STRAINSERT
PROUDLY MADE IN THE USA

Tension Link Sensor Troubleshooting Guide

An AS9100 (including ISO 9001) Certified Company

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PHYSICAL INSPECTION

1. Inspect the sensor for physical damage, cracks bending, distortion, corrosion, etc.
2. Inspect connector and receptacle pins and sockets for damage (loose or bent) or contamination from debris or moisture.
3. Inspect cable thoroughly for damage, such as cuts, nicks, bent, or pinched wiring. A cable bend greater than 60° could cause short readings.
4. Verify good connections at any intermediate wire terminations between the load sensor and facility instrumentation.

ZERO LOAD MEASUREMENT (Use Existing DAQ or Strain Meter)

1. Observe the Tension Link bridge readings while under no load. If the load is drifting or the unloaded readings are greater than 5% of the full-scale output, this may indicate a problem with the sensor. Please note this "zero" magnitude can change slowly over time and is normal in strain gage bridges.

FOR NON-AMPLIFIED SENSORS

BRIDGE RESISTANCE MEASUREMENT (Using a Digital Multimeter)

1. Disconnect all Tension Link cable wires at instrumentation termination point.
2. Set the Digital Multimeter (DMM) to measure "Ohms".
3. With the DMM, measure and record resistance readings using the pin assignments provided in the customer wiring diagram or control drawing in accordance with Table 1:

Standard Single / Dual Bridge Description for Cable Wire Colors Resistance, Ohms
(For Custom Wiring see your data package for all Bridge Connections)
Table 1

Description	Standard Connector Pins	Standard Cable Wire Colors	Nominal Resistance (Ohms) ±9 ohms
Standard Single Bridge:			
Excitation (+) / Excitation (-)	A / D	Red / Black	350(*)
Signal (+) / Signal (-)	B / C	Green / White	350
Excitation (+) / Signal (+)	A / B	Red / Green	265
Excitation (+) / Signal (-)	A / C	Red / White	265
Excitation (-) / Signal (+)	D / B	Black / Green	265
Excitation (-) / Signal (-)	D / C	Black / White	265
Dual Bridge:			
Excitation (+) / Excitation (-)	E / H	Blue / Brown	350(*)
Signal (+) / Signal (-)	F / G	Orange / Yellow	350
Excitation (+) / Signal (+)	E / F	Blue / Orange	265
Excitation (+) / Signal (-)	E / G	Blue / Yellow	265
Excitation (-) / Signal (+)	H / F	Brown / Orange	265
Excitation (-) / Signal (-)	H / G	Brown / Yellow	265

(*) Actual value may be as high as 15% above the nominal value due to signal trim, compensation resistors and cable resistance.

4. Repeat Step 1 – Step 3 for bridge 2 when applicable.

TENSION LINK RAW OUTPUT SIGNAL MEASUREMENT (Using a Power Supply and Digital Multimeter)

1. Measurements are independent of customer strain meter / DAQ.
2. Connect the E+ and E- cable leads to a power supply providing between 5-12 Volts DC.
3. Connect the S+ and S- cable leads to a DMM and set to measure either DC Volts or DC mV (if equipped). Recommended measurement range to be in millivolts.
4. Standard cable color and hook ups are provided in the Table 2 below. For custom applications, please review your data package for Custom Wiring Diagrams or Control Drawings.

Standard Single Bridge Description for Pinout and Cable Colors
(For Dual Bridge Custom Wiring see your data package for all Bridge Connections)
Table 2.

Standard Cable Color	Standard Connector Pin Out	Function	Bridge Number
Red / Blue	A / E	Excitation (+)	1 / 2(*)
Green / Orange	B / F	Signal (+)	1 / 2(*)
White / Yellow	C / G	Signal (-)	1 / 2(*)
Black / Brown	D / H	Excitation (-)	1 / 2(*)

(*) When option is available.

5. Power on power supply to provide voltage across E+ and E-.
6. Measure and record Tension Link sensor output signal (mV) between S- and S+ under no-load condition.
7. Apply a load to the sensor then repeat measurement.
8. Using the offset recorded in Step 6, compare output to calibration data (mV/V vs. Engineering Units)
9. See Strainsert Calibration Certificate for comparison.
10. Calibration certificates are available on the Strainsert website https://www.strainsert.com/services/online-calibration-certificate-lookup-tool/
11. For dual bridge Tension Link sensors repeat Steps 2 through 10 for bridge 2 if applicable.

TENSION LINK INSULATION RESISTANCE (IR) MEASUREMENT (Using a Megohm Insulation Tester)

1. Connect all Tension Link sensor wire leads to the positive side (+) lead of the insulation tester.
2. Connect negative (-) insulation tester lead to a secure point on the Tension Link sensor body.
3. Set insulation test voltage to 50V (maximum)
   Warning: Insulation test voltages that exceed 50 Volts between the sensor wires and/or sensor body can cause permanent damage to the internal strain gages and will void the manufacturer's warranty.
4. Initiate the test using the insulation meter test button.
5. Verify measurement is nominally greater than 5 Giga-ohms.
6. If test value is less than 5 Giga-ohm contact Strainsert.
7. For dual bridge repeat Steps 1 – Step 5 for each bridge.
8. **Bridge to Bridge (IR):** For dual bridge Tension Link sensors, connect bridge 1 Tension Link sensor wire leads to the positive side (+) lead of the insulation tester. Connect bridge 2 Tension Link sensor leads to the negative (-) insulation tester leads.
9. Repeat Step 5 through Step 7.

FOR 2-WIRE AMPLIFIED TENSION LINK SENSORS (ONLY)

TENSION LINK AMPLIFIED OUTPUT MEASUREMENT (4 to 20 mA)

Note: Tension Links do not typically have dual bridge amplified circuits.

1. Connect positive side of the power supply per Table 3.
2. Connect the negative side of the power supply to a load resistor (typically 250 Ohms).
3. Connect the opposite side of the load resistor to the return wire per Table 3.
4. Connect a DMM across the load resistor per the drawing below. Set the DMM to measure DC Volts.
5. Standard cable color and hook ups are provided in the table below. For custom applications, please review your data package for Custom Wiring Diagrams or Control Drawings.

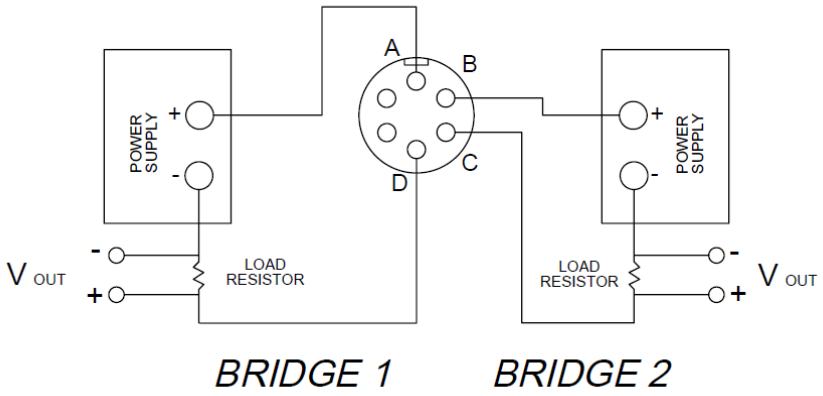

Table 3.

Standard Cable Color	Standard Connector Pin Out	Function	Bridge Number
Red	A (13-28 Volt)	13-28 VDC Power	1
Black	D (Return)	Power Return	1
Green	B (13-28 Volt)	13-28 VDC Power	2(*)
White	C (Return)	Power Return	2(*)

(*) When option is available.

6. Power on power supply to provide current to the circuit.
7. Measure and record sensor output volts DC under no load condition. Zero load should be 1.00 Vdc +/- 50 mV nominal across a 250 Ohm load resistor.
8. Apply a load to the sensor then repeat measurement.
9. Using recorded zero load offset from Step 7, compare output to the calibration data (Volts DC vs. Engineering Units)
10. See Strainsert Calibration Certificate for comparison.
11. Calibration certificates are available on the Strainsert website https://www.strainsert.com/services/online-calibration-certificate-lookup-tool/
12. For dual bridge Tension Link sensors repeat Steps 1 through 11 for bridge 2 if applicable.

2-WIRE TENSION LINK INSULATION RESISTANCE MEASUREMENT (ONLY) **(Using a Megohm R Tester)**

1. Connect all Tension Link sensor wire leads to the positive side (+) lead of the insulation tester.
2. Connect negative (-) insulation tester lead to a secure point on the Tension Link sensor body.
3. Set insulation test voltage to 50V (maximum)
   Warning: Insulation test voltages that exceed 50 Volts between the sensor wires and/or sensor body can cause permanent damage to the internal strain gages and void the manufacturer's warranty.
4. Initiate the test using the insulation meter test button.
5. Verify measurement is nominally greater than 5 Giga-ohm's.
6. If test value is less than 5 Giga-ohm contact Strainsert.
7. For dual bridge Tension Link sensors, connect bridge 1 Tension Link sensor wire leads to the positive side (+) lead of the insulation tester. Connect bridge 2 Tension Link sensor leads to the negative (-) insulation tester leads.
8. Repeat Step 4 through Step 6.

Problem	Possible Cause	Possible Solution
Load readings are low or do not increase with applied load	Gages are Damaged	Factory Repair/Replacement
	Link is not installed correctly and not deflecting	Verify the Link is properly installed and allowed to stretch
	Damaged or disconnected cable	Inspect cable for damage and reconnect/repair as needed.
Load readings are saturated or opposite polarity to what is expected	Wiring connection swapped	Inspect cable and wiring for proper connections and reconnect, as required.
Load readings do not match calibration data sheet	Scaling in instrument is incorrect	Adjust instrument scaling to match calibration certificate
	Load Distribution is significantly different from the factory calibration	Conduct an in-place calibration or proof load to obtain new scaling per in-place applied load
	Wiring connected improperly	Inspect cable and wiring for proper connections and reconnect, as required.
(High Zero Reading) No load readings >5% of full scale	Shift due to overload	Factory repair/replacement
	Instrumentation offset or Tare has shifted	Investigate software, meter, display, etc. offset value
	Insulation Resistance Short	Return to manufacturer for evaluation and repair.
(Zero Reading Shift) No load readings < 5% full scale	Strain gage shift over time	This is a phenomenon of strain gage circuits, and this initial offset can be zeroed out on instrumentation without effecting the transducer span
Bridge Resistance readings are outside of tolerances	Broken pin, broken connection, moisture in connector or receptacle, open gage circuit	Return to manufacturer for evaluation and repair.
Readings are slightly drifting with no load applied	Heating on one side of transducer	Possible temperature gradients due to non-uniform temperature across Tension Link sensor body.
	Loose or cold solder connections inside bridge circuit. Internal damage to strain gage circuit.	Return to manufacturer for evaluation and repair.