

PGA900, PGA300 and PGA305 Use Case for Weight Scale (Load Cell) Applications



Introduction

The resistive bridge sensors are used in a variety of end-equipment like Pressure Transmitters or Transducers, Flow Meters, HVAC, and Weight Scales. In weight or force-sensing applications, the weight scale feature relies on the load cell-sensing element that is built around a metal base (usually aluminum) with resistance elements deposited on the side of the base. Once the load cell is exposed to mechanical stress (bending), the resistance elements change their typical values based on the amount of force applied to the cell.

Load Cell

Figure 1 shows the load cell mechanism. The load cell resistive elements are connected in a Wheatstone bridge configuration that has 4 resistors (shown in yellow). The resistor values and output voltage from the resistive bridge change when the load cell detects the weight.

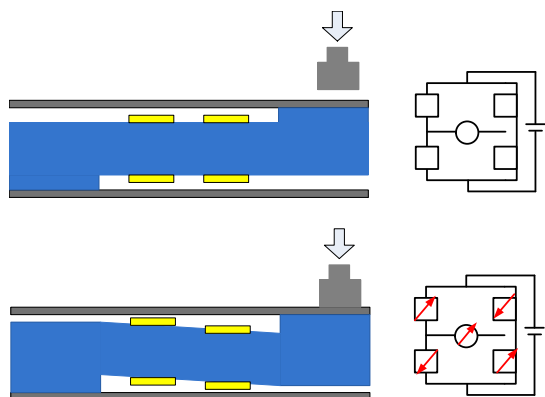


Figure 1. Load Cell Mechanism

Ideally, the signal from the resistive bridge would be linear with the change of weight on the load cell, but this is not always the case. Furthermore, each individual resistance is not equal to the others, so a voltage offset is observed. This particularly comes to effect when no weight is applied to the load cell. Finally, the output is temperature-dependent, meaning the signal from the resistive bridge has to be temperature-compensated in the system. This requires that the typical system connected to a load cell sensor is capable of linearization and temperature dependency cancellation for accurate measurements across weight and temperature.

Important System Factors

The load cell system needs to measure the weight precisely, so the following specifications are needed from the signal conditioning device:

- High resolution
- High accuracy
- Linearization and offset cancel
- Temperature compensation
- Output interface: voltage, current or digital output

The PGA900, PGA300, and PGA305 devices are sensor signal conditioners that can directly connect to a resistive bridge Load Cell sensor where the measured is gained by the internal low-noise instrumentation amplifier (IA) and passed to the analog-to-digital converter (ADC). Further the ADC data is then processed by the internal digital signal processing engine that will compensate for the sensor non-linearity to output a linear data before it is available at the PGA900, PGA300, or PGA305 output that can be either analog or digital. Therefore, the PGA900, PGA300, and PGA305 devices are a suitable fit for the weight scale application.

PGA900

Figure 2 shows the PGA900 Functional Diagram. The device has two high-resolution ADCs (24-bit) with an integrated ARM M0 MCU that allows the development of application-specific compensation linearization algorithms. The PGA900 supports multiple output choices, including the analog voltage (0 – 5, 0 – 10 V), the current output (4 – 20 mA), and the digital I2C, UART, PWM, and One Wire interface.

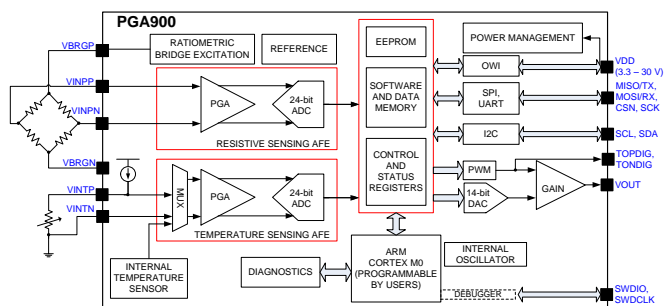


Figure 2. PGA900 Block Diagram

PGA300

Figure 3 shows the PGA300 Block Diagram. The PGA300 integrates two 16-bit ADCs while a 3rd-order compensation algorithm is employed for sensor linearization. The system accuracy achieved can be <math><0.1\%FS</math> over temperature. The PGA300 supports the analog voltage, the current output (4 – 20 mA), and the One Wire interface.

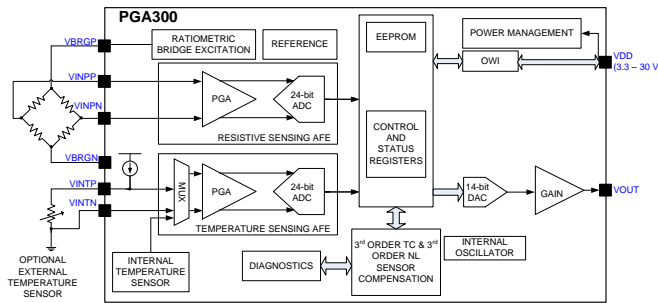


Figure 3. PGA300 Block Diagram

PGA305

Figure 4 shows the PGA305 Block Diagram. This device integrates a dual-channel, 24-bit ADC, followed by a 3rd-order digital linearity compensation algorithm. The system accuracy achieved can be <math><0.1\%FS</math> over temperature. The PGA305 supports the analog voltage and current output (4 – 20 mA), along with the I2C output and One Wire Interface.

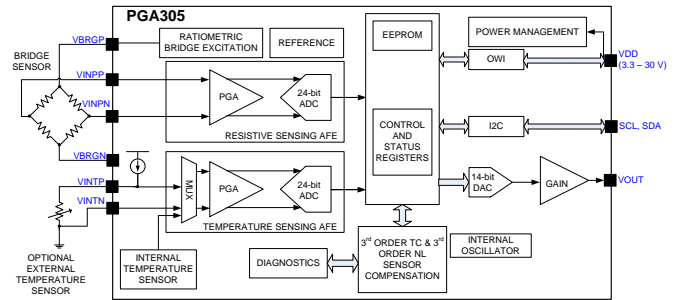


Figure 4. PGA305 Block Diagram

Table 1. Alternative Device Recommendations

Device	Optimized Parameters	Performance Trade-Off
PGA308	High Gain Setting, Automotive AECQ100 available	High current consumption
PGA309	High Gain Setting	High current consumption

Table 2. Adjacent Tech Notes

SLYA025	PGA900/300/305 Use Case for the HVAC Application
SLYA026	PGA900/300/305 Use Case for the Pressure Transmitter Application

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