC: Technical Specifications

MIL series ruggedized chassis		UEIPAC xxx-1G series GigE Cubes		RACKtangle Chassis	
Computer Interface					
USB Port	USB 2.0 fully supported				
Net Teaming/Bonding	Supported in Linux deployments				
Ethernet/Diagnostic Port	10/100/1000Base-T, 38999 connector	10/100/1000Base-T, RJ-45 connector			
Video output	n/a	HDMI (1366 x 768 on CPU option 12)			
M2 PCIe slot (internal)	1 slot, 22 or 30 width, 42, 60 or 80 length, B key				
Configuration/Serial Port	RS-232 port on LAN/COM 38999	RS-232			
Synch Options	1. DNA-SYNC-1G series cables and boards provide both clock and trigger sync signals. 2. DNA-IRIG-650 for IRIG and GPS synch 3. IEEE-1588 synchronization				
I/O Board Support					
Series supported	All DNA/DNR-series boards as appropriate (DNF for FLATRACK)				
Software / Operating System					
Embedded OS	Linux or kernel 4.9.x				
Real-time support	4.9.88 kernel based Real-time Linux				
EPICS CAS interface	Yes				
SNMP Library	Yes				
Development Language	C/C++, C++11/14/17, Eclipse IDE support				
Development Environments	Linux PC or Cygwin Windows environment				
Processor/System					
CPU	SoloX / i.MX6 series ARM processor, Cortex A9 core @ 1Ghz				
Memory	1 Gbyte RAM				
FLASH memory	8 Gbyte				
Solid-State Hard Drive	8, 16, 32 Gbyte drives available*				
Solid State Drive	Optional 320 Gbyte M.2 SSD available*				
µSD card interface	µSD cards up to 128 Gbyte**				
Physical Dimensions					
1 I/O slot	n/a	UEIPAC 100-1G: 4.1" x 4.0" x 2.7"		n/a	
3 I/O slots	n/a	UEIPAC 300-1G: 4.1" x 5.0" x 4.0"		n/a	
4 I/O slots	UEIPAC 400-MIL: 6.2" x 7.1" x 8.7" UEIPAC BRICK 4: 9.5" x 7.06" x 3.55"	n/a		UEIPAC 400R: 1.75" x 7.8" x 16" (Std 1U)	
6 I/O slots	UEIPAC 600-MIL 1 .6" x 7.0" x 6.4"	UEIPAC 600-1G: 4.1" x 5.0" x 5.8"		UEIPAC 600R: 5.25" x 6.2" x 10.5"	
7 I/O slots	n/a	UEIPAC 700-1G: 4.1" x 5.0" x 6.6"		n/a	
12 I/O slots	UEIPAC 1200-MIL: 17.5" x 8.1" x 7.0"	n/a		UEIPAC 1200R: 5.25" x 6.2" x 17.5" (Std 3U)	
Environmental					
Temperature (operating)	UEIPAC 600/1200-MIL/BRICK 4: -40 °C to 85 °C UEIPAC 400-MIL: -40 °C to 70 °C z	-40 °C to 70 °C			
Temperature (storage)	-40 °C to 85 °C				
Humidity	0 to 95%, non-condensing				
Electrical Isolation	350 Vrms				
<b>Vibration</b>	MIL-STD-810G plus the IEC specs below				
(IEC 60068-2-64)	10–500 Hz, 5 g (rms), Broad-band random	10–500 Hz, 3 g (rms), Broad-band random			
(IEC 60068-2-6)	10–500 Hz, 5 g, Sinusoidal	10–500 Hz, 3 g, Sinusoidal			
<b>Shock</b>	MIL-STD-810G plus the IEC specs below				
(IEC 60068-2-27)	100 g, 3 ms half sine, 18 shocks at 6 orientations; 30 g, 11 ms half sine, 18 shocks at 6 orientations				
EMI/RFI	Designed to meet MIL-STD-461, CE, FCC Part 15, Subpart B	n/a		n/a	
Altitude	70,000 feet, maximum				
Sealing	Default unit sealed to IP 66 or better. Pressure relief valves support continuous altitude changes of 5000 fpm	n/a			
Power Requirements					
Voltage	9-36 VDC designed to meet MIL-STD-1275/704 UEIPAC BRICK 4: PoE++ (IEEE 802.3bt) power with redundant power input, 9–36 VDC	9-36 VDC (115–220 VAC adaptor included)			
Power	10 W (not including I/O boards)	7 W (not including I/O boards)		10 W (not including I/O boards)	
Reliability					
MBTF	UEIPAC 600/1200-MIL: >130,000 hours UEIPAC 400-MIL: >100,000 hours	>160,000 hours		UEIPAC 600R: >160,000 hours UEIPAC 1200R: >130,000 hours	

\*The SD cards, µsd cards and SSD devices used are not built by UEI. As we do not control the source, we cannot offer our 10-year availability guarantee on these devices.

\*\* SD and (µSD are not available on MIL and BRICK chassis.



## Extended Features:

### Easy to configure and deploy

- Standard Linux operating system
- Eclipse IDE support
- Optional 1366 x 768 HDMI video
- IOT ready with pre-installed MQTT support
- Supports DDS packages including ZeroMQ, OpenSplice and CoreDX
- EPICS CAS provided
- Web server
- Web Browser (Web Socket) interface included
- FTP server included
- Over 90 different I/O boards available
- Built-in signal conditioning
- Optional 8, 16, or 32 GB Solid-State hard drives
- M2 PCIe slots
- Flange kit for mounting to wall/flat surface

- DIN rail and Rack Mount kits
- Standard "Off-the-shelf" products and delivery

### Flexible connectivity

- 00Base-T or GigE with Cat-5 or higher cable
- RS-232 Interface
- Supports Wi-Fi / GSM / Cell networks

### Rugged and Industrial

- 100Base-T Cubes operation tested from -40 °C to 85 °C
- RACKS and GigE Cubes operation tested from -40 °C to 70 °C
- 100Base-T Cubes Vibration tested to 3 g
- RACKs and GigE Cubes Vibration test g to 3 g
- Shock tested to 100 g (operating)

### Compact Size and High Channel Density

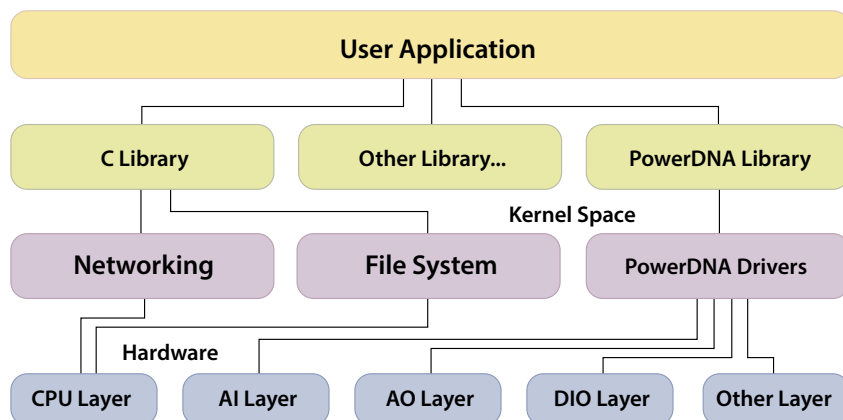
- Analog Inputs: up to 175/300 channel per Cube/RACKtangle

- ICP/IEPE: up to 28/48 channels per Cube/RACKtangle
- Analog Outputs: up to 224/384 channels per Cube/RACKtangle
- Digital I/O: up to 336/576 DIO per Cube/RACKtangle
- ARINC 429: up to 112/192 channels per Cube/RACKtangle
- Counter/Timer: up to 56/96 counter channels per Cube/RACKtangle
- CAN-bus: up to 28/48 ports per Cube/RACKtangle
- RVDT/LVDT: up to 28/48 channels per Cube/RACKtangle
- RS-232/422/485: up to 56/96 ports per Cube/RACKtangle
- Synchro: up to 28/48 channels per Cube/RACKtangle
- MIL-1553: up to 14/24 redundant ports per Cube/RACKtangle

## Typical Applications:

- Embedded Controller
- Hardware-in-the-loop controller
- Unmanned vehicle controller
- Wind energy and turbine controller
- Smart, Flexible data loggers
- Slaved controller with fail-safe local control and/or shut-down if communication is lost
- HVAC / Environmental controller
- Modern replacement for obsolete VME systems
- Solar Energy system controller
- Machine Health Monitor
- DUT simulator
- In-vehicle test systems
- Avionics simulator
- Single and multiple PID loop controller
- Rugged and remote DA

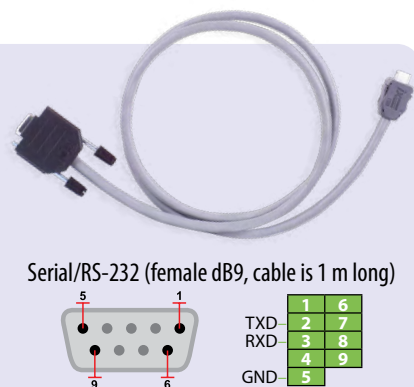
## System Block Diagram:



Please see ordering guide on the following page.

### CBL-SX6-DIAG (Optional Diagnostic Serial Port Cable)

This cable brings the diagnostic RS-232 port on the CPU board out to a standard female DB-9 connector. Though the diagnostic port provides access to a wealth of boot-time information and configuration/set-up tools, most customers will never need to use it. For this reason, we have made the cable an optional purchase. However, though you certainly will not need a cable per chassis, we do recommend users purchase one or two of these cables for the development lab. Note that we do keep these cables in stock so should you need one in the future, it could be overnighted to you. Note also that the information displayed on the diagnostic port is also available on the HDMI port on option 12 CPUs that include the video port.



## Ordering Guide: (All chassis except -MIL series include: Universal AC power supply, Serial and Ethernet cables and pre-installed Linux OS.)

### Chassis Configuration

100-1G	Gigabit Ethernet, Programmable Automation Controller with 1 available I/O slots (a.k.a. UEINET-PAC)
300-1G	Gigabit Ethernet, Programmable Automation Controller with 3 available I/O slots
600-1G	Gigabit Ethernet, Programmable Automation Controller with 6 available I/O slots
700-1G	Gigabit Ethernet, Programmable Automation Controller with 7 available I/O slots
600R	Gigabit Ethernet, Programmable Automation Controller, RACKtangle with 6 available I/O slots
1200R	Gigabit Ethernet, Programmable Automation Controller, RACKtangle with 12 available I/O slots
400F-AC	1U FLATRACK, rack mountable 4 slot chassis with Gigabit Ethernet and 100-240 VAC AC power
400F-DC	1U FLATRACK, rack mountable 4 slot chassis with Gigabit Ethernet and 9-36 VDC power
400-MIL	Military style, 4 slot Cube with GigE Ethernet ports and 38999 connectivity
BRICK 4	Military style, 4 slot RACKtangle with GigE Ethernet ports and 38999 connectivity
600-MIL	Military style, 6 slot RACKtangle with GigE Ethernet ports and 38999 connectivity
1200-MIL	Military style, 12 slot RACKtangle with GigE Ethernet ports and 38999 connectivity

### UEIPAC

#### \*CPU Configuration

- 11 - SoloX / i.MX6  
CPU with 1 GB RAM and  
8 GB FLASH
- 12 - SoloX / i.MX6  
CPU with 1 GB RAM,  
8 GB FLASH and optional  
1366 x 768 HDMI video interface

#### \*Boot Software Location

The unit is designed to boot directly from FLASH Memory, though the unit can be configured to boot from SSD if one is installed.

#### Software Deployment options

- PA - Standard UEIPAC deployment
- SM - Simulink (UEISIM) deployment option
- MB - Modbus (UEIModbus) deployment option
- OP - OPC-UA (UEIOPC-UA) deployment option
- VS - VISTAS deployment option

#### μSD Card\*\*

- 00 - No μSD card
- U8 - 8 GByte μSD card
- U3 - 32 GByte μSD card

#### Solid State Hard Drive

- 00 - No SS Drive
- 08 - includes 8 GByte SS Drive in standard SSD slot
- 16 - includes 16 GByte SS Drive in standard SSD slot
- 32 - includes 32 GByte SS Drive in standard SSD slot
- 40 - includes 40 GByte M.2 SS Drive in standard SSD slot (SoloX only)
- M3 - includes 320 GByte M.2 SS Drive in standard SSD slot (SoloX only)

For example, a 3-slot GigE Cube with HDMI, an 8 GB SS Drive, no SD card in standard PAC mode would be:

UEIPAC 300-1G - 12 - 08 - 00 - PA

\*\* SD and μSD cards are not available on MIL and BRICK chassis.

### Accessories & Software including SDK/Board Support Packages (Only one toolkit is required, regardless of the number of UEIPACs deployed)

Part Number	Description
<a href="#">UEIPAC-Linux TK-SX (Software Only)</a>	UEIPAC Linux Programmer's Toolkit.
<a href="#">CBL-SX6-DIAG</a>	Diagnostic cable. Connects diagnostic RS-232 connector on the CPU module to standard
<a href="#">Extended Warranty</a>	Option to purchase UEI's extended 5 year warranty is available
<a href="#">DNA-SSD-40-M2</a>	40 GB M.2 solid state drive for UEI SoloX processor chassis
<a href="#">DNA-SSD-320-M2</a>	320 GB M.2 solid state drive for UEI SoloX processor chassis