For more efficiency.

VSB TECHNICAL UNIVERSITY OF OSTRAVA

in cooperation with Fraunhofer

PROMESS
ASSEMBLY + SENSOR TECHNOLOGY

PROMESS
Assembly + Sensor Technology

100% Quality monitoring in the production of bipolar plates and in the stacking process

Using Servo-electric Assembly Presses

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PROMESS

Assembly + Sensor Technology - Made in Berlin, Germany!

CERTIFIED ISO 9001:2015 CERTIFIED

CERTIFIED ISO 14001 CERTIFIED

CERTIFIED DAkkS CERTIFIED

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PROMESS

Assembly + Sensor Technology

1977
Founded as an engineering office in the field of production measurement

1980
Foundation of **PROMESS Ges. für produktions-technisches Messen mbH**

1984
Formation of **PROMESS Inc**. in Brighton, USA

1989
Foundation of **PROMESS Gesellschaft für Montage- und Prüfsysteme mbH**

2004
Foundation of **PROMESS Ltd.** in Manchester and cooperation with **SystenceLtd.** in Shanghai

2015
Investment in own mechanical production

2021
Expansion through the construction of another building

Today
Represented in over **30 countries worldwide**

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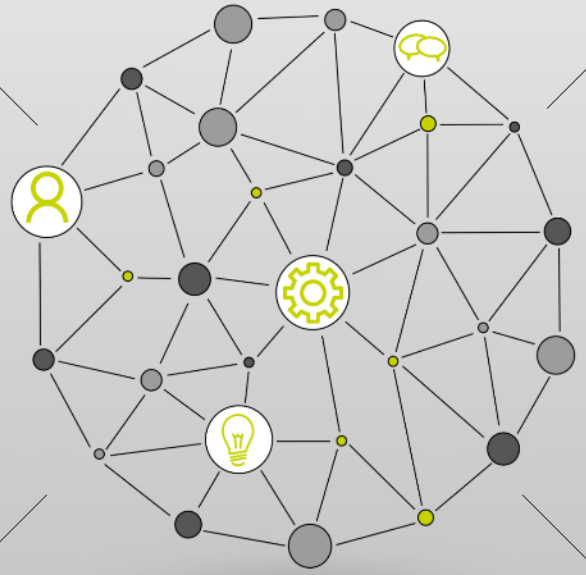
PROMESS

One of the world's leading press manufacturers

Over **200 employees** worldwide,
including 110 in Berlin

Worldwide over
30,000 joining units in use



Represented in over **30 countries**

Worldwide **service and sales network**

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References

Universal assembly presses

The mechanics

AC servo motor with absolute encoder
(Optional: holding/safety brake)

Central lubrication opening

Optimized price-performance **ratio** and **short delivery times** thanks to standardization and large-scale production

Non-rotating ram

Steel housing

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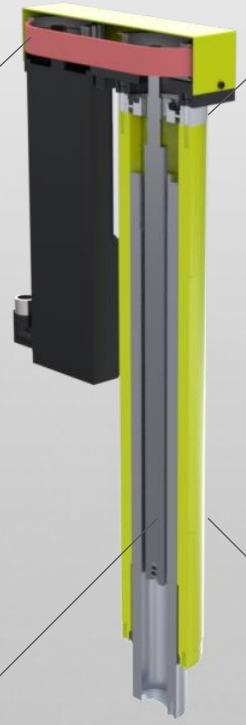
Universal assembly presses

The mechanics

Belt / reversing gear or inline design



Internal or external force transducer (DMS/Piezo), up to 0.1% accuracy in relation to nominal load)

Ball / planetary roller screw drive (safety factor dyn. load rating min. 2.5)

Assembly presses with **robust design** (> 15 million strokes, up to 10 years warranty)

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Spectrum of universal assembly presses

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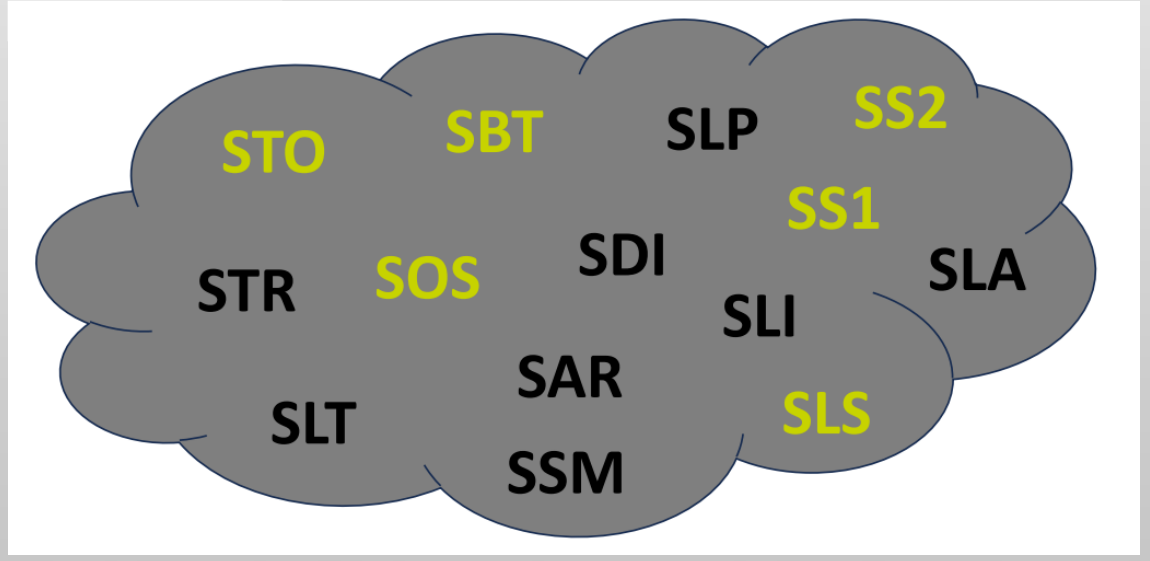
Wide range of security functions

Safety technology in accordance with current DIN EN ISO 16092

- **Operator intervention in the workspace while the fuel cell stack is actively compressed by the assembly press, e.g. for clamping process,**
- **Safety functions such as: SOS, SS2** are required**,**

  Safety brake activated if necessary (service stop),

  Regular automated **testing of the Brake**



- Safety functions can be **achieved** with **performance level d or e**

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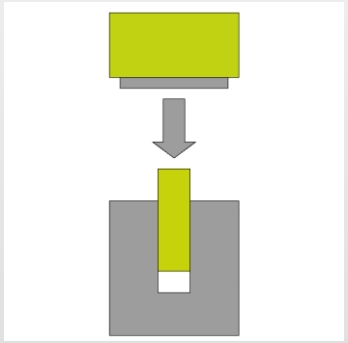
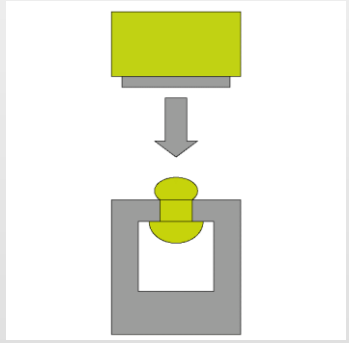
General application examples

Proven assembly processes with universal assembly presses

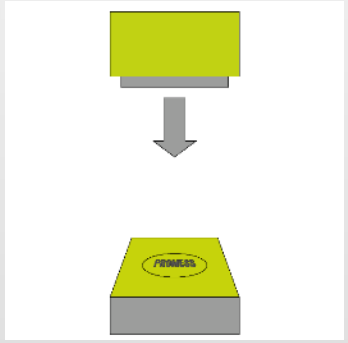
Pressing



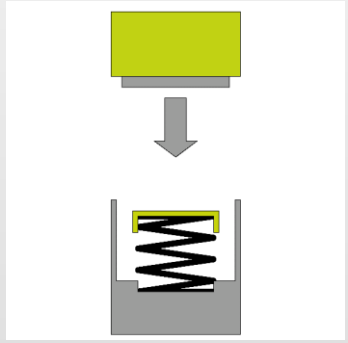
Riveting



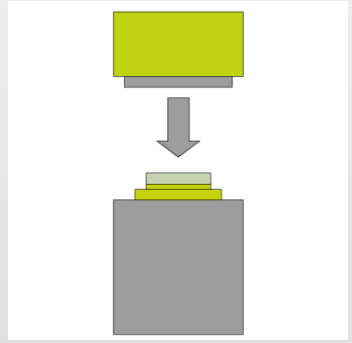
Embossing



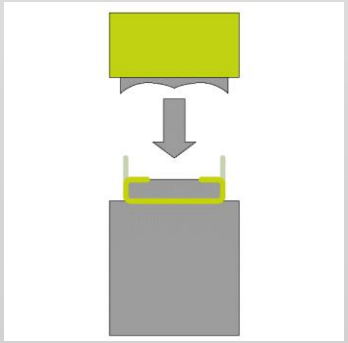
Testing/measuring



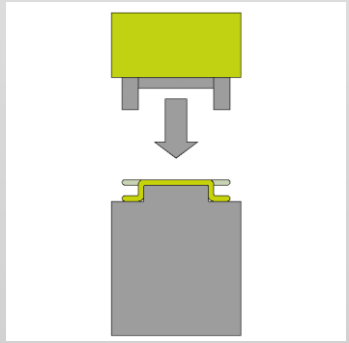
Check haptics



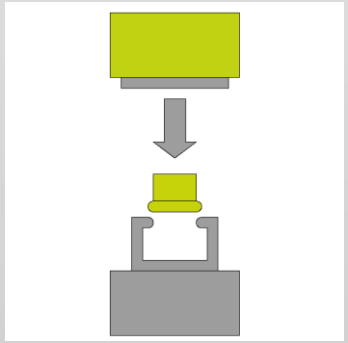
Bending



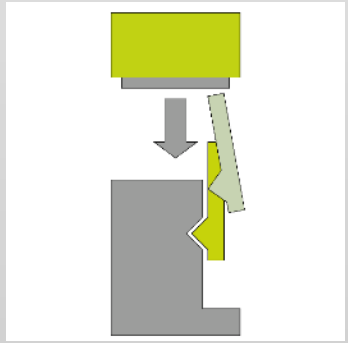
Deep drawing



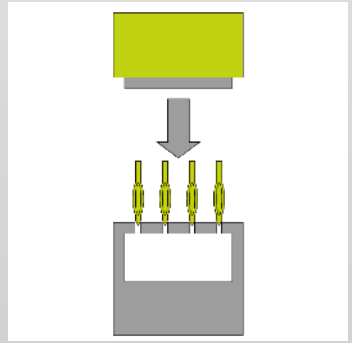
Clipping



Engaging



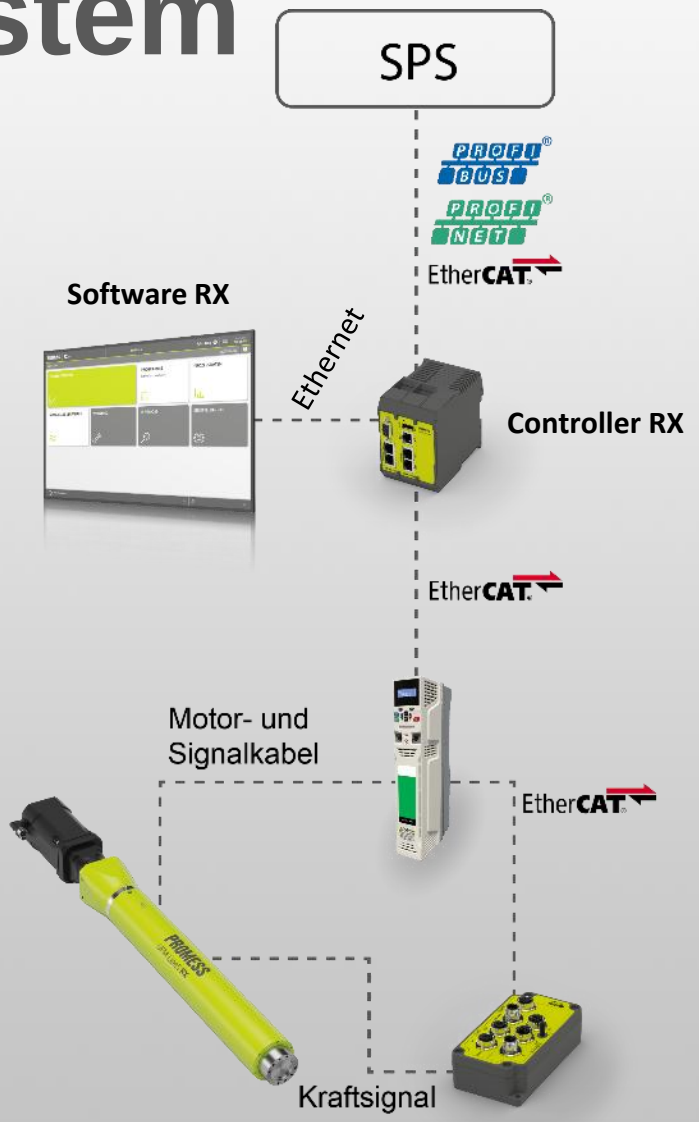
Press-Fit



The PROMESS joining system

Revolution X

- **Controller RX** as the **central connecting element**
- **Software** runs **on Controller RX**
- **Integrated fieldbus** (can be parameterized via software)
- Support for **various Servo Drives**



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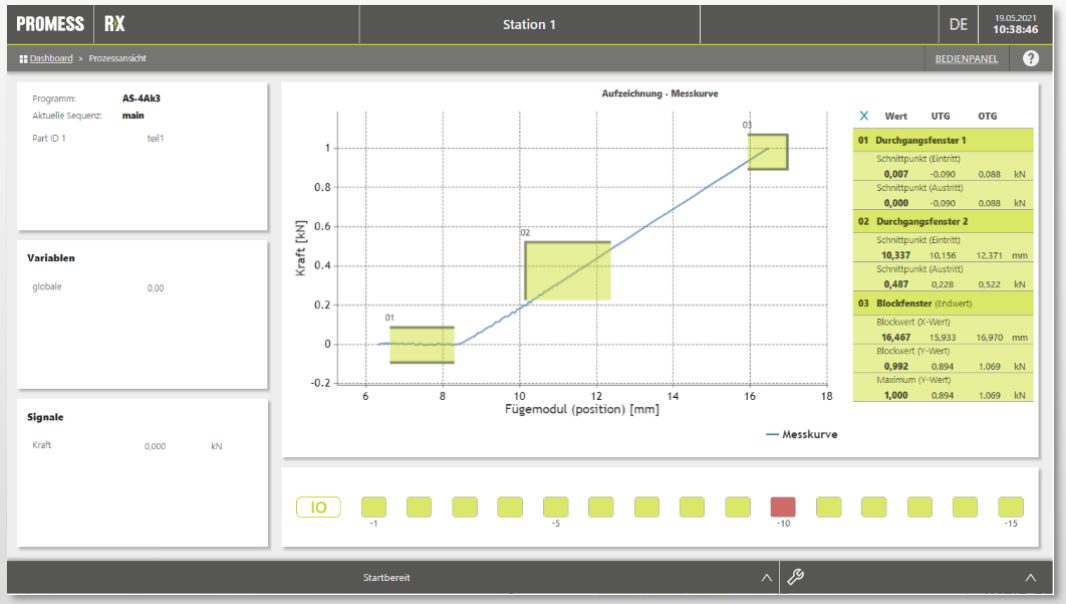
Revolution X

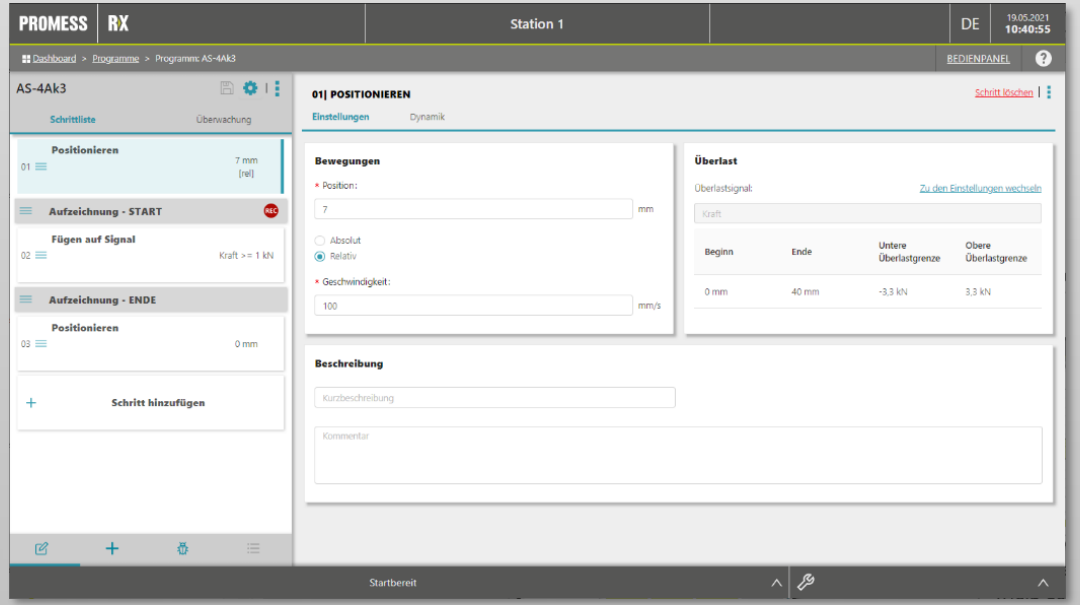
Parameterization and operating software

- **Step list editor with process monitoring**
- Intuitive **web interface** (UX design)
- Display in all common browsers,

→ **No additional PC** required

- Diagnostic functions, **integrated online help**
- **Fast cycle time** (0.5 ms / 2 kHz)





Multi-sensor technology

Revolution X

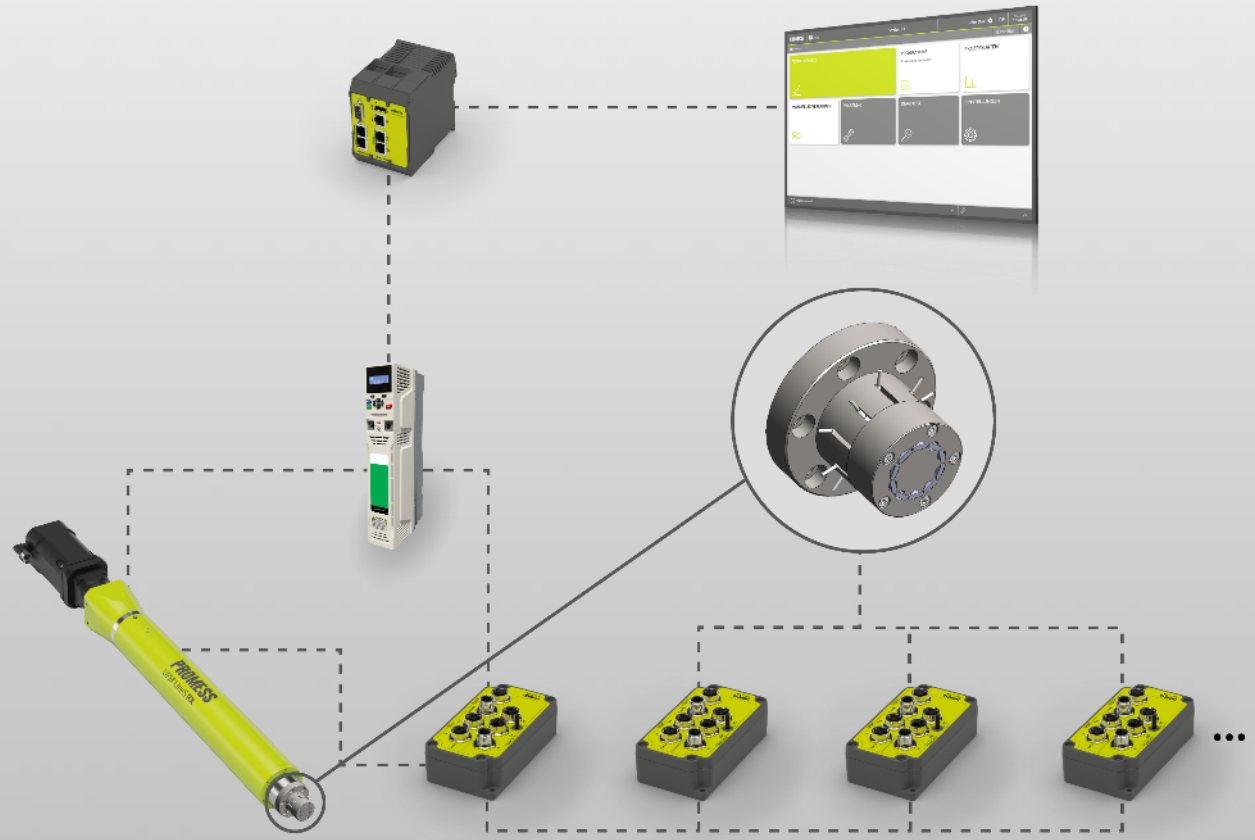
- **Individual force-displacement monitoring**

  for several sensors

- Support for **up to 12 PDMs**

- Up to 16 signals + time

  Up to **12 sensor signals** and 4 buttons



Multi-axis control

Revolution X

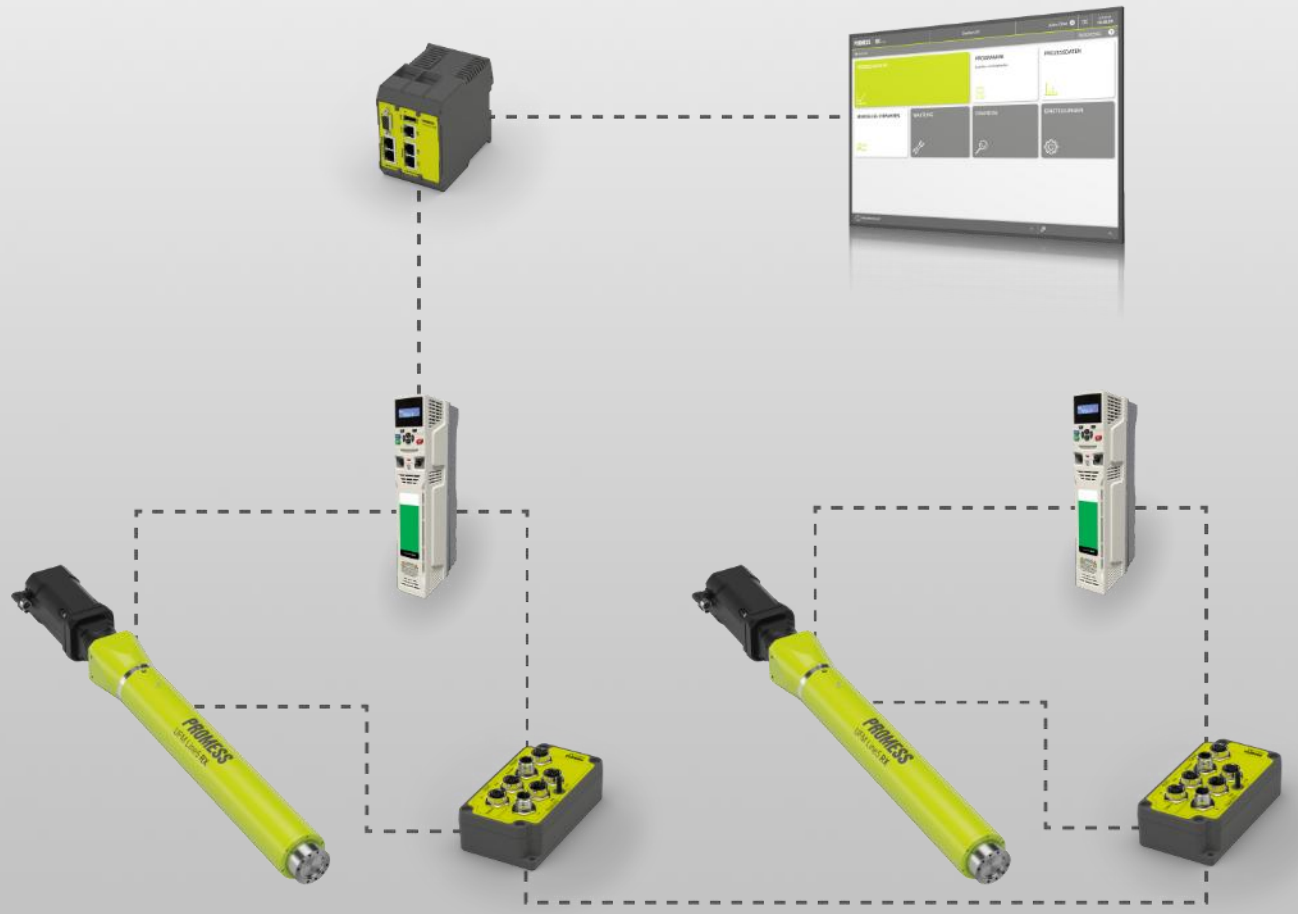
- Support of processes with **Up to 4 axes**

  (with one start signal)

- Couple axes temporarily/permanently

  (**synchronous driving**)

- Offset at 100 mm/s ≈ 0.1 µm (+ position error)



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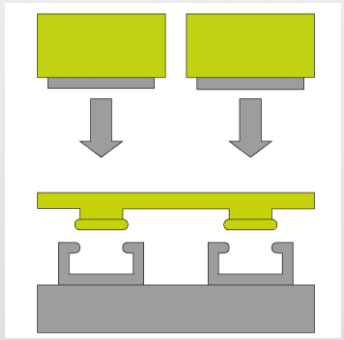
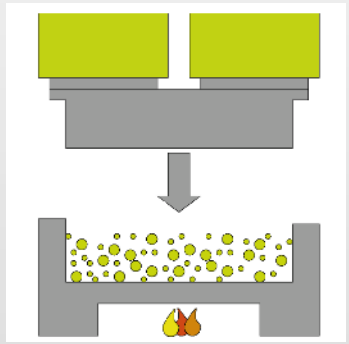
Application examples multi-sensor technology / multi-axis

More options thanks to flexibility and speed

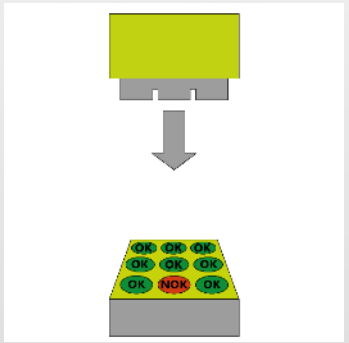
Temporary coupling



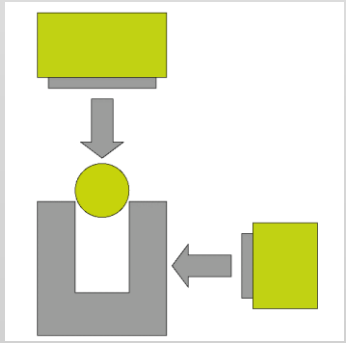
Sintering



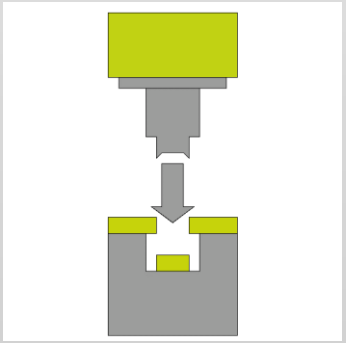
Multi part joining



Complex processes



Punching



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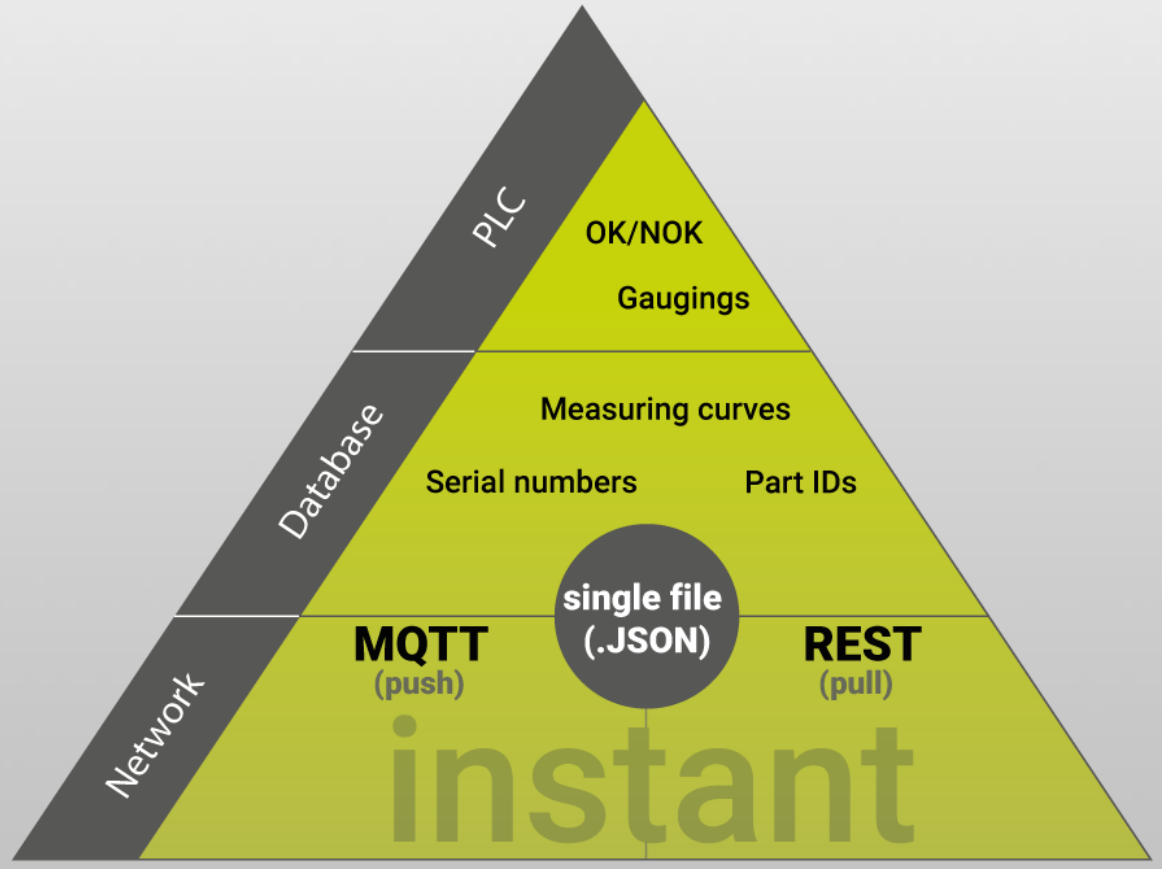
Data storage

Prepared for the future

- **PLC-transfer** of **gaugings** and monitoring **results**
  - Intuitiv **PLC-editor** in RX
- **Data storage** on Controller RX
  - **DDS RX** to retrieve **.**JSON files
- **Modern network interfaces**

  REST API

  MQTT (Data + automation)



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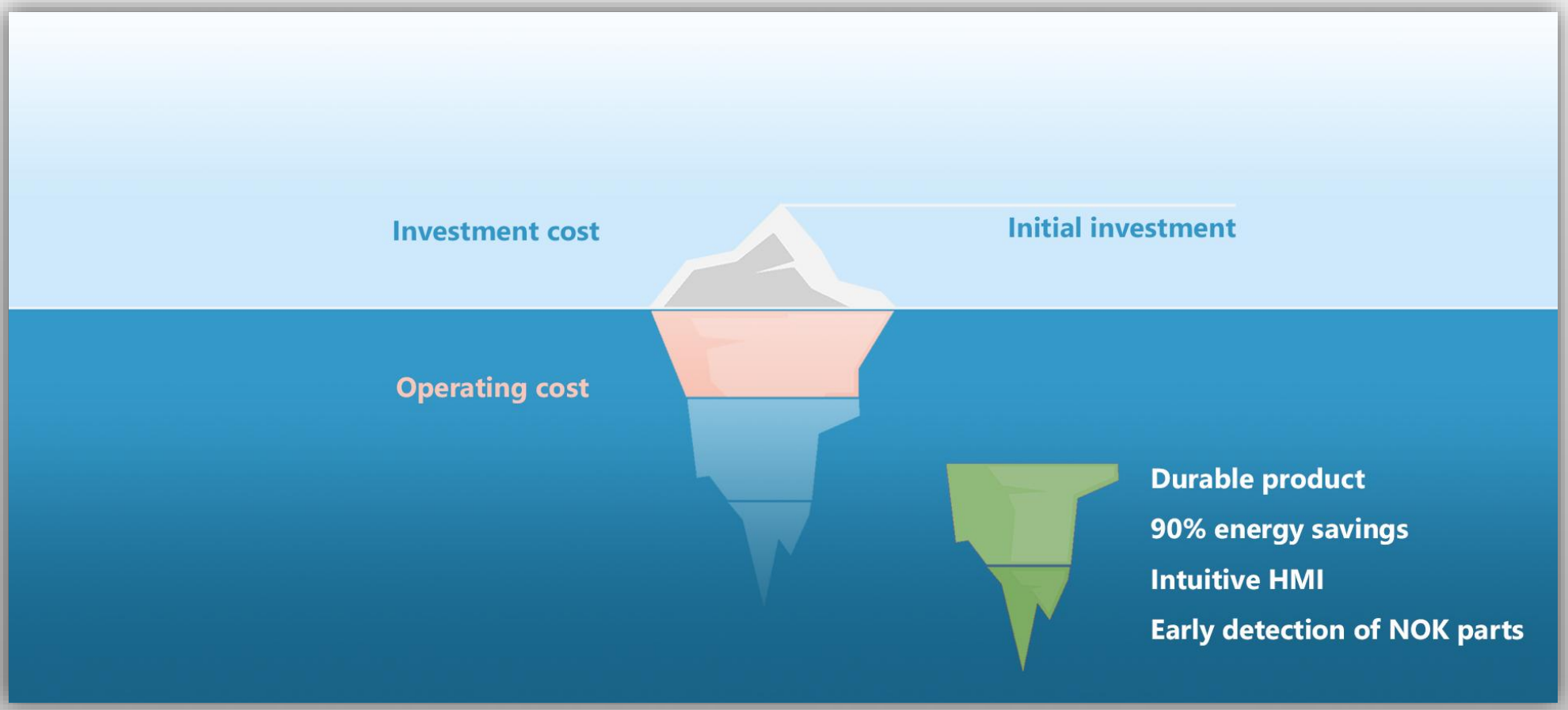
Why PROMESS?

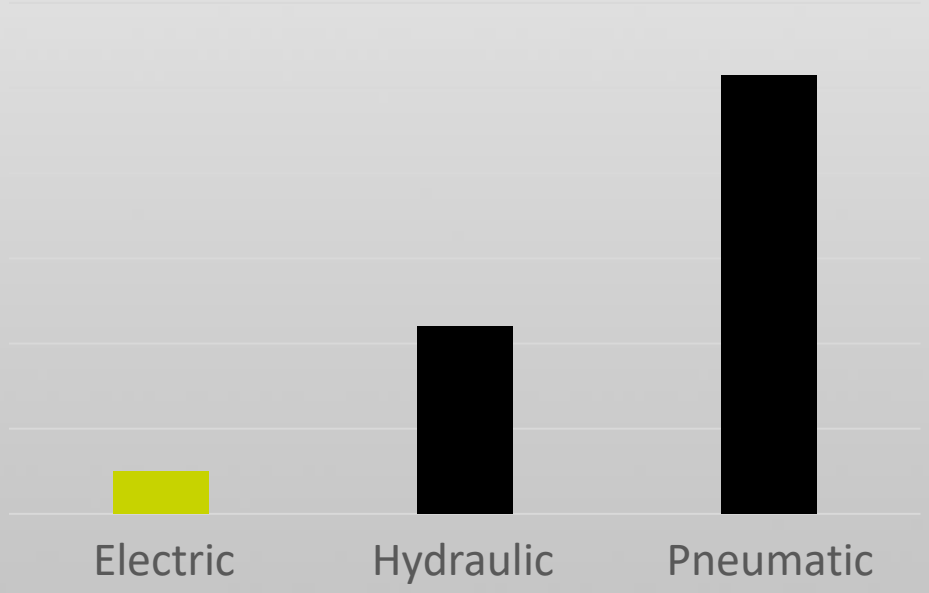
Reduction of operating cost



Energetically superior with Electrical Assembly Presses

Resource-saving production and making a contribution to climate protection

	Electric	Hydraulic	Pneumatic
Energy Consumption	816 kWh	3602 kWh	8380 kWh
CO2 emissions	525 kg	2,3 t	5,3 t



Savings

of **up to 90 %**

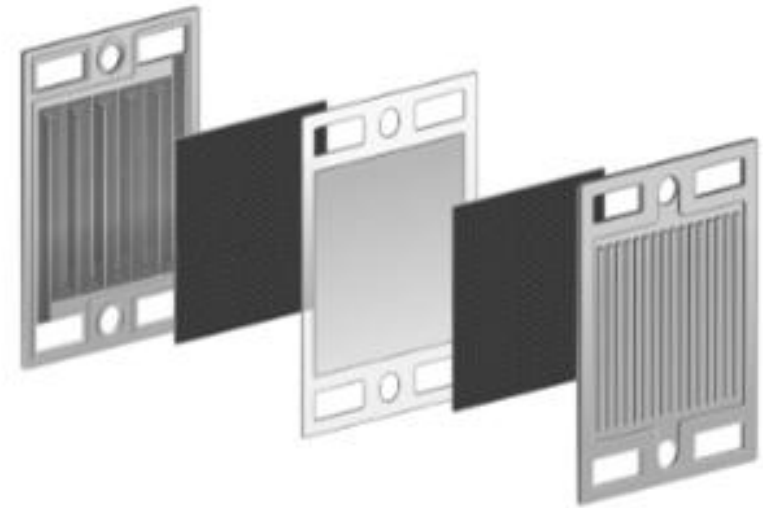
Movement of a 100 kg block over 6000 hours

Source: C. Pohl/C. Becker/J. Hesselbach: Electro mechanical actuators as key for energy efficiency for linear movements

From the component to the fuel cell system

Application for servo-electric assembly presses in the manufacturing process

Fuels cell stack Components



Fuels cell stack

Fuels cell stack System

Source: PRODUKTION VON BRENNSTOFFZELLEN-KOMPONENTEN, 2nd edition, PEM of RWTH Aachen University, VDMA, Heimes, Kehrer, Hagedorn, Hausmann, Krieger, Müller

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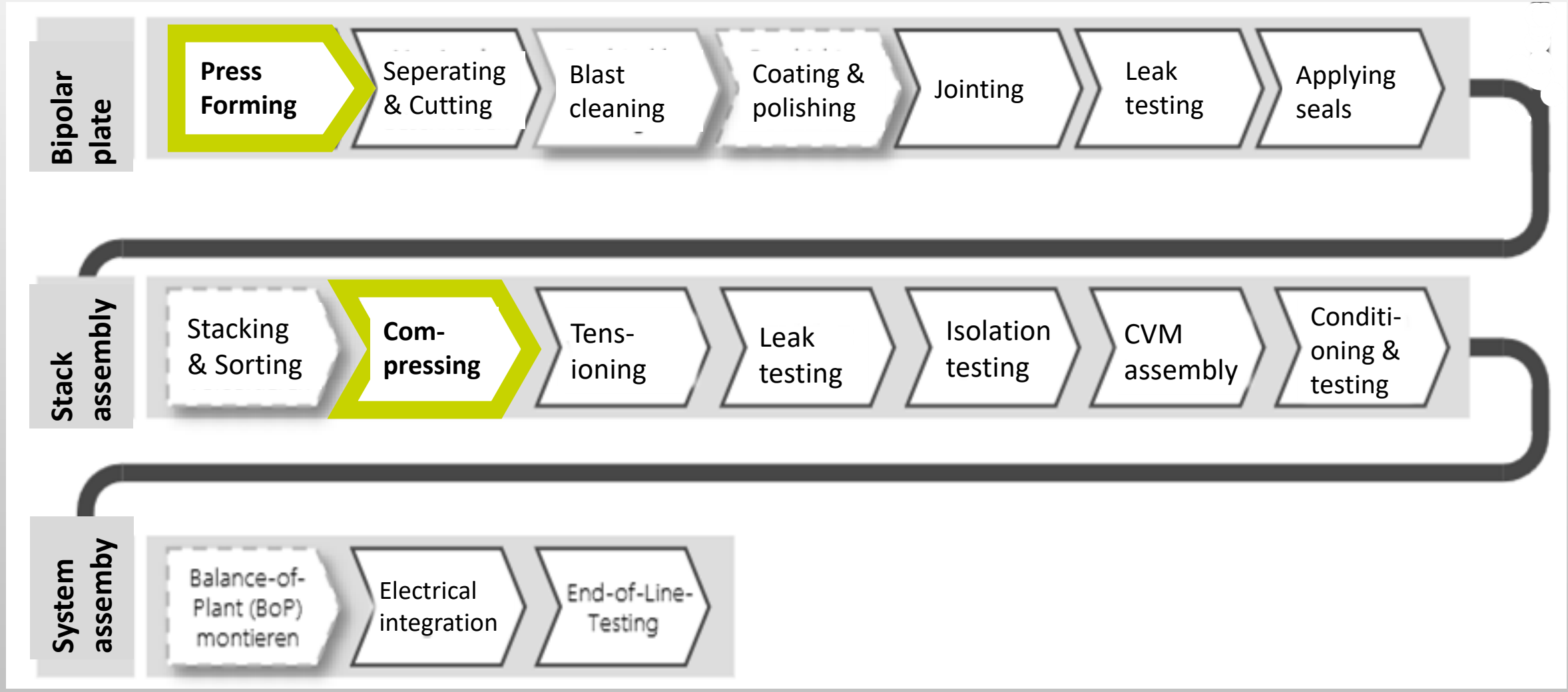
From the component to the fuel cell system

Application for Servo-electric Assembly Presses in the manufacturing process

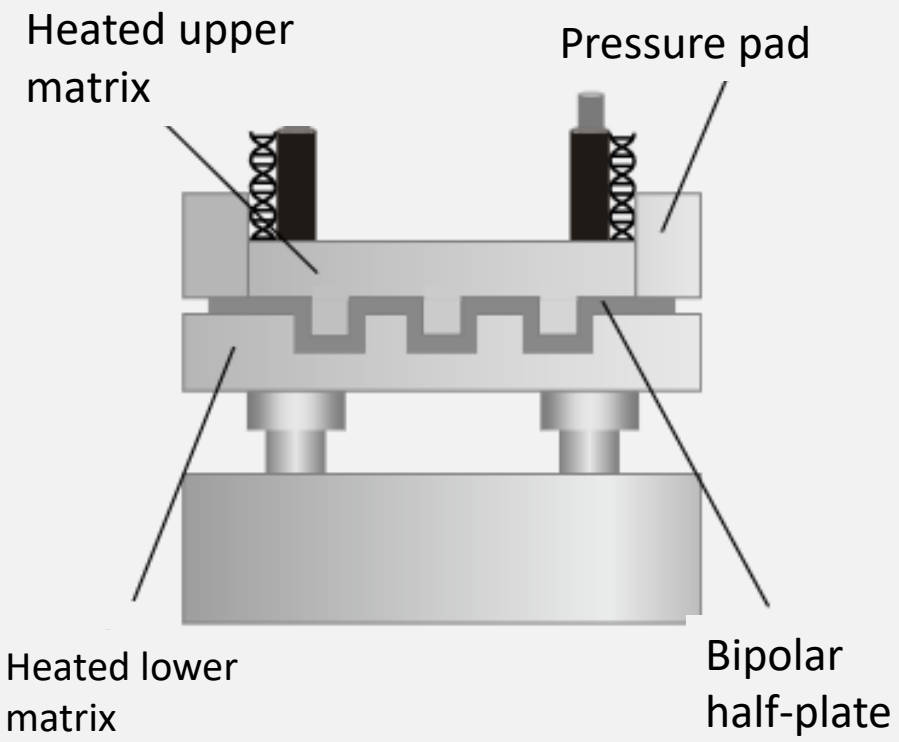


Source: PRODUKTION VON BRENNSTOFFZELLEN-SYSTEMEN, 1st edition, PEM of RWTH Aachen University, VDMA, Heimes, Kehrer, Hagedorn, Hausmann, Krieger, Müller

Graphite bipolar plate / compression molding

Application of Universal Assembly Presses with force-distance monitoring

Form Pressing



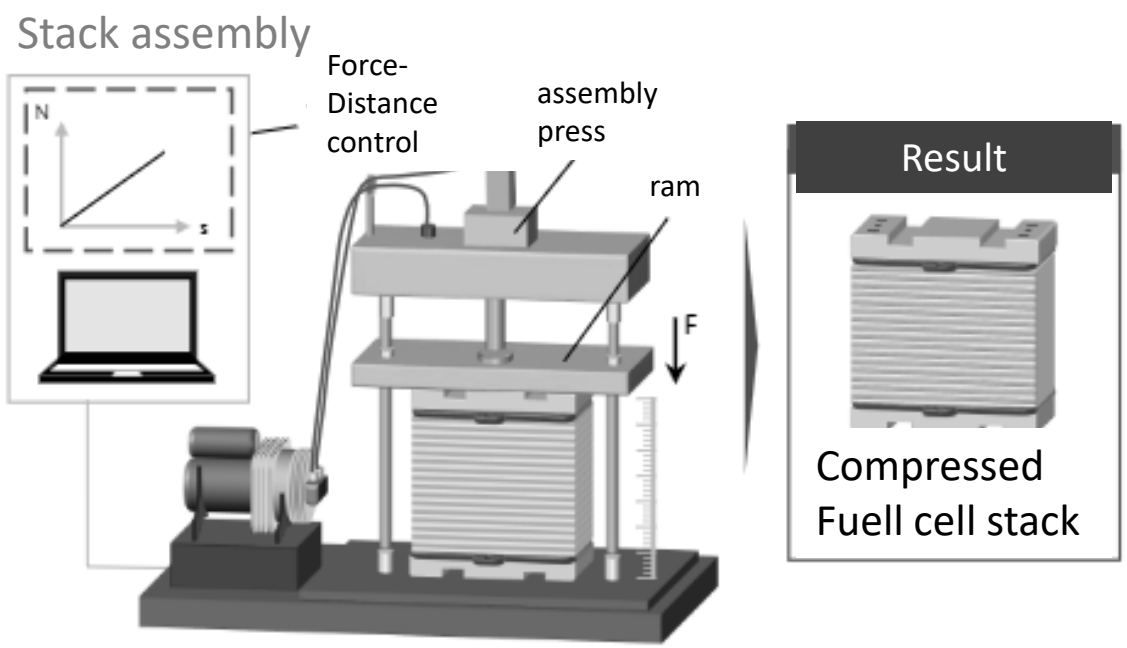
- **Compression molding requires a press, molding tool and molding compound.**
- **Parameters such as hold-down or pressing force** should be precisely adjustable.
- Excess molding compound fills cavities.
- Losses due to high process scrap rates and excess material

Source: PRODUKTION VON BRENNSTOFFZELLEN-KOMPONENTEN, 2nd edition, PEM of RWTH Aachen University, VDMA, Heimes, Kehrer, Hagedorn, Hausmann, Krieger, Müller

Stacking / Compressing

Application of Universal Assembly Presses with force-distance monitoring

Compressing



Process parameters:

- **Pressing force (product-dependent) 60 - 2000 kN, for metallic bipolar plates**
- **Uniform contact pressure**
- **Press stroke (depending on product) 10-300mm**
- **Process time 150 sec. to 30 min. per stack**

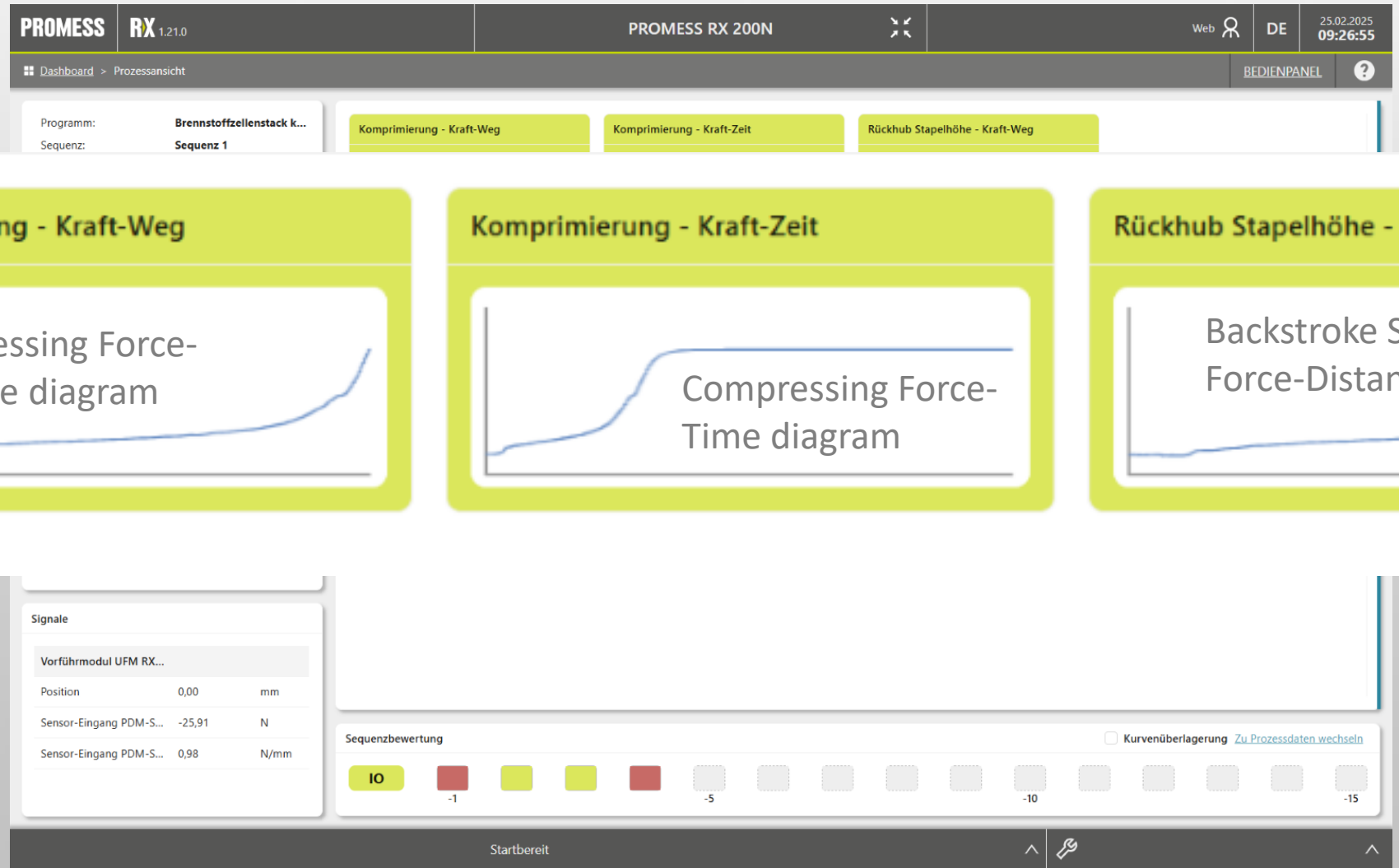
Quality influences:

- **Press force and distance measurement, accuracy +/- 1%**
- **Process speed**

Source: PRODUKTION VON BRENNSTOFFZELLSYSTEMEN, 2nd edition, PEM of RWTH Aachen University, VDMA, Heimes, Kehrer, Hagedorn, Hausmann, Krieger, Müller

Stacking / Compressing

Application of Universal Assembly Presses with force-displacement monitoring



Komprimierung - Kraft-Weg

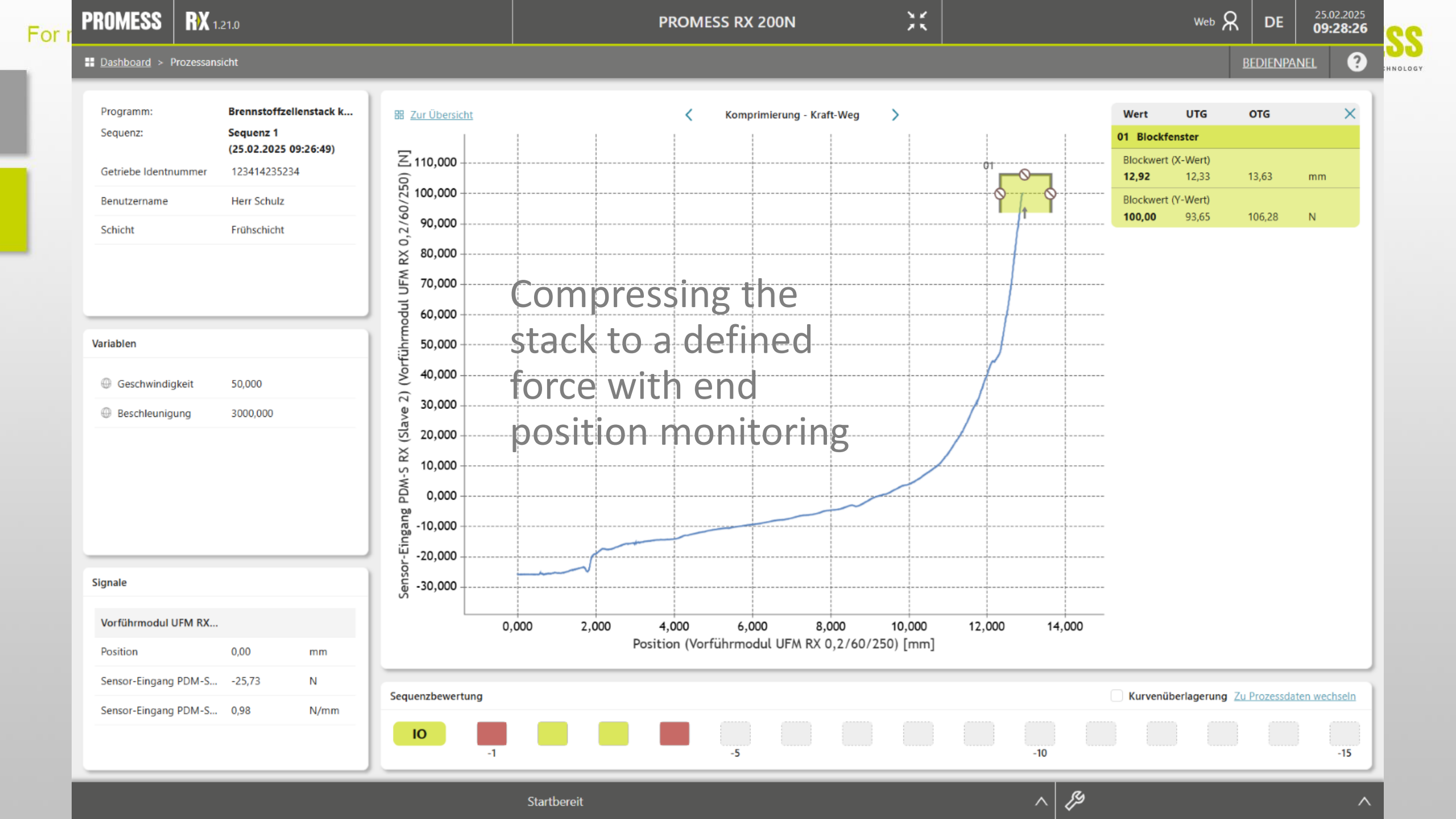
Compressing Force-Distance diagram

Komprimierung - Kraft-Zeit

Compressing Force-Time diagram

Rückhub Stapelhöhe - Kraft-Weg

Backstroke Stack height Force-Distance diagram


PROMESS
RX 1.21.0
PROMESS RX 200N
Web
DE
25.02.2025
09:28:26
Dashboard > Prozessansicht
BEDIENPANEL
Programm: Brennstoffzellenstack k...
Sequenz: Sequenz 1 (25.02.2025 09:26:49)
Getriebe Identnummer 123414235234
Benutzername Herr Schulz
Schicht Frühschicht
Variablen
Geschwindigkeit 50,000
Beschleunigung 3000,000
Signale
Vorführmodul UFM RX...
Position 0,00 mm
Sensor-Eingang PDM-S... -25,73 N
Sensor-Eingang PDM-S... 0,98 N/mm
Zur Übersicht
Komprimierung - Kraft-Weg
Sensor-Eingang PDM-S RX (Slave 2) (Vorführmodul UFM RX 0,2/60/250) [N]
Position (Vorführmodul UFM RX 0,2/60/250) [mm]
Compressing the stack to a defined force with end position monitoring
Wert UTG OTG
01 Blockfenster
Blockwert (X-Wert)
12,92 12,33 13,63 mm
Blockwert (Y-Wert)
100,00 93,65 106,28 N
Sequenzbewertung
Kurvenüberlagerung
Zu Prozessdaten wechseln
IO
Startbereit

Programm:	**Brennstoffzellenstack k...**
Sequenz:	**Sequenz 1 (25.02.2025 09:26:49)**
Getriebe Identnummer	123414235234
Benutzername	Herr Schulz
Schicht	Frühschicht

Variablen

Geschwindigkeit	50,000
Beschleunigung	3000,000

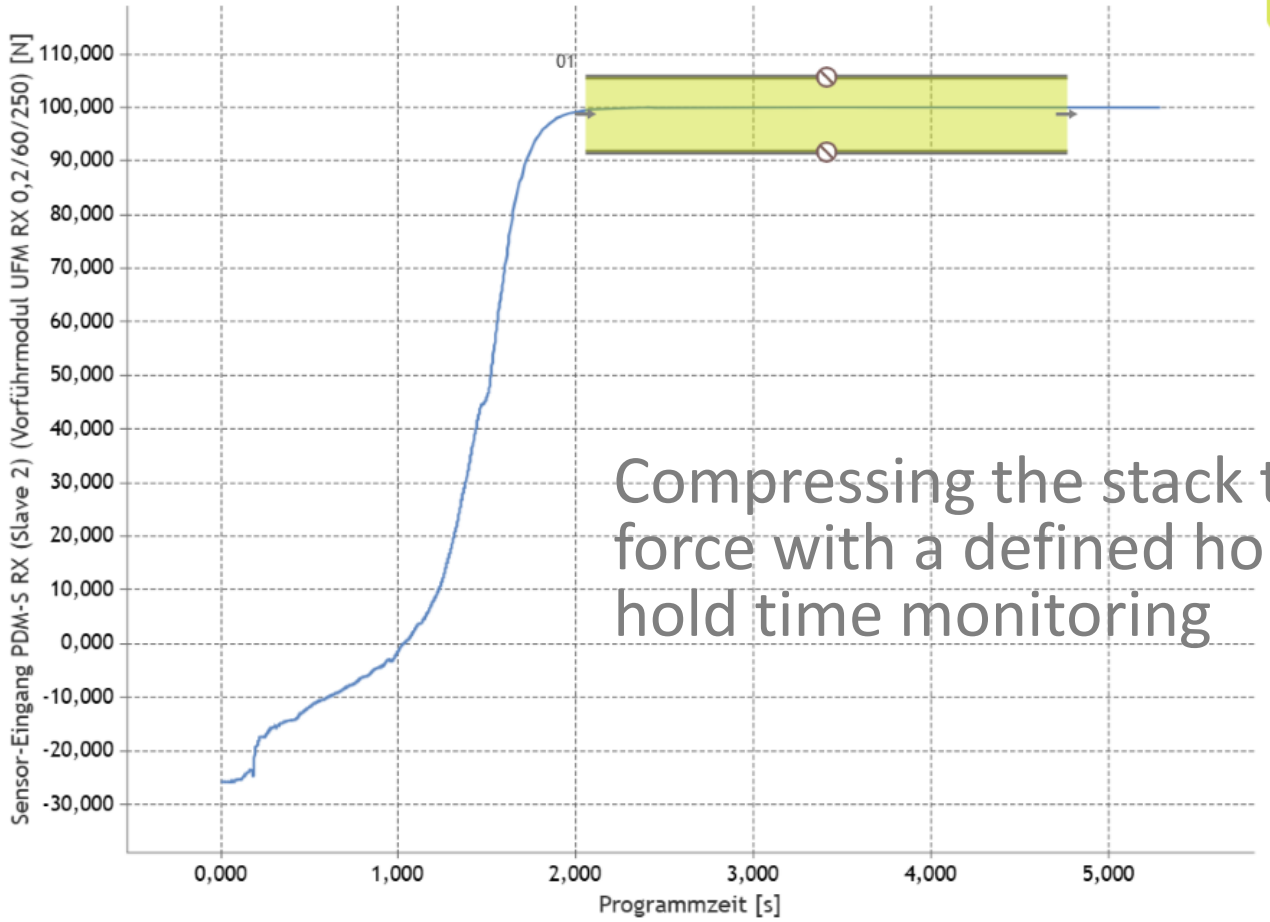
Signale

Vorführmodul UFM RX...		
Position	0,00	mm
Sensor-Eingang PDM-S...	-25,74	N
Sensor-Eingang PDM-S...	0,98	N/mm

Zur Übersicht

Komprimierung - Kraft-Zeit

Wert	UTG	OTG
01 Durchgangsfenster 1		



Compressing the stack to a defined force with a defined hold time and hold time monitoring

Sequenzbewertung

Kurvenüberlagerung Zu Prozessdaten wechseln

IO -1 -5 -10 -15

PROMESS RX 1.21.0 | PROMESS RX 200N | Web | DE | 25.02.2025 09:29:11

Dashboard > Prozessansicht | BEDIENPANEL

Programm:	**Brennstoffzellenstack k...**
Sequenz:	**Sequenz 1 (25.02.2025 09:26:49)**
Getriebe Identnummer	123414235234
Benutzername	Herr Schulz
Schicht	Frühschicht

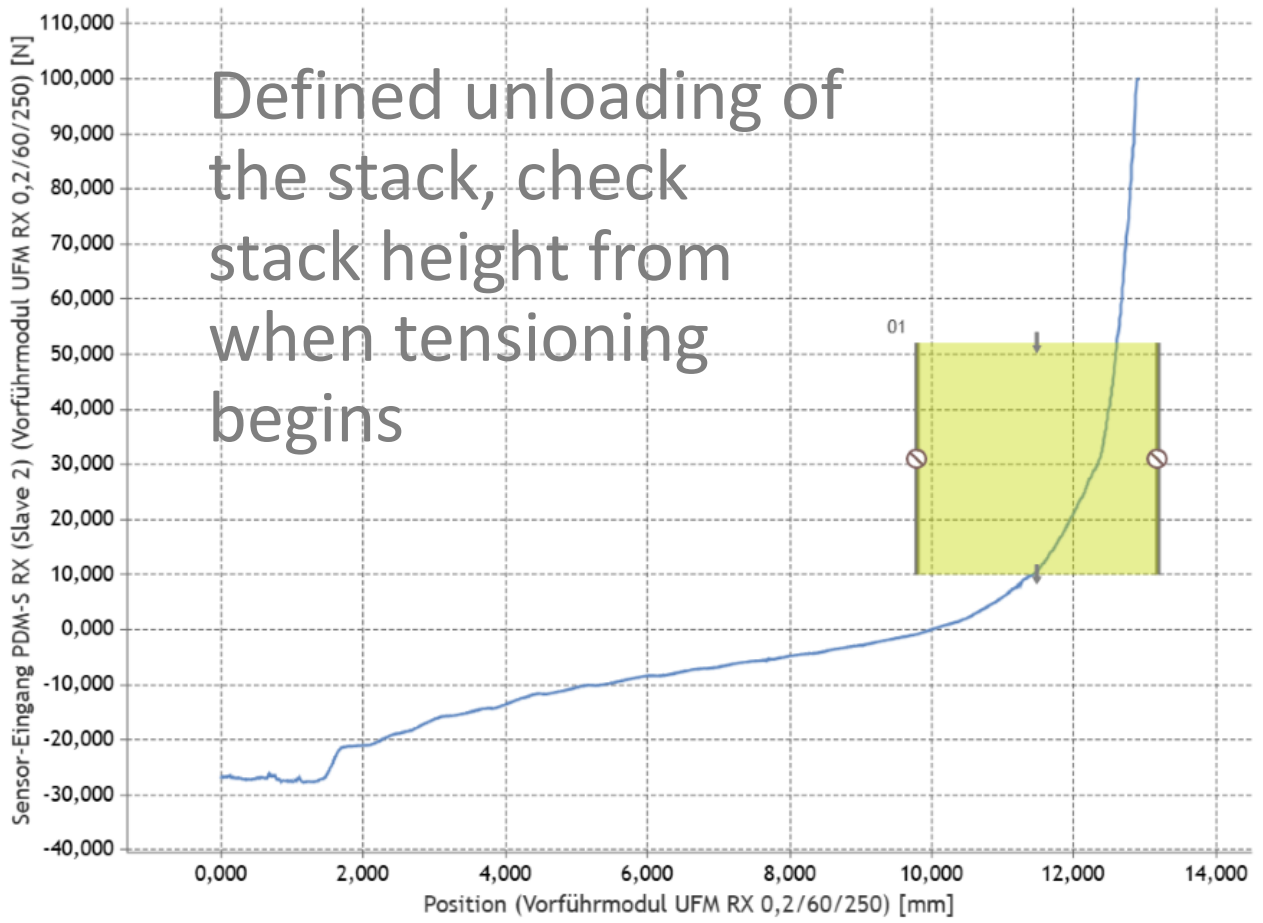
Variablen

Geschwindigkeit	50,000
Beschleunigung	3000,000

Signale

Vorführmodul UFM RX...		
Position	-0,00	mm
Sensor-Eingang PDM-S...	-25,75	N
Sensor-Eingang PDM-S...	0,98	N/mm

Zur Übersicht | Rückhub Stapelhöhe - Kraft-Weg



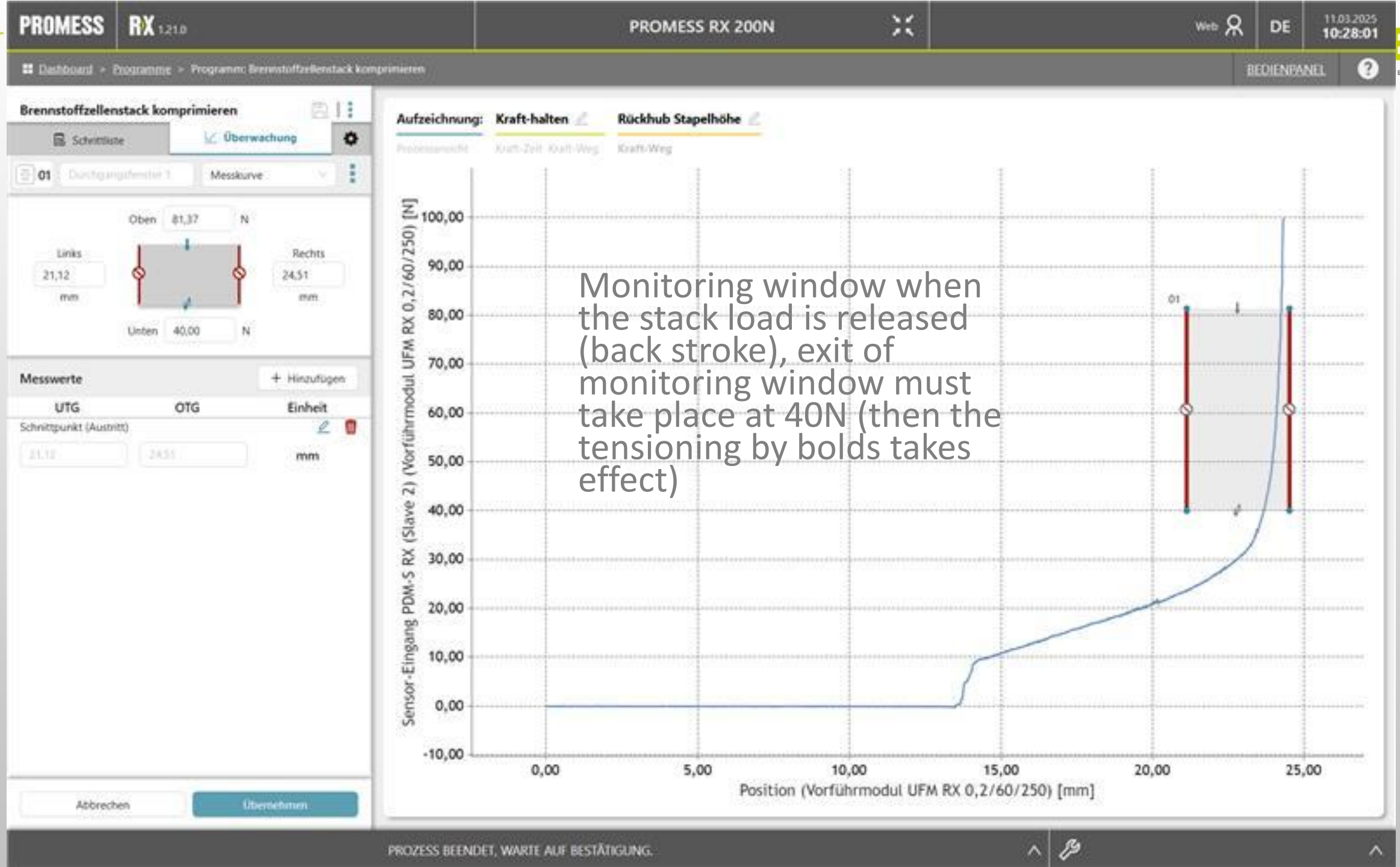
Defined unloading of the stack, check stack height from when tensioning begins

Wert	UTG	OTG	
01 Durchgangsfenster 1			
Schnittpunkt (Austritt)			
11,42	9,80	13,19	mm

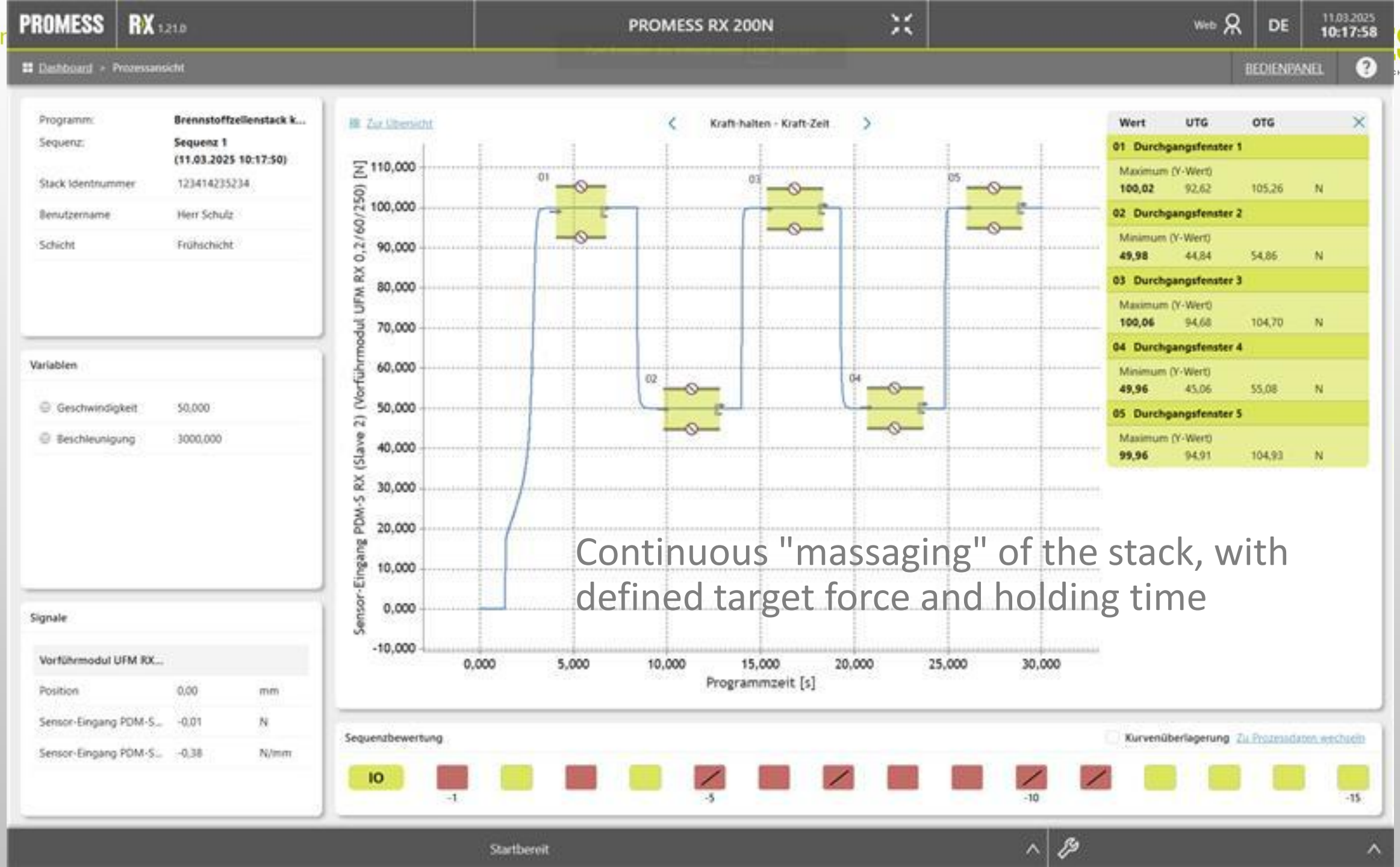
Sequenzbewertung | Kurvenüberlagerung | Zu Prozessdaten wechseln

IO | -1 | -5 | -10 | -15

Startbereit



Monitoring window when the stack load is released (back stroke), exit of monitoring window must take place at 40N (then the tensioning by bolds takes effect)


PROMESS RX 1.21.0
PROMESS RX 200N
Web
DE
11.03.2025
10:17:58
Dashboard > Prozessansicht
BEDIENPANEL
Programm: Brennstoffzellenstack k...
Sequenz: Sequenz 1 (11.03.2025 10:17:50)
Stack Identnummer 123414235234
Benutzername Herr Schulz
Schicht Frühschicht
Variablen
Geschwindigkeit 50,000
Beschleunigung 3000,000
Signale
Vorführmodul UFM RX...
Position 0,00 mm
Sensor-Eingang PDM-S... -0,01 N
Sensor-Eingang PDM-S... -0,38 N/mm
Zur Übersicht
Kraft-halten - Kraft-Zeit
Sensor-Eingang PDM-S RX (Slave 2) (Vorführmodul UFM RX 0,2/60/250) [N]
110,000
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0,000
-10,000
01
02
03
04
05
0,000
5,000
10,000
15,000
20,000
25,000
30,000
Programmzeit [s]
Wert UTG OTG
01 Durchgangsfenster 1
Maximum (Y-Wert)
100,02 92,62 105,26 N
02 Durchgangsfenster 2
Minimum (Y-Wert)
49,98 44,84 54,86 N
03 Durchgangsfenster 3
Maximum (Y-Wert)
100,06 94,68 104,70 N
04 Durchgangsfenster 4
Minimum (Y-Wert)
49,96 45,06 55,08 N
05 Durchgangsfenster 5
Maximum (Y-Wert)
99,96 94,91 104,93 N
Continuous "massaging" of the stack, with defined target force and holding time
Sequenzbewertung
Kurvenüberlagerung Zu Prozessdaten wechseln
IO
-1
-5
-10
-15
Startbereit

Thank you for your attention!

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