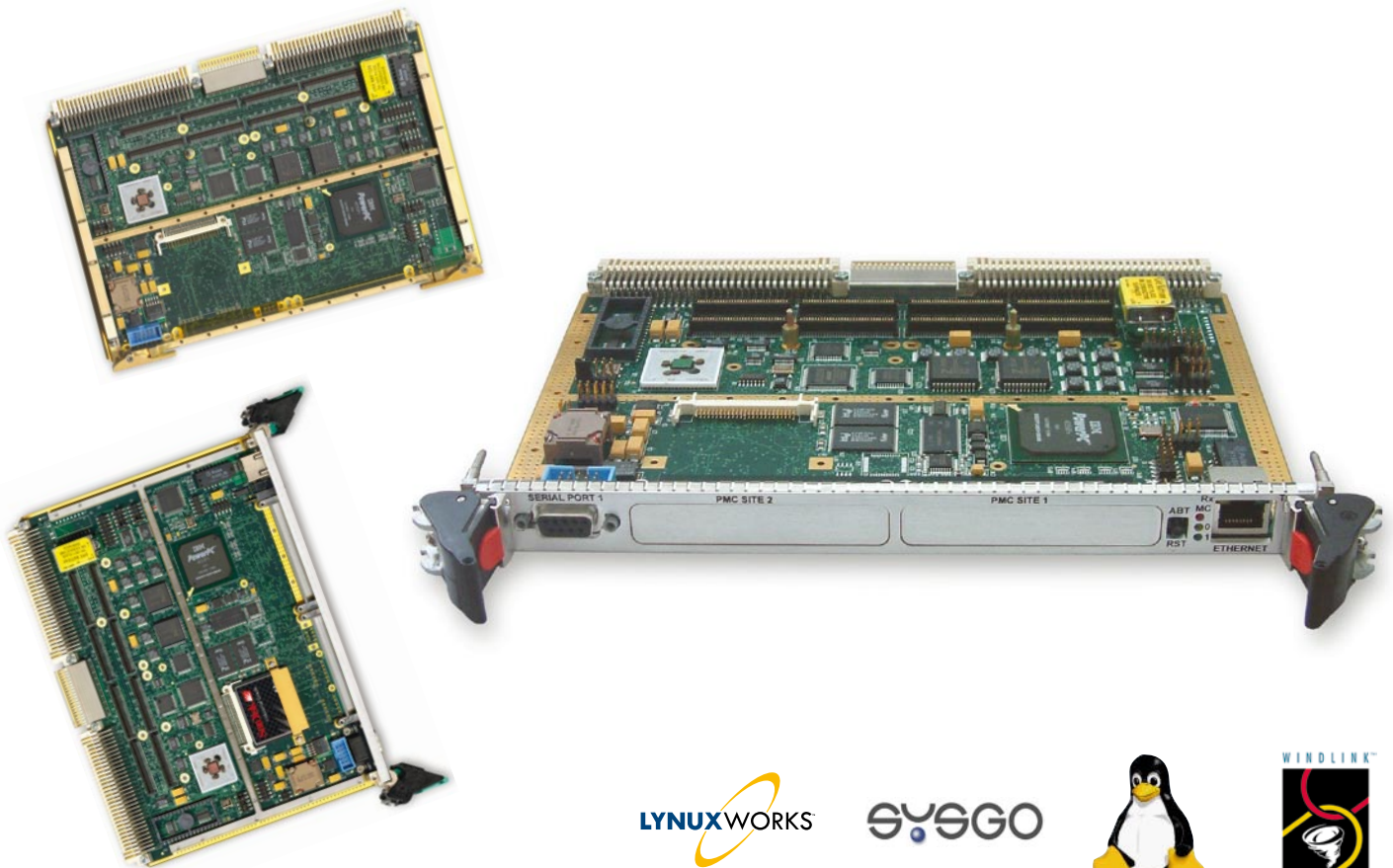


# ➤ VCE405

## I/O-Oriented Single-Board Computer with Ultra Low Power Consumption



- 400 MHz PowerPC 405GPr Engine
- Draws less than 7 Watts of Power
- 128 MB SDRAM, 8 MB Flash, CompactFlash Socket
- Ethernet 10/100BASE-T; IIC Port; 6 Serial Lines
- 2 PMC Slots
- Capable of Running with Natural Convection Only
- Supports VxWorks, LynxOS 4.0, and Linux

## ► Product Overview

The VCE405 Connectivity Engine provides a flexible off-the-shelf method for quickly developing and deploying cost-conscious highperformance custom systems.

The low power consumption of the powerful, IBM PowerPC 405GP/GPr and the ALMA2e PCI/VME bridge make the VCE405 well-suited to critical environments such as aerospace or medical applications.

### **PowerPC 405GP/GPr**

The IBM PowerPC 405GP™ is a 32-bit RISC embedded controller. High performance and peripheral integration of the 405GP/GPr make the device ideal for wired communications and other pervasive computing applications.

The 405GP/GPr is powered by a PowerPC 405B3 embedded core. This core tightly couples either a 266 MHz CPU and 24 KB data cache (16 KB I-cache; 8 KB D-cache) for the PowerPC 405GP or a 400 MHz and 32 KB data cache (16 KB I-cache; 16 KB D-cache) for the PowerPC 405 GPr. This finelytuned core reduces data transfer overhead and minimizes pipeline stalls to greatly improve performance.

The general architecture of the 405GP/GPr consists of a 64-bit, 133 MHz Processor Local Bus (PLB) and a 32-bit, 44 MHz On-Chip Peripheral Bus (OPB).

High-performance peripherals attach to the PLB and less performance-critical peripherals attach to the OPB.

### **Real-Time Clock**

The Real-Time Clock (RTC) function is provided by a Dallas Semiconductor DS1602 Elapsed Time Counter. This device can keep track of over 125 years worth of seconds in each of its 32-bit counters. One counter runs continuously.

The other counter counts seconds only while +5V is active. Software can determine how long the RTC has been running on battery power by subtracting the VCC active counter from the continuous counter.

### **Memory**

#### *128 MB SDRAM*

The system memory consists of two banks of 64 MB yielding, 128 MB of synchronous DRAM with Error Control and Correction. The SDRAM is directly controlled by the processor using a 32-bit, 133 MHz bus.

A version featuring the PowerPC 405GP at 266 MHz and only 64 MB is also available.

#### *8 MB Flash EPROM*

In addition, the board provides one Flash memory array which is composed of two equal-sectored Intel® 28F320-J5a-110, 2M x 16 Flash EPROMs for a total of 8 MB. Each EPROM has 32 128 kB blocks, but since the EPROMs are concatenated to form a 32-bit data path,

the paired EPROM block size is 256 kB. Kontron uses the lowest addressed blocks for its test and boot software and for storing the EPROM's programming algorithm. These blocks are then locked into the array so they cannot be accidentally erased or overwritten. The Flash EPROM array may optionally be populated with Intel® 28F640J5a-120 (4M x 16) devices to provide 16 MB respectively. Please contact Kontron for this option.

#### *UVEPROM socket*

The board also provides a 32-pin DIP socket for a 27C801 8 Mb (1 MB) UVEPROM. The UVEPROM may be used to store user code or user data, or to provide the initial boot code for the Flash EPROM and then be removed.

#### *Compact Flash Socket*

A Compact Flash module can be fitted to the onboard plug-in site to provide up to 1 GB of field-removable storage.

### **Serial EEPROM**

The board provides a 64 kb serial EEPROM, a Fairchild part# NM24C65U or equivalent, with an IIC interface. The EEPROM hooks directly to the PPC405GP/GPr IIC bus lines.

### **Ethernet Interface**

The board provides 100Base-TX Ethernet, with auto-negotiation to 10Base-T when connected to networks not capable of 100 Mb/s operation. Ethernet support through the Media Access Control (MAC) layer is provided in the PPC405GP/GPr chip. The Physical Layer Device (PHY) and the Physical Medium Dependent sub-layer and interface (PMD) are provided onboard. The connections between the MAC and the PHY conform to the Medium Independent Interface (MII) specification.

The supported media is Category 5 Unshielded Twisted Pair cable (UTP), accessed via an RJ-45 connector on the front panel (convection-cooled version).

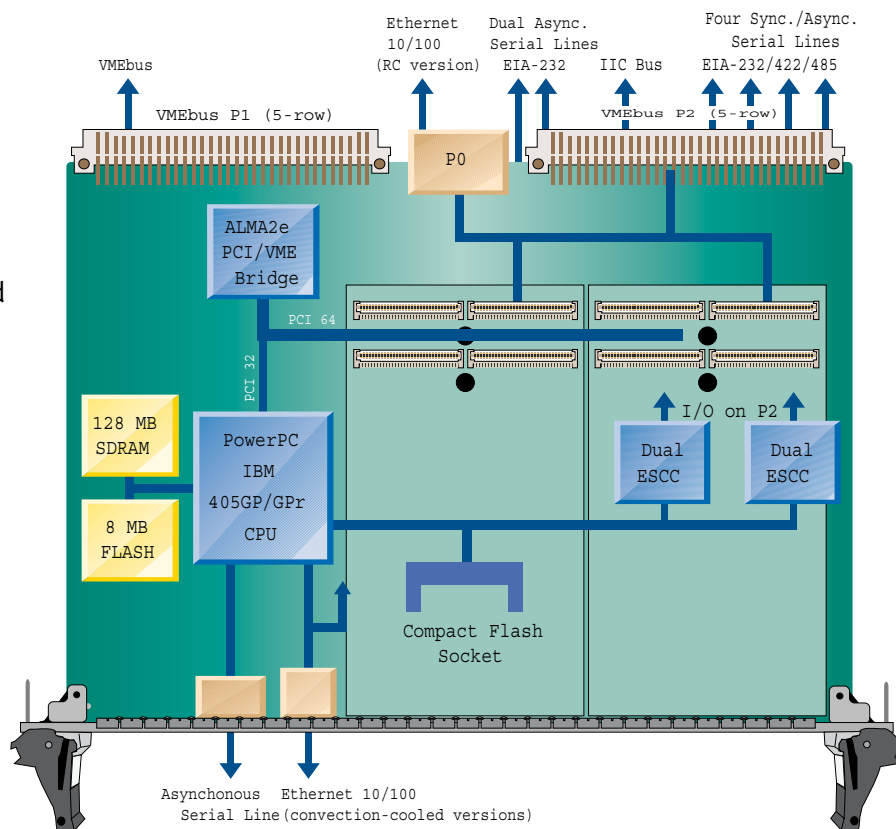
The Ethernet port can also go out the rear of the board for conduction-cooled or special builds.

The Ethernet media access controller of the PPC405GP/GPr is a generic implementation of the Ethernet MAC protocol complying with ANSI/IEEE 802.3 and IEEE 802.3u supplement. Its major features are:

- Dual speed (10/100 Mb/s) CSMA/CD (half-duplex) and full-duplex Ethernet MAC
- Independent, large (2 kB) transmit and (4 kB) receive FIFOs with programmable thresholds to minimize overruns and underruns
- Unicast, multicast, broadcast, and promiscuous address filtering capabilities

- Two 64-bit hash filters for unicast and multicast packets
- Automatic retransmission of collided packets
- Compliance with IEEE 802.3x standard packet-based flow control, including self-assembled control pause packet transmitting.
- Support for VLAN tag ID in compliance with IEEE Draft 802.3ac/D1.0 standard
- VLAN tag insertion or replacement for transmit packets is a programmable option
- Wake on LAN (WOL) handling  
Please ask Kontroon for support of this feature.

VCE405 Connectivity Engine Block Diagram



### Dual Asynchronous Serial Lines

The PPC405GP/GPr provides two asynchronous 16550-compliant EIA-232 serial ports (0 and 1). Port 1 is available on the front panel and on the P2 connector, and port 0 is available on the P2 connector. Serial port 1 features a 2-wire interface (Tx, Rx, GND) while serial port 0 features a full modem interface (Tx, Rx, DCD, CTS, RTS, GND).

### Quad Synchronous Asynchronous Serial Lines

Two enhanced serial communications controllers (ESCC) from Zilog, Z85230-16 provides synchronous/asynchronous serial lines at data rates up to 3.6 Mb/s. One controller provides dual independent full-duplex synchronous or asynchronous channels with software-selectable EIA-232/422/485 transceivers (ports 4 & 5).

The other provides dual independent full-duplex asynchronous channels with no handshaking capability and with software-selectable EIA-232/422/485 transceivers (ports 2 & 3). All four serial lines are available on the software-selectable EIA-232/422/485 transceivers.

Every ESC Controller features:

- Dual full-duplex channels
- Ability to accommodate a crystal oscillator, baud rate generator, and digital phase-locked loop on each channel

- Multiprotocol format (asynchronous, monosynchronous, bisynchronous, SDLC/HDLC, SDLC/HDLC loop)
- Encodes in the following modes:  
NRZI, FMO, FM1, and Manchester
- CRC-16 or CRC-CCITT error detection
- 4-byte transmit FIFO/8-byte receive FIFO

### IIC Bus Port

The PPC405GP/GPr provides an inter-integrated circuit (IIC) bus interface which is available to the users on the backplane.

The IIC bus is a two-wire, bi-directional, open-drain, low-speed serial interface. The serial clock (IICSCL) and serial data (IICSDA) lines are bidirectional to support multiple bus masters and to mix high- and low-speed devices on the same bus. The IIC interface is compliant with Philips Semiconductor's I2C specification, dated 1995. It supports the following standard and enhanced features:

- 100 KHz and 400 KHz operation
- 8-bit data transfers
- 7-bit and 10-bit addressing
- Slave transmitter and receiver
- Master transmitter and receiver
- Multiple bus masters

The IIC interface can switch between 7-bit and 10-bit addressing under program control.

### Low-Power VME Interface

Managed by the IBM/Kontron ALMA2e PCI-to-VME bridge component that provides a highly integrated low-power singlechip solution:

- VME-to-PCI 64-bit/66 MHz
- VME and IEEE-STD-1014-1987 compliant (32-bit) with VME64 capability
- VMEbus system controller
- VMEbus requester (Level 1-4)
- VMEbus interrupter and interrupt handler (IRQ1-7)
- VME transfer rate up to 70 MB/s
- VMEbus master/slave A32, A24, A16: D32, D16, D8, UAT
- VMEbus master/slave A32, A24: D32BLT, D64MBLT
- Programmable VME slave image base address and size (8 VME slave channels)
- VME-to-PCI access conversion through 8 MB granularity mapping table
- Transmit/Receive FIFOs
- Programmable posted write, prefetch read, coupled mode
- Programmable BB2BLT mode: mapping of multiple single PCI accesses to a VMEbus BLT/MBLT cycle
- Semaphore registers
- VME/PCI 2-channel DMA controller

### User PCI Interface

The VCE405 features two 64-bit PMC site suitable for connecting IEEE1386.1 standard PCI mezzanine cards (PMCs). The PCI bus supports either 3.3V or 5V PCI signaling. The default manufacturing PCI signaling key setting is for 3.3V use, but it can be modified by the user in order to support 5V-only signaling PMCs. Care should be taken for coherent signaling levels on the PCI bus.

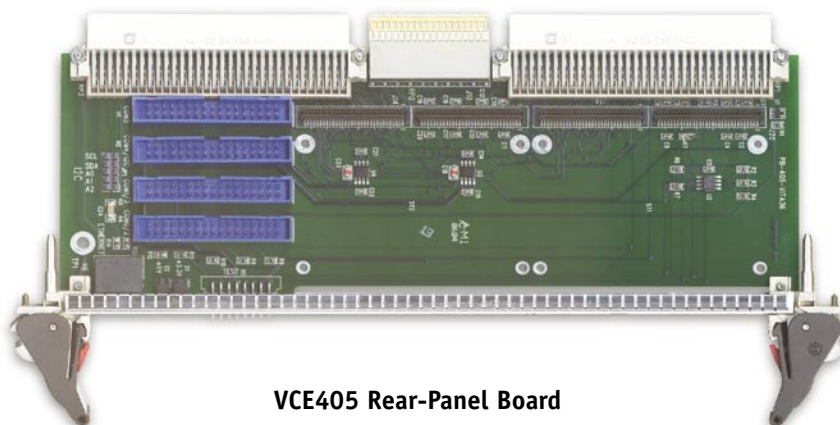
- PMC #1 routes the first 46 of its 64 I/O lines via J14 to P2 rows D and Z; the remaining 18 I/O lines are routed via P0.
- All of PMC #2's 64 I/O lines are routed to P0 via J24.

### Remote Panel Expansion Port

For easy integration into an enclosure where the VCE405's front panel may not be visible or conveniently accessible, a 10-pin header is provided to connect a remote front panel with five LEDs and Reset/Abort.

### Miscellaneous

- Board size: VME double Eurocard (6U - 233.3 mm x 160 mm)
- Single VME slot
- Power requirements:
  - +5V (+5%, -2.5%): 1.5A;
  - +12V for flash memory programming and PMC site
  - 12V for PMC site only
- Weight: 370g in RC version
- Conduction-cooled version (RC) is IEEE 1101.2-1992 compliant and is a single VME slot solution.
- Electromagnetic compatibility:
  - NF EN 55022 Class B
  - NF EN 50082-2
- All Kontron SBCs are EC-compliant.



VCE405 Rear-Panel Board

## ► Customer Service

### Quality Assurance

Kontron's ISO 9001 certification is just another way for us to back Kontron's commitment to quality products and customer service.

### Warranty

All of Kontron's hardware products are covered by a two-year return-to-factory warranty.

### Support Services

Kontron offers a standard Support and Service program which includes update services, hotline access, product repair and exchange services, on-site or remote technical assistance, Pre-Planned Program technology Insertion (P3I) and long-term support (over 15 years). Moreover, Kontron's structure is flexible enough to provide custom support such as frozen configurations.

### Derived Designs

Leveraging more than 15 years of new product development and customer support in embedded and rugged computers, Kontron has been selected for derived designs based on our excellence in PowerPC, Real-Time and Unix OS, and PCI/PMC technology.

## ► Related Products

### Software

The Tornado/VxWorks Board Support Package (BSP) is available in accordance with WindRiver's Windlink partnership program. The VCE405 also supports LynxOS 4.0 from LynuxWorks, the only hard real-time OS with a Linux ABI, and the Linux 2.6 from Sysgo.

The VCE405 supports various boot options such as boot from Ethernet or boot from CompactFlash disk. Software support of the synchronous serial lines such as SDLC, bisynchronous, and IIC slave mode are not included in the BSP. Please contact Kontron.

### Rear-Panel Connections

Kontron has designed two rear-panel boards for easy access to backplane I/O, a VITA 36-compliant one and a short form factor one.

### PMC

When the Connectivity Engine does not fully provide all the features required by your system, COTS PMCs are a cost-effective solution. Kontron offers an extensive choice of COTS PMCs for commercial to harsh environments: networking, additional serial lines, parallel I/O, graphics, etc.

## ► Technical Information

Environmental Specifications				
	SA Standard Commercial	WA Extended Temperature	RA Rugged Air-Cooled	RC Rugged Conduction-Cooled
Conformal Coating	Optional	Standard	Standard	Standard
Airflow	1.2 m/s	1.5 m/s	1.8 m/s	NA
Temperature	VITA 47-Class AC1	VITA 47-Class AC2	VITA 47-Class AC3	VITA 47-Class CC4
Cooling Method	Convection	Convection	Convection	Conduction
Operating	0° to +55°C	-20° to +65°C	-40° to +75°C	-40° to +85°C
Storage	-45° to +85°C	-45° to +85°C	-45° to +100°C	-45° to +100°C
Vibration Sine (Operating)	20/500 Hz: 2g	20/500 Hz: 2g	20/2,000 Hz: 3g	20/2,000 Hz: 5g
Random	VITA 47-Class V1	VITA 47-Class V1	VITA 47-Class V2	VITA 47-Class V3
Shock (Operating)	20g/11 ms Half Sine	20g/11 ms Half Sine	40g/20 ms Half Sine	40g/20 ms Half Sine
Altitude (Operating)	-1,640 to 15,000 ft	-1,640 to 33,000 ft	-1,640 to 33,000 ft	-1,640 to 50,000 ft
Relative Humidity	90% without condensation	95% without condensation	95% without condensation	95% without condensation

### Natural Convection Enabled:

No fan required. The VCE405 has been designed for use in natural convection environments. It has been successfully tested in a fanless chamber at up to 65°C. Please contact Kontron for more information.  
The VCE405 is delivered without Compact Flash Card.

➤ Ordering Information

		VCE405											00
		SA	WA	RA	RC	↑	↑	↑	↑	↑	↑	↑	↑
<b>Environment Class</b>	Standard	X				SA							
	Extended Temperature		(1)			WA							
	Rugged Convection-Cooled			X		RA							
	Rugged Conduction-Cooled				X	RC							
<b>Processor Speed</b>	PowerPC 405GP 266 MHz	X	X	X	X		2						
	PowerPC 405GPr 400 MHz	X	X	X	X		4						
<b>SDRAM Memory</b>													
	- 266 MHz Version Only											1	
	- 266 MHz & 400 MHz Versions											2	
<b>Flash</b>	8 MB	X	X	X	X				1				
<b>Ethernet Link</b>	Front Panel	X	X	X							-		
	Rear I/O on P2				X						-		
<b>Firmware Option</b>													
	- 266 MHz Version												L
		VxWorks 5.4 for Bootstring	X	X	X	X							V
	- 400 MHz Version												V
<b>Conformal Coating</b>	Default	-	X	X	X								-
	Option	X											V
<b>PO Connector</b>	Equipped	X	X	X	X								0
	Non-equipped	X	X	X	X								N

(1) Contact Kontron

(2) For booting VxWorks, please select the correct bootstring option:

- ➔ VxWorks Tornado 2.2 Integrated Bootstring
- ➔ VxWorks Tornado 2.0 Integrated Bootstring
- ➔ VITA 36 Rear I/O paddle board without front panel
- ➔ VITA 5.5.1 Rear I/O paddle board with front panel
- ➔ VxWorks BSP for VCE405
- ➔ Linux 2.4 BSP for VCE405 (3)
- ➔ LynxOS 4.0 BSP for VCE405

- ➔ **PROM-1C-VCE405**
- ➔ **PROM-1A-VCE405**
- ➔ **PBV36-PO-VCE405-00**
- ➔ **PBV36-PO-VCE405-0F**
- ➔ **BSP-1C-VCE405**
- ➔ **BSP-3A-VCE405**
- ➔ Contact LynuxWorks

(3) Available 2Q05 on 400 MHz, available now on 266 MHz version

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 guarantees Total Customer Satisfaction