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Project Book – Powertrain 2025 (Trucks and Passenger Cars)

Stationary and handheld EC fastening technology from company APEX Tool Group

**Stationäre und handgehaltene EC-Schraubtechnik
von Fa. APEX Tool Group**

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Change service

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Preface

The sum of all available planning guidelines and material release lists is the basis for the integrated standardization of all technology scopes for production and factory technology at Daimler AG.

For specific items for which this planning guideline does not provide exact specifications, or, where applicable, items that have not been taken into consideration in the associated electrical or mechanical standard models and in the corresponding software standard, agreement must be coordinate with the representative of Daimler AG.

For this purpose, the supplier must use the existing planning guidelines, hardware standard models and the software standard to work out proposals and submit them to the representative of Daimler AG. The introduction of joint project-based meetings to assess the solutions is also planned.

The supplier undertakes to inform Daimler AG about any necessary improvements, changes and additions to this planning guideline.

Adopted improvements, changes and additions shall be integrated by Daimler AG in the course of document updating in a follow-up version of this planning guideline.



This planning guideline does not release the supplier from its responsibility for the correct design of the system and documentation to be delivered, which makes allowance for the applicable and relevant laws, specifications, stipulations and requirements at the respective production location.

In the event of contradictions in the planning guidelines or invitations to tender, the higher-order requirement shall apply in case of doubt.

Document contents

This document defines the stationary EC fastening technology with "Intelligent Spindle" technology (hereinafter referred to as "BTS"). This is a highly integrated spindle solutions that integrates the complete actuation electronics and measuring equipment in its housing.

The second part of the document discusses handheld EC fastening technology and the definition in the project is explained and illustrated.

1. Limitation

1.1. Who processes what

- The fastening system supplier is to be included in planning of the system for the design of the fastening system, the fastening spindles and the preparation of tender.
- The fastening system supplier shall supply the fastener box (CPMx) with fastener controller, fastener cables, fastening spindles, accessories and the accompanying documentation.
- The general contractor / system supplier shall set up the fastener box (CPMx) with fastening controller, install the fastener cables, assemble the fastening spindles and connect the fastener box / controller to the supply voltage / field bus / network.
- Stationary systems:
The general contractor / system supplier shall transfer the documentation from the fastening system supplier into the overall documentation for the system in accordance with Daimler AG specifications.
- Handheld fastening systems:
The documentation corresponds to the standard documentation of the fastening system supplier.
- Activation and start-up support for the fastening system is to be commissioned by the APEX Tool Group GmbH if the general contractor, system supplier or commissioning party has not received training for Daimler's fastening system.

1.2. System Responsibility

The APEX Tool Group assumes responsibility for deliveries within the scope of the product partnership and is also the contact for project planning, during implementation and during the service life of the systems in the target plants.

In order for it to perform this task correctly, all components for the stationary and handheld fastening technology (control, cables, spindles, etc.) must be procured from the APEX Tool Group.

2. System Description

2.1. Stationary and Handheld EC Fastening Technology

2.1.1. Overview

The Powertrain 2025 project standardizes stationary EC fasteners and fastener controls without visualization and handheld EC fasteners and fastener controls at the plants in Stuttgart, Berlin, Hamburg, Kölleda, Jawor, Mannheim, Gaggenau and Kassel for Powertrain Cars + Trucks.

The projects in the USA, China, Russia, Mexico, India and Brazil will also be incorporated into this standardization if this is deemed necessary (to be decided by the management of the model series projects concerned).

Up-to-date versions of the system software in the fastener controls and the related documents needed for this, are made available via an internet site.

Daimler AG provides templates for the OEMs, whose application represents the standard. This also includes the sequence control of the manual workstations with the associated PLC connections and the stationary control modules based on S7-TIA. The compatible nutrunner control software (mPro) is also stored in the template.

For system designs that do not comply with this standard, special applications can also be implemented after consultation with Daimler AG. For this purpose, S7-TIA control modules for nutrunner control are available on the APEX website for the PT2025 project

<http://software.apextoolgroup.com/customer-pages/daimler-pps2025/>
(Initial) access is secured with a password "pps2025".

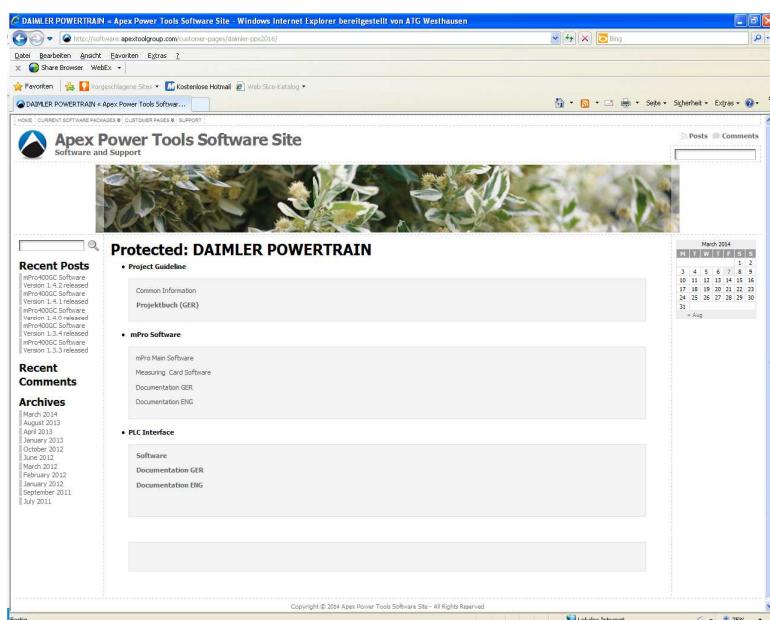


Fig. 1 Access to APEX internet project portal

Project name:	Stationary and handheld EC fastening technology from company APEX Tool Group
File name:	Projektbuch eng MCG_LKW_PKW_Powertrain_2025_V01.14
Version / Release:	01.14
Author:	APEX Tool Group

Stationary EC fastening technology feature BTS technology. That means the complex servo and measuring technology is located in the fastener itself and only external power conditioning is needed. This central component contains all communications interfaces. Power is supplied to the fastener via cables bridged from one fastener to the next, which greatly reduces the wiring complexity. The fastener control does not have a separate control and visualization unit.

The operation and visualisation is available with the handheld EC nutrunners, but only on the first nutrunner channel. Additional fastening channels at one manual work bay are operated with controls with reduced features (secondary controls).

The fastener is controlled via the PROFINET-IO field bus, in version with M12 connection technology.

The stationary fastener control can be used to control up to 32 fastener channels. The channels are numbered according to the address setting for the fastener concerned. Groups of fastening spindles can be formed in the fastener control. These can be controlled using shared process signals. The process within such a group runs synchronously to the phases for the spindles involved. Each group can be controlled independently of the others. In other words they work asynchronously. Groups are used, for example, as subsequences or are employed for special construction features such as separate fastener in feeds or robot solutions.

As a rule, a workpiece is processed in a machine. To do this, the fastener control can be given a workpiece identifier. For applications in which two or more workpieces are processed simultaneously, separate workpiece identifiers can be given to each group. The fastener control uses the identifier for unambiguous and traceable documentation.

To simplify the PLC connection, function blocks are provided in the Daimler AG template. These must be used in order to achieve consistent and homogeneous activations. These modules assume the role of communicating with the fastener control and make the results available in the data modules for the PLC program. The interface on the fastener control is configured either automatically or with default settings. Evaluations are always valid for the package commissioned. Complete results therefore have to be generated in the PLC application.

The same principle applies to the handheld EC nutrunner, whereby in addition to the nutrunner control, the sequence control with visualisation and connection to the cell system is also specified in the template. In this way, classic single screwdrivers as well as hand-guided multiple screwdrivers can be set up. The manual workstations can be configured in the Daimler standard HAP with up to 5 screw channels*.

For special applications, provided they have been approved by the project managers at Daimler AG, S7-TIA control modules are available on the APEX website.

* If more than 5 channels are processed, it is imperative that the project manager is consulted.

2.1.2. System Integration – Stationary EC Fasteners

Layout of PROFINET individual couplings with data network and access to fastener control with separate data network

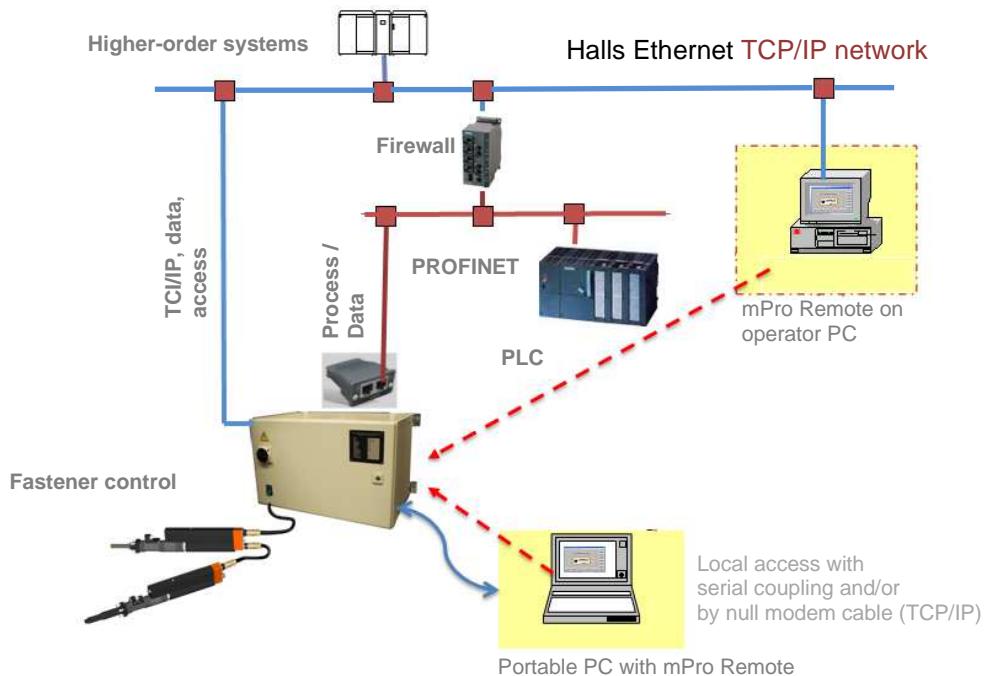


Fig. 2 Overview schematic of system integration in the basic PROFINET Variant 1

And with combined systems network with Profinet and data function

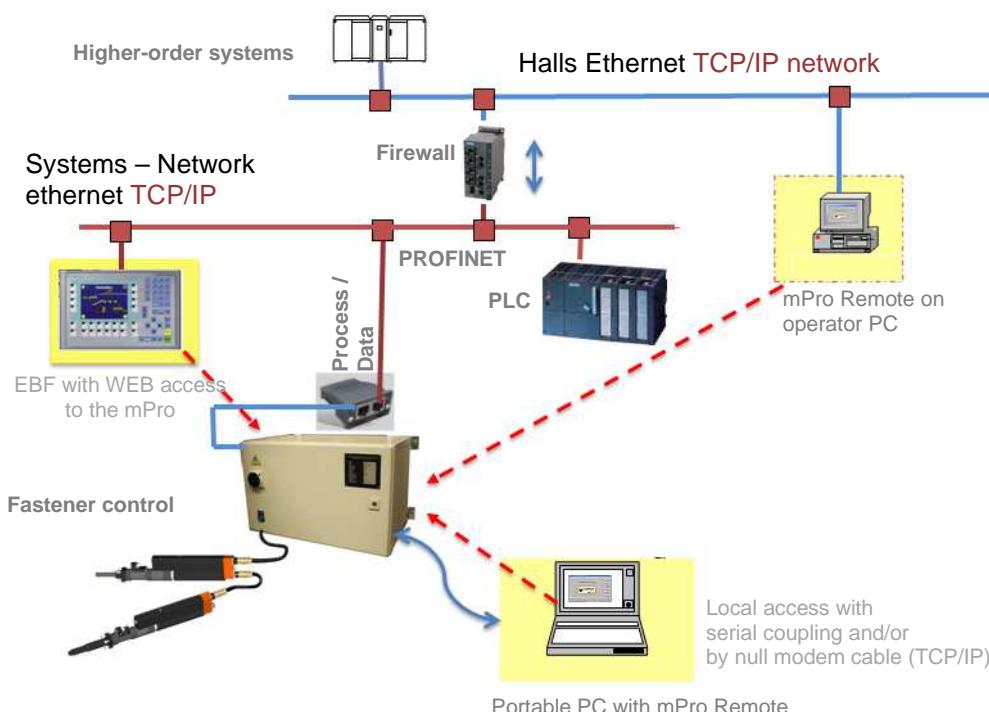


Fig. 3 Overview schematic of system integration in the basic PROFINET system
(cf. Chapter 3.1.2 "System Integration – Handheld Fasteners")

Project name:	Stationary and handheld EC fastening technology from company APEX Tool Group
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Power is supplied to the fastener control with separate leads for 400V and 230 V from the supply panel. The emergency off function is realized using discrete signals and failsafe inputs/outputs from the PLC.

Data and control connections are made via PROFINET-IO. The ident, the fastening program selection and the signals for process control from the PLC are transmitted/controlled via the field bus.

Data communication from the fastener controller to the higher-order systems runs via Ethernet (TCP/IP).

At the end of the fastening process, the rundown data can be transferred to the QDA system or others (depending on the operating plant) for statistical analysis. The prompt to do this is given by the PLC after processing has ended.

2.1.3. Fastener Box – System Set-Up

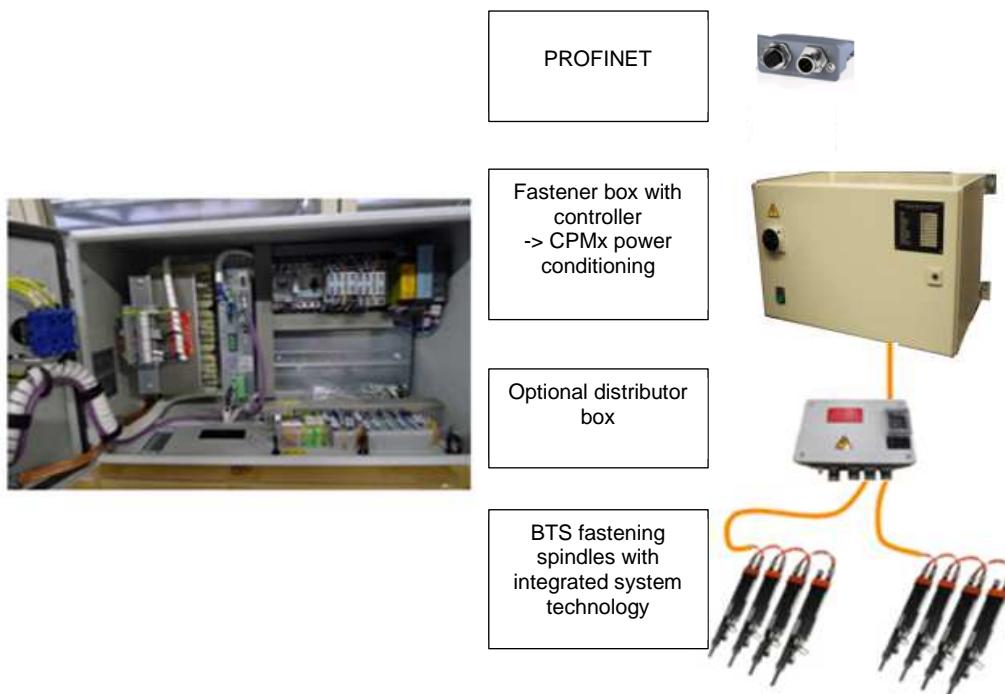


Fig. 4  Schematic system set-up / system overview BTS

Important framework conditions:

Power supply

German locations and China (Beijing)

Mains specification / power supply

3x 400 VAC / N / PE 50 Hz

Separate incoming feeder for control/controller

1x 230 VAC / N / PE 50 Hz

USA, Russia, Mexico, India or Brazil are to be clarified in case of need.

2.1.4. Fastener Box – Order Data

The central power supply is a compact structure and is always employed in the same standard way. Included in the system set-up are the power conditioning, the fastener controller and the monitoring organs. The connection is made with a detachable cable entry which provides IP protection and strain relief element, plus the standardized Harting plug connection for emergency off activation. The cables are fed in at the underside.

The special thing about BTS technology is that from power conditioning, one to max. Three cables (depending on load) must be routed to the fastener unit. Within the fastener network itself, only bridging cables are used for distributing to the spindles and a terminator is plugged on the end.

If several fastener units are used, as is often the case on the line due to left/right side or in applications with distributed robots, there is still no need for incoming and outgoing supply lines. Here, a distributor box with up to three outputs can be employed so that every sub-unit is wired as a separate train.



mPro400 SC-CPM3

Fig. 5  Supply unit for BTS

Order data:

Designation	Type	Order no.
PROFINET		
mPro400SC-CPM3	2-port M12	S133585-PN-EU *
mPro400SC-CPM6	2-port M12	S133586-PN-EU *
mPro400SC-CPM9	2-port M12	S133587-PN-EU *
mPro400SC-CPM12	2-port M12	S133588-PN-EU *

*= firmware: HMS **V2.03**

Table 1  Controller order data

2.1.5. Fastener Box – Technical Specifications

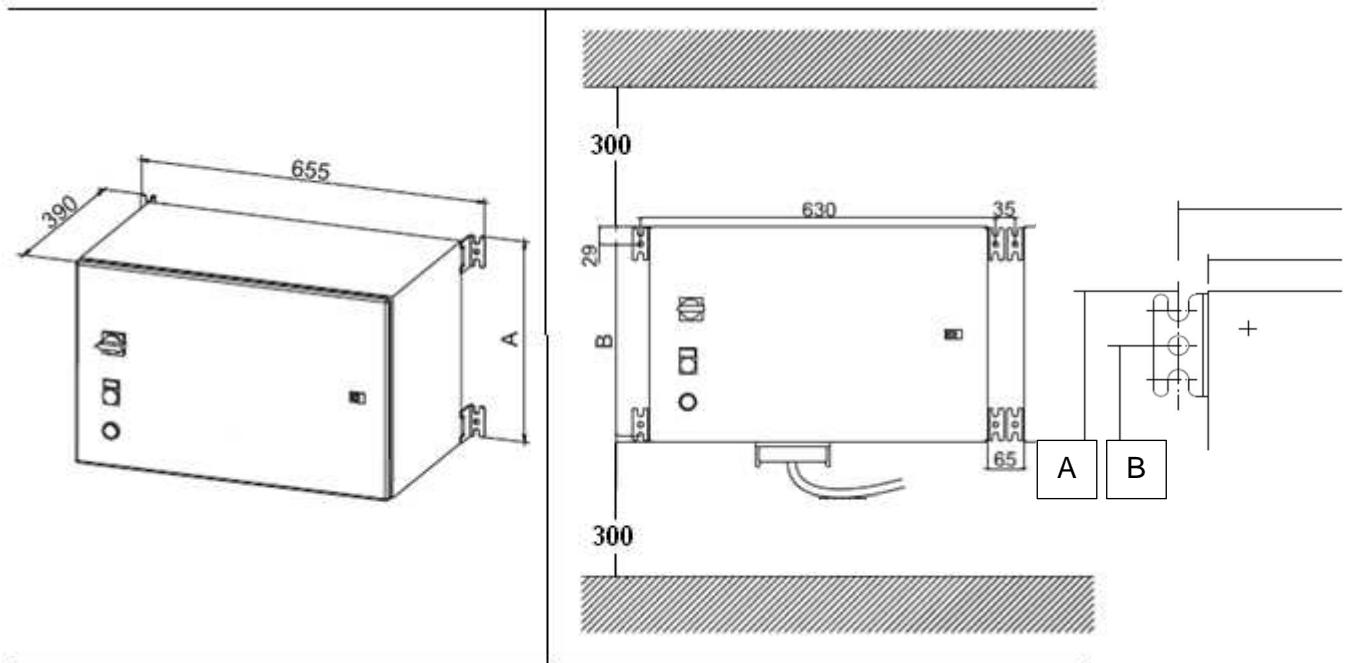


Fig. 6 Control unit dimensions

Dimensions

	Width in mm	Height in mm	Depth in mm	Weight kg	A mm	B mm	Drill dimensions in mm (template)
CPM3	600	380	390	86	380	340	630.0 340.0
CPM6	600	600	390	140	600	560	630.0 560.0
CPM9	600	2400	500	270			
CPM12	1200	2400	500	310			

Table 2 CPMx dimensions

Set-up:

Assembly frames are available for mounts. These can be employed as required. Here, the mPro-400SG-CPMx is attached to the machine or a mounting frame with four M8, 8.8 screws. The screws are included in the delivery specification.

The mPro-400SG-CPMx is ventilated via self-convection!



NOTE: No heated air may ingress below the cooling element. No objects must interfere with the airflow above and below the cooling element (see shaded area in graphic). The mPro-400SC-CPM... must not be exposed to direct sunlight.

Assembly frames available:

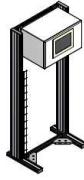
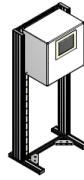
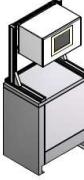
	Order no.	CPM3	CPM6	Dimensions HxWxD (mm)
Floor set-up CPM3/6	S319292			1750x780x500
Robot cabinet set-up CPM3/6	S319291			790x752x560

Table 3  Mounting frames

2.1.6. Fastener Box – Configuration

Only spindles of the BTS series can be operated at the central power supply. These may be combined in different sizes and numbers. Different power requirements can be serviced by differing both the number of units and their size (capacity).

Possible channel numbers (typical applications under normal load)

	Max. number of BTS fasteners				Number of system cable outlets (PMA number)
	1B(U)TS..	2B(U)TS..	3B(U)TS..	4B(U)TS..	
mPro-400SC-CPM3	16	6	6	6	1
mPro-400SC-CPM6	32	12	12	12	2
mPro-400SC-CPM9	...	18	18	18	3
mPro-400SC-CPM12	...	32	32	32	4

Table 4  Overview of channel numbers

This maximum number of spindles depends on the load. In order to ensure the data indicated, the following must be taken into account:

- The load at maximum rpm capacity must not exceed 20% of the max. spindle capacity
- Final tightening up to 500 Nm → max. speed 50 rpm with maximum usage of spindle capacity
- Final tightening over 500 Nm → max. speed 20 rpm with maximum usage of spindle capacity

If settings above those indicated are selected, the number of channels must be reduced accordingly.

If combinations of different spindle sizes are used, a simple calculation can be used to determine if the supply unit can deliver sufficient power. If higher output is needed, the next larger basic type may be used.

Calculation-based determination (approximate calculation)

(Calculation for typical **increased load**, without consideration of the above-mentioned restriction).

The number and type of the required power modules can be calculated with the help of the number of power module connections (PMAs).

Example: (X = number).

Formula for calculation of the PMA number:

$$\text{PMA} = X \text{ 1BTS..} \times 0.10 + X \text{ 2BTS} \times 0.17 + X \text{ 3BTS} \times 0.20 + X \text{ 4BTS} \times 0.33$$

Step 1 – Ascertainment of the individual situation and determination of the PMA number, e.g. for a station with 5/2/2/1 spindles of different sizes

Built-in fasteners		Factor	PMA
Size	Number (X)		
1BTS..	5	$\times 0.10 =$	0.50
2BTS..	2	$\times 0.17 =$	0.34
3BTS..	2	$\times 0.20 =$	0.40
4BTS..	1	$\times 0.33 =$	0.33
Total			1.57
The result is rounded up (to the next whole number)		2	thumb up

Table 5 ↗ Calculation via PMA number

Step 2 – Choice of power modules

	PMA number
CPM3	1
CPM6	2
CPM9	3
CPM12	4

For the example, the requirement
PMA = 2 means one CPM6 needs to be chosen.

Table 6 ↗ PMA numbers



A well ventilated place is needed for installation. If the control is positioned above other heat-emitting components/devices, make sure that the distance between them is adequate or that thermal baffle plates are used to prevent the absorption of additional heat.



The cable entry is designed to be located in the floor of the unit. Sufficient maneuvering room must therefore be left for this purpose. Important: note bending radius of cables.

2.1.7. Optional Distributor Box

The distributor box can be simply plugged into the fastener wire. This can also substitute for the envisaged transfer from fixed to mobile cables.

The distributor box should be used if the EC fasteners are split, for example, between 2 robots. It is then possible to wire the fastening spindles to the robot concerned with just one fastening spindle cable (cf. Fig. 15  Example of routing).



Fig. 7  BTS distributor box

Order data

Designation	Order no.
Distributor box BTS 3STR	S133471

Table 7  Distributor box order data

Technical specifications

	Width in mm	Height in mm	Depth in mm	Weight kg
Distributor box BTS 3STR	300	120	200	5.5

Table 8  Distributor box dimensions

-  To be able to operate the selectivity of the overcurrent devices safely, a maximum of 12 screw channels may be used per distributor box, regardless of the size of the fastening spindles.
Cascading is not approved!
-  Use of the distributor box does not change the maximum total number of the fastening spindle cables of 50 m.

2.2. Interfaces

2.2.1. Overview of Interfaces

The fastener system is actuated by the PLC via either PROFINET-IO (agreement with Planning essential)

The connection is made with the M12-compatible modules, which are plugged directly into the controller.

The necessary functional modules for the PLC are available and are to be used for standardization purposes. Provision is made by Daimler AG or, for special applications, by APEX.

PROFINET wiring:

In order to increase the availability of the field bus technology, the controllers are supplied with voltage on a permanent basis (separate incoming feeder for control). Wiring must be conformant with PNO specifications.

The behavior in this set-up is equivalent to a field bus element / slave.

PROFISAFE (PROFINET):

The Fieldbus-modules are not configured for PROFISAFE. For integration into the system's safety circuit, secure 24-volt IO signals must be provided through external secure components under the responsibility of the system.

Workpiece ID:

No separate reading units are connected to the fastener controller. The identification of the components to be fastened is transmitted to the fastening control by higher-level control systems.

The system is intended to be employed in a standardized manner and requires higher-order functions for this (PLC, read ident, Issue job, Control data_Send to QDA, Touch up, etc.).

For applications in which there is no higher-order control, a special set-up can be fitted to enable the fastener control to take over such tasks. The standard set-up (delivered state) is neither intended nor designed for this. Detailed agreement is necessary prior to project planning. Such solutions are expensive as they are special solutions and must therefore first be agreed with the operator and manufacturer.

Connecting wires

Fixed wires to the PLC and robots can be routed directly on a terminal strip. Fixed wires to the fastening spindles can be plugged directly to the CPSx module in the fastener box. Flexibly routed wires (e.g. lines to fastening spindles on the robot or switch board) must have an intermediate connection!

2.2.2. Ethernet Interface Port

Parameters, programs, curve profiles and result data can be transmitted and diagnosis programs (mPro Remote) launched via the Ethernet interface port (IEE 802.3 transitional interface port: RJ45, protocol: TCP/IP).

When using the PROFINET module, a bridge (patch cable) and the integrated switch function can enable the connection to be made via a single network line to the system network. For this, the fastener control needs two separate addresses.

Project name:	Stationary and handheld EC fastening technology from company APEX Tool Group
File name:	Projektbuch eng MCG_LKW_PKW_Powertrain_2025_V01.14
Version / Release:	01.14
Author:	APEX Tool Group

2.2.3. Documentation of Rundown Data

Rundown data from the fastening controller is transmitted to the QDA system or others (depending on the operating plant) via the Ethernet interface port (IEE 802.3 transition interface: RJ45, Protocol: TCP/IP).

2.3. Fastener Cables

2.3.1. General

The wires to the fastening spindles must not be longer than 50 m (**in total!**). Regardless of this, the shortest possible connection should always be used.

An Arcnet high-performance system bus is integrated into the spindle cables. The fastener cables are thus to be routed separately from the power cables.

In order to achieve a long service life for the cables, the cables must be secured using special clips with elastomer inserts.

Procurement source	For type	Order no.
Company Stauff	BTS fastening spindle cable in general	414PPR
APEX Tool Group		961509PT

Table 9 Stauff clamp order data

Auxiliary devices are available for fixing the cables/clamps to the fastening spindles themselves. These retainers are beneficial in particular in areas with more difficult fixing options such as in robot assembly. Three different clamp positions are possible on the bar. The spindle cables themselves can be twisted and adjusted on the connector for optimal securing.



Fig. 8 Cable fixing on the spindle (example)

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Order data

Procurement source	Assembly	Assignment for	Order no.
APEX Tool Group	Holder with 2 rubber-padded cable clamps, including fastening materials	1BTS – 4BTS	S390 083
		1BUTS – 4BUTS	S390 095

Table 10 ☐ Order data for cable mounting on fasteners

The cable connections are securely made using push-pull plug connectors. Clips can also be used to additionally secure the slide lock on the fastener cable. These prevent the lock from sliding open. The clips can be permanently fitted to the cable.

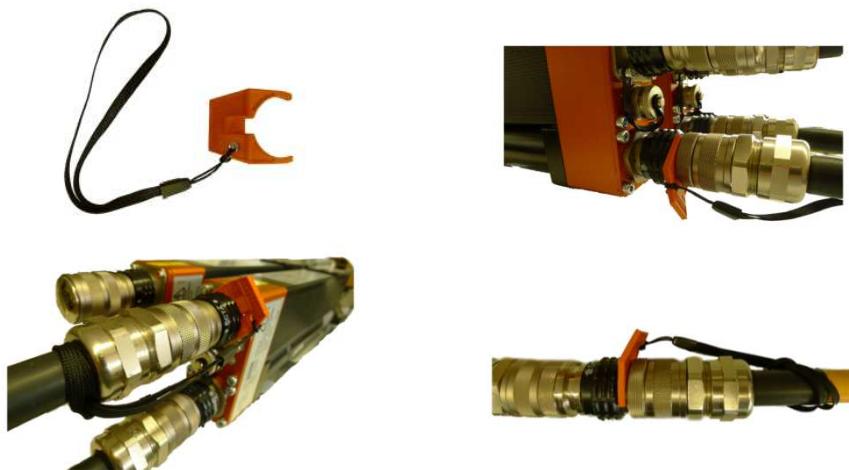


Fig. 9 ☐ Lock secured with clips

Order data

Procurement source	Assembly	Order no.
APEX Tool Group	Securing clips with strap (cannot be lost)	S800 555

Table 11 ☐ Order data for securing clips



Additional information is available in the APEX Tool Group "Cable Management Reference Guide" P2102JH/EN.

<http://www.clecotools.de/downloads?>

2.3.2. Routing Instructions

Instructions for routing cables:

General

- Do not kink the cables as they are unwound. Do not allow loops or twists to form.
- Note that a strain relief element and compression set must be incorporated within the bending radius.
- Don't use extra-long cables and wires (reserve). Avoid mutual interference.
- Route the fastener cables separately from other energy and signal wires.

NOTE!

- Only original cables approved by the APEX Tool Group may be used.
- Note the maximum total cable length is **50 m**.
- Take appropriate measures to limit cable bending radii and torsion. Note the permissible bending radii and torsional lengths.
- All connections must be closed. The locks must be securely applied.
- On plug connectors with a slide lock, the red ring around the outer diameter should not be visible.

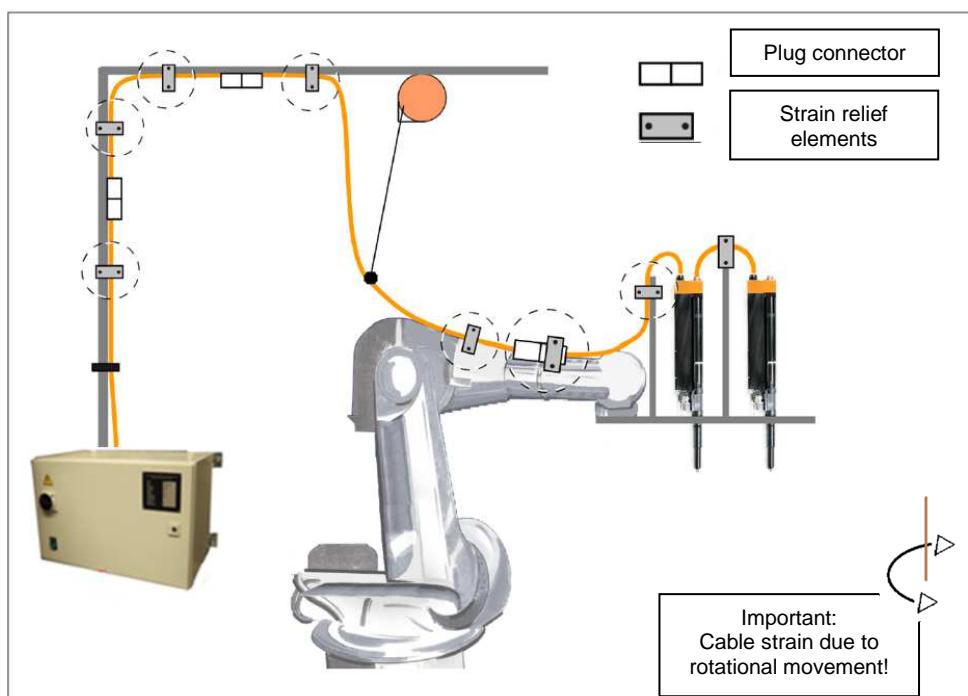


Fig. 10  Use illustrated on a robot



As a general rule, cable and hose components must have strain relief elements at the beginning and end of all sections. No tensile stress or lateral forces shall occur at connectors, plugs and screw joints.

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Position strain relief elements such that the cables have maximum freedom of movement. Route cables in light loops such that the cables never come under stress with extended cable drag. A remedy can be provided using cables between the carriages or end limits on the rail.

Our recommendation: after the initial installation of the cables, move through a few movement cycles. Then check the cable routing once more and optimize as necessary.

Only secure cables with strain relief elements suitable for the cable diameters concerned. Use screwed cable clamps. the clamping surface should be suitable for the tensile strain encountered. If the clamping surface is too narrow, this can cause the cable to fail earlier.

→ Avoid pinching individual wires or sub-components. A clamping force around the full circumference of the cable is recommended.

→ Only secure the cables at the strain relief element.

→ A secure strain relief element prevents the cable from shifting inside the flexible power supply chain.



Additional information is available in the APEX Tool Group "Cable Management Reference Guide" P2102JH/EN.

<http://www.clecotools.de/downloads>

2.3.3. Shielding

The shielding in the wires restricts the dispersion of interfering energy into the surroundings and protects the system against external interference. The cables between the fastener module and built-in fastener are shielded against external interference. This measure also counters the emission of interference.

→ Extensively connect the shielding of the fastener cables (skin effect) to the lower edge of the tightening module housing with the aid of shield connecting elements.

Use the following shield clamps for this:

	Shield clamp Order no.	Phoenix identifier	Phoenix order no.
Cable BTS series	S961062	SK14	3025176

Table 12 Shield clamps

The shielding of the system bus wire is connected to the connector housing. In the power supply, the cables are fixed to the CPS3 with the shield clamp and thus routed for reference potential. The cables are prepared for this.

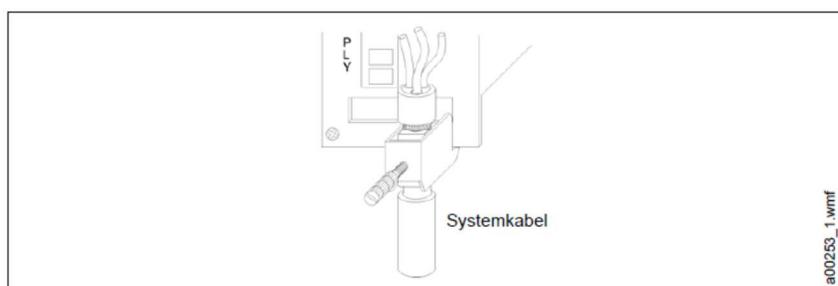


Fig. 11 Shield clamp

NOTE!

Field bus M12 shielding – A ground connection for the PROFINET cables is automatically made through the housing of the M12 connector. In particular when requirements are high (long distances, high data transmission speeds, different voltage sources,...) it is recommended to ground the cable shield of the PROFINET cables directly after they enter the CPM housing. For this purpose, contact rails are fitted to the inside of the cable entry. Contacting is made via the shield clamps.



Fig. 12 Profinet shield clamp

2.3.4. Routing "HighFlex Quality" Cables in Power Supply Chains

The routing of lines in power supply chains must be carried out with the greatest possible care. In general, the following points must be noted:

- The cables must not be twisted in the power supply chain. Prior to assembly, lay the cables on an even surface so that they can be inserted while stretched out.
- Route the cables in the power supply chain individually, lying loosely adjacent to each other whenever possible. Route no more than 2 cables per section.
- Separate cables lying adjacent to each other using cut-off bridges whenever possible.
- Don't bundle cables or fasten them with cable ties.
- Never route cables of different diameters ($> 3 \text{ mm}$) together in the same section.
- Cables must be able to follow the radius of curvature without being forced around it.

Vertical installation:



Fig. 13  Routing in power supply chain

- Allow for approx. 20% clearance within the web height. The wires droop downward due to the weight of the cables, including the chain. Monitor this sag at regular intervals and adjust as necessary.

2.3.5. Wiring in the Robot Area "SuperHighFlex Quality"

In order to achieve optimal service life of cables in robotics applications, comply with the following points when laying the cables:

- Avoid using cable ties to secure cables.
- Lay the cable duct so that the cables have maximum freedom of movement.
- Route the cables so that the sleeves do not rub during operation. The cables must not make contact with static parts or droop.
- Cables should not shift during operation.
- The bending radius must not be smaller than the minimum bending radius stated. The larger the bending radius, the longer the service life.
- Make sure that the length of the cable compensates for torsional loads.

2.3.6. Cable Types

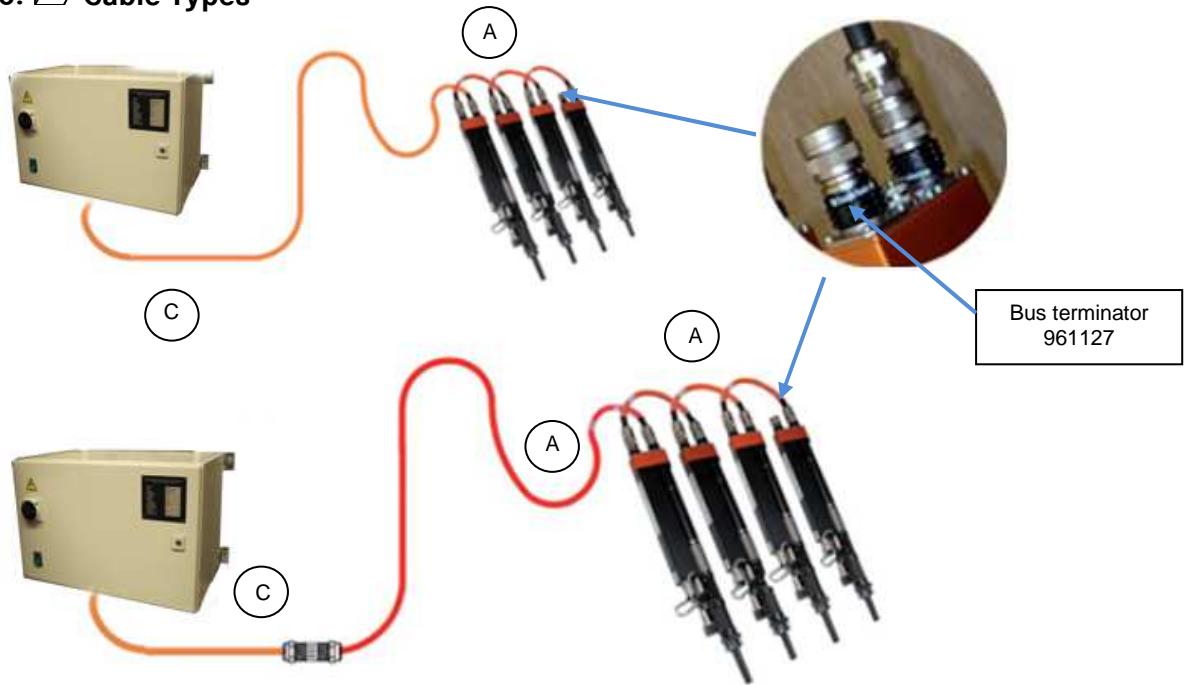


Fig. 14 Cabling types

C	A	A	A
Highly flexible direct connection between the fastener / intermediate plug position and fastener control in HighFlex quality (straight connector)	Connection between the fastener and intermediate plug position in HighFlex Quality (straight connector)	Ditto for robot applications in SuperHighFlex quality (straight connector)	Jumper cable type A between the fasteners (straight connector)

Cable length m	Type C HighFlex	Type A HighFlex	Type A SuperHighFlex	Bus terminator
0.5		961104-005 *1		
1		961104-010 *1		
2	961109-020	961104-020	961103-020	
4	961109-040	961104-040	961103-040	
6	961109-060	961104-060	961103-060	
8	961109-080	961104-080	961103-080	
10	961109-100	961104-100	961103-100	
	*2	*2	*2	

*1 - Jumper cable

*2 - Other lengths are available, preferably in 2 m increments

Other length increments in agreement with Daimler / plant specification

Table 13 Overview of cables and accessories



Cables of the type "SuperHighFlex" must always be used for robot applications!

Distribution of cables at a robot station as an example

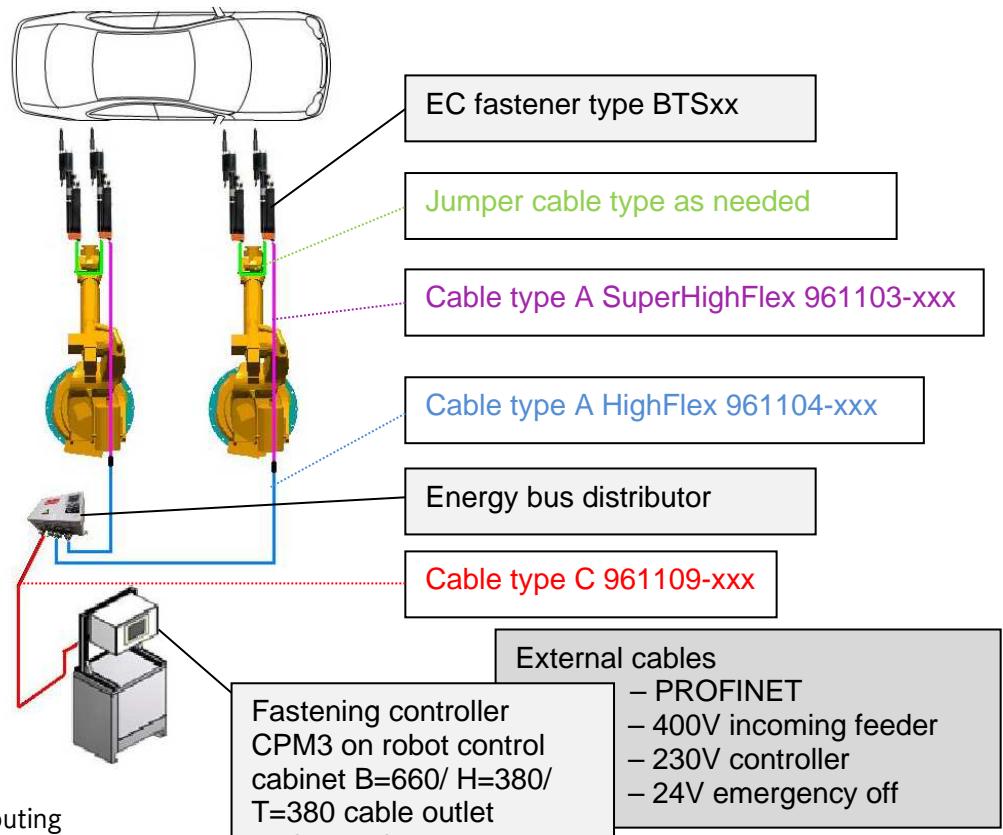


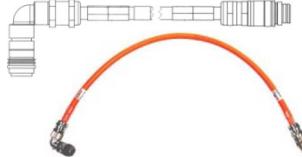
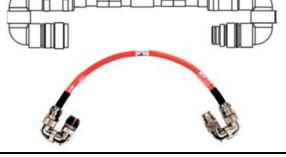
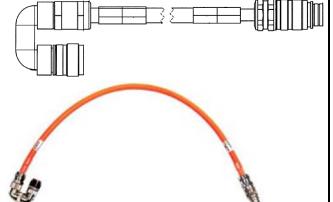
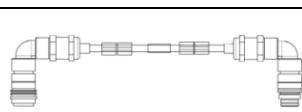
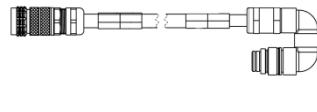
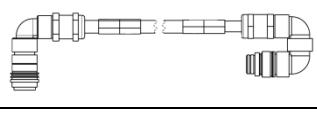
Fig. 15 Example of routing

Because of the cable system, assembled cable conduit packages have been specified by Daimler in earlier projects and are available from the company Kuka (robots).

2.3.7. Special Cable Types



These special types must only be used in agreement with the responsible department at Daimler!

Figure	Designation	Cable length	Order No. SuperHighFlex	Order No. HighFlex
	HighFlex type I Plug 90° connector revolving, plugged directly into CPSx	2 m		961294-020
		4 m		961294-040
		6 m		961294-060
		8 m		961294-080
		10 m		961294-100
	HighFlex and SuperHighFlex type F (Jumper) Plug 90° connector, revolving pin straight connector	0.5 m	961395-005	961295-005 *1
		1 m	961395-010	961295-010 *1
		10 m	961395-100	961295-100
	HighFlex type G (Jumper) Double-sided 180° connector, revolving connector housing with PG screw joint.	0.5 m		961298-005 *1
		1 m		961298-010 *1
		2 m		961298-020
	HighFlex and Super HighFlex type H (Jumper) Plug 180° connector, revolving Pin straight connector housing with PG screw joint.	0.5 m	961397-005	961297-005 *1
		1 m	961397-010	961297-010 *1
		2 m	961397-020	961297-020
		4 m	961397-040	961297-040
		6 m	961397-060	961297-060
		8 m	961397-080	961297-080
		10 m	961397-100	961297-100
	HighFlex type E (Jumper) Double-sided 90° connector, revolving connector housing with PG screw joint	0.5 m		961299-005 *1
		1 m		961299-010 *1
		2 m		961299-020
	HighFlex type L (Jumper) Plug straight connector Pin 180° connector	0.5 m		961293-005 *1
		1 m		961293-010 *1
		2 m		961293-020
		4 m		961293-040
		6 m		961293-060
		8 m		961293-080
		10 m		961293-100
	HighFlex type M (Jumper) Pin 90° connector Pin 180° connector	0.5 m		961296-005 *1
		1 m		961296-010 *1
		2 m		961296-020

1 – Jumper cable *2 – Other lengths are available, preferably in 2 m increments
Other length increments in agreement with Daimler / plant specification

Table 14  Distributor / jumper cables

2.3.8. Cable Properties

HighFlex quality, suitable for power supply chains

Thermal properties		
Ambient temperature °C -20...+80	Flammability flame-retardant and self-extinguishing in accordance with	EN 50265-2-1, IEC 60332-1 and UL1581
Chemical properties of the coating		
Coating material	PUR, low-adhesion, resistant to hydrolysis and microbes, UV-resistant, abrasion-resistant, tear-resistant, cut-resistant, notch-resistant	
Oil resistance		Oil-resistant in accordance with DIN VDE 0472 part 803, ASTM oil 1 to 3 and HD 505.2.1
Resistance to hydrolysis		In accordance with VDE 0283, part 10
Color		RAL 2003 matt
Mechanical properties		
Diameter	mm	approx. 13.8
Bending radii:		30 min.
Single bends	mm	95 mm min. flexing action
Multiple bends		130 min alternate bending
Torsional length (±180 ° around separate central axis)	mm	500 min.
Max. acceleration	m/s ²	100

Table 15  HighFlex cable properties

SuperHighFlex, suitable for robots

Thermal properties		
Ambient temperature	°C	-20...+90
Flammability		Flame-retardant and self-extinguishing in accordance with EN 50265-2-1, IEC 60332-1 and UL1581
Chemical properties of the coating		
Coating material	PUR, low-adhesion, resistant to hydrolysis and microbes, UV-resistant, abrasion-resistant, tear-resistant, cut-resistant, notch-resistant	
Oil resistance		Oil resistant in accordance with DIN VDE 0472, part 803 ASTM oil 1 to 3 and HD 505.2.1
Resistance to hydrolysis		In accordance with VDE 0283, part 10
Color		Orange RAL 2003 matt
Mechanical properties		
Diameter	mm	approx. 14
Bending radii:		30 min.
Single bends	mm	60 mm min. flexing action
Multiple bends		43 min alternate bending
Torsional length (±180 ° around separate central axis)	mm	500 min.
Max. acceleration	m/s ²	100

Table 16  Super HighFlex cables

2.4. □ Incoming Feeders

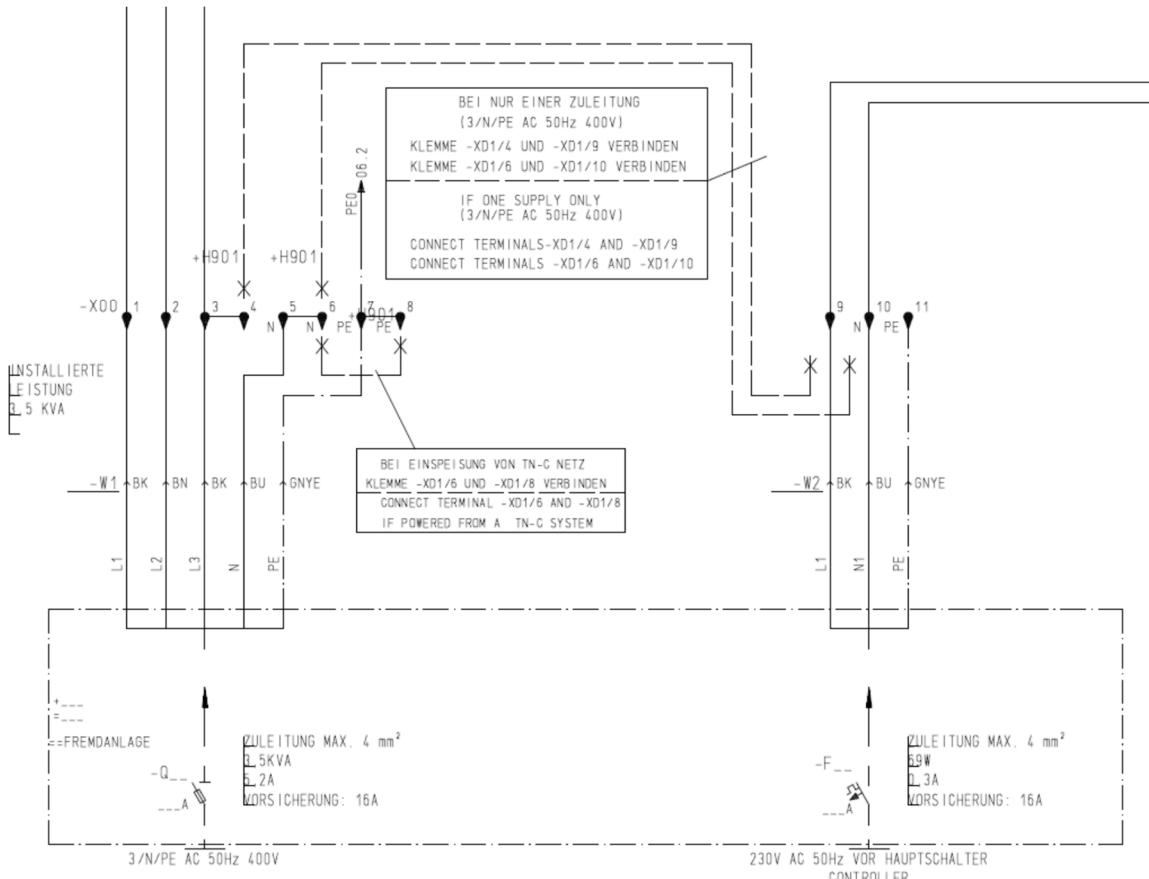


Fig. 16 ✎ Incoming feeders

Incoming feeders are split between power and control / PC!

Can be bridged if necessary.

Important:

Control / PC under voltage even when the main switch is turned off!

Separate incoming feeders should guarantee higher availability of the installed station controller. When switched off, the field bus and other connections via the Ethernet network remain ready for communication.

For maintenance or service purposes, this electrical circuit can also be switched off via a motor protection switch.

From size 9 upward, cooling units are included in the CPM. In this version, a temperature disturbance is also reported to the emergency off activation via the Harting connector.



The cross sections of the cables for the incoming feeder lines must be designated for each specific system.

	Area of power connection		Area of control		
	Installed power	Backup fuse min.	Installed power	Backup fuse min.	Backup fuse type
mPro-400SC-CPM3	3.5 kVA	16 A	69 VA	4 A	16 A
mPro-400SC-CPM6	6.5 kVA	25 A			
mPro-400SC-CPM9	10 KVA	32 A			

Table 17 CPM power data

2.4.1. Emergency Off Concept with Connection to PLC

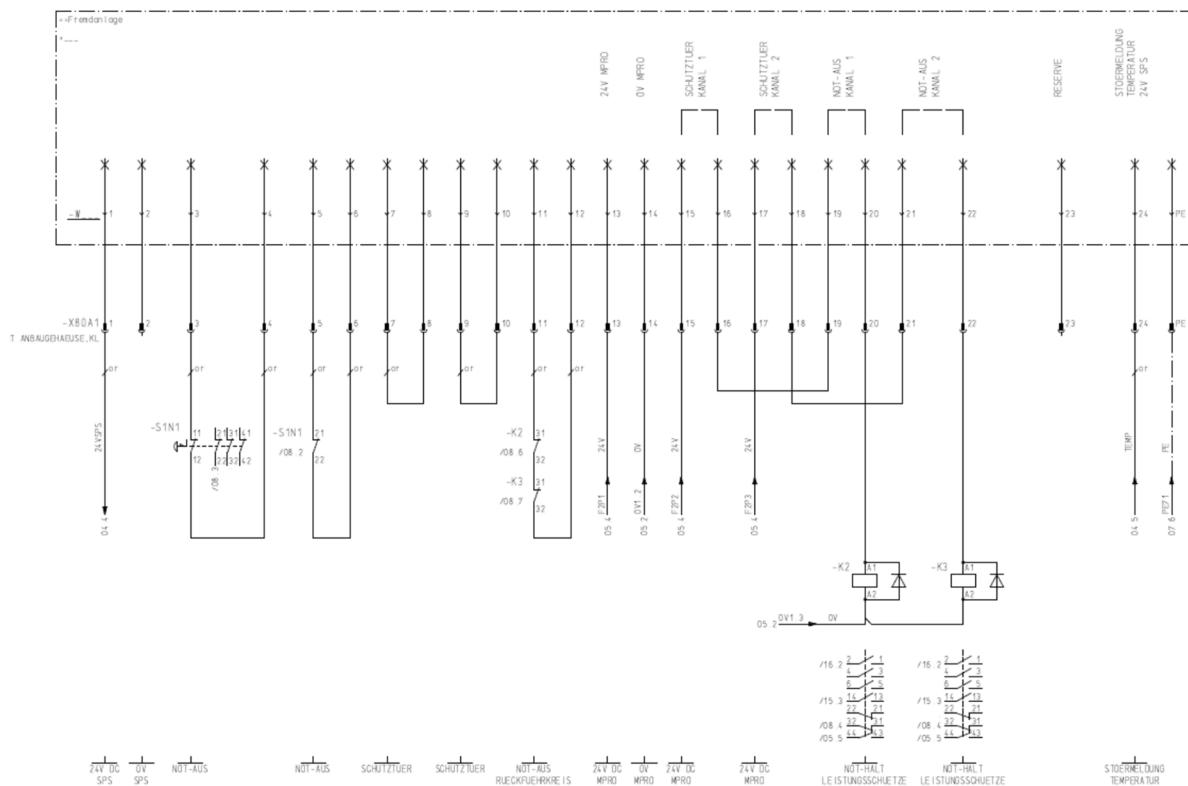


Fig. 17 EMERGENCY OFF concept with PLC

The hardware IO signals are activated via a Harting connector standardized by Daimler. No separate emergency off command units are installed within the fastening system. In the event of a PLC emergency off, the power supply to the fastening spindles is interrupted. The system remains ready for communication.

Project name:	Stationary and handheld EC fastening technology from company APEX Tool Group
File name:	Projektbuch eng MCG_LKW_PKW_Powertrain_2025_V01.14
Version / Release:	01.14
Author:	APEX Tool Group

The fastening system is self-acknowledging. No special signal sequences have to be observed to switch the system back on again when booting and after a system emergency off. The emergency off always causes the fastening to be aborted and a new fastening order has to be generated by the PLC after switching back on after an emergency off.

The types CPM9 and CPM12 include heat exchangers. Only these output temperature warnings on the PLC interface port.

2.4.2. Emergency Off Concept without Connection to PLC

In the case of autarchic fastening technology systems (without higher-level control, additional EMERGENCY OFF control devices must be integrated and connected to the terminal strip.



Use of this type of operation necessitates coordination with the specialist department at Daimler and the APEX Tool Group Company.

2.5. Fasteners

2.5.1. Spindle Summary

Size and corresponding fields of application

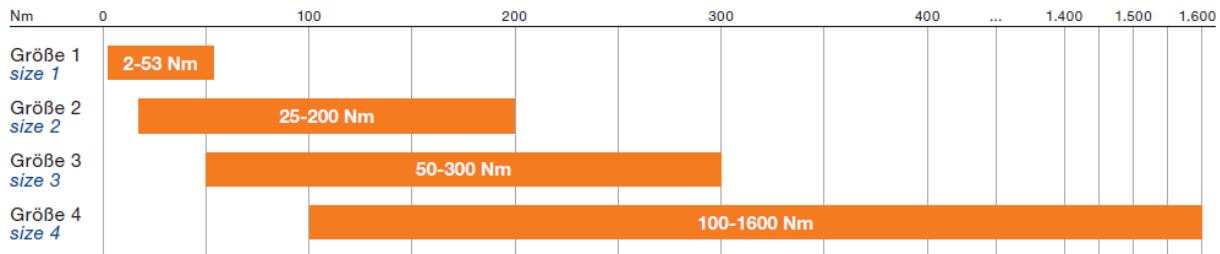


Fig. 18 Spindle capacity – overview

- 👉 The following fastener types represent a list of preferences. These are to be planned as a matter of priority. If particular requirements mean that other fastener types from the overall range or special types are needed, a separate approval will be necessary. This approval is to be obtained from the responsible project manager for EC fastening technology. The fastening spindles will then be configured together with APEX
- 👉 The following fasteners are presented as complete fasteners. In reality however, the fasteners are always formed from the basic fastener (order type) and a selected output (spring collet). These outputs are to be ordered separately!
- 👉 All spindle selections must be coordinated with the specialist department at Daimler and Apex!
- 👉 Maximum permanent capacity utilization: 80% of spindle capacity (Daimler specification). Increased loading due to heat buildup, stick-slip effect, etc. to be taken into account.
- 👉 Configuration of performance of fasteners to be agreed with the person/department responsible for fastening technology. As a rule, the max. permissible spindle speeds are less than the spindle capacity (important for programming cycle times)



Efficiency elements (gears, angle attachments, etc.) between the torque transducer and the built-in fasteners are not permissible because process stability cannot be ensured here and either up to 100% re-working is required or the process has to be validated in another manner!

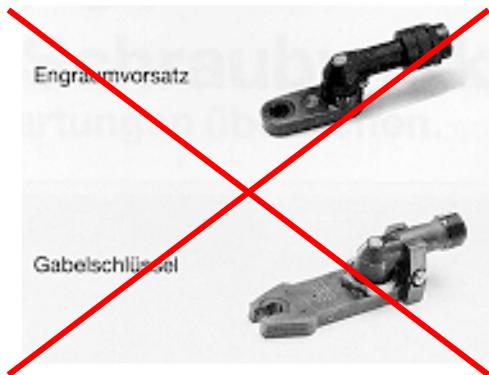


Fig. 19 ✎ Flat drives for fastening spindles



The fastening technology ends at the fastener output. If the system manufacturer is planning other "adapter spindles / outputs", possibly for reasons of efficiency, the perspective of the operator must also be taken into account. This will affect commissioning and maintenance.

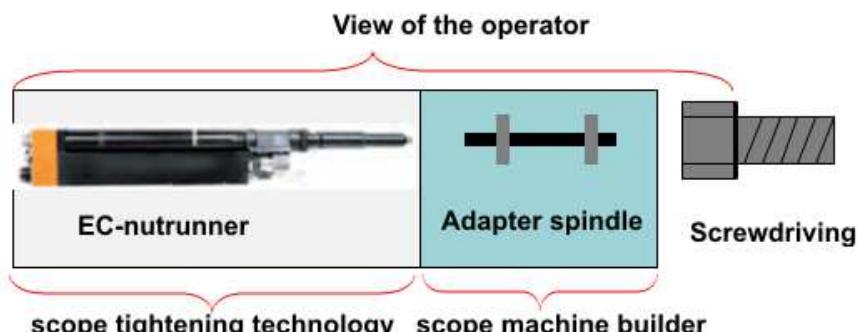


Fig. 20 ✎ Example of an adapter spindle



When planning and ordering and when creating spare parts lists, make sure that an unambiguous order number exists for the basic type, output and special fastener. Fastening spindles are always ordered as complete units.



Changes in the set-up of spindles (modular technology) are generally possible, e.g. output on the basic fastener turned through 15 degrees, but are only permissible in agreement with the responsible project manager/department at Daimler.

2.5.2. Spindle selection table; size 1

Overview and Technical drawings on the internet

<http://www.clecotools.de/downloads>

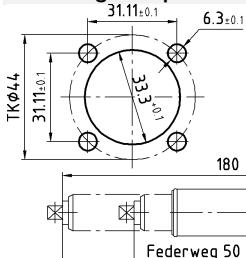
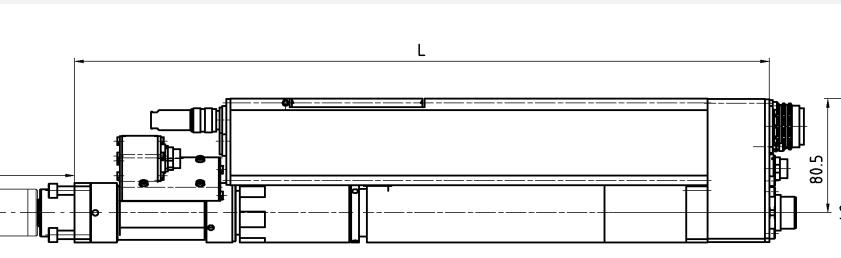
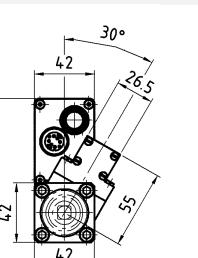
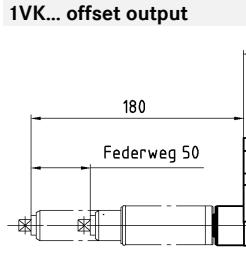
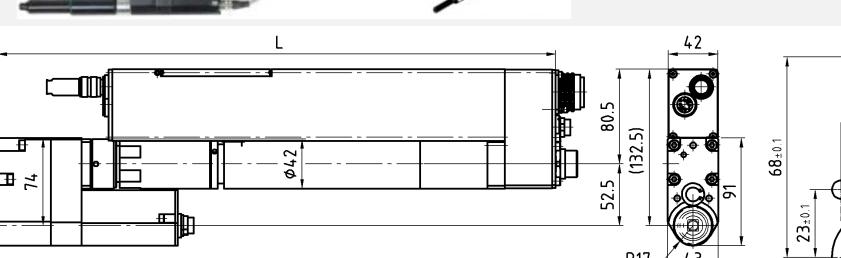
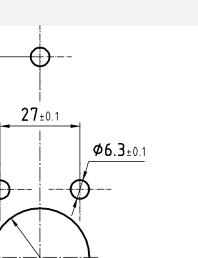
BTS Size 1							
Torque range 5 – 53 Nm							
Tightening torque Nm	Idling speed rpm	Square	Mid- distance	L	Weight	Type	Order no.
max.	min.	max.		mm	mm	kg	
							
1K... straight output							
							
12	2	1921	3/8"	43	486	4.8	1BTS-1B012A-1K3B-1ZB
35	5	727	3/8"	43	486	4.8	1BTS-1B035A-1K1B-1ZB
53	15	427	3/8"	43	486	4.8	1BTS-1B060A-1K2B-1ZB
							
1VK... offset output							
							
12	2	1825	3/8"	35	474	5.3	1BTS-1B012A-1VK3B
35	5	690	3/8"	35	474	5.3	1BTS-1B035A-1VK1B
53	15	405	3/8"	35	474	5.3	1BTS-1B060A-1VK2B

Table 18 BTS fastening spindles, size 1

2.5.3. Spindle selection table; size 2

Overview and Technical drawings on the internet

<http://www.clecotools.de/downloads>

BTS Size 2				L	Weight	Type	Order no.
Tightening torque Nm	Idling speed rpm	Square	Mid-distance				
Torque range 25 – 200 Nm							
max.	min.	max.	mm	mm	kg		
2K... straight output							
							
110	25	890	1/2"	56	528	7.6	2BTS-2B110A-2K1B-2ZB
200	40	502	3/4"	56	528	7.6	2BTS-2B200A-2K3B-2ZB
2VK... offset output							
							
110	25	831	1/2"	44	551	9.2	2BTS-2B110A-2VK1B
200	40	468	3/4"	44	551	9.2	2BTS-2B200A-2VK3B

Table 19 BTS fastening spindles, size 2

2.5.4. Spindle selection table; size 3

Overview and Technical drawings on the internet

<http://www.clecotools.de/downloads>

BTS Size 3				L	Weight	Type	Order no.
Tightening torque Nm	Idling speed rpm	Square	Mid-distance				
max.	min.	max.	mm	mm	kg		
Torque range 50 – 300 Nm							
3K... straight output							
300	50	453	3/4"	81	598	14.1	3BTS-3B300A-3K2B-3ZB 947577A6
3VK... offset output							
300	50	421	3/4"	59	584	15.2	3BTS-3B300A-3VK2B 947579A4

Table 20 BTS fastening spindles, size 3

2.5.5. Spindle selection table; size 4

Overview and Technical drawings on the internet

<http://www.clecotools.de/downloads>

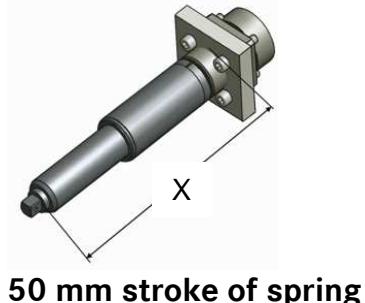
BTS Size 4				Torque range 100 – 1600 Nm				
Tightening torque Nm	Idling speed rpm	Square	Mid- distance	L	Weight	Type	Order no.	
max.	min.	max.		mm	mm	kg		
4K... straight output								
190	Federweg 50mm		L					
								
500	100	254	3/4"	91	719	21	4BTS-4B500A-4K2B-4ZA	947589A2
660	130	174	1"	91	719	21	4BTS-4B660A-4K3B-4ZA	947601A5
1250 *1	320	86	1"	121	771	29	4BTS-4B360A-4K1B-4Z1250A	947617A7
1600 *1	400	86	1 1/2"	121	771	29	4BTS-4B500A-4K2B-4Z1600A	947621A1

* 1 Special version – technical drawings on request

Table 21 BTS fastening spindles, size 4

2.5.6. Spring collet (straight/offset output)

Spring collet



50 mm stroke of spring

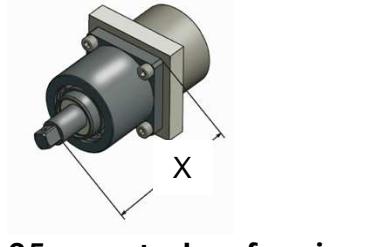
Size	Order no.	Square	Max. torque Nm	X (mm)	Output
1	922325PT	3/8"	60	180	1ZA 1VK
2	910609	1/2"	160	180	2ZA 2VK
2	935552	3/4"	200	180	2ZA 2VK
3	910613	3/4"	520	185	3ZA 3VK
4	912106	3/4"	520	190	4VK
4	912147	1"	750	186	4VK
4	S976956	1"	750	140	4ZA
4	S308441	1 1/2"	1600	140	4ZA
4	916642	1"	630	190	4ZA
4	916643	3/4"	520	185	4ZA

Table 22  Spring collets for BTS fastening spindles

Accompanying spring drives are required for each BTS fastener used.

2.5.7. Spring collets (angular output)

Spring collet including flange housing for angular output



25 mm stroke of spring

Size	Order no.	Square	Max. torque Nm	X (mm)
1	929041	3/8"	60	75
2	929053	1/2"	170	90
2	929061	3/4"	200	115
3	929065	3/4"	300	105
4	929077PT	3/4"	520	115
4	929089	1"	660	115

Table 23  Spring collets for angular drive BTS fastening spindles

2.6. Interesting Facts About stationary Screwdriver Control System

2.6.1. Application

BTS-EC fastening technology is design to comply with the requirements of VDI2862.

The fasteners are modular in design. The modules, for example an output, can be used to adapt the unit to local conditions in 10°/15° increments. Based on the standard specifications for type testing (VDI / VDE 2647) and Capability study (VDI / VDE 2645) must meet certain minimum requirements. These include the guarantee of the delivered quality characteristics and the management of machine capability examinations. Because these constitute the final quality assurance step at APEX, the modular adaptation at the site of use can actually only be made if the MCT (MFU) examination is then repeated, or if the provisions for upholding production quality are adapted accordingly by the user. A spindle modified in this ways also constitutes a risk of the new assembly not being adequately documented, which can lead to longer replacement times in the event of replacement.



For this reason, adaptations at the site of use must only be made after consulting the responsible project manager for fastening technology.

2.6.2. Replacing a Tool

BTS fasteners can be exchanged at any time for a fastener of the same type. For reasons of safety, the control electronics must be switched off when doing this. The fastener can be exchanged at the cable connections and the mechanical support. The fastener is always to be replaced as a complete unit. Because communications are based on a bus system, the address must be entered again on the replaced fastener (speed switch under service hatch). Function and readiness for operation must be verified after replacement.

2.6.3. Replacing Control

All programs, including the operating system and all settings and parameters are stored on the interchangeable CF card of the controller. This means that in the event of a hardware defect, the system can be restarted in the shortest possible time by changing the CF card in a new controller.

2.6.4. Maintenance

The maintenance schedule can be found in the differentiated descriptions of the assembly groups (fasteners). The specified maintenance must be performed for a longer term of warranty.

A fastening counter is integrated in every fastener. This can be called up in the self-identification mask of the fastener control. To ensure that the maintenance cycle is not missed, the controller warns before reaching the maintenance interval and when the Maintenance limit with a signal message to the PLC to automate the message to be able to pass it on.

The tool remains operational after the advance warning has been given and after the service threshold has been reached. After the service has been performed, the fastener control will automatically detect this and cancel the signal.

For installations with the higher-order system Torque.net, a concise function is stored there which supports convenient handling. The warning threshold and advance warning threshold can be programmed in the maintenance info mask and notification arranged with specific messages (e-mails).

In accordance with the contract, regular maintenance is performed by APEX before the limits are reached

and at the agreed conditions. Here, the counter is correctly reset to zero. Regular maintenance reduces operating disturbances, repair costs and downtimes.

In addition to the following service schedule, implement a safety-related service program that takes the local regulations for repair and service for all operating phases of the tool into account.

After a service is performed, the information is stored on a tool memory in the spindle. There, brief information about the last MCT (MFU) examination performed is also stored.

Overview of maintenance specifications:

	Use of APEX BTS at ...% of maximum torque		Measures
	80 %	100 %	
After ... fastening cycles)	3 million	1 million	General layout of the fasteners of all types with exceptions (see following lines) A general overhaul is necessary once the fastening cycles have been reached. Send fasteners to Sales & Service Center.
	1 million	500.000	For angular spindles in size 4 4B(U)TS-4B...A-4K...B-4WK...B: Send BTS to the Sales & Service Center for checking and recalibration.
	1 million	700.000	For angular spindles in sizes 3 and 2 3B(U)TS-3B300A-3K2B-3WK2B 2B(U)TS-2B200A-...-2WK3B Send BTS to the Sales & Service Center for checking and recalibration.
	1 million	700.000	For all drives used xB(U)TS-...VK... (x = 1, 2, 3, 4) Send BTS to the Sales & Service Center for checking and recalibration.

Table 24  Maintenance specifications (BTS fasteners)

2.6.5. Commissioning

The fastening technology parts are commissioned after they have been delivered. This can be performed by the system manufacturer and additionally / or only at the destination plant (Daimler).

Commissioning is performed after the system has been completely set up and installed ready for operation, including the necessary data interface. Commissioning by APEX is supported by an on-site inspection during which correct installation is checked. The successful examination is the basis for warranty cover. Corrections must be approved by way of subsequent on-site inspections at the request of the system manufacturer.

Commissioning includes the basic programming of the fastener control target values for joints, the testing of interface communications with the PLC and PROFINET (joint-specific optimizations are not included in the tender package).

Because many tangent groups (PLC programmers, IT-QDA system programmers, quality management ...) must be involved, detailed fine planning is necessary in order to avoid unnecessary waiting time.



Commissioning includes a process examination. This means a check of every individual screw with its respective fastening ID to determine if it is correctly displayed and recorded in the correct position as status (OK / NOK) in the respective systems (system visualization, QDA client, fastening controller...).

As a rule, start-up support is necessary following commissioning to optimize the joint together with the quality management team from the plant. This is referred to as fine parameterization. This is dealt with separately.

2.6.6. Test Functions

Test functions (TQ Calibration, TQ measurement, angle measurement, speed measurement, voltages) can be performed on each individual channel.

APEX technology makes it possible to electronically block built-in fasteners for checking the torque sensor (static test). A calibrated electronic torque wrench can be used to apply a defined torque to the output of the fastener.

The displays on the two system units must then be compared.

To examine the angle sensor, an angle test can be started on the fastener control. This turns the built-in fastener through 360°. The test is completed with a visual inspection, e.g. using a marking and angle measuring disk.

2.6.7. Production Spread

The production spread of the EC fasteners is so marginal that reprogramming or recalibration of the system is not necessary when replacing the fastener with a fastener of the same size (torque). The tools are equipped with a suitable tool memory containing all calibration information.

2.6.8. Ambient Temperature

Operation: 0 ... 45°C, relative humidity 0 ... 90%,
working height max. 3,000 m above sea level

Storage: -20 ... 70°C.

2.6.9. Torque Accuracy of Overall System

Total measurement error ±0.70%

2.6.10. Angular Precision – Complete System

Total measurement error + 3.3° / -2.55°

2.7. Appendix



Instructions for programming and configuring the fastener controls are to be taken from the differentiated descriptions.

An overview of the fastening diagrams can be found in the APEX Tool Group "System Description" P1730E.

<https://www.clecotools.de/downloads>

The definition of which fastening diagrams are actually used is dealt with differently in the different plants and must first be agreed with the project managers responsible for fastening technology.

2.8. Disposal Instructions

CAUTION!



Injuries and environmental damage from improper disposal.

Components and auxiliary materials of the tool pose risks to the health and the environment.

- Catch auxiliary materials (oils, greases) when drained and dispose of them properly.
- Separate the components of the packing and segregate the different materials before disposing of them.
- Follow the locally applicable regulations.



Observe generally valid disposal guidelines such as, in Germany, the Electrical and Electronic Equipment Act (ElektroG) and Battery Ordinance (BattV):

- Return the electronics and defective/used batteries to your company collection facility or to the APEX Tool Group.
- Do not throw the batteries in household refuse, fire or water.

3. Handheld Fastening Technology



3.1. Overview

The Fastening System

The mPro 400GCD (digital Hybrid) is a fastener control for corded handheld fasteners with the form of a "primary and secondary" (master-slave) control. In primary mode, the same control computer and the same fastener control software work as in the station solutions described above. Additional visualization and control options are integrated. Secondary mode is controlled by primary via a system bus. Secondary mode also has a variable system bus address which in the ideal case is assigned in consecutive order. Primary mode itself has a fixed address.

At the control boxes, the handheld fasteners are connected via a tool cable and push-pull plug connection. The control boxes can be operated with all EC fasteners of the 18/48 series as well as the new 30/50 and 70 types of the NeoTek series. They automatically adapt to the fastener concerned.

In addition, Livewire 2 can also be connected to the primary or the servo-less master cordless screwdriver and/or the I-Wrench production wrench and its successor Freedom F4 can be connected.

[For details of functions and Interfaces, please refer to the preceding chapters.](#)

The fastener control includes all commonly encountered fastening sequences. If required special sequences are also available whose application has to be adapted in the project or destination plant. The system must be adapted by setting the parameters for the task.

A password management system can also give the user additional access control after commissioning. The complete parameters are stored on the fastener control concerned.

If necessary, the data can also be stored on external network drives and portable memory devices.

The mPro400GCD has many different features for dealing with a NOK situation without requiring PLC functions. The fastener system works on the principle that a fastening task is received (from the worker or the PLC), autonomously processed, evaluated after processing and the results reported back to the originator.

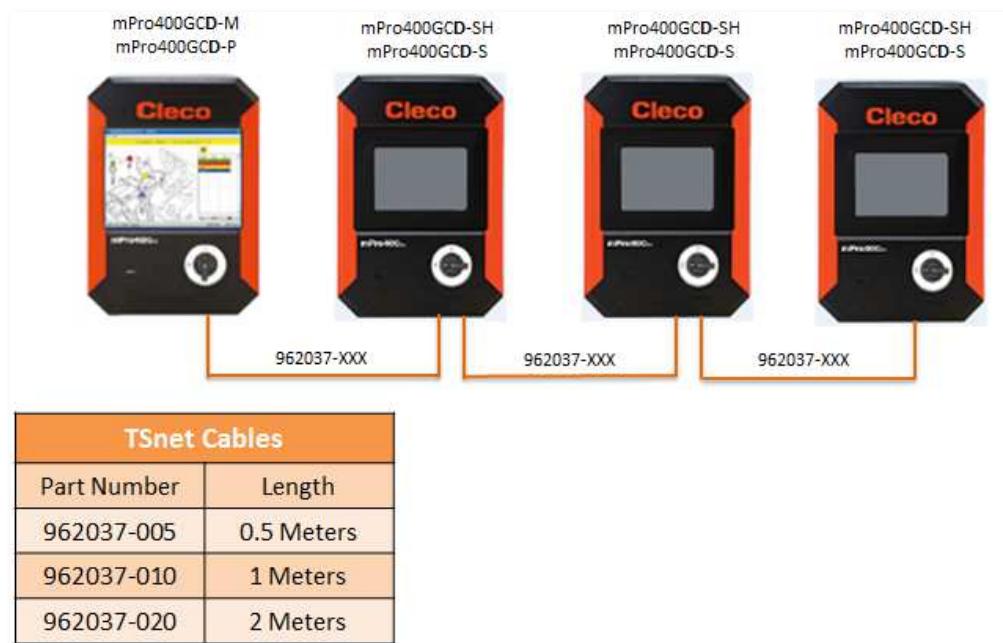


Fig. 21 System Structure Hybrid Controller

Hybrid-Primary with 2 Tool connector – 18/48 Tool und 30/50/70 NeoTek Tool and the System Interfaces

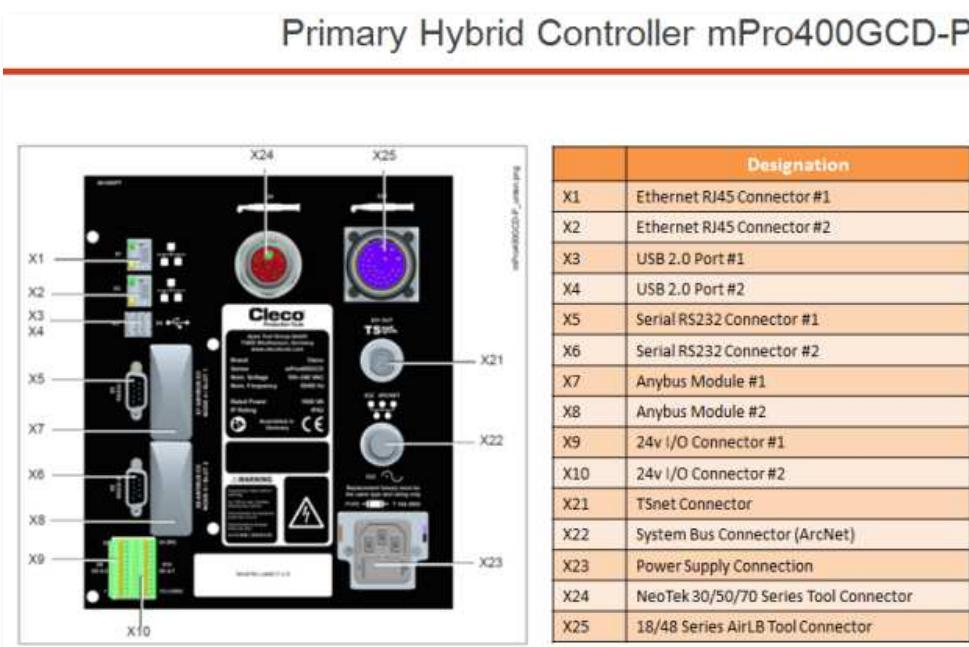


Fig. 22 Hybrid Controller Primary recognition feature

Hybrid Secondary also with 2 Tool connector

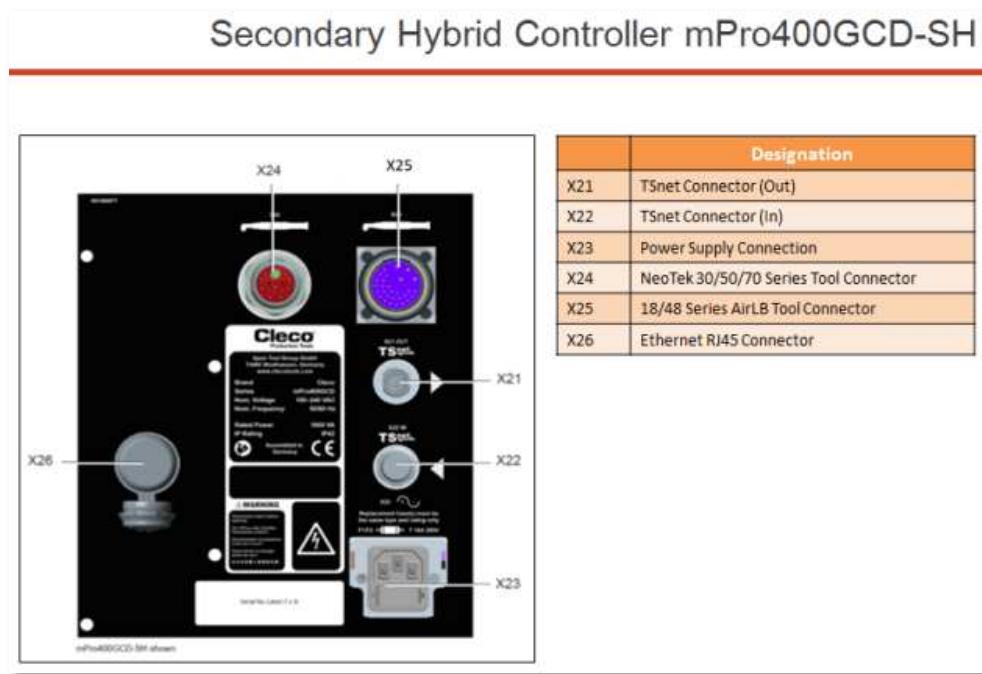


Fig. 23 Hybrid Controller Secondary recognition feature

The Handheld Fasteners (Tools)

EC handheld fasteners are available as angled, straight and pistol tools. All tools are designed with EC electric motors, precision gears and intermeshed gear housings for flexible adjustment. The ergonomics, weight and torque reproducibility were at the heart of the development activities. The fasteners can be switched between clockwise and counterclockwise rotation. Robust connector and cable technology enhances availability in harsh environments. The operator sees the assessment of a fastening with lights or a light ring directly on the tool.

Corded and cordless EC screwdrivers can be used. The cordless Screwdrivers are operated with rechargeable/replaceable batteries.

In case of wireless communication, interruptions of the radio link must always be expected, the components are designed for this. Tasks and results will be restored connection cached in the tool. Process security with radio-based solutions requires more complex approaches. The system lives here from the fact that each screw connection must be ordered individually. The results must be confirmed before a new job can be sent.

The radio-based production wrench is an exception here, since technically a bolting operation can be carried out with these tools even without an active job.

The fast Worker handling was included to the extent that here so-called "batch mode" – the functions have been implemented and released. This slows down the worker in his processing is less than with a single order.

In order to increase the diagnostic capability, appropriate functions have been implemented in the radio tools are installed to facilitate troubleshooting.

3.1.1. HAP Setup

Setup in Daimler Standard Manual Work bay (HAP) or as Standalone

Provision is made to set up so-called manual work bays. This is done by installing equipment which can accommodate up to 5 handheld fasteners. Here, the first channel is configured as the primary and this remains permanently on the HAP. The first fastener can be connected to this. If additional fasteners are required in the HAP, this facility can be set up by installing secondary's with Tools or wireless Tools. It can happen that a planned HAP is not yet equipped with a primary. In such cases, one must first be installed at the HAP.

The fasteners at a manual work bay thus only need a Profinet connection and an Ethernet connection for external access and data interface.

For the connection of a battery tool, at least one primary in the HAP concept is also required. For more open designs (depending on the operating plant), a master controller that cannot be driven by a cable tool can be used here instead of a primary.

The HAP control system (PLC) is set up according to the specifications and possibilities of the Daimler templates. Please inform yourself about the possibilities before ordering the screwdriver systems, as these are subject to continuous adaptation.

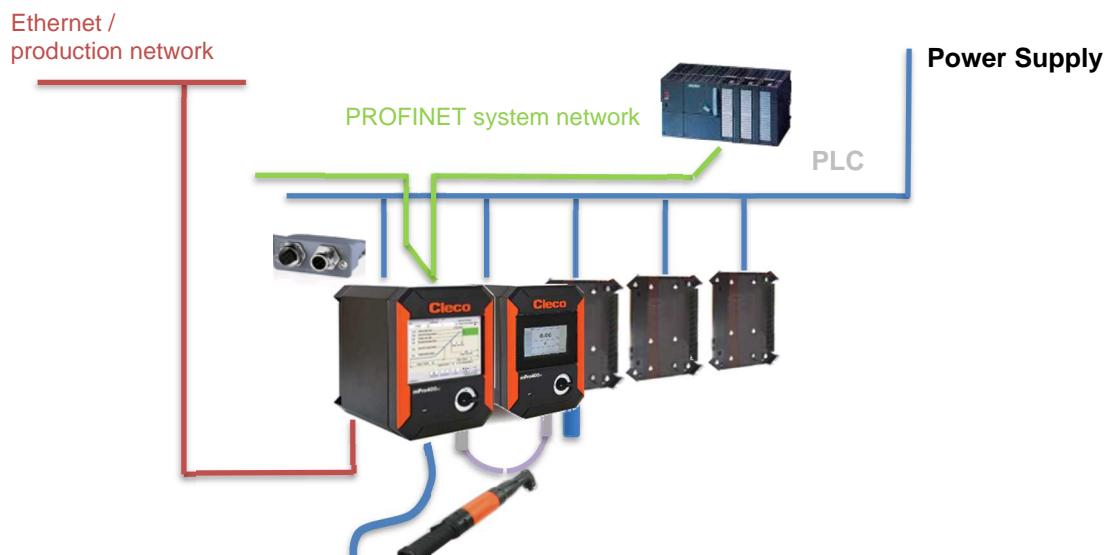


Fig. 24 Principle of 5-channel manual work bay

The controls are designed such that standalone solutions without PLC can also be set up. As a rule, additional equipment has to be installed in such cases to enable workpieces to be changed reliably. This installation is only possible after consultation with and approval by the project manager of the target plant.



Fig. 25 Standalone solution

Project name:	Stationary and handheld EC fastening technology from company APEX Tool Group
File name:	Projektbuch eng MCG_LKW_PKW_Powertrain_2025_V01.14
Version / Release:	01.14
Author:	APEX Tool Group

3.1.2. System Integration – Handheld Fasteners

Different constellations for integrating the fastener control into the environment are provided for in the project.

1) Version with Profinet (direct)

In addition to Fieldbus (process control), a data connection also has to be set up to the data network. This is used to organize the Q data (QDA or others) and to manage remote access to the mPro. In addition, remote access can also be managed from the EBF with switches/routers (system network).

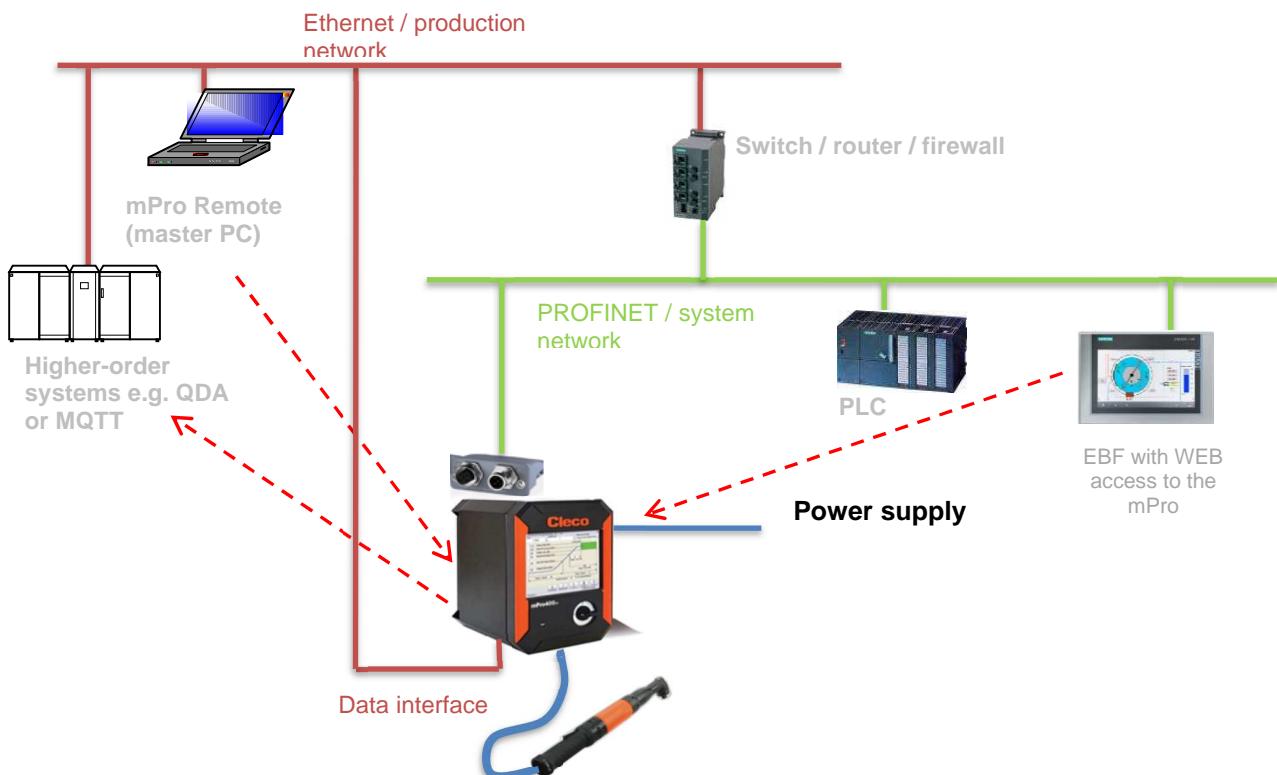


Fig. 26  Incorporation in system environment

- 2) If network integration is not wanted, the second Ethernet interface on the mPro can also be used. The fastener control then requires a further Ethernet address and an additional security function with simultaneous remote access from the EBF and master PC.

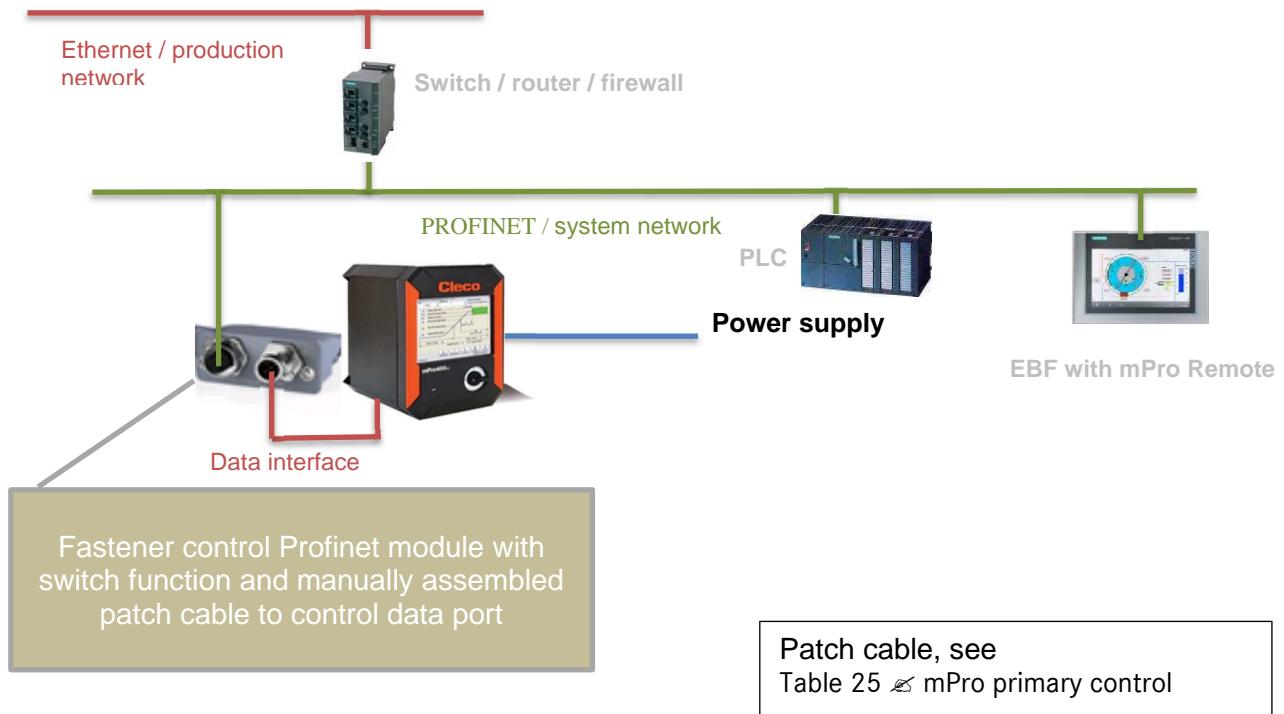


Fig. 27 ↗ Alternative Access

3.1.3. Shifting Tasks with Adaptation of Equipment

When changing cycle times for work content, the task is first manually cancelled in the cell computer (assignment of which fastener is intended for the task – unravel). The new target HAP is then selected by changing the secondary's and the related handheld fasteners, effectively shifting the tool. Now the channel parameters have to be copied from the original HAP (primary) to a stick and on into the new HAP (primary). The complete channel or individual parameters can be copied.

The task can then be activated on the new HAP in the cell computer.

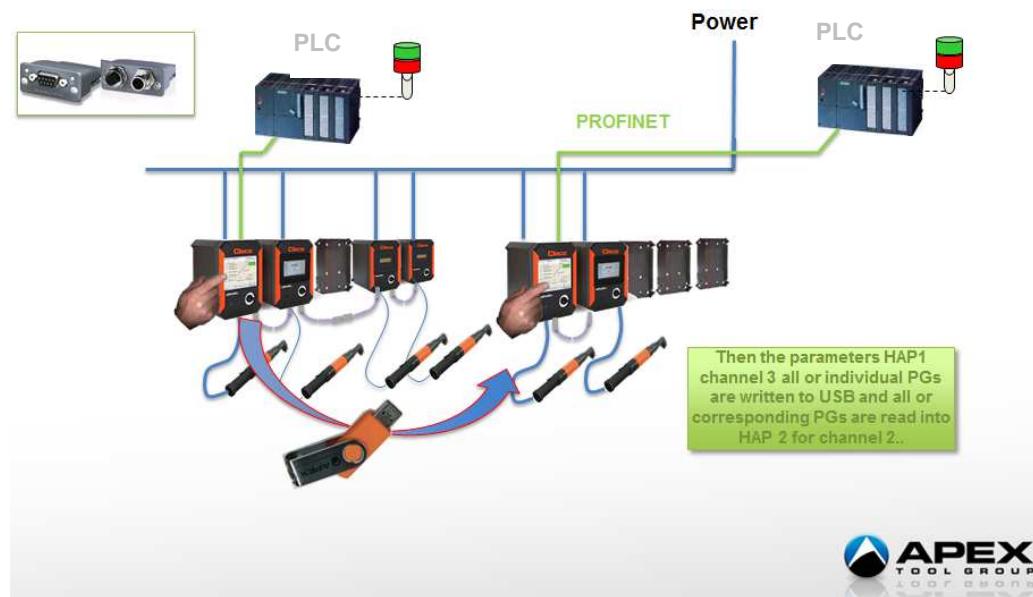
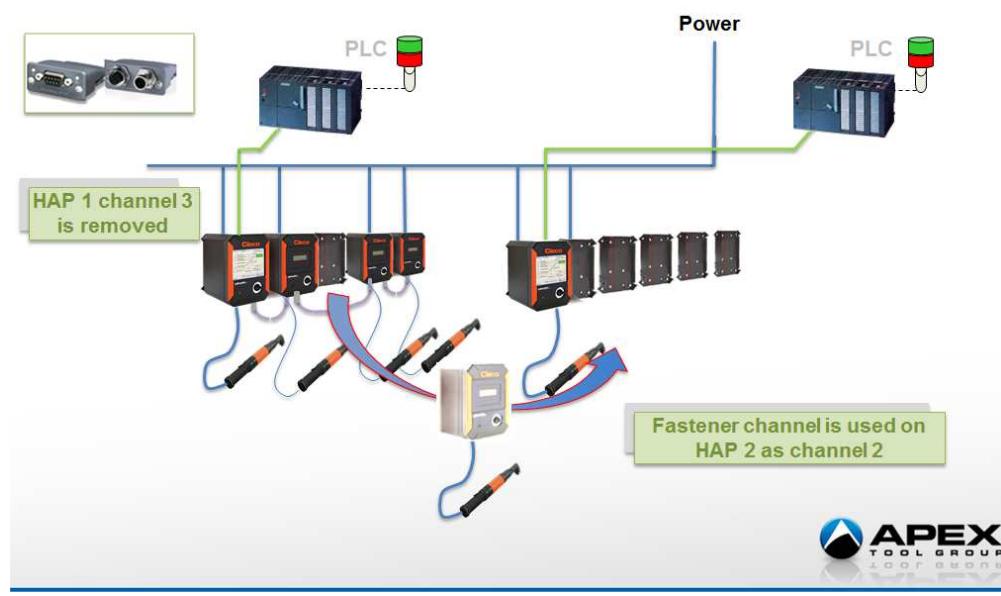


Fig. 28 Example of changing cycle time in HAP

3.1.4. Multiple Fasteners in HAP

Within the manual work bay solution, single or multiple fasteners can also be formed with BTS fastening technology. Specific power modules are needed for these cases. These solutions are subject to special conditions in their set-up, the accommodation of components an application, and are therefore to be treated as special solutions. Their use must be agreed with Planning. Contact APEX if necessary.

3.1.5. I-Wrench (Radio controlled wrench) and LW2 Battery tools in HAP

The design also allows including up to 4 Livewire-2 battery tools or I-Wrench radio production wrench. The maximum number of 5 channels per HAP remains unchanged. The wireless Tools work on the basis of WLAN and can be integrated into the hall network or operated with separate access points.

The application requires coordination with the planning, if necessary, also contact APEX.



The implementation takes place in steps - please inform yourself in the Daimler template which functionality is released or which restrictions are to be observed.

3.1.6. Replacing Tools

EC fasteners can be replaced at any time by a fastener of the same type. For reasons of safety, the control electronics must be switched off when doing this. Function and readiness for operation must be verified after replacement.

Livewire-2 screwdrivers can easily be put back into operation by changing the "live-wire button" to the exchange tool. The connection to the mPro controller is automatic.

When replacing an I-Wrench production wrench, the new wrench must first be prepared using the I-Wrench Configurator and the wrench must also be registered in the wireless network and the mPro.

The successor model Freedom 4 has a replaceable WLAN module that can be used to change tools more quickly. There is no need for the new participant to register in the WLAN network.

3.1.7. Replacing Control

All programs, including the operating system and all settings and parameters are stored on the interchangeable CF card of the controller. This means that in the event of a hardware defect, the system can be restarted in the shortest possible time by changing the CF card in a new controller.

The CF slot is accessible after the control has been removed from the mounting frame



Fig. 29  CF card slot on controller

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Version / Release:	01.14
Author:	APEX Tool Group

3.1.8. Replacing Secondary Control

A secondary control can be replaced by simply exchanging the actual control. After the exchange, the address setting on the digital Hybrid Secondary must be made via its touch display. The address is only active after a restart.

3.1.9. Control of the screwing task by PLC

The concept was based on individual commissioning of each individual Tightening task and Visualization of the task details on the PLC side.

For working with the production keys, a different procedure was chosen in order to accommodate the quick change of the bolting points by the worker. This function is called batch mode, in which the production key is assigned several screwdriving positions. The results are continuously passed on to the PLC.

This can lead to delays in refreshing the image on the plant visualisation of the PLC (asynchronous organisation).

If superstructures (S7-TIA) are to be used without the Daimler template, the APEX control modules can also be used. It must also be ensured that the compatible versions of the modules and the mPro are used. This type of control must be coordinated with the project managers of the target plants. It must be taken into account that such setups are usually more complex to plan and commission, and that additional costs must be expected for availability during the runtime.

3.1.10. Special features for extension of old plants - Mixed operation

For new deliveries and new installations there are no special features to consider.

The use of analog Secondary's from old stock is possible.



Fig. 30 Expansion with analog Secondary's

As well as the extension of existing old installations with new Secondary's.



Fig. 31 ↗ Extension of old plant with digital hybrid Secondary's

The extension of installations with other Arcnet components is also possible.

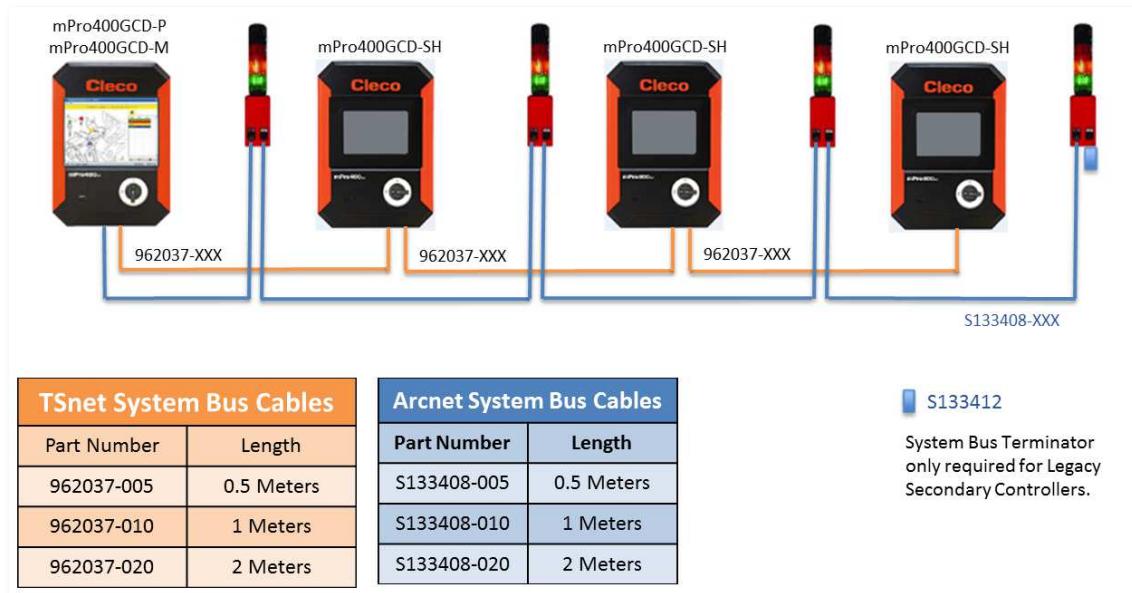


Fig. 32 ↗ Extensions with existing Arcnet components

Important

When accepting the CF card from an analog primary controller, the EA parameters (from PMDIDO to TMDIDO) must be changed once.

The CF card can then no longer be exchanged back!

For further information see the explanatory document on the APEX-website

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3.1.11. Order Data for Control

Primary and secondary control

Primary (master)



Order no.		Language	Power supply	Weight
mPro400GCD-P	Primary Hybrid Controller	Deutsch / English	100 ¹ - 230V~ / 50/60Hz	13,7 kg
mPro400GCD-M	Master- Steuerung			9,7 kg
S133174-V2.03	PROFINET Option (M12)* fw-Version 2.3			
S133174-V2.17.02	PROFINET Option (M12)* fw-Version 2.17.02			
S133539-003	Patchkabel for Profinet module when using internal switch			

¹ = (± 10%) When operating outside the permissible voltage limits, the integrated power supply changes to protection mode and switches off.
This protection mode can be reset by restarting the screwdriver control.

* = firmware: HMS V2.03 or. V2.17.02

Table 25  mPro primary control

Secondary (slave)



Order no.	Process	Language	Power supply	Weight
mPro400GCD-P	Secondary Hybrid Controller		1001 - 230V~ / 50/60Hz	12,8 kg

¹ = (± 10%) When operating outside the permissible voltage limits, the integrated power supply changes to protection mode and switches off.
This protection mode can be reset by restarting the screwdriver control.

Table 26  mPro secondary control

Important

The digital Primary Hybrid requires at least firmware S168833-4xx and Sysdisk 2.6.

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File name: Projektbuch eng MCG_LKW_PKW_Powertrain_2025_V01.14
Version / Release: 01.14
Author: APEX Tool Group

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3.1.12. Dimensional Drawing of Control

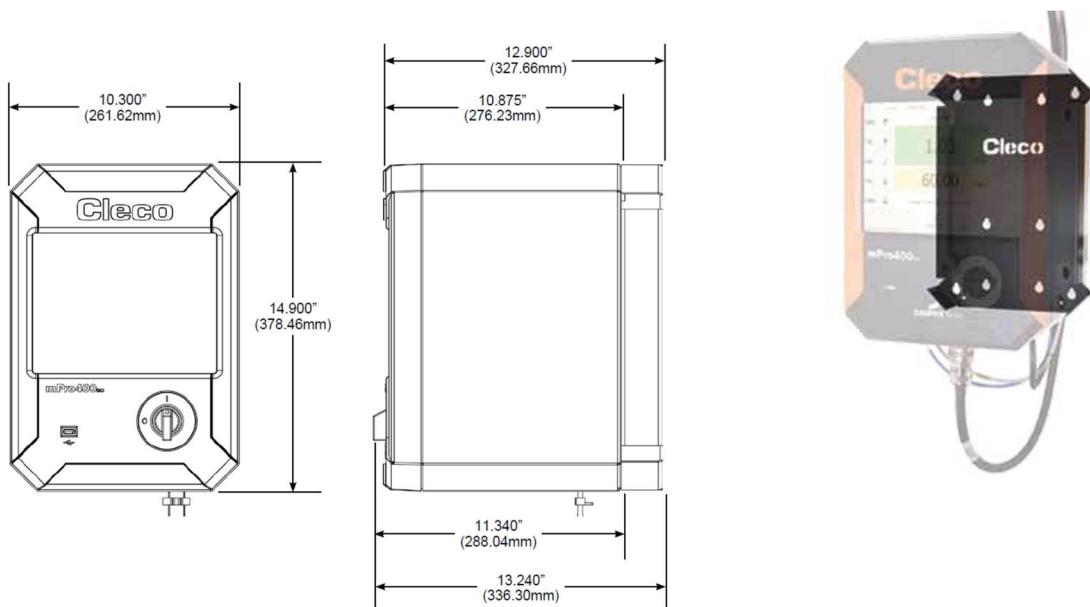


Fig. 33 Dimensional drawing of controller housing

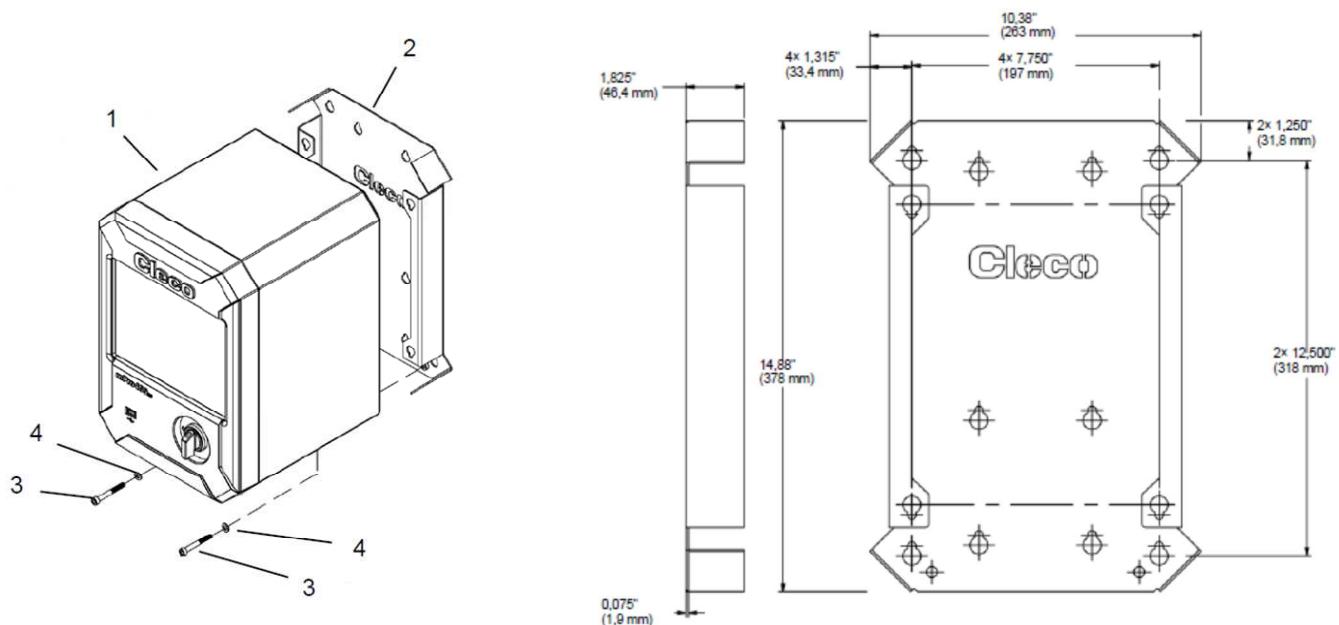


Fig. 34 Control mounts

	Order no.	Process
1	mPro400GCD-P, -S	Hybrid Primary (secondary) control
2	544128PT	Rear wall assembly plate
3	542940-31	Safety screw (M6 x 1.0 x 50 mm)
4	542942-4	Washer (M6)

Table 27 Control accessories

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 Author: APEX Tool Group

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3.1.13. System Cables

Primary – Secondary and Secondary – Secondary Connection Cables

Figure	Designation	Cable length	Order no.
	System bus cable TSnet M12 – M12	0,5m	962037-005
		0,5m	962037-005
		1m	962037-010

Table 28  System cables TSnet

If a digital hybrid secondary is connected to an existing analog primary system, a special cable is required.

Figure	Designation	Cable length	Order no.
	System bus cable TSnet RJ45 auf M12	0,5m	962275-005
		1m	962275-010
		2m	962275-020

Table 29  System cables TSnet in special design

Important

Attention: A free Ethernet interface must be available on the controller.

When wiring the equipment with the system bus, make sure that no address is assigned more than once. No specific order is stipulated, but it is advisable to aim for a rational or logical order to prevent faults from occurring.

3.2. Handheld Fasteners

3.2.1. Tool with Pistol Grip

Series 18EPE, 48EPE

Torque Range



18EP06Q

2-48 Nm preferred types / 2-240 Nm total

Fastening Sequences

Torque fastening with angle monitoring

Angle control with torque monitoring

Torque control with time monitoring

- ✓ Brushless DC motor
- ✓ Indicator lights
- ✓ Reversible

Order no.		Output	Idling speed	Torque range	Weight kg
Tool with slide chuck	Tool with square ■		rpm	Nm	without scanner
18EPE06Q		1/4" Hex	4000	2 – 6	1.0
18EPE12Q		1/4" Hex	1820	3 – 12	1.1
18EPE17Q		1/4" Hex	1290	4 – 17	1.1
48EPE12Q		1/4" Hex	4000	3 – 12	1.2
	18EPE06D2	1/4"	4000	2 – 6	1.0
	18EPE12D3	3/8"	1820	3 – 12	1.1
	18EPE17D3	3/8"	1290	4 – 17	1.1
	18EPE22D3	3/8"	985	5 – 22	1.1
	18EPE31D3	3/8"	695	7 – 31	1.1
	48EPE12D2	1/4"	4000	3 – 12	1.2
	48EPE25D3	3/8"	1820	5 – 25	1.3
	48EPE36D3	3/8"	1290	8 – 36	1.3
	48EPE48D3	3/8"	985	10 – 48	1.4
	48EPE65D4	1/2"	750	13 – 65	2.3
	48EPE90D4	1/2"	510	19 – 90	2.4
	48EPE125D4	1/2"	360	26 – 125	2.4
	48EPE150D4	1/2"	240	31 – 150	2.4

Important: 18EPE06Q

Tools marked like this are preferred tools; the use of other tools requires express approval from Daimler.

Note:

Weight data without tool cable, mounts, reaction support or additional handle.

Table 30 Pistol fastener order data

Project name:	Stationary and handheld EC fastening technology from company APEX Tool Group
File name:	Projektbuch eng MCG_LKW_PKW_Powertrain_2025_V01.14
Version / Release:	01.14
Author:	APEX Tool Group

3.2.2. Angled Electric Tools

Series 18EAE, 48EAE



Torque Range

2-230 Nm

Fastening Sequences

- Torque control with angle monitoring
- Angle control with torque monitoring
- Torque control with time monitoring

- ✓ Brushless DC motor
- ✓ Display ring
- ✓ Reversible

Order no.	Output	Idling speed rpm	Torque range Nm	Weight kg
18EAE08AL2	1/4"	3000	2-8	1.3
18EAE15AM3	3/8"	1300	4-15	1.5
18EAE22AM3	3/8	920	5-22	1.5
18EAE28AM3	3/8"	700	6-28	1.5
48EAE15AL3	3/8"	2855	3-15	1.7
48EAE28AL3	3/8"	1300	6-28	1.9
48EAE41AM3	3/8"	1090	9-41	2.0
48EAE58AM3	3/8"	770	12-58	2.0
48EAE58AM4	1/2"	770	12-58	2.0
48EAE90AH4	1/2"	515	18-87	3.0
48EAE105AH4	1/2"	340	21-104	3.0
48EAE135MH4	1/2"	265	27-133	3.3
48EAE175AX6	3/4"	190	36-176	4.6
48EAE230AX6	3/4"	145	46-230	4.6

Important: 18EAE08AL2

Tools marked like this are preferred tools; the use of other tools requires express approval from Daimler

Note:

Weight data without tool cable, mounts, reaction support or additional handle.

Table 31  Angle fastener order data

3.2.3. Straight Electric Fasteners

Series 18ESE, 48ESE

Torque Range

2-150 Nm

Fastening Sequences

- Torque control with angle monitoring
- Angle control with torque monitoring
- Torque control with time monitoring



Only to be used
after consulting
Daimler

- ✓ Brushless DC motor
- ✓ Display ring
- ✓ Reversible

Order no.		Output	Idling speed	Torque range	Weight kg
Tool with slide chuck	Tool with square ■		rpm	Nm	
18ESE06Q		1/4" Hex	4000	2 – 6	1.1
18ESE12Q		1/4" Hex	1820	3 – 12	1.2
18ESE17Q		1/4" Hex	1290	4 – 17	1.2
48ESE12Q		1/4" Hex	4000	3 – 12	1.4
	18ESE06D2	1/4"	4000	2 – 6	1.1
	18ESE12D3	3/8"	1820	3 – 12	1.2
	18ESE17D3	3/8"	1290	4 – 17	1.2
	18ESE22D3	3/8"	985	5 – 22	1.2
	18ESE31D3	3/8"	695	7 – 31	1.2
	48ESE12D2	1/4"	4000	3 – 12	1.4
	48ESE25D3	3/8"	1820	6 – 25	1.5
	48ESE36D3	3/8"	1290	8 – 36	1.5
	48ESE48D3	3/8"	985	10 – 48	1.5
	48ESE65D4	1/2"	750	13 – 65	2.4
	48ESE90D4	1/2"	510	19 – 90	2.5
	48ESE125D4	1/2"	360	26 – 125	2.5
	48ESE150D4	1/2"	240	31 – 150	2.5

Important:

These tools require the express approval of Daimler.

Note:

Weight data without tool cable, mounts, reaction support or additional handle.

Table 32  Baton fastener order data

3.2.4. Accessories

Tool Mounts / Trays (Angle /Straight Tools)

Rotary mount	Fixed mount	Tool tray (1 set = 2x V form)	Start lever extension
			
541715-2	1110909	941293	S387710

Table 33  Angle/Straight fastener tool accessories

Suspension	Tools	Position	assembly specification	
1110909	all	  		5,5 Nm to 6,8 Nm
541715-2	all	  		
541715-2	48EAE90AH4 .. 48EAE135MH4			3,5 Nm to 4 Nm with Loctite 222
541715-2	48EAE175AX6 + 48EAE230AX6		mounting without half-shells	

Table 34  Angle/Straight fastener tool suspensions

Additional handles

For pistols or straight fasteners from 10 Nm – 17 Nm in delivery specification,
From 17 Nm reaction rod in delivery specification

Scratch Protection / Paint Protection

A scratch protection (wear part), which additionally serves as a fan guard for the rotating output drive, is available for the angled fastener.



Tool	Scratch protection for output drive Order no.	Type
18EP06Q	upon request	Pistol fasteners
18EP17Q	upon request	
18E	936 382	Angle fasteners
18E	936 383	
48E	936 387	
48E	936 384	
48E	936 385	
48E	936 386	

Table 35 Scratch protection for tools



Length m	Paint protection Order no.	Type
1.4	961265PT	Suitable for straight fixed and straight rotating tool cables
2.5	961268PT	

Table 36 Paint protection

3.2.5. Tool Cables

The cables for handheld fasteners are also to be used in the specified lengths. Special cable lengths are only to be used after consulting Daimler.

Tool cables are available as either fixed or rotating adapters on the tool, depending on the application concerned. The rotating connection is available in either straight or angled form. If the arrangement of the components permits, the cables can be connected directly.

For cables that are partly mounted in cable ducts or on cable trolleys, disconnecting points must be provided. An extension cable is provided for this type of routing.

Figure	Designation	Cable length	Order No. SuperHighFlex	Order No. HighFlex
	Tool cables, straight fixed connector	3 m	961250-030	961259-030
		6 m	961250-060	961259-060
		10 m	961250-100	961259-100
	Tool cables, straight angle connector	3 m	961251-030	
		6 m	961251-060	
		10 m	961251-100	
	Tool cables, rotating angle connector	3 m	961252-030	961260-030
		6 m	961252-060	961260-060
		10 m	961252-100	961260-100
	Extension cables	3 m		961249-030
		6 m		961249-060
		10 m		961249-100

Table 37  Tool cables

Important

To ensure compliance with statutory stipulations regarding discharge currents, a maximum of 20 m of tool cable may be connected to each control.

Longer lengths are only possible with additional technical complexity, which makes agreement with the manufacturer and the operator necessary.

3.2.6. Shielding

The shielding in the wires restricts the dispersion of interfering energy into the surroundings and protects the system against external interference. The cables between the fastener module and the handheld fastener are shielded against external interference. This measure also counters the emission of interference.

→ No special measures are needed for the tool cables.

NOTE!

Field bus M12 shielding – A ground connection for the PROFINET cables is automatically made through the housing of the M12 connector. In particular when requirements are high (long distances, high data transmission speeds, different voltage sources,...) it is recommended to ground the cable shield of the PROFINET cables directly after they enter the CPM housing. For this purpose, contact rails (10 x 2 mm) are fitted on the underside. These can be connected to commercially available shield clamps.

3.3. Handheld Fasteners NeoTec

3.3.1. Tool with Pistol Grip

Series 30EPN, Serie 50EPN

Torque Range

0,9 - 123 Nm

Fastening Sequences

Torque fastening with angle monitoring

Angle control with torque monitoring

Torque control with time monitoring



- ✓ Brushless DC motor
- ✓ Indicator lights
- ✓ Reversible

Order no. / Model	Output	Idling speed	Torque range	Weight
Tool with slide Chuck	Tool with square	rpm	Nm	kg
30EPN05BDQ	1/4" Hex	4275	0,9 - 4,7	0,91
30EPN12EAQ	1/4" Hex	1650	3,9 - 11,6	1,0
30EPN05BD2	1/4"	4275	0,9 - 4,7	0,93
30EPN12FA3	3/8"	1650	3,9 - 11,6	0,98
30EPN19FB3	3/8"	1000	3,9 - 19	1,0
30EPN26FC3	3/8"	750	5,1 - 26	1,0
50EPN28FD3	3/8"	2125	5,6 - 28	1,58
50EPN43GD3	3/8"	1375	9 - 43	1,65
50EPN65HD4	1/2"	900	14 - 66	2,14
50EPN85JD4	1/2"	670	17 - 84	2,22
50EPN125KD4	1/2"	455	25 - 123	2,62

Important:

30EPN12F

Tools marked like this are preferred tools; the use of other tools requires express approval from Daimler.

Note:

Weight data without tool cable, mounts, reaction support or additional handle.

Table 38 Pistol fastener order NeoTec

3.3.2. Angled Electric Tools

Series 30EAN, 50EAN, 70EAN

Torque Range

1,3 - 350 Nm

Fastening Sequences

Torque fastening with angle monitoring

Angle control with torque monitoring

Torque control with time monitoring



- ✓ Brushless DC motor
- ✓ Indicator lights
- ✓ Reversible

Order no. / Model	Output	Idle speed	Torque range	Weight
Tool with square ■		rpm	Nm	kg
30EAN06EA3	3/8"	2925	1,3 - 6	1,13
30EAN12EA3	3/8"	1450	2,6 - 12	1,14
30EAN21FA3	3/8"	835	4,4 - 21	1,32
30EAN28FA3	3/8"	615	5,7 - 28	1,32
50EAN30FA3	3/8"	1765	6 - 30	1,60
50EAN39GA3	3/8"	1375	8 - 39	1,77
50EAN59HA3	3/8"	915	12 - 59	1,94
50EAN80JA4	1/2"	670	16 - 80	2,17
50EAN110KA4	1/2"	475	22 - 109	2,76
50EAN150KB4	1/2"	320	32 - 150	3,75
50EAN205NA6	3/4"	250	41 - 205	3,93
70EAN155NA6	3/4"	740	39 - 156	6,5
70EAN205NA6	3/4"	555	52 - 205	6,5
70EAN240PA6	3/4"	480	60 - 239	7,0
70EAN350PA6	3/4"	325	88 - 350	7,0

70EAN350PA6

Important

Tools marked like this are preferred tools; the use of other tools requires express approval from Daimler.

Note:

Weight data without tool cable, mounts, reaction support or additional handle.

Table 39  Pistol fastener order NeoTec

3.3.3. Straight Electric Fasteners

Series 30ESN, 50ESN, 70ESN



Torque Range

0,9 - 850 Nm

Fastening Sequences

Torque fastening with angle monitoring

Angle control with torque monitoring

Torque control with time monitoring

Only to be used
after consulting
Daimler

- ✓ Brushless DC motor
- ✓ Indicator lights
- ✓ Reversible

Tool with slide chuck	Order no.	Output	Idle speed	Torque range	Weight
Tool with slide chuck	Tool with square chuck		rpm	Nm	kg
	30ESN05BD2	1/4"	4275	0,9 – 4,7	0,96
30ESN05BDQ		1/4" Hex	4275	0,9 – 4,7	0,96
30ESN12EAQ		1/4" Hex	1650	3,9 – 11,6	1,06
	30ESN12FA3	3/8"	1650	3,9 – 11,6	1,06
	30ESN19FB3	3/8"	1000	3,9 – 19	1,06
	30ESN26FC3	3/8"	750	5,1 – 26	1,06
	50ESN28FD3	3/8"	2125	5,6 – 28	2,98
	50ESN43GD3	3/8"	1375	9 – 43	3,64
	50ESN65HD4	1/2"	900	14 – 66	4,19
	50ESN85JD4	1/2"	670	17 – 84	4,41
	50ESN125KD4	1/2"	455	25 – 123	5,29
	70ESN95ND6	3/4"	1325	23 – 93	5,2
	70ESN130ND6	3/4"	1000	31 – 124	5,2
	70ESN185ND6	3/4"	680	46 – 184	5,2
	70ESN245ND6	3/4"	510	61 – 245	5,2
	70ESN355SD8	1"	335	89 – 354	7,6
	70ESN475SD8	1"	250	118 – 473	7,6
	70ESN700SD8	1"	170	175 – 700	7,6
	70ESN850SD8	1"	125	213 – 850	7,6

Important:

These tools require the express approval of Daimler.

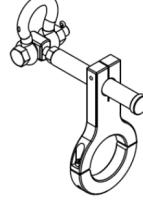
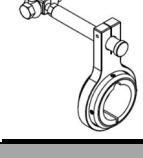
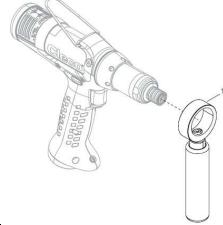
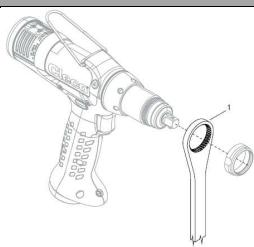
Note:

Weight data without tool cable, mounts, reaction support or additional handle.

Table 40  Baton fastener order data NeoTec

3.3.4. Accessories

Suspension bracket, Locking ring, reaction mount, tool hangers / trays.

Order no. Use tool	Description	Description Use Tool	picture
Tool suspension / Toolaufhängungen			
T50-3000048	Fix		
T50-3000060	Staggered fixed	Series 30/50 (excluding pistol)	
T50-3000063	ratable		
T50-3000061	Offset ratable		
Dead Handle Handgriff			
301943PT für 30EPN12EAQ 30EPN12FA3 30ESN12EAQ 30ESN12FA3		for 30EPN12EAQ 30EPN12FA3 30ESN12EAQ 30ESN12FA3	
Reaction Bar / Gegenhalter			
542127 for 30EPN19FB3 30EPN26FC3 30ESN19FB3 30ESN26FC3 50ESN28FD3 50ESN43GD3 50EPN28FD3 50EPN43GD3		for 30EPN19FB3 30EPN26FC3 30ESN12FA3 30ESN19FB3 30ESN26FC3 50ESN28FD3 50ESN43GD3 50EPN28FD3 50EPN43GD3	
48047128 for 50ESN65HD4 50ESN85JD4 50ESN125KD4 50EPN65HD4 50EPN85JD4 50EPN125KD4		for 50ESN65HD4 50ESN85JD4 50ESN125KD4 50EPN65HD4 50EPN85JD4 50EPN125KD4	

Project name: Stationary and handheld EC fastening technology from company APEX Tool Group
 File name: Projektbuch eng MCG_LKW_PKW_Powertrain_2025_V01.14
 Version / Release: 01.14
 Author: APEX Tool Group

46036202 for 70ESN355SD8 70ESN475SD8 70ESN700SD8 70ESN850SD8		for 70ESN355SD8 70ESN475SD8 70ESN700SD8 70ESN850SD8	
Enclosure extension sets / Gehäuseverlängerungssätze			
T50-3000072 for 50EAN59HA3 T50-3000071 for 50EAN80JA4 T50-3000069 for 50EAN110KA4 T50-3000070 for 50EAN150KB4 50EAN205NA6		for 50EAN59HA3 50EAN80JA4 50EAN110KA4 50EAN150KB4 50EAN205NA6	
Reaction bar Bracket / Reaktionsaufnahme Halterung			
201034 for 70ESN95ND6 70ESN130ND6 70ESN185ND6 70ESN245ND6		for 70ESN95ND6 70ESN130ND6 70ESN185ND6 70ESN245ND6	
Cable fixation on the tool / Kabelfixierung am Tool			
943527PT	Fixes tool cable with the NeoTec tool		
Others / Sonstiges			
Reaction recordings	See document P2279SB and various Part Manuals for the individual tools (part numbers, installation, tightening instructions).		
Electrical accessories such as 2D-redner, TAGs, gyroscope or tool light	See P2279SB		
Tool tray 941293	(1 set = 2x V-Form)		

Table 4.1 Toolzubehör Winkel- gerade Schrauber

3.3.5. Tool Cable

The cables for hand-held screwdrivers must also be used in the specified lengths. Special cable lengths are only to be used after consultation with Daimler.

Tool cables are available as fixed adaptations on the tool.

Rotatable adaptations (straight and angled) on the tool are not yet available.

Separation points are urgently required for cable routing that is partly installed in the cable duct or as cable suspension on cable trolleys. An extension cable is provided for this type of installation.

Project name:	Stationary and handheld EC fastening technology from company APEX Tool Group
File name:	Projektbuch eng MCG_LKW_PKW_Powertrain_2025_V01.14
Version / Release:	01.14
Author:	APEX Tool Group

picture	Designation	Cable lenght	Order no.
	Tool cables straight fixed connector	3m	961560-030
		6m	961560-060
		8m	961560-080
		10m	961560-100
	Tool cable rotatable (Swivel)	2m	961921-020
		4m	961921-040
		6m	961921-060
		10m	961921-100
	Extension cables	5m	961923-050
		10m	961923-100
		20m	961923-200
		25m	961923-250

Table 42  Tool cable

 **Attention**

In order to comply with the legal requirements for leakage currents, a maximum of 45 m of tool cable per primary control unit and 30 m per secondary control unit may be connected.

3.3.6. Schirmung

Die Schirmung in den Leitungen schränkt die Ausbreitung von Störenergie an die Umgebung ein und schirmt das System gegen Störeinflüsse von außen ab. Die Kabel zwischen Schraubmodul und Handschrauber sind gegen Störbeeinflussung von außen abgeschirmt. Diese Maßnahme wirkt aber auch der Störaussendung entgegen.

→Für die Toolkabel sind keine besonderen Maßnahmen erforderlich.

3.4. Handheld Fasteners (cordless)

Prerequisite: PLC library from S501412-1-1-2 and mPro from S168833-412R1.

3.4.1. Tool with Pistol Grip LiveWire-2

Series 17BPY..QL

Torque Range

3-13 Nm

Screw size

M4 – M6

Fastening Sequences

Torque fastening with angle monitoring
Angle control with torque monitoring
Torque control with time monitoring

- ✓ Brushless DC Motor
- ✓ Complete control integrated
- ✓ Display Text / Background in Color
- ✓ Control keys with IrDA and WLAN
- ✓ Reversible
- ✓ With extension platform
- ✓ Improved ergonomics (weight reduction)



Order no.	Idling speed		Torque range	Weight kg
Tool with Platform	at 26V rpm	at 44V rpm	Nm	Without Battery
17BPYPB07QL	1160	1720	3 - 7	1,26
17BPYPB09QL	885	1310	3 - 9	1,26
17BPYPB13QL	625	930	3 - 13	1,26

Weight 26V Akku – 687 g, 44V Akku – 1010g

Table 43 Pistol fastener LW-2

Attention:

The tools are equipped with SW 6 (6.4mm +0.127 = $\frac{1}{4}$ ") as hexagon socket with quick change at the outlet, marking Q in order no.

Attention:

All tools are supplied without accessories such as scanners!

See The Tool trays are provided with mounting holes for fixing. In order to achieve correct function, it is necessary to fix them on a firm base or a sufficiently stable support.

3.4.5. Accessories for Livewire-2 tools

Project name:	Stationary and handheld EC fastening technology from company APEX Tool Group
File name:	Projektbuch eng MCG_LKW_PKW_Powertrain_2025_V01.14
Version / Release:	01.14
Author:	APEX Tool Group

3.4.2. Angle Tool LiveWire-2

Series LiveWire-2 – P3/P4 with new spiral-toothed angle heads
47BAY...P3/4L

Torque Range

5-65 Nm

Screw size

M5 – M10

Fastening Sequences

Torque fastening with angle monitoring
Angle control with torque monitoring
Torque control with time monitoring



- ✓ Brushless DC Motor
- ✓ Complete control integrated
- ✓ Display Text / Background in Color
- ✓ Control keys with IrDA and WLAN
- ✓ Reversible
- ✓ With extension platform
- ✓ Improved ergonomics (weight reduction)
- ✓ improved helical angle heads, longer life

Order no.	Idling speed		Torque range	Weight kg
Tool ohne Scanner	at 26V	at 44V	Nm	Without Battery
	rpm	rpm		
47BAYPB15P3L	487	891	5,5 - 15	1,83
47BAYPB28P3L	264	482	10 - 28	1,83
47BAYPB35P3L	255	446	12 - 35	1,88
47BAYPB48P3L	181	316	18 - 48	1,97
47BAYPB65P4L	135	236	15 – 65	2,065

Weight 26V Akku – 687 g, 44V Akku – 1010g

Table 44  Angle tool LW-2

Attention:

All tools are supplied without accessories such as scanners!

See The Tool trays are provided with mounting holes for fixing. In order to achieve correct function, it is necessary to fix them on a firm base or a sufficiently stable support.

3.4.5. Accessories for Livewire-2 tools

3.4.3. Angle Tool LiveWire-1

Series Angle Tools
47BAYPB...

Torque Range

40-90 Nm

Screw size

M8 – M12

Fastening Sequences

Torque fastening with angle monitoring
Angle control with torque monitoring
Torque control with time monitoring



- ✓ Brushless DC Motor
- ✓ Complete control integrated
- ✓ Display Text / Background in Color
- ✓ Control keys with IrDA and WLAN
- ✓ Reversible
- ✓ With extension platform
- ✓ partly improved helical angle heads, longer

Order no.	Idling speed		Torque range	Weight kg
Tool mit Plattform	at 26V	at 44V.	Nm	Without Battery
	rpm	rpm		
47BAYPB70P4	121	211	24-70	4,18
47BAYPB90P4	81	141	40-90	4,12

Weight 26V Akku – 687 g, 44V Akku – 1010g

Table 45 Angle tool LW-1

Attention:

All tools are delivered without accessories such as scanners!

See also. 3.3.5 Accessories for Livewire-1 tools

Tools larger than 65Nm.

The tools up to 90 Nm are preferably equipped with 44V-battery or "LiveWire supply module PM 48" (power supply unit).

3.4.4. Accessories

3.4.4.1. Tool tray Pistol shape

Picture	Order no.	Type / Dimensions WxHxL	Weight
	935396	Shelf for pistol screwdriver 110 x 250 x 310 mm	1,5 kg
	935144	Programming Tray for pistol screwdriver with IrDA --	1,5 kg
	930119	Screw quiver large	
	931041	Screw quiver small	
	935172	Screw quiver pistol (Rubber quiver separate from 935396)	

Table 46 Tool tray (pistol type)

The Tool trays are provided with mounting holes for fixing. In order to achieve correct function, it is necessary to fix them on a firm base or a sufficiently stable support.

3.4.4.2. Tool Trays (all types angle screwdriver)

Picture	Order no.	Type / Dimensions WxHxL	Weight
	935395	Standard shelf for angle screwdrivers up to 50Nm 120 x 140 x 320 mm	1,3 kg
	935290	Programming shelf for angle screwdrivers up to 50Nm with IrDA	1,5 kg
	935998	Standard shelf for angle screwdrivers from 70Nm 120 x 140 x 420 mm	1,3 kg
	935999	Programming shelf for angle screwdrivers from 70Nm with IrDA	1,5 kg
	941293	Set of tool holder for angle screwdriver (2x V-form set)	

Table 47 Tool tray (angle type)

The Tool trays are provided with mounting holes for fixing. In order to achieve correct function, it is necessary to fix them on a firm base or a sufficiently stable support.

3.4.5. Accessories for Livewire-2 tools

for all Livewire 2 cordless screwdrivers!

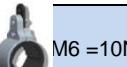
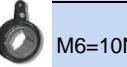
Picture	Order no.	Type
	937255PT *	Cover plate instead of scanner
	943077PT	Scratch protection for base with cover plate LW-2 black (pistol Tool)
	937718PT	Scratch protection for base with cover plate LW-2 (angle tool)
	937715PT	Scratch protection for display LW-2 (angle tool)
	942045PT	Suspension eye fixed for LW-2 (angle tool)
	942185PT	Suspension rotatable for LW-2 (angle tool)
	942040PT	Reaction recording (angle tool)
	937704PT	Scratch protection LW-2 (LW-1) for 47BA...P3 up to 28Nm
	937706PT	Scratch protection LW-2 (LW-1) for 47BA...P3 up to 35Nm
	937708PT	Scratch protection LW-2 (LW-1) for 47BA...P3 up to 48Nm
	942328PT	Scratch protection angle screwdriver LW-2 for 47BA...P4 65Nm

Table 48  Accessoires LW-2

* = Can also be used for LW-1 "Platform"

3.4.6. Accessories for Livewire-1 tools

Picture	Order no.	Type
	937711PT	Scratch protection angle screwdriver LW-1 for 47BAYPB70 / 90P4
	937649PT	Scratch protection Scanner Platform LW-1
	937210PT	Scratch protection Cover Display LW-1

Table 49  Accessories LW-1

3.4.7. Accessories (all type)

3.4.7.1. Tool identification

Adhesive labels can be used to identify the tools

be attached to the tool

from 1,5-12Nm – order no.: 935078, from 3-28Nm – order no.: 935330,
from 30-49Nm – order no.: 935759



Fig. 35 Torque identification

3.4.7.2. Infrared adapter with cable (without mounting)

for all listed cordless screwdrivers



Order no.	Technology	Dimensions WxHxL	Supply	Cable length
935170	IrDA / Infrared		--	1,2 m

Table 50 Tool tray / Programming tray

The infrared adapter is used to make the Ethernet addresses for the battery tool known during initial commissioning. The adapter is supplied without mechanics, for mounting in your own mounting technology.

The IrDA connection is made on the X6 interface on the bottom of the global controller.

3.4.7.3. Power supply Vmax



Picture	Order no.	Type	Dimensions WxHxL	Weight
	961350PT	Vmax Power Module PM48 110/230V 50/60Hz	240/120/150 mm	3,1 kg
	961341-030	Tool cable	3 m	
	961341-060		6 m	
	961341-080		8 m	
	961341-100		10 m	
	961342-030	Extension cable	3 m	
	961342-060		6 m	
	961342-080		8 m	
	961342-100		10 m	
	961369-060	Tool cable angled	6 m	

Table 51 Vmax-Components

Attention

When laying the tool/extension cables, please observe the following instructions.
Minimum bending radius for continuous load must not be less than 5 times the cable diameter.

The twist must be limited to a maximum of +/-180° for 1m cable length.
Double loads due to bending and twisting lead to premature wear.

Wear can be significantly reduced by a tighter interpretation of the specifications. Where possible, the maximum load should therefore be avoided during installation.

3.4.7.4. Battery Charger

Single charger



Fig. 36 Single charger

Order no.	Battery voltage	Dimensions WxHxL	Supply	Weight
962085PT	26/44 V DC	130 x 210 x 93 mm	100V – 240V AC	0,82 kg

Table 52 Battery charger

The charger should be installed near the application and requires a 230V shockproof socket.

* Power cables for EU, GB and NA are included for better connection to different countries.

3.4.7.5. Battery / replacement battery

for all listed cordless screwdrivers



Order no.	Battery voltage	Dimensions WxHxL	Weight	Capacity
961101PT	26 V DC	81 x 79,5 x 122 mm	0,687 kg	2,5 Ah
961102PT	44 V DC	81 x 79,5 x 153 mm	1,01 kg	2,0 Ah

Table 53 Battery's

For handling, technical data and further information see document P2496BA and P2497BA

Replace battery

Insert battery

Push the battery into the guide of the tool until the lock engages



Remove the battery

Press the release button and push the battery forward out of the handle

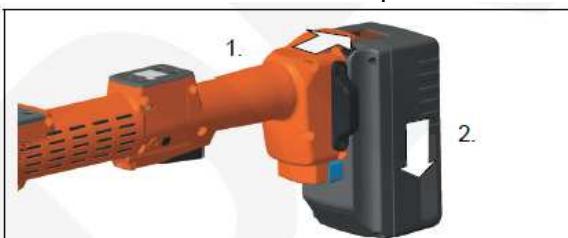


Fig. 37 ↗ Replace battery

3.5. Interesting facts about the handheld Screwdriver Control System

3.5.1. Maintenance

The maintenance schedule can be found in the differentiated descriptions of the assembly groups (fasteners). The specified maintenance must be performed for a longer term of warranty.

A fastening counter is integrated in every fastener. This can be called up in the self-identification mask of the fastener control. To ensure that the maintenance cycle is not missed, the controller warns before reaching the maintenance interval and when the maintenance limit is reached with a signal message to the PLC so that the message can be passed on automatically.

The tool remains operational after the advance warning has been given and after the service threshold has been reached. After the service has been performed, the fastener control will automatically detect this and cancel the signal.

For installations with the higher-order system Torque.net, a concise function is stored there which supports convenient handling. The warning threshold and advance warning threshold can be programmed in the maintenance info mask and notification arranged with specific messages (e-mails).

In accordance with the contract, regular maintenance is performed by APEX before the limits are reached
and at the agreed conditions. Here, the counter is correctly reset to zero.
Regular maintenance reduces operating disturbances, repair costs and downtimes.

In addition to the following service schedule, implement a safety-related service program that takes the local regulations for repair and service for all operating phases of the tool into account.

After a service is performed, the information is stored on a tool memory in the spindle. There, brief information about the last MCT (MFU) examination performed is also stored.

Dynamic service counter are integrated within the fastener. These calculate the service requirements depending on the actual loading. This function can be used to optimally monitor and control the maintenance tasks.

3.5.1.1. Overview maintenance wired handheld wrenches (18/48-er)

The maintenance plan can be found in the separate descriptions.

Wartungsintervall / maintenance Interval	Verschraubungs -zähler* / rundowns*	Bezeichnung / designation
Täglich / daily		Sichtprüfung aller Kabel und Anschlüsse. Sichtkontrolle des Werkzeugs. Überprüfen Sie das Werkzeug auf übermäßigen Vibrationen oder ungewöhnliche Geräusche Sichtkontrolle aller externen Komponenten der Werkzeuge. Visual inspection of all cables and connections Visual inspection of the tool. Check the tool for excessive vibration or unusual noises. Visual inspection of all external components of the tool.
W1	100,000	Sichtprüfung der zerlegten Werkzeuge. Überprüfen Sie Einzelteile auf Verschleiß oder Beschädigung und ersetzen sie diese ggf.. Reinigen und schmieren des Winkelkopf, der Getriebe- und Motorlager und Rekalibrierung des Aufnehmers. Inspect the tool cable for damage or wear. Inspect the square drive output spindle for damage or wear. Inspect the tool cable connection for a secure fit Check the maximum free speed.
W2	250,000	Sichtprüfung der zerlegten Werkzeuge. Überprüfen Sie Einzelteile auf Verschleiß oder Beschädigung und ersetzen sie diese ggf.. Reinigen und schmieren des Winkelkopf, der Getriebe- und Motorlager und Rekalibrierung des Aufnehmers. Visual inspection of disassembled tool. Check individual parts for wear or damage and replace if necessary. Clean and lubricate angle head, gearing and motor bearings. Check and recalibrate transducer.
W3	500,000	ditto

* Rundowns when operating the tool at 100% of maximum torque.

Table 54 Maintenance specifications (handheld fasteners)

3.5.1.2. Overview Maintenance Corded Handheld Screwdrivers (NeoTec)

The maintenance schedule can be found in the separate description **P2279SBxx**,
In order to be able to guarantee the warranty promises, it is necessary to comply with the specified maintenance.

Maintenance Interval	Rundowns*	designation
daily All models, with Exceptions, see below		<ul style="list-style-type: none"> ➤ Checking all cables and connections. ➤ Checking all external tool components. ➤ Checking the tool for excessive vibrations or unusual noises.
Series 70 – Angle 70EAN350PA6 Series 70 – straight 70ESN350SD8 70ESN475SD8 70ESN700SD8 70ESN850SD8	250.000	<ul style="list-style-type: none"> ➤ Send tool to a certified Sales & Service Centre for assessment.
Series 70 – Angle 70EAN240PA6 Series 70 – straight 70ESN180ND6 70ESN245SD6	500.000	<ul style="list-style-type: none"> ➤ Send tool to a certified Sales & Service Centre for assessment.
All models	1.000.000	<ul style="list-style-type: none"> ➤ Send tool to a certified Sales & Service Centre for assessment.

* Rundowns when operating the tool at 80 % of the maximum torque.

Table 55 Maintenance data (manual screwdriver NeoTec)

3.5.1.3. Overview maintenance cordless handheld wrenches (LW)

The maintenance plan can be found in the separate descriptions, **P1890xx** for pistol screwdrivers and **P2291xx** for hand-held angle screwdrivers.

In order to be able to guarantee the warranty promises, it is necessary to comply with the specified maintenance. A screwing counter is integrated in every cordless screwdriver. The screwing cycle corresponds to the Daimler standard 2-phase screwing process. In order not to miss this cycle, the tool warns before reaching the maintenance interval when the tool is switched on and displays the number of screw joints still possible.

The tool remains ready for operation after reaching the pre-warning and also after reaching the service threshold (must be acknowledged with left button on the tool).

The screwdrivers also include a dynamic maintenance counter.

This allows partial extensions of the maintenance intervals. If tools are mainly operated close to the capacity limit, shorter maintenance intervals can also become effective.

3.5.2. Ambient temperature handheld screwdriver

wired (18/48-er):

Operation: 0 ... 45°C, relative humidity 0 ... 90%,
Working height max. 3000m above sea level (with performance reduction [-20%])

Storage: -20 ...70°C.

wired (NeoTec):

Operation: 0 ... 45°C, relative humidity 10 ...90%, no condensation
Working height max. 3000m above sea level

Storage: -20 ...70°C.

cordless (LW-2):

Operation: 0 ... 40°C, relative humidity 0 ...80%, (non-condensing)
Working height max. 3000m above sea level

Storage: -20 ...70°C.

3.5.3. Torque accuracy overall system

Corded hand screwdriver (18/48)

Measurement deviation in total 0.70%

The static measuring accuracy of the torque value for the screwdriving system is therefore less than 1%.

See also P2033DBxx

Corded handheld screwdriver (NeoTec)

Measurement deviation in total: ±0.55

The static measuring accuracy of the torque value for the screwdriving system is therefore less than 1%.

See also P2328DBxx

Cordless LW2 screwdriver

Measurement deviation in sum: ±0.70%

The static measuring accuracy of the torque value for the screwdriving system is therefore less than 1%.

See also P2042DBxx

3.5.4. Angular accuracy overall system

Corded hand screwdriver (18/48)

The total measuring accuracy of the angle value in the screwdriving system is in the range of the sum:

+3,16° / -1,16°

See also P2033DBxx

Corded hand screwdriver (NeoTec)

The total measuring accuracy of the angle value for the screwdriving system is in the range of the sum:

+1,74° / -1,08°

See also P2328DBxx

Cordless LW2 screwdriver

The total measuring accuracy of the angle value for the screwdriving system is in the range of the sum:

+3,16° / -1,16°

See also P2042DBxx

3.4.5. capability and type approvals: Bolt system

The bolting technology is designed according to the requirements of VDI2862. On the basis of the standard specifications for type testing (VDI/VDE 2647) and capability testing (VDI/VDE 2645), certain minimum requirements must be observed.

APEX carries out type tests for all standard screwdriver types and checks every screwdriver before delivery. Important for the plant manufacturer / machine builder is the specification, that although individual quality documents are supplied with the screwdrivers, these are not require special handling. In case of need, the operator may request the (MCD) MFU from APEX (to serial number).

<http://software.apextoolgroup.com/MCD/>

3.5.5. Commissioning

The fastening technology parts are commissioned after they have been delivered. This can be performed by the system manufacturer and additionally / or only at the destination plant (Daimler).

Commissioning is performed after the system has been completely set up and installed ready for operation, including the necessary data interface and logon to the IT department, e.g. the WLAN devices to be installed (MAC addresses). Commissioning by APEX is supported by an on-site inspection during which correct installation is checked. The successful examination is the basis for warranty cover. Corrections must be approved by way of subsequent on-site inspections at the request of the system manufacturer.

Commissioning includes the basic programming of the fastener control target values for joints, the testing of interface communications with the PLC and PROFINET (joint-specific optimizations are not included in the tender package).

Because many tangent groups (PLC programmers, IT-QDA system programmers, quality management ...) must be involved, detailed fine planning is necessary in order to avoid unnecessary waiting time.



Commissioning includes a process examination. This means a check of every individual screw with its respective fastening ID to determine if it is correctly displayed and recorded in the correct position as status (OK / NOK) in the respective systems (system visualization, QDA client, fastening controller...).

As a rule, start-up support is necessary following commissioning to optimize the joint together with the quality management team from the plant. This is referred to as fine parameterization. This is dealt with separately.

3.5.6. Production Spread

The production spread of the EC fasteners is so marginal that reprogramming or recalibration of the system is not necessary when replacing the fastener with a fastener of the same size (torque). The tools are equipped with a suitable tool memory containing all calibration information.

3.6. Interesting facts about LW-2 cordless screwdrivers

3.6.1. Technical details radio technology

WLAN (with deliveries from KW24/2018)

Wi-Fi Standards IEEE 802.11a/b/g/n

IEEE 802.11d/e/i/h/r/w)

WiFi Channels 2,4G 1-13

5 GHz 36-165 (U-NII Band 1,2,2e,3)

[36, 40, 44, 48, 52, 56, 60, 64, 100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140, 149, 153, 157, 161, 165]

Security WEP64/128, WPA und WPA2, TKIP und AES/CCMP hardware accelerator, LEAP, PEAP, EAP-TLS

Transmission

power 18dBm EIRP (radiated)

Sensitivity -95 dBm EIRP 2,4GHz

-90 dBm EIRP 5GHz

Certificate/approval

Europe (ETSI R&TTE);

US (FCC/CFR 47 part 15 unlicensed modular transmitter approval);

Canada (IC RSS);

Japan (MIC);

Taiwan (NCC);

China (SRRCC);

South Korea (KCC);

Australia (ACMA);

New Zealand; Brazil (Anatel);

South Africa (ICASA)

EN 62479, EN/IEC 60950-1, EN60601-1-2

Application Communication between the EC cordless screwdriver and the mPro-Screwdriver control using the customer network



Which frequency band is released in the individual plants must be coordinated with the department.

3.6.2. Infrared IrDA Application

Commissioning

infrared interface IrDA,
(57.6 kbit/s, no parity, 8 Data, 1 Stop, CRC check)

Application

For initial operation, programming of the EC nutrunner is necessary. A tool deposit with integrated infrared interface is used for this purpose. All EC nutrunners have an integrated infrared interface. This programming makes the EC tool known to the network. For this purpose, the necessary input is made via the fastening control, on which the tool deposit is installed, and transmitted to the tool.(use mPro400 GCD-M-> (X6) or RS. 232-2. interface)

Following this, all communication with the tool is via the WLAN.

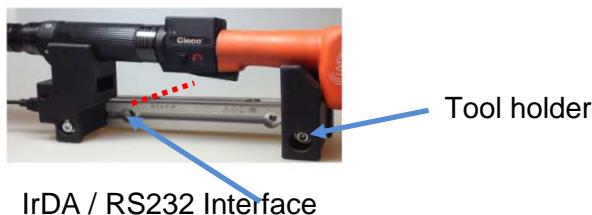


Fig. 38 Infrared interface

3.6.3. Initial Operation of the Tool

Preparation / setup of the tool via IrDA (infrared interface)

The Setup mask can be called up via **System programming/Service/TMA Configuration**. Setup runs entirely without regard to the parameters set in the system. To establish communication, the tool must be deposited on the programming station and switched to standby mode using the start button.

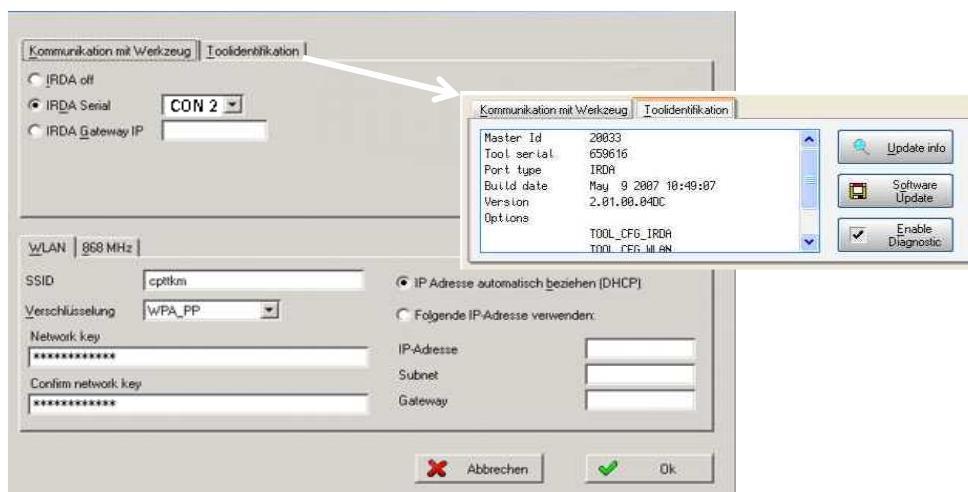


Fig. 39 Tool setup mask

The Ethernet settings for the initial introduction of the cordless nutrunner in the network should be made here.

Procedure:

1. Inquire about Ethernet settings from the IT department
2. Place tool in programming station
3. Call up menu (see above), enter Ethernet settings from IT
4. Switch to tool identification and actuate the start button at the tool
5. Carry out software update as required
6. Actuate the OK button to trigger the transmission to the tool

The procedure can be checked by switching to the tool identification. If the connection was made via IrDA, as indicated above the tool will be read out and displayed. However, this process can also be initiated manually using the Update info button.

Following this procedure, the tool is "known" in the network and can communicate with the fastening controller via the WLAN. The assignment with which screwdriver controller this tool works is controlled in the respective mPro with an entry in the "extended IP" mask.

For testing/termination, the transferred network setting can be checked on the tool and the tool can be checked in the controller using the test function and "live-wire button".

3.6.4. Operating Controls and Display Elements in the Tool

The tool has an LCD display for text, a red and green LED and two buttons for the operator.



Fig. 40  Tool displays

Each tool has three red and three green LEDs, which display the fastening status after every rundown. If the job (step operation) is complete, the overall status is displayed by flashing LEDs. NOK rundowns are indicated additionally by red background illumination at the LCD display. After every rundown, the LCD display shows the status and the torque and angle values.

For NOK rundowns, it is possible to block the tool until start in counter clockwise rotation, or an input is activated at the control system.

3.6.5. Energy Management Concept

There are four operating modes Active, Energy Saving, Standby and Sleep.

Operating mode **Sleep** is indicated by : Backlight off and LED off
The internal power supply is switched off. The current is < 1 mA
(measuring card, servo and backlight are switched off)

Standby mode is indicated by : Backlight off and LED off
The measuring card or the communication is active. The current is ~90 mA

Power save mode is indicated by : Backlight off and LED flashes. The measuring card and servo are active.

Operating mode **Active** is indicated by : Backlight on and LED show status
The internal electronics are fully active. All functions are available.

Operating mode change:

Sleep → Active

by pressing the start button and holding.

Active → energy saving mode

Automatic changeover after a rest period of 1 minute (parameterizable)

Energy saving mode → Standby

Automatic changeover after a further rest period of 5 minutes (parameterizable)

standby → sleep

Automatic changeover after a further rest period of 5 minutes (parameterizable)

The times can be parameterized in the tool configuration mask.

3.6.6. Servicing and maintenance

3.6.6.1. tool change

A replaceable memory module ("live-wire button") is built in to allow easy replacement of the tools in production. When the tool is switched on, the network settings are read from it and used for the WLAN connection setup. When changing tools, the "live-wire button" must be installed from the tool to be replaced into the new tool to be used. This eliminates the need to set up the replacement tool externally using the programming shelf.



Attention

The "live-wire button" may only be changed when the battery is disconnected.

MAC-address will be set by APEX and can't be changed. Other data may be changed by means of an infrared connection of the tool to mPro-400GCD.

Fig. 41 Change chip on tool

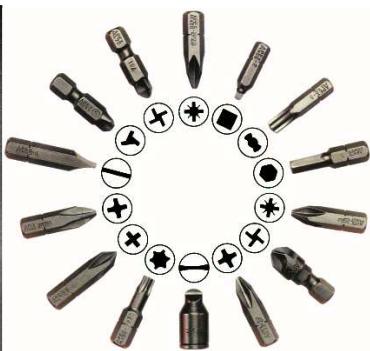
Attention

The controller does not check whether all parameterized screwdriving cases can be processed with the new screwdriver type. This is the task of the setter, who can check the parameters in the screwdriver controller or determine the suitability by means of test screwings. With overstrained tools the IP error will occur.

3.6.7. Selection of Accessories/Options



General accessories



Apex  guard
(hand protection, surface protection)



Note

Further accessories can be found at **APEX Tool Group**

<http://www.clecotools.de/downloads/service-literature>

3.7. Production-wrench

3.7.1. Overview I-Wrench

Optionally, electronic radio-operated torque wrenches can also be connected to the fastener controls. These wrenches are optimized for use as production wrenches and thus represent an ideal supplement for incorporation in the process environment.

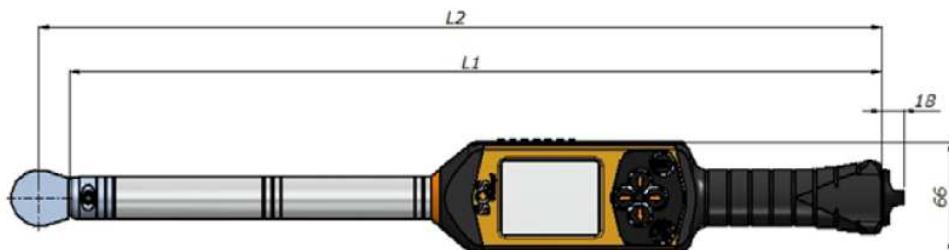


Only to be used after consulting Daimler

Product discontinued

3.7.2. Torque Range

The production wrenches are subdivided into torque ranges,



Torque Range (Nm)	Output Drive	L1 (mm)	Length	Weight (kg)
			Length L2 * (mm)	
15	9x12 female	374	392	0,8
30	9x12 female	374	392	0,86
50	9x12 female	374	392	0,86
70	9x12 female	476	494	0,93
100	9x12 female	476	494	0,93
200	14x18 female	604	630	1,5
300	14x18 female	754	780	1,86
400	14x18 female	854	880	2
600	14x18 female	1034	1060	3,65
800	Ø 20	1236	1315	5,1
1000	Ø 20	1516	1595	6,25
1200	Ø 28	1576	1730	7

* L2 is the dimension with the mounting tool used for calibration. For more information, refer to the I-Wrench P2383 special instructions.

Table 56 Overview of the I-Wrench

Project name: Stationary and handheld EC fastening technology from company APEX Tool Group
File name: Projektbuch eng MCG_LKW_PKW_Powertrain_2025_V01.14
Version / Release: 01.14
Author: APEX Tool Group

3.7.3. Order Data

Order no. - for version with multi-pin tool recognition		Torque range Nm *
I-Wrench with rubber protection and barcode scanner	I-Wrench without rubber protection and barcode scanner	
PRW-0015-1110-WI	PRW-0015-0110-WI	15
PRW-0030-1110-WI	PRW-0030-0110-WI	30
PRW-0070-1110-WI	PRW-0070-0110-WI	70
PRW-0100-1110-WI	PRW-0100-0110-WI	100
PRW-0200-1110-WI	PRW-0200-0110-WI	200
PRW-0300-1110-WI	PRW-0300-0110-WI	300
PRW-0400-1110-WI	PRW-0400-0110-WI	400
PRW-0600-1110-WI	PRW-0600-0110-WI	600
PRW-0800-1110-WI	PRW-0800-0110-WI	800
PRW-1000-1110-WI	PRW-1000-0110-WI	1000
PRW-1200-1110-WI	PRW-1200-0110-WI	1200

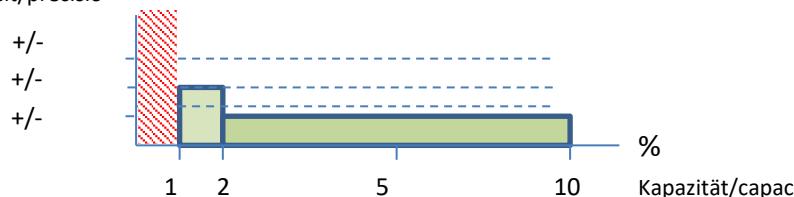
Order no. - for version with 1-Pin-Tool Recognition (F3-EVO)		Torque range Nm *
I-Wrench with rubber protection and barcode scanner	I-Wrench without rubber protection and barcode scanner	
To be define	PRW-0015-0111-WI	15
To be define	PRW-0030-0111-WI	30
To be define	PRW-0070-0111-WI	70
To be define	PRW-0100-0111-WI	100
To be define	PRW-0200-0111-WI	200
To be define	PRW-0300-0111-WI	300
To be define	PRW-0400-0111-WI	400
To be define	PRW-0600-0111-WI	600
To be define	PRW-0800-0111-WI	800
To be define	PRW-1000-0111-WI	1000
To be define	PRW-1200-0111-WI	1200

Table 57 Order no. I-wrench

3.7.4. Measuring Instrument Accuracy

* = Measuring instrument accuracy depends on the percentage of target use of the I-Wrench capacitance from 20% -> +/- 0,5%, at 10%-20% of capacity with an accuracy of +/- 1%, less than 5% of capacity task becomes denied (mPro-Function)

Genauigkeit/precisión



Through continuous maintenance and further development of the system technology, the structure of the production wrenches was changed from 2020. In particular, the tool recognition was transferred to an improved version known as "1-Pin Tool Recognition". This means that inserts with multi-pin solutions can no longer be operated.

3.7.5. Accessories I-Wrench



1 2 3 4 5

1: reversible insertion ratchet			
Ratchet without tool recognition Order no.	with tool recognition (1-Pin-Lösung) Order no.	with tool recognition (multi-pin solution) Order no.	Size /Torque Capacity
197170001	on request	197179001	9x12 – 1/4“ MD=40Nm
197170002	on request	197179002	9x12 – 3/8“ MD=100Nm
197170003	on request	197179003	9x12 – 1/2“ MD=100Nm
197170005	on request	197179005	14x18 – 1/2“ MD=300Nm
197170006	on request		14x18 – 3/4“ MD=400Nm
197170004	on request	197179004	14x18 – 3/4“ MD=600Nm
197170007	on request		Ø20 – 3/4“ MD=1050Nm
197170008	on request		Ø28- 1“ MD=1300Nm
2: Use for customer adaptations (welding adapters)			
197170146	on request	on request	9x12
197170147	on request	on request	14x18
3: Inserts with open end			
on request			
4: Inserts with ring			
on request			
5: Inserts with open ring			
on request			
6: special Inserts			
on request			

Table 58  Order number I-Wrench Ratchets



Order no	Further accessories - Designation	Model name
313110030	Rubber protection with display protection	I-Wrench-DRP
943081PT	Protective screen Plexiglas for Rubber protection	

Table 59  Order number I-Wrench Protection Accessories

Project name: Stationary and handheld EC fastening technology from company APEX Tool Group
 File name: Projektbuch eng MCG_LKW_PKW_Powertrain_2025_V01.14
 Version / Release: 01.14
 Author: APEX Tool Group

DAIMLER



Order no.	Further accessories - Designation	Model name
197140013	Programming unit for Tool recognition	I-Wrench-PU
To be define	Programming unit for tool recognition (1-pin solution)	To be define
197990008	USB Cable 2m	I-Wrench-USB

Table 60 ☐ Order number I-Wrench Programming Accessories



Charging station for CLECO Live Wire I-Wrench	
Order no.	Order information
197130020	For I-Wrench with rubber cover - Torque range 15/30 Nm
197130021	For I-Wrench with rubber cover - Torque range 70/100 Nm
197130022	For I-Wrench with rubber cover - Torque range 200 Nm
197130023	For I-Wrench with rubber cover - Torque range 300 Nm
197130024	For I-Wrench with rubber cover - Torque range 400 Nm
197130025	For I-Wrench with rubber cover - Torque range 600 Nm
197130026	For I-Wrench with rubber cover - Torque range 800 Nm
197130027	For I-Wrench with rubber cover - Torque range 1000 Nm
197130028	For I-Wrench with rubber cover - Torque range 1200 Nm

Table 61 ☐ Order number I-Wrench charging station



Order no.	description	Model name
197140025	External charger for battery with J21	I-Wrench-EC1
313210042	LI-ION battery 3,7V	I-Wrench-BA
943082PT	Replacement battery compartment cover on I-Wrench	

Table 62 ☐ Order number I-Wrench external charger / battery

3.8. Interesting facts about the handheld Screwdriver Control System

The I-Wrench is a production-related, high-precision torque and angle wrench. In principle, it can be used wherever hand-held EC screw drivers are used. Its slim design makes it ideal for difficult access applications. It is also excellently suited for universal tasks such as reworking.

The I-Wrench must receive a basic setup before use. The I-Wrench is connected to a PC via USB and a configuration program is used to make the necessary basic settings on the production wrench (manually) or a setup file is loaded onto the I-Wrench (compact). Among other things, the target mPro (WIFI Host=IP address of the mPro), with which the production wrench is to communicate later, is also entered. In addition, the channel (Wrench-ID) is entered as what the I-Wrench should report to the target mPro. The production wrench is then prepared for use in the field.

In the production area, it can now be operated by the assigned screw driver control after it has been parameterized and assigned a task. The I-Wrench receives the screw driving parameters from the screwdriver control, to which it reports back its results or errors.

In the event of an error, an I-Wrench is replaced according to the same setup method, whereby care must be taken that the wrench to be replaced is first set to inactive. The replacement wrench is then automatically supplied with the remaining order from the screw driver control and can be processed seamlessly.

When the production wrenches are placed in the charging cups, the batteries are charged and the wrench is kept ready for use. The batteries can also be removed and replaced from the shaft in the handle and charged independently in a separate charging device.

The production wrenches can be equipped with tool recognition. The recognition serves on the one hand for process assurance that the target screw connection is also carried out with the correct insert and on the other hand it can also be used to organize any corrections of the measurement changed inserts. This applies to both torque measurement and angle measurement.

In principle, a production wrench can also be used for tighten or loosen a screw connection due to its internal structure. In the end, however, the action is not automatically detected and documented by the technology - this must be taken into account when using a process. The I-Wrench is in this project not intended for controlled loosening

The LED display and the progressing bar on the display help the operator to safely reach the target switch-off point when the order is placed to tighten the screws. After the screw connection has been completed, the success is reported back to the operator via the LED or tactile.

The I-Wrench also provides further information and feedback for the operator via the display, which can be answered via the wrenches.

The production wrench is normally supplied with calibration certificates for torque measurement valid for a maximum of one year. For auditing, an angular calibration or MFU measurement can also be ordered for the wrench.

Also within the screw driver control there are some differences to the cordless screw driver.

- - Only stage 1 is used for a screw connection.
- - Only Dia 30 and Dia 50 are available as screw connection diagrams.
- - The speed specification is used for the measuring direction of the I-Wrench.
(n=0 measuring right, n=1 measuring left)
- - No redundancy possibility.
- - No stick-slip detection.
- - No valuation moment.
(min. moment when a value is exceeded, an evaluation is output)
- - Changed counting IO/NIO
- - The I-Wrench has a release detection when removing the wrench from the screw head after the screw connection.
- - The I-Wrench has a block recognition
(screwing attempt on already tightened screw).

3.9. Appendix



Instructions for programming and configuring the fastener controls are to be taken from the differentiated descriptions.

An overview of the fastening diagrams can be found in the APEX Tool Group "System Description" P1730E.

<http://www.clecotools.de/downloads>

The definition of which fastening diagrams are actually used is dealt with differently in the different plants and must first be agreed with the project managers responsible for fastening technology.

3.10. □ Production Wrench Freedom4 (Successor)

The successor of the APEX -I-Wrench is the production wrench of the company SCS. The wrench can replace the I-Wrench 1:1, contains technical improvements and behaves analogue to the I-Wrench. Communication with the screwdriver control is possible from S168833-415.

The wrench is called Freedom4 and is offered on the market in different versions. For use in production, the wrench is configured according to our specifications. It can be identified by the code Freedom4S and the designation PRW- in the order number. No warranty and/or service is provided by APEX for wrenches that were procured for quality assurance or laboratory use and not via APEX.

Only to be used after
consulting Daimler

Product discontinued !



Fig. 42 ✎ Freedom4

3.10.1. Torque Range

The production wrenches are subdivided into torque ranges,



Torque capacity (Nm))	Drive	Length		Weight (kg)
		L1 (mm)	L2 * (mm)	
1,5-15	9x12 female	364	382	0,97
3-30	9x12 female	364	382	0,98
5-50	9x12 female	364	382	0,98
7-70	9x12 female	470,5	489	1,01
10-100	9x12 female	470,5	489	1,01
20-200	14x18 female	604,5	630	1,19
30-300	14x18 female	754,5	780	1,2
40-400	14x18 female	854,5	880	1,4
60-600	14x18 female	1034,5	1060	1,4
800	Ø 20	Not yet available		
1000	Ø 20			
1200	Ø 28			

Table 63  Overview Freedom4

* L2 is the dimension with the final assembly tool used for calibration. For further information in this regard, refer to the special instructions for Freedom4.

3.10.2. Order Data



Order no. Freedom4 Production wrench Torque/angle wrenches, with PRW firmware, radio-controlled blades, display and rubber protection, without Plug insert					Torque range
without socket wrench recognition		with socket wrench recognition (1-Pin)			
without barcode scanner	with 2D barcode scanner	without barcode scanner	with 2D barcode scanner	Nm	
PRW-0015-F4-0000	PRW-0015-F4-2000	PRW-0015-F4-0001	PRW-0015-F4-2001	1,5 - 15	
PRW-0030-F4-0000	PRW-0030-F4-2000	PRW-0030-F4-0001	PRW-0030-F4-2001	3 - 30	
PRW-0050-F4-0000	PRW-0050-F4-2000	PRW-0050-F4-0001	PRW-0050-F4-2001	5 - 50	
PRW-0070-F4-0000	PRW-0070-F4-2000	PRW-0070-F4-0001	PRW-0070-F4-2001	7 - 70	
PRW-0100-F4-0000	PRW-0100-F4-2000	PRW-0100-F4-0001	PRW-0100-F4-2001	10 - 100	
PRW-0200-F4-0000	PRW-0200-F4-2000	PRW-0200-F4-0001	PRW-0200-F4-2001	20 - 200	
PRW-0300-F4-0000	PRW-0300-F4-2000	PRW-0300-F4-0001	PRW-0300-F4-2001	30 - 300	
PRW-0400-F4-0000	PRW-0400-F4-2000	PRW-0400-F4-0001	PRW-0400-F4-2001	40 - 400	
PRW-0600-F4-0000	PRW-0600-F4-2000	PRW-0600-F4-0001	PRW-0600-F4-2001	60 - 600	
PRW-0800-F4-0000	PRW-0800-F4-2000	PRW-0800-F4-0001	PRW-0800-F4-2001	800	
PRW-1000-F4-0000	PRW-1000-F4-2000	PRW-1000-F4-0001	PRW-1000-F4-2001	1000	
PRW-1200-F4-0000	PRW-1200-F4-2000	PRW-1200-F4-0001	PRW-1200-F4-2001	1200	

Shown in grey Order numbers = preferred types

Table 64  Order data 1 Freedom4

3.10.3. Declaration Nomenklatura

P	R	W	0015	F4	2	1	0	1
---	---	---	------	----	---	---	---	---

PRW Suitability as production wrench
 0015 Upper value of the torque range
 F4 Body type SCS Freedom4
 2101 first digit - Scanner equipment 0= none, 1= 1D, 2= 2D
 second digit - equipment location 0= none, 1=Ubisense-TAG D4,
 third place - reserve
 fourth digit - socket wrench recognition 0= none, 1= 1Pin Variant

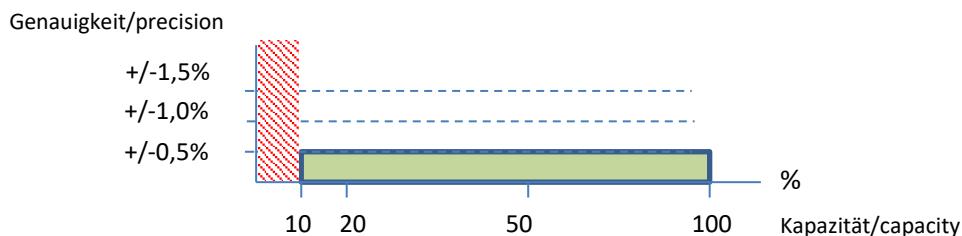
3.10.4. Measuring Instrument Accuracy

* = Torque accuracy 0.5% of the read value

Torque range 10 to 100 %

Angular accuracy +/-1° over 360

Meets the OEM homologation requirements according to VDI/VDE2647, VDI/VDE2645-2, DAKKS-DKD 3-7 / 10-7 (Class1 -1%), VDI/VDE2648-2, ISO6789-1/-2



3.10.5. Accessories

The specifications of the valid VA must be taken into account when operating insert tools. In principle, process-reliable operation is only possible with functioning tool recognition, since the torque and angle of rotation measurement can be significantly impaired when the insert tools are changed, which can lead to an incorrect evaluation of the screwdriving result. If tool recognition is not used, organizational measures must be taken.

In the case of special insertion tools, the memory chip must be written with an ID that cannot be confused and the corresponding correction factors.

3.10.5.1. Plug-in Ratchets



1a: Socket wrench ratchet, reversible		
without socket wrench recognition Order no. / Modell No.. STAHLWILLE 60 Gear Teeth	with 1-Pin socket wrench recognition Order no. / Modell no. STAHLWILLE 60 Gear Teeth	Size/capacity
197 17 0001 / Freedom S/1	197 17 8001 / Freedom STR/1	9x12 – 1/4" MD=40Nm
197 17 0002 / Freedom S/2	197 17 8002 / Freedom STR/2	9x12 – 3/8" MD=100Nm
197 17 0003 / Freedom S/3	197 17 8003 / Freedom STR/3	9x12 – 1/2" MD=100Nm
197 17 0005 / Freedom S/4	197 17 8005 / Freedom STR/4	14x18 – 1/2" MD=300Nm
197 17 0006 / Freedom S/5 400	167 17 8006 / Freedom STR/5 400	14x18 – 3/4" MD=400Nm
197 17 0004 / Freedom S/6 600	197 17 8004 / Freedom STR/5 600	14x18 – 3/4" MD=600Nm
197 17 0007 / Freedom S/6		Ø20 – 3/4" MD=1050Nm
197 17 0008 / Freedom S/7	197 17 8008 / Freedom S/7	Ø30- 1" MD=1300Nm
without socket wrench recognition Order no. / Modell no. SCS 52 Gear Teeth	with 1-Pin socket wrench recognition Order no. / Modell no. SCS 52 Gear Teeth	Size/capacity
197 17 0201 / Freedom TS-1-1/4"	197 17 8201 / Freedom TSTR-1-1/4"	9x12 – 1/4" MD=40Nm
197 17 0202 / Freedom TS-1-3/8"	197 17 8202 / Freedom TSTR-1-3/8"	9x12 – 3/8" MD=100Nm
197 17 0203 / Freedom TS-1-1/2"	197 17 8203 / Freedom TSTR-1-1/2"	9x12 – 1/2" MD=100Nm
197 17 0205 / Freedom TS-2-1/2"	197 17 8205 / Freedom TTRS-2-1/2"	14x18 – 1/2" MD=300Nm
197 17 0206 / Freedom TS-2-3/4"	197 17 8206 / Freedom TSTR-2-3/4"	14x18 – 3/4" MD=400Nm
		14x18 – 3/4" MD=600Nm
		Ø20 – 3/4" MD=1050Nm
		Ø30- 1" MD=1300Nm

Order numbers shown in black = preferred types

Order numbers shown in grey can only be used after consultation with Daimler.

Table 65  Order ratchet, reversible

3.10.5.2. Welding adapters



Order no.		
2: Socket wrench - use for customer adaptations (welding adapter)		
without socket wrench recognition	with 1-Pin socket wrench recognition	Size
197 17 0146	On request	9x12
197 17 0147	On request	14x18

Table 66  Order data welding adapter

3.10.5.3. Plug-in adapter open end



3: Socket wrench open end 9x12

Order no. / Modell no. without socket wrench recognition	Order no. / Modell no. with 1-Pin socket wrench recognition
197 17 0024 / Open End 7 mm 9x12	197 17 8024 / Open End 7 mm 9x12
197 17 0025 / Open End 8 mm 9x12	197 17 8025 / Open End 8 mm 9x12
197 17 0026 / Open End 9 mm 9x12	197 17 8026 / Open End 9 mm 9x12
197 17 0027 / Open End 10 mm 9x12	197 17 8027 / Open End 10 mm 9x12
197 17 0028 / Open End 11 mm 9x12	197 17 8028 / Open End 11 mm 9x12
197 17 0029 / Open End 12 mm 9x12	197 17 8029 / Open End 12 mm 9x12
197 17 0030 / Open End 13 mm 9x12	197 17 8030 / Open End 13 mm 9x12
197 17 0031 / Open End 14 mm 9x12	197 17 8031 / Open End 14 mm 9x12
197 17 0032 / Open End 15 mm 9x12	197 17 8032 / Open End 15 mm 9x12
197 17 0033 / Open End 16 mm 9x12	197 17 8033 / Open End 16 mm 9x12
197 17 0034 / Open End 17 mm 9x12	197 17 8034 / Open End 17 mm 9x12
197 17 0035 / Open End 18 mm 9x12	197 17 8035 / Open End 18 mm 9x12
197 17 0036 / Open End 19 mm 9x12	197 17 8036 / Open End 19 mm 9x12
197 17 0167 / Open End 21 mm 9x12	197 17 8167 / Open End 21 mm 9x12
197 17 0157 / Open End 22 mm 9x12	197 17 8157 / Open End 22 mm 9x12
197 17 0158 / Open End 23 mm 9x12	197 17 8158 / Open End 23 mm 9x12
197 17 0159 / Open End 24 mm 9x12	197 17 8159 / Open End 24 mm 9x12
197 17 0160 / Open End 28 mm 9x12	197 17 8160 / Open End 28 mm 9x12
197 17 0161 / Open End 30 mm 9x12	197 17 8161 / Open End 30 mm 9x12
197 17 0168 / Open End 32 mm 9x12	197 17 8168 / Open End 32 mm 9x12
197 17 0169 / Open End 36 mm 9x12	197 17 8169 / Open End 36 mm 9x12
197 17 0086 / Open End 1/4" 9x12	197 17 8086 / Open End 1/4" 9x12
197 17 0087 / Open End 5/16" 9x12	197 17 8087 / Open End 5/16" 9x12
197 17 0088 / Open End 3/8" 9x12	197 17 8088 / Open End 3/8" 9x12
197 17 0089 / Open End 7/16" 9x12	197 17 8089 / Open End 7/16" 9x12
197 17 0090 / Open End 1/2" 9x12	197 17 8090 / Open End 1/2" 9x12
197 17 0091 / Open End 9/16" 9x12	197 17 8091 / Open End 9/16" 9x12
197 17 0092 / Open End 5/8" 9x12	197 17 8092 / Open End 5/8" 9x12
197 17 0093 / Open End 11/16" 9x12	197 17 8093 / Open End 11/16" 9x12
197 17 0094 / Open End 3/4" 9x12	197 17 8094 / Open End 3/4" 9x12

Order numbers shown in black = preferred types

Order numbers shown in grey can only be used after consultation with Daimler.

Table 67  Ordering data 1 Plug-in adapter open end



3: Socket wrench open end 14x18

Order no. / Modell no. without socket wrench recognition	Order no. / Modell no. with 1-Pin socket wrench recognition
197 17 0037 / Open End 13 mm 14x18	197 17 8037 / Open End 13 mm 14x18
197 17 0038 / Open End 14 mm 14x18	197 17 8038 / Open End 14 mm 14x18
197 17 0039 / Open End 15 mm 14x18	197 17 8039 / Open End 15 mm 14x18
197 17 0040 / Open End 16 mm 14x18	197 17 8040 / Open End 16 mm 14x18
197 17 0041 / Open End 17 mm 14x18	197 17 8041 / Open End 17 mm 14x18
197 17 0042 / Open End 18 mm 14x18	197 17 8042 / Open End 18 mm 14x18
197 17 0043 / Open End 19 mm 14x18	197 17 8043 / Open End 19 mm 14x18
197 17 0044 / Open End 21 mm 14x18	197 17 8044 / Open End 21 mm 14x18
197 17 0045 / Open End 22 mm 14x18	197 17 8045 / Open End 22 mm 14x18
197 17 0178 / Open End 23 mm 14x18	
197 17 0046 / Open End 24 mm 14x18	197 17 8046 / Open End 24 mm 14x18
197 17 0047 / Open End 25 mm 14x18	197 17 8047 / Open End 25 mm 14x18
197 17 0179 / Open End 26 mm 14x18	
197 17 0048 / Open End 27 mm 14x18	197 17 8048 / Open End 27 mm 14x18
197 17 0049 / Open End 30 mm 14x18	197 17 8049 / Open End 30 mm 14x18
197 17 0050 / Open End 32 mm 14x18	197 17 8050 / Open End 32 mm 14x18
197 17 0051 / Open End 34 mm 14x18	197 17 8051 / Open End 34 mm 14x18
197 17 0052 / Open End 36 mm 14x18	197 17 8052 / Open End 36 mm 14x18
197 17 0053 / Open End 38 mm 14x18	197 17 8053 / Open End 38 mm 14x18
197 17 0054 / Open End 41 mm 14x18	197 17 8054 / Open End 41 mm 14x18
197 17 0180 / Open End 46 mm 14x18	197 17 8180 / Open End 46 mm 14x18
197 17 0181 / Open End 48 mm 14x18	197 17 8181 / Open End 48 mm 14x18
197 17 0182 / Open End 50 mm 14x18	197 17 8182 / Open End 50 mm 14x18
197 17 0096 / Open End 1/2" 14x18	197 17 8096 / Open End 1/2" 14x18
197 17 0097 / Open End 9/16" 14x18	197 17 8097 / Open End 9/16" 14x18
197 17 0098 / Open End 5/8" 14x18	197 17 8098 / Open End 5/8" 14x18
197 17 0099 / Open End 11/16" 14x18	197 17 8099 / Open End 11/16" 14x18
197 17 0100 / Open End 3/4" 14x18	197 17 8100 / Open End 3/4" 14x18
197 17 0101 / Open End 13/16" 14x18	197 17 8101 / Open End 13/16" 14x18
197 17 0102 / Open End 7/8" 14x18	197 17 8102 / Open End 7/8" 14x18
197 17 0103 / Open End 15/16" 14x18	197 17 8103 / Open End 15/16" 14x18
197 17 0104 / Open End 1" 14x18	197 17 8104 / Open End 1" 14x18
197 17 0105 / Open End 1 1/8" 14x18	197 17 8105 / Open End 1 1/8" 14x18

Order numbers shown in black = preferred types

Order numbers shown in grey can only be used after consultation with Daimler.

Table 68 Ordering data 2 Plug-in adapter open end

3.10.5.4. Plug-in adapter ring spanner



4: Socket wrench Ring spanner 9x12

Order no. / Modell no. without socket wrench recognition	Order no. / Modell no. with 1-Pin socket wrench recognition
197 17 0055 / Ring End 7 mm 9x12	197 17 8055 / Ring End 7 mm 9x12
197 17 0056 / Ring End 8 mm 9x12	197 17 8056 / Ring End 8 mm 9x12
197 17 0057 / Ring End 10 mm 9x12	197 17 8057 / Ring End 10 mm 9x12
197 17 0058 / Ring End 11 mm 9x12	197 17 8058 / Ring End 11 mm 9x12
197 17 0059 / Ring End 12 mm 9x12	197 17 8059 / Ring End 12 mm 9x12
197 17 0060 / Ring End 13 mm 9x12	197 17 8060 / Ring End 13 mm 9x12
197 17 0061 / Ring End 14 mm 9x12	197 17 8061 / Ring End 14 mm 9x12
197 17 0062 / Ring End 15 mm 9x12	197 17 8062 / Ring End 15 mm 9x12
197 17 0063 / Ring End 16 mm 9x12	197 17 8063 / Ring End 16 mm 9x12
197 17 0064 / Ring End 17 mm 9x12	197 17 8064 / Ring End 17 mm 9x12
197 17 0065 / Ring End 18 mm 9x12	197 17 8065 / Ring End 18 mm 9x12
197 17 0066 / Ring End 19 mm 9x12	197 17 8066 / Ring End 19 mm 9x12
197 17 0067 / Ring End 21 mm 9x12	197 17 8067 / Ring End 21 mm 9x12
197 17 0068 / Ring End 22 mm 9x12	197 17 8068 / Ring End 22 mm 9x12
197 17 0106 / Ring End 1/4" 9x12	197 17 8106 / Ring End 1/4" 9x12
197 17 0107 / Ring End 5/16" 9x12	197 17 8107 / Ring End 5/16" 9x12
197 17 0108 / Ring End 3/8" 9x12	197 17 8108 / Ring End 3/8" 9x12
197 17 0109 / Ring End 7/16" 9x12	197 17 8109 / Ring End 7/16" 9x12
197 17 0110 / Ring End 1/2" 9x12	197 17 8110 / Ring End 1/2" 9x12
197 17 0111 / Ring End 9/16" 9x12	197 17 8111 / Ring End 9/16" 9x12
197 17 0112 / Ring End 5/8" 9x12	197 17 8112 / Ring End 5/8" 9x12
197 17 0113 / Ring End 11/16" 9x12	197 17 8113 / Ring End 11/16" 9x12
197 17 0114 / Ring End 3/4" 9x12	197 17 8114 / Ring End 3/4" 9x12
197 17 0115 / Ring End 13/16" 9x12	197 17 8115 / Ring End 13/16" 9x12
197 17 0116 / Ring End 7/8" 9x12	197 17 8116 / Ring End 7/8" 9x12

Order numbers shown in black = preferred types

Order numbers shown in grey can only be used after consultation with Daimler.

Table 69  Ordering data 1 Plug-in adapter Ring spanner



4: Socket wrench Ring spanner 14x18

Order no. / Modell no. without socket wrench recognition	Order no. / Modell no. with 1-Pin socket wrench recognition
197 17 0069 / Ring End 13 mm 14x18	197 17 8069 / Ring End 13 mm 14x18
197 17 0070 / Ring End 14 mm 14x18	197 17 8070 / Ring End 14 mm 14x18
197 17 0071 / Ring End 15 mm 14x18	197 17 8071 / Ring End 15 mm 14x18
197 17 0072 / Ring End 16 mm 14x18	197 17 8072 / Ring End 16 mm 14x18
197 17 0073 / Ring End 17 mm 14x18	197 17 8073 / Ring End 17 mm 14x18
197 17 0074 / Ring End 18 mm 14x18	197 17 8074 / Ring End 18 mm 14x18
197 17 0075 / Ring End 19 mm 14x18	197 17 8075 / Ring End 19 mm 14x18
197 17 0076 / Ring End 21 mm 14x18	197 17 8076 / Ring End 21 mm 14x18
197 17 0077 / Ring End 22 mm 14x18	197 17 8077 / Ring End 22 mm 14x18
197 17 0078 / Ring End 24 mm 14x18	197 17 8078 / Ring End 24 mm 14x18
197 17 0079 / Ring End 27 mm 14x18	197 17 8079 / Ring End 27 mm 14x18
197 17 0081 / Ring End 30 mm 14x18	197 17 8081 / Ring End 30 mm 14x18
197 17 0082 / Ring End 32 mm 14x18	197 17 8082 / Ring End 32 mm 14x18
197 17 0083 / Ring End 34 mm 14x18	197 17 8083 / Ring End 34 mm 14x18
197 17 0084 / Ring End 36 mm 14x18	197 17 8084 / Ring End 36 mm 14x18
197 17 0085 / Ring End 41 mm 14x18	197 17 8085 / Ring End 41 mm 14x18
197 17 0117 / Ring End ½" 14x18	197 17 8117 / Ring End ½" 14x18
197 17 0118 / Ring End 9/16" 14x18	197 17 8118 / Ring End 9/16" 14x18
197 17 0119 / Ring End 5/8" 14x18	197 17 8119 / Ring End 5/8" 14x18
197 17 0120 / Ring End 11/16" 14x18	197 17 8120 / Ring End 11/16" 14x18
197 17 0121 / Ring End ¾" 14x18	197 17 8121 / Ring End ¾" 14x18
197 17 0122 / Ring End 13/16" 14x18	197 17 8122 / Ring End 13/16" 14x18
197 17 0123 / Ring End 7/8" 14x18	197 17 8123 / Ring End 7/8" 14x18
197 17 0124 / Ring End 15/16" 14x18	197 17 8124 / Ring End 15/16" 14x18
197 17 0125 / Ring End 1" 14x18	197 17 8125 / Ring End 1" 14x18

Order numbers shown in black = preferred types

Order numbers shown in grey can only be used after consultation with Daimler.

Table 70 Ordering data 2 Plug-in adapter Ring spanner

3.10.5.5. Plug-in adapter open-end box wrench



5: Socket wrench Ring open-end 9x12

Order no. / Modell no. without socket wrench recognition	Order no. / Modell no. with 1-Pin socket wrench recognition
197 17 0126 / Ring Open End 10 mm 9x12	197 17 8126 / Ring Open End 10 mm 9x12
197 17 0127 / Ring Open End 11 mm 9x12	197 17 8127 / Ring Open End 11 mm 9x12
197 17 0128 / Ring Open End 12 mm 9x12	197 17 8128 / Ring Open End 12 mm 9x12
197 17 0129 / Ring Open End 13 mm 9x12	197 17 8129 / Ring Open End 13 mm 9x12
197 17 0130 / Ring Open End 14 mm 9x12	197 17 8130 / Ring Open End 14 mm 9x12
197 17 0131 / Ring Open End 16 mm 9x12	197 17 8131 / Ring Open End 16 mm 9x12
197 17 0132 / Ring Open End 17 mm 9x12	197 17 8132 / Ring Open End 17 mm 9x12
197 17 0133 / Ring Open End 18 mm 9x12	197 17 8133 / Ring Open End 18 mm 9x12
197 17 0134 / Ring Open End 19 mm 9x12	197 17 8134 / Ring Open End 19 mm 9x12
197 17 0135 / Ring Open End 21 mm 9x12	197 17 8135 / Ring Open End 21 mm 9x12
197 17 0136 / Ring Open End 22 mm 9x12	197 17 8136 / Ring Open End 22 mm 9x12
197 17 0137 / Ring Open End 24 mm 9x12	197 17 8137 / Ring Open End 24 mm 9x12

Order numbers shown in black = preferred types

Order numbers shown in grey can only be used after consultation with Daimler.

Table 71  Ordering data Plug-in adapter Ring open end

3.10.5.6. Rubber Protection / Display Protection Replacement



Fig. 43 ✎ Rubber protection

Order number	Further accessories - designation	Tool designation
313 11 0177	Rubber protection with screen protection	
323 19 0105	Rubber protection as a substitute	
323 19 0012	Plexiglas protective screen for the rubber protection as a substitute	

Table 72 ✎ Rubber protection and display protection order numbers

3.10.5.7. Freedom4 Programming Unit



Fig. 44 ✎ Programming unit

Order number	Further accessories - designation	Tool designation
197 14 0040	Programming unit for 1-Pin socket wrench recognition	Freedom-PU Monopin
333 41 0103	USB Cable type C (PC-Freedom4, spare cable)	USB-C Kabel

Table 73 ✎ Programming unit for tool recognition order numbers

3.10.5.8. Induction charging tray



Fig. 45  Charging tray

Inductions-charging tray for Freedom4 Production wrenches	
Order number	Tool designation
197 13 0049	Inductions-charging tray 15/30/50 Nm
197 13 0050	Inductions-charging tray 70/100 Nm
197 13 0051	Inductions-charging tray 200 Nm
197 13 0052	Inductions-charging tray 300 Nm
197 13 0053	Inductions-charging tray 400 Nm
197 13 0054	Inductions-charging tray 600 Nm
197 13 0055	Inductions-charging tray 800 Nm
197 13 0056	Inductions-charging tray 1000 Nm

Table 74  charging station order numbers



Quick battery exchange on the charger without having to restart the wrench!

3.10.5.9. Rechargeable Battery



Fig. 46 Rechargeable battery

Order number	Further accessories - designation	Tool designation
197140029	EXTERNAL CHARGER for 1 battery 2A with J21	Freedom3-EC1-2A
313210280	Spare battery 3.6 V /3,100 mAh/50 g	Freedom3-BA
To be define	Replacement rechargeable battery cover for Freedom4	

Table 75 Order numbers Freedom4 charger / battery

3.10.6. Special Considerations of the Production Wrenches

The Freedom4 is a production-related, highly precise torque and tightening angle wrench. It can basically be used wherever hand-held EC screwdrivers are also used. Thanks to its slender design, it is perfectly suited for use in areas which are difficult to access. It is also perfectly suitable in universal tasks such as in rework.

At present, however, its approval is currently limited to use on the toe adjustment stands.

The application is functionally integrated in the tightening controller and offers the same interface options into the Daimler infrastructure as the cordless screwdrivers.

3.10.7. Processing time

The communication of the production wrench is handled sequentially by the screwdriver control. This means each additional wrench connected to a control increases the processing time. This is independent of the LW-2 Screwdrivers used on the control. When used in flow production, the simultaneity factor is rather low, so that this is hardly noticeable. With a clocked controlled line or at more synchronously the wrenches are used, the more this effect becomes visible.



With a 4-fold assignment and almost synchronous processes, however, this can already result in a noticeable reaction time, this must be taken into account during installation!

Handling of the production wrenches differs from that of the cordless screwdrivers. Prior to use, the Freedom4 must be given a basic setup. To do this, the production wrench is connected to a PC by USB and a configuration program is used to carry out the necessary basic settings on the production wrench (manually). Or simply load a saved setup file onto the Freedom4 (compact). In this process, the target mPro (WIFI host=IP address of the mPro) with which the production wrench is to subsequently communicate is also loaded. The channel is additionally entered (wrench ID); i.e. as what the Freedom4 is to report to the target mPro. The production wrench is then prepared for use in the field. In the Production organizational unit, it can now be operated by the assigned tightening controller according to its parameterization and task definition. The Freedom4 receives the tightening parameters from the tightening controller to which it feeds back its results or faults.

The exchange of a Freedom4 in the event of a fault is carried out according to the same setup method, in which case it must be noted that the wrench to be exchanged must initially be set to inactive. The replacement wrench is then automatically supplied with the remaining job by the tightening controller and processing can be continued seamlessly. Unlike the cordless screwdriver, the Freedom4 has no interchangeable chip that enables direct exchange, but the WIFI module can be changed to the exchange key. This reduces the network administration work (no adjustment of firewall settings etc., as the MAC address changes).

When putting the production wrenches down in the contactless charging cradles, the rechargeable batteries are charged and the wrench is therefore kept operational. The rechargeable batteries can also be removed from the slot in the handle, changed, and charged in a separate charging facility.

The production wrenches can be equipped with socket wrench recognition. This recognition is used firstly for process validation that the target threaded connection is carried out with the correct bit and secondly, it can be used to adjust the bits due to changed measurements. This applies to both torque measurement and angle measurement. The wrenches can also be equipped with scanners to enable their use in the controlled procedure according to Daimler specifications as with the cordless screwdriver solution.

3.10.8. Configuration recommendation

The maximum number of WLAN tools on a GC controller is limited to 5 tools. For a mixed operation of LW2 screwdrivers and Freedom4 Wrench, 2 Freedom4 wrench are recommended. Due to the internal sequential sequence of the GC control, the response times when handling the Freedom 4 wrench are significantly higher if more than two Freedom 4 wrench are connected.



If the recommendation is exceeded, this must be coordinated with the Daimler specialist planner.

Thanks to its internal structure and due to the job, a production wrench can basically be used for tightening or loosening a threaded connection with or without an active Job. However, the manual loosening of a screw connection with a single application involves uncertainties, both in terms of technology and handling. - This must be taken into account when using the process.

After the tightening job has been assigned, the LED display and the progress bar on the display help the worker to reliably achieve the target shutoff point. After ending the tightening process, the worker is provided with LED or tactile feedback on success. The Freedom4 display also provides the operator with further information and feedback which can be responded to accordingly using the buttons.

The production wrench is normally delivered with a calibration certificate for the torque, which is typically valid for one year. For auditing purposes, an angle calibration or MFU test can also be ordered with the wrench. In order to be able to work in the same way as the cordless screwdrivers, a maintenance counter is also provided in the Freedom4, but processing in the screwdriver control is not yet possible.

There are also some differences compared to the cordless screwdriver within the tightening controller.

- Only stage 1 is used for a threaded connection.
- Only Dia 30 and Dia 50 are available as tightening diagrams.
- The speed specification is used for the measurement direction of the Freedom4 ($n=0$ measuring to the right, $n=1$ measuring to the left)
- No redundancy option.
- No stick-slip detection.
- No evaluation torque
(min. torque at which an evaluation is output if exceeded)
- Changed counting behavior in comparison with cordless screwdriver
- The freedom4 has release detection when removing the wrench from the screw head after tightening.
- The Freedom4 has blocking detection (attempt to tighten a screw that is already tightened).

3.11. Disposal Instructions

CAUTION!



Injuries and environmental damage from improper disposal.

Components and auxiliary materials of the tool pose risks to the health and the environment.

- Catch auxiliary materials (oils, greases) when drained and dispose of them properly.
- Separate the components of the packing and segregate the different materials before disposing of them.
- Follow the locally applicable regulations.

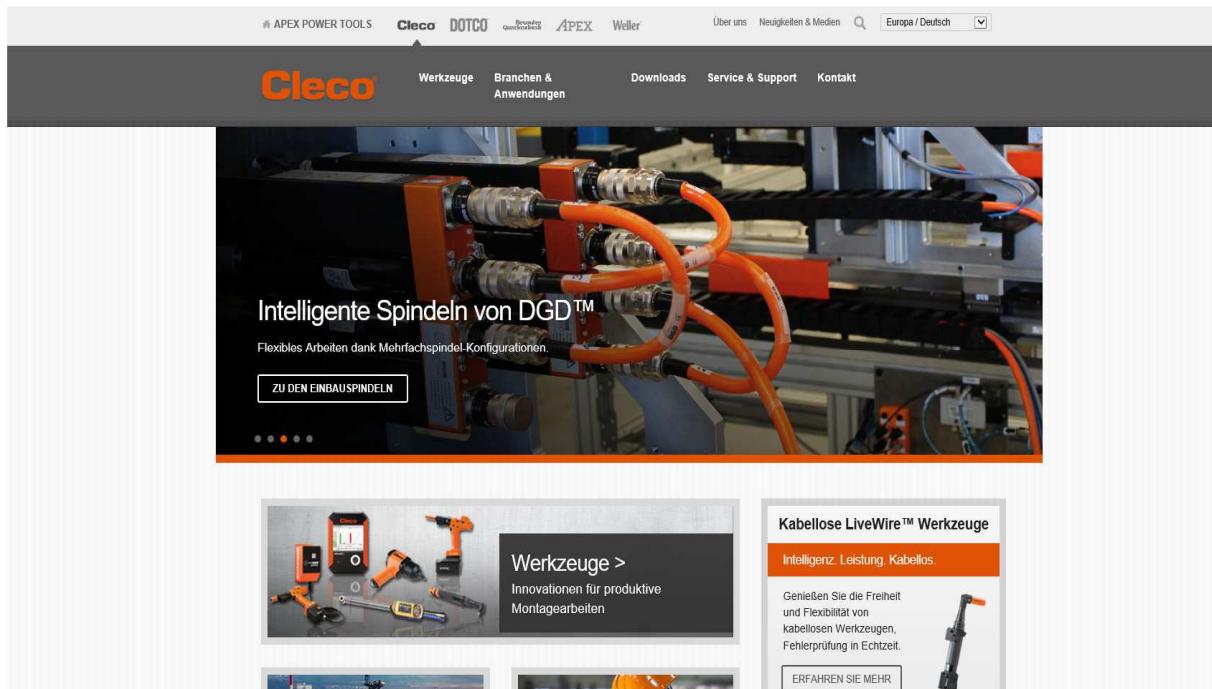


Observe generally valid disposal guidelines such as, in Germany, the Electrical and Electronic Equipment Act (ElektroG) and Battery Ordinance (BattV):

- Return the electronics and defective/used batteries to your company collection facility or to the Apex Tool Group.
- Do not throw the batteries in household refuse, fire or water.

3.12. □ Documents on the Internet

<http://www.clecotools.de>



Here you can see the product catalogs, the technical details as well as the homologations and downloaded.

List of Abbreviations, Glossary

EC	Electronic commutated (motors)
HIP	Hall installation plate
RIP	Robot installation plate
CF card	Data memory in Compact Flash format/technology
QDA	Quality data recording
Q data	Quality data
MA	Employees
PLC	Programmable Logic Controller
DHCP	Dynamic Host Configuration Protocol
torque.net	Network-based higher-order control and visualization system (software)
PN number	Production number

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