Field Set-up of Transducer and Instrument

The most common method for quick field calibration is the “shunt calibration” technique. This method applies a known, accurate resistance across one leg of the transducer, which simulates an actual physical stimulus when one is not present. Upon application of this resistance, the output of the transducer changes exactly as it would if a known pressure or load were applied.

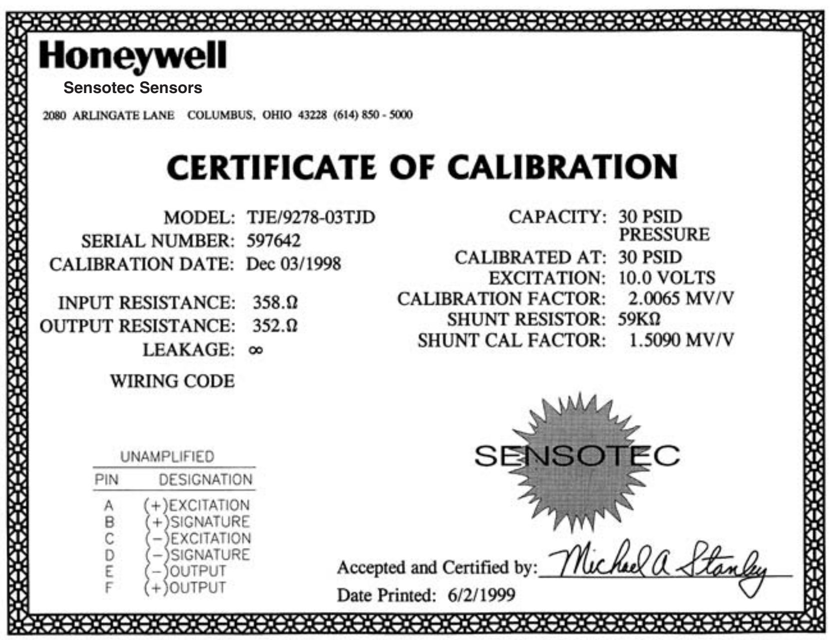
In performing shunt calibration, the transducer should have no pressure or load applied, so that it is at “zero” initially. The data instrument’s ZERO control can then be adjusted to give a zero output on its indicator, or a zero voltage on its output terminals. (In the case of 4-20 milliampere outputs, this value would be a 4 milliamperes.) The shunt calibration circuitry may then be activated by use of the front-panel SHUNT CAL button. A step change in amplifier out put or reading will occur. If the amount of the step change does not agree with the expected change as indicated by the Transducer Calibration Data sheet, adjust the SPAN or GAIN control until it does. This will insure that the amplification given by the data device will be correct, so that an actual stimulus will give correct readings.

It is advisable to recheck the zero when the shunt calibration resistance is removed, since there may be some interaction if the GAIN or SPAN control adjustments were large.

Strain gage transducers with internal amplifiers usually have a shunt calibration resistor installed. The shunt calibration resistor may be activated by interconnecting two terminals on the connector. The wiring code section of the Transducer Calibration Data sheet will indicate which terminals are to be interconnected to activate the shunt calibration. For current output units (4-20 milliamperes), several full cycles of adjusting the ZERO and SPAN controls may be required, since these controls interact greatly in such units.

Shown is a typical Transducer Calibration Data sheet. This sheet will be used as an example to illustrate the setup procedure for both unamplified transducers, as well as instruments with an amplified output. The calibration record for amplified transducers includes the “amplified” shunt cal value so no calculation is required.

Calibration Data Sheet



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CERTIFICATE OF CALIBRATION

MODEL: TJE/9278-03TJD

SERIAL NUMBER: 597642

CALIBRATION DATE: Dec 03/1998

INPUT RESISTANCE: 358.Ω

OUTPUT RESISTANCE: 352.Ω

LEAKAGE: ∞

CAPACITY: 30 PSID PRESSURE

CALIBRATED AT: 30 PSID

EXCITATION: 10.0 VOLTS

CALIBRATION FACTOR: 2.0065 MV/V

SHUNT RESISTOR: 59KΩ

SHUNT CAL FACTOR: 1.5090 MV/V

WIRING CODE

UNAMPLIFIED

PIN	DESIGNATION
A	(+)EXCITATION
B	(+)SIGNATURE
C	(−)EXCITATION
D	(−)SIGNATURE
E	(−)OUTPUT
F	(+)OUTPUT

Accepted and Certified by: Michael A Stanley

Date Printed: 6/2/1999

Step-by-Step Procedure for Shunt Cal

1. Make all required connections between the transducer and the instrument.
2. Apply power and allow 10 to 20 minutes for stabilization.
3. Turn the ZERO adjustment so that the indicator reads zero. (If you are working with a PSIA transducer, the transducer must be evacuated to get zero. However, the unit can be shunt calibrated at atmosphere, and the atmospheric reading added to the shunt calibration reading.)
4. From the Transducer Calibration Data sheet, obtain the transducer full scale output in millivolts per volt, and the shunt calibration output in millivolts per volt.
5. Select and perform the proper calculation from the discussion below.
6. Depress the SHUNT CAL switch and turn the SPAN or GAIN adjustment to obtain the value calculated in step 5.

Unamplified Transducers

Transducers with millivolt outputs usually do not have internal shunt calibration circuitry, but the effect of a known shunt calibration resistor being connected across the leads will be noted on the Transducer Calibration Data sheet. To determine the output of an unamplified transducer under shunt calibration conditions, perform the following calculation:

$$(\text{Shunt Cal Factor in mV/V}) \times \text{Excitation Voltage} = \text{Output Voltage}$$

Substituting the values from the sample Transducer Calibration Data sheet into the above equation provides the following:

$$(1.5090 \text{ mv/v}) \times (10 \text{ V}) = 15.090 \text{ millivolts}$$

Instrument with 0 to 5 Volt Output

Consider next an amplified transducer with a 0 to 5 volt output, or an instrument which has been factory calibrated with a transducer. Determining the output under shunt calibration conditions is done with the following equation:

$$\frac{\text{Shunt Cal Factor in mV/V}}{\text{Full-Scale Output in mV/V}} \times \text{Full-Scale Output} = \text{Output Voltage}$$

Using the same data sheet as before, and assuming an amplified transducer with a 5 volt full scale provides:

$$\frac{(1.5090 \text{ mV/V})}{(3.0057 \text{ mV/V}} \times 5 \text{ volts} = 2.510 \text{ volts}$$

Instrument with 4-20 Milliampere Output

Consider next the case of a 4-20 milliampere output from an amplified transducer. Notice that this represents a span of 16 milliamperes, offset upward by 4 milliamperes. To calculate the shunt cal output, use the following equation:

$$\frac{\text{Shunt Cal Output in mV/V}}{\text{Full-Scale Output in mV/V}} \times 16 \text{ mA.} + 4 \text{ mA.} = \text{Output Current}$$

Using the same data sheet again, and assuming a 4-20 mA. case,

$$\frac{(1.5090 \text{ mV/V})}{(3.0057 \text{ mV/V})} \times 16 \text{ mA.} + 4 \text{ mA.} = 12.033 \text{ mA.}$$

Instrument Display

The following equation applies to instruments with a display:

$$\frac{\text{Shunt Cal Factor in mV/V}}{\text{Full-Scale Output in mV/V}} \times \text{Full-Scale Display Value} = \text{Shunt Cal Display Value}$$

Since the transducer shown on the Transducer Calibration Data sheet is a 1,000-pound unit, the display should read:

$$\frac{(1.5090 \text{ mV/V})}{(3.0057 \text{ mV/V})} \times 1{,}000 \text{ lbs.} = 502 \text{ lbs.}$$