

# E-MOBILITY

## ASSEMBLY SOLUTIONS



# KEY COMPONENTS

## E-MOBILITY

- Body in white, bodywork chassis
- Electric motors and gears
- Battery pack
- Battery housing
- Control and power electronics
  - Inverter
  - OBC on board charger
  - BMS battery management system
  - IGBT



E-mobility imposes certain requirements on the assembly process: Top process reliability for safety-related components, high flexibility due to the wide ranging variety, requirements for traceability and targeted reliable electro-static discharge (ESD capability) of system components. In addition, these components require an assembly environment which fulfils the guidelines of technical cleanliness and also scores highly on ergonomic and safety aspects.

Users may face difficulties in coming up with an economical solution to this complexity.  
The solution: **DEPRAG – your innovative partner in the field of E-mobility.**

From components and manual work stations, up to semi or fully-automatic assembly systems, we provide flexible assembly solutions for all stages of expansion, which can all be adapted to the current market situation at any time. This flexibility specifically counteracts planning uncertainties and enables reactive responses to changing requirements.

**DEPRAG**  
machines unlimited

**Products for all stages of expansion,  
from one source, available internationally!**





# ASSEMBLY

## BATTERY PACK

The innovative high-voltage components of an electric vehicle present new challenges for production assembly. It is not only for the integration of high voltage components that new solutions must be developed, it is also when dealing with the whole topic of high-voltage in work processes.

Electric vehicles have significantly higher voltages (up to 800 volt direct current). This necessitates higher safety requirements for employees in assembly processes.

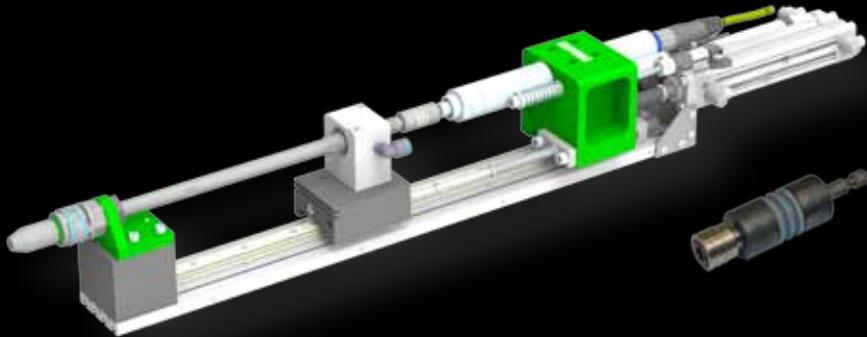
During battery assembly, the cell module is assembled first. The individual battery cells are stacked, placed in the battery housing and then connected to the battery management system. Next the current collector is connected to the power supply, connections are checked and the housing closed. Then power supplies and contacts are connected before the finished modules can be tested. The individual cell modules are connected to a floor element via contact rails and assembled with fasteners. Electronic boards and seals can then be attached.

- Installation of the module requires complete traceability.
- The battery size and resulting high number of assemblies is usually automated and has short cycle times.
- Avoidance of particle contamination.
- Safety for operators: Contact with live power circuits can cause serious, even deadly injuries.

## Insulated screwdriving tools

DEPRAG insulation concept:

- special ceramic and synthetic parts
- protects against voltage of up to 1000 volts



### Safety at work:

Insulated solutions protect both the operator and tool from electric shocks. The applicable standards are met e.g.

- ISO 6469-3

Electrically propelled road vehicles – Safety specifications – Part 3: Electrical safety

- DIN EN IEC 60900 (VDE 0682-201)

Live working; Hand tools for use up to 1000 V AC and 1500 V DC

and many more. Of course, we work to your specifications and can react flexibly to the standards required in the field of E-mobility.

### Traceability:

Adaptive screwdriving procedures, to guarantee complete traceability.

### Technical cleanliness:

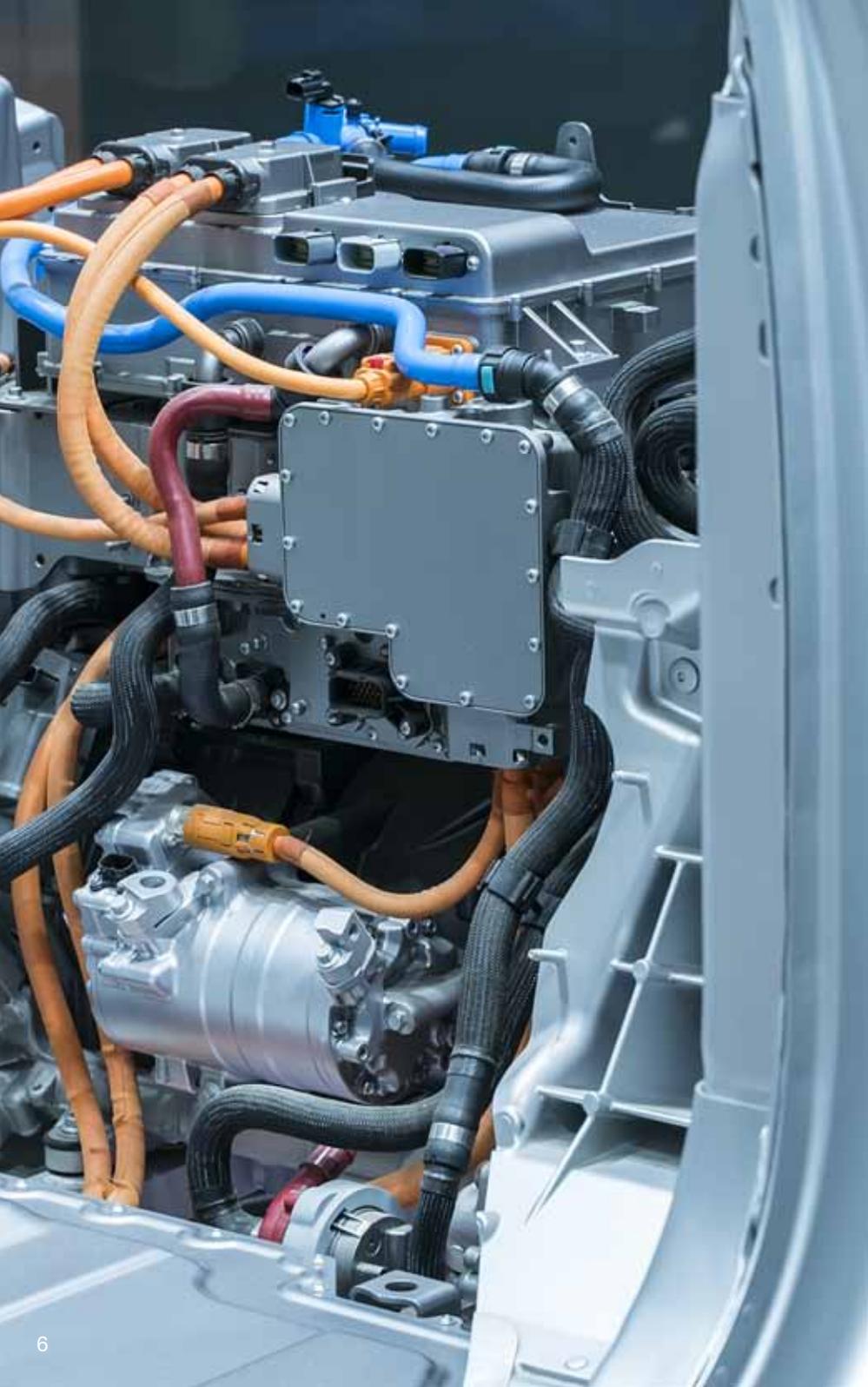
DEPRAG CleanFeed concept with screwdriving function module with vacuum suction and screw feeding via step feeding system

## Multi-spindle version for short cycle times

## Gripper jaws to avoid dropping the screw



Screw feeding systems to increase productivity:  
Step feeding system easy step feed



# ASSEMBLY

## POWER ELECTRONICS

When assembling electronic components and modules in the field of power electronics and particularly in the field of high-voltage components, technical cleanliness is of utmost importance: Particle contamination can quickly lead to insulation errors, mechanical contact blockages or undermining or interruptions of light barriers for highly sensitive components in power electronics.

The critical particles may be created directly within the process, due to both the high number of components introduced into the process and the assembly steps themselves. Conductive particles in particular may cause high voltage arc flashes and short circuits.

Due to the complex design of individual components the operator may often have to deal with screw positions which are difficult to access, which must also be assembled in a specific sequential order.

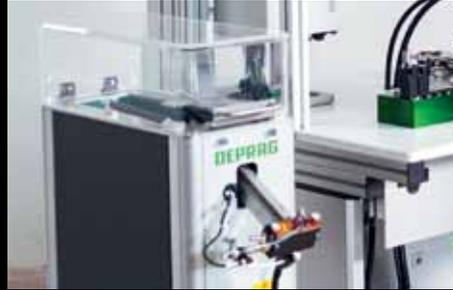
- Technical cleanliness
- Difficult to access screw positions
- Worker safety
- Safety-critical assemblies of category A
- Correct sequential order of assemblies
- ESD design



## Technical cleanliness



DEPRAG particle killer:  
Dirt particles are targeted and removed from the conveyor



Low abrasion, gentle feeding with the DEPRAG sword feeder



DEPRAG easy step feed step feeder



Vacuum suction

## For difficult to access screw positions



### DEPRAG Feed Module DFM with vacuum:

- fatigue-free working
- optimised cycle time
- technical cleanliness

### DEPRAG EC cordless tools:

- flexible
- documentation available
- user friendly
- high performance
- cordless communication



### ESD capability:

ESD capable screwdrivers and accessories, e.g. feed hoses

### User friendly:

Ergonomic screwdriving tools for difficult to access screw positions

### Traceability:

Complete traceability of all screwdriving processes

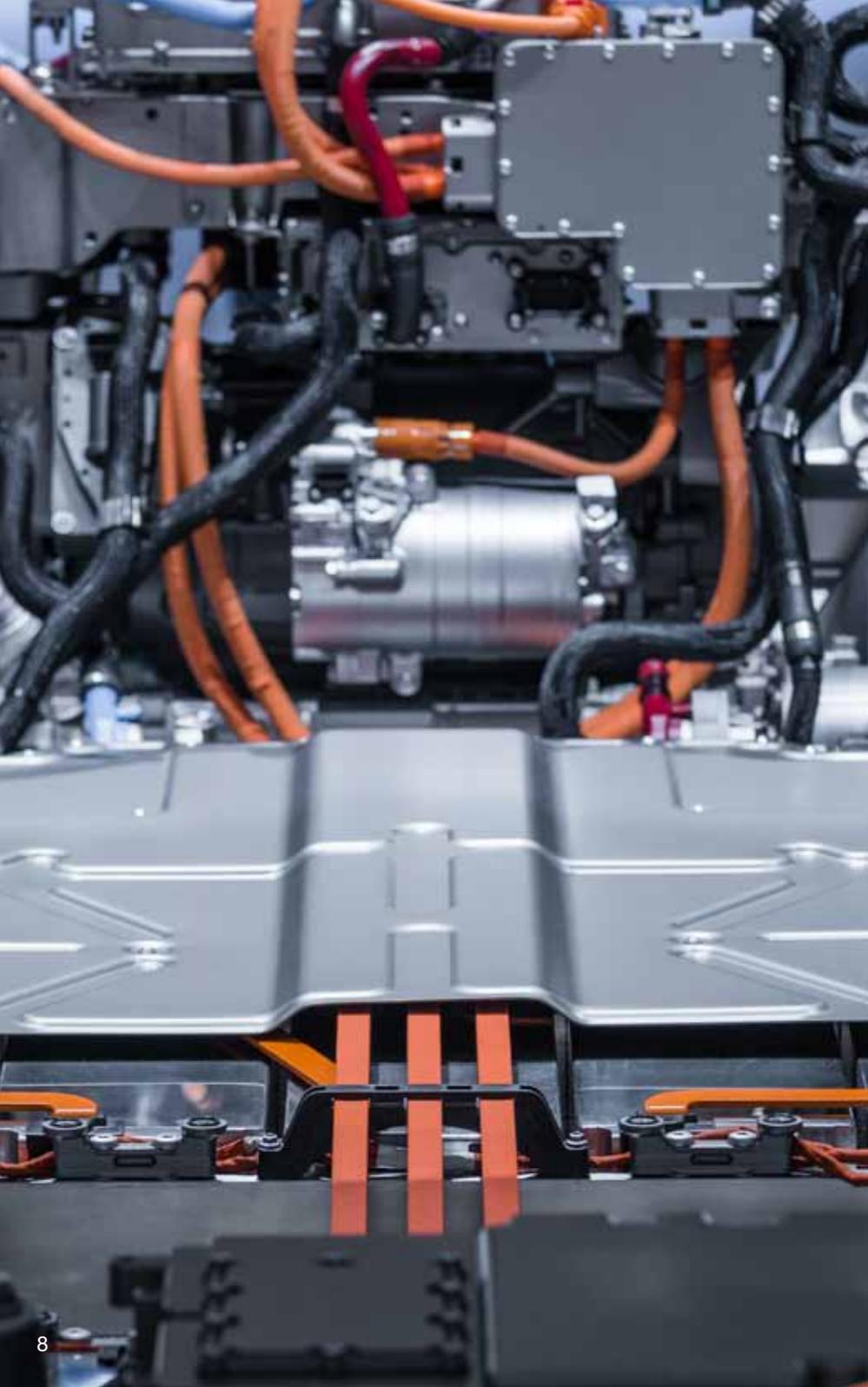
### Technical cleanliness:

With the DEPRAG CleanFeed concept in all processing steps – from screw handling and feeding up to screw assembly – Avoid, reduce and remove particles.

### DEPRAG EC screwdriving technology:

- freely programmable screw tightening
- torque, speed and rotation can be adjusted individually to the assembly task
- high torque accuracy
- comprehensive monitoring functions
- ESD capable
- ergonomic
- documentation available





# ASSEMBLY COMPONENTS

It is usually screw joints of the category A in accordance with VDI standard 2862, which are used for the assembly of elements in the automotive industry. Process reliability is of utmost importance and all processing steps must be documented and monitored.

The assembly process entailed for battery module or power electronics with a wide variety of components is highly complex: numerous screws must be assembled in the correct order to guarantee a consistent pre-load force.

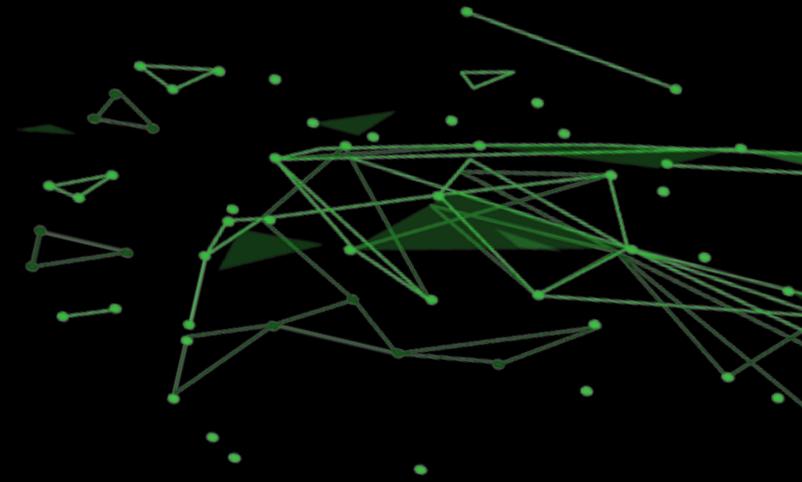
Within lightweight construction, above all in the field of E-mobility, aluminium, other lightweight metals and synthetic materials are increasingly used. Widely varying torques are commonly a result of the frequently employed direct assemblies. Due to different material characteristics, settling conditions can also vary. As these are predominantly conductive connections and conductivity must be guaranteed, adaptive screwdriving procedures are recommended for reliable detection of the seating point.

- Settling conditions when using varying materials
- Screw tightening in a prescribed order to guarantee consistent pre-load force
- Safety-critical assembly of category A

## EC-Servo technology with DEPRAG CFC Clamp Force Control



Adaptive screwdriving procedure DEPRAG CFC Clamp Force Control: Despite fluctuating tightening torques, the procedure guarantees reliable detection of the seating point and ensures a consistent final position for the subsequent final tightening resulting in a constant pre-load force.



## Process monitoring

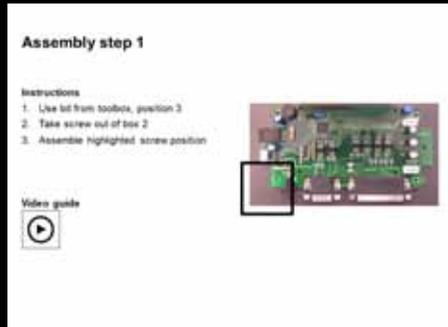


Position control stand (PKS), position control gantry (PKP) camera systems

### Top process reliability:

- Screwdriving procedure DEPRAG CFC Clamp Force Control: Zero error production and traceability
- Position control: correct sequence of screws for optimum quality
- Process monitoring with camera systems
- Complete documentation of production data
- Visual operator guidance with DEPRAG Operator Guidance DOG

## Process visualisation with DEPRAG Operator Guidance



Digital assembly guides for operators: error-free assembly and traceability of all processing steps, MES communication



# ASSEMBLY

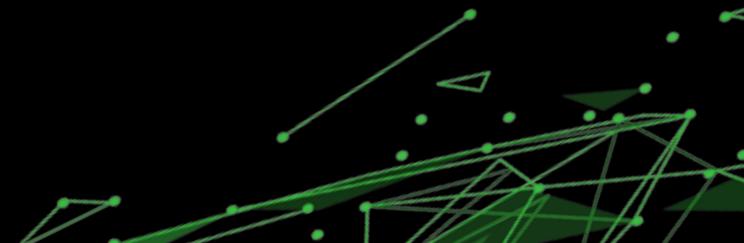
## BODYWORK CONSTRUCTION AND BATTERY HOUSING

Lightweight construction and the subsequent weight savings involved are amongst the greatest driving forces for innovation, not only in bodywork construction, but also in the production of battery housing for E-mobility.

As the weight of the battery is relatively high, the weight of the bodywork and furnishings must be kept as low as possible. Therefore lightweight construction materials are utilised which will reduce the net weight of the vehicle and also reduce energy consumption.

Assembly and joining technology is experiencing a radical transformation due to lightweight construction – the material mix determines the process and requires the highest possible levels of flexibility from the fastening system.

The achievable travel range is today the decisive factor when purchasing an electric vehicle. Lightweight construction to reduce energy consumption remains a hot topic within the field of E-mobility. The established approaches for bodywork construction are adopted. Whether aluminium design or a sophisticated multi-material mix, DEPRAG has the solution.



## ADAPTIVE DFS DEPRAG FASTENING SYSTEM

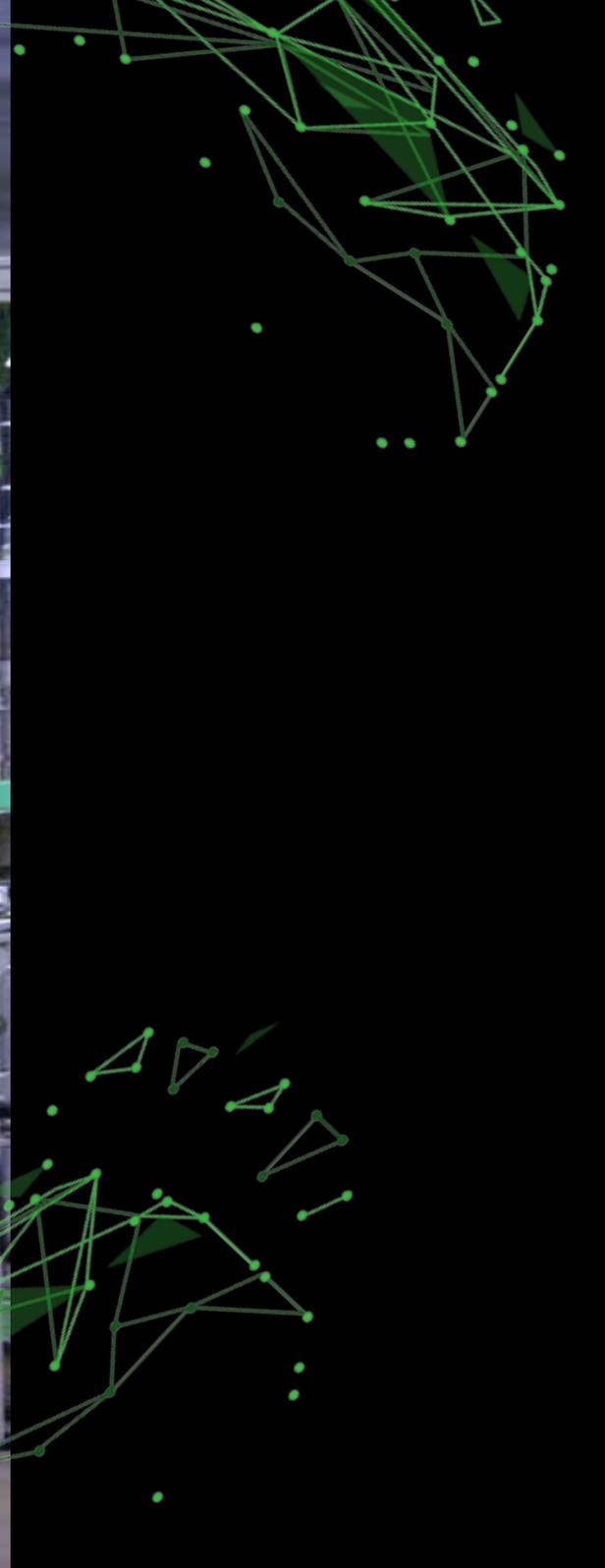
### Screwdriving system for lightweight construction assemblies

Our many years of experience and the continual expansion of our global knowledge has placed DEPRAG as a forerunner and leading innovator in the development of FDS smart tools. This is attributable not least, to our patented drive technology. The hundreds of systems operating at automobile manufacturers around the world are impressive evidence of this.

The selection of the correct fastening technology for lightweight construction is of utmost importance and consequently flow drill screw assemblies are the established technology for bodywork construction in the automobile industry. The adaptive assembly unit Adaptive DFS combines EC Servo screwdriving technology with EC Servo feed technology. This enables automatic piercing detection throughout the flow drill assembly, independent from screw and component tolerances. The processing parameters are adjusted automatically and the processing sequence is continually optimised. The screwdriving system can also easily be connected to a robot. There is no longer any need for complicated costly parameter adjustments.

- Top process reliability
- Shortest possible cycle time
- Optimised funnel forming
- Eliminates thread damage
- Low stress on screw and component
- Minimum set-up time
- Ready for new materials, fasteners and joining methods





# SCREWDRIVING AND ASSEMBLY SYSTEMS

From highly automated large-scale systems, fully automated assembly lines, standard assembly units right through to semi-automated reliable manual work stations, we offer an enormous range of automation solutions for E-mobility applications.

DEPRAG screwdriving and automation solutions fulfil all assembly requirements for E-mobility:

- Process reliability
- Flexibility
- Technical cleanliness
- ESD capability
- Ergonomics
- Traceability / MES

High flexibility specifically counteracts planning uncertainties and enables reactive responses to constantly changing requirements.

Please contact your DEPRAG advisor for more information – together we will find the most suitable solution for your assembly process!



# DEPRAG COCKPIT

## INTERCONNECTED SCREWDRIVING SYSTEMS – IT'S EASY WITH DEPRAG COCKPIT

DEPRAG Cockpit is the new digital service facilitating an easy introduction to the interconnected factory. Using the DEPRAG Cockpit, the operator retains an overview of any number of various screwdriving controllers, regardless of manufacturer.

The software enables employees to monitor production data from various assembly lines. The data from a company's various factory locations, their production lines and connected devices is collected centrally by the DEPRAG Cockpit.

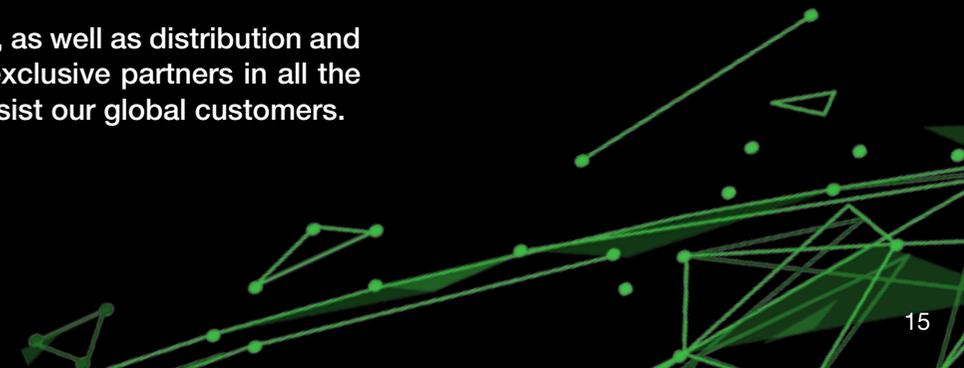
- Software for screwdriving and assembly technology
- Reliable production data acquisition
- Detailed capacity and usage statistics
- Process monitoring and notifications
- Analyse and trend detection with system messages





# Your global partner for E-mobility

The DEPRAG group has production facilities in Germany, the Czech Republic and China, as well as distribution and service companies in France, Mexico, Sweden, the USA and the UK. Our network of exclusive partners in all the main industrialised countries around the world means that we are always on hand to assist our global customers.



**Further Informationen:**  
**[www.deprag.com](http://www.deprag.com)**

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