Analog Devices’ Products and Signal Chain Solutions for Field Instrument/Smart Transmitter Design

ADI Field Instrument Segment Overview
Analog Devices is a leading supplier of industrial precision signal measurement solutions. These products are designed into field instruments in process and manufacturing plants across a wide range of industries including chemical and pharmaceutical, hydrocarbon (oil and gas), environmental (waste water and treatment), and food and beverage. The combination of ADI’s proven system expertise in industrial applications and a comprehensive portfolio of products with leading performance vs. power makes ADI a strong partner for engineers designing field instruments.

Main Challenges and System Considerations
- High reliability, longevity of supply, and lower assembly and manufacturing costs
- Operation in harsh environments requiring support for a wide temperature range
- Limited available power for loop-powered instruments drives the need for components with high performance at very low power
- Increasing end market need for higher levels of functional safety

Why Choose ADI?
- ADI is a technology leader in precision converters and signal processing with a long history of serving the needs of industrial customers
- ADI is continually investing in core technology and application specific products to meet current and future industrial needs
- Best-in-class signal chain solutions for precision measurement over a wide range of sensor inputs with high accuracy and very low power
- ADI’s dedicated team of industrial application engineers provides system expertise to support our customers through their complete design cycle
- Long product life cycles, superior reliability, and on time delivery

Field Instrument Applications
- Temperature transmitters
- Pressure transmitters
- Electromagnetic flow transmitters
- Ultrasonic flow transmitters
- Differential pressure flow transmitters

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### Temperature Transmitter

![Temperature Transmitter Diagram]

### Pressure Transmitter

![Pressure Transmitter Diagram]

### Pressure and Temperature Analog Front End

A wide portfolio of very low power precision converters and integrated solutions to meet the requirements of temperature and pressure transmitters.

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Key Features and Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Integrated Digital Temperature Sensor</strong></td>
<td></td>
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</tr>
<tr>
<td>ADT7320/ADT7420</td>
<td>±0.25°C accurate, 16-bit SPV/FC temperature sensor</td>
<td>±0.25°C accuracy from –20°C to +105°C at 3.3 V&lt;br&gt;Ultralow temperature drift: 0.0073°C&lt;br&gt;Easy implementation&lt;br&gt;Low power</td>
</tr>
<tr>
<td><strong>ADC</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AD7793/AD7794/AD7799</td>
<td>16-/24-bit, 3-channel/6-channel, low noise, low power, Σ-Δ ADC with on-chip in-amp</td>
<td>16-bit/24-bit versions available&lt;br&gt;Low power: 400 μA&lt;br&gt;Internal programmable gain amplifier&lt;br&gt;4 ppm/°C on-chip reference (AD7793/AD7794)&lt;br&gt;Programmable current sources (AD7793/AD7794)&lt;br&gt;Low-side power switch (AD7794, AD7799)&lt;br&gt;Burnout currents&lt;br&gt;Internal clock and buffer&lt;br&gt;Simultaneous 50 Hz and 60 Hz rejection&lt;br&gt;4.17 SPS to 400 SPS output data rate&lt;br&gt;Supply: 2.7 V to 5.25 V&lt;br&gt;Temperature: –40°C to +105°C</td>
</tr>
<tr>
<td><strong>Microcontroller</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADuC7060/ADuC7061</td>
<td>Low power precision analog microcontroller, ARM Cortex™-M3 with dual/single Σ-Δ ADCs</td>
<td>Analog performance&lt;br&gt;Dual PGA and 24 bit, 4 kSPS ADCs&lt;br&gt;12 multiplexed analog inputs&lt;br&gt;12-bit DAC&lt;br&gt;Digital performance&lt;br&gt;32-bit ARM Cortex-M3 processor&lt;br&gt;128 kB flash, 8 kB SRAM&lt;br&gt;Power consumption only 1 mA with core operating at 500 kHz (both ADCs on, input buffers off, PGA gain of 4, one SPI port on, and all timers on)&lt;br&gt;Package and temperature&lt;br&gt;48-lead LF CSP (7 mm × 7 mm)&lt;br&gt;–40°C to +125°C</td>
</tr>
<tr>
<td>ADuC7060/ADuC7061</td>
<td>Low power, precision analog microcontroller, dual Σ-Δ ADCs, flash/EE, 16-/32-bit ARM7DMII™</td>
<td>Dual 24-bit 8 kSPS Σ-Δ ADCs&lt;br&gt;Single 14-bit DAC&lt;br&gt;ARM7DMII 16-/32-bit RISC controller&lt;br&gt;32 kB flash and 4 kB SRAM&lt;br&gt;UART, SPI, GPIO, PWM&lt;br&gt;Nominal supply 2.5 V&lt;br&gt;Temperature range: –40°C to +125°C</td>
</tr>
</tbody>
</table>
### Instrumentation Amplifier

**AD8228**
- **Part Number**: AD8228
- **Description**: Low gain drift precision instrumentation amplifier
- **Key Features and Benefits**:
  - Fixed $G = 10$, 100
  - Wide power supply range: $\pm 2.3\,\text{V}$ to $\pm 18\,\text{V}$
  - 2 ppm/°C max gain drift
  - 100 dB CMRR to 10 kHz ($G = 10$)
  - 650 kHz –3 dB bandwidth ($G = 10$)
  - 2 V/μs slew rate
  - 8 nV/√Hz @ 1 kHz min
  - 0.8 μV/°C max voltage offset drift

### Multiplexer

**ADG1611**
- **Part Number**: ADG1611
- **Description**: 1.8 Ω max on resistance, ±5 V, ±12 V, ±5 V, and ±3.3 V quad SPST switches
- **Key Features and Benefits**:
  - 1.8 Ω on resistance
  - 0.2 Ω on resistance flatness

**ADG1411**
- **Part Number**: ADG1411
- **Description**: 1.8 Ω max on resistance, ±15 V/12 V/±5 V, ±12 V, ±15 V, ±5 V, and ±3.3 V quad SPST switch
- **Key Features and Benefits**:
  - 1.5 Ω on resistance
  - 0.3 Ω on resistance flatness

### Amplifier

**ADA4077-2**
- **Part Number**: ADA4077-2
- **Description**: 4 MHz, 7 nV/√Hz, low offset and drift, high precision amplifier
- **Key Features and Benefits**:
  - Low offset voltage: 25 μV max
  - Low offset voltage drift: 0.25 μV/°C max
  - Low input bias current: <1.0 nA max
  - Low noise: 7 nV/√Hz typical
  - Low supply current: 400 μA per amplifier typical

### Voltage Reference

**ADR3412/ADR3420**
- **Part Number**: ADR3412/ADR3420
- **Description**: Low power, 10 ppm/°C CMOS voltage reference
- **Key Features and Benefits**:
  - Low quiescent current: 100 μA max
  - Initial accuracy: ±0.1%
  - Max temperature coefficient: 8 ppm/°C
  - Low frequency noise: <10 μV p-p (0.1 Hz to 10 Hz)
  - Wide temperature range: −40°C to +125°C operation

**ADR3425/ADR3430**
- **Part Number**: ADR3425/ADR3430
- **Description**: Mains voltage reference
- **Key Features and Benefits**:
  - 1.20 V/2.048 V/2.50 V/3.00 V/4.096 V/5.00 V

**ADR3440/ADR3450**
- **Part Number**: ADR3440/ADR3450
- **Description**: 1.20 V/2.048 V/2.50 V/3.00 V/4.096 V/5.00 V

### ADC

**AD7192**
- **Part Number**: AD7192
- **Description**: 4.8 kHz ultralow noise 24-bit ΔΣ ADC with PGA
- **Key Features and Benefits**:
  - 4.7 Hz to 4.8 kHz output data rate
  - PGA: gain from 1 to 128
  - Offset drift: 5 mV/°C
  - Gain drift: 1 ppm/°C

### Microcontroller

**ADuCM360/ADuCM361**
- **Part Number**: ADuCM360/ADuCM361
- **Description**: Low power precision analog microcontroller, ARM Cortex-M3 with dual/single ΔΣ ADCs
- **Key Features and Benefits**:
  - Analog performance
  - Dual PGA and 24-bit, 4 kS/s ADCs
  - 12 multiplexed analog inputs
  - 12 bit DAC
  - Digital performance
  - 32-bit ARM Cortex-M3 processor
  - 128 kB flash, 8 kB SRAM
  - Power consumption only 1 mA with core operating at 500 kHz (both ADCs on, input buffers off, PGA gain of 4, one SPI port on, and all timers on)
  - Package and temperature
  - 48-lead LFCS (7 mm × 7 mm)
  - −40°C to +125°C

### Digital Processor

**ADSP-BF50x**
- **Part Number**: ADSP-BF504/ADSP-BF504F/ADSP-BF506F
- **Description**: ADSP-BF50x fixed-point DSP
- **Key Features and Benefits**:
  - 400 MHz Blackfin® core
  - True 12-bit, dual SAR ADC (ADSP-BF506F)
  - UART, SPI, SPORT, and CAN interfaces for communications
  - PPI for LCD display interface
  - 32 MB executable flash (ADSP-BF504F/ADSP-BF506F)

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Ultrasonic Flow Transmitter

### Ultrasonic Flow Transmitter Analog Front End

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<tr>
<th>Part Number</th>
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<th>Key Features and Benefits</th>
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<tbody>
<tr>
<td>ADG1611</td>
<td>1 Ω typical on resistance, ±5 V, +12 V, +5 V, and +3.3 V quad SPST switches</td>
<td>1 Ω on resistance, 0.2 Ω on resistance flatness</td>
</tr>
<tr>
<td>ADG1411</td>
<td>1.8 Ω max on resistance, ±15 V/12 V/±5 V, iCOMS, quad SPST switch</td>
<td>1.5 Ω on resistance, 0.3 Ω on resistance flatness</td>
</tr>
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**Integrated Digital Temperature Sensor**

| ADT7320/ADT7420 | ±0.25°C accurate, 16-bit SPI/I2C temperature sensor | ±0.25°C accuracy from –20°C to +105°C at 3.3 V, Ultra Low temperature drift: 0.0073°C, Easy implementation, Low power |

**ADC**

| AD9609/AD9629/AD9649 | 10-/12-/14-bit, 20 MSPS/40 MSPS/65 MSPS/80 MSPS, 1.8 V analog-to-digital converter | 2 V p-p analog input, 1.8 V to 3.3 V parallel and SPI interface, 74.3 dBFS SNR at 9.7 MHz input |

**Variable Gain Amplifiers**

| AD8331/AD8332/AD8334 | Single/dual/quad VGA with ultralow noise preamplifier and programmable $R_n$ | LNA: Ultralow noise: 0.74 nV/√Hz; 2.5 pA/√Hz, Active termination match via external resistor, VGA: 48 dB gain range, Postamplifier with 12 dB gain switch: output SNR optimized for 10-/12-bit ADCs, Fully differential, Selectable output clamping levels |

**DAC**

| AD5641 | 2.7 V to 5.5 V, 100 μA, 14-bit nanDAC®, SPI interface in LFCS and SC70 | Minimum board area 14-bit in SC70 or 2 mm × 3 mm 6-lead LFCS, Low power DAC, Max 100 μA supply current |

**High Speed DAC**

| AD9705 | 10-bit, 175 MSPS TxDAC® digital-to-analog converter | 175 MSPS DAC update rate, SFDR to Nyquist, 84 dBc at 5 MHz output, Wide supply range 1.7 V to 3.6 V, Low power dissipation, 12 mW at 80 MSPS, 1.8 V, Power-down mode: <2 mW, On-chip 1 V reference |

**Digital Processor**

| ADSP-BF504/ADSP-BF504F/ADSP-BF506F | ADSP-BF50x fixed-point DSP | 400 MHz Blackfin core, True 12-bit, dual SAR ADC (ADSP-BF50x), UART, SPI, SPORT, and CAN interfaces for communications, PPI for LCD display interface, 32 MB executable flash (ADSP-BF504F/ADSP-BF506F) |
Differential Pressure Flow Transmitter

Differential Pressure Flow Transmitter Analog Front End

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<th>Part Number</th>
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<td>ADT7320/ADT7420</td>
<td>±0.25°C accurate, 16-bit SPI/FCS temperature sensor</td>
<td>±0.25°C accuracy from –20°C to +105°C at 3.3 V</td>
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<td></td>
<td>Ultralow temperature drift: 0.0073°C</td>
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<tr>
<td>Multiplexer</td>
<td></td>
<td>Latch-up proof</td>
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<tr>
<td>ADG5409</td>
<td>High voltage latch-up proof 4-channel/8-channel multiplexers</td>
<td>8 kV HBM ESD rating</td>
</tr>
<tr>
<td>ADG5209</td>
<td>High voltage latch-up proof 4-channel/8-channel multiplexers</td>
<td>Latch-up proof</td>
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<td>0.4 pC charge injection</td>
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<tr>
<td>Amplifier</td>
<td></td>
<td>Fully specified: –40°C to +125°C</td>
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<tr>
<td>AD8226</td>
<td>Wide supply range, rail-to-rail output instrumentation amplifier</td>
<td>Gain of 1 to 1000</td>
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<td></td>
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<td>2.2 V to 36 V supply range</td>
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<tr>
<td>ADC</td>
<td></td>
<td>Gain of 1 to 1000</td>
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<tr>
<td>AD7794/AD7799</td>
<td>16-/24-bit, 3-channel/6-channel, low noise, low power, Σ-Δ ADC with on-chip in-amp</td>
<td>16-/24-bit versions available</td>
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<tr>
<td></td>
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<td>Low power: 400 μA</td>
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<td>Internal programmable gain amplifier</td>
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<td></td>
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<td>4 ppm/°C on-chip reference (AD7794)</td>
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<td>Programmable current sources (AD7794)</td>
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<td>Low-side power switch</td>
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<tr>
<td>Microcontroller</td>
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<td>Analog performance</td>
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<td>ADuC360/ADuC361</td>
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<td>12 multiplexed analog inputs</td>
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<td>12-bit DAC</td>
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<td></td>
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<td>32-bit ARM Cortex-M3 processor</td>
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<td></td>
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<td>128 kB flash, 8 kB SRAM</td>
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<tr>
<td></td>
<td></td>
<td>Digital performance</td>
</tr>
<tr>
<td>ADuC7606/ADuC7601</td>
<td>Low power, precision analog microcontroller, dual Σ-Δ ADCs, flash/EE, 16-bit/32-bit ARM7TDMI</td>
<td>24-bit 8 kSPS Σ-Δ ADCs</td>
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<tr>
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<td>Single 14-bit DAC</td>
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<td></td>
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<td>ARM7TDMI 16-bit/32-bit RISC controller</td>
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<tr>
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<td>32 kB flash and 4 kB SRAM</td>
</tr>
</tbody>
</table>

DIFFERENTIAL PRESSURE FLOW TRANSMITTER ANALOG FRONT END

INTEGRATED DIGITAL TEMPERATURE SENSOR

ADT7320/ADT7420
- ±0.25°C accuracy, 16-bit SPI/FCS temperature sensor
- ±0.25°C accuracy from –20°C to +105°C at 3.3 V
- Ultralow temperature drift: 0.0073°C
- Easy implementation
- Low power

MULTIPLEXER

ADG5409
- High voltage latch-up proof 4-channel/8-channel multiplexers
- Latch-up proof
- 8 kV HBM ESD rating
- Low on resistance: 13.5 Ω

ADG5209
- High voltage latch-up proof 4-channel/8-channel multiplexers
- Latch-up proof
- 0.4 pC charge injection
- Low on resistance: 160 Ω

AMPLIFIER

AD8226
- Wide supply range, rail-to-rail output instrumentation amplifier
- Fully specified: –40°C to +125°C
- Gain of 1 to 1000
- 2.2 V to 36 V supply range
- Input noise: 22 nV/√Hz
- 350 μA typical supply current

ADC

AD7794/AD7799
- 16-/24-bit, 3-channel/6-channel, low noise, low power, Σ-Δ ADC with on-chip in-amp
- 16-/24-bit versions available
- Low power: 400 μA
- Internal programmable gain amplifier
- 4 ppm/°C on-chip reference (AD7794)
- Programmable current sources (AD7794)
- Low-side power switch
- Burnout currents
- Internal clock and buffer
- Simultaneous 50 Hz and 60 Hz rejection
- 4.17 SPS to 400 SPS output data rate
- Supply: 2.7 V to 5.25 V
- Temperature: –40°C to +105°C

MICROCONTROLLER

ADuC360/ADuC361
- Low power precision analog microcontroller, ARM Cortex-M3 with dual/single Σ-Δ ADCs
- Analog performance
  - Dual PGA and 24-bit, 4 kSPS ADCs
  - 12 multiplexed analog inputs
  - 12-bit DAC
- Digital performance
  - 32-bit ARM Cortex-M3 processor
  - 128 kB flash, 8 kB SRAM
- Package and temperature
  - 48-lead LFCS (7 mm × 7 mm)
  - –40°C to +125°C

ADuC7606/ADuC7601
- Low power, precision analog microcontroller, dual Σ-Δ ADCs, flash/EE, 16-bit/32-bit ARM7TDMI
- Analog performance
  - Dual 24-bit 8 kSPS Σ-Δ ADCs
  - Single 14-bit DAC
  - ARM7TDMI 16-bit/32-bit RISC controller
- Nominal supply 2.5 V
- Temperature range: –40°C to +125°C
### Isolation, Power, and Communication

A wide range of supporting products to meet the various isolation, power, and communications requirements for temperature, pressure, and flow transmitters.

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<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>Key Features and Benefits</th>
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</thead>
<tbody>
<tr>
<td><strong>Isolation</strong></td>
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</tbody>
</table>
| ADuM3481 | 3.75 kV rms quad-channel digital isolator | - Small package: 20-lead SSOP  
- Low dynamic power consumption  
- Low voltage I/O: 1.8 V to 5.5 V  
- 50 year lifetime at 565 V pk |
| ADuM4401 | 5 kV rms quad-channel digital isolator | - Low power operation  
- Reinforced isolation rating  
- 16-lead SOIC wide package  
- 50 year lifetime at 565 V pk |
| ADuM1401 | 2.5 kV rms quad-channel isolator | - Low power consumption  
- 16-lead SOIC wide package |

| **Integrated DAC** | | |
| AD5421 | 16-bit, serial input, loop-powered, 4 mA to 20 mA current source DAC | - 16-bit resolution and monotonicity, pin selectable NAMUR-compliant ranges  
- Internal regulator and reference  
- Total unadjusted error (TUE): 0.05% max  
- Very low power: quiescent current: 300 μA max  
- HART compatible |
| AD5420 | 16-bit, serial input, single-channel, 4 mA to 20 mA current source DAC | - Current output ranges: 4 mA to 20 mA, 0 mA to 20 mA, or 0 mA to 24 mA  
- ±0.01% FSR typical total unadjusted TUE  
- ±3 ppm/°C typical output drift  
- On-chip reference and output fault detection  
- HART compatible |

| **DAC** | | |
| AD5660/AD5662 | Single nanoDAC, 16-bit monotonic DAC | - 12-bit accuracy guaranteed  
- On-chip, 1.25 V/2.5 V, 5 ppm/°C reference (AD5660)  
- Tiny 8-lead SOT-23 and MSOP packages  
- Power-on reset to 0 V or midscale  
- 10 μs settling time |

| **Power Management/LDO** | | |
| ADP160 | Ultralow quiescent current 150 mA, CMOS linear regulator | - Input voltage range: 2.2 V to 5.5 V  
- Iq = 11 μA at 10 mA load  
- Max output current: 150 mA  
- Low dropout voltage: 195 mV @ 150 mA load |
| ADP1720 | 50 mA, high voltage, micropower linear regulator | - Wide input voltage range: 4 V to 28 V  
- Iq = 74 μA at 1 mA load  
- Max output current: 50 mA  
- Low dropout voltage: 275 mV @ 50 mA load |

| **Power management/DC-DC step-down** | | |
| ADP2441 | 36 V, 1 A, synchronous step-down dc-to-dc regulator | - Wide input voltage range: 4.5 V to 36 V  
- High efficiency up to 94%  
- Adjustable output down to 0.6 V  
- ±1% output voltage accuracy  
- Adjustable frequency 300 kHz to 1 MHz |
| ADP2570 | High voltage, 1.2 MHz/600 kHz, 800 mA, low quiescent current buck regulator | - Input voltage range: 3.2 V to 15 V, output current: 800 mA  
- Quiescent current <14 μA in power saving mode (PSM)  
- >90% efficiency  
- Force PWM pin (SYNC), 600 kHz/1.2 MHz frequency pin (FSEL) |

| **Amplifier** | | |
| AD5749 | Industrial current out driver, single-supply, 55 V compliant with programmable ranges | - Iout range  
- 4 mA to 20 mA, 0 mA to 24 mA  
- 0.03% accuracy (TUE)  
- 2 ppm/°C full scale output drift  
- 11.8 V to 55 V supply range  
- Diagnostic/fault detection  
- Digital input cyclical redundancy check  
- External 4.096 V reference |

| **Voltage Reference** | | |
| ADR3525 | Micropower, precision, 2.5 V voltage reference | - Max temperature coefficient (TC): 5 ppm/°C (B grade)  
- 100 μA max quiescence current  
- Output noise (0.1 Hz to 10 Hz): 18 μV p-p at 2.5 V (typical)  
- 8-lead MSOP  
- Max temperature coefficient (TC): 2 ppm/°C |
| ADR4525 | Ultralow noise, high accuracy 2.5 V voltage reference | - ±0.02% max initial error  
- Output noise (0.1 Hz to 10 Hz): <1.25 μV p-p @ 2.5 Vout typical  
- Input voltage range: 3 V to 15 V |
| ADR291 | Low noise micropower precision voltage reference (2.5 V) | - Supply range: 2.8 V to 15 V  
- Supply current 12 μA max  
- Low noise: 8 μV and 12 μV p-p (0.1 Hz to 10 Hz)  
- 10 ppm/°C  
- −40°C to +125°C operating temperature range |
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<tr>
<td><strong>HART Modem</strong></td>
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</table>
| AD5700/AD5700-1 | Low power HART modem | • HART-compliant fully integrated FSK modem  
• 115 μA maximum supply current in receive mode  
• On-chip oscillator (AD5700-1)  
• Buffered HART output  
• Suitable for intrinsically safe applications |
| **PROFIBUS** | | |
| ADM1486 | 5 V, high speed, low power, half duplex RS-485 PROFIBUS transceiver | • 30 Mbps data rate  
• 2.1 V min differential output with 54 Ω termination  
• Low power 0.8 mA \( I_{CC} \) |
| ADM2485/ADM2496 | 2.5 kV single isolated, high speed, half duplex RS-485 transceiver | • Fully isolated digital interface  
• 50 nodes on bus  
• 5 V or 3.3 V operation  
• 16 Mbps/20 Mbps data rate (ADM2485/ADM2496)  
• Integrated oscillator driver for external transformer (ADM2485) |
| **RS-485** | | |
| ADM2587E | 2.5 kV signal and power isolated, ±15 kV ESD protected, full/half duplex RS-485 transceiver 500 kbps | • Fully isolated digital interface  
• \( iso \)Power integrated isolated dc-to-dc converter  
• ±15 kV ESD protection on RS-485 I/O pins  
• 5 V or 3.3 V operation  
• Connect up to 256 nodes on one bus  
• Open- and short-circuit, fail-safe receiver inputs |
| ADM2482E | 2.5 kV signal isolated, ESD protected, full/half duplex RS-485 transceiver with transformer driver 16 Mbps | • Integrated oscillator driver for external transformer  
• ±15 kV ESD protection on RS-485 I/O pins  
• 5 V or 3.3 V operation  
• 256 nodes on bus  
• Open- and short-circuit, fail-safe receiver inputs  
| ADM2490E | 5 kV signal isolated, high speed (16 Mbps), ESD protected, full duplex RS-485 | • ±8 kV ESD protection on RS-485 I/O pins  
• Suitable for 5 V or 3 V operation  
• Receiver open-circuit fail-safe design |
| **CAN** | | |
| ADM3051 | High speed industrial CAN transceiver with bus protection for 24 V systems | • Physical layer CAN transceiver  
• 5 V operation  
• High speed data rates up to 1 Mbps |
| ADM3052 | 5 kV rms isolated CAN transceiver with integrated high voltage, bus side linear regulator | • Fully isolated digital interface  
• Integrated V+ linear regulator  
• Bus side powered by V+ and V–  
• 11 V to 25 V operation on V+  
• High speed data rate up to 1 Mbps |
| ADM3053 | 2.5 kV rms signal and power isolated CAN transceiver with integrated isolated dc-to-dc converter | • Fully isolated digital interface  
• Signal and power isolation  
• 5 V or 3.3 V operation  
• High speed data rate up to 1 Mbps  
• Slop control for reduced EMI |
| ADM3054 | 5 kV rms signal isolated high speed CAN transceiver with bus protection | • Fully isolated digital interface  
• 5 V or 3.3 V operation  
• High speed data rate of up to 1 Mbps  
• Short-circuit protection on CANH and CANL against shorts to power/ground in 24 V systems |
| **RS-232** | | |
| ADM3251E/ADM3252E | Isolated single-/dual-channel RS-232 line driver/receiver | • Fully isolated digital interface  
• 2.5 kV fully isolated (power and data) RS-232 transceiver  
• \( iso \)Power integrated, isolated dc-to-dc converter  
• 460 kbps data rate  
• 15 kV ESD protection on R/N and TOUT pins |
| ADM3101E | ±15 kV ESD protected, 3.3 V single-channel RS-232 line driver/receiver | • 460 kbps data rate  
• 0.1 μF charge pump capacitors  
• 32-bit ARM Cortex-M3 processor  
• 128 kB flash, 16 kB SRAM  
• UART, I2C, and SPI serial I/O  
• 64-lead LF CSP |
| **Wireless** | | |
| ADuCRF101 | Precision analog microcontroller  
ARM Cortex-M3 with RF transceiver | • 6-channel 12-bit SAR ADC  
• Low power consumption  
• Integrated RF transceiver: 862 MHz to 928 MHz and 431 MHz to 464 MHz  
• 32-bit ARM Cortex-M3 processor  
• 128 kB Flash, 16 kB SRAM  
• UART, I2C, and SPI serial I/O  
• 64-lead LF CSP |
| ADF7023-J | High performance, low power, ISM band FSK/GFSK/MSK/GMSK transceiver IC | • Ultralow power  
• Frequency bands: 902 MHz to 958 MHz  
• Data rate supported: 1 kbps to 300 kbps  
• Flexible firmware programmable system controller and packet processor |
| ADF7242 | Low power IEEE 802.15.4/proprietary GFSK/FSK zero-IF 2.4 GHz transceiver IC | • Frequency range (global ISM band) 2400 MHz to 2483.5 MHz  
• Programmable data rates and modulation  
• Low power consumption  
• High sensitivity |
Circuits from the Lab Reference Designs

Analog Devices Circuits from the Lab® Reference Designs are engineered and tested by our technology and applications experts to ensure both performance and function. Low cost hardware is available to allow for evaluation and rapid prototyping with several development platforms. Thorough documentation and design files are provided to ease application understanding and minimize system integration issues.

CN0267 Complete 4 mA to 20 mA Loop-Powered Field Instrument with HART Interface

Features and Benefits

- Low power, small footprint
- 4 mA to 20 mA loop-powered field instrument
- HART compliant interface
- Registered by HART Communication Foundation (HFC)

For more information on this reference circuit, visit www.analog.com/cn0267.
## Reference Circuits for Field Instruments

<table>
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<tr>
<th>Circuit Description</th>
<th>Functions</th>
<th>Key Features and Benefits</th>
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<td><strong>Loop-Powered</strong></td>
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<tr>
<td>CN0267 Complete 4 mA to 20 mA Loop-Powered Field Instrument with HART Interface</td>
<td>Sensors signal conditioning, Digital processing, Analog communication</td>
<td>Complete 4 mA to 20 mA loop-powered field instrument, HART compliant interface, Registered by HART Communication Foundation (HCF), Low power, small footprint</td>
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<tr>
<td>CN0300 Complete Closed-Loop Precision Analog Microcontroller Thermocouple Measurement System with 4 mA to 20 mA Output</td>
<td>Sensors signal conditioning, Digital processing, Analog communication</td>
<td>Complete 4 mA to 20 mA loop-powered field instrument, Thermocouple and RTD measurement, Single chip solution with Cortex processing core</td>
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<tr>
<td>CN0319 4 mA to 20 mA Loop-Powered Temperature Monitor Using the Integrated PWM On the ADuC360 Precision Analog Microcontroller</td>
<td>Sensors signal conditioning, Digital processing, Analog communication</td>
<td>Complete 4 mA to 20 mA loop-powered field instrument, Thermocouple and RTD measurement, 24-bit input, 14-bit output resolution</td>
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<tr>
<td>CN0145 4 mA to 20 mA Loop-Powered Temperature Monitor Using the ADuC7060/ADuC7061 Precision Analog Microcontroller</td>
<td>Sensors signal conditioning, Digital processing, Analog communication</td>
<td>Complete 4 mA to 20 mA loop-powered field instrument, RTD measurement, 24-bit precision conversion with integrated processor</td>
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<tr>
<td>CN0289 Flexible, 4 mA to 20 mA, Loop-Powered Pressure Sensor Transmitter with Voltage or Current Drive</td>
<td>Sensors signal conditioning, Analog communication</td>
<td>Complete 4 mA to 20 mA loop-powered field instrument, Optimized for pressure sensors, Analog only design</td>
</tr>
<tr>
<td>CN0206 Complete Type T Thermocouple Measurement System with Cold Junction Compensation</td>
<td>Sensors signal conditioning</td>
<td>Thermocouple and thermister measurement, Low power, 500 μA max, Low system noise of 0.2° for T-type thermocouple</td>
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<tr>
<td>CN0009 4 mA to 20 mA Process Control Loop Using the AD5662 DAC</td>
<td>Analog communication</td>
<td>Loop-powered 4 mA to 20 mA output, 16-bit resolution</td>
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<tr>
<td>CN0314 Precision, Low Cost, Highly Programmable 4 mA to 20 mA Current Loop Using the AD8420 Low Power Instrumentation Amplifier</td>
<td>Analog communication</td>
<td>Transmitter or receiver board for 4 mA to 20 mA systems, Gain and scaling jumpers for different input types, Connects directly to ADC driver boards for modular evaluation experience</td>
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<tr>
<td>CN0179 Less Than 200 μA, Low Power, 4 mA to 20 mA, Process Control Current Loop</td>
<td>Analog communication</td>
<td>Low power 4 mA to 20 mA output, 12-bit, 14-bit, or 16-bit resolution</td>
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<tr>
<td>CN0313 EMC Compliant RS-485 Transceiver Protection Circuits</td>
<td>Digital communication</td>
<td>Robust EMC compliant RS-485 transceiver interface, Tested to specific ESD, EFT, and surge levels</td>
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<tr>
<td><strong>Nonloop-Powered</strong></td>
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<tr>
<td>CN0303 MEMS-Based Vibration Analyzer with Frequency Response Compensation</td>
<td>Sensor signal conditioning</td>
<td>High-g MEMS-based vibration analyzer, Flat response to 22 kHz, 70 g, 250 g, and 500 g range</td>
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<tr>
<td>CN0270 Complete 4 mA to 20 mA HART Solution</td>
<td>Analog communication</td>
<td>4 mA to 20 mA output, HART compliant solution, Low power</td>
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<tr>
<td>CN0064 16-Bit Fully Isolated 4 mA to 20 mA Output Module Using the AD5662 DAC, ADuM1401 Digital Isolator, and External Amplifiers</td>
<td>Analog communication</td>
<td>4 mA to 20 mA output, Digitally isolated, 16-bit resolution</td>
</tr>
<tr>
<td>CN0179 Less Than 200 μA, Low Power, 4 mA to 20 mA, Process Control Current Loop</td>
<td>Analog communication</td>
<td>Low power 4 mA to 20 mA output, 12-bit, 14-bit, or 16-bit resolution</td>
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Online Tools And Resources
To learn more about products, signal chain solutions, and technical expertise offered by Analog Devices to help engineers meet today's field instrument design challenges, visit processcontrol.analog.com/fieldinstruments.

Signal Chain Designer—
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Signal Chain Designer™ is an advanced selection and design environment that accesses verified product combinations and tested applications circuits, which can be customized or newly created according to your specifications.

Analog Filter Wizard™— www.analog.com/filterwizard
This online tool simplifies the filter design process with an intuitive user interface and easily accessible tutorials and help.

ADIsimPower— www.analog.com/adisimpower
ADIsimPower™ is a collection of downloadable Excel spreadsheets that produce complete power designs optimized to your design goals. Get a schematic, bill of materials, and performance data customized to your specific needs in minutes.

ADIsimDAC— www.analog.com/adisimdac
The purpose of the ADIsimDAC™ tool is to assist the user with finding Analog Devices DACs and DAC application circuits. It takes user inputs along with typical parametric data to sort, select, and suggest applicable DACs, system components, and circuits solutions.

Multisim ADC Component Evaluator,
The free downloadable version of NI Multisim™ 12.0 is tailored for circuit design with ADI components in a SPICE simulation environment.

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