

OPERATION MANUAL

Tension and compression load cell Model 8427

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4529-BA8427EN-5699-031527

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The measurement solution.

EU-Konformitätserklärung (nach EN ISO/IEC 17050-1:2010) EU-Declaration of conformity (in accordance with EN ISO/IEC 17050-1:2010)

Name des Ausstellers: burster präzisionsmesstechnik gmbh & co kg
Issuer's name:

Anschrift des Ausstellers: Talstr. 1-5
Issuer's address: 76593 Gernsbach, Germany

Gegenstand der Erklärung: Kraftsensor
Object of the declaration: Load Cell

Modellnummer(n) (Typ): 84xx; 85xx
Model number / type: 84xx; 85xx

Diese Erklärung beinhaltet obengenannte Produkte mit allen Optionen
This declaration covers all options of the above product(s)

Das oben beschriebene Produkt ist konform mit den Anforderungen der folgenden Dokumente:
The object of the declaration described above is in conformity with the requirements of the following documents:

Dokument-Nr. <i>Documents No.</i>	Titel <i>Title</i>	Ausgabe <i>Edition</i>
2011/65/EU	Richtlinie zur Beschränkung der Verwendung bestimmter gefährlicher Stoffe in Elektro- und Elektronikgeräten <i>Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment</i>	2011
2014/30/EU	Richtlinie zur Harmonisierung der Rechtsvorschriften der Mitgliedsstaaten über die Elektromagnetische Verträglichkeit <i>Directive on the harmonization of the laws of the Member States relating to electromagnetic compatibility</i>	2014
EN 61326-1	Elektrische Mess-, Steuer-, Regel- und Laborgeräte – EMV-Anforderungen – Teil 1: Allgemeine Anforderungen <i>Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements</i>	2013
EN 61326-2-3	Elektrische Mess-, Steuer-, Regel- und Laborgeräte – EMV-Anforderungen – Teil 2-3: Besondere Anforderungen <i>Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 2-3: Particular requirements</i>	2006

Gernsbach 20.04.2016 i.V. Christian Karius
Ort / place Datum / date Quality Manager

Dieses Dokument ist entsprechend EN ISO/IEC 17050-1:2010 Abs. 6.1g ohne Unterschrift gültig
According EN ISO/IEC 17050 this document is valid without a signature.

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UST-Identnr./VAT No. DE 144 005 098 · Steuernr./Tax Ident No. 39454/10503

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1 For your safety

The following symbols are used in this operation manual to warn of hazards.

1.1 Symbols used in the operation manual

1.1.1 Signal words

The following signal words are used in the operation manual according to the specified hazard classification.

	DANGER
High degree of risk: indicates a hazardous situation which, if not avoided, will result in death or serious injury.	
	WARNING
Moderate degree of risk: indicates a hazardous situation which, if not avoided, may result in death or serious injury.	
	CAUTION
Low degree of risk: indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.	
NOTICE	
Property damage to the equipment or the surroundings will result if the hazard is not avoided.	

Hinweis: It is important to heed these safety notices in order to ensure you handle the model 8427 tension and compression load cell correctly.

WICHTIG: Follow the information given in the operation manual.

1.1.2 Pictograms

	Hazard warning
	Observe the advice for protecting the sensor.

2 Introduction

WICHTIG: Read the operation manual carefully before using the equipment, and keep it for future reference.

2.1 Intended use

The load cells in the 8427 model series are primarily designed for the measurement of force in production equipment, using newtons (N) as the unit of measurement. The local gravitational acceleration ($g \approx 9.81 \text{ m/s}^2$) must be taken into account when determining masses. Customer service

2.1.1 Customer service department

For repair inquiries, please call our customer service department on +49 7224 645-53.

Please have the serial number to hand. The serial number is the only way to clearly identify the technical version of the instrument so that we can provide help quickly. You will find the serial number on the type plate of the model 8427 tension and compression load cell.

2.1.2 Contact person

If you have any questions relating to the model 8427 tension and compression load cell, please contact your representative or go directly to burster präzisionsmesstechnik gmbh & co. kg.

Head office

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2.2 Download the test certificate

You have the option to download the test certificate for your model 8427 tension and compression load cell online. You can download the test certificate via either the direct download link or the burster website (<https://www.burster.com>). The serial number of your model 8427 tension and compression load cell is required for the download.

2.3 Ambient conditions

Please note the following temperature ranges:

- Rated temperature range: +15 °C ... +70 °C
- Operating temperature range: -30 °C ... +80 °C

2.3.1 Storage

The model 8427 tension and compression load cell must be stored under the following conditions:

- dry
- no condensation
- temperature between 0 °C and 60 °C

Hinweis: Provided the storage conditions have been observed, no special steps need to be taken after storage and prior to commissioning.

2.3.2 Operating conditions

	NOTICE
	<p>Only connect the model 8427 tension and compression load cell to instrumentation amplifiers that are fitted with a safety transformer to EN 61558. Transmitters connected to the outputs or other devices that are galvanically connected to the sensor's signal lines must also be fitted with safety transformers to EN 61558.</p>

2.3.3 Restrictions on use

The model 8427 tension and compression load cell does not pose a hazard if used within its specification and in accordance with the safety regulations.

The manufacturer does not accept liability for any personal injury or property damage arising from improper installation or operation, or from misinterpretation of measurement results.

2.3.4 Cleaning

	CAUTION
	<p>Disconnect the model 8427 tension and compression load cell from the electrical supply before cleaning.</p>

Disconnect the model 8427 tension and compression load cell from the power supply and use a dry cloth to clean it.

	NOTICE
	<p>Do not immerse the model 8427 tension and compression load cell in water or hold it under running water. Do not use strong cleaning agents as these may damage the model 8427 tension and compression load cell. Clean the model 8427 tension and compression load cell using a dry cloth.</p>

2.4 Personnel

Personnel must be familiar with the relevant regulations. They must follow these regulations. Only trained personnel who are familiar with the applicable safety regulations are permitted to operate the model 8427 tension and compression load cell.

2.5 Contents of pack

- Tension and compression load cell, model 8427
- Operation manual
- Data sheet

2.6 Unpacking

	<div style="background-color: yellow; padding: 5px;">  CAUTION </div> <p>Never connect the model 8427 tension and compression load cell if it shows signs of damage incurred in transit. Only ever use the model 8427 tension and compression load cell under the conditions specified in this operating manual.</p>
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Inspect the model 8427 tension and compression load cell for damage. If you suspect that the device has been damaged during shipping, notify the delivery company within 72 hours.

The packaging should be retained by a representative of the manufacturer and/or the delivery company.

The model 8427 tension and compression load cell should be shipped only in its original packaging or in packaging capable of providing an equivalent degree of protection.

2.7 Warranty

burster präzisionsmesstechnik gmbh & co. kg provides a manufacturer's warranty for a period of 24 months after delivery.

Any repairs required during this time will be made without charge. This does not include damage arising from improper use.

Please note the following when sending the model 8427 tension and compression load cell in for repair:

- If there is a problem with the sensor, please attach a note to the body of the device summarizing the fault.
- Technical specifications subject to change at any time without notice.
We also state explicitly that we do not accept liability for consequential damage.
- The device must always be dispatched in suitable packaging.

2.8 Maintenance

2.8.1 Recalibration

The model 8427 tension and compression load cell should be recalibrated by the manufacturer after no more than 12 months.

Hinweis: If the model 8427 tension and compression load cell is used in machines with high cycle rates, recalibration should be carried out sooner.

2.9 Conversions and modifications

Hinweis: The warranty shall be deemed void **immediately** if you open or dismantle the model 8427 tension and compression load cell during the warranty period.

The model 8427 tension and compression load cell does not contain any parts that are intended to be serviced by the user. Only the manufacturer's own qualified personnel are permitted to open the model 8427 tension and compression load cell.

It is not permitted to make any changes to the model 8427 tension and compression load cell without the written agreement of burster präzisionsmesstechnik gmbh & co. kg. burster präzisionsmesstechnik gmbh & co. kg does not accept liability for damages or injury if this condition is disregarded.

3 Concept and general information

Please refer to the data sheet for the model 8427 precision tension and compression load cell for full details of dimensions, weight, degree of protection etc.

3.1 Mechanical design

In the model 8427 tension and compression load cell, the spring element is designed as a horizontally oriented elastic membrane with a centrally arranged ring.

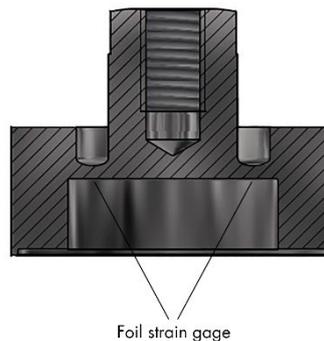


Figure 1: Horizontally oriented membrane

This elastic membrane is deflected by the applied force, resulting in a reduction in the height of the sensor. This deformation cannot be seen by the naked eye. It is measured with the aid of strain gages. In the model 8427 tension and compression load cell, the strain gages are mounted on the underside of the spring element. As a result, they are subject to the same deformation as the spring element.

3.2 Principle of operation

The model 8427 tension and compression load cell utilizes a spring element. The spring element is elastically deformed by the force being measured. Strain gages are used to convert this deformation into an electrical signal. The strain gages and spring element together constitute the measuring element.

3.2.1 Spring element

The spring element is the most important mechanical part of a load cell. Its purpose is to take the force being measured and convert it into a linear extension. It relies on the elastic properties of the material in order to determine the force indirectly.

The materials used to make load cells must satisfy other conditions in addition to their elastic properties. As a result, only a small number of carefully selected materials come into question for high-quality load cells.

burster goes a step further, using mainly aviation materials that satisfy additional quality requirements instead of DIN materials.

3.2.2 Strain gages

The electrical resistance of a wire rises with increasing length and falling cross-section. When a wire is pulled, it becomes thinner and longer – both of these effects result in an increase in its electrical resistance.

This is the principle on which strain gages are based. In practice, however, strain gages do not consist of a single wire, but of a metal foil laminated onto a carrier material. The metal foil is etched to create a meandering structure (see Figure 2).

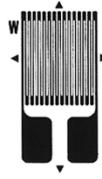


Figure 2: Foil strain gage

Special techniques are used to mount strain gages manufactured in this way onto the surface of the spring element.

3.2.2.1 Strain gage wiring

In order to reduce undesirable influences on the measurement, the strain gages in model 8427 tension and compression load cells are connected as a Wheatstone bridge. Figure 3 illustrates this wiring in a simplified form.

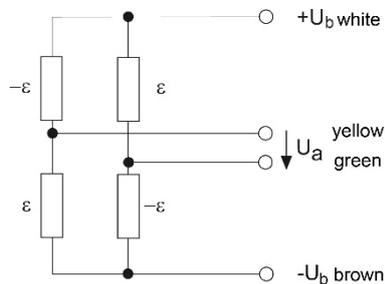


Figure 3: Full-bridge strain gage for model 8427 tension and compression load cells

In addition to the four strain gages shown here, compensation resistors to reduce the effect of temperature and balancing resistors to balance the bridge circuit are also incorporated.

Depending on the version of the model 8427 tension and compression load cell, further resistors for the purpose of standardizing the full-scale output are integrated into the cable or the connector.

The output voltage U_a of the model 8427 tension and compression load cell is calculated as follows:

$$U_a = c * U_b$$

- U_b : Reference excitation voltage
- c : Rated output of the load cell

You can find the rated output “c” on the test certificate for the model 8427 tension and compression load cell. It is typically in the region of approx. 1.1 mV.

In conjunction with the reference excitation voltage (U_b) in the region of 5 V, signals (U_a) of around 5.5 mV are produced at 100 % loading of the sensor.

3.2.2.2 Full-scale deflection

On sensors that have an elastic membrane, the load depresses the measuring element in the center of the sensor. This deformation is known as the full-scale deflection, and is so small that it cannot be seen with the naked eye.

On model 8427 tension and compression load cells, the deformation at maximum load is in the region of approx. 60 μm and is directly proportional to the load.

3.2.2.3 External forces

External forces here refers to any force that acts outside the sensor's axis of symmetry – particularly transverse forces, bending moments and torsional forces.

	NOTICE
	<p>Damage to the model 8427 tension and compression load cell Avoid vibrations, even if the generated loads remain below the rated load, and avoid external forces acting on the load cell. Design your measuring system in such a way as to prevent these external forces.</p>

WICHTIG: External forces acting on the model 8427 tension and compression load cell will significantly falsify the measurement result!

4 Using the device for the first time

	CAUTION
	<p>Never connect the model 8427 tension and compression load cell if it shows signs of damage incurred in transit. Only ever use the model 8427 tension and compression load cell under the conditions specified in this operating manual.</p>

	NOTICE
	<p>Only connect the model 8427 tension and compression load cell to instrumentation amplifiers that are fitted with a safety transformer to EN 61558.</p>

Hinweis: Transmitters connected to the outputs or other devices that are galvanically connected to the signal lines of the model 8427 tension and compression load cell must also be fitted with safety transformers to EN 61558.

4.1 Grounding and equipotential bonding

All connecting wires (including the cable screening braid) are electrically insulated from the sensor body. The insulation resistance between the connecting wires and the sensor body is measured. The test certificate states that the minimum resistance is greater than 30 MΩ (test voltage 45 V).

5 Installation

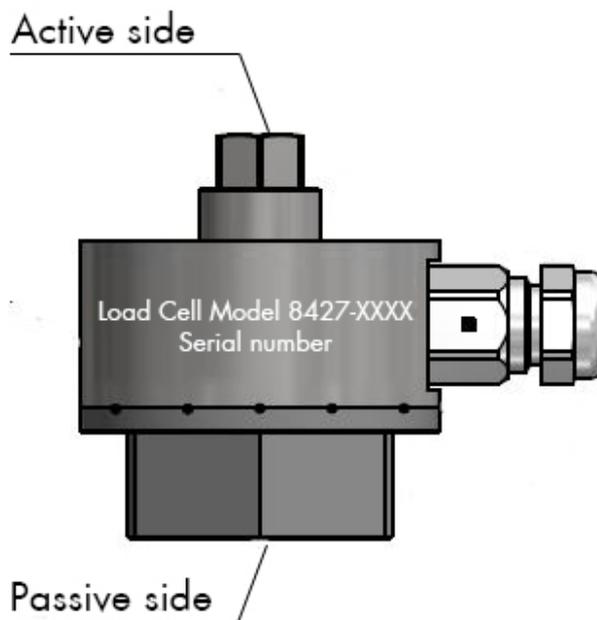
5.1 Mechanics

Mounting surface

A high quality measurement depends on a defined deformation of the measuring element under load. To be certain of excluding any unwanted deformations, the model 8427 tension and compression load cell must lie flat on the mounting surface.

The mounting surface must meet the following requirements:

- adequately stable
- hardened, minimum hardness 58 HRC
- polished, preferably lapped, surface quality: Ra 0.1, evenness 2 μm
- not coated in any material



WICHTIG: Prevent torsional moments, lateral forces and bending forces.

Application of force



This is how it works

1. Apply the force being measured to the model 8427 tension and compression load cell via the central thread.
2. Apply the force centrally exactly along the axis of symmetry.

WICHTIG: Eliminate any lateral forces and torques.

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	<h2>NOTICE</h2>
	<ul style="list-style-type: none"> • The force application components must be ground flat, and lapped. • The material must be hardened, not just surface-hardened, and have 60 HRC hardness. • In the force application component, the contact surfaces must be stable without unnecessary holes, recesses, etc. • The specifications are valid exclusively with the provided load buttons.



Figure 4: Applying force to the 8427

Hinweis: burster offers additional accessories for all measurement ranges of this model 8427 tension and compression load cell: rod end bearings, load button and external threaded rods.

Accessories



With external thread

With rod end bearings

With load button

Overload

You can recognize an overload from an increased output signal at no load. Bending plates are relatively insensitive to overloading.

Hinweis: Check the model 8427 tension and compression load cell if the signal increases by more than approx. 5 %

NOTICE

- Do not apply sudden loads to the model 8427 tension and compression load cell.
- Dynamic loads above 70 % of the rated force reduce the life of sensors.
- If used as a weighing device via axles or entire vehicles, use design measures to absorb the dynamic loading (due to driving onto ramps, braking vehicles, etc.)
- Make sure that the load does not generate any lateral forces.
- Use design measures to prevent lateral forces caused by thermal expansion if the model 8427 tension and compression load cell is used as a weighing device on containers.

5.2 Fixing method

The entire contact surface of the model 8427 tension and compression load cell must lie on a hardened (min. 58 HRC), flat, ground or lapped mounting surface.

The load cell is designed for universal use with a wide range of fixing options.

Bolts

Hinweis: Refer to the latest data sheet for the maximum fastening torques for mounting the model 8427 tension and compression load cell.

Minimum screw-in depth "D":

M3 fixing screws D = 4.5 mm

M4 central internal thread D = 6 mm

M10 central internal thread D = 14 mm

Only use bolts that have the following characteristics:

- Bolt strength 8.8 or higher
- Hex socket head bolts to DIN 912
- Hexagon spanner size top and bottom: see data sheet
- Central internal thread for load application: see data sheet
- Three M3 mounting screws for tensile and compressive loads (for tensile loads up to measuring range 0 ... 1 kN)
- Please observe the tightening torques specified in the data sheet.

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Cable



This is how it works

1. Install the cable so that it does not vibrate.
2. Ensure sufficiently large bending radiuses for the cable.

	NOTICE
	<ul style="list-style-type: none"> Relieve the bending stress exerted by the connecting cable on the cable sleeve, at the sensor housing. Avoid pulsating or alternating loads on the cable sleeve. Avoid vibrating the cables so that the cable sheath is not damaged. Protect the cables from strain. Protect the model 8427 tension and compression load cell from vapors and liquids.

5.3 Electrical system, evaluation instrumentation

The output signal from the model 8427 tension and compression load cell, with an excitation voltage of 5 V, is 7.5 mV max. Therefore for a measurement accuracy of 0.5 % you will need a resolution of approx. 15 μ V or better. Interference affects the model 8427 tension and compression load cell, cables and measurement electronics accordingly.

The following points apply to the sensor's electrical connection:

	NOTICE
	<ul style="list-style-type: none"> Position the model 8427 tension and compression load cell outside the electromagnetic field of high-energy equipment. This includes transformers, motors, contactors, frequency converters and so forth. Otherwise the electromagnetic fields from such equipment will act with their full effect on the measurement chain, causing incorrect measurements. Route the measuring leads separately from power cables. If the measuring leads are laid parallel to power cables, the latter will cause inductive and capacitive interference.

Hinweis: You can place an extra screen over the measuring cable for additional protection, or run it through a metal tube or pipe.

5.3.1 Connector pin assignment

The model 8427 tension and compression load cell is supplied with an open cable end. The model 8427 tension and compression load cell is optionally fitted with connectors for burster display and calibration equipment.

Hinweis: For optionally supplied display and calibration devices, please follow the operating instructions for the device to ensure compatibility.

Wire colors for model 8427 tension and compression load cell with open cable ends

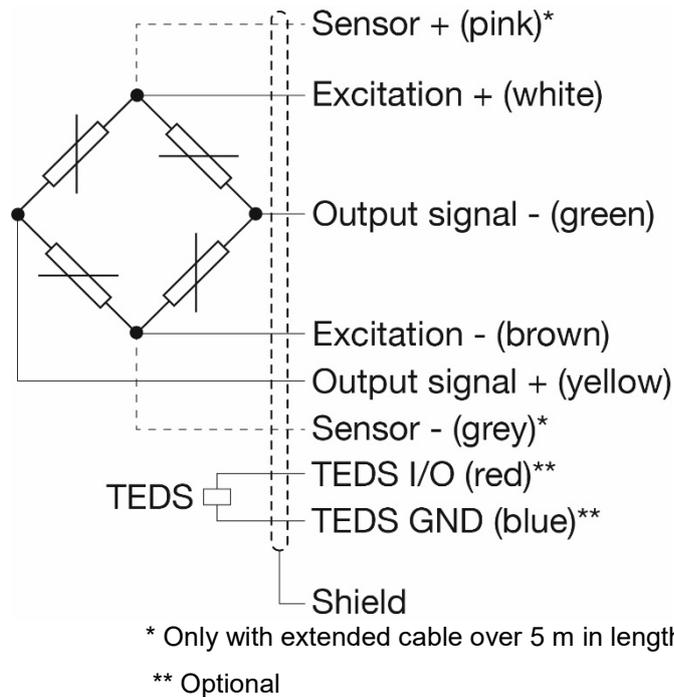


Figure 5: Wire colors for model 8427 tension and compression load cell

5.3.1.1 Option 8427-xxxx-xxBxxxxx

Connection to burster devices with 9-pin D-sub socket with 6-wire system

WICHTIG: The tension and compression load cell cannot be connected to the 9163 device with this pin assignment.

Tension and Compression Load Cell 8427

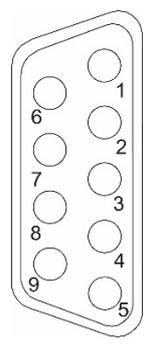


Figure 6: Device connection

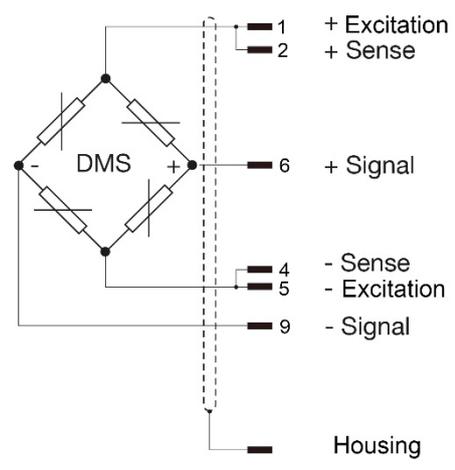


Figure 7: 9-pin connection with 6-wire system

5.3.1.2 Option 8427-xxxx-xxTxxxxx

Connection to burster devices with 9-pin D-sub socket with 6-wire system with burster TEDS.

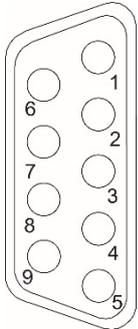


Figure 8: Device connection

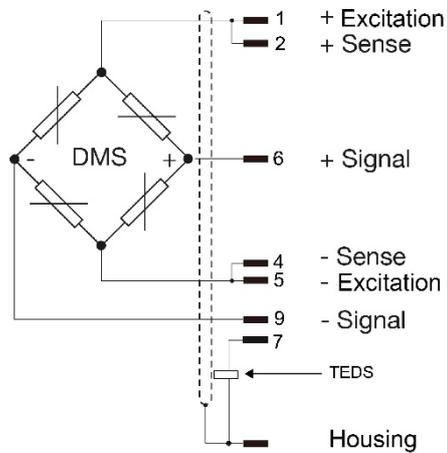


Figure 9: Connection to 9-pin burster TEDS

5.3.1.3 Option 8427-xxxx-xxExxxxx

Connection to burster devices with 9-pin D-sub socket with 4-wire system for 9163-V3xxx.

WICHTIG: Only applicable to 9163 digital indicator.

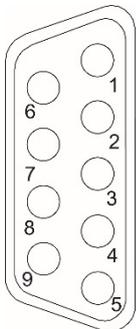


Figure 10: Device connection

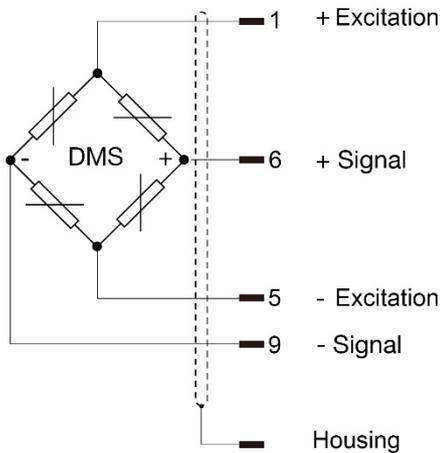


Figure 11: 9-pin connection with 4-wire system

Tension and Compression Load Cell 8427

5.3.1.4 Option 8427-xxxx-xxFxxxxx

Connection to burster devices with 12-pin round connector.

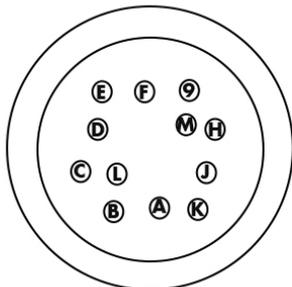


Figure 12: Device connection

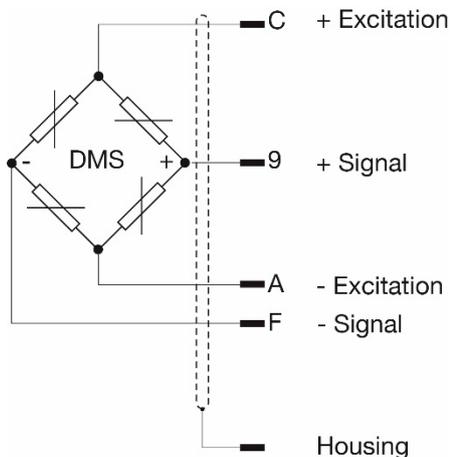


Figure 13: 12-pin round connector pin assignment

5.3.1.5 Option 8427-xxxx-xxHxxxxx

Connection with 8-pin connector.

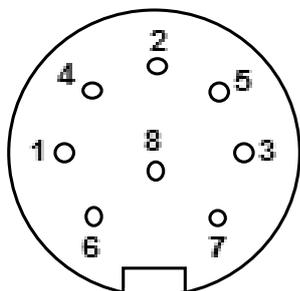


Figure 14: Solder side

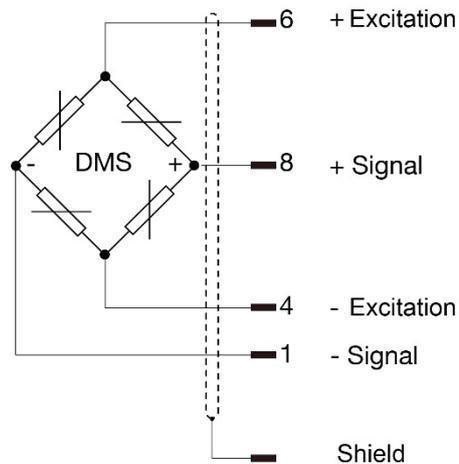


Figure 15: 8-pin connector pin assignment

6 Measurement chain calibration

Model 8427 tension and compression load cells are precalibrated. Each model 8427 tension and compression load cell has an individual test and calibration certificate, which you can download via a download link or from the burster website (www.burster.com).

The downstream electronics must be calibrated for the respective model 8427 tension and compression load cell. This calibration is a basic setup requirement for measurement chains consisting of a sensor and instrumentation amplifier or digital indicator.

6.1 Calibration using data from the test and calibration certificate

You can calibrate the downstream electronics by entering the data directly from the test and calibration certificate. You can set the data manually using a strain gage simulator or calibration shunt.

6.2 Shunt calibration



This is how it works

1. Connect a precision resistor (calibration shunt) between the negative lead of the signal input and the negative lead of the reference excitation voltage.
2. The imbalance which this creates in the bridge circuit corresponds to a specific degree of strain, i.e. to a particular load applied to the sensor.
3. This results in a defined offset in the output signal, which can be used to calibrate the entire measurement chain.

Hinweis: The magnitude of the change in the output signal, and the value of the associated calibration shunt, can be found in the test certificate for your model 8427 tension and compression load cell. The load cell should be load-free and without any attachment parts before carrying out the shunt calibration.

6.3 Calibration with a physical variable

A known physical quantity is applied to the model 8427 tension and compression load cell, and the entire measurement chain consisting of the model 8427 tension and compression load cell and instrumentation amplifier or digital indicator is calibrated.



This is how it works

1. Relieve the load on the model 8427 tension and compression load cell.
2. Calibrate the zero point.
3. Apply a known reference weight to the model 8427 tension and compression load cell.
4. Calibrate this reference value.

WICHTIG: On request, burster can issue factory calibration certificates for sensors and the entire measurement chain. burster offers a recalibration service for these devices. At burster, measurements are carried out on reference-standard measuring equipment.

6.4 Calibration with a strain gage simulator

A strain gage simulator is a bridge simulation circuit, built from precision resistors, which can be put into various output states.



This is how it works

1. Connect the strain gage simulator (e.g. burster TRANS CAL 7281-V0001) to the instrumentation amplifier instead of the load cell and carry out the simulation by referring to the operating instructions for the devices concerned.
2. Simulate the zero point with a rated output of 0 mV/V.
3. Calibrate the zero point on the amplifier.
4. Simulate the rated output of the load cell by setting the output signal from the test certificate (e.g. 1.1003 mV/V).

Hinweis: For the most precise calibration possible, you must add the zero point to the rated output, as the rated output on the test certificate is measured with a tared zero point.

6.5 Calibration with a precision voltage source

The model 8427 tension and compression load cell is calibrated using a high-precision voltage source (e.g. burster TRANS CAL 7281-V0001, DIGISTANT® model 4423).



This is how it works

1. Simulate the zero point by short-circuiting the amplifier's signal inputs (signal+ / signal-).
2. Calibrate the zero point on the amplifier.
3. Connect the precision voltage source to the instrumentation amplifier's signal leads (signal+ / signal-) instead of the load cell.
4. Simulate the rated value of the load cell by setting the output signal at rated load.

Example

$$U_a = (c + S_o) * U_b$$

(U_a = output signal, c = rated output of the load cell, S_o = zero signal, U_b = reference excitation voltage)

Example calculation:

burster certificate values for the load cell:

Rated output: 1.1003 mV/V, zero signal: 0.0147 mV/V, reference excitation voltage: 5.022 V

$$(1.1003 \text{ mV/V} + 0.0147 \text{ mV/V}) * 5.022 \text{ V} = 5.59953 \text{ mV}$$

Hinweis: The excitation voltage of full-bridge strain gage sensors affects the result of the measurement. It is possible that the actual excitation voltage will vary slightly from the rated excitation voltage. If you want to verify the proper functioning of the instrumentation amplifier with voltage sources, you should use a precision digital voltmeter to measure the sensor excitation voltage and then calculate the calibration voltage.

7 Technical data

Please refer to the enclosed data sheet for the technical specification. The latest version of the data sheet is available at <https://www.burster.com/en/load-cells/p/detail/8427> or simply use the following QR code:



Figure 16: Technical data QR code

7.1 Electromagnetic compatibility

7.1.1 Interference immunity

Interference immunity in compliance with EN 61326-1:2013 and EN 61326-2-3:2006
Industrial environment

7.1.2 Interference emission

Interference emission in compliance with EN 61326-1:2013 and EN 61326-2-3:2006

8 Accessories available

Please refer to the enclosed data sheet for details of the accessories available. The latest version of the data sheet is available at <https://www.burster.com/en/load-cells/p/detail/8427> or simply use the following QR code:



Figure 17: Accessories available

9 Disposal



Instrument disposal

If your instrument is no longer usable, please comply with your legal obligations by disposing of the instrument described here in accordance with statutory regulations. You will then be helping to protect the environment!