

# DATA INSTRUMENTS

Advanced Silicon Group



## SURSENSE™ Ultra Low Pressure Sensors

# DCAL4 Series

Ratiometric 4-Volt Output

High Accuracy Compensation

Full Scale Pressure Ranges

0 to 1 in. H<sub>2</sub>O to 0 to 30 in. H<sub>2</sub>O

±0 to ±1 in. H<sub>2</sub>O to ±0 to ±30 in. H<sub>2</sub>O



### DESCRIPTION

The SURSENSE™ line of ultra low pressure sensors is based upon a proprietary, patent applied for technology designed to reduce all output offset or common mode errors.

These sensors utilize a silicon, micromachined sensing element which features a unique stress concentration enhanced structure to provide a highly stable linear output that is proportional to applied pressure. Output offset errors due to changes in temperature, warm-up, long term stability and position sensitivity have all been significantly reduced when compared to conventional sensors.

The DCAL series sensors provide a precision calibrated ratiometric 4 -volt output with SURSENSE enhanced stability. Each sensor features the precision calibration found in the DCX series with the addition of fully integrated signal conditioning in an industry standard package. Intended to operate from a fixed 5Vdc supply, the DCAL4 gage pressure sensors provide a 0.25v to 4.25v output while the differential versions provide a ±2.0 volt output centered on a 2.25 volt zero pressure offset. These highly stable sensors are ideally suited for microprocessor or microcontroller based systems.

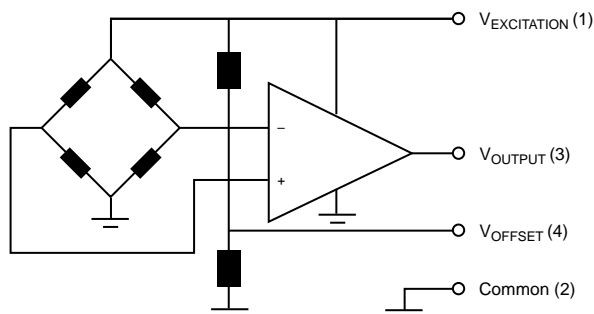
### APPLICATIONS

- Medical Instrumentation
- HVAC
- Environmental Controls
- Portable Monitors

### FEATURES

- Available in Gage and Differential Pressure Ranges
- Temperature Compensated over 0°C to 50°C
- Position Sensitivity to ±5mV/g
- Warm-up drift < ±5mV
- Long Term Stability < ±10mV
- Combined Linearity and Hysteresis Error < ±0.25%FS
- Custom Calibration Available

### EQUIVALENT CIRCUIT



#### PINOUT

1	V <sub>EXCITATION</sub>
2	Common
3	V <sub>OUTPUT</sub>
4	V <sub>OFFSET</sub>

# DCAL401GN

**Ratiometric 4-Volt Output**  
**High Accuracy Compensation**  
**1 in. H<sub>2</sub>O Full Scale Pressure**

## MAXIMUM RATINGS

PARAMETER	MINIMUM	MAXIMUM	UNITS
Operating Temperature Range	-25	85	°C
Storage Temperature	-40	125	°C
Proof Pressure	100		in. H <sub>2</sub> O
Burst Pressure	200		in. H <sub>2</sub> O
Supply Current			
Output Source Current			
Output Sink Current			
Excitation Voltage	3	16	V
Common Mode Pressure	50		psig

## ELECTRICAL SPECIFICATIONS

PARAMETER, note 1	MINIMUM	NORMAL	MAXIMUM	UNITS
Operating Pressure Range, gage pressure		1.0		in. H <sub>2</sub> O
Output Span, note 2	3.9	4.0	4.1	V
Offset Voltage	0.15	0.25	0.35	V
Temperature Effect on Offset (0°C–50°C), note 3			±60	mV
Combined Temperature Effect on Span (0°C–50°C), note 3			±2	%Span
Offset Warm-up Shift, note 4			±20	mV
Offset Position Sensitivity (±1g)			±10	mV
Offset Long Term Drift (one year)			±10	mV
Combined Linearity and Hysteresis Error, note 5		0.05	0.25	%FS

**Note 1:** Reference conditions (unless otherwise noted): Supply Voltage,  $V_S = 5V_{DC}$ ,  $T_A = 25^\circ\text{C}$ , Common Mode Line Pressure = 0 psig. Pressure measurements are with pressure applied to Port B.

**Note 2:** The voltage added to the offset voltage at full scale pressure. Nominally the output voltage range is 0.25 to 4.25 volts.

**Note 3:** Shift is relative to 25°C.

**Note 4:** Shift is within the first hour of excitation applied to the device.

**Note 5:** Measured at one-half full scale rated pressure using best straight line curve fit.

# DCAL401DN

Ratiometric 4-Volt Output  
High Accuracy Compensation  
±1 in. H<sub>2</sub>O Full Scale Pressure

## MAXIMUM RATINGS

PARAMETER	MINIMUM	MAXIMUM	UNITS
Operating Temperature Range	-25	85	°C
Storage Temperature	-40	125	°C
Proof Pressure	100		in H <sub>2</sub> O
Burst Pressure	200		in H <sub>2</sub> O
Supply Current			
Output Source Current			
Output Sink Current			
Excitation Voltage	3	16	V
Common Mode Pressure	50		psig

## ELECTRICAL SPECIFICATIONS

PARAMETER, note 1	MINIMUM	NORMAL	MAXIMUM	UNITS
Operating Range, differential pressure		±1.0		in. H <sub>2</sub> O
Output Span, note 2	±1.90	±2.0	±2.10	V
Offset Voltage @ zero differential pressure	2.15	2.25	2.35	V
Temperature Effect on Offset (0°C–50°C), note 3			±40	mV
Combined Temperature Effect on Span (0°C–50°C), note 3			±2	%Span
Offset Warm-up Shift, note 4			±20	mV
Offset Position Sensitivity (±1g)			±10	mV
Offset Long Term Drift (one year)			±10	mV
Combined Linearity and Hysteresis Error, note 5		0.05	0.25	%FS

**Note 1:** Reference conditions (unless otherwise noted): Supply Voltage,  $V_S = 5V_{DC}$ ,  $T_A = 25^\circ\text{C}$ , Common Mode Line Pressure = 0 psig. Pressure measurements are with pressure applied to Port B.

**Note 2:** The voltage added to the offset voltage at full scale pressure. Nominally the output voltage range is 0.25 to 4.25 volts.

**Note 3:** Shift is relative to 25°C.

**Note 4:** Shift is within the first hour of excitation applied to the device.

**Note 5:** Measured at one-half full scale rated pressure using best straight line curve fit.

# DCAL405GN

**Ratiometric 4-Volt Output**  
**High Accuracy Compensation**  
**5 in. H<sub>2</sub>O Full Scale Pressure**

## MAXIMUM RATINGS

PARAMETER	MINIMUM	MAXIMUM	UNITS
Operating Temperature Range	-25	85	°C
Storage Temperature	-40	125	°C
Proof Pressure	150		in. H <sub>2</sub> O
Burst Pressure	300		in. H <sub>2</sub> O
Output Source Current			
Output Sink Current			
Excitation Voltage	3	16	V
Common Mode Pressure	50		psig

## ELECTRICAL SPECIFICATIONS

PARAMETER, note 1	MINIMUM	NORMAL	MAXIMUM	UNITS
Operating Pressure Range, gage pressure		5.0		in. H <sub>2</sub> O
Output Span, note 2	3.9	4.0	4.1	V
Offset Voltage	0.15	0.25	0.35	V
Temperature Effect on Offset (0°C–50°C), note 3		10	±40	mV
Combined Temperature Effect on Span (0°C–50°C), note 3			±1	%Span
Offset Warm-up Shift, note 4			±5	mV
Offset Position Sensitivity (±1g)			±5	mV
Offset Long Term Drift (one year)			±10	mV
Combined Linearity and Hysteresis Error, note 5		0.05	0.25	%FS

**Note 1:** Reference conditions (unless otherwise noted): Supply Voltage,  $V_S = 5V_{DC}$ ,  $T_A = 25^\circ C$ , Common Mode Line Pressure = 0 psig. Pressure measurements are with pressure applied to Port B.

**Note 2:** The voltage added to the offset voltage at full scale pressure. Nominally the output voltage range is 0.25 to 4.25 volts.

**Note 3:** Shift is relative to 25°C.

**Note 4:** Shift is within the first hour of excitation applied to the device.

**Note 5:** Measured at one-half full scale rated pressure using best straight line curve fit.

# DCAL405DN

**Ratiometric 4-Volt Output**  
**High Accuracy Compensation**  
**±5 in. H<sub>2</sub>O Full Scale Pressure**

## MAXIMUM RATINGS

PARAMETER	MINIMUM	MAXIMUM	UNITS
Operating Temperature Range	-25	85	°C
Storage Temperature	-40	125	°C
Proof Pressure	150		in. H <sub>2</sub> O
Burst Pressure	300		in. H <sub>2</sub> O
Output Source Current			
Output Sink Current			
Excitation Voltage	3	16	V
Common Mode Pressure	50		psig

## ELECTRICAL SPECIFICATIONS

PARAMETER, note 1	MINIMUM	NORMAL	MAXIMUM	UNITS
Operating Range, differential pressure		±5.0		in. H <sub>2</sub> O
Output Span, note 2	±1.90	±2.0	±2.10	V
Offset Voltage	2.15	2.25	2.35	V
Temperature Effect on Offset (0°C–50°C), note 3		+1	±20	mV
Combined Temperature Effect on Span (0°C–50°C), note 3			±1	%Span
Offset Warm-up shift, note 4			±5	mV
Offset Position Sensitivity (±1g)			±5	mV
Offset Long Term Drift (one year)			±10	mV
Combined Linearity and Hysteresis Error, note 5		0.05	0.25	%FS

**Note 1:** Reference conditions (unless otherwise noted): Supply Voltage,  $V_S = 5V_{DC}$ ,  $T_A = 25^\circ C$ , Common Mode Line Pressure = 0 psig. Pressure measurements are with pressure applied to Port B.

**Note 2:** The voltage added to the offset voltage at full scale pressure. Nominally the output voltage range is 0.25 to 4.25 volts.

**Note 3:** Shift is relative to 25°C.

**Note 4:** Shift is within the first hour of excitation applied to the device.

**Note 5:** Measured at one-half full scale rated pressure using best straight line curve fit.

# DCAL410GN

**Ratiometric 4-Volt Output**  
**High Accuracy Compensation**  
**10 in. H<sub>2</sub>O Full Scale Pressure**

## MAXIMUM RATINGS

PARAMETER	MINIMUM	MAXIMUM	UNITS
Operating Temperature Range	-25	85	°C
Storage Temperature	-40	125	°C
Proof Pressure	150		in. H <sub>2</sub> O
Burst Pressure	300		in. H <sub>2</sub> O
Output Source Current			
Output Sink Current			
Excitation Voltage	3	16	V
Common Mode Pressure	50		psig

## ELECTRICAL SPECIFICATIONS

PARAMETER, note 1	MINIMUM	NORMAL	MAXIMUM	UNITS
Operating Pressure Range, gage pressure		10.0		in. H <sub>2</sub> O
Output Span, note 2	3.9	4.0	4.1	V
Offset Voltage	0.15	0.25	0.35	V
Temperature Effect on Offset (0°C–50°C), note 3		±3	±20	mV
Combined Temperature Effect on Span (0°C–50°C), note 3			±1	%Span
Offset Warm-up shift, note 4			±5	mV
Offset Position Sensitivity (±1g)			±1	mV
Offset Long Term Drift (one year)			±10	mV
Combined Linearity and Hysteresis Error, note 5		0.05	0.25	%FS

**Note 1:** Reference conditions (unless otherwise noted): Supply Voltage,  $V_S = 5V_{DC}$ ,  $T_A = 25^\circ\text{C}$ , Common Mode Line Pressure = 0 psig. Pressure measurements are with pressure applied to Port B.

**Note 2:** The voltage added to the offset voltage at full scale pressure. Nominally the output voltage range is 0.25 to 4.25 volts.

**Note 3:** Shift is relative to 25°C.

**Note 4:** Shift is within the first hour of excitation applied to the device.

**Note 5:** Measured at one-half full scale rated pressure using best straight line curve fit.

# DCAL410DN

**Ratiometric 4-Volt Output**  
**High Accuracy Compensation**  
**±10 in. H<sub>2</sub>O Full Scale Pressure**

## MAXIMUM RATINGS

PARAMETER	MINIMUM	MAXIMUM	UNITS
Operating Temperature Range	-25	85	°C
Storage Temperature	-40	125	°C
Proof Pressure	150		in. H <sub>2</sub> O
Burst Pressure	300		in. H <sub>2</sub> O
Output Source Current			
Output Sink Current			
Excitation Voltage	3	16	V
Common Mode Pressure	50		psig

## ELECTRICAL SPECIFICATIONS

PARAMETER, note 1	MINIMUM	NORMAL	MAXIMUM	UNITS
Operating Pressure Range, gage pressure		±10.0		in. H <sub>2</sub> O
Output Span, note 2	±1.90	±2.0	±2.1	V
Offset Voltage	2.15	2.25	2.35	V
Temperature Effect on Offset (0°C–50°C), note 3		±4	±20	mV
Combined Temperature Effect on Span (0°C–50°C), note 3			±1	%Span
Offset Warm-up shift, note 4			±5	mV
Offset Position Sensitivity (±1g)			±1	mV
Offset Long Term Drift (one year)			±10	mV
Combined Linearity and Hysteresis Error, note 5		0.05	0.25	%FS

**Note 1:** Reference conditions (unless otherwise noted): Supply Voltage,  $V_S = 5V_{DC}$ ,  $T_A = 25^\circ C$ , Common Mode Line Pressure = 0 psig. Pressure measurements are with pressure applied to Port B.

**Note 2:** The voltage added to the offset voltage at full scale pressure. Nominally the output voltage range is 0.25 to 4.25 volts.

**Note 3:** Shift is relative to 25°C.

**Note 4:** Shift is within the first hour of excitation applied to the device.

**Note 5:** Measured at one-half full scale rated pressure using best straight line curve fit.

# DCAL420GN

**Ratiometric 4-Volt Output**  
**High Accuracy Compensation**  
**20 in. H<sub>2</sub>O Full Scale Pressure**

## MAXIMUM RATINGS

PARAMETER	MINIMUM	MAXIMUM	UNITS
Operating Temperature Range	-25	85	°C
Storage Temperature	-40	125	°C
Proof Pressure	300		in. H <sub>2</sub> O
Burst Pressure	450		in. H <sub>2</sub> O
Output Source Current			
Output Sink Current			
Excitation Voltage	3	16	V
Common Mode Pressure	50		psig

## ELECTRICAL SPECIFICATIONS

PARAMETER, note 1	MINIMUM	NORMAL	MAXIMUM	UNITS
Operating Pressure Range, gage pressure		20.0		in. H <sub>2</sub> O
Output Span, note 2	3.9	4.0	4.1	V
Offset Voltage	0.15	0.25	0.35	V
Temperature Effect on Offset (0°C–50°C), note 3		7	±20	mV
Combined Temperature Effect on Span (0°C–50°C), note 3			±1	%Span
Offset Warm-up shift, note 4			±5	mV
Offset Position Sensitivity (±1g)			±1	mV
Offset Long Term Drift (one year)			±10	mV
Combined Linearity and Hysteresis Error, note 5		0.05	0.25	%FS

**Note 1:** Reference conditions (unless otherwise noted): Supply Voltage,  $V_S = 5V_{DC}$ ,  $T_A = 25^\circ\text{C}$ , Common Mode Line Pressure = 0 psig. Pressure measurements are with pressure applied to Port B.

**Note 2:** The voltage added to the offset voltage at full scale pressure. Nominally the output voltage range is 0.25 to 4.25 volts.

**Note 3:** Shift is relative to 25°C.

**Note 4:** Shift is within the first hour of excitation applied to the device.

**Note 5:** Measured at one-half full scale rated pressure using best straight line curve fit.



# DCAL420DN

**Ratiometric 4-Volt Output**  
**High Accuracy Compensation**  
**±20 in. H<sub>2</sub>O Full Scale Pressure**

## MAXIMUM RATINGS

PARAMETER	MINIMUM	MAXIMUM	UNITS
Operating Temperature Range	-25	85	°C
Storage Temperature	-40	125	°C
Proof Pressure	300		in. H <sub>2</sub> O
Burst Pressure	450		in. H <sub>2</sub> O
Output Source Current			
Output Sink Current			
Excitation Voltage	3	16	V
Common Mode Pressure	50		psig

## ELECTRICAL SPECIFICATIONS

PARAMETER, note 1	MINIMUM	NORMAL	MAXIMUM	UNITS
Operating Pressure Range, gage pressure		±20.0		in. H <sub>2</sub> O
Output Span, note 2	±1.90	±2.0	±2.1	V
Offset Voltage	2.15	2.25	2.35	V
Temperature Effect on Offset (0°C–50°C), note 3		±3	±20	mV
Combined Temperature Effect on Span (0°C–50°C), note 3			±1	%Span
Offset Warm-up shift, note 4			±5	mV
Offset Position Sensitivity (±1g)			±1	mV
Offset Long Term Drift (one year)			±10	mV
Combined Linearity and Hysteresis Error, note 5		0.05	0.25	%FS

**Note 1:** Reference conditions (unless otherwise noted): Supply Voltage,  $V_S = 5V_{DC}$ ,  $T_A = 25^\circ\text{C}$ , Common Mode Line Pressure = 0 psig. Pressure measurements are with pressure applied to Port B.

**Note 2:** The voltage added to the offset voltage at full scale pressure. Nominally the output voltage range is 0.25 to 4.25 volts.

**Note 3:** Shift is relative to 25°C.

**Note 4:** Shift is within the first hour of excitation applied to the device.

**Note 5:** Measured at one-half full scale rated pressure using best straight line curve fit.

# DCAL430GN

**Ratiometric 4-Volt Output**  
**High Accuracy Compensation**  
**30 in. H<sub>2</sub>O Full Scale Pressure**

## MAXIMUM RATINGS

PARAMETER	MINIMUM	MAXIMUM	UNITS
Operating Temperature Range	-25	85	°C
Storage Temperature	-40	125	°C
Proof Pressure	450		in. H <sub>2</sub> O
Burst Pressure	750		in. H <sub>2</sub> O
Output Source Current			
Output Sink Current			
Excitation Voltage	3	16	V
Common Mode Pressure	50		psig

## ELECTRICAL SPECIFICATIONS

PARAMETER, note 1	MINIMUM	NORMAL	MAXIMUM	UNITS
Operating Pressure Range, gage pressure		30.0		in. H <sub>2</sub> O
Output Span, note 2	3.9	4.0	4.1	V
Offset Voltage	0.15	0.25	0.35	V
Temperature Effect on Offset (0°C–50°C), note 3			±20	mV
Combined Temperature Effect on Span (0°C–50°C), note 3			±1	%Span
Offset Warm-up shift, note 4			±5	mV
Offset Position Sensitivity (±1g)			±1	mV
Offset Long Term Drift (one year)			±10	mV
Combined Linearity and Hysteresis Error, note 5		0.05	0.25	%FS

**Note 1:** Reference conditions (unless otherwise noted): Supply Voltage,  $V_S = 5V_{DC}$ ,  $T_A = 25^\circ\text{C}$ , Common Mode Line Pressure = 0 psig. Pressure measurements are with pressure applied to Port B.

**Note 2:** The voltage added to the offset voltage at full scale pressure. Nominally the output voltage range is 0.25 to 4.25 volts.

**Note 3:** Shift is relative to 25°C.

**Note 4:** Shift is within the first hour of excitation applied to the device.

**Note 5:** Measured at one-half full scale rated pressure using best straight line curve fit.

# DCAL430DN

**Ratiometric 4-Volt Output**  
**High Accuracy Compensation**  
**±30 in. H<sub>2</sub>O Full Scale Pressure**

## MAXIMUM RATINGS

PARAMETER	MINIMUM	MAXIMUM	UNITS
Operating Temperature Range	-25	85	°C
Storage Temperature	-40	125	°C
Proof Pressure	450		in. H <sub>2</sub> O
Burst Pressure	750		in. H <sub>2</sub> O
Output Source Current			
Output Sink Current			
Excitation Voltage	3	16	V
Common Mode Pressure	50		psig

## ELECTRICAL SPECIFICATIONS

PARAMETER, note 1	MINIMUM	NORMAL	MAXIMUM	UNITS
Operating Pressure Range, gage pressure		±30.0		in. H <sub>2</sub> O
Output Span, note 2	±1.90	±2.0	±2.1	V
Offset Voltage	2.15	2.25	2.35	V
Temperature Effect on Offset (0°C–50°C), note 3			±20	mV
Combined Temperature Effect on Span (0°C–50°C), note 3			±1	%Span
Offset Warm-up shift, note 4			±5	mV
Offset Position Sensitivity (±1g)			±1	mV
Offset Long Term Drift (one year)			±10	mV
Combined Linearity and Hysteresis Error, note 5		0.05	0.25	%FS

**Note 1:** Reference conditions (unless otherwise noted): Supply Voltage,  $V_S = 5V_{DC}$ ,  $T_A = 25^\circ\text{C}$ , Common Mode Line Pressure = 0 psig. Pressure measurements are with pressure applied to Port B.

**Note 2:** The voltage added to the offset voltage at full scale pressure. Nominally the output voltage range is 0.25 to 4.25 volts.

**Note 3:** Shift is relative to 25°C.

**Note 4:** Shift is within the first hour of excitation applied to the device.

**Note 5:** Measured at one-half full scale rated pressure using best straight line curve fit.

**APPLICATIONS INFORMATION**

**MEDIA CAPABILITY, WETTED MATERIALS**

*(Apply clean dry air only)*

Pressure Port B (High)	Silicon diaphragm, glass filled nylon, and alumina ceramic. Pressure measuring port.
Pressure Port A (Low)	Silicon diaphragm, glass filled nylon, and alumina ceramic. The vent port.

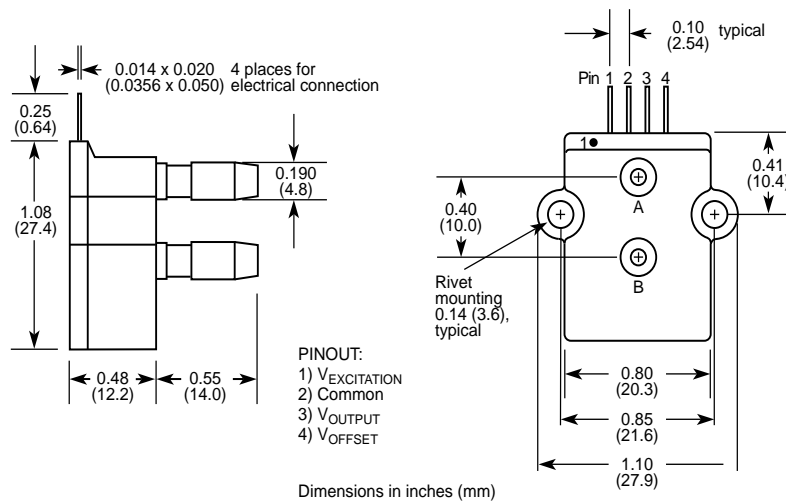
**Pressure Compatibility:**

Measures differential or gage pressure only with positive pressure to port B. There will be a small output voltage between the actual offset voltage and ground proportional to vacume if applied to port B.

**Ratiometric Output:**

The output voltage of the sensor is ratiometric, proportional, to the excitation voltage. For this model sensor all specifications will change proportionally to any changes in the excitation voltage. The excitation may vary between 3 to 16 volts. All specifications will nominally be change by a ratio of  $V_{EXCITATION}/5.0$  volts. For example: if the excitation voltage is 3.0 volts then both the full scale output voltage and the offset voltage would be 3/5th the specified value.

**MOLDED PACKAGE DIMENSIONS**



**Ordering Information**

MODEL NO.	PACKAGE TYPE
DCAL401GN	1 in. H <sub>2</sub> O F. S.
DCAL401DN	±1 in. H <sub>2</sub> O F. S.
DCAL405GN	5 in. H <sub>2</sub> O F. S.
DCAL405DN	±5 in. H <sub>2</sub> O F. S.
DCAL410GN	10 in. H <sub>2</sub> O F. S.
DCAL410DN	±10 in. H <sub>2</sub> O F. S.
DCAL420GN	20 in. H <sub>2</sub> O F. S.
DCAL420DN	±20 in. H <sub>2</sub> O F. S.
DCAL430GN	30 in. H <sub>2</sub> O F. S.
DCAL430DN	±30 in. H <sub>2</sub> O F. S.