

FACTORY TRENDS

Proprietary Factories
Turn-Key Factories

TENSION-CRITICAL PROCESSES

Electrode Manufacturing
Separator Manufacturing

DFE PERFORMANCE ADVANTAGES

Signal Output

Semiconductor vs Foil Strain Gage

Reliability

High EMI Environments
Beam Deflection & Deformation

Scalability

ADC & DAC Resolution

Longevity

5 Year Warranty
15-20 Year Typical Lifespan

MEASUREMENT & CONTROL

TA500, TA1, 1100TV,
SteadyWeb 6

LOAD CELL FORM FACTORS

Tension Roll, Narrow Web,
Segmented Tension Roll
Model C, Model F
Tension Cell™

FOR DESIGNERS

CAD Catalog
Application Assistance

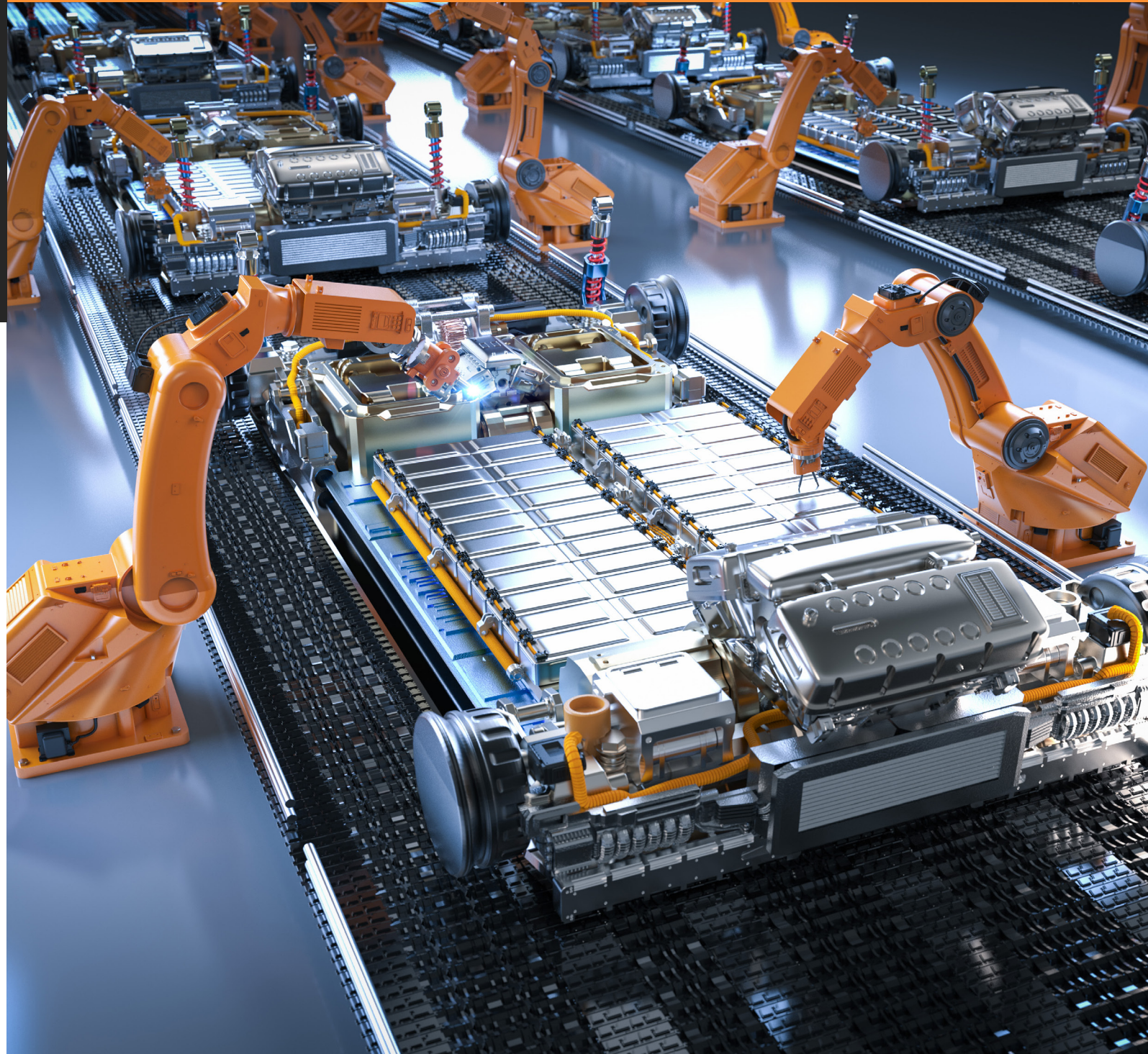


TENSION CONTROL SOLUTIONS FOR BATTERY MANUFACTURING

AN APPLICATION GUIDE

FACTORY TRENDS

As battery demand accelerates, so does the pace of technology development. Factory construction and optimization projects must consider production flexibility, scalability, speed and reliability.



PROPRIETARY FACTORIES

Battery manufacturers seeking to gain a performance or cost advantage are more likely to develop or optimize production processes and control systems in-house with dedicated engineering teams. While this approach can require a longer time investment, it can also enable maximum flexibility during equipment evaluation and deployment, helping to ensure the best components are selected to meet both performance and efficiency targets.

TURN-KEY FACTORIES

Some modular and continuous turn-key battery production lines leverage pre-engineered control systems with motivation components selected to operate within a pre-determined spec. While packaged systems can reduce the time needed to scale to full production, overall flexibility may be hindered if sub-par components with low performance or reliability are specified by an OEM. Selecting an OEM partner that offers choice in component selection can provide greater flexibility, performance and value over the long run.

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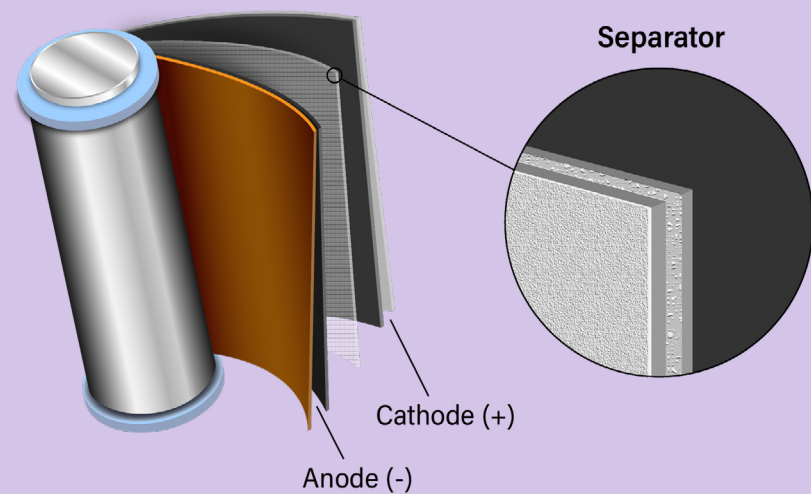
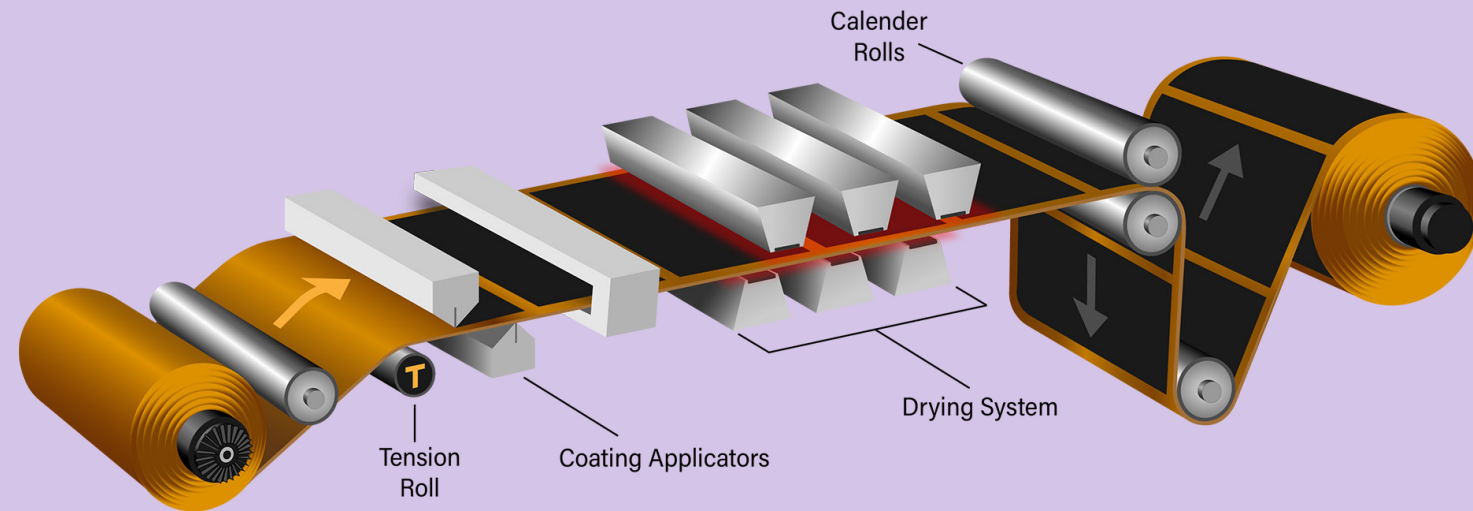
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TENSION-CRITICAL PRODUCTION PROCESSES

ELECTRODE MANUFACTURING

In battery electrode manufacturing a variety of processes may be employed including coating, drying, calendaring, inspection and slitting. Tension control is a critical part of each electrode manufacturing process. Without precise control the coating process may be inconsistent, resulting in voids that calendaring cannot adequately resolve. A careful balance between anode and cathode mass must also be achieved during the production and assembly process or an unbalanced battery cell could result. Electrode production runs may have to be scrapped altogether if it is determined engineering specifications have not been properly achieved.



SEPARATOR MANUFACTURING

Modern separator designs such as those used in Li-ion battery production vary in composition. Some designs consist of porous polyethylene membranes sandwiched between polypropylene layers. Other designs may employ a combination of modified PE membranes layered together with nanoparticle composite. Some separators also have coatings applied to influence properties such as strength, dimensional stability and temperature resistance. The successful management of tension at each step of a separator's manufacture is crucial. Closed-loop tension control utilizing load cell (transducer) feedback is an effective way to ensure performance and quality targets are met at each stage of production.

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CAD Catalog
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Proprietary Factories
Turn-Key Factories

TENSION-CRITICAL PROCESSES

Electrode Manufacturing
Separator Manufacturing

DFE PERFORMANCE ADVANTAGES

Signal Output
Semiconductor vs Foil Strain Gage

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High EMI Environments
Beam Deflection & Deformation

Scalability
ADC & DAC Resolution

Longevity
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15-20 Year Typical Lifespan

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TA500, TA1, 1100TV,
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SIGNAL OUTPUT

Maximize your control response with the best sensors available. DFE's high dynamic range semiconductor strain gauges provide up to **33 times more signal output** than competing foil gauge systems. Struggles with signal attenuation and the noise floor are a thing of the past.

100:1 Output
SEMICONDUCTOR

3:1 Output
FOIL

RELIABILITY

DFE's unique dual-cantilever beams have a lower chance of beam deformation during tension spikes or wrap-up incidents. Semiconductor strain gauges also deliver full output with less mechanical deflection. This reduces material stress, enabling load cell designs with up to 5X overload protection, two times more than typical foil gauge load cells.

Overload Capability
SEMICONDUCTOR

Overload Capability
FOIL

SCALABILITY

Factories evolve and change over time. DFE's HDR load cells combined with high resolution amplifiers, indicators and controllers provide the flexibility to swap between applications without suffering a significant drop in performance. Save money by repurposing higher tension load cells in lower tension measurement zones or by standardizing on fewer load ratings, reducing the number of spare parts that must be kept in inventory.

LONGEVITY

DFE is confident its products deliver the highest ROI in the industry. Load cells, controllers, amplifiers, pneumatic brakes and idler rolls are all designed and manufactured in the USA and covered by an industry-leading 5 year warranty. Under typical operating conditions, DFE load cells deliver a 15 to 20 year service life. Under light duty conditions some load cells may even last 30 years or more. When load cells finally fail, repair services are available for customers that prefer to conserve, rather than throw away equipment.



MEASUREMENT & CONTROL INTERFACES

TA500 ETHERNET TENSION AMPLIFIER

Offering both high resolution and speed, the TA500 is available with EtherCAT®, EtherNet/IP™ and PROFINET connectivity for convenient integration with popular PLC brands.

TA1 TRUETENSION™ AMPLIFIER

An inexpensive, easy to use signal amplifier with digital Quik-Cal™ push-button calibration functionality. The TA1 provides highly stable 0-10 VDC and 4-20 mA analog signal outputs in a space-saving package.

TRUEVIEW™ 1100 DISPLAY INDICATOR

Machined from a solid block of billet aluminum, this durable, easy to use touchscreen display enables rapid setup with flexible calibration options. Provides 0-10 VDC and 4-20 mA analog signal outputs. Hardware included to support panel, pole or DIN rail mounting.

STEADYWEB 6™ TENSION CONTROLLER

A stand-alone tension controller with simple touchscreen interface. Ready to run out of the box for most applications. Simple to adjust using the TuneView™ display mode. Interfaces with most drives and electric or pneumatic clutches and brakes. Panel-mount and enclosure versions available.

AMPLIFIER, INDICATOR AND
CONTROLLER INTERFACES
ENERGIZE LOAD CELL STRAIN
GAUGES AND RECEIVE A
RETURN SIGNAL THAT IS
PROPORTIONAL TO TENSION

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DFE tension load cells are available in a variety of different form factors to suit a wide range of mounting footprints and orientations. Each load cell utilizes semiconductor strain gauge technology for a superior signal to noise ratio and service life.

DFE developed and patented the first shaft-centric, integral load cell roller in 1987, aptly named, the **Tension Roll®**. It is one of the most popular OEM and refit load cells due to its ability to be custom specified for specific lengths, diameters, load ratings and roll finishes. Low inertia roll shells and low drag bearings are also available.



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Application Assistance

TENSION ROLL®

The ultimate in performance and convenience. Built to your specifications for easy installation and integration. Its precision balanced roll shell is available in aluminum, steel or stainless steel.

MODEL C

The industry standard in cartridge type load cells. Five mounting styles for easy adaptation between an idler roller and your mounting footprint. Compatible with live or dead shaft rollers.

MODEL F

Designed and tested for use in harsh environments, the Model F is perfect for mounting under pillow block bearings with live shaft rollers. Horizontal and vertical force directions are available.

NARROW WEB

A cantilevered version of the Tension Roll®, well-suited for mounting on single-sided machine frames. Available with and without a display indicator mounted in the end of the roll.

SEGMENTED TENSION ROLL®

Perfect for slitting and parallel processing applications. Each roll segment employs two sensing beams to measure tension across the roll face. Configurable with up to 10 roll segments.



TENSION CELL™

TensionCell™ is an elite variant within the Tension Roll® and Narrow Web (cantilevered) transducer product lines. Both designs feature a thin wall, precision-machined and balanced 6 inch diameter roll shell riding on low-drag bearings. The increased roll diameter supports electrode manufacturing applications with larger bend radius requirements.

The high-resolution TensionCell™ is able to sample low tension applications with measurement increments landing comfortably in the microgram range. Available with a dye-free, natural hard coat anodize roll finish, the TensionCell™ is also abrasion and corrosion-resistant for a long service life.

Each TensionCell™ is manufactured in the USA and covered by DFE's industry-leading 5 year warranty.



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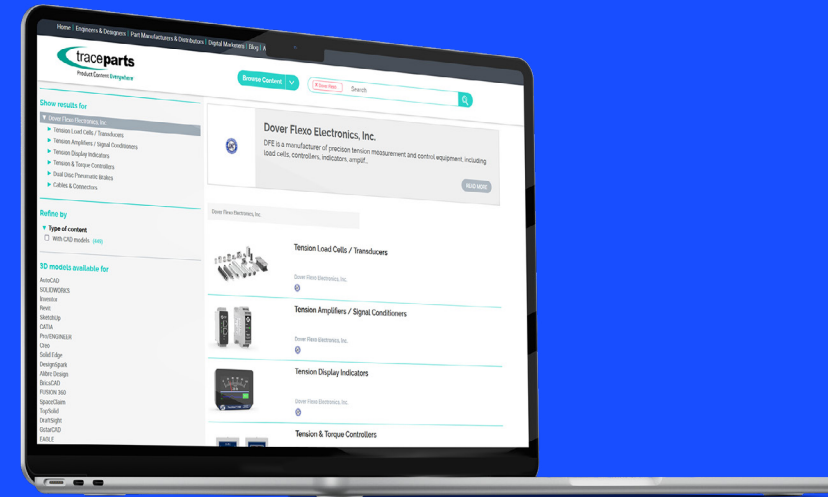
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CAD CATALOG & APPLICATION ASSISTANCE

The DFE CAD catalog contains models of our most popular products available for download in over 60 native CAD formats. Models can also be browsed and imported from within popular CAD programs such as SolidWorks® and Fusion360® using the TraceParts® connector.



APPLICATION SPECIALISTS READY TO ASSIST

DFE applications engineers have extensive experience assisting process engineers and mechanical designers in the battery, aerospace, medical, pharmaceutical, packaging, converting (paper, film, foil), wire & cable, textile and automotive industries.

Contact our sales team today for expert design assistance while quoting your next tension control system.



PHONE: 603.332.6150

E-MAIL: SALES@DFE.COM

WEB: WWW.DFE.COM

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