Acromag Redefines SWaP-C With Our New AcroPack® I/O Platform

Industrial / Military Ready mPCIe-based Mezzanine Modules

The AcroPack® product line updates our popular Industry Pack I/O modules by using the mPCIe interface format. We added 19mm and a 100 pin connector to provide up to 50 isolated rear I/O signals, giving you a tremendous amount of capability on an **Extremely Small Footprint - Without Cabling!**

Designed for COTS applications, these general purpose I/O modules deliver high-speed and high-resolution A/D and D/A, digital I/O, counter/timers, communication (Ethernet, serial, MIL-STD-1553) and reconfigurable FPGA functions.

Whether it’s server-based lab activities or ship-based test systems, contact Acromag to discuss how AcroPacks can help you with tomorrow’s applications, today.

**Key Features Include:**

- A/D, D/A, digital I/O, counter/timers, Ethernet, communication, and reconfigurable FPGA options
- Low-power consumption
- Solid-state electronics
- -40 to 85°C standard operating temperature
- Conduction-cooled option available
- Mix and match I/O combinations in a single slot by using our PCIe, VPX or XMC carriers

**Size** = 70mm x 30mm

**Weight** = .05 oz. avg

**Power** = <5 watts per module

**Cost** = Starting at $395

Visit Acromag.com/AcroPacks TO LEARN MORE
## Product Series Selection Guide

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<td>48 bidirectional channels</td>
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<td>Four isolated CAN channels</td>
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**Description**

**Model:** AP220-16E-LF

The AcroPack® product line updates our popular Industry Pack I/O modules with a PCIe interface format. This COTS tech-refresh offers a compact size, low-cost I/O, the same functionality and memory map of the existing IP modules in a rugged form factor. Combine different AcroPack modules on one carrier for a simplified modular approach to system assembly.

The AP220 outputs analog voltage signals to drive up to 16 devices. When used with a carrier that holds two AcroPack AP modules, up to 32 voltage outputs can be obtained from a single card cage slot.

Each output channel has its own 12-bit D/A converter (DAC). Individual DACs are faster, and they eliminate glitches typically caused by the re-acquisition process of sample and holds found on multiplexed output boards.

Individual channels also have double-buffered data latches. You can select to update each output when it is written to, or to update all outputs simultaneously. Simultaneous outputs better simulate linear movements in motion processes.

Designed for COTS applications these analog output modules deliver high-density, high-reliability, and high-performance at a low cost.

AcroPack modules are RoHS compliant and ideal for military, defense, automation, aerospace, scientific, and development labs industries.

The AP220 modules are 70mm long, 19.05mm longer than the full length mini PCIe card. The board’s width is the same as mPCIe board and use the same mPCIe standard board hold down standoff and screw keep out areas.

A down facing 100 pin Samtec connector will mate with the carrier card. Fifty of these signals are available as field I/O signals.

The AP220 supports 6 independent software selectable output ranges plus capabilities to monitor the status of each output.

**Key Features & Benefits**

- PCI Express Generation 1 interface
- Independent 12-bit D/A converters per channel
- Mix and match countless I/O combinations in a single slot.
- Sample software and diagnostics
- Double-buffered DACs
- Built-in calibration coefficients
- Independent selectable output ranges
- Outputs reset to 0 volts
- Internally stored calibration coefficients ensure accuracy.
- Software provides easy selection of transparent or simultaneous output modes.
- Double-buffered DACs allow new data to be written to each channel before the simultaneous trigger updates the outputs.
- Alarm function
- Solid-down connector I/O interface
- Wide temperature range
- PCIe, VPX and XMC carriers
- Linux®, Windows®, and VxWorks® support
Performance Specifications

- **Analog Output**
  - Output configuration: 16 non-isolated bipolar/unipolar differential outputs. Each channel is paired with a signal return reference.
  - D/A Resolution: 12 bits.
  - Output ranges:
    - Unipolar: 0V to 5V, 0V to 10V.
    - BiPolar: -2.5V to 7.5V, ±3V, ±5V, ±10V.
  - Settling time:
    - 9μS - 20V step to 1 LSB at 16-bit resolution.
    - 7.5μS - 10V step to 1 LSB at 16-bit resolution.
  - Maximum throughput rate:
    - Outputs can be updated simultaneously or individually.
    - One channel: 7.5μS/conversion.
    - Sixteen channels simultaneously: 17μS/16 channels.
  - Calibrated system accuracy:
    - Linearity error: ±0.5 LSB.
    - Offset error: ±0.0625 LSB.
    - Gain error: ±0.0625 LSB.
    - Total error: ±0.625 LSB (±0.0152% FSR) maximum.
  - Data format (left-justified):
    - Straight Binary or Two’s Complement.
  - Output at reset: 0 volts.
  - Output current: 10mA (maximum). This corresponds to a minimum load resistance of 1k ohms with a 10V output.
  - Short circuit protection: Indefinite at 25°C.
  - Alarm function:
    - Software readable for brownout, short-circuit and temperature exceeding 150 °C conditions.

- **PCI Express Base Specification**
  - Conforms to PCIe base specification Revision 2.1.
  - Lanes: 1 lane in each direction.
  - Bus Speed: 2.5 Gbps (Generation 1).
  - Memory: 4k space required.
  - 1 base address register.

- **Environmental**
  - Operating temperature: -40 to 70°C.
  - Storage temperature: -55 to 150°C.
  - Relative humidity: 5 to 95% non-condensing.
  - Power:
    - +3.3 VDC, ±5% 400mA Typical, 480mA Maximum.
    - +12 VDC, ±5% 85mA Typical, 275mA Maximum.
    - -12 VDC, ±5% 50mA Typical, 200mA Maximum.

- **Physical**
  - Length: 70mm.
  - Width: 30mm.

Ordering Information

- **AcroPack® Modules**
  - **AP220-16E-LF**
    - 16 voltage outputs, 12-bit DAC
    - (Note: AcroPack modules are compatible only with the carriers listed below)

- **Accessories**
  - **AP-CC-01**
    - Conduction-cool kit.

- **Carrier Cards**
  - **APCe7010E-LF**
    - PCIe AcroPack carrier, holds one AcroPack module, air-cooled.
  - **APCe7022E-LF**
    - PCIe AcroPack carrier, holds two AcroPack modules, air-cooled.
  - **APCe7040E-LF**
    - PCIe AcroPack carrier, holds four AcroPack modules, air-cooled.
  - **VPX4500E-LF**
    - 3U VPX AcroPack carrier, holds three AcroPack modules, air-cooled.
  - **VPX4500-CC-LF**
    - 3U VPX AcroPack carrier, holds three AcroPack modules, conduction-cooled.
  - **XMCAP2020-LF**
    - XMC AcroPack carrier; holds two AcroPack modules, 2-slots out front, air-cooled.
  - **XMCAP2021-LF**
    - XMC AcroPack carrier; holds two AcroPack modules, 2-slots out rear, air-cooled.

- **Software** (see software documentation for details)
  - **APSW-API-VXW**
    - VxWorks® software support package.
  - **APSW-API-WIN**
    - Windows® DLL driver software support package.
  - **APSW-API-LNX**
    - Linux® support (website download only).

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AcroPack® Modules

AP200 12-bit DAC Analog Voltage Output

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ISO9001
AS9100

Made in USA

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### Description

The AcroPack® product line updates our popular Industry Pack I/O modules with a PCIe interface format. This **COTS tech-refresh** offers a compact size and low-cost I/O in a rugged form factor. Combine different AcroPack modules on one carrier for a simplified modular approach to system assembly.

The AP225 outputs analog voltage signals to drive up to 16 devices. When used with a carrier that holds two AcroPack AP modules, up to 32 voltage outputs can be obtained from a single card cage slot. The AP225 is ideal for waveform generation application that require high speed capabilities.

Each output channel has its own 12-bit D/A converter (DAC). Individual DACs are faster, and they eliminate glitches typically caused by the re-acquisition process of sample and holds found on multiplexed output boards. A 64K sample memory is provided for waveform storage on board. This memory is shared between the sixteen channels. Waveforms can be continuously output from onboard memory without host intervention. Additionally, a DMA controller is provided for streaming waveform data from host memory.

Designed for COTS applications these analog output modules deliver high-density, high-reliability, and high-performance at a low cost.

AcroPack modules are RoHS compliant and ideal for military, defense, automation, aerospace, scientific, and development labs industries.

The AP225 modules are 70mm long, 19.05mm longer than the full length mini PCIe card. The board's width is the same as mPCIe board and use the same mPCIe standard board hold down standoff and screw keep out areas.

A down facing 100 pin Samtec connector will mate with the carrier card. Fifty of these signals are available as field I/O signals.

### Key Features & Benefits

- PCI Express Generation 1 interface
- Independent 12-bit D/A converters per channel
- Waveforms can be continuously output from onboard memory without host intervention
- DMA controller provides for streaming waveform data from host memory
- Mix countless I/O combinations in a single slot
- Per channel configurability of bipolar and unipolar output ranges
- Sample software and diagnostics
- Configurable FIFO sizes up to 64K samples offer flexible waveform lengths
- Built-in calibration coefficients
- Flexible trigger, operating modes, and memory allocation
- Independent selectable output ranges
- Outputs reset to 0 volts
- Internally stored calibration coefficients ensure accuracy.
- Synchronization of multiple modules using an external trigger
- Solid-down connector I/O interface
### Analog Output
- **Output configuration**: 16 non-isolated bipolar/unipolar.
- **D/A Resolution**: 12 bits.
- **Output ranges**:
  - Unipolar: 0V to 5V, 0V to 10V.
  - Bipolar: -2.5V to 7.5V, ±-3V, ±5V, ±10V.
- **Output rate**: 100kS/s
- **Settling time**:
  - 9μS - 20V step to 1 LSB at 16-bit resolution.
  - 7.5μS - 10V step to 1 LSB at 16-bit resolution.
- **Maximum throughput rate**: Outputs can be updated simultaneously or individually.
  - One channel: 7.5μS/conversion.
  - Sixteen channels simultaneously: 17μS/16 channels.
- **Calibrated system accuracy**
  - Linearity error: ±0.5 LSB.
  - Offset error: ±0.0625 LSB.
  - Gain error: ±0.0625 LSB.
  - Total error: ±0.625 LSB (±0.0152% FSR) maximum.
- **Data format (left-justified)**:
  - Straight Binary or Two’s Complement.
- **Output at reset**: 0 volts.
- **Output current**: 10mA (maximum). This corresponds to a minimum load resistance of 1K ohms with a 10V output.
- **Short circuit protection**: Indefinite at 25°C.

### PCI Express Base Specification
- **Conforms to PCIe base specification Revision 2.1**.
- **Lines**: 1 lane in each direction.
- **Bus Speed**: 2.5 Gbps (Generation 1).
- **Memory**: 1MB space required. 1 base address register.

### Environmental
- **Operating temperature**: -40 to 70°C (requires an AcroPack heatsink conduction-cool kit)
- **Storage temperature**: -55 to 150°C.
- **Relative humidity**: 5 to 95% non-condensing.
- **MTBF**: Please contact the factory.

### Physical
- **Length**: 70mm.
- **Width**: 30mm.

### Ordering Information

#### AcroPack® Modules
- **AP225-16E-LF**: 16 voltage outputs, 12-bit DAC with waveform generation capabilities.
  - (Note: AcroPack modules are compatible only with the carriers listed below)

#### Accessories
- **AP-CC-01**: Conduction-cool kit

#### Carrier Cards
- **APcE7010E-LF**: PCIe AcroPack carrier, holds one AcroPack module, air-cooled.
- **APcE7022E-LF**: PCIe AcroPack carrier, holds two AcroPack modules, air-cooled.
- **APcE7040E-LF**: PCIe AcroPack carrier, holds four AcroPack modules, air-cooled.
- **VPX4500E-LF**: 3U VPX AcroPack carrier, holds three AcroPack modules, air-cooled.
- **VPX4500-CC-LF**: 3U VPX AcroPack carrier, holds three AcroPack modules, conduction-cooled.
- **XMCAP2020-LF**: XMC AcroPack carrier; holds two AcroPack modules, 2-slots out front, air-cooled.
- **XMCAP2021-LF**: XMC AcroPack carrier; holds two AcroPack modules, 2-slots out rear, air-cooled.

#### Software
- (see software documentation for details)
  - **APSW-API-VXW**: VxWorks® software support package.
  - **APSW-API-WIN**: Windows® DLL driver software support package.
  - **APSW-API-LNX**: Linux® support (website download only).
**Description**

The AcroPack® product line updates our popular Industry Pack I/O modules with a PCIe interface format. This COTS tech-refresh offers a compact size, low-cost I/O, the same functionality and memory map of the existing IP modules in a rugged form factor. Combine different AcroPack modules on one carrier for a simplified modular approach to system assembly.

The AP226 outputs analog voltage signals to drive up to 8 devices. When used with a carrier that holds four AcroPack modules, up to 32 voltage outputs can be obtained from a single card cage slot.

Each output channel has its own 12-bit D/A converter (DAC). Individual DACs are faster, and they eliminate glitches typically caused by the re-acquisition process of sample and holds found on multiplexed output boards.

Individual channels also have double-buffered data latches. You can select to update each output when it is written to, or to update all outputs simultaneously. Simultaneous outputs better simulate linear movements in motion processes.

Designed for COTS applications these analog output modules deliver high-density, high-reliability, and high-performance at a low cost. AcroPack modules are RoHS compliant and ideal for military, defense, automation, aerospace, scientific, and development labs industries.

The AP226 modules are 70mm long, 19.05mm longer than the full-length mini PCIe card. The board's width is the same as mPCIe board and use the same mPCIe standard board hold down standoff and screw keep out areas.

A down-facing 100 pin Samtec connector will mate with the carrier card. Fifty of these signals are available as field I/O signals.

The AP226 supports 6 independent software selectable output ranges plus capabilities to monitor the status of each output.

**Key Features & Benefits**

- PCI Express Generation 1 interface
- Independent 12-bit D/A converters per channel
- Sample software and diagnostics
- Double-buffered DACs
- Built-in calibration coefficients
- Independent selectable output ranges
- Outputs reset to 0 volts
- Internally stored calibration coefficients ensure accuracy.
- Software provides easy selection of transparent or simultaneous output modes.
- Double-buffered DACs allow new data to be written to each channel before the simultaneous trigger updates the outputs.
- Alarm function
- Solid-down connector I/O interface
- Wide temperature range
- PCIe, VPX and XMC carriers
- Linux®, Windows®, and VxWorks® support
### Performance Specifications

**Analog Output**
- Output configuration
  - 8 isolated bipolar/unipolar.
- D/A Resolution
  - AP226-8E-LF: 12 bits.
- Output ranges
  - Unipolar: 0V to 5V, 0V to 10V.
  - BiPolar: -2.5V to 7.5V, ±3V, ±5V, ±10V.
- Settling time
  - 9μS - 20V step to 1 LSB at 12-bit resolution.
  - 7.5μS - 10V step to 1 LSB at 12-bit resolution.
- Maximum throughput rate
  - Outputs can be updated simultaneously or individually.
  - One channel: 7.5μS/conversion.
  - Eight channels simultaneously: 17μS/8 channels.
- Calibrated system accuracy
  - Linearity error: ±0.5 LSB.
  - Offset error: ±0.0625 LSB.
  - Gain error: ±0.0625 LSB.
  - Total error: ±0.625 LSB (±0.0152% FSR) maximum.
- Data format (left-justified)
  - Straight Binary or Two’s Complement.
- Output at reset
  - 0 volts.
- Output current
  - 10mA (maximum). This corresponds to a minimum load resistance of 1K ohms with a 10V output.
- Short circuit protection
  - Indefinite at 25°C.
- Alarm function
  - Software readable for brownout, short-circuit and temperature exceeding 150 °C conditions.

**Environmental**
- Operating temperature
  - -40 to 70°C.
  - -40 to 85°C. (requires an AcroPack heatsink conduction-cool kit)
- Storage temperature
  - -55 to 150°C.
- Relative humidity
  - 5 to 95% non-condensing.
- MTBF
  - Contact the factory.
- Power
  - See user manual for specifics.

### Ordering Information

**AcroPack® Modules**
- **AP226-8E-LF**
  - 8 isolated voltage outputs, 12-bit DAC
  - (Note: AcroPack modules are compatible only with the carriers listed below)

**Accessories**
- **AP-CC-01**
  - Conduction-cool kit

**Carrier Cards**
- **APCe7010E-LF**
  - PCIe AcroPack carrier, holds one AcroPack module, air-cooled.
- **APCe7022E-LF**
  - PCIe AcroPack carrier, holds two AcroPack modules, air-cooled.
- **APCe7040E-LF**
  - PCIe AcroPack carrier, holds four AcroPack modules, air-cooled.
- **VPX4500E-LF**
  - 3U VPX AcroPack carrier, holds three AcroPack modules, air-cooled.
- **VPX4500-CC-LF**
  - 3U VPX AcroPack carrier, holds three AcroPack modules, conduction-cooled.
- **XMCAP2020-LF**
  - XMC AcroPack carrier; holds two AcroPack modules, 2-slots out front, air-cooled.
- **XMCAP2021-LF**
  - XMC AcroPack carrier; holds two AcroPack modules, 2-slots out rear, air-cooled.

**Software**
- (see software documentation for details)
  - **APSW-API-VXW**
    - VxWorks® software support package.
  - **APSW-API-WIN**
    - Windows® DLL driver software support package.
  - **APSW-API-LNX**
    - Linux® support (website download only).

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**AP-CC-01 Conduction-Cool Kit**

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**AcroPack® Modules**

AP226 Series Isolated Analog Voltage Output

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**ISO9001 AS9100**

**Acromag**

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**AP231 16-bit DAC Analog Voltage Output**

**Description**

**Model:** AP231-16E-LF

The AcroPack® product line updates our popular Industry Pack I/O modules with a PCIe interface format. This COTS tech-refresh design offers a compact size, low-cost I/O, the same functionality and memory map of the existing IP modules in a rugged form factor. Combine different AcroPack modules on one carrier for a simplified modular approach to system assembly.

The AP231 outputs analog voltage signals to drive up to 16 devices. When used with a carrier that holds two AcroPack AP modules, up to 32 voltage outputs can be obtained from a single card cage slot.

Each output channel has its own 16-bit D/A converter (DAC). Individual DACs are faster, and they eliminate glitches typically caused by the re-acquisition process of sample and holds found on multiplexed output boards.

Individual channels also have double-buffered data latches. You can select to update each output when it is written to, or to update all outputs simultaneously. Simultaneous outputs better simulate linear movements in motion processes.

Designed for COTS applications these analog output modules deliver high-density, high-reliability, and high-performance at a low cost.

AcroPack modules are RoHS compliant and ideal for military, defense, automation, aerospace, scientific, and development labs industries.

The AP231 modules are 70mm long, 19.05mm longer than the full length mini PCIe card. The board’s width is the same as mPCIe board and use the same mPCIe standard board hold down standoff and screw keep out areas.

A down facing 100 pin Samtec connector will mate with the carrier card. Fifty of these signals are available as field I/O signals.

The AP231 supports 6 independent software selectable output ranges plus capabilities to monitor the status of each output.

**Key Features & Benefits**

- PCI Express Generation 1 interface
- Independent 16-bit D/A converters per channel
- Mix and match countless I/O combinations in a single slot.
- Sample software and diagnostics
- Double-buffered DACs
- Built-in calibration coefficients
- Independent selectable output ranges
- Outputs reset to 0 volts
- Internally stored calibration coefficients ensure accuracy.
- Software provides easy selection of transparent or simultaneous output modes.
- Double-buffered DACs allow new data to be written to each channel before the simultaneous trigger updates the outputs.
- Alarm function
- Solid-down connector I/O interface
- Wide temperature range
- PCIe, VPX and XMC carriers
- Linux®, Windows®, and VxWorks® support
### Performance Specifications

- **Analog Output**
  - Output configuration
    - 16 non-isolated bipolar/unipolar differential outputs.
    - Each channel is paired with a signal return reference.
  - D/A Resolution
    - 16 bits.
  - Output ranges
    - Unipolar: 0V to 5V, 0V to 10V.
    - BiPolar: -2.5V to 7.5V, ±-3V, ±5V, ±10V.
  - Settling time
    - 9uS - 20V step to 1 LSB at 16-bit resolution.
    - 7.5uS - 10V step to 1 LSB at 16-bit resolution.
  - Maximum throughput rate
    - Outputs can be updated simultaneously or individually.
    - One channel: 7.5μS/conversion.
    - Sixteen channels simultaneously: 17μS/16 channels.
  - Calibrated system accuracy
    - Linearity error: ±2 LSB.
    - Offset error: ±0.0625 LSB.
    - Gain error: ±0.0625 LSB.
    - Total error: ±2.125 LSB (±0.0032% FSR) maximum.
  - Data format (left-justified)
    - Straight Binary or Two's Complement.
  - Output at reset
    - 0 volts.
  - Output current
    - 10mA (maximum). This corresponds to a minimum load resistance of 1K ohms with a 10V output.
  - Short circuit protection
    - Indefinite at 25°C.
  - Alarm function
    - Software readable for brownout, short-circuit and temperature exceeding 150 degrees C conditions.

- **PCI Express Base Specification**
  - Conforms to PCIe base specification Revision 2.1.
  - Lanes
    - 1 lane in each direction.
  - Bus Speed
    - 2.5 Gbps (Generation 1).
  - Memory
    - 4k space required.
    - 1 base address register.

- **Environmental**
  - Operating temperature
    - -40 to 70°C.
    - -40 to 85°C (requires an AcroPack heatsink conduction-cool kit).
  - Storage temperature
    - -55 to 150°C.
  - Relative humidity
    - 5 to 95% non-condensing.
  - MTBF
  - Power
    - +3.3 VDC ±5% 400mA Typical, 480mA Maximum.
    - +12 VDC ±5% 85mA Typical, 275mA Maximum.
    - -12 VDC ±5% 50mA Typical, 200mA Maximum.

- **Physical**
  - Length
    - 70mm.
  - Width
    - 30mm.

### Ordering Information

- **AcroPack® Modules**
  - **AP231-16E-LF**
    - 16 voltage outputs, 16-bit DAC
    - (Note: Acropack modules are compatible only with the carriers listed below)

- **Accessories**
  - **AP-CC-01**
    - Conduction-cool kit

- **Carrier Cards**
  - **APCe7010E-LF**
    - PCIe AcroPack carrier, holds one AcroPack module, air-cooled.
  - **APCe7022E-LF**
    - PCIe AcroPack carrier, holds two AcroPack modules, air-cooled.
  - **APCe7040E-LF**
    - PCIe AcroPack carrier, holds four AcroPack modules, air-cooled.
  - **VPX4500E-LF**
    - 3U VPX AcroPack carrier, holds three AcroPack modules, air-cooled.
  - **VPX4500-CC-LF**
    - 3U VPX AcroPack carrier, holds three AcroPack modules, conduction-cooled.
  - **XMCAP2020-LF**
    - XMC AcroPack carrier; holds two AcroPack modules, 2-slots out front, air-cooled.
  - **XMCAP2021-LF**
    - XMC AcroPack carrier; holds two AcroPack modules, 2-slots out rear, air-cooled.

- **Software**
  - (see software documentation for details)
    - **APSW-API-VXW**
      - VxWorks® software support package.
    - **APSW-API-WIN**
      - Windows® DLL driver software support package.
    - **APSW-API-LNX**
      - Linux® support (website download only).
Description

The AcroPack® product line updates our popular Industry Pack I/O modules with a PCIe interface format. This COTS tech-refresh offers a compact size and low-cost I/O in a rugged form factor. Combine different AcroPack modules on one carrier for a simplified modular approach to system assembly.

The AP235 outputs analog voltage signals to drive up to 16 devices. When used with a carrier that holds two AcroPack AP modules, up to 32 voltage outputs can be obtained from a single card cage slot. The AP235 is ideal for waveform generation application that require high speed capabilities.

Each output channel has its own 16-bit D/A converter (DAC). Individual DACs are faster, and they eliminate glitches typically caused by the re-acquisition process of sample and holds found on multiplexed output boards. A 64K sample memory is provided for waveform storage on board. This memory is shared between the sixteen channels. Waveforms can be continuously output from onboard memory without host intervention. Additionally, a DMA controller is provided for streaming waveform data from host memory.

Designed for COTS applications these analog output modules deliver high-density, high-reliability, and high-performance at a low cost.

AcroPack modules are RoHS compliant and ideal for military, defense, automation, aerospace, scientific, and development labs industries.

The AP235 modules are 70mm long, 19.05mm longer than the full length mini PCIe card. The board's width is the same as mPCIe board and use the same mPCIe standard board hold down standoff and screw keep out areas.

A down facing 100 pin Samtec connector will mate with the carrier card. Fifty of these signals are available as field I/O signals.

The AP235 supports 6 independent software selectable output ranges.
Performance Specifications

■ Analog Output
Output configuration
16 non-isolated bipolar/unipolar.
D/A Resolution
16 bits.
Output ranges
Unipolar: 0V to 5V, 0V to 10V.
BiPolar: -2.5V to 7.5V, ±3V, ±5V, ±10V.
Output rate
100kS/s
Settling time
9μS - 20V step to 1 LSB at 16-bit resolution.
7.5μS - 10V step to 1 LSB at 16-bit resolution.
Maximum throughput rate
Outputs can be updated simultaneously or individually.
7.5μS/conversion.
Calibrated system accuracy
Linearity error: ±0.2 LSB.
Offset error: ±0.0625 LSB.
Gain error: ±0.0625 LSB.
Total error: ±2.125 LSB (±0.0032% FSR) maximum.
Data format (left-justified)
Straight Binary or Two's Complement.
Output at reset
0 volts.
Output current
10mA (maximum). This corresponds to a minimum load resistance of 1K ohms with a 10V output.
Short circuit protection
Indefinite at 25°C.

■ PCI Express Base Specification
Conforms to PCIe base specification
Revision 2.1.
Lanes
1 lane in each direction.
Bus Speed
2.5 Gbps (Generation 1).
Memory
1MB space required.
1 base address register.

■ Environmental
Operating temperature
-40 to 70°C.
-40 to 75°C.
Requires an AcroPack heatsink conduction-cool kit.
Storage temperature
-55 to 150°C.
Relative humidity
5 to 95% non-condensing.
MTBF
Please contact factory.
Power
+3.3 VDC ±5% 0.5A typical, 1A maximum.
+12 VDC ±5% 85mA typical, 275mA maximum.
-12 VDC ±5% 50mA typical, 200mA maximum.

■ Physical
Length
70mm.
Width
30mm.

Ordering Information

AcroPack® Modules
AP235-16E-LF
16 voltage outputs, 16-bit DAC with waveform generation capabilities.
(Note: AcroPack modules are compatible only with the carriers listed below)

Accessories
AP-CC-01
Conduction-cool kit

Carrier Cards
APCe7010E-LF
PCIe AcroPack carrier, holds one AcroPack module, air-cooled.
APCe7022E-LF
PCIe AcroPack carrier, holds two AcroPack modules, air-cooled.
APCe7040E-LF
PCIe AcroPack carrier, holds four AcroPack modules, air-cooled.
VPX4500E-LF
3U VPX AcroPack carrier, holds three AcroPack modules, air-cooled.
VPX4500-C-LF
3U VPX AcroPack carrier, holds three AcroPack modules, conduction-cooled.
XMCPAP2020-LF
XMC AcroPack carrier; holds two AcroPack modules, 2-slots out front, air-cooled.
XMCPAP2021-LF
XMC AcroPack carrier; holds two AcroPack modules, 2-slots out rear, air-cooled.

Software (see software documentation for details)
APSW-API-VXW
VxWorks® software support package.
APSW-API-WIN
Windows® DLL driver software support package.
APSW-API-LNX
Linux® support (website download only).
**Description**

The AcroPack® product line updates our popular Industry Pack I/O modules with a PCIe interface format. This COTS tech-refresh offers a compact size, low-cost I/O, the same functionality and memory map of the existing IP modules in a rugged form factor. Combine different AcroPack modules on one carrier for a simplified modular approach to system assembly.

The AP236 outputs analog voltage signals to drive up to 8 devices. When used with a carrier that holds four AcroPack modules, up to 32 voltage outputs can be obtained from a single card cage slot.

Each output channel has its own 16-bit D/A converter (DAC). Individual DACs are faster, and they eliminate glitches typically caused by the re-acquisition process of sample and holds found on multiplexed output boards.

Individual channels also have double-buffered data latches. You can select to update each output when it is written to, or to update all outputs simultaneously. Simultaneous outputs better simulate linear movements in motion processes.

**Key Features & Benefits**

- PCI Express Generation 1 interface
- Independent 16-bit D/A converters per channel
- Sample software and diagnostics
- Double-buffered DACs
- Built-in calibration coefficients
- Independent selectable output ranges
- Outputs reset to 0 volts
- Internally stored calibration coefficients ensure accuracy.
- Software provides easy selection of transparent or simultaneous output modes.
- Double-buffered DACs allow new data to be written to each channel before the simultaneous trigger updates the outputs.
- Alarm function
- Solid-down connector I/O interface
- Wide temperature range
- PCIe, VPX and XMC carriers
- Linux®, Windows®, and VxWorks® support

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**AP236 Isolated Analog Voltage Output**

16-bit DAC ◆ 8 Channels Voltage Output ◆ Wide Temperature Range ◆ PCIe Bus Interface

- Designed for COTS applications these analog output modules deliver high-density, high-reliability, and high-performance at a low cost.
- AcroPack modules are RoHS compliant and ideal for military, defense, automation, aerospace, scientific, and development labs industries.
- The AP236 modules are 70mm long, 19.05mm longer than the full-length mini PCIe card. The board's width is the same as mPCIe board and use the same mPCIe standard board hold down standoff and screw keep out areas.
- A down-facing 100 pin Samtec connector will mate with the carrier card. Fifty of these signals are available as field I/O signals.
- The AP236 supports 6 independent software selectable output ranges plus capabilities to monitor the status of each output.
## Performance Specifications

### Analog Output
- **Output configuration**: 8 isolated bipolar/unipolar.
- **D/A Resolution**: AP236-8E-LF: 16 bits.
- **Output ranges**:
  - Unipolar: 0V to 5V, 0V to 10V.
  - BiPolar: -2.5V to 7.5V, ±3V, ±5V, ±10V.
- **Settling time**:
  - 9μS - 20V step to 1 LSB at 16-bit resolution.
  - 7.5μS - 10V step to 1 LSB at 16-bit resolution.
- **Maximum throughput rate**:
  - Outputs can be updated simultaneously or individually.
  - One channel: 7.5μS/conversion.
  - Eight channels simultaneously: 17μS/8 channels.
- **Calibrated system accuracy**:
  - Linearity error: ±0.5 LSB.
  - Offset error: ±0.0625 LSB.
  - Gain error: ±0.0625 LSB.
  - Total error: ±0.625 LSB (±0.0152% FSR) maximum.
- **Data format (left-justified)**: Straight Binary or Two’s Complement.
- **Output at reset**: 0 volts.
- **Output current**: 10mA (maximum). This corresponds to a minimum load resistance of 1K ohms with a 10V output.
- **Short circuit protection**: Indefinite at 25°C.
- **Alarm function**: Software readable for brownout, short-circuit and temperature exceeding 150 °C conditions.

### PCI Express Base Specification
- **Conforms to PCIe base specification**
  - Revision 2.1.
  - **Lanes**: 1 lane in each direction.
  - **Bus Speed**: 2.5 Gbps (Generation 1).
  - **Memory**: 4k space required.
  - **1 base address register**.

### Environmental
- **Operating temperature**:
  - -40 to 70°C.
  - -40 to 85°C. (requires an AcroPack heatsink conduction-cool kit)
- **Storage temperature**: -55 to 150°C.
- **Relative humidity**: 5 to 95% non-condensing.
- **MTBF**: Contact the factory
- **Power**:
  - See user manual for specifics.

### Physical
- **Length**: 70mm.
- **Width**: 30mm.

## Ordering Information

### AcroPack® Modules
- **AP236-8E-LF**: 8 isolated voltage outputs, 16-bit DAC
- **APC7010E-LF**: PCIe AcroPack carrier, holds one AcroPack module, air-cooled.
- **APC7022E-LF**: PCIe AcroPack carrier, holds two AcroPack modules, air-cooled.
- **APC7040E-LF**: PCIe AcroPack carrier, holds four AcroPack modules, air-cooled.
- **VPX4500E-LF**: 3U VPX AcroPack carrier, holds three AcroPack modules, air-cooled.
- **VPX4500-CC-LF**: 3U VPX AcroPack carrier, holds three AcroPack modules, conduction-cooled.
- **XMCAP2020-LF**: XMC AcroPack carrier; holds two AcroPack modules, 2-slots out front, air-cooled.
- **XMCAP2021-LF**: XMC AcroPack carrier; holds two AcroPack modules, 2-slots out rear, air-cooled.

### Software
- (see software documentation for details)
  - **APSW-API-VXW**: VxWorks® software support package.
  - **APSW-API-WIN**: Windows® DLL driver software support package.
  - **APSW-API-LNX**: Linux® support (website download only).
**Description**

**Model:** AP323E-LF

The AcroPack® product line updates our popular Industry Pack I/O modules with a PCIe interface format. This **COTS tech-refresh** design offers a compact size, low-cost I/O in a rugged form factor. Combine different AcroPack modules on one carrier for a simplified modular approach to system assembly.

AP323E-LF AcroPack model monitors 20 differential or 40 single-ended input channels. When used with a carrier that holds four AP modules, up to 160 inputs can be obtained from a single card cage slot.

Software or an external hardware input can trigger A/D conversions for synchronization to external events.

On-board, precision voltage references enable accurate software calibration of the module without external instruments.

**Key Features & Benefits**

- PCI Express Generation 1 interface
- 20 differential or 40 single-ended inputs
- Mix and match countless I/O combinations in a single slot.
- Flexible scan control
- 8µs conversion time
- FIFO buffer with 16K sample memory
- Interrupt upon FIFO threshold condition
- FIFO full, empty and threshold reached flags
- Programmable channel conversion control
- Programmable conversion timer
- Several scanning modes
- External trigger
- Solid-down connector I/O interface
- Wide temperature range
- PCIe, VPX and XMC carriers
- Linux®, Windows®, and VxWorks® support

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**16-bit ADC ◆ 20 Differential or 40 Single-Ended Channels ◆ Wide Temp. Range ◆ PCIe Bus Interface**
### Performance Specifications

- **Analog Input**
  - Input configuration: 20 differential or 40 single-ended.
  - A/D Resolution: 16 bits.
  - Input range (dip switch-selectable):
    - Bipolar ±5V or ±10V
    - Unipolar 0 to +5V or 0 to +10V
  - Data sample memory: 16K sample FIFO buffer.
  - Maximum throughput rate: 200KHz (5µS/conversion).
  - A/D triggers: External, and software.
  - System accuracy: 2.4 LSB (0.014%)
  - Maximum overall calibrated error at 25°C

<table>
<thead>
<tr>
<th>Input Range (Volts)</th>
<th>ADC Range (Volts)</th>
<th>Maximum Error ±LSB (%span)</th>
<th>Typical Error ±LSB (%span)</th>
</tr>
</thead>
<tbody>
<tr>
<td>±5</td>
<td>±5</td>
<td>±8.6 LSB (0.013%)</td>
<td>±4 LSB (0.006%)</td>
</tr>
<tr>
<td>±10</td>
<td>±10</td>
<td>±9.4 LSB (0.014%)</td>
<td>±3 LSB (0.005%)</td>
</tr>
</tbody>
</table>

- **Data format**
  - Binary two's compliment and straight binary.
- **Input overvoltage protection**
  - Power on: -20V to +40V.
  - Power off: -35V to +55V.
- **Common mode rejection ratio (60Hz)**
  - 96dB typical.
- **Channel-to-channel rejection ratio (60Hz)**
  - 96dB typical.

- **PCI Express Base Specification**
  - Conforms to PCIe base specification Revision 2.1.
  - Lanes: 1 lane in each direction.
  - Bus Speed: 2.5 Gbps (Generation 1).
  - Memory: 4k space required.
  - Base address register.
  - System accuracy: 2.4 LSB (0.014%)
  - Maximum overall calibrated error at 25°C

- **Environmental**
  - Operating temperature: -40 to 70°C.
  - Storage temperature: -40 to 85°C (requires an AcroPack heatsink conduction-cool kit).
  - Relative humidity: 5 to 95% non-condensing.
  - Power:
    - 3.3 VDC ±5% 400mA typical, 500mA maximum.
    - 5.0 VDC ±5% 20mA typical, 30mA maximum.
    - ±12 VDC ±5% 0.7mA typical, 1.4mA maximum.

- **Physical**
  - Length: 70mm.
  - Width: 30mm.

### Ordering Information

- **AcroPack® Modules**
  - **AP323E-LF**: 20 differential or 40 singel-ended inputs, 16-bit (Note: AcroPack modules are compatible only with the carriers listed below).

- **Accessories**
  - **AP-CC-01**: Conduction-cool kit.

- **Carrier Cards**
  - **APCe7010E-LF**: PCIe AcroPack carrier, holds one AcroPack module, air-cooled.
  - **APCe7022E-LF**: PCIe AcroPack carrier, holds two AcroPack modules, air-cooled.
  - **APCe7040E-LF**: PCIe AcroPack carrier, holds four AcroPack modules, air-cooled.
  - **VPX4500E-LF**: 3U VPX AcroPack carrier, holds three AcroPack modules, air-cooled.
  - **VPX4500-CC-LF**: 3U VPX AcroPack carrier, holds three AcroPack modules, conduction-cooled.
  - **XMCAP2020-LF**: XMC AcroPack carrier; holds two AcroPack modules, 2-slots out front, air-cooled.
  - **XMCAP2021-LF**: XMC AcroPack carrier; holds two AcroPack modules, 2-slots out rear, air-cooled.

- **Software** (see software documentation for details)
  - **APSW-API-VXW**: VxWorks® software support package.
  - **APSW-API-WIN**: Windows® DLL driver software support package.
  - **APSW-API-LNX**: Linux® support (website download only).
**Description**

**Model:** AP341E-LF

The AcroPack® product line updates our popular Industry Pack I/O modules with a PCIe interface format. This COTS tech-refresh design offers a compact size, low-cost I/O, the same functionality and memory map of the existing IP modules in a rugged form factor. Combine different AcroPack modules on one carrier for a simplified modular approach to system assembly.

AP341E-LF AcroPack provides fast, high resolution, simultaneous A/D conversion of up to eight channels. Simultaneous channel conversion and on-board memory enable megahertz throughput rates. Programmable interrupts simplify data acquisition by providing greater control.

These modules have sixteen differential analog inputs which are sampled as two eight-channel banks. Eight A/D converters (ADCs) permit simultaneous conversion of up to eight channels in a bank. A FIFO buffer holds the first bank’s data while the second bank is converted. Conversion of each bank requires only 8µS, and all 16 channels can be sampled in just 16µS.

Flexible configuration options give you extensive control over the conversion process. The channels or bank to be converted, timing, scan mode, and other parameters are user-programmable. Interrupt support adds further control to flag a FIFO that is full or filled to a user-defined threshold level.

Designed for COTS applications these analog input modules deliver high-density, high-reliability, and high-performance at a low cost. AcroPack modules are RoHS compliant and ideal for military, defense, automation, aerospace, scientific, and development labs industries.

The AP341E-LF modules are 70mm long, 19.05mm longer than the full-length mini-PCIe card. The board’s width is the same as mPCIe board and they use the same mPCIe standard board hold down standoff and screw keep out areas.

A down facing 100 pin Samtec connector will mate with the carrier card. Fifty of these signals are available as field I/O signals.

**Key Features & Benefits**

- PCI Express Generation 1 interface
- Eight 14-bit A/D converters with simultaneous multi-channel conversion
- 16 differential inputs with ±10VDC input range
- Mix and match countless I/O combinations in a single slot
- 8µs conversion time (125kHz) for 8-ch. bank
- FIFO buffer with 1025 sample memory
- Interrupt upon FIFO threshold condition
- FIFO full, empty and threshold reached flags
- Programmable channel conversion control
- Programmable conversion timer
- Continuous and single-cycle conversion modes
- External trigger input and output
- Calibration constants for gain and offset correction stored on-board
- Solid-down connector I/O interface
- Wide temperature range
- PCIe, VPX and XMC carriers
- Linux®, Windows®, and VxWorks® support
### Performance Specifications

**Analog Input**
- Input configuration: 16 differential.
- ADC Resolution: 14 bits.
- Input range: ±10V.
- Data sample memory: 1025 sample FIFO buffer.
- Maximum throughput rate: Eight channels can be simultaneously acquired. One channel: 125kHz (8µS/conversion), 8 channels (same bank): 1MHz (8µS/8 channels), 16 channels (high & low banks): 1MHz (16µS/16 ch. at minimum 2.2K ohm source resistance).
- ADC triggers: Internal timer, external, and software.
- System accuracy: 2.8 LSB (0.017%).
- ADC overvoltage protection: ±25V with power on, ±40V with power off.
- Common mode rejection ratio (60Hz): 96dB typical.
- Channel-to-channel rejection ratio (60Hz): 96dB typical.

**PCI Express Base Specification**
- Conforms to PCIe base specification Revision 2.1.
- Lanes: 1 lane in each direction.
- Bus Speed: 2.5 Gbps (Generation 1).
- Memory: 128k space required.
- 1 base address register.

**Environmental**
- Operating temperature: -40 to 70°C.
- Storage temperature: -55 to 150°C.
- Relative humidity: 5 to 95% non-condensing.
- Power:
  - +3.3 VDC ±5% 500mA typical, 580mA max.
  - +5 VDC ±5% 35mA typical, 70mA max.
  - +12 VDC ±5% 14mA typical, 40mA max.
  - -12 VDC ±5% 7mA typical, 20mA max.

**Physical**
- Length: 70mm.
- Width: 30mm.

### Ordering Information

**AcroPack® Modules**
- **AP341E-LF**: 14-bit ADC simultaneous sample and hold.
- **APCC01**: Conduction-cool kit

**Carrier Cards**
- **APCC7012E-LF**: PCIe AcroPack carrier, holds one AcroPack module, air-cooled.
- **APCC7022E-LF**: PCIe AcroPack carrier, holds two AcroPack modules, air-cooled.
- **APCC7040E-LF**: PCIe AcroPack carrier, holds four AcroPack modules, air-cooled.
- **VPX4500E-LF**: 3U VPX AcroPack carrier, holds three AcroPack modules, air-cooled.
- **VPX4500-CC-LF**: 3U VPX AcroPack carrier, holds three AcroPack modules, conduction-cooled.
- **XMCAP2020-LF**: XMC AcroPack carrier; holds two AcroPack modules, 2-slots out front, air-cooled.
- **XMCAP2021-LF**: XMC AcroPack carrier; holds two AcroPack modules, 2-slots out rear, air-cooled.

**Software** (see software documentation for details)
- **APSW-API-VXW**: VxWorks® software support package.
- **APSW-API-WIN**: Windows® DLL driver software support package.
- **APSW-API-LNX**: Linux® support (website download only).

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**AP-CC-01 Conduction-Cool Kit**
Description

The AcroPack® product line updates our popular Industry Pack I/O modules with a PCIe interface format. This COTS tech-refresh design offers a compact size, low-cost I/O, the same functionality and memory map of the existing IP modules in a rugged form factor. Combine different AcroPack modules on one carrier for a simplified modular approach to system assembly.

AP342E-LF AcroPack provides fast, high resolution, simultaneous A/D conversion of up to six channels. Simultaneous channel conversion and on-board memory enable megahertz throughput rates. Programmable interrupts simplify data acquisition by providing greater control.

These modules have twelve differential analog inputs which are sampled as two six-channel banks. Six A/D converters (ADCs) permit simultaneous conversion of up to six channels in a bank. A FIFO buffer holds the first bank's data while the second bank is converted. Conversion of each bank requires only 8µs, and all 12 channels can be sampled in just 16µs.

Flexible configuration options give you extensive control over the conversion process. The channels or bank to be converted, timing, scan mode, and other parameters are user-programmable. Interrupt support adds further control to flag a FIFO that is full or filled to a user-defined threshold level.

Designed for COTS applications these analog input modules deliver high-density, high-reliability, and high-performance at a low cost. AcroPack modules are RoHS compliant and ideal for military, defense, automation, aerospace, scientific, and development labs industries.

The AP342E-LF modules are 70mm long, 19.05mm longer than the full-length mini-PCIe card. The board's width is the same as mPCIe board and they use the same mPCIe standard board hold down standoff and screw keep out areas.

A down facing 100 pin Samtec connector will mate with the carrier card. Fifty of these signals are available as field I/O signals.

Key Features & Benefits

- PCI Express Generation 1 interface
- Six 14-bit A/D converters with simultaneous multi-channel conversion
- 12 differential inputs with ±10VDC input range
- Mix and match countless I/O combinations in a single slot
- 8µs conversion time (125kHz) for 6-ch. bank
- FIFO buffer with 1025 sample memory
- Interrupt upon FIFO threshold condition
- FIFO full, empty and threshold reached flags
- Programmable channel conversion control
- Programmable conversion timer
- Continuous and single-cycle conversion modes
- External trigger input and output
- Calibration constants for gain and offset correction stored on-board
- Solid-down connector I/O interface
- Wide temperature range
- PCIe, VPX and XMC carriers
- Linux®, Windows®, and VxWorks® support

Acromag
THE LEADER IN INDUSTRIAL I/O
Performance Specifications

■ Analog Input
Input configuration
12 differential.
ADC Resolution
14 bits.
Input range
±10V.
Data sample memory
1025 sample FIFO buffer.
Maximum throughput rate
Eight channels can be simultaneously acquired.
One channel: 125KHz (8µS/conversion).
6 channels (same bank): 750kHz (8µS/6 channels).
12 channels (high and low banks): 750kHz (16µS/12 channel at minimum 2.2K ohm source resistance).
ADC triggers
Internal timer, external, and software.
System accuracy
2.8 LSB (0.017%).
Data format
Binary two’s compliment.
Input overvoltage protection
±25V with power on, ±40V with power off.
Common mode rejection ratio (60Hz)
96dB typical.
Channel-to-channel rejection ratio (60Hz)
96dB typical.

■ Environmental
Operating temperature
-40 to 70°C.
-40 to 85°C.
(Requires an AcroPack heatsink conduction-cool kit)
Storage temperature
-55 to 125°C.
Relative humidity
5 to 95% non-condensing.
Power
<table>
<thead>
<tr>
<th>Power Supply Voltage</th>
<th>Current Draw (typical)</th>
</tr>
</thead>
<tbody>
<tr>
<td>+3.3 VDC ±5%</td>
<td>470mA 550mA max.</td>
</tr>
<tr>
<td>+12 VDC isolated ±5%</td>
<td>60mA 75mA max.</td>
</tr>
<tr>
<td>-12 VDC isolated ±5%</td>
<td>7mA 20mA max.</td>
</tr>
</tbody>
</table>
Isolation Voltage
250V field I/O to FPGA logic
60V field I/O to field I/O

■ Physical
Length
70mm.
Width
30mm.

Ordering Information

AcroPack® Modules
AP342E-LF
14-bit ADC simultaneous sample and hold.
(Note: AcroPack modules are compatible only with the carriers listed below)

Accessories
AP-CC-01
Conduction-cool kit

Carrier Cards
APCe7012E-LF
PCIe AcroPack carrier, holds one AcroPack module, air-cooled.
APCe7022E-LF
PCIe AcroPack carrier, holds two AcroPack modules, air-cooled.
APCe7040E-LF
PCIe AcroPack carrier, holds four AcroPack modules, air-cooled.

XPX4500E-LF
3U VPX AcroPack carrier, holds three AcroPack modules, air-cooled.

XPX4500-CC-LF
3U VPX AcroPack carrier, holds three AcroPack modules, conduction-cooled.

XMCAP2020-LF
XMC AcroPack carrier; holds two AcroPack modules, 2-slots out front, air-cooled.

XMCAP2021-LF
XMC AcroPack carrier; holds two AcroPack modules, 2-slots out rear, air-cooled.

Software (see software documentation for details)
APSW-API-VXW
VxWorks® software support package.
APSW-API-WIN
Windows® DLL driver software support package.
APSW-API-LNX
Linux® support (website download only).

AP-CC-01 Conduction-Cool Kit
The AcroPack® product line updates our popular Industry Pack I/O modules with a PCIe interface format. This tech-refresh design offers a compact size, low-cost I/O, the same functionality and memory map of the existing Industry Pack modules and a rugged form factor.

The AP408 monitors or controls the on/off (high/low) status of up to 32 devices. Each channel can be used as an input or output.

All 32 input channels can be configured with interrupts for a change of state or level detection of any bit. The TTL input threshold includes hysteresis for increasing noise immunity.

In order to ensure safe, reliable control under all conditions, output operation is “fail-safe.” That is, the outputs are always off upon power-up and are automatically cleared following a software reset.

Loopback monitoring of critical control signals is easy since the input and output circuitry are connected in tandem to each channel.

The AP408 is 70mm long, this is 19.05mm longer than the full length mini PCIe card at 50.95mm. The board width is the same as mPCIe board of 30mm and uses the same mPCIe standard board hold down standoff and screw keep out areas. A down facing 100 pin Samtec connector will mate with the carrier card. Fifty of these signals are available as field I/O signals. Pin spacing and signal assignments will allow for 100V of signal to signal isolation. The AP408 maintains the same functionality and memory map of the existing Industry Pack modules providing a smooth transition to the AcroPack I/O modules.

32 Digital I/O Channels  ◆  High impedance  ◆  PCIe Bus Interface

Key Features & Benefits
- PCI Express Generation 1 interface
- 32 digital input/output channels
- 0 to 60V DC input range, 60V DC low-side switch outputs
- Outputs sink up to 1A per channel
- TTL-compatible input threshold with hysteresis
- Change-of-state/level interrupts (up to 32)
- Buffered inputs include hysteresis to increase noise immunity.
- Interrupts are software-programmable for a change of state or level detection.
- Loopback monitoring enables self-test and fault diagnostics to detect open output switches or shorts.
- High impedance inputs prevent loading of the input source and minimize current.
- Individual outputs sink up to 1A DC continuous. No deration of output current required at elevated temperatures.

Tel 248-249-0310  ▬ Fax 248-624-9234  ▬ solutions@acromag.com  ▬ www.acromag.com  ▬ 30765 Wixom Rd, Wixom, MI 48393 USA

Bulletin #8400-879f
AP408 High Voltage Digital Input/Output

Performance Specifications

- **Digital Inputs**
  - Input channel configuration
    - 32 noninverting buffered inputs with a common connection
  - Input signal voltage range
    - 0 to 60V DC, maximum
  - Input signal threshold
    - TTL compatible. Limited to TTL levels of 0.8V DC (max. low level) and 2.0V DC (minimum high level)
  - Interrupts
    - Change-of-state and level on channels 0-31

- **Digital Outputs**
  - Channel configuration
    - 32 open-drain MOSFETs with common source connection
  - Output ON current range
    - 0 to 1A DC, continuous per channel (5A total for all channels combined). No deration required at elevated ambients
  - Output Rds ON Resistance
    - 0.1 Ω maximum

- **PCI Express Base Specification**
  - Conforms to revision 2.1
  - Lanes
    - 1 lane in each direction
  - Bus Speed
    - 2.5 Gbps (Generation 1)
  - Memory
    - 4k space required
    - 1 base address register

- **Environmental**
  - Operating temperature
    - -40 to 70°C.
    - -40 to 85°C.
  - Storage temperature
    - -40°C (requires an AcroPack heatsink conduction-cool kit)
  - Relative humidity
    - 5 to 95% non-condensing
  - Power
    - +3.3V (±5%) — 400mA typical 600mA maximum
    - +5V (±5%) — 20mA typical 50mA maximum

- **Physical**
  - Length
    - 70mm
  - Width
    - 30mm

Ordering Information

- **AcroPack® Modules**
  - **AP408E-LF**
    - 32 bidirectional input/output channels
    - (Note: AcroPack modules are compatible only with the carriers listed below)

- **Accessories**
  - **AP-CC-01**
    - Conduction-cool kit

- **Carrier Cards**
  - **APCe7010E-LF**
    - PCIe AcroPack carrier, holds one AcroPack module, air-cooled.
  - **APCe7022E-LF**
    - PCIe AcroPack carrier, holds two AcroPack modules, air-cooled.
  - **APCe7040E-LF**
    - PCIe AcroPack carrier, holds four AcroPack modules, air-cooled.
  - **VPX4500E-LF**
    - 3U VPX AcroPack carrier, holds three AcroPack modules, air-cooled.
  - **VPX4500-CC-LF**
    - 3U VPX AcroPack carrier, holds three AcroPack modules, conduction-cooled.
  - **XMCAP2020-LF**
    - XMC AcroPack carrier, holds two AcroPack modules, 2-slots out front, air-cooled.
  - **XMCAP2021-LF**
    - XMC AcroPack carrier, holds two AcroPack modules, 2-slots out rear, air-cooled.

- **Software** (see software documentation for details)
  - **APSW-API-VXW**
    - VxWorks® software support package.
  - **APSW-API-WIN**
    - Windows® DLL driver software support package.
  - **APSW-API-LNX**
    - Linux® support (website download only).

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**Description**

**Model: AP418E-LF**

The AcroPack® product line updates our popular Industry Pack I/O modules with a PCIe interface format. This tech-refresh design offers a compact size, low-cost I/O, the same functionality and memory map of the existing Industry Pack modules and a rugged form factor.

The AP418 monitors or controls the on/off (high/low) status of up to 16 devices. Each channel can be used as an input or output.

All 16 input channels can be configured with interrupts for a change of state or level detection of any bit. The TTL input threshold includes hysteresis for increasing noise immunity.

In order to ensure safe, reliable control under all conditions, output operation is “fail-safe.” That is, the outputs are always off upon power-up and are automatically cleared following a software reset.

Loopback monitoring of critical control signals is easy since the input and output circuitry are connected in tandem to each channel.

Designed for COTS applications these digital I/O modules deliver high-density, high-reliability, and high-performance at a low cost.

AcroPack modules are RoHS compliant and ideal for military, defense, automation, aerospace, scientific, and development labs industries.

The AP418 module is 70mm long, this is 19.05mm longer than the full length mini PCIe card at 50.95mm. The boards width is the same as mPCIe standard board hold down standoff and screw keep out areas.

A down facing 100 pin Samtec connector will mate with the carrier card. Fifty of these signals are available as field I/O signals.

The AP418 maintains the same functionality and memory map of the existing Industry Pack modules providing a smooth transition to the AcroPack I/O modules.

**Key Features & Benefits**

- PCI Express Generation 1 interface
- 16 digital input/output channels
- 0 to 60V DC input range, 60V DC low-side or high-side switch outputs
- Outputs sink up to 2A per channel
- TTL-compatible input threshold with hysteresis
- Change-of-state/level interrupts (up to 16)
- Buffered inputs include hysteresis to increase noise immunity.
- Interrupts are software-programmable for a change of state or level detection.
- Loopback monitoring enables self-test and fault diagnostics to detect open output switches or shorts.
- High impedance inputs prevent loading of the input source and minimize current.
- Individual outputs sink up to 2A DC continuous. No deration of output current required at elevated temperatures.
AcroPack® Modules

AP400 Series  High Voltage Digital Input/Output

Performance Specifications

- **Digital Inputs**
  - Input channel configuration: 16 noninverting buffered inputs with a common connection
  - Input signal voltage range: 0 to 60V DC, maximum
  - Input signal threshold: TTL compatible. Limited to TTL levels of 0.8V DC (max. low level) and 2.0V DC (minimum high level)
  - Interrupts: Change-of-state and level on channels 0-15

- **Digital Outputs**
  - Channel configuration: Each output can be configured to be a low-side switch or a high-side switch.
    - Low-side switch has open-drain output with source connected to common.
    - High-side switch has open-drain output with source connected to excitation voltage source.
  - Output ON current range: 0 to 2A DC, per channel (5A total). No deration required at elevated ambients
  - Output Rds ON Resistance:
    - Low-side switch: 0.1 ohm Max.
    - High-side switch: 0.2 ohm Max.

- **PCI Express Base Specification**
  - Conforms to revision 2.1
  - Lanes: 1 lane in each direction
  - Bus Speed: 2.5 Gbps (Generation 1)
  - Memory: 4k space required
  - 1 base address register

- **Environmental**
  - Operating temperature: -40 to 70°C.
  - Storage temperature: -40 to 125°C.
  - Relative humidity: 5 to 95% non-condensing.
  - Power:
    - +3.3V (±5%): ~400mA typical 600mA maximum.
    - +12V (±5%): ~20mA typical 50mA maximum.

- **Physical**
  - Length: 70mm.
  - Width: 30mm.

Ordering Information

- **AcroPack® Modules**
  - AP418E-LF: 16 bidirectional input/output channels
  - (Note: AcroPack modules are compatible only with the carriers listed below)

- **Accessories**
  - AP-CC-01: Conduction-cool kit

- **Carrier Cards**
  - APCe7010E-LF: PCIe AcroPack carrier, holds one AcroPack module, air-cooled.
  - APCe7022E-LF: PCIe AcroPack carrier, holds two AcroPack modules, air-cooled.
  - APCe7040E-LF: PCIe AcroPack carrier, holds four AcroPack modules, air-cooled.
  - VPX4500E-LF: 3U VPX AcroPack carrier, holds three AcroPack modules, air-cooled.
  - VPX4500-CC-LF: 3U VPX AcroPack carrier, holds three AcroPack modules, conduction-cooled.
  - XMCAP2020-LF: XMC AcroPack carrier; holds two AcroPack modules, 2-slots out front, air-cooled.
  - XMCAP2021-LF: XMC AcroPack carrier; holds two AcroPack modules, 2-slots out rear, air-cooled.

- **Software**
  - APSW-API-VXW: VxWorks® software support package.
  - APSW-API-WIN: Windows® DLL driver software support package.
  - APSW-API-LNX: Linux® support (website download only).

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AS9100

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**AP441 Isolated Digital Input with Interrupts**

The AcroPack® product line updates our popular Industry Pack I/O modules with a PCIe interface format. This tech-refresh design offers a compact size, low-cost I/O, the same functionality of the existing IP modules and a rugged form factor.

AP441-XE-LF modules provide 32 optically isolated inputs to safely monitor a wide range of digital input voltage levels.

Isolation protects your computer system from noise, transient signals, and field wiring faults. The inputs are grouped into four 8-channel ports. Ports are isolated from the logic and each other.

Change-of-state, high-to-low and low-to-high interrupts are individually programmable for each channel. Debounce eliminates spurious interrupts from noise and switching transients for error-free edge detection.

Closed-loop monitoring of critical control signals is easily accomplished using the AP441-XE-LF in conjunction with Acromag’s AP445E-LF digital output module.

**Key Features & Benefits**

- PCI Express Generation 1 interface
- 2.5 Gbps bus speed with one lane in each direction
- 32 port-isolated input channels
- Interrupt support for each channel
- Programmable event interrupts (change-of-state, low-to-high or high-to-low transitions)
- Programmable debounce
- Input hysteresis
- Reverse polarity protection
- Software configuration (no jumpers or switches)
- Software configuration allows “on-the-fly” changes without removing modules.
- Pins are compatible with AP445E-LF output module for loopback monitoring
- Loopback monitoring enables self-test and fault diagnostics to detect open switches or shorts.
- Extended temperature range

**Description**

**Models**

- AP441-1E-LF: ±4 to ±18V DC or AC peak input
- AP441-2E-LF: ±16 to ±40V or AC peak input
- AP441-3E-LF: ±38 to ±60 or AC peak input

The AP441 module is 70mm long, this is 19.05mm longer than the full length mini PCIe card at 50.95mm. The board’s width is the same as mPCIe board of 30mm and they use the same mPCIe standard board hold down standoff and screw keep out areas.

A down facing 100 pin Samtec connector will mate with the carrier card. Fifty of these signals are available as field I/O signals.

Pin spacing and signal assignments will allow for 100V of port to port isolation. Logic and field lines are isolated from each other for voltages up to 250V AC or DC on a continuous basis.

The AP441 series maintains the same functionality of the existing Industry Pack modules providing a smooth transition to the AcroPack I/O modules.

AcroPack modules are RoHS compliant and ideal for military, defense, automation, aerospace, scientific, and development labs industries.
**Performance Specifications**

- **Digital Inputs**
  - Input channel configuration
  - 32 optically isolated inputs
  - **Isolation**
  - Logic and field connections are optically isolated. Individual ports are also isolated from each other. Input lines of individual ports share a common connection and are not isolated from each other. Logic and field lines are isolated from each other for voltages up to 250V AC rms, 250V DC on a continuous basis (unit will withstand a 1250V AC dielectric strength test for one minute without breakdown).
  - **Bipolar input voltage range**
    - AP441-1E-LF: ±4 to ±18V DC or AC peak
    - AP441-2E-LF: ±16 to ±40V DC or AC peak
    - AP441-3E-LF: ±38 to ±60V DC or AC peak
  - **Input low-to-high threshold**
    - AP441-1E-LF: ±4V maximum
    - AP441-2E-LF: ±16V maximum
    - AP441-3E-LF: ±38V maximum
  - **Input response time**
    - On to off: 15μS typical
    - Off to on: 35μS typical
  - **Interrupts**: 32 channels configurable as below
    - High-to-low transitions
    - Low-to-high transitions
    - Change-of-state
  - **Debounce**
    - Selectable for 4μS, 64μS, 1mS, or 8mS

- **Environmental**
  - **Operating temperature**
    - -40 to 70°C.
    - -40 to 85°C. (requires an AcroPack heatsink conduction-cool kit)
  - **Storage temperature**
    - -55 to 150°C
  - **Relative humidity**
    - 5 to 95% non-condensing
  - **MTBF**
    - Contact the factory
  - **Power**
    - +1.5 VDC (±5%) not used
    - +3.3 VDC (±5%) 0.48 A typical, 0.63 A maximum
    - +3.3 VDC (±5%) 0.043 A typical, 0.052 A maximum
    - +12 VDC (±5%) not used
    - -12 VDC (±5%) not used

- **Physical**
  - **Length**
    - 70mm
  - **Width**
    - 30mm

- **PCI Express Base Specification**
  - **Conforms to** revision 2.1
  - **Lanes**
    - 1 lane in each direction
  - **Bus Speed**
    - 2.5 Gbps (Generation 1)
  - **Memory**
    - 4k space required
    - 1 base address register

**Ordering Information**

- **AcroPack® Modules**
  - AP441-1E-LF
    - Digital input, ±4 to ±18V
  - AP441-2E-LF
    - Digital input, ±16 to ±40V input range
  - AP441-3E-LF
    - Digital input, ±38 to ±60V input range

- **Accessories**
  - AP-CC-01
    - Conduction-cool kit

- **Carrier Cards**
  - AcroPack Carriers
    - CompactPCI® Serial, XMC, PCI Express or VPX bus carrier cards for AcroPack modules.

- **Software**
  - (see software documentation for details)
  - APSW-API-XXV
    - VxWorks® software support package.
  - APSW-API-WIN
    - Windows® DLL driver software support package.
  - APSW-API-LNX
    - Linux® support (website download only).

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**AP445 Isolated Digital Output**

**Description**

Models

AP445-LF: 0 to ±60V DC or AC peak input

The AcroPack® product line updates our popular Industry Pack I/O modules with a PCIe interface format. This tech-refresh design offers a compact size, low-cost I/O, the same functionality and memory map of the existing IP modules and a rugged form factor.

AP445 modules provide 32 isolated solid-state relay outputs to safely control discrete devices.

A major AP445 advantage is its flexibility. The module supports wide range bipolar (AC or DC) voltage switching. Each port can be configured for high or low-side switches. The outputs are TTL-compatible when configured as low-side switches and populating on board pull up resistors or using external pull-ups.

Isolation protects your computer system from noise, transient signals, and field wiring faults. Outputs are grouped into four 8-channel ports. Ports are isolated via solid-state relays from the logic and from each other.

Readback buffers simplify output status monitoring. And for easy closed-loop monitoring of critical control signals, use the AP445 with an AP440 input module.

The AP445 series modules are 70mm long, this is 19.05mm longer than the full length mini PCIe card at 50.95mm. The boards width is the same as mPCIe board of 30mm and they use the same mPCIe standard board hold down standoff and screw keep out areas. A down facing 100 pin Samtec connector will mate with the carrier card. Fifty of these signals are available as field I/O signals. Pin spacing and signal assignments will allow for 100V of port to port isolation. Logic and field lines are isolated from each other for voltages up to 250V AC or DC on a continuous basis. The AP445 series maintains the same functionality and memory map of the existing Industry Pack modules providing a smooth transition to the AcroPack I/O modules.

**Key Features & Benefits**

- 32 bipolar solid state relays
- High/low-side switch configuration
- Port-isolated output channels
- ±60V AC/DC voltage range
- High speed processing
- TTL-compatible
- Failsafe power-up and system reset
- Output readback function
- On board pull-up resistors can be populated for low-side switching applications
- Unique ground reference points for each port permits AC and DC switching on one module.

[Diagram showing simplified output channel and FPGA Xilinx® Artix-7]

When used together, the AP440 input module and AP445 output module simplify loop-back monitoring of your critical signals.
**Performance Specifications**

- **Digital Outputs**
  - Output channel configuration
  - 32 isolated solid-state relays support AC or DC (high/low-side switching) operation.
  - Isolation
  - Logic and field connections are optically isolated by solid-state relays. Individual ports are also isolated from each other. Output lines of an individual port share a common connection and are not isolated from each other. IP Logic and field lines are isolated from each other for voltages up to 250V AC or 354V DC on a continuous basis (unit will withstand a 1450V AC dielectric strength test for one minute without breakdown).
  - Voltage range
    - 0 to ±60V DC or peak AC
  - Output ON current range
    - 150mA maximum continuous (up to 1A total per port)
  - Turn on time
    - 1ms typical, 2ms maximum
  - Turn off time
    - 0.2ms typical, 1ms maximum
  - Output pull-up resistors
    - Not populated, consult factory

- **PCI Express Base Specification**
  - Conforms to revision 2.1
  - Lanes
    - 1 lane in each direction
  - Bus Speed
    - 2.5 Gbps (Generation 1)
  - Memory
    - 4k space required
    - 1 base address register

- **Environmental**
  - Operating temperature
    - -40 to 70°C
    - -40 to 85°C (requires an AcroPack heatsink conduction-cool kit)
  - Storage temperature
    - -40 to 125°C
  - Relative humidity
    - 5 to 95% non-condensing
  - Power
    - +3.3V (±5%) all outputs off: 495mA typical
    - +3.3V (±5%) all outputs on: 675mA typical

- **Physical**
  - Length
    - 70mm
  - Width
    - 30mm

---

**Ordering Information**

- **AcroPack® Modules**
  - **AP445E-LF**
    - Isolated digital output module
    - (Note: Acropack modules are compatible only with the carriers listed below)

- **Accessories**
  - **AP-CC-01**
    - Conduction-cool kit

- **Carrier Cards**
  - **APCe7010E-LF**
    - PCIe AcroPack carrier, holds one AcroPack module, air-cooled.
  - **APCe7022E-LF**
    - PCIe AcroPack carrier, holds two AcroPack modules, air-cooled.
  - **APCe7040E-LF**
    - PCIe AcroPack carrier, holds four AcroPack modules, air-cooled.
  - **VPX4500E-LF**
    - 3U VPX AcroPack carrier, holds three AcroPack modules, air-cooled.
  - **VPX4500-CC-LF**
    - 3U VPX AcroPack carrier, holds three AcroPack modules, conduction-cooled.
  - **XMCAP2020-LF**
    - XMC AcroPack carrier; holds two AcroPack modules, 2-slots out front, air-cooled.
  - **XMCAP2021-LF**
    - XMC AcroPack carrier; holds two AcroPack modules, 2-slots out rear, air-cooled.

- **Software** (see software documentation for details)
  - **APSW-API-VXW**
    - VxWorks® software support package.
  - **APSW-API-WIN**
    - Windows® DLL driver software support package.
  - **APSW-API-LNX**
    - Linux® support (website download only).

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![AP-CC-01 Conduction-Cool Kit](image)
The AcroPack® product line updates our popular Industry Pack I/O modules with a PCIe interface format. This tech-refresh design offers a compact size, low-cost I/O, the same functionality of the existing IP modules and a rugged form factor. Combine different AcroPack modules on one carrier for a simplified modular approach to system assembly.

AP471 AcroPack I/O (AP) modules provide 48 general-purpose, bidirectional I/O points to economically monitor and control a large quantity of digital devices.

Each channel has interrupt capability for detecting low-to-high or high-to-low transitions. Change- of-state interrupts are supported using paired channels. Debounce eliminates interrupts from noise and switching transients for error-free edge detection.

AP471 outputs are full-featured. They provide closed-loop readback status monitoring. TTL level thresholds and 15mA sink capability allow a direct interface to standard relay racks. For safety, outputs go to a failsafe state upon power-up/reset without any instantaneous toggling to prevent false alarms.

48 bidirectional input/output channels ◆ Digital I/O ◆ Wide Temperature Range ◆ PCIe Bus Interface

**Key Features & Benefits**
- PCI Express Generation 1 interface
- 48 bidirectional input/output channels
- Mix and match countless I/O combinations in a single slot.
- Sample software and diagnostics
- TTL-compatible inputs
- CMOS-compatible open-drain outputs
- Interrupt support for each channel
- Input debounce
- Electronic overvoltage protection on individual channels
- Open drain outputs
- Output readback registers - Output readback capability eliminates the need for additional input channels to verify the output channel state
- Output channels do not “glitch” after a power-up/reset to eliminate false alarms
- Solid-down connector I/O interface
- Wide temperature range
- XMC, VPX and PCIe carriers
- Linux®, Windows®, and VxWorks® support

**AP471 TTL Level Digital I/O**

Designed for COTS applications these TTL level digital I/O modules deliver high-density, high-reliability, and high-performance at a low cost.

AcroPack modules are RoHS compliant and ideal for military, defense, automation, aerospace, scientific, and development labs industries.

The AP471 module is 70mm long, this is 19.05mm longer than the full length mini PCIe card at 50.95mm. The boards width is the same as mPCIe board of 30mm and they use the same mPCIe standard board hold down standoff and screw keep out areas.

A down facing 100 pin Samtec connector will mate with the carrier card. Fifty of these signals are available as field I/O signals.

The AP471 maintains the same functionality of the existing Industry Pack modules providing a smooth transition to the AcroPack I/O modules.
Performance Specifications

■ Digital Inputs
Input channel configuration
48 buffered inputs.
Input voltage range
0 to 5V DC.
Input signal threshold
1.5V typical.

■ Digital Outputs
Output channel configuration
48 open-drain CMOS outputs.
Voltage range
0 to 5V DC.
Output ON current range
0 to 15mA DC.
Output pull-ups
4.7kΩ internal pull-ups installed on board.

■ PCI Express Base Specification
Conforms to revision 2.1
Lanes
1 lane in each direction.
Bus Speed
2.5 Gbps (Generation 1).
Memory
4k space required.
1 base address register.

■ Environmental
Operating temperature
-40 to 70°C.
-40 to 85°C.
(requires an AcroPack heatsink conduction-cool kit)
Storage temperature
-55 to 150°C.
Relative humidity
5 to 95% non-condensing.
Power
+3.3V (±5%): 400mA typical 600mA max.
+5V (±5%): 60mA all outputs ON w/4.7KΩ pull-ups
0.5mA all outputs Off.

■ Physical
Length
70mm.
Width
30mm.

Ordering Information

AcroPack® Modules
AP471E-LF
48-channel digital I/O module
(Note: Acropack modules are compatible only with the
carriers listed below)

Accessories
AP-CC-01
Conduction-cool kit

Carrier Cards
APCe7010E-LF
PCIe AcroPack carrier, holds one AcroPack
module, air-cooled.
APCe7022E-LF
PCIe AcroPack carrier, holds two AcroPack
modules, air-cooled.
APCe7040E-LF
PCIe AcroPack carrier, holds four AcroPack
modules, air-cooled.

Software
(see software documentation for details)
APSW-API-VXW
VxWorks® software support package.
APSW-API-WIN
Windows® DLL driver software support package.
APSW-API-LNX
Linux® support (website download only).

AP-CC-01 Conduction-Cool Kit
The AP482 module is 70mm long, this is 19.05mm longer than the full length mini PCIe card at 50.95mm. The board’s width is the same as mPCIe board of 30mm and they use the same mPCIe standard board hold down standoff and screw keep out areas.

A down facing 100 pin Samtec connector will mate with the carrier card. Fifty of these signals are available as field I/O signals.

The AP482 maintains the same functionality and memory map of the existing Industry Pack modules providing a smooth transition to the AcroPack I/O modules.

**Key Features & Benefits**

- PCI Express Generation 1 interface
- Ten 32-bit counter/timers
- Mix and match countless I/O combinations in a single slot.
- Sample software and diagnostics
- 62.5MHz clock time base
- Single counter/timer modes:  - Event counting  - Frequency measurement  - Period/pulse-width measurement  - Quadrature position measurement  - Pulse width modulated output  - Watchdog timer  - One shot pulse output
- Configuration is handled by a single register which minimizes programming.
- Solid-down connector I/O interface
- Wide temperature range
- PCIe, VPX and XMC carriers
- Linux®, Windows®, and VxWorks® support
AP482 TTL Counter/Timers

Performance Specifications

■ Counter/timers

Counter/timer configuration:
AP482: Ten 32-bit counters – TTL I/O

Counter Input:
Each counter has an InA, InB, and InC input port. These TTL or RS485 input ports are used to control Start/Stop, Reload, Event Input, External Clock, Trigger, and Up/Down operations.

Clock frequency
Selectable internal clock frequencies: 1.95MHz, 3.9MHz, 7.81MHz, 15.62MHz, or 62.5MHz.

Minimum input event
32nS.

Minimum pulse measurement
32nS.

Minimum period measurement
64nS.

Minimum gate/trigger pulse
32nS.

Interrupts
Supported for watchdog timer time-out, event count complete, pulse width or periodic rate measurement complete, pulse wave complete (one-shot mode), successive waveform generation (continuous).

Triggering/gate
Programmable via register write or external trigger. Minimum pulse width 32nS. Line may be used for gating of counter.

Counter trigger
Interface for triggering counter functions. Input level is TTL digital.

Counter input
Interface for events and pulse/period measurements. Also triggers load of watchdog timer register. Level is TTL digital.

TTL compatibility
VIH = 2.0V and VIL = 0.8V. inputs are buffered and include 4.7K pull-ups to +3.3V.

Counter output
Each counter has an output port. These TTL or RS485 output ports are used for waveform output, watchdog active indicator, or 1.73 µs pulse upon counter function completion. Counter output is programmable as active high or low.

■ PCI Express Base Specification

Conforms to revision 2.1

Lanes
1 lane in each direction.

Bus Speed
2.5 Gbps (Generation 1).

Memory
4k space required.

■ Environmental

Operating temperature
-40 to 70°C.
-40 to 85°C. (requires an AcroPack heatsink conduction-cool kit)

Storage temperature
-55 to 150°C.

Relative humidity
5 to 95% non-condensing.

Power
3.3V DC ± 5.
1.6A typical, 2.0A maximum.

■ Physical

Length
70mm.

Width
30mm.

Ordering Information

AcroPack® Modules

AP482E-LF
Ten 32-bit TTL counters
(Note: Acropack modules are compatible only with the carriers listed below)

Accessories

AP-CC-01
Conduction-cool kit

Carrier Cards

APCe7010E-LF
PCIe AcroPack carrier, holds one AcroPack module, air-cooled.

APCe7022E-LF
PCIe AcroPack carrier, holds two AcroPack modules, air-cooled.

APCe7040E-LF
PCIe AcroPack carrier, holds four AcroPack modules, air-cooled.

VPX4500E-LF
3U VPX AcroPack carrier, holds three AcroPack modules, air-cooled.

VPX4500-CC-LF
3U VPX AcroPack carrier, holds three AcroPack modules, conduction-cooled.

XMCAP2020-LF
XMC AcroPack carrier; holds two AcroPack modules, 2-slots out front, air-cooled.

XMCAP2021-LF
XMC AcroPack carrier; holds two AcroPack modules, 2-slots out rear, air-cooled.

Software (see software documentation for details)

APSW-API-VXW
VxWorks® software support package.

APSW-API-WIN
Windows® DLL driver software support package.

APSW-API-LNX
Linux® support (website download only).
AcroPack® Modules

AP483 TTL and RS422/RS485 Counter/Timers

**Description**

**Model**
AP483E-LF: Five 32-bit TTL counters & three 32-bit RS422/RS485 counters

The AcroPack® product line updates our popular Industry Pack I/O modules with a PCIe interface format. This tech-refresh design offers a compact size, low-cost I/O, the same functionality and memory map of the existing IP modules and a rugged form factor. Combine different AcroPack modules on one carrier for a simplified modular approach to system assembly.

Support for internal or external triggering simplifies the synchronization of operations to specific events.

Designed for COTS applications these RS422/RS485 & TTL counter/timers deliver high-speed and high-performance.

AcroPack modules are RoHS compliant and ideal for military, defense, automation, aerospace, scientific, and development labs industries.

The AP483 module is 70mm long, this is 19.05mm longer than the full length mini PCIe card at 50.95mm. The board’s width is the same as mPCIe standard board hold down standoff and screw keep out areas.

A down facing 100 pin Samtec connector will mate with the carrier card. Fifty of these signals are available as field I/O signals.

The AP483 maintains the same functionality and memory map of the existing Industry Pack modules providing a smooth transition to the AcroPack I/O modules.

**Key Features & Benefits**

- PCI Express Generation 1 interface
- Mix and match countless I/O combinations in a single slot.
- Sample software and diagnostics
- Available with both TTL and RS422/RS485 driver interface
- 62.5MHz clock time base
- Single counter/timer modes:
  - Event counting
  - Frequency measurement
  - Period/pulse-width measurement
  - Quadrature position measurement
  - Square wave/pulse train generation
  - Time/period interrupter
  - Pulse width generation
- Most configuration is handled by a single register which minimizes programming.
- Solid-down connector I/O interface
- Wide temperature range
- PCIe, VPX and XMC carriers
- Linux®, Windows®, and VxWorks® support

Tel 248-295-0310  Fax 248-624-9234  solutions@acromag.com  www.acromag.com  30765 Wixom Rd, Wixom, MI 48393 USA
Performance Specifications

Counter/timers
Counter/timer configuration:
AP483: Five 32-bit counters – TTL
Three 32-bit counters – RS422/RS485
Clock frequency
Selectable internal clock frequencies: 1.95MHz, 3.9MHz, 7.81MHz, 15.62MHz, or 62.5MHz.
Minimum input event
32nS.
Minimum pulse measurement
32nS.
Minimum period measurement
64nS.
Minimum gate/trigger pulse
32nS.
Interrupts
Supported for watchdog timer time-out, event count complete, pulse width or periodic rate measurement complete, pulse wave complete (one-shot mode), successive waveform generation (continuous).
Triggering/gate
Programmable via register write or external trigger. Minimum pulse width 32nS. Line may be used for gating of counter.
Counter trigger
Interface for triggering counter functions. Input level is TTL and RS422 differential digital.
Counter input
Interface for events and pulse/period measurements. Also triggers load of watchdog timer register. Level is TTL and RS422 differential digital.
TTL compatibility
VIH = 2.0V and VIL = 0.8V. inputs are buffered and include 4.7K pull-ups to +3.3V.
Counter output
Level is TTL and RS422 differential digital.

PCI Express Base Specification
Conforms to revision 2.1
Lanes
1 lane in each direction.
Bus Speed
2.5 Gbps (Generation 1).
Memory
4k space required. 1 base address register.

Environmental
Operating temperature
-40 to 70°C.
-40 to 85°C. (requires an AcroPack heatsink conduction-cool kit)
Storage temperature
-55 to 150°C.
Relative humidity
5 to 95% non-condensing.
Power
3.3V DC ± 5%.
1.6A Typical, 2.0A Maximum.

Physical
Length
70mm.
Width
30mm.

Ordering Information

AcroPack® Modules
AP483E-LF
Five 32-bit TTL and three 32-bit RS422/RS485 counters (Note: AcroPack modules are compatible only with the carriers listed below)

Accessories
AP-CC-01
Conduction-cool kit

Carrier Cards
APCe7010E-LF
PCle AcroPack carrier, holds one AcroPack module, air-cooled.
APCe7022E-LF
PCle AcroPack carrier, holds two AcroPack modules, air-cooled.
APCe7040E-LF
PCle AcroPack carrier, holds four AcroPack modules, air-cooled.
VXP4500E-LF
3U VPX AcroPack carrier, holds three AcroPack modules, air-cooled.
VXP4500-CC-LF
3U VPX AcroPack carrier, holds three AcroPack modules, conduction-cooled.
XMCAP2020-LF
XMC AcroPack carrier; holds two AcroPack modules, 2-slots out front, air-cooled.
XMCAP2021-LF
XMC AcroPack carrier; holds two AcroPack modules, 2-slots out rear, air-cooled.

Software (see software documentation for details)
APSW-API-VXW
VxWorks® software support package.
APSW-API-WIN
Windows® DLL driver software support package.
APSW-API-LNX
Linux® support (website download only).

AP-CC-01 Conduction-Cool Kit
**AcroPack® Modules**

**AP484 RS422/RS485 Counter/Timers**

**Description**

**Model**
AP484E-LF: Six 32-bit counters - RS422/RS485

The AcroPack® product line updates our popular Industry Pack I/O modules with a PCIe interface format. This tech-refresh design offers a compact size, low-cost I/O, the same functionality and memory map of the existing IP modules and a rugged form factor. Combine different AcroPack modules on one carrier for a simplified modular approach to system assembly.

Support for internal or external triggering simplifies the synchronization of operations to specific events.

Designed for COTS applications these RS422/RS485 counter/timers deliver high-speed and high-performance.

AcroPack modules are RoHS compliant and ideal for military, defense, automation, aerospace, scientific, and development labs industries.

The AP484 module is 70mm long, this is 19.05mm longer than the full length mini PCIe card at 50.95mm. The board’s width is the same as mPCIe board of 30mm and they use the same mPCIe standard board hold down standoff and screw keep out areas.

A down facing 100 pin Samtec connector will mate with the carrier card. Fifty of these signals are available as field I/O signals.

The AP484 maintains the same functionality and memory map of the existing Industry Pack modules providing a smooth transition to the AcroPack I/O modules.

**Key Features & Benefits**

- PCI Express Generation 1 interface
- Mix and match countless I/O combinations in a single slot.
- Sample software and diagnostics
- 62.5MHz clock time base
- Single counter/timer modes:
  - Event counting
  - Frequency measurement
  - Period/pulse-width measurement
  - Quadrature position measurement
  - Square wave/pulse train generation
  - Time/period interrupter
  - Pulse width generation
- Most configuration is handled by a single register which minimizes programming
- Solid-down connector I/O interface
- Wide temperature range
- PCIe, VPX and XMC carriers
- Linux®, Windows®, and VxWorks® support

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Tel 248-295-0310  ■  Fax 248-624-9234  ■  solutions@acromag.com  ■  www.acromag.com  ■  30765 Wixom Rd, Wixom, MI 48393 USA
### AP484 RS422/RS485 Counter/Timers

#### Performance Specifications

- **Counter/timers**
  - Clock frequency
    - Selectable internal clock frequencies: 1.95MHz, 3.9MHz, 7.81MHz, 15.62MHz, or 62.5MHz.
  - Minimum input event 32nS.
  - Minimum pulse measurement 32nS.
  - Minimum period measurement 64nS.
  - Minimum gate/trigger pulse 32nS.
  - Interrupts
    - Supported for watchdog timer time-out, event count complete, pulse width or periodic rate measurement complete, pulse wave complete (one-shot mode), successive waveform generation (continuous).
  - Triggering/gate
    - Programmable via register write or external trigger.
    - Minimum pulse width 32nS. Line may be used for gating of counter.
  - Counter trigger
    - Interface for triggering counter functions. Input level is RS422 differential digital.
  - Counter input
    - Interface for events and pulse/period measurements. Also triggers load of watchdog timer register. Level is RS422 differential digital.
  - Counter output
    - Level is RS422 differential digital.

- **PCI Express Base Specification**
  - Conforms to revision 2.1
  - Lanes
    - 1 lane in each direction.
  - Bus Speed
    - 2.5 Gbps (Generation 1).
  - Memory
    - 4k space required.
    - 1 base address register.

- **Environmental**
  - Operating temperature
    - -40 to 70°C.
    - -40 to 85°C.
    - (requires an AcroPack heatsink conduction-cool kit)
  - Storage temperature
    - -55 to 150°C.
  - Relative humidity
    - 5 to 95% non-condensing.
  - Power
    - 3.3V DC ± 5%. 1.6A typical, 2.0A maximum.

- **Physical**
  - Length
    - 70mm.
  - Width
    - 30mm.

#### Ordering Information

- **AcroPack® Modules**
  - AP484E-LF
    - Six 32-bit RS422 counters
    - (Note: Acropack modules are compatible only with the carriers listed below)

- **Accessories**
  - AP-CC-01
    - Conduction-cool kit

- **Carrier Cards**
  - APCe7010E-LF
    - PCIe AcroPack carrier, holds one AcroPack module, air-cooled.
  - APCe7022E-LF
    - PCIe AcroPack carrier, holds two AcroPack modules, air-cooled.
  - APCe7040E-LF
    - PCIe AcroPack carrier, holds four AcroPack modules, air-cooled.
  - VPX4500E-LF
    - 3U VPX AcroPack carrier, holds three AcroPack modules, air-cooled.
  - VPX4500-CC-LF
    - 3U VPX AcroPack carrier, holds three AcroPack modules, conduction-cooled.
  - XMCAP2020-LF
    - XMC AcroPack carrier; holds two AcroPack modules, 2-slots out front, air-cooled.
  - XMCAP2021-LF
    - XMC AcroPack carrier; holds two AcroPack modules, 2-slots out rear, air-cooled.

- **Software** (see software documentation for details)
  - APSW-API-VXW
    - VxWorks® software support package.
  - APSW-API-WIN
    - Windows® DLL driver software support package.
  - APSW-API-LNX
    - Linux® support (website download only).

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**AP-CC-01 Conduction-Cool Kit**
The AcroPack® product line updates our popular Industry Pack I/O modules with a PCIe interface format. This tech-refresh design offers a compact size, low-cost I/O, the same functionality and memory map of the existing Industry Pack modules and a rugged form factor.

The AP500 modules provide four asynchronous serial communication interfaces for your system. Software-configuration helps you quickly set baud rates, character-sizes, stop bits, and parity. Full signal support for modem control is also included.

A down facing 100 pin Samtec connector will mate with the carrier card. Fifty of these signals are available as field I/O signals. Pin spacing and signal assignments will allow for 100V of signal to signal isolation.

The AP500 series maintains the same functionality and memory map of the existing Industry Pack modules providing a smooth transition to the AcroPack I/O modules.

**Key Features & Benefits**
- PCI Express Generation 1 interface
- Four RS232E serial ports
- 256-byte FIFO buffers
- Programmable baud rate (up to 500Kbps)
- Individual modem control signals on each channel
- Handshake lines (RTS, CTS, DTR, DSR, DCD, RI)
- Line-break and false start-bit detection
- 16550 compatible register set
- 256-byte FIFO buffers minimize CPU interaction for improved system performance.
- Each serial channel provides full handshake support to simplify interfacing with modems.
- Extended temperature range
## Performance Specifications

### RS232E Serial Ports
- **Configuration**
  - Independent, non-isolated serial ports with a common single return connection and configured as a DTE device.
- **Data Rate**
  - Programmable up to 500K bits/second using internal baud rate generator.
- **Max. Cable Length**
  - 15 meters (50 feet) typical, limited to a cable capacitive load of 2500pF
- **Character size**
  - 5 to 8 bits, software-programmable
- **Parity**
  - Odd, even, or no parity; software-programmable.
- **Stop bits**
  - 1, 1-1/2, or 2 bits; software-programmable
- **Data register buffers**
  - 256-byte receive FIFO buffer and 256-byte transmit FIFO buffer.
- **Interrupts**
  - Receiver line status (overrun, parity, framing error, or break interrupt); received data available (FIFO level reached) or character time-out; transmitter holding register empty; or modem status (CTS, DSR, RI, or DCD).

### PCI Express Base Specification
- Conforms to revision 2.0
- **Lanes**
  - 1 lane in each direction
- **Bus Speed**
  - 2.5 Gbps (Generation 1)
- **Memory**
  - 8k space required
  - 1 base address register

### Environmental
- **Operating temperature**
  - -40 to 70°C
  - -40 to 85°C
- **Storage temperature**
  - -55 to 125°C
- **Relative humidity**
  - 5 to 95% non-condensing
- **Power**
  - +3.3V (±5%) 100mA typical

### Physical
- **Length**
  - 70mm
- **Width**
  - 30mm

## Ordering Information

### AcroPack® Modules
- **AP500E-LF**
  - Four RS232E serial ports
  - (Note: AcroPack modules are compatible only with the carriers listed below)

### Accessories
- **AP-CC-01**
  - Conduction-cool kit

### Carrier Cards
- **APCe7010E-LF**
  - PCIe AcroPack carrier, holds one AcroPack module, air-cooled.
- **APCe7022E-LF**
  - PCIe AcroPack carrier, holds two AcroPack modules, air-cooled.
- **APCe7040E-LF**
  - PCIe AcroPack carrier, holds four AcroPack modules, air-cooled.
- **VPX4500E-LF**
  - 3U VPX AcroPack carrier, holds three AcroPack modules, air-cooled.
- **VPX4500-CC-LF**
  - 3U VPX AcroPack carrier, holds three AcroPack modules, conduction-cooled.
- **XMCAP2020-LF**
  - XMC AcroPack carrier; holds two AcroPack modules, 2-slots out front, air-cooled.
- **XMCAP2021-LF**
  - XMC AcroPack carrier; holds two AcroPack modules, 2-slots out rear, air-cooled.

### Software
- (see software documentation for details)
- **APSW-API-VXW**
  - VxWorks® software support package.
- **APSW-API-WIN**
  - Windows® DLL driver software support package.
- **APSW-API-LNX**
  - Linux® support (website download only).
Description
The AcroPack® product line updates our popular Industry Pack I/O modules with a PCIe interface format. This tech-refresh design offers a compact size, low-cost I/O, the same functionality and memory map of the existing Industry Pack modules and a rugged form factor.

These modules provide four asynchronous serial communication ports from a single AP carrier slot for a high-densigy solution. Software-configuration helps you quickly set baud rates, character-sizes, stop bits, and parity.

For more efficient data processing, each serial port is equipped with 256-character FIFO buffers on the transmit and receive lines.

The data ports generate individually controlled transmit, receive, line status, data set, and flow control interrupts. All interrupts can be read from a single register.

The AP512 series modules are 70mm long. This is 19.05mm longer than the full length mini PCIe card at 50.95mm. The boards width is the same as mPCIe board of 30mm and they use the same mPCIe standard board hold down standoff and screw keep out areas.

A down facing 100 pin Samtec connector mates with the carrier card. Fifty of these pins are available for field I/O signals. Pin spacing and signal assignments will allow for 100V of port to port isolation.

The AP512 series maintains the same functionality and memory map of the existing Industry Pack modules providing a smooth transition to the AcroPack I/O modules.

Key Features & Benefits
- Four asynchronous, full duplex RS422 serial ports (supports RS485)
- Ports are isolated to 250V from digital and 100V from each other
- 256-byte transmit FIFO buffers
- 256-byte receive FIFO buffers
- Programmable baud rate (up to 16Mbps)
- Line-break and false start-bit detection
- Failsafe receivers
- 16550 compatible register set
- High-density design lowers per-port costs and saves IP carrier card slots for other functions.
- 256-byte FIFO buffers minimize CPU interaction for improved system performance.
- Extended temperatures deliver dependable operation in extreme conditions.
### Performance Specifications

**Serial Ports**
- **Configuration**: Independent, isolated serial ports.
- **Data Rate**: 16M bits/second, maximum
- **Max. Cable Length**: 1200 meters (4000 feet) typical
- **Character size**: 5 to 8 bits, software-programmable
- **Parity**: Odd, even, or no parity; software-programmable.
- **Stop bits**: 1, 1-1/2, or 2 bits; software-programmable
- **Data register buffers**: 256-byte FIFO buffer
- **Interrupts**: Receiver line status (overrun, parity, framing error, or break interrupt); receive/transmit FIFO level reached or character time-out; Xon/Xoff or special character detected.

**PCI Express Base Specification**
- **Conforms to revision 2.0**
- **Lanes**: 1 lane in each direction
- **Bus Speed**: 2.5 Gbps (Generation 1)
- **Memory**: 8k space required
- **Data register buffers**: 256-byte FIFO buffer

### Environmental
- **Operating temperature**: -40 to 70°C
- **Storage temperature**: -55 to 125°C
- **Relative humidity**: 5 to 95% non-condensing
- **Power**: +3.3V (±5%) 450mA typical

### Physical
- **Length**: 70mm
- **Width**: 30mm

### Ordering Information

**AcroPack® Modules**
- **AP512E-LF**: Four RS422/485 serial ports
- **AP512EL-F**: Four RS422/485 serial ports

**Accessories**
- **AP-CC-01**: Conduction-cool kit
- **S028-009**: Cable, 68-pin VHDCI to four male DE-9, 7” long.

**Carrier Cards**
- **APCe701E-LF**: PCIe AcroPack carrier, holds one AcroPack module, air-cooled.
- **APCe702E-LF**: PCIe AcroPack carrier, holds two AcroPack modules, air-cooled.
- **APCe704E-LF**: PCIe AcroPack carrier, holds four AcroPack modules, air-cooled.
- **V PX4500E-LF**: 3U VPX AcroPack carrier, holds three AcroPack modules, air-cooled.
- **V PX4500CC-LF**: 3U VPX AcroPack carrier, holds three AcroPack modules, conduction-cooled.
- **XMCAP2020-LF**: XMC AcroPack carrier, holds two AcroPack modules, 2-slots out front, air-cooled.
- **XMCAP2021-LF**: XMC AcroPack carrier, holds two AcroPack modules, 2-slots out rear, air-cooled.

**Software** (see software documentation for details)
- **APSW-API-VXW**: VxWorks® software support package.
- **APSW-API-WIN**: Windows® DLL driver software support package.
- **APSW-API-LNX**: Linux® support (website download only).

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![AP-CC-01 Conduction-Cool Kit](image-url)
The AcroPack® product line updates our popular Industry Pack I/O modules with a PCIe interface format. This tech-refresh design offers a compact size, low-cost I/O, the same functionality and memory map of the existing Industry Pack modules and a rugged form factor.

The AP520 modules provide eight asynchronous serial communication ports from a single AP carrier slot for a high-density solution. Software-configuration helps you quickly set baud rates, character-sizes, stop bits, and parity. Signal support for RTS/CTS handshaking is also included.

For more efficient data processing, each serial port is equipped with 256-character FIFO buffers on the transmit and receive lines.

The data ports generate individually controlled transmit, receive, line status, and data set interrupts. All interrupts can be read from a single register.

The AP520 series modules are 70mm long, this is 19.05mm longer than the full length mini PCIe card at 50.95mm. The boards width is the same as mPCIe board of 30mm and they use the same mPCIe standard board hold down strandoff and screw keep out areas. A down facing 100 pin Samtec connector will mate with the carrier card. Fifty of these signals are available as field I/O signals. Pin spacing and signal assignments will allow for 100V of signal to signal isolation. The AP520 series maintains the same functionality and memory map of the existing Industry Pack modules providing a smooth transition to the AcroPack I/O modules.

**Key Features & Benefits**

- PCI Express Generation 1 interface
- Eight RS232E serial ports
- 256-byte transmit FIFO buffers
- 256-byte receive FIFO buffers
- Programmable baud rate (up to 500Kbps)
- Individual handshake lines (RTS, CTS) on each channel
- Line-break and false start-bit detection
- 16550 compatible register set
- High-density design lowers per-port costs and saves IP carrier card slots for other functions
- 256-byte FIFO buffers minimize CPU interaction for improved system performance.
- Each serial channel provides handshake support to simplify interfacing with modems.
- Extended temperature range
### Performance Specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RS232E Serial Ports</strong></td>
<td>Configuration: Independent, non-isolated serial ports with a common single return connection and configured as a DTE device.</td>
</tr>
<tr>
<td><strong>Data Rate</strong></td>
<td>Programmable up to 500K bits/second using internal baud rate generator. Consult factory for custom baud rates up to 512K baud.</td>
</tr>
<tr>
<td><strong>Max. Cable Length</strong></td>
<td>15 meters (50 feet) typical, limited to a cable capacitive load of 2500pF.</td>
</tr>
<tr>
<td><strong>Character size</strong></td>
<td>5 to 8 bits, software-programmable.</td>
</tr>
<tr>
<td><strong>Parity</strong></td>
<td>Odd, even, or no parity; software-programmable.</td>
</tr>
<tr>
<td><strong>Stop bits</strong></td>
<td>1, 1-1/2, or 2 bits; software-programmable.</td>
</tr>
<tr>
<td><strong>Data register buffers</strong></td>
<td>256-byte FIFO buffer</td>
</tr>
<tr>
<td><strong>Interrupts</strong></td>
<td>Receiver line status (overrun, parity, framing error, or break interrupt); received data available (FIFO level reached) or character time-out; transmitter (FIFO level reached); or modern status (CTS).</td>
</tr>
</tbody>
</table>

### Environmental

- Operating temperature: -40 to 70°C
- Storage temperature: -55 to 125°C
- Relative humidity: 5 to 95% non-condensing
- Power: +3.3V (±5%) 110mA typical

### Physical

- Length: 70mm
- Width: 30mm

### Ordering Information

**AcroPack Modules**

- **AP520-64E-LF**
  - Eight RS232E serial ports
  - (Note: AcroPack modules are compatible only with the carriers listed below)

**Accessories**

- **AP-CC-01**
  - Conduction-cool kit

**Carrier Cards**

- **APCe7010E-LF**
  - PCIe AcroPack carrier, holds one AcroPack module, air-cooled.
- **APCe7022E-LF**
  - PCIe AcroPack carrier, holds two AcroPack modules, air-cooled.
- **APCe7040E-LF**
  - PCIe AcroPack carrier, holds four AcroPack modules, air-cooled.
- **VPX4500E-LF**
  - 3U VPX AcroPack carrier, holds three AcroPack modules, air-cooled.
- **VPX4500-CC-LF**
  - 3U VPX AcroPack carrier, holds three AcroPack modules, conduction-cooled.
- **XMCAP2020-LF**
  - XMC AcroPack carrier; holds two AcroPack modules, 2-slots out front, air-cooled.
- **XMCAP2021-LF**
  - XMC AcroPack carrier; holds two AcroPack modules, 2-slots out rear, air-cooled.

**Software** (see software documentation for details)

- **APSW-API-VXW**
  - VxWorks® software support package.
- **APSW-API-WIN**
  - Windows® DLL driver software support package.
- **APSW-API-LNX**
  - Linux® support (website download only).

---

AP-CC-01 Conduction-Cool Kit

ISO9001
AS9100

Tel 248-295-0310  Fax 248-624-9234  solutions@acromag.com  www.acromag.com  30765 Wixom Rd, Wixom, MI 48393 USA

All trademarks are property of their respective owners. Copyright © Acromag, Inc. 2018. Data subject to change without notice. Printed in USA 9/2018.
The AcroPack® product line updates our popular Industry Pack I/O modules with a PCIe interface format. This tech-refresh design offers a compact size, low-cost I/O, the same functionality and memory map of the existing Industry Pack modules and a rugged form factor.

These modules provide eight asynchronous serial communication ports from a single AP carrier slot for a high-densigy solution. Software-configuration helps you quickly set baud rates, character-sizes, stop bits, and parity.

For more efficient data processing, each serial port is equipped with 256-character FIFO buffers on the transmit and receive lines.

The data ports generate individually controlled transmit, receive, line status, data set, and flow control interrupts. All interrupts can be read from a single register.

The AP522 series modules are 70mm long, this is 19.05mm longer than the full length mini PCIe card at 50.95mm. The boards width is the same as mPCIe board of 30mm and they use the same mPCIe standard board hold down standoff and screw keep out areas.

A down facing 100 pin Samtec connector will mate with the carrier card. Fifty of these signals are available as field I/O signals. Pin spacing and signal assignments will allow for 100V of signal to signal isolation.

The AP522 series maintains the same functionality and memory map of the existing Industry Pack modules providing a smooth transition to the AcroPack I/O modules.

**Key Features & Benefits**

- Eight asynchronous, full duplex RS422B serial ports (supports RS485)
- 256-byte transmit FIFO buffers
- 256-byte receive FIFO buffers
- Programmable baud rate (up to 20Mbps)
- Individual handshake lines (RTS, CTS) on each channel
- Line-break and false start-bit detection
- Failsafe receivers
- Built-in termination and bias resistors
- Consult factory for no termination
- 16550 compatible register set
- High-density design lowers per-port costs and saves IP carrier card slots for other functions.
- 256-byte FIFO buffers minimize CPU interaction for improved system performance.
- Extended temperatures deliver dependable operation in extreme conditions.
Performance Specifications

- **Serial Ports**
  - **Configuration**: Independent, non-isolated serial ports with a common single return connection.
  - **Data Rate**: 20M bits/second, maximum
  - **Max. Cable Length**: 1200 meters (4000 feet) typical
  - **Character Size**: 5 to 8 bits, software-programmable
  - **Parity**: Odd, even, or no parity; software-programmable
  - **Stop Bits**: 1, 1-1/2, or 2 bits; software-programmable
  - **Data Register Buffers**: 256-byte FIFO buffer
  - **Interrupts**: Receiver line status (overrun, parity, framing error, or break interrupt); receive/transmit FIFO level reached or character time-out; Xon/Xoff or special character detected.

- **Environmental**
  - **Operating temperature**: -40 to 85°C
  - **Storage temperature**: -55 to 125°C
  - **Relative Humidity**: 5 to 95% non-condensing
  - **Power**: +3.3V (±5%) 150mA typical
  - **+5V (±5%) 40mA typical**

- **Physical**
  - **Length**: 70mm
  - **Width**: 30mm

PCI Express Base Specification

- **Conforms to revision 2.0**
- **Lanes**: 1 lane in each direction
- **Bus Speed**: 2.5 Gbps (Generation 1)
- **Memory**: 8k space required
- **1 base address register**

Ordering Information

- **AcroPack® Modules**
  - **AP521-64E-LF**: Eight RS422/485 serial ports
  - **(Note: AcroPack modules are compatible only with the carriers listed below)**

- **Accessories**
  - **AP-CC-01**: Conduction-cool kit

- **Carrier Cards**
  - AcroPack carrier cards

- **Software**
  - (see software documentation for details)
  - **APSW-API-VXW**: VxWorks® software support package.
  - **APSW-API-WIN**: Windows® DLL driver software support package.
  - **APSW-API-LNX**: Linux® support (website download only).

---

**APCC-01 Conduction-Cool Kit**
AcroPack® Modules

AP560 Isolated CAN Bus Interface

Description
AP560 modules provide four independent CAN bus interface channels. Each channel has a Holt H13111 CAN controller with an ADM3053 transceiver. The advantage of this design is that it has the ability to transmit, receive and perform message filtering on extended and standard messages.

This module offers an effective solution for avionics and other applications implementing the CAN 2.0A/B specification. The controller is configurable to comply with both the ARINC 825 and CANaerospace standards. High channel density and high-level isolation make this rugged module well-suited for use in a variety of challenging environments.

The AcroPack CAN module is RoHS compliant and ideal for the following applications:
- Avionics and aerospace
- Defense vehicles
- Marine control and navigation systems

Key Features & Benefits
- Four isolated CAN channels
- H13111 CAN bus controller with high-speed ADM3053 CAN transceiver
- 1000V isolation, channel-to-channel and channel-to-host
- ISO 11898 compliance for Part A (11-bit) and Part B extended (29-bit) arbitration IDs
- CAN 2.0A/B protocol with programmable bit rate up to 1Mbit/sec. ISO 11898-5 compliant
- Configurable to support ARINC 825 and CANaerospace Standards
- Standard, Extended and Remote frames supported
- 8 maskable identifier filters
- Filtering on ID and first two data bytes for both Standard and Extended Identifiers
- Monitor (Listen-only) mode
- 8-message Transmit and Receive FIFOs
- Internal 16-bit free running counter for time tagging of transmitted or received messages
- Re-transmission disable capability
**AcroPack® Modules**

### AP560 Isolated CAN Bus Interface

#### Performance Specifications

**General**

**Power**

<table>
<thead>
<tr>
<th>Power Supply</th>
<th>Idle*</th>
<th>Max**</th>
</tr>
</thead>
<tbody>
<tr>
<td>+3.3V</td>
<td>480 mA</td>
<td>500 mA</td>
</tr>
<tr>
<td>+5V</td>
<td>66 mA</td>
<td>680 mA</td>
</tr>
</tbody>
</table>

* Idle current draw was measured with no external loopbacks or termination installed and no active communication on any port.

**CAN Bus**

**Configuration**

Four independent CAN bus channels. Holt H13111 CAN controller with ADM3053 transceiver.

**ISO 11898 standard**

Supports the standard data and remote frame as well as the extended data and remote frame according to CAN specification 2.0 Part A and Part B.

**Isolation**

1kV DC isolation.

**Maximum data rate**

1Mb/s.

**PCI Express Base Specification**

Conforms to PCIe base specification Revision 2.1.

**Lanes**

1 lane in each direction.

**Bus Speed**

2.5 Gbps (Generation 1).

**Memory**

2K space required.

1 base address register.

**Environmental**

**Operating temperature**

-40 to 71°C.

65 to 71°C. (Requires an AcroPack heatsink conduction-cool kit, model AP-CC-01).

See user manual for airflow specifications.

**Storage temperature**

-55 to 125°C.

**Relative humidity**

5 to 95% non-condensing.

**Operating Vibration**

Designed to comply with IEC 60068-2-64: 10-500Hz, 5G-rms, 2 hours/axis.

**Operating Shock**

Designed to comply with IEC 60068-2-27: 30G, 11ms half sine, 50G, 3ms half sine, 18 shocks at 6 orientations for both test levels.

**EMC Directive**

Conforms to EMC Directive 2004/108/EC.

**Physical**

**Length**

70mm

**Width**

30mm

#### Ordering Information

**Model**

AP560E-ISO-LF

Quad-channel isolated CAN bus interface module.

(Note: AcroPack modules are compatible only with AcroPack carriers)

**Accessories**

AP-CC-01

Conduction-cool kit

5028-609

Adapter cable, 68-pin VHDCI to four male DSUB-9 connectors, 7” long.

**Carrier Cards**

AcroPack carrier cards

**Software**

(see software documentation for details)

APSW-API-VXW

VxWorks® software support package.

APSW-API-WIN

Windows® DLL driver software support package.

APSW-API-LNX

Linux® support (website download only).

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AcroPack® Modules

**AP570 MIL-STD-1553 Communication**

One Dual Redundant MIL-STD-1553 Channel  ◆  Extended Temperature  ◆  PCIe Bus Interface

**Models**

AP571-000: Single function MIL-STD-1553.

**Description**

The AcroPack® product line updates our popular Industry Pack I/O modules with a PCIe interface format. This tech-refresh design offers a compact size, low-cost I/O, and a rugged form factor. Combining different AcroPack module types on one CompactPCI Serial, XMC, VPX, or PCIe carrier allows for a simplified modular approach to system assembly.

These modules provide a dual redundant MIL-STD-1553 channel with four open/ground avionics level (+35V) discrete I/O signals in addition to IRIG-B input and Trigger I/O. Hard wired RT address signal input pins are also available at the connector.

This Acropack card utilizes the latest AIM Common Hardware Core derived from the field proven MIL-STD-1553 interface to deliver low power consumption and high performance for rugged environments and embedded applications.

Designed for COTS applications these avionics communication mezzanine modules deliver high-density, high-reliability, and high-performance at a low cost.

The AP570 series modules are 70mm long, which is 19.05mm longer than the full-length mini PCIe card at 50.95mm. The board’s width is the same as an mPCIe board of 30mm and uses the same mPCIe standard board hold down standoff and screw keep-out areas.

A down-facing 100-pin Samtec connector mates with the carrier card. This ensures a secure connection for your I/O without the vulnerabilities of cabling.

**Key Features & Benefits**

- Very small form factor at 70mm x 30mm
- One dual redundant MIL-STD-1553 channel
- Transformer or direct coupling options
- IRIG-B input
- 4 open/ground avionics level (+35V) discrete I/O
- 2 digital discrete inputs
- 1 trigger input, 1 trigger output
- RT address inputs
- 128MB global RAM onboard for data scheduling and buffering
- -40°C to +85°C operating temperature
- High performance RISC processors onboard
- Host CPU offload for low CPU utilization
- Hard real time precision and timing
- DMA engine for optimized bus transfers and low PCIe bus utilization
- Flexible & upgradeable firmware design provides full control of obsolescence and configuration management
AP570 MIL-STD-1553 Communication

Features

■ BC Features
- Autonomous operation including sequencing of multiple minor and major frames.
- Support for acyclic message insertion/deletion.
- Support for instructions for synchronization to external events and timing control.
- Programmable BC retry without host interaction.
- Multi-buffering with real time data buffer updates.
- Synchronization of BC operation to external trigger inputs and outputs.
- 4μs intermessage gaps.
- Interrupt generation on BC transfer events.

■ Multi-RT Features
- Programmable RT response time down to 4μs for each simulated RT.
- Programmable & intelligent response to mode codes.
- Multi-buffering with real time data buffer updates.
- Mailbox monitor mode.
- Interrupt generation on RT events.

■ MT Features
- 100% data capture on 1 stream at full bus rates.
- Single shot, continuous or selective capture modes.
- Autonomous message synchronization and full error detection.
- Static/dynamic complex triggers with sequencing.
- Message filter and selective capture.
- Bus activity recording independent from trigger and capture mode.
- Time tagging: All bus traffic to 1μs – intermessage gaps & response time to 250ns.
- External Trigger Inputs and Outputs.
- Programmable response time.

■ IRIG-B Time Encoder/Decoder
- Onboard, free wheeling IRIG-B formatted time encoder/decoder for time tagging.
- Amplitude modulated sinusoidal IRIG-B output.
- Synchronization with multiple AIM modules or any IRIG-B compatible module.

■ Discrete I/O
- 4 bi-directional open/ground +35V avionics discrete I/O signals.
- 2 additional LV TTL digital discrete inputs.
- 6 signals above can be used for hard-wired RT address input support.

■ Driver Software Support
- Common application programming interface (API) supports C and C#.
- Drivers for 32/64-bit Linux and 32/64-bit Windows 7/8/10.

Performance Specifications

X1 Lane PCIe Interface
Compatible with PCI-Express Standard (Release 2.0).

Memory
128MB RAM.

Processor
SoC device with 2x 400MHz processors.

Time Tagging
46-bit absolute IRIG-B formatted.

Discrete I/O
4 open/ground avionics level discrete I/O. 2 LV TTL digital discrete inputs. 6 signals listed above can be used for RT address inputs.

Trigger I/O
1 BC/BM trigger Input and 1 BC/BM trigger output.

Encoder/Decoder
1x MIL-STD-1553 Encoder/decoder with full error detection bus support.

Physical Bus Interface
Transformer coupled MIL-STD-1553 bus or optional direct coupled MIL-STD-1553 bus.

Connector
100 pin board to board samtec connector.

Dimensions
70mm x 30mm.

Operating Temperature Range
-40°C to +85°C for conduction cooled applications measured at FPGA component case.
-40°C to +70°C for air cooled applications measured at ambient air with 2000lfm airflow.

Storage Temperature Range
-55°C to +125°C.

Relative Humidity
5 to 95% non-condensing.

Operational Shock
Tested to IEC 60668-2-27: 30G, 11ms half sine, 50G, 3ms half, 18 shocks at 6 orientations for both test levels.

Sinusoidal Operating Vibration
Tested to IEC 60668-2-6: 10-500Hz, 5G, 2 hours/axis.

Random Operating Vibration
Tested to IEC 60668-2-64: 10-500Hz, 5G-rms, 2 hours/axis.

Ordering Information

AcroPack® Modules

AP571-000
One dual redundant single function MIL-STD-1553 channel (BC + BM or multi-RT + BM operation).

AP572-000
One dual redundant full multi-function MIL-STD-1553 channel (BC + multi-RT + BM simultaneous operation).

Options (Contact factory for ordering)
- Safety critical monitoring only (Tx inhibit).
- Polyurethane conformal coating.

(Note: AcroPack modules are compatible only with the carrier cards listed below)

Accessories

5028-621
Breakout panel for AP570 series. Converts 68-pin CHAMP to two TRB jacks and one DB15 connector.

Carrier Cards

See Acromag.com/AcroPack-Carriers for a full list of AcroPack carrier cards.

Software

See Acromag.com for software documentation for details

APSW-API-VXW
VxWorks® software support package.

APSW-API-WIN
Windows® DLL driver software support package.

APSW-API-LNX
Linux® support (website download only).

Acromag, Inc.
30765 Wixom Rd, Wixom, MI 48393 USA

Tel 844-878-2352 ▪ solutions@acromag.com ▪ www.acromag.com
**Description**

The AcroPack® product line updates our popular Industry Pack I/O modules with a PCIe interface format. This tech-refresh design offers a compact size, low-cost I/O, and a rugged form factor. Combining different AcroPack module types on one XMC, VPX, or PCIe carrier allows for a simplified modular approach to system assembly.

These modules provide a single port Ethernet which is capable of speeds of 10, 100 or 1000 Mbps data rates.

The AP580E-POE-LF offers an option which makes the AP580E a power sourcing equipment (PSE) that provides 52V DC up to 10 watts of power to powered devices (PD) such as a video camera and VOIP phones or any other PD device. This allows a user to connect point to point without contending with any other traffic on a network.

**Key Features & Benefits**

- Power over Ethernet as a power sourcing device
- Supports Intel i210 Ethernet controller PROset drivers
- Small form factor
- Intel 1Gb i210 Ethernet Controller
- Single port
- Failsafe receivers
- Audio Video bridging
- Jumbo frames
- Interrupt moderation, VLAN support and IP checksum offload
- PCIe optimized system power management
- Four transmit and four receive queues
- RSS and MSI-X to lower CPU utilization in multi-core systems
- Advanced cable diagnostics, auto MDI-X
- Error correcting memory in packet buffers
- CE compliant
### Performance Specifications

#### General

<table>
<thead>
<tr>
<th>Power Supply Voltage</th>
<th>Current Draw</th>
</tr>
</thead>
<tbody>
<tr>
<td>+3.3V DC ±5%</td>
<td>115 mA (max.)</td>
</tr>
<tr>
<td>1.5V DC</td>
<td>Not used</td>
</tr>
<tr>
<td>5.0V DC</td>
<td>Not used</td>
</tr>
<tr>
<td>+12V DC</td>
<td>1.5A (min.)*</td>
</tr>
<tr>
<td>-12V DC</td>
<td>Not used</td>
</tr>
</tbody>
</table>

*AP580E-POE-LF only

AP580E-POE-FL Output Power 52V DC at 0.193A (max.) 10 watts.

#### Environmental
- Operating temperature: -40 to 70°C.
- Storage temperature: -55 to 125°C
- Relative humidity: 5 to 95% non-condensing.
- Operating Vibration: Designed to comply to MIL-STD-810G, method 514.6.

#### Physical
- Length: 70mm.
- Width: 30mm.

#### PCI Express Base Specification
- Conforms to revision 2.1
- Lanes: 1 lane.
- Bus Speed: 2.5 Gbps (Generation 1).
- Memory: 4K required.

### Ordering Information

**AcroPack® Modules**

- **AP580E-LF**
  - 1Gb Ethernet board
- **AP580E-POE-LF**
  - 1Gb Ethernet with Power Over Ethernet
  (Note: AcroPack modules are compatible only with the carriers listed below)

**Carrier Cards**

- **APCe7010E-LF**
  - PCIe AcroPack carrier, holds one AcroPack module, air-cooled.
- **APCe7022E-LF**
  - PCIe AcroPack carrier, holds two AcroPack modules, air-cooled.
- **APCe7040E-LF**
  - PCIe AcroPack carrier, holds four AcroPack modules, air-cooled.
- **VPX4500E-LF**
  - 3U VPX AcroPack carrier, holds three AcroPack modules, air-cooled.
- **VPX4500-CC-LF**
  - 3U VPX AcroPack carrier, holds three AcroPack modules, conduction-cooled.
- **XMCAP2020-LF**
  - XMC AcroPack carrier; holds two AcroPack modules, 2-slots out front, air-cooled.
- **XMCAP2021-LF**
  - XMC AcroPack carrier; holds two AcroPack modules, 2-slots out rear, air-cooled.

**Software** (see software documentation for details)

- **APSW-API-VXW**
  - VxWorks® software support package.
- **APSW-API-WIN**
  - Windows® DLL driver software support package.
- **APSW-API-LNX**
  - Linux® support (website download only).
The AcroPack® product line updates our popular Industry Pack I/O modules with a PCIe interface format. This tech-refresh design offers a compact size, low-cost I/O, the same functionality as the existing Industry Pack modules and a rugged form factor.

The APA7-500 series provides a FPGA based user-configurable bridge between a host processor and a custom digital interface via PCI Express. These boards feature a best in class Artix®-7 interface to deliver the industry's lowest power and high performance.

Designed for COTS applications these FPGA based digital I/O modules deliver user-customizable I/O, high-density, high-reliability, and high-performance at a low cost.

Key Features & Benefits
- PCI Express Generation 1 interface
- Reconfigurable Xilinx® FPGA
- High channel count digital interface: RS485, LVDS and TTL interface options.
- 32Mb quad serial Flash memory
- 52,160 logic cells
- 65,200 Flip flops
- 2,700 kb block RAM
- 120 DSP slices
- External LV/TTL clock input
- Long distance data transmission
- Example design
- Power up and system reset is failsafe
- Conduction-cooled options
# APA7-500 Series User-Configurable Artix®-7 FPGA I/O Modules

## Performance Specifications

<table>
<thead>
<tr>
<th>FPGA</th>
</tr>
</thead>
<tbody>
<tr>
<td>FPGA device</td>
</tr>
<tr>
<td>Xilinx Artix-7 FPGA Model XC7A50T.</td>
</tr>
<tr>
<td>FPGA configuration</td>
</tr>
<tr>
<td>Download via flash memory.</td>
</tr>
<tr>
<td>Example FPGA program</td>
</tr>
<tr>
<td>IP integrator block diagram provided for PCIe bus 1 lane Gen 1 interface, DMA controller, on-chip block RAM, flash memory and control of field I/O. See EDK kit.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>I/O Processing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field I/O Interface</td>
</tr>
<tr>
<td>PCIe bus 1 lane Gen 1 interface.</td>
</tr>
<tr>
<td>I/O Connector</td>
</tr>
<tr>
<td>100-pin field I/O connector.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Engineering Design Kit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides user with basic information required to develop a custom FPGA program. Kit must be ordered with the first purchase of a APA7-500 series module (see <a href="http://www.acromag.com">www.acromag.com</a> for more information).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PCI Express Base Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conforms to revision 2.0</td>
</tr>
<tr>
<td>Lanes</td>
</tr>
<tr>
<td>1 lane in each direction.</td>
</tr>
<tr>
<td>Bus Speed</td>
</tr>
<tr>
<td>2.5 Gbps (Generation 1).</td>
</tr>
<tr>
<td>Memory</td>
</tr>
<tr>
<td>128k space required.</td>
</tr>
<tr>
<td>1 base address register.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Environmental</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
</tr>
<tr>
<td>Air-Cooled with heatsink: -40°C to 80°C.</td>
</tr>
<tr>
<td>Air-Cooled without heatsink: -40°C to 70°C.</td>
</tr>
<tr>
<td>Conduction Cooled: -40°C to 85°C.</td>
</tr>
<tr>
<td>Storage temperature: -55°C to 125°C.</td>
</tr>
<tr>
<td>Relative humidity: 5% to 95% non-condensing.</td>
</tr>
<tr>
<td>Power</td>
</tr>
<tr>
<td>+3.3V (±5%) 500mA typical.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Physical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
</tr>
<tr>
<td>70mm.</td>
</tr>
<tr>
<td>Width</td>
</tr>
<tr>
<td>30mm.</td>
</tr>
</tbody>
</table>

## Ordering Information

### AcroPack® Modules

| APA7-500E-LF |
| 48 TTL channels. |
| APA7-502E-LF |
| 24 EIA-485/422 channels. |
| APA7-503E-LF |
| 24 TTL & 12 EIA-485/422 channels. |
| APA7-504E-LF |
| 24 LVDS channels. |

(Note: AcroPack modules are compatible only with the carriers listed below)

### Accessories

| AP-CC-01 |
| Conduction-cool kit. |
| APA7-EDK |
| Engineering design kit. (One kit required) |

### Carrier Cards

| APCe7012E-LF |
| PCIe AcroPack carrier, holds one AcroPack module, air-cooled. |
| APCe7022E-LF |
| PCIe AcroPack carrier, holds two AcroPack modules, air-cooled. |
| APCe7040E-LF |
| PCIe AcroPack carrier, holds four AcroPack modules, air-cooled. |
| VPX4500E-LF |
| 3U VPX AcroPack carrier, holds three AcroPack modules, air-cooled. |
| VPX4500-CC-LF |
| 3U VPX AcroPack carrier, holds three AcroPack modules, conduction-cooled. |
| XMCP2020-LF |
| XMC AcroPack carrier, holds two AcroPack modules, 2-slots out front, air-cooled. |
| XMCP2021-LF |
| XMC AcroPack carrier, holds two AcroPack modules, 2-slots out rear, air-cooled. |

### Software

(see software documentation for details)

| APSW-API-VXW |
| VxWorks® software support package. |
| APSW-API-WIN |
| Windows® DLL driver software support package. |
| APSW-API-LNX |
| Linux® support (website download only). |

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![AP-CC-01 Conduction-Cool Kit](image1.jpg)

ISO9001
AS9100

Made in USA

Tel 248-295-0310 solutions@acromag.com www.acromag.com 30765 Wixom Rd, Wixom, MI 48393 USA

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AcroPack® Carriers

ACPS3310 CompactPCI® Serial Carrier Cards for AcroPack Modules

3U CompactPCI Serial ◆ Two isolated I/O expansion slots (AcroPack or mini PCIe) ◆ Front I/O access

Description
The ACPS3310 is a 3U CompactPCI Serial carrier card for Acromag’s AcroPack mezzanine modules. Two isolated I/O expansion slots interface AcroPack or mini PCIe modules to the PCIe bus. All connections to field signals are made through front panel connectors on the carrier board which passes them to the individual AcroPack modules.

Select from 25+ AcroPack modules to install any combination of analog I/O, digital I/O, serial I/O, communication, and FPGA processor functions. This modular approach allows the user to create a board which is customized to the application, thus saving slots and reducing costs.

The AcroPack product line updates our popular Industry Pack I/O modules with a PCIe interface format. This tech-refresh design offers a compact, low-cost I/O solution with the same functionality and memory map of the original Industry Pack mezzanine modules. New modules offer additional capabilities such as FPGA computing, Ethernet, CAN bus, and avionics interfaces.

These carriers are ideal for high-performance systems in aerospace, defense, transportation, oil/gas, test/measurement, manufacturing, and scientific research applications. End-users and system integrators benefit from a broad range of I/O functions in a small form factor.

Key Features & Benefits

General
■ Two AcroPack or mini-PCIe module slots support any combination of I/O functions
■ PCI Express Version 2.1 compliant carrier
■ Compliant with PICMG CPCI-S.0 R2.0 standard
■ PCIe switch allows two devices to share a single 4HP peripheral board slot in a CPCI-S chassis
■ Geographical addressing identifies carrier location on the backplane
■ Front panel 68-pin VHDCI CHAMP 0.8mm connectors for field I/O signals
■ Isolated power supply option for use with isolated AcroPack modules
■ Fused +1.5V, +3.3V, +5V, +12V, -12V DC power. A fuse is present on each supply line serving each AcroPack module.
■ JTAG header for programming and debugging AcroPack modules with an FPGA
■ Extended temperature range
■ Software development tools for VxWorks, Linux, and Windows environments
**Performance Specifications**

- **Interfaces**
  - **CompactPCI Serial**
    CompactPCI Serial (CPCI-S.0) peripheral slot card with P1 connector. PCIe x4. Geographical addressing (GA0-GA3).
  - **PCI Express**
    PCIe Gen 2 switch expands host PCIe port to two ports, one for each AcroPack site. The host port has one or four PCIe lanes (depending on CPCI-S slot). Each AcroPack site has one lane.

- **AcroPack / Mini PCIe Mezzanine**
  Two AcroPack or mPCIe (full-length) slots. PCIe x1. Site B includes USB 2.0 interface.
  Front panel interface: Each AcroPack module routes to a 68-pin VHDCI CHAMP connector (stacked).
  Rear interface: Both AcroPack modules have a PCIe x1 link (via switch) to the CPCI-S P1 connector.
  Isolation: Host logic and field I/O isolated from each other up to 250V AC/DC continuous (1500V AC for one minute). Optional isolated DC/DC converter is required for use with isolated AcroPack modules. Carrier also provides 100VAC/DC continuous isolation between AcroPack module signals. Isolation between adjacent pins/signals on front I/O cable is 30V.

- **Compliance**
  - **CompactPCI Serial**
    Meets or exceeds PICMG® CPCI-S.0 R2.0.
  - **PCI Express**
    PCI Express Version 2.1 compliant carrier.

- **EMC**
  Designed to comply with EMC Directive 2004/108/EC. Immunity: EN 61000-6-2. Emissions: EN 61000-6-4, Class A.

- **Electrical / Mechanical**
  **Power Requirements**
  +12V supply (+10%): 290mA typical with no AcroPacks installed.
  The ACPS3310 has four DC/DC converters to provide the power supply voltages to the AcroPack modules that are not present at the host interface.
  The +5V, +3.3V, +1.5V and -12V supplies are sourced from the +12V host power.

  **Dimensions**
  3U CompactPCI Serial 4HP.
  Size: 100 x 160 mm (3.937 x 6.299 inches).
  Weight: 158 g.

- **Environmental**
  **Operating / Storage Temperature Range**
  Operation: -40 to 85°C (200 LFM airflow).
  Storage: -55 to 125°C.

  **Relative Humidity**
  5 to 95% non-condensing.

  **Shock, Operating**
  Designed to comply with IEC 60068-2-27: 30G, 11ms half sine, 50G, 3Ms half sine, 18 shocks at 6 orientations for both test levels.

  **Vibration, Operating**
  Sinusoidal: Designed to comply with IEC 60068-2-6: 10-500Hz, 5G, 2 Hours/axis.
  Random: Designed to comply with IEC 60068-2-64: 10-500Hz, 5G-rms, 2 Hours/axis.

- **Certifications**
  CE compliant.

- **Software Support**
  **Operating Systems**
  Drivers available for Linux®, Windows® and VxWorks®.

- **Ordering Information**
  **Carrier Boards**
  ACPS3310: 3U CPCI-S carrier, two AcroPack/mPCIe sites, front I/O, air-cooled.
  See Acromag.com/AcroPacks for a full list of I/O modules.

  **Accessories**
  5025-288: Termination panel, DIN-rail mountable, SCSI-3 connector, 68 screw terminals.
  5028-420: Round cable, shielded, male SCSI-3 connector to 68-pin CHAMP 0.8mm, 2 meters long.
  5028-615: Cable, 68-pin CHAMP to pigtail, 36 inches long.
  5028-616: Cable, 68-pin CHAMP to pigtail, 70 inches long.

  **Software**
  (see software documentation for details)
  APSW-API-LNX: Linux® support (website download only)
  APSW-API-VXW: VxWorks software support package
  APSW-API-WIN: Windows DLL driver software support pkg.

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**Diagram**

- **AcroPack Site A**
  - 68-pin Dual CHAMP
  - ±12V ISO DC/DC
  - Field I/O A
  - PCI Express x1
  - Slot ID CPLD
  - JTAG Header

- **AcroPack Site B**
  - 68-pin Dual CHAMP
  - ±12V ISO DC/DC
  - Field I/O B
  - PCI Express x1
  - PCI Express Switch
  - Power: +1.5, +3.3, +5, +12, -12

**Coating/Sealant**
Conformal coating available on request.

**MTBF**
According to MIL-HDBK-217 FN2, GBGC.
25°C: Contact factory.
40°C: Contact factory.

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The ACPS3320 is a 3U CompactPCI Serial carrier card for Acromag’s AcroPack mezzanine modules. Two I/O expansion slots interface AcroPack or mini PCIe modules to the PCIe bus. All connections to field signals are made through rear backplane connectors on the carrier board which passes them to the individual AcroPack modules.

Select from 25+ AcroPack modules to install any combination of analog I/O, digital I/O, serial I/O, communication, and FPGA processor functions. This modular approach allows the user to create a board which is customized to the application, thus saving slots and reducing costs.

The AcroPack product line updates our popular Industry Pack I/O modules with a PCIe interface format. This tech-refresh design offers a compact, low-cost I/O solution with the same functionality of the original Industry Pack mezzanine modules. New modules offer additional capabilities such as FPGA computing, Ethernet, CAN bus, and avionics interfaces.

These carriers are ideal for high-performance systems in aerospace, defense, transportation, oil/gas, communication, and scientific research applications. End-users and system integrators benefit from a broad range of I/O functions in a small form factor.

**Key Features & Benefits**

**General**
- Two AcroPack or mini-PCIe module slots support any combination of I/O functions
- PCI Express Version 2.1 compliant carrier
- Compliant with PICMG CPCI-S.0 R2.0 standard
- PCIe switch allows two devices to share a single 4HP peripheral board slot in a CPCI-S chassis
- Geographical addressing identifies carrier location on the backplane
- Fused +1.5V, +3.3V, +5V, +12V, -12V DC power. A fuse is present on each supply line serving each AcroPack module.
- JTAG header for programming and debugging AcroPack modules with an FPGA
- Extended temperature range
- Software development tools for VxWorks®, Linux®, and Windows® environments

**Description**

The ACPS3320 is a 3U CompactPCI Serial carrier card for Acromag’s AcroPack mezzanine modules. Two I/O expansion slots interface AcroPack or mini PCIe modules to the PCIe bus. All connections to field signals are made through rear backplane connectors on the carrier board which passes them to the individual AcroPack modules.

Select from 25+ AcroPack modules to install any combination of analog I/O, digital I/O, serial I/O, communication, and FPGA processor functions. This modular approach allows the user to create a board which is customized to the application, thus saving slots and reducing costs.
Performance Specifications

- **Interfaces**
  CompactPCI Serial
  CompactPCI Serial (CPCI-S 0) peripheral slot card with P1 connector. PCIe x4. Geographical addressing (GA0-GA3).
  PCIe Express
  PCIe Gen 2 switch expands host PCIe port to two ports, one for each AcroPack site. The host port has one or four PCIe lanes (depending on CPCI-S slot). Each AcroPack site has one lane.

- **AcroPack / Mini PCIe Mezzanine**
  Two AcroPack or mPCIe (full-length) slots. PCIe x1. Site B includes USB 2.0 interface.
  Rear interface: Both AcroPack modules have a PCIe x1 link (via switch) to the CPCI-S P1 connector.
  **Field I/O**
  Fifty field I/O signals from each AcroPack are brought out to CPCI-S backplane connectors P2 and P3.

- **Compliance**
  CompactPCI Serial
  Meets or exceeds PICMG® CPCI-S.0 R2.0.
  PCI Express
  PCI Express Version 2.1 compliant carrier.
  **EMC**
  Designed to comply with EMC Directive 2004/108/EC. Immunity: EN 61000-6-2. Emissions: EN 61000-6-4, Class A.

- **Electrical / Mechanical**
  **Power Requirements**
  +12V supply (+10%): 290mA typical with no AcroPacks installed.
  The ACPS3320 has four DC/DC converters to provide the power supply voltages to the AcroPack modules that are not present at the host interface. The +5V, +3.3V, +1.5V and -12V supplies are sourced from the +12V host power.
  **Dimensions**
  3U CompactPCI Serial 4HP. Size: 100 x 160 mm (3.937 x 6.299 inches). Weight: 163 g.

- **Environmental**
  **Operating / Storage Temperature Range**
  Operation: -40 to 85°C (200 LFM airflow). Storage: -55 to 125°C.
  **Relative Humidity**
  5 to 95% non-condensing.
  **Shock, Operating**
  Designed to comply with IEC 60068-2-27: 30G, 11ms half sine, 50G, 3ms half sine, 18 shocks at 6 orientations for both test levels.
  **Vibration, Operating**
  Sinusoidal: Designed to comply with IEC 60068-2-6: 10-500Hz, 5G, 2 Hours/axis.
  Random: Designed to comply with IEC 60068-2-64: 10-500Hz, 5G-rms, 2 Hours/axis.
  **Certifications**
  CE compliant.

- **Coating/Sealant**
  Conformal coating available on request.

- **Software Support**
  **Operating Systems**
  Drivers available for Linux®, Windows® and VxWorks®.
  **Software**
  (see software documentation for details)
  APSW-API-LNX: Linux® support (website download only)
  APSW-API-VXW: VxWorks software support package
  APSW-API-WIN: Windows DLL driver software support pkg

Ordering Information

**Carrier Boards**
ACPS3320: 3U PCI-S carrier, two AcroPack/mPCIe sites, rear I/O, air-cooled
See Acromag.com/AcroPacks for a full list of I/O modules.

**Accessories**
ACPS3320-RTM: Rear transition module, 68-pin CHAMP 5025-288: Termination panel, DIN-rail mountable, SCSI-3 connector, 68 screw terminals
5028-420: Round cable, shielded, male SCSI-3 connector to 68-pin CHAMP 0.8mm, 2 meters long
5028-615: Cable, 68-pin CHAMP to pigtail, 36 inches long
5028-616: Cable, 68-pin CHAMP to pigtail, 70 inches long

See Acromag.com/AcroPacks for a full list of I/O modules.
**APA7-500 Series** User-Configurable Artix®-7 FPGA I/O Modules

### Performance Specifications

- **FPGA**
  - FPGA device: Xilinx Artix-7 FPGA Model XC7A50T.
  - FPGA configuration: Download via flash memory.
  - Example FPGA program: IP integrator block diagram provided for PCIe bus 1 lane Gen 1 interface, DMA controller, on chip block RAM, flash memory and control of field I/O. See EDK kit.

- **I/O Processing**
  - Field I/O Interface: PCIe bus 1 lane Gen 1 interface.
  - I/O Connector: 100 pin field I/O connector.

- **Engineering Design Kit**
  - Provides user with basic information required to develop a custom FPGA program. Kit must be ordered with the first purchase of a APA7-500 series module (see www.acromag.com for more information).

- **PCI Express Base Specification**
  - Conforms to revision 2.0
  - Lanes: 1 lane in each direction.
  - Bus Speed: 2.5 Gbps (Generation 1).
  - Memory: 128k space required. 1 base address register.

- **Environmental**
  - Operating temperature: Air Cooled with heat sink -40 to 80°C.
  - Air Cooled without heat sink -40 to 70°C.
  - Conduction Cooled -40 to 85°C.
  - Storage temperature: -55 to 125°C.
  - Relative humidity: 5 to 95% non-condensing.
  - Power: +3.3V (+5%) 500mA typical.

- **Physical**
  - Length: 70mm.
  - Width: 30mm.

### Ordering Information

**AcroPack® Modules**

- APA7-501E-LF: 48 TTL channels.
- APA7-502E-LF: 24 EIA-485/422 channels.
- APA7-503E-LF: 24 TTL & 12 EIA-485/422 channels.
- APA7-504E-LF: 24 LVDS channels.
  - (Note: AcroPack modules are compatible only with the carriers listed below)

**Accessories**

- AP-CC-01: Conduction-cool kit.
- APA7-EDK: Engineering design kit. (One kit required)

**Carrier Cards**

- APc7012E-LF: PCIe AcroPack carrier, holds one AcroPack module, air-cooled.
- APc7022E-LF: PCIe AcroPack carrier, holds two AcroPack modules, air-cooled.
- APc7040E-LF: PCIe AcroPack carrier, holds four AcroPack modules, air-cooled.
- VPX4500E-LF: 3U VPX AcroPack carrier, holds three AcroPack modules, air-cooled.
- VPX4500-CC-LF: 3U VPX AcroPack carrier, holds three AcroPack modules, conduction-cooled.
- XMCAP2020-LF: XMC AcroPack carrier, holds two AcroPack modules, 2-slots out front, air-cooled.
- XMCAP2021-LF: XMC AcroPack carrier, holds two AcroPack modules, 2-slots out rear, air-cooled.

**Software** (see software documentation for details)

- APSW-API-VXW: VxWorks® software support package.
- APSW-API-WIN: Windows® DLL driver software support package.
- APSW-API-LNX: Linux® support (website download only).

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AcroPack® Carriers

APCe7012 PCI Express Carrier Cards for AcroPack® Modules

Description
The AcroPack® product line updates our popular Industry Pack I/O modules with a PCIe interface format. This tech-refresh design offers a compact size, low-cost I/O, the same functionality and memory map of the existing Industry Pack modules.

This board interfaces one AcroPack mezzanine module to a PCI Express bus on a PC-based computer system.

Select I/O modules from Acromag’s offering or use most third-party mPCIe compliant modules.

Key Features & Benefits
- One AcroPack or mini-PCIe module slot
- PCI Express compliant
- Plug-and-play carrier configuration and interrupt support
- Fused +1.5V, +3.3V, +5V, +12V, and -12V DC power is provided. A fuse is present on each supply line serving each AcroPack module.
- Front panel 68-pin CHAMP 0.8mm connectors for field I/O signals
- Optional isolated power supplies. Support for AcroPacks requiring ±12 Volt isolated power.
- Extended temperature range
- DIP switch card identification
- Standard 14-pin Xilinx JTAG programming header
- Software development tools for VxWorks®, Linux®, and Windows® environments.

One AcroPack or mini-PCIe mezzanine module slot ◆ Low-profile PCIe carrier card
**Performance Specifications**

- **PCI Express Bus Compliance**
  This device meets or exceeds all written PCI Express specifications per revision 2.1.
  The host port consists of one PCIe lane, each of the mini-PCIe sites have one lane each.

- **I/O Interface**
  Connectors
  - P1 (PCIe Bus): PCIe V2.1
  - J3 (Carrier Field I/O): 68-pin, CHAMP
  - P2 (AcroPack Field I/O): 100-pin socket
  - J1, (Mini-PCIe): 52-pin socket
  - P3 (JTAG): 14-pin header
  Gold plating in the connection area, M2.5 screws and spacers provide excellent connection integrity and stability for harsh environments.

- **Ease of Use**
  A standard 14-pin Xilinx JTAG programming header is provided for programming and debugging the FPGA on some AcroPack modules.

- **Physical**
  **Physical Configuration**
  PCIe x1 low-profile
  Length: 6.3 inches (160 mm).
  Height: 2.711 inches (68.86 mm).
  Includes standard and low-profile brackets.

- **Environmental**
  Operating temperature
  -40 to +85°C
  Storage temperature
  -55 to +125°C.
  Relative humidity
  5 to 95% non-condensing.
  Power
  +3.3 Volts (±10%): 0.95mA typical
  +12 Volts (±5%): 25mA Typical
  The APCe7012E-LF has DC/DC converters to provide the power supply voltages to the AcroPack modules that are not present at the host interface. The +1.5 Volt supply is sourced from the +3.3 Volt host power. The +5 Volt and -12 Volt supply is sourced from +12 Volt host power.

**Ordering Information**

- **Carrier Card**
  - APCe7012E-LF: AcroPack carrier card for AcroPack or mPCIe modules, one module slot.
  - See Acromag.com/AcroPacks for a full list of I/O modules.

- **Accessories**
  - 5025-288: Termination panel, DIN-rail mountable, SCSI-3 connector, 68 screw terminals.
  - 5028-420: Round cable, shielded, male SCSI-3 connector to 68-pin CHAMP. 0.8mm, 2 meters long.
  - 5028-615: Cable, 68-pin CHAMP to pigtail, 36 inches long.
  - 5028-616: Cable, 68-pin CHAMP to pigtail, 70 inches long.

- **Software**
  - (see software documentation for details)
  - APSW-API-VXW: VxWorks software support package
  - APSW-API-WIN: Windows DLL driver software support pkg
  - APSW-API-LNX: Linux® support (website download only)
**AcroPack® Carriers**

**APCe7022 PCI Express Carrier Cards for AcroPack® Modules**

Two AcroPack or mini-PCIe mezzanine module slots  ◆  Non-Intelligent carrier card  ◆  PCIe x4 interface

**Model**

APCe7022E-LF

**Description**

The AcroPack® product line updates our popular Industry Pack I/O modules with a PCIe interface format. This tech-refresh design offers a compact size, low-cost I/O, the same functionality and memory map of the existing Industry Pack modules.

This board interfaces two AcroPack mezzanine modules to a PCI Express bus on a PC-based computer system.

Two AcroPack module slots give you the freedom to mix a variety of I/O functions (A/D, D/A, digital in, digital out, serial I/O, etc.) on a single board. Or, combine modules of the same type for almost one hundred channels on a single card. Either way, the APCe7022 saves your precious card slots and reduces your costs.

Select I/O modules from Acromag’s offering or use most third-party mPCIe compliant modules.

**Key Features & Benefits**

- Two AcroPack or mini-PCIe module slots support any combination of I/O functions
- PCI Express compliant
- Plug-and-play carrier configuration and interrupt support
- Fused +1.5V, +3.3V, +5V, +12V, and -12V DC power is provided. A fuse is present on each supply line serving each AcroPack module.
- Front panel 68-pin CHAMP 0.8mm connectors for field I/O signals
- Extended temperature range
- DIP switch card identification
- Standard 14-pin Xilinx JTAG programming header
- Software development tools for VxWorks®, Linux®, and Windows® environments.

Order I/O modules separately.
**Performance Specifications**

- **PCI Express Bus Compliance**
  This device meets or exceeds all written PCI Express specifications per revision 2.1.
  Includes a PCIe Gen 2 switch to expand the single host PCIe port to two ports, one to each device (AcroPack or mini-PCIe).
  The host port consists of four PCIe lanes, each of the mini-PCIe sites have one lane each.

- **I/O Interface**
  Connectors
  - P1 (PCIe Bus): PCIe V2.1 x4 lane (PCIe Gen 2 Switch).
  - J3 (Carrier Field I/O): 68-pin, stacked, CHAMP (TE Connectivity 5787962).
  - P2, 3 (AcroPack Field I/O): 100-pin socket (Samtec SS5-50-3.00-L-D-K-RT).
  - J1, 2 (Mini-PCIe): 52-pin socket (TE Connectivity 1759547-1).
  - P6 (JTAG): 14-pin header (Molex 87832-1420).

  Gold plating in the connection area, M2.5 screws and spacers provide excellent connection integrity and stability for harsh environments.

- **Ease of Use**
  A unique carrier and site number can be set for each AcroPack site by a DIP switch. This provides the capability to distinguish a particular AcroPack module from others when multiple instances of the same module are used in a system.
  A standard 14-pin Xilinx JTAG programming header is provided for programming and debugging the FPGA on some AcroPack modules. The JTAG ports of the two AcroPack modules are daisy-chained.

**Ordering Information**

**Carrier Card**
APCe7022E-LF: AcroPack carrier card for AcroPack or mini-PCIe modules, plus extended temperature range.
See Acromag.com/AcroPacks for a full list of I/O modules.

**Accessories**
- 5025-288: Termination panel, DIN-rail mountable, SCSI-3 connector, 68 screw terminals.
- 5028-420: Round cable, shielded, male SCSI-3 connector to 68-pin CHAMP. 0.8mm, 2 meters long.
- 5028-616: Cable, 68-pin CHAMP to pigtail, 70 inches long.

**Software** (see software documentation for details)
- APSW-API-VXW: VxWorks software support package.
- APSW-API-WIN: Windows DLL driver software support pkg.
- APSW-API-LNX: Linux® support (website download only).
**Description**

**Model:** APCe7040E-LF

The AcroPack® product line updates our popular Industry Pack I/O modules with a PCIe interface format. This tech-refresh design offers a compact size, low-cost I/O, the same functionality and memory map of the existing Industry Pack modules.

This board interfaces four AcroPack mezzanine modules to a PCI Express bus on a PC-based computer system. It is designed to provide isolation between the AcroPack field I/O signals and the host when used with an isolated AcroPack module.

Four AcroPack module slots give you the freedom to mix a variety of I/O functions (A/D, D/A, digital in, digital out, serial I/O, FPGA, etc.) on a single board. Or, combine modules of the same type for almost two hundred channels on a single card. Either way, the APCe7040 saves your precious card slots and reduces your costs.

Select I/O modules from Acromag’s offering or use most third-party mPCIe compliant modules.

**Key Features & Benefits**

- Four AcroPack or mini-PCIe module slots support any combination of I/O functions
- PCI Express 2.1 compliant
- Plug-and-play carrier configuration and interrupt support
- Fused +1.5V, +3.3V, +5V, +12V, and -12V DC power is provided. A fuse is present on each supply line serving each AcroPack module.
- Front panel 68-pin VHDC1 CHAMP 0.8 connectors for field I/O signals
- Optional isolated power supplies. Support for AcroPacks requiring ±12 V isolated power.
- Extended temperature range
- DIP switch card identification
- Standard 14-pin Xilinx JTAG programming header
- Software development tools for VxWorks®, Linux®, and Windows® environments.
Performance Specifications

PCI Express Bus Compliance
This device meets or exceeds all written PCI Express specifications per revision 2.1.
Includes a PCIe Gen 2 switch to expand the single host PCIe port to four ports, one to each device (AcroPack or mini-PCIe).
The host port consists of four PCIe lanes, each of the mini-PCIe sites have one lane each.

I/O Interface
Front I/O
Connector: Four 68-pin CHAMP cable connections. Pin assignments are defined by the installed AcroPack module.
The field side connector of the AcroPack I/O module mates to a Samtec SS5-50-3.00-L-D-K-TR socket connector P2 on the carrier board.
Gold plating in the connection area, M2.5 screws and spacers provide excellent connection integrity and stability for harsh environments.

Ease of Use
A unique carrier and site number can be set for each AcroPack site by a DIP switch. This provides the capability to distinguish a particular AcroPack module from others when multiple instances of the same module are used in a system.
A standard 14-pin Xilinx JTAG programming header is provided for programming and debugging the FPGA on some AcroPack modules. The JTAG ports of the four AcroPack modules are daisy-chained.

Physical
Physical Configuration
PCIe x4 lane.
Length: 12.283 inches (312.0 mm).
Height: 4.375 inches (111.12 mm).

Environmental
Operating temperature
-40 to +85°C.
Storage temperature
-55 to +125°C.
Relative humidity
5 to 95% non-condensing.
Power
+3.3 Volts (±10%): 0.383mA typical.
+12 Volts (±5%): 0.175mA typical.
The APCe7040E-LF has four DC/DC converters to provide the power supply voltages to the AcroPack modules that are not present at the host interface. The +1.5 Volt supply is sourced from the +3.3 Volt host power. The +5 Volt, +3.3 Volt and -12 Volt supply is sourced from +12 Volt host power.

PCle Switch
x4 PCIe

DC/DC Converters and Fuses
+/-12V
+3.3V

JTAG

1.5V, 3.3V, 5V, 12V, -12V

Slot Address

CPLD

JTAG

Field I/O A

+/-12V
Isolated Power

Field I/O B

+/-12V
Isolated Power

Field I/O C

+/-12V
Isolated Power

Field I/O D

+/-12V
Isolated Power

DIP Switch SW1

Ordering Information

Carrier Card
APCe7040E-LF: AcroPack carrier card for AcroPack or mini-PCIe modules, four module slots.
See Acromag.com/AcroPacks for a full list of I/O modules.

Accessories
5028-420: Round cable, shielded, male SCSI-3 connector to 68-pin CHAMP: 0.8mm, 2 meters long.
5025-288: Termination panel, DIN-rail mountable, SCSI-3 connector, 68 screw terminals.
5028-615: Cable, 68-pin CHAMP to pigtail, 36 inches long.
5028-616: Cable, 68-pin CHAMP to pigtail, 70 inches long.

Software (see software documentation for details)
APSW-API-VXW: VxWorks software support package.
APSW-API-WIN: Windows DLL driver software support pkg.
APSW-API-LNX: Linux® support (website download only).
**Description**

Models:
- XMCAP2020-LF: Front I/O
- XMCAP2021-LF: Rear I/O
- XMCAP2022-LF: For use with ARCX-4000 rugged computers

The AcroPack® product line updates our popular Industry Pack I/O modules with a PCIe interface format. This tech-refresh design offers a compact size, low-cost I/O, the same functionality and memory map of the existing Industry Pack modules.

This board interfaces two AcroPack mezzanine modules to a PCI Express bus on an air-cooled XMC carrier.

Two AcroPack module slots give you the freedom to mix a variety of I/O functions (A/D, D/A, digital in, digital out, serial I/O, etc.) on a single board. Or, combine modules of the same type for almost one hundred channels on a single card. Either way, the XMCAP2020/2021 saves your precious card slots and reduces your costs.

Select I/O modules from Acromag's offering or use most third-party mPCIe compliant modules.

**Key Features & Benefits**

- Two AcroPack or mini-PCIe module slots support any combination of I/O functions
- PCI Express compliant
- Plug-and-play carrier configuration and interrupt support
- Front panel 68-pin CHAMP 0.8mm connectors for field I/O
- Rear P14 and P16 connectors for field I/O
- DIP switch and/or geographical addressing for card identification
- VITA 42.0, 42.3 complaint
- JTAG programming through XMC P15 connector or through onboard micro connector
- Software development tools for VxWorks®, Linux®, and Windows® environments.
### Performance Specifications

**PCI Express Bus Compliance**
This device meets or exceeds all written PCI Express specifications per revision 2.1. It includes a PCIe Gen 2 switch to expand the single host PCIe port to two ports, one to each device (AcroPack or mini-PCIe).
The host port consists of four PCIe lanes, each of the mini-PCIe sites have one lane each.

**Field I/O Connectors**
Front I/O
XMCAP2020-LF: Two 68-pin 0.8mm Champ cable connection. Pin assignments are defined by the installed AcroPack or mini-PCIe module.
Rear I/O
XMCAP2021-LF: One AcroPack routed to rear P14 connector and one AcroPack routed to rear P16 connection.
XMCAP2022-LF: One AcroPack routed to P16 and the second to P14. Intended for ARCX-4000 applications only.

**Ease of Use**
A unique carrier and site number can be set for each AcroPack site by a DIP switch or geographical addressing. This provides the capability to distinguish a particular AcroPack module from others when multiple instances of the same module are used in a system.
JTAG signal are provided for programming and debugging the FPGA on some AcroPack modules. The JTAG ports of the two AcroPack modules are daisy-chained.

### Ordering Information

**Carrier Card**
- XMCAP2020-LF: AcroPack carrier card for AcroPack or mPCIe modules, front I/O, air-cooled, two AcroPack slots.
- XMCAP2021-LF: AcroPack carrier card for AcroPack or mPCIe modules, rear I/O, air-cooled, two AcroPack slots.
- XMCAP2022-LF: AcroPack carrier card, rear I/O, two AcroPack slots, for ARCX-4000 applications (consult factory).

**Accessories**
- 5028-420: VHDCI 68-pin, round cable, shielded, SCSI-3 to CHAMP .0.8mm, 2 meters long.
- 5025-288: Termination panel, SCSI-3 connector, 68 screw terminals.
- 5028-615: Cable, 68-pin CHAMP to pigtail, 36 inches long
- 5028-616: Cable, 68-pin CHAMP to pigtail, 70 inches long

**Heatsinks for ARCX-4000** (consult factory)
- AP-CC-02: Heat sink for two generic AP modules (right rail or single wide ARCX)
- AP-CC-03: Heat sink for AP57x and generic AP modules (left rail or single wide ARCX)
- AP-CC-05: Heat sink for two generic AP modules (right rail)

**Software** (see software documentation for details)
- APSW-API-VXW: VxWorks® software support package
- APSW-API-WIN: Windows® DLL driver software support pkg
- APSW-API-LNX: Linux® support (website download only)
AcroPack® Carriers

VPX4500 VPX Carrier Cards for AcroPack® Modules

Description

Models
VPX4500E-LF: Air-cooled
VPX4500-CC-LF: Conduction-cooled

The VPX4500 is a 3U VPX carrier for Acromag AcroPack (AP) mezzanine modules.

The carrier board provides a modular approach to system assembly since each carrier can be populated with any combination of analog input/output, digital input/output, communication, AcroPack or some third-party mPCIe compliant modules.

The modularity allows the user to create a board which is customized to the application. This saves money and space; a single carrier board populated with AP modules may replace several dedicated function VPX boards. The VPX4500 carrier board provides impressive functionality at low cost.

Model VPX4500E-LF is an air-cooled product that supports three AcroPack sites. Two of the sites provide field I/O connections through front panel mounted 50 pin shielded connectors. The third site provides field I/O connections through the VPX backplane.

Model VPX4500-CC-LF is a conduction-cooled product that supports three AcroPack sites. Two of the sites provide field I/O connections through 50 pin ribbon cable connectors. The third site provides field I/O connections to the VPX backplane.

Model VPX4500-RTM-LF is a rear transition module used with both the VPX4500E-LF and the VPX4500-CC-LF carriers to provide access to the slot C AcroPack field I/O signals.

The AcroPack® product line updates our popular Industry Pack I/O modules with a PCIe interface format. This tech-refresh design offers a compact size, low-cost I/O, the same functionality and memory map of the existing Industry Pack mezzanine modules.

Key Features & Benefits

- Three AcroPack or mini-PCIe module slots support any combination of I/O functions.
- PCI Express version 2.1 compliant.
- Fused +1.5V, +3.3V, +5V, +12V, and -12V DC power is provided. A fuse is present on each supply line serving each AcroPack module.
- Front panel SCSI-2 connectors for the field I/O signals using VPX4500E-LF.
- Extended temperature range.
- Standard 14-pin Xilinx JTAG programming header.
- Software development tools for VxWorks®, Linux®, and Windows® environments.
**Performance Specifications**

### PCI Express Bus Compliance
This device meets or exceeds all written PCI Express specifications per revision 2.1.
Includes a PCIe Gen 2 switch to expand the single host PCIe port to three ports, one to each device.
(AcroPack or mini-PCIe).
The host port consists of four PCIe lanes, each of the mini-PCIe sites have one lane each.

### Ease of Use
A unique carrier and site number is set via slot address.
This provides the capability to distinguish a particular AcroPack module from others when multiple instances of the same module are used in a system.
A standard 14-pin Xilinx JTAG programming header is provided for programming and debugging the FPGA on some AcroPack modules. The JTAG ports of the two AcroPack modules are daisy-chained.

### General
**Form Factor**
3U VPX bus 6.299” (160mm) x 3.937” (100.0mm).
**Pitch**
VPX4500-LF (air-cooled): 1” pitch.
VPX4500-CC-LF (conduction-cooled): 1” pitch.
**VPX Carrier Interface**
Compatible VITA 65 module / slot profiles:
FRU EEPROM with temperature monitor.
**AcroPack Interface**
One AcroPack module in single VPX slot.
3.3V, 5V and ±12V provided for AcroPack modules via the VPX backplane.

### Power Requirements
**Power**
+3.3 Volts (±10%): 0.55mA typical.
+12 Volts (±5%): 25mA Typical.
The VPX4500 has two DC/DC converters to provide the power supply voltages to the AcroPack modules that are not present at the host interface. The +1.5 Volt supply is sourced from the 5 Volt host power.
The -12 Volt supply is sourced from +12 Volt host power.

### Environmental
**Operating temperature**
-40 to +85°C.
**Storage Temperature Range**
-55 to 125°C.
**Relative Humidity**
5 to 95% non-condensing.
**Vibration**
0.05g RMS (20 - 2000Hz) random, operating 6g RMS per Hz spectrum.
**Shock**
30g each axis, 11ms.

### Ordering Information
**Carrier Cards**
VPX4500-LF: VPX carrier card, 3U, three AcroPack slots.
VPX4500-CC-LF: Conduction-cooled version of VPX-4500.
See Acromag.com/AcroPacks for a full list of I/O modules.

**Accessories**
VPX4500-RTM-LF: Rear transition module
5028-372: Round cable, shielded, SCSI-2 to CHAMP. 0.8mm, 2 meters long.
5028-378: Termination panel, SCSI-2 connector, 50 screw terminals
5025-552: Termination panel, DIN-rail mountable panel
5025-550-3: Non-shielded cable, 3 feet long
5025-550-7: Non-shielded cable, 7 feet long
5025-550-10: Non-shielded cable, 10 feet long
5025-551-3: Shielded cable, 3 feet long
5025-551-4: Shielded cable, 4 feet long
5025-551-7: Shielded cable, 7 feet long
5025-551-10: Shielded cable, 10 feet long
5028-619: Cable, 50-pin CHAMP to pigtail, 36 inches long
5028-620: Cable, 50-pin CHAMP to pigtail, 70 inches long

**Software** (see software documentation for details)
APSW-API-VXW: VxWorks software support package
APSW-API-WIN: Windows DLL driver software support pkg
APSW-API-LNX: Linux support (website download only)
Linux® Libraries  I/O Function Routines

Description
IPSW-API-LNX
Support for Industry Pack modules and carriers
PCISW-API-LNX
Support for PCl/CompactPCI boards and PMC modules
APSW-API-LNX
Support for AcroPack® modules and carriers

Application Programming Interface (API)
Acromag’s software development tools greatly simplify the interface between the I/O boards and your software application program. The Linux libraries are supplied as “C” source code. These libraries provide easy-to-use function routines that quickly integrate with your application. Function routines are ready for use “as-is,” but they are also easily customized for your unique application.

Demonstration Program
This powerful program lets you fully exercise the libraries and your hardware before running the actual application. These diagnostics will save you hours troubleshooting and debugging your applications. You can set addresses, set up registers, read real-world inputs, or drive outputs. The demonstration program steps you through the exact functions that are called in your application.

Key Features & Benefits
- Easy installation procedure
- Readme files with step-by-step instructions
- Programming tools for most Acromag I/O boards (excludes serial I/O and VME products)
- Demonstration program
- Downloadable at no charge from the Acromag website
- Source code provided to ensure maximum flexibility in implementing your driver
- Verify operation of your I/O modules and carrier cards with a demonstration program to ensure proper hardware operation before attaching your application

Ordering Information
NOTE: This unsupported software is available ONLY by download from Acromag’s website.

IPSW-API-LNX
Linux example libraries for Industry Pack modules and PCl/CompactPCI carrier cards
PCISW-API-LNX
Linux example libraries for PCI, CompactPCI, and PMC modules.
APSW-API-LNX
Linux example libraries for AcroPack® modules and carriers.

This free software utility is available for download from Acromag’s website.
Support Software

VxWorks® Libraries  I/O Function Routines

VxWorks®

The VxWorks software libraries provide a simple API to quickly integrate Acromag’s I/O boards with your application program.

Supports any CPU target with quick modification  ◆ API easily convertible for any operating system

Description
Application Programming Interface (API)
Acromag’s software development tools greatly simplify the interface between the I/O boards and your software application program. VxWorks libraries are supplied as “C” source code. These libraries provide easy-to-use function routines that quickly integrate with your application. Function routines are ready for use “as-is,” but they are also easily customized for your unique application.

This powerful program lets you fully exercise the libraries and your hardware before running the actual application. These diagnostics will save you hours troubleshooting and debugging your applications. You can set addresses, set up registers, read real-world inputs, or drive outputs. The demonstration program steps you through the exact functions that are called in your application.

Target any CPU
Acromag provides direct support for VxWorks when using PowerPC, x86 and 68000 CPU boards. The VxWorks C Library includes support for x86 PCI, MV167 and MV2700 CPU boards. Each library contains detailed information on integrating with the CPU’s Board Support Package (BSP). The libraries also include instructions for implementing this software with other manufacturer’s CPU board BSPs. Use with Industry Pack carriers from third-party board vendors is also supported.

The IPSW-API-VXW library package offers support for Acromag carriers. Other carriers are compatible, but require some minor modifications. Acromag uses a very innovative modular programming technique. This allows new carrier files to be created without affecting any of the complex IP module files or interrupt service routines.

User-Friendly Licensing
Acromag’s VxWorks software libraries are provided with a full site license. This allows anyone at your location to use this software without any additional charges. Additionally, no run-time license is required either.

The VxWorks software libraries include support for the full family of boards or modules, not just certain models unless otherwise noted.

Key Features & Benefits
■ Easy installation procedure
■ Readme files with step-by-step instructions
■ Quickly creates libraries
■ Targeted support for Power PC, x86, and 68000 series CPUs
■ Supports any CPU target with quick modification
■ API easily convertible for any operating system
■ Source code provided to ensure maximum flexibility in implementing your application
■ Ability to verify operation of your modules and carriers with a demonstration program to ensure proper hardware operation before attaching your application

Ordering Information
APSW-API-VXW
VxWorks software support package for AcroPack modules and carriers.
IPSW-A7VM-E-VXW
VxWorks software support package for Acromag VME SBC Series XVME6500 and XVME6700 when used with Industry Pack modules.
IPSW-API-VXW
VxWorks software support package for Industry Pack modules and carriers.
PMCSW-API-VXW
VxWorks software support package for XMC, PMC, PCI, and CompactPCI products (supports all Acromag PMC modules and PCI or cPCI boards except IP carriers).

Tel 248-295-0310  Fax 248-624-9234  solutions@acromag.com  www.acromag.com  30765 Wixom Rd, Wixom, MI 48393 USA
Software Support

IPSW AcroPack® and Industry Pack Driver Software for Windows® Operating Systems

Description
Application Programming Interface
Acromag’s software development tools greatly simplify the interface between the I/O boards and your Windows-based application program. These packages provide DLL driver level support for Acromag’s line of Industry Pack products. In addition, “C” source demonstration programs provide easy-to-use tools to test the operation of the module.

Demonstration Programs
Powerful programs let you fully exercise your hardware before developing the actual application. These diagnostics will save you hours troubleshooting and debugging your applications. You can set addresses, set up registers, read real-world inputs, or drive outputs. The demonstration programs step you through the exact functions that are called in your application.

Key Features & Benefits
- Easy installation procedure
- Documentation with step-by-step instructions
- Support for active Acromag Industry Pack I/O and Industry Pack FPGA modules and carriers
- Support for 32-bit and 64-bit systems
- Demonstration Programs
- Driver level support for desktop and embedded Windows level programming environments
- Compatible with Windows Embedded Standard applications
- Verifies operation of your I/O boards with a demonstration program to ensure proper hardware performance before attaching your application

User-Friendly Licensing
Acromag’s PCI Windows driver software is provided with a full site license. This allows anyone at your location to use this software without any additional charges. No run-time license is required.

You do not need to order additional software for different models within the family.

Ordering Information
- Software
  For more information, see www.acromag.com.
  APSW-API-WIN
  32-bit and 64-bit Windows driver software package with DLLs and demonstration programs for AcroPack products. Supports all active Acromag AcroPack products. Supplied on CD-ROM.
  IPSW-API-WIN
  32-bit and 64-bit Windows driver software package with DLLs and demonstration programs for Industry Pack products. Supports all active IP-based (Industry Pack modules, PCI carriers, & CompactPCI carriers) products. Supplied on CD-ROM.
  IPSW-VME-WIN
  32-bit and 64-bit Windows driver software package with DLLs and demonstration programs for Industry Pack products. Supports carrier models AVME9630, AVME9660, AVME9668, AVME9670 and all IP modules except IPSxx and XVME-6300 or XVME-6400 single board computers. Supplied on CD-ROM. (requires XVME board support package [BSP], sold separately)

NOTE: For PMC, XMC, PCI, and cPCI modules and carrier cards support software, please refer to PCISW-API-WIN.

For Windows 10 / 8 / 7
- Supports Acromag AcroPack & Industry Pack modules & carriers
- Includes DLLs

For Windows 10 / 8 / 7
- Supports Acromag AcroPack & Industry Pack modules & carriers
- Includes DLLs

ISO9001
AS9100
Made in USA

Acromag
The Leader in Industrial I/O

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