The CP213 is a single-width, 6U, CompactPCI/PXI module with either 32 or 64 differential analog input channels that can alternately be configured under software control as 64 or 128 single-ended analog input channels.

A 16-bit ADC scans each channel at a scan rate chosen by the user. The number of channels scanned and scan rate are software selectable.

**APPLICATIONS**
- Temperature measurements
- General-purpose data acquisition
- Powertrain/engine testing
- Automatic Test Equipment (ATE)

**FEATURES**
- 32, 64 or 128 channels of analog input
- 16 multi-function digital I/O (TTL) channels that may be configured as digital in, digital out, or selectively attached to 2 frequency in, 2 counter in, and/or 2 timer out channels
- 16-bit resolution
- Programmable gain per channel
- Programmable scan rates of <1 S/s through 100 kS/s
- Optional 10 Hz to 1 kHz low pass filters
- Precision on-board reference for end-to-end calibration
GENERAL DESCRIPTION
The CP213 is a single-width, 6U, CompactPCI/PXI module with either 32 or 64 differential analog input channels that can alternately be configured under software control as 64 or 128 single-ended analog input channels. A 16-bit ADC scans each channel at a scan rate chosen by the user. The number of channels scanned and scan rate are software selectable. Scans may be triggered from either the internal clock, one of eight PXI backplane triggers, the PXI star trigger bus or an external SMB connector on the module front panel. Single and continuous scan operations are supported. If single scan operation is chosen, an interrupt may be generated at the end of the scan.

The CP213 has programmable gain that can be set on a channel-by-channel basis. Gains of 1, 2, 5, 10, 20, 50, 100, 200, 500 and 1000 are available. On-board calibration is available on each channel for end-to-end calibration. Optional fixed, 2-pole, passive filters are available in a 1, 2, 5 progression from 10 Hz to 1 kHz. Under software control, channels 1 and 33 may be configured as isothermal reference channels for temperature measurement applications.

In addition to the analog input channels, 16 multi-function digital I/O (TTL) channels are provided. Any of these channels may be configured as digital in, digital out, or selectively attached to 2 frequency in, 2 counter in, and/or 2 timer out channels.

BASIC CIRCUIT OPERATION
The CP213 analog input channels are multiplexed to a high-speed programmable gain amplifier (PGA) that provides full-scale input ranges of ±10 volts at a gain of 1 down to ±10 millivolts at a gain of 1000. The PGA supports scan rates up to 100 kHz at all gain settings. The analog input channels may be configured as single-ended or differential inputs via software control. The number of channels scanned and the scan rate are also software programmable. A 16-bit Successive Approximation Register (SAR) ADC samples the output of the PGA. Converted data from the ADC is stored in a 32, 64 or 128 word memory, allowing "present value monitoring". DMA capability allows converted data to be stored on host memory at the required data rates.

The CP213 also provides 16 multi-function digital I/O channels. Any of these channels may be configured as digital in, digital out, or selectively attached to 2 frequency in, 2 counter in, and/or 2 timer out channels. Two channels each of frequency in, counter in and timer out are provided. These channels operate at standard TTL levels.

SOFTWARE
The CP213 comes with a Plug and Play driver for configuring and using the device and application examples to illustrate its basic functionality.

APPLICATION EXAMPLE
This and other tools, including their source code, are provided.
ANALOG INPUT CHANNELS
Number of analog input channels:
- 32 differential / 64 single-ended or
- 64 differential / 128 single-ended (depending on option)

Input:
- Common Mode
  - Input range: ±10 V
- Differential Mode
  - Input range: ±10 V
  - Input protection: ±25 V continuous
  - Input impedance: Channel + to ground = 1MΩ
  - Channel - to ground = 1MΩ
  - Input coupling: DC
  - Resolution: 16-bits
  - Gain ranges: 1, 2, 5, 10, 20, 50, 100, 200, 500 and 1000
  - Scan Rate (Per Channel):
    - Internal frequency choices: 0.0000232 Hz to 100 kHz
    - External sources: Front-panel SMB, TTL to 100 kHz
    - Duty cycle: 50%
    - Backplane source: 1 of 8 PXI backplane triggers or the PXI star trigger bus
  - ADC Rate (Aggregate): 100 kHz (software programmable to 20 kHz or 2 kHz for lower noise)

Transfer Characteristics:
- Integral Non-linearity (INL):
  - 0.014% FSR maximum @ gain = 1-500
  - 0.04% FSR maximum @ gain = 1000
- Differential Non-linearity (DNL):
  - No missing codes
- Initial accuracy, RTI:
  - After automatic calibration
  - Absolute Accuracy:
    - Differential: ±2.2 mV
    - Single-Ended: ±2.2 mV
    - Gain = 1
    - ±220 µV
    - ±250 µV
    - Gain = 10
    - ±28 µV
    - ±65 µV
    - Gain = 100
    - ±15 µV
    - ±55 µV
    - Gain = 1000
    - ±12 µV/°C maximum @ gain = 1000
    - ±18 ppm/°C maximum @ gain < 100
    - ±60 ppm/°C maximum @ gain 100-500
    - ±150 ppm/°C maximum @ gain = 1000
    - Offset stability, RTI:
    - ±12 µV/°C maximum @ gain = 1000
    - ±18 ppm/°C maximum @ gain < 100
    - ±60 ppm/°C maximum @ gain 100-500
    - ±150 ppm/°C maximum @ gain = 1000
    - Gain stability:
    - ±18 ppm/°C maximum @ gain < 100
    - ±60 ppm/°C maximum @ gain 100-500
    - ±150 ppm/°C maximum @ gain = 1000
    - Common mode rejection: 75 dB minimum
    - Noise, RTI: 5 µV rms @ gain = 1000, ADC rate = 2 kHz

Channel-to-channel crosstalk: 14 µV rms @ gain = 1000, ADC rate = 20 kHz -90 dB
Analog input connector type(s): 1(2)- 68P High Density, 2-pin LEMO (for external calibration input)

MULTI-FUNCTION DIGITAL I/O CHANNELS
Number of multi-function digital I/O channels: 16 digital I/O channels (channels may be configured as digital in, digital out or selectively attached to 2 frequency in, 2 counter in, and/or 2 timer out channels)

I/O type:
- Single-ended TTL
- Direction control: Yes
- Input termination: Pulled-up
- Input switching threshold:
  - “0” Level: 0.8 V maximum
  - “1” Level: 2 V minimum
- Output voltage level:
  - “0” Level: 0.4 V maximum (I_{out} = 2.5 mA)
  - “1” Level: 2.7 V minimum (I_{out} = 2.5 mA)
- Low level output current:
  - -24 mA, maximum
- High level output current:
  - ±20 µA
- Input current:
  - ±20 µA
- Frequency channels (2):
  - Frequency range: 0.06 Hz to 1 MHz
  - Window period: 1 mS
- Counter channels (2):
  - Counter size: 32-bits
- Timer channels (2):
  - Timer size: 32-bits
- Digital I/O connector type: 1- 26P Subminiature D connector

POWER
Power Requirements:
- With Filters
  - +5 V: 3740 mA*
  - +3.3 V: 350 mA
  - +12 V: 800 µA
  - -12 V: 800 µA
- Without Filters
  - +5 V: 1850 mA*
  - +3.3 V: 350 mA
  - +12 V: 800 µA
  - -12 V: 800 µA

* The +5 V power requirement listed is for no-load. For each digital I/O channel sourcing current, add that amount to the no-load power to determine the total +5 volt requirement.

ENVIRONMENTAL AND MECHANICAL
Temperature range:
- Operational: 0°C to +50°C
- Storage: -25°C to +75°C
Relative humidity:
- 0 to 85%, non-condensing to 40°C
Cooling requirements:
- 10 CFM
Dimensions:
- 233.35 mm x 160 mm (6U CompactPCI/PXI module)
Front-panel potential:
- Chassis ground
### RELATED PRODUCTS

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 5868-B001</td>
<td>Shorting Connector for CP213</td>
</tr>
<tr>
<td>Model 5868-Bxyz</td>
<td>Cable: 68S High Density to Unterminated</td>
</tr>
<tr>
<td>Model 5868-Dxyz</td>
<td>Cable: 68S High Density to 68P High Density</td>
</tr>
<tr>
<td>Model 5868-Exyz</td>
<td>Cable: 68S High Density to 68S High Density</td>
</tr>
<tr>
<td>Model 5857-Cxyz</td>
<td>Cable: 2-contact LEMO to Unterminated</td>
</tr>
<tr>
<td>Model 5857-Dxyz</td>
<td>Cable: 2-contact LEMO to 2-contact LEMO</td>
</tr>
<tr>
<td>Model 5857-Gxyz</td>
<td>Cable: 2-contact LEMO to BNC; shielded</td>
</tr>
<tr>
<td>Model 5826-Bxyz</td>
<td>Cable: 26S Subminiature D to Unterminated</td>
</tr>
<tr>
<td>Model T910-Axyz</td>
<td>Cable: SMB to SMB; shielded</td>
</tr>
<tr>
<td>Model T910-Bxyz</td>
<td>Cable: SMB to BNC; shielded</td>
</tr>
<tr>
<td>Model T910-Cxyz</td>
<td>Cable: SMB to Unterminated</td>
</tr>
<tr>
<td>Model 5926-Z1A</td>
<td>26S Subminiature D Mating Connector; shielded change</td>
</tr>
<tr>
<td>Model V765-ZA11</td>
<td>Rack-mount Termination Panel</td>
</tr>
<tr>
<td>Model V792-ZA11</td>
<td>Rack-mount Isothermal Termination Panel</td>
</tr>
</tbody>
</table>

### ORDERING INFORMATION

| Model CP213-AA11 | 16-bit Scanning ADC, No Filters, Programmable 32-ch Differential/64-ch Single-Ended |
| Model CP213-ABB1 | 16-bit Scanning ADC, 10Hz Filters, 32-ch Differential                           |
| Model CP213-AEB1 | 16-bit Scanning ADC, 100Hz Filters, 32-ch Differential                          |
| Model CP213-AHB1 | 16-bit Scanning ADC, 1kHz Filters, 32-ch Differential                           |
| Model CP213-ABC1 | 16-bit Scanning ADC, 10Hz Filters, 64-ch Single-Ended                           |
| Model CP213-AEC1 | 16-bit Scanning ADC, 100Hz Filters, 64-ch Single-Ended                           |
| Model CP213-AHC1 | 16-bit Scanning ADC, 1kHz Filters, 64-ch Single-Ended                           |
| Model CP213-BA11 | 16-bit Scanning ADC, No Filters, Programmable 64-ch Differential/128-ch Single-Ended |
| Model CP213-BBB1 | 16-bit Scanning ADC, 10Hz Filters, 64-ch Single-Ended                           |
| Model CP213-BEB1 | 16-bit Scanning ADC, 100Hz Filters, 64-ch Single-Ended                           |
| Model CP213-BHB1 | 16-bit Scanning ADC, 1kHz Filters, 64-ch Single-Ended                           |
| Model CP213-BBC1 | 16-bit Scanning ADC, 10Hz Filters, 128-ch Single-Ended                           |
| Model CP213-BEC1 | 16-bit Scanning ADC, 100Hz Filters, 128-ch Single-Ended                           |
| Model CP213-BHC1 | 16-bit Scanning ADC, 1kHz Filters, 128-ch Single-Ended                           |

Specifications contained within this data sheet are subject to change without notice.

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