

The Manual Work Station

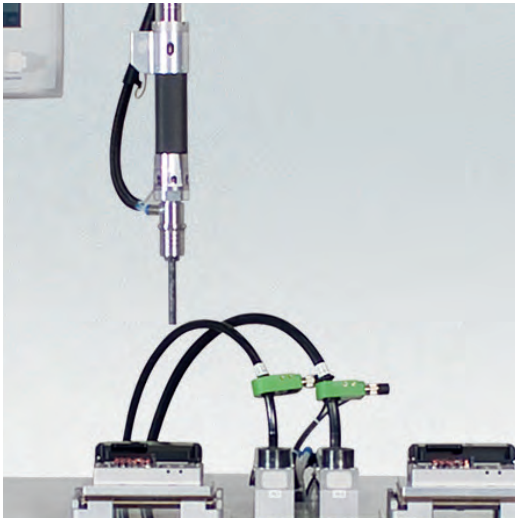
Short conversion times, varying production numbers, integration of the operator into the assembly process whilst at the same time conforming to the highest quality standards are requirements which all call for a flexible and intelligent manual work station.

Coordinated components guarantee:

- | | | | |
|--|---|--|---|
|  Processing reliability |  Technical cleanliness |  ESD capability |  Documentation capability |
|  Flexibility |  Ergonomics |  Efficiency |  Industry 4.0 (product data acquisition/ manufacturing execution systems) |

Determine the required processes for your application and shape your own work station. Your advantage: All components come from one source and are coordinated with each other.

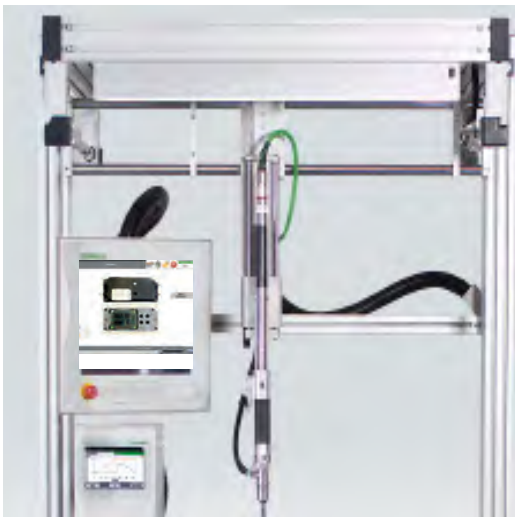




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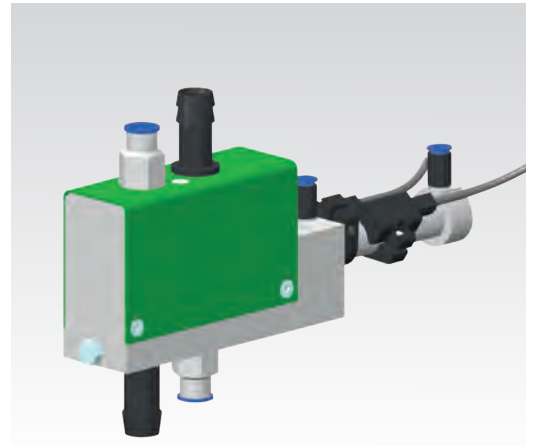


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The Basic Components of your Manual Work Station

Screwdriving Technology

EC-/EC servo screwdriver

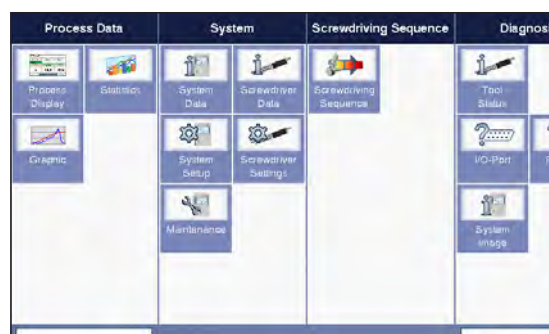
EC-/EC Servo screwdrivers provide maximum processing reliability, flexibility and traceability of your assembly results.

- Precise control and regulation of the screw tightening due to integrated torque and angle measurement
- Free programming of the screwdriving sequences
- Various user programs
- Documentation capabilities

Mechanical shut-off screwdriver with function control

The screwdriver is push-to-start. Once torque has been reached the screwdriver switches off via the highly accurate decoupler and shut-off clutch. The function control monitors the shut-off procedure.

- 100% torque control
- Counts screw assemblies - monitors screw cycles
- Integrated torque measurement functions, diagnosis and evaluation



Comprehensive analysis and documentation options

Feeding Technology

DEPRAG feeding systems increase the automation level and improve the ergonomics of a manual work station. Connection elements of a suitable shape can be fed using a calibrated feed hose. If feeding via hose is not an option then Pick & Place systems come into play.



Feeding via feed hose

Options:

- Vibratory bowl feeder
- Sword feeder

Notes:

- For rotationally symmetrical components, such as screws, nuts and rivets, etc.
- Short cycle times (preload function available in the mouthpiece)
- Fed directly to the screw position
- Several feeders can be attached to the same screwdriver

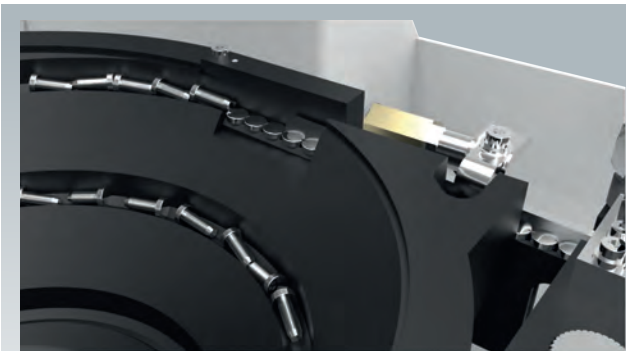
Feeding via Pick & Place

Options:

- Vibratory bowl feeder
- Linear feed system
- Screw presenter
- Tape-on-reel feed system for self-adhesive components (e.g. labels)

Notes:

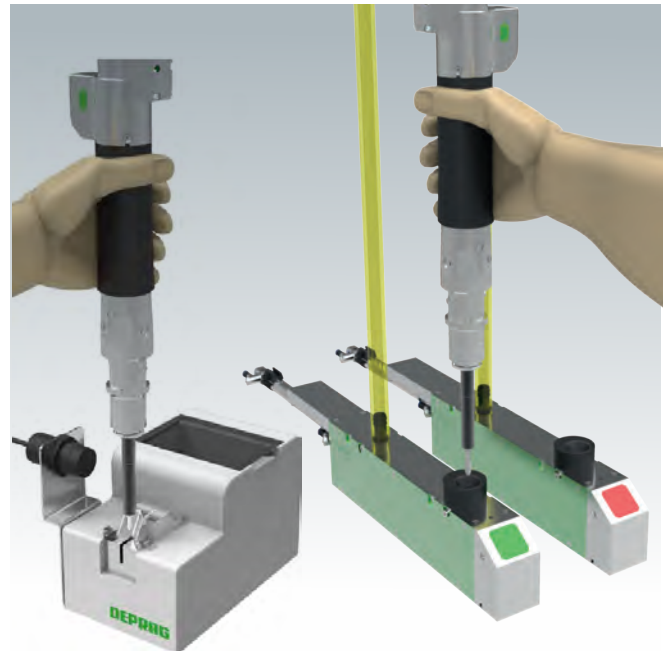
- For geometrically complex components
- Rotationally symmetrical components with awkward diameter or length
- Separating systems suited to any feed component
- Pick & Place with vacuum, magnet or gripper



Vibratory technology



Sword feeder technology



Pick & Place with vacuum

Pick-to-Light - the visual operator guide

Ergonomics and Tool Guidance on the Manual Work Station

Perfectly coordinated stand and portal solutions guide the tool securely to the screw position taking the strain from the operator. Position control systems ensure that at the correct time, on the correct position, the correct connection element is assembled with the correct torque.

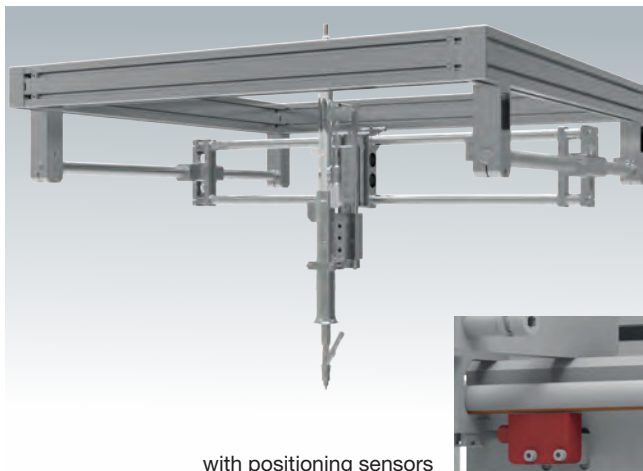
Tool guidance with position monitoring

Options:

- Position control portal
- Position control stand

Notes:

- Monitoring of the screw position and screw sequence, freely programmable
- Individual screw tightening parameters available for each screw position
- Takes the strain for the operator by absorbing the reaction torque
- Vertical screwdriver guidance
- Optionally with integrated vertical stroke to relieve the operator. The pressure is activated by a cylinder.
- Sequential ordering of the connection elements according to position



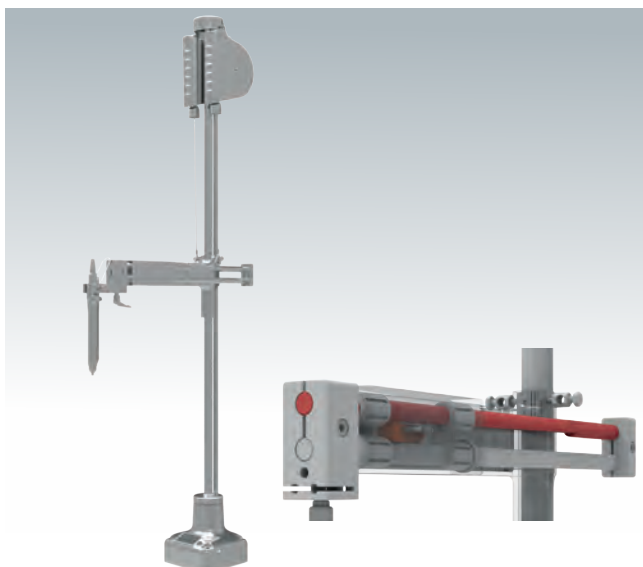
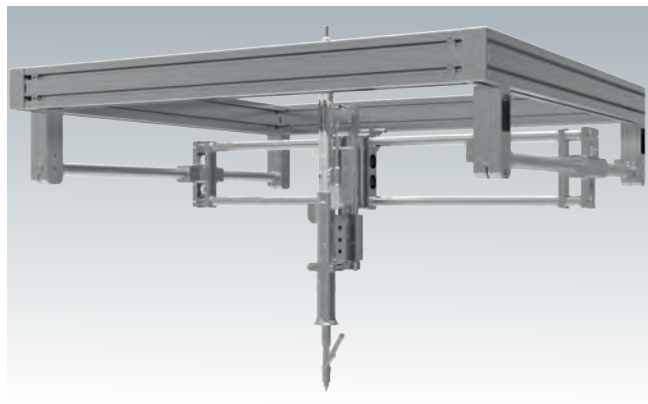
Tool guidance without position monitoring

Options:

- Linear stand
- Rail guided telescope arm
- Parallelogram stand
- Balancer

Notes:

- Takes the strain for the operator by absorbing the reaction torque
- Vertical screwdriver guidance
- Optionally with integrated vertical stroke to relieve the operator. The pressure is activated by a cylinder.



DEPRAG Feed Module (DFM)

The DEPRAG Feed Module (DFM) enables screw assemblies on screw positions which are difficult to access (e.g. round housing forms), by using vacuum assistance. Screws or nuts can be positioned mechanically and set-in-place by using vacuum suction. The operator can therefore access even hard-to-reach screw positions without any problems. Independent from the operator, the integrated stroke-mechanics uses cylinders to control the precise pressure required for the positioning element.

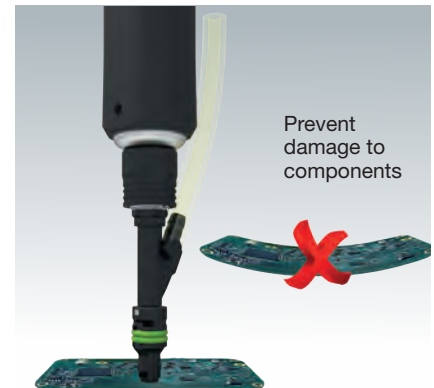
For recessed screw positions



For nut assemblies



For pressure control



Technical Cleanliness

Dirt particles can cause damage to products or product related systems.

Therefore: avoid abrasion, reduce abrasion or target and remove abrasion! These are the essential requirements for screw assembly in cleanrooms to ensure a high quality result for the assembled components. The DEPRAG CleanFeed concept provides an all-encompassing solution.

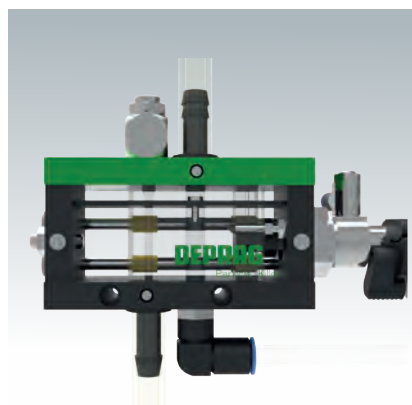
Avoid abrasion

Low abrasion, component friendly feeding of connection elements with a DEPRAG sword feeder.



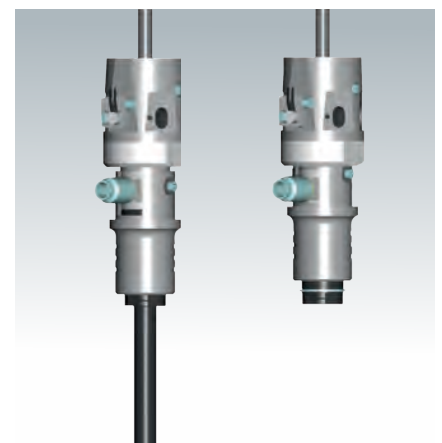
Reduce abrasion

Particle Killer



Remove abrasion

Vacuum suction



ESD capability

Uncontrolled electrostatic charge (electrostatic discharge, known as ESD) destroys electronic components. All components used on the manual work stations such as screwdriver housing, connection hoses and workpiece fixtures conduct electricity and therefore ensure ESD safe assembly of sensitive components.

DEPRAG manual work station components = ESD safe!



Perfectly coordinated interfaces between standard components and an intuitive operator guidance guarantee the best in user friendliness.

- allocation
- visualisation
- guidance
- control
- evaluation
- documentation
- communication

The screenshot shows the DEPRAG Teach-In software interface. At the top, there's a header with '700' and 'Teach-In'. Below this, the main workspace is divided into several sections. On the left, there's a section for 'F2=Auswahl Achse' (X-Achse) and 'F4=Betriebsart' (Manuellfahrt). In the center, there's a table for 'Aktuell' and 'Ziel' coordinates, and a 'Position' display showing '1'. Below the table, there are buttons for 'F1 X-', 'F3 X+', and 'Eilgang deaktiviert'. On the right, there's a 'Speichern als' (Save as) dialog box with options like 'Akt.-Position übernehmen', 'AST30', 'Zylinder', and 'Parameter'. At the bottom left, there's a red emergency stop button. The bottom right corner shows a 'USB-PORT' label.

The screenshot shows the NetBeans IDE with the 'Main' class file open. The left sidebar shows the project structure with 'Main' selected. The main editor area displays the source code of the 'Main' class. The code is as follows:

```

1 // Import der Klassen
2 import java.util.Scanner;
3
4 // Klasse Main
5 public class Main {
6
7     // Methode main
8     public static void main(String[] args) {
9         // Erstelle Scanner-Objekt
10         Scanner scanner = new Scanner(System.in);
11
12         // Aufruf der Methode mainLoop
13         mainLoop(scanner);
14     }
15
16     // Methode mainLoop
17     public static void mainLoop(Scanner scanner) {
18         // while-Schleife
19         while (true) {
20             // Lese Eingabe
21             String input = scanner.nextLine();
22
23             // Wenn 'q' eingegeben wird, beende die Schleife
24             if (input.equals("q")) {
25                 break;
26             }
27
28             // Sonstige Eingabe
29             System.out.println("Eingabe: " + input);
30         }
31     }
32 }

```

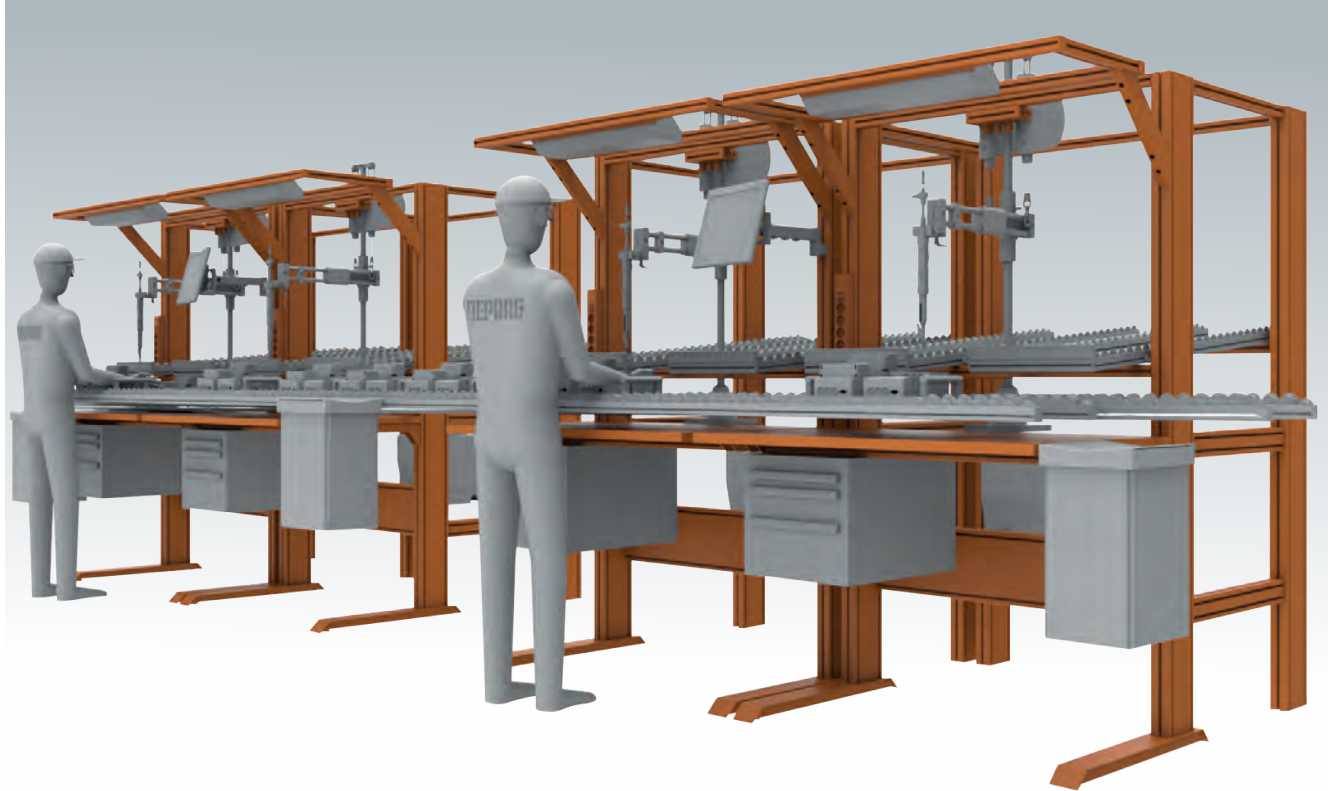
[illegible]

| BOTTLE BOTTLE | | BOTTLE BOTTLE | |
|-------------------------------|---------|-------------------------------|----------|
| Verschleißarten und -zustände | | Verschleißarten und -zustände | |
| Stromerzeuger | 2400,00 | Stromerzeuger | 2000,00 |
| Elektroventil | 1900,00 | Elektroventil | 40,00 |
| Motorventil | 1800,00 | Motorventil | 20,00 |
| Umkleventil | 2100,00 | Umkleventil | 10,00 |
| Umkleventil | 0,00 | Druckluft 1 | 100,00 |
| Umkleventil | 40,00 | Schleife, Druckluft 2 | 20,00 |
| Druckluft | 900,00 | Druckluft 2 | 100,00 |
| | | Motorventil | 0,00 |
| | | Stromerzeuger | 0,00 |
| | | Motorventil | 0,00 |
| | | Elektroventil | 10000,00 |

DAST
DEPRAG Ablauf**ST**euering
Operation of all EC screwdriver
sequence controllers centrally
via DCOS operator panel

The base structure with aluminium design provides the basis for integration of all types of components for the manual work station.

Suitable as an individual work station or combined into a complete assembly line.



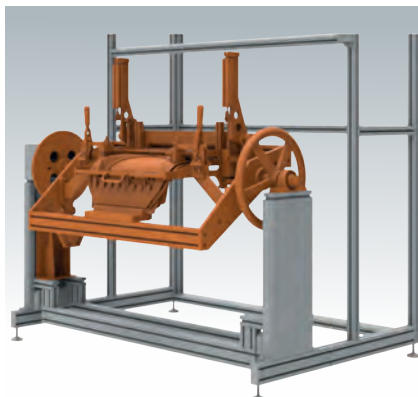
Base frame for your individual work station or for your assembly line:

- Available in various standard sizes
- Electronic height adjustment
- Rotational part fixtures (access from all sides)
- With integrated part feeding, e.g. via gripper container with „Pick-to-Light“ display
- Integrated lighting and energy supply

Electronic height adjustment



Rotational part fixtures



Integrated part feeding



The DEPRAG Manual Work Station

Example: Assembly of vehicle interior



Components of the work station

- Aluminium base frame
- Intelligent, rotational workpiece fixtures
- Height adjustable working platform
- EC-Servo screwdriving system
- Pick-to-Light Gripper system
- DCOS Control system

Notes:

- Monitoring of the screw sequence
- Torque and angle control
- Communicates with a higher level data collection point

Example: Assembly of sunglasses



Components of the work station

- Aluminium base frame
- Intelligent workpiece fixtures with visual indication on screwdriver housing (green = pass / red = fail)
- Automatic screw feeding via vibratory spiral bowl
- Torque evaluation via integrated measurement equipment
- DCOS control system

Notes:

- Displays the status of assembly for the operator directly at the screw location
- Recognises and confirms presence of all required components
- Checks the number of screws
- Communicates with a higher level data collection point

Example: Assembly of electronic components



Components of the work station

- Aluminium base frame
- Position control portal
- Automatic screw feeding using sword feeder
- CleanFeed concept for technical cleanliness
- Intuitive Pick-to-Light feeding module
- EC-Servo screwdriving system
- Bitbox bit exchange system
- DCOS control system

Notes:

- Ensures Technical Cleanliness
- Monitors screw position and screw sequence
- Automatically assigns the type of connection element and screw program to the screw position
- Torque and angle control
- Data recording and storage in data bank, connection to data management system
- ESD capability

Example: Assembly of on-board electronics in vehicle construction



Components of the work station

- Aluminium base frame
- Position control stand
- Barcode Scanner
- EC screwdriving system
- DCOS control system

Notes:

- Monitors screw position and screw sequence
- Automatically assigns the type of connection element and screw program to the screw position
- Barcode recording
- Torque and angle control
- Data recording and storage in data bank, connection to data management system
- Linking with several work stations



DEPRAG

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