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Application Story

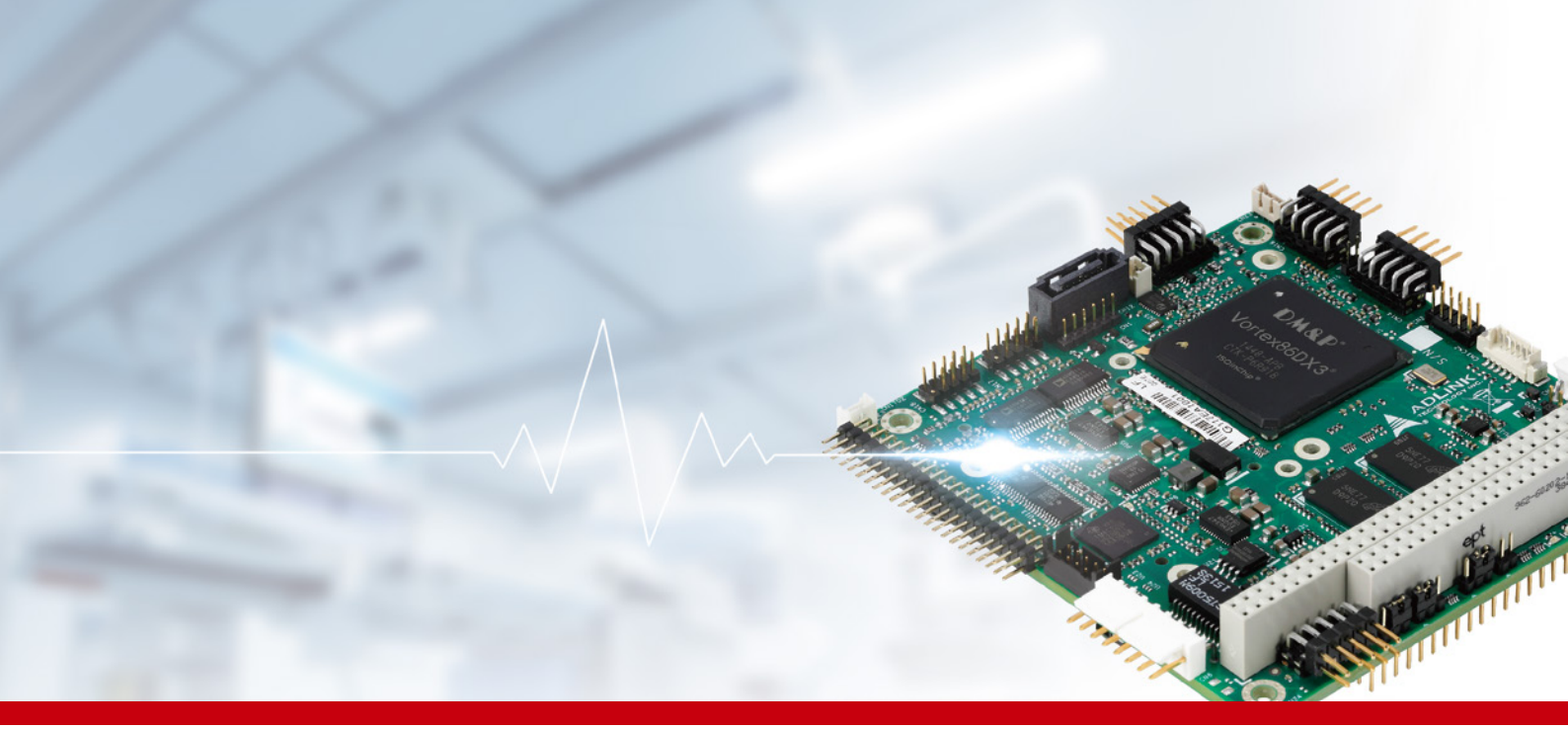
PC/104 SBC Offers High Reliability for Quality Infant Ventilators

An Application Story between Hitex (UK) Ltd and ADLINK



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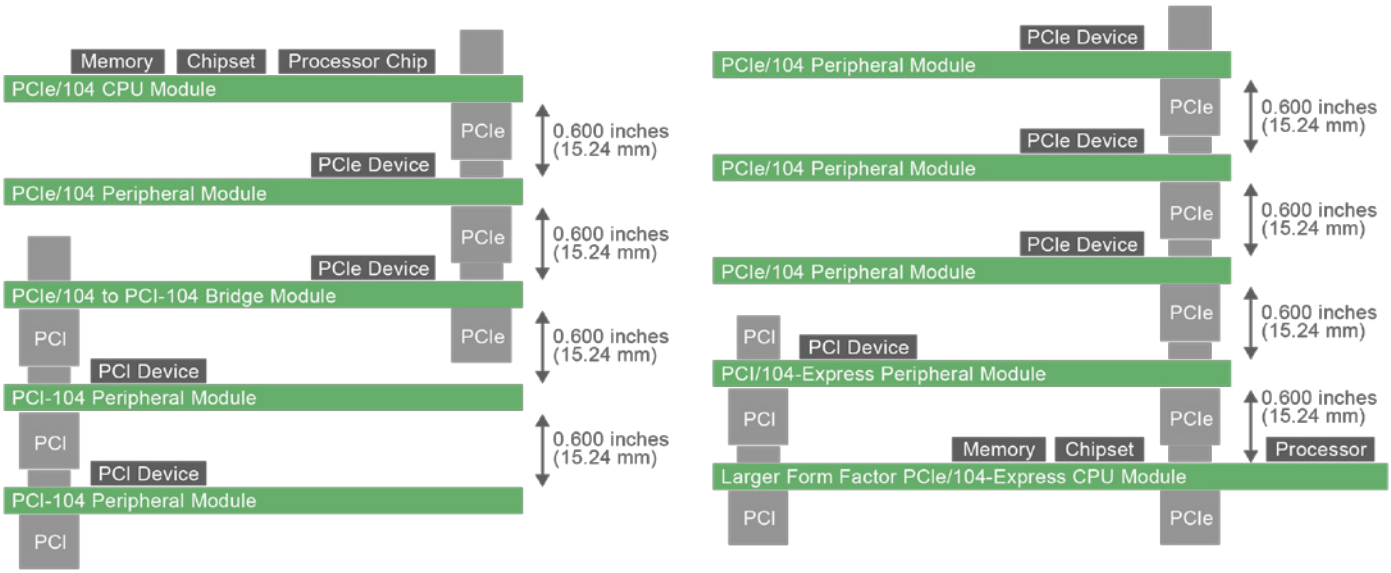


Advanced version of an infant ventilation system re-allies with PC/104 SBC

Despite recent advances in healthcare technologies, it is still challenging for medical professionals to treat breathing difficulties in newborn babies, even using ventilators. Increasing the ventilation frequency or airway pressure, run the high risks of volutrauma or lung injury. The use case presented here is a ventilation system that offers High Frequency Oscillation (HFO) ventilation for infants. Based on the ADLINK PC/104 Single Board Computer (SBC), this ventilation system is designed for premature newborns, infants or children weighing up to 20kg. Aside from providing pressure-controlled, volume-targeted ventilation, the infant ventilation system can also serve as a time-cycled, pressure-limited ventilator or an HFO ventilator.

PC/104
Embedded PC Modules

With no backplane (Figure 1.), PC/104 modules are stackable and rugged, making PC/104 an ideal choice for systems with considerations for high availability, high reliability and space constraints, such as medical equipment like the infant ventilation system in discussion here. When ADLINK's UK-based partner Hitex helped end-customer SLE bring its first-generation infant ventilation system to market over a decade ago, Hitex chose to use the PC/104 SBC to build the system. Since its launch, the ventilation system has been enthusiastically embraced by healthcare professionals for its time-proven reliability. In view of this, when designing the next-generation model SLE5000, Hitex decided to still go with the PC/104 SBC with no backplane.



(Figure 1. PC/104 Board Stack Assembly)

Compact and energy-efficient



Figure 2: Neonatal Ventilator with High Frequency Oscillation: SLE5000

The processor that powers the next-generation infant ventilation system has advanced from the AMD® Geode LX800 to the DM&P® Vortex86DX3 and is still based on the standard 96mm x 90mm PC/104 footprint, allowing the SLE5000 (Figure 2) to maintain a compact form factor. To meet the stringent demand for dust resistance by medical equipment, the fanless design is a critical consideration. Furthermore, space constraints also make heat dissipation a focus of effort. ADLINK's CM1-86DX3 SBC, based on a modular design, integrates a Vortex86DX3 processor for embedded systems. The self-stacking bus eliminates the need for backplanes or slots and reduces the required bus drive on most signals to 4mA, keeping the component count and power consumption to a minimum. The total system power consumption is only about 6 Watts. Energy efficiency and heat dissipation design allow the CM1-86DX3 to fully meet the needs of an infant ventilation system for optimal portability.

Reliable, rugged and long-lasting

Besides having a compact form factor, a product can stand out from the competition with its ability to guarantee reliable performance. A PC/104 SBC boasts exceptional reliability and ruggedness. To ensure premium quality from design to production, ADLINK's PC/104 family of products has been tested and certified to MIL-STD-202F 214A to withstand 11.95G vibration and MIL-STD-202F Method 213B to withstand 50G shock. The ADLINK PC/104 also features a wide operating temperature range between -40°C and +85°C and has passed HALT and voltage testing. The connectivity of PC/104 allows the boards to be stacked and connected using press-fit pins and mounting holes, enabling superior resistance against vibration, which helps the ventilation unit maintain normal operation even when it is on the move or under impact (no greater than the force under test).



Superior product service and maintenance is critical for medical equipment and only can be achieved on a foundation of broad experience. ADLINK, through its acquisitions of Ampro Computers and LiPPERT Embedded Computers GmbH, is one of the original developers of the PC/104 standard, which defines all the PC/104 interfaces including PC/104, PC/104-plus, PCI-104, PCI/104-Express and PCIe/104. This foundation allows ADLINK to guarantee a long product life cycle of 10+ years and long-term availability of processors and other components.

Retaining legacy operating systems shortens time-to-market

Even with an upgrade to the overall architecture, SLE hopes to continue using the operating system it is familiar with. This way, it will be able to accelerate time-to-market and reduce development costs. The older generation infant ventilation system ran Datalight ROM DOS, which worked smoothly with application software. For SLE to keep using the original operating system, ADLINK has tailored config.sys with adjusted DOS configurations based on SLE's requirements so that its application software remains compatible with the operating system without having to be re-written.

"Hitex's partnership with ADLINK spans almost 20 years. We have built a unique trusted relationship which covers technical support as well as local market expansion strategies. For SLE, ADLINK again shared its expertise to solve the upgrade requirement, especially on the migration of ROM-DOS to a new system."

Paul Roberts, Hitex Embedded Products Specialist

Supporting existing interfaces while enabling convenient expandability

Aside from the operating system, SLE requires the hardware to continue to support legacy interfaces. As such, CM1-86DX3 not only accommodates existing interfaces but also features PC/104 expandability, fully supporting all current standards as well as future needs for connection to printers or tablets. Most SBCs currently on the market use LPC instead of ISA bus. SLE wishes for its new-generation system to still support CAN bus expansion cards. With both 8-bit and 16-bit full ISA bus, CM1-86DX3 allows a seamless transition between generations. Furthermore, for SLE to keep display settings intact, such as special default settings and screen settings, from previous generation systems, ADLINK provides services to customize BIOS utilities. In addition, ADLINK's new SBC continues to provide slots for LVDS, CompactFlash and SSD as well as SATA interface and RS-232/RS-485 ports, so upgrades from the previous version to SLE5000 is achieved with minimal costs.

The infant ventilation system in the use case is based on a the CM1-86DX3 SBC, which processes input and output showing biophysical information of newborns and uses a Softing CAN bus controller to operate system pneumatics. Powered by a Vortex 86DX3 processor, CM1-86DX3 delivers high performance graphics in addition to 8 GPIOs, Ethernet, video & audio, USB and a host of other functions. With up to 1920x1440 resolution and VGA interface, CM1-86DX3 can support a large number of monitoring parameters, making the system suitable for both indoor and outdoor uses to maintain regular, continuous or long-term monitoring on patients' vital signs.

The SLE5000 conventional ventilator is the benchmark in conventional infant/pediatric ventilators. Touch screen control and a comprehensive range of ventilation modalities and monitoring modes make the SLE5000 the conventional choice ventilator for today's demanding NICU environment.

Local support and prompt service

PC/104 has been market proven for 25 years. To meet the needs of diverse applications, developers of PC/104 products not only have to keep abreast of the latest hardware, software and firmware technologies but also need extensive experience in embedded systems so that their products can guarantee forward and backward compatibility across different standards and different generations. Through back and forth communication, senior application engineers working at ADLINK's office in Europe gained a clear understanding of the customer's needs and sat alongside the customer's engineers to jointly work out the best solutions on the basis of those that had been proposed. This is how the new-generation infant ventilation system came to life.

About SLE

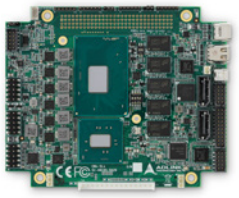
SLE is a recognized world leader in the design and manufacture of Diagnostic and Life Support electro-medical solutions. They have built a specific expertise in neonatal intensive care, establishing a reputation for excellence in this field. Since marketing the Newborn 150 in 1981, SLE has evolved into a market leader in infant ventilation systems. Today, you will find SLE ventilators helping newborns in hospitals across the world.

About Hitex

Hitex single board computers and modules are all selected from partners we have worked with for over 15 years, as such we are able to offer long term available, ruggedized and extended temperature products that can be designed in with the knowledge that you will have the expertise of the designers on hand to offer in depth technical support when required.

All our modules come with starter kits to help kick-start your project and many have the BSPs for various operating systems and

PC/104 Product Series

Product	CMx-SLx	CMx-BTx	CM1-86DX3
			
CPU	Intel® Core® i3-6102E, Intel® Core® Opt.: i3-6100E (opt.) Intel® Xeon® E3-1505L v5 (opt.)	Intel Atom® E3800 Series SoC	Vortex86DX3 SoC
Cache	Core i3: 3MB (opt: Xeon: 8MB)	Primary 32 KiB, 8-way L1 instruction cache and 24 KiB, 6-way L1 write-back data cache	L2: 512kB
Memory	Up to 16GB soldered ECC DDR4	4 GB DDR3L SO-DIMM	2 GB soldered DDR3L
PATA / SATA	2x SATA 6Gbit/s and 1x SATA to on-board SATA-SSD	1x SATA 3G/s shared with mSATA	1x SATA 1.5Gb/s (or CFast)
Serial Port	2x RS-232	4x RS-232/485	2x RS-232 2x RS-232/422/485
USB	1x USB 3.1, 6x USB 2.0	3x USB 2.0	2x USB 2.0
GPIO	8	8	8
LAN	2x GbE	2x GbE	1x GbE 1x 10/100 Mbit
Graphics	Intel® HD Graphics	Intel® HD Graphics	Integrated 2D graphics
Video	HDMI/DVI, DisplayPort	VGA	VGA
Flat Panel	Single channel 18/24-bit LVDS	Single/dual channel 18/24-bit LVDS	Single channel 18/24-bit TTL/TFT
Operating Temperature	Std: 0°C to +60°C Wide: -40°C to +85°C (opt.)	Std: 0°C to +60°C Wide: -40°C to +85°C (opt.)	Std: 0°C to +60°C Wide: -40°C to +85°C (opt.)
Dimensions	117.4 x 96	90 x 96	90 x 96
OS support	Windows 10, Windows 7, Linux, VxWorks 7, QNX 6.6	Windows 7, Windows 8, WEC7, Linux, QNX, VxWorks	WES2009, WES7, Linux, QNX WEC7, Windows CE 6.0 (by request)

Note: All specifications are subject to change without further notice.

About ADLINK

ADLINK Technology is a global leader in Edge Computing. We provide robust boards, platforms and user interfaces; real-time data connectivity solutions; and application enablement for state-of-the-art industrial computing (e.g., AI-at-the-Edge). Together, these also enable innovative end-to-end IoT solutions in support of operational excellence or new revenue streams. ADLINK serves customers in many vertical markets and has an excellent eco-system of technology partners. ADLINK is a valued thought-leader and contributor to many standards and interoperability initiatives, with products available in more than 40 countries. ADLINK is publicly-traded on TAIEX (Stock Code: 6166).

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