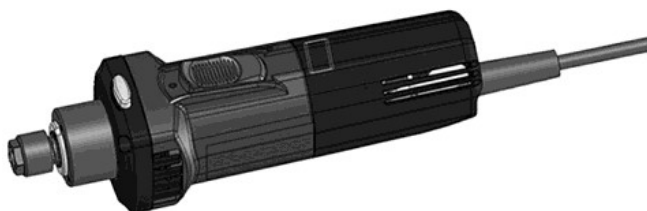


mafell

FM 800 / FM 1000

170558.0920/j

| | | | |
|-----------|---------------------|--|-----|
| de | Fräsmotor | Originalbetriebsanleitung | 8 |
| en | Milling motor | Translation of the original operating instructions | 21 |
| fr | Moteur de fraisage | Traduction de la notice d'emploi originale | 34 |
| it | Motore di fresatura | Traduzione delle istruzioni d'uso originali | 47 |
| nl | Freemotor | Vertaling van de originele gebruiksaanwijzing | 60 |
| es | Motor de fresado | Traducción del manual de instrucciones original | 73 |
| fi | Jyrsinmoottori | Käännös alkuperäiskäyttöohjeesta | 86 |
| sv | Fräsmotor | Översättning av originalbruksanvisningen | 99 |
| da | Fræsemotor | Oversættelse af den originale betjeningsvejledning | 112 |
| ru | Фрезерный двигатель | Перевод оригинальной инструкции по эксплуатации | 125 |
| pl | Silnik frezarski | Tłumaczenie oryginalnej instrukcji obsługi | 139 |
| cs | Motor na frézování | Překlad původního provozního návodu | 152 |
| sl | Motor rezkalnika | Prevod izvirnih navodil za uporabo | 165 |



MAF02163/a



MAF02193/a

WARNUNG

Lesen Sie alle Sicherheitshinweise und Anweisungen. Versäumnisse bei der Einhaltung der Sicherheitshinweise und Anweisungen können elektrischen Schlag, Brand und/oder schwere Verletzungen verursachen. **Bewahren Sie alle Sicherheitshinweise und Anweisungen für die Zukunft auf.**

WARNING

Please read all safety instructions and directions. Failure to comply with the safety instructions and directions can cause electric shock, fire and/or serious injuries. **Please retain all safety instructions and directions for future reference.**

AVERTISSEMENT

Veillez lire toutes les consignes de sécurité et instructions. Tout non-respect des consignes de sécurité et instructions risque d'être à l'origine de décharges électriques, d'incendies et/ou de blessures graves. **Conservez toutes les consignes et instructions pour pouvoir les relire à tout moment.**

AVVERTENZA

Leggere tutte le avvertenze di sicurezza e le istruzioni. La mancanza del rispetto delle avvertenze di sicurezza e delle istruzioni possono causare scossa elettrica, incendio e/o gravi lesioni. **Conservare tutte le avvertenze di sicurezza e le istruzioni per il futuro.**

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1 Signs and symbols



This symbol appears at places where you will find instructions for your own safety.

Non-compliance with these instructions may result in very serious injuries.



This symbol indicates a potentially hazardous situation.

If this situation is not avoided, the product or objects in its vicinity may get damaged.



This symbol indicates tips for the user and other useful information.

2 Product information

Model

FM 800
FM 1000
FM 1000 PV
FM 1000 PV-ER
FM 1000 WS
FM 1000 PV-WS

Art.-No.

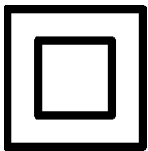
9M0010, 9M0030, 9M0031
9M0001, 9M0020, 9M0021, 9M0023
9M0201, 9M0223
9M0401, 9M0423
9M0101
9M0301, 9M0323

2.1 Manufacturer's data

MAFELL AG, Beffendorfer Straße 4, D-78727 Oberndorf / Neckar, Phone +49 (0)7423/812-0, Fax +49 (0)7423/812-218

2.2 Machine identification

All details required for machine identification are available on the attached rating plate.



Protection class II



CE symbol to document compliance with the basic safety and health requirements according to Appendix I of the Machinery Directive.



For EU countries only

Do not dispose of milling motors together with domestic waste!

In accordance with the European directive 2002/96/EC on waste electrical and electronic equipment and transposition into national law, obsolete milling motors must be collected separately and recycled in an environmentally-compatible manner.



To reduce the risk of injury, please read the operating instructions.

2.3 Technical data

| | FM 800 | FM 1000 | FM 1000 PV | FM 1000 PV-ER | FM 1000 WS | FM 1000 PV-WS | FM 1000 (120 V) |
|--|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|------------------|
| Operating voltage / V | 230 | 230 | 230 | 230 | 230 | 230 | 120 |
| Mains frequency / Hz | 50 | 50 | 50 | 50 | 50 | 50 | 60 |
| Input power / W | 800 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| Nominal current / A | 4.0 | 4.6 | 4.6 | 4.6 | 4.6 | 4.6 | 8.3 |
| Supply voltage / V* | - | - | 8 - 56 | 8 - 56 | - | 8 - 56 | - |
| Control voltage for speed specification / V* | - | - | 0 - 10 | 0 - 10 | - | 0 - 10 | - |
| Display remaining runtime / V* | - | - | 0 - 5 | 0 - 5 | - | 0 - 5 | - |
| Power consumption / mA* | - | - | 3 - 5 | 3 - 5 | - | 3 - 5 | - |
| Idling speed / rpm | 7000 – 25000 | 4000 – 25000 | 4000 – 25000 | 4000 – 25000 | 4000 – 25000 | 4000 – 25000 | 10000 – 25000 |
| Tool holding fixture with collet ø / mm | 6 | 8 | 8 | 8 | 8 | 8 | 6.35 (1/4") |
| Tool shank / mm | 3 - 8 | 3 - 8 | 3 - 8 | 3 - 8 | 3 - 8 | 3 - 8 | 3 - 8 |
| Milling cutter ø, max. / mm | 36 | 36 | 36 | 36 | 36 | 36 | 36 |
| Grinding tool ø, max. / mm | 40 | 40 | 40 | 40 | 40 | 40 | 40 |
| Weight without mains cable / kg | 1.6 | 1.6 | 1.6 | 1.6 | 2.8 | 2.8 | 1.6 |
| Length of connecting cable / m | 1 | 4 | 0.75 + 4 | 0.75 + 4 | 4 | 0.75 + 4 | 4 |
| Dimensions (W x L x H) / mm | 73 x 254 x 79 | 73 x 254 x 79 | 73 x 254 x 79 | 73 x 254 x 79 | 92 x 280 x 85 | 92 x 280 x 85 | 73 x 254 x 79 |

* Specifications for the portal interface (PV interface)

2.4 Emissions

The values stated are emission levels. Although there is a correlation between emission and imission level, it cannot be reliably derived from this whether additional precautions are necessary. Factors influencing the current imission level existing at the workplace comprise the duration of exposure, the room characteristic, other sources of noise, etc. such as e.g. the number of machines and other adjacent machining operations. In addition, the permissible imission level may differ from country to country. This information is nevertheless suitable for providing the machine user with an improved assessment of the hazard and risk.

2.4.1 Noise emission specifications

Noise emission values determined according to DIN EN ISO 3744:

Sound pressure level $L_{PA} = 71 \text{ dB (A)}$

Uncertainty $K_{PA} = 3 \text{ dB (A)}$

Sound power level $L_{PA} = 82 \text{ dB (A)}$

Uncertainty $K_{PA} = 3 \text{ dB (A)}$

The noise measurement was done without tool at idling speed.

2.5 Scope of supply

| | FM 800 | FM 1000 | FM 1000 PV | FM 1000 PV-ER | FM 1000 WS | FM 1000 PV-WS |
|------------------------------|--------|---------|---------------|------------------|---------------|------------------|
| Operating manual | x | x | x | x | x | x |
| Open-ended spanner AF 17 | x | x | x | - | - | - |
| Open-ended spanner AF 25 | - | - | - | x | - | - |
| Collet OZ \varnothing / mm | 6 | 8 | 8 | - | - | - |
| Collet ER 16 | - | - | - | 8 | - | - |
| Cable / m | 1 | 4 | 0.75 + 4 | 0.75 + 4 | 4 | 0.75 + 4 |
| Covering cap Z | - | - | x | x | - | x |

2.6 Use according to intended purpose

- The milling motor is intended for permanent installation in guiding portal systems with $\varnothing 43 \text{ mm}$ clamping collar.
- The milling motor with quick tool clamping can be flanged directly to a portal system using six screws (M6 thread) according to the specifications of the portal system (Fig. 5).
- The milling motor is not designed for continuous industrial operation.
- The milling motor is considered an incomplete machine. The milling motor may only be commissioned once it has been determined that the portal system into which the milling motor is to be incorporated complies with the provisions of the current and valid Machinery Directive. Please also note the corresponding warranty conditions for the milling motor and any supplementary appliances.

2.7 Residual risks



Danger

Even if used in accordance with its intended purpose and despite conforming with the safety instructions, residual risks caused by the intended use that can lead to health consequences will always remain.

- Breakage of the rotating tool.
- Breakage of the tools and risk of the tools or parts of them being hurled away.
- Touching live parts with the housing open and the mains plug not removed.
- Hearing can be impaired when working for long periods without ear protectors.
- Emission of hazardous or potentially explosive dusts (all types) during longer lasting operation without extraction. Please note the safety data sheet of the material to be machined.

3 Safety instructions



Danger

Always observe the following safety instructions and the safety regulations applicable in the respective country of use!

General instructions:

- Children and adolescents must not operate this machine. This rule does not apply to young persons receiving training and being supervised by an expert.
- Never work without the guards of the portal system into which the power tool is inserted and that are prescribed for each operation. Do not make any changes to the portal system and the milling motor that could compromise safety.
- Damaged cables or plugs must be immediately replaced. Replacement may only be carried out by Mafell or an authorised MAFELL service workshop in order to avoid safety hazards.
- Avoid sharp bends in the cable. Do not wind the cable around the milling motor especially when transporting and storing the milling motor.
- The use of the power tool with water or conductive liquids is prohibited.
- We exclude the use as hand-guided milling motor.
- Keep the milling motor away from rain or moisture. The penetration of water into the milling motor increases the risk of electric shock.

Do not use:

- Damaged tools or tools that have changed their shape.
- Blunt tools due to the excessive motor load.
- Tools that are not suitable for the milling motor speed during idling.

Instructions on the use of personal protective equipment:

- Always wear ear protectors during work.
- Always wear a dust mask during work.
- Always wear protective goggles during work.

Instructions on operation:

- Do not reach with your hands into the danger zone of the tool.
- Examine the workpiece for foreign objects.
- Monitor the speed. If an uncontrolled speed increase or speed jump occurs, the power supply must be switched off immediately.

Instructions on service and maintenance:

- Regular cleaning of the milling motor is an important safety factor.
- Only original MAFELL spare parts and accessories may be used. Otherwise, the manufacturer will not accept any warranty claims and cannot be held liable.

4 Setting / Adjustment

4.1 Mains connection

Prior to initial operation, make sure that the mains voltage agrees with the operating voltage stated on the milling motor's rating plate.

4.2 Selection of tools

Only use the collets/adaptor sleeves listed in the chapter "Optional accessories". Tools are selected depending on the materials to be processed and the capacity of the feed drives. Please take into account the milling motor capacity at maximum tool diameter and anticipated machining depth.

4.3 Tool change



Danger

Pull the power plug during all service work.



Wear protective gloves during a **tool change**. The insertion tool can get very hot during longer operation and/or the insertion tool's cutting edges are sharp.

4.3.1 Tool clamping by means of collet

The spindle **1** (Fig. 1) of the milling and grinding motor is equipped with a precision collet **2** (Fig. 1) to hold the tools. The spindle lock is triggered by the locking button **4** and facilitates tightening and loosening of the union nut **3** (Fig. 1).

Proceed as follows for the tool change:

- Lock the spindle **1** (Fig. 1) to unclamp the tool by pressing the locking button **4** (Fig. 1).
- Detach the union nut **3** with an open-ended spanner AF 17 or wrench ER 16 M.
- Pull off the tool to the front.
- Push the new tool into the tool holding fixture up to the limit stop.
- Check the tool's seat.
- Spindle **1** (Fig. 1) is locked when the tool is clamped.
- The union nut **3** is tightened with the open-ended spanner AF 17 / wrench ER 16 M.

4.3.2 Quick tool clamping



- Switch on the milling motor only when the lever **6** (Fig. 3) is not in the tool change position.
- Do not actuate lever **6** (Fig. 3) until the milling motor is at a standstill.

The spindle **7** (Fig. 3) of the quick tool clamping device is equipped with a precision holding fixture for a tool shank $\varnothing 8$.

Proceed as follows for the tool change:

- To unclamp the tool, move lever 6 (Fig. 3) forward up to the stop.
- Pull off the tool to the front.
- Push the new tool into the tool holding fixture up to the limit stop.
- Check the tool's seat.
- To clamp the tool, move the lever back to its original position.

4.4 Collets



Danger

To protect the thread, only screw the union nut 3 (Fig. 1) lightly onto the spindle 1 (Fig. 1), but do not tighten when no tool is inserted. Collet 2 (Fig 1.) could get pressed together too much and be damaged in the process.

4.4.1 Information on the use of collets:

- Please always use the correct milling cutter size for OZ collets (DIN 6388) and also for ER16 collets (DIN 6499).
- Please always click the collet into the union nut first, then insert the milling cutter.
- If jammed, please loosen the collet with a square timber or rubber hammer with a light blow from behind (no metal tool!).
- Please oil the collet collets at the beginning as well as after longer use as otherwise they can get stuck.
- A significantly better concentricity can also be achieved by using a solid lubricant (e.g. Molykote P-40) or by lightly greasing the collets.

4.4.2 Recommended tightening torques (observe overall system)

Tightening torque for union nut / collet = 10 -11 Nm

Tightening torque for clamping collar 43 mm = 7 Nm

The Euro neck mount "V" should not be smaller than dimension "h" (Fig. 8). Dimension "h" amounts to 20 mm. Clamp the milling motor as far as possible across the entire mounting diameter in the Euro neck mount "V1" (Fig. 8). Tighten clamping screw „W“ with max. 7 Nm. (Fig. 9)

As far as possible, avoid punctual clamping (for instance using a grub screw) in the Euro neck mount „V2“ (Fig. 10).

4.4.3 Maximum speed when using a collet adapter

The recommended maximum speed for the use of the collet chuck adapter OZ and the collet chuck adapter ER is max. 16000 rpm.

5 Operation

5.1 Initial operation

Personnel entrusted to work with the milling motor must be made aware of the operating manual, calling particular attention to the chapter "Safety instructions".

This operating manual only deals with the milling motor and does not consider the installation situation. Please take note of any other operating manuals.

5.1.1 Switching on

Push the power switch 5 (Fig. 1) forward until it engages. If the milling motor is connected to the mains voltage, the setting wheel X (Fig. 2) lights up in blue (BU) and the milling motor accelerates to the previously set speed after 0.2 s with a soft start. The duration of the soft start depends on the set speed and is approx. 1.2 s at maximum speed.

5.1.2 Switching off

Push onto the rear end of the power switch 5 (Fig. 1). The switch audibly jumps back to off position. The lighting on the setting wheel X (Fig. 2) goes out and the motor coasts to a standstill.

5.2 PV design

With the PV design Y (Fig. 2) you can control the speed via the PV interface and automatically monitor the remaining runtime in the event of overload.

To protect the user and the connected systems, the PV interface is electrically isolated from the power supply of the drive train (safety isolation). All signal and operating voltages refer to the reference potential “GND”.

As soon as the supply pin “U_{PV}” of the PV interface is supplied with voltage in accordance with the specification, the milling motor switches to “portal mode”.

The bottom status table 3 shows all possible control constellations.

| Input | | | | | | Output | |
|--------|---------------------|---------------------|-----------------|--------------------|--------------------|------------------|--------------|
| HS / - | U _{AC} / V | U _{PV} [V] | PS _S | U _S [V] | U ₀ / V | Operating mode | n [rpm] |
| OFF | N/A | N/A | N/A | N/A | N/A | Out of operation | 0 |
| ON | 0 | N/A | N/A | N/A | N/A | Out of operation | 0 |
| ON | 198-253 | < 6 | 1 | N/A | N/A | Manual mode | 4000 |
| ON | 198-253 | < 6 | 6 | N/A | N/A | Manual mode | 25000 |
| ON | 198-253 | 8 - 56 | N/A | 0 | 0 - 1 | Portal mode | 4000 |
| ON | 198-253 | 8 - 56 | N/A | 10 | 0 - 1 | Portal mode | 25000 |
| ON | 198-253 | 8 - 56 | N/A | 0 - 10 | 1.5 - 5 | Overload mode | 4000 - 25000 |

Table 3: Possible control constellations

Legend:

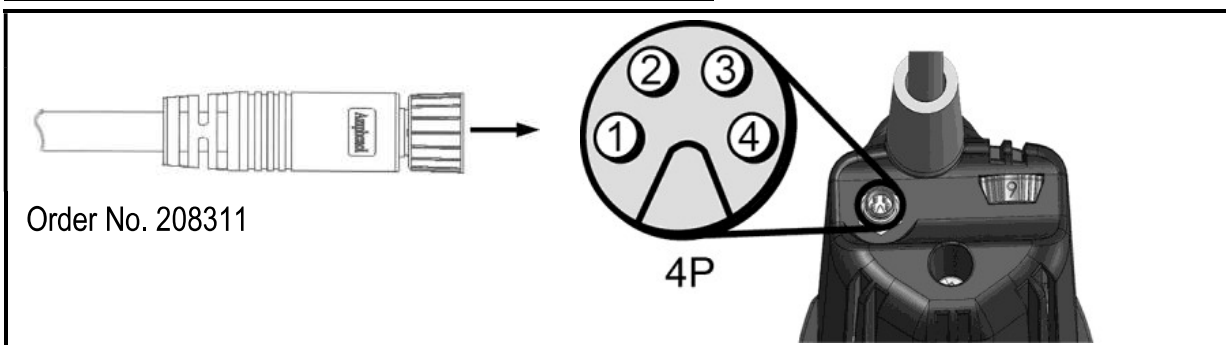
| Unit | Meaning |
|----------|---|
| HS | = power switch |
| U_{AC} | = mains voltage |
| U_{PV} | = power supply (PV interface) |
| PS_S | = position setting wheel |
| U_S | = control voltage speed (PV interface) |
| U_o | = display remaining runtime in overload mode (PV interface) |
| GND | = reference potential for voltages of the PV interface |
| n | = speed of the working spindle |
| N/A | = not applicable or not relevant |

When the PV interface is not in use, protect it against dirt with the supplied covering cap Z (Fig. 4).

5.2.1 Assignment portal connector

All pins on the portal connector are protected against reverse polarity. At voltages above 30 V, continuous operation with reversed polarity must be avoided as this can lead to failure of the PV interface.

| Pin No. | Parameter | Colour of wire | Order No. 208311 |
|---------|-----------|----------------|------------------|
| 1 | U_{PV} | Brown | |
| 2 | U_S | White | |
| 3 | U_o | Black | |
| 4 | GND | Blue | |



5.3 Speed specification

With the setting wheel **X** (Fig. 2) you can adjust the speed continuously. The concrete speed values of individual stages can be found in the table on page 5 or on the speed sticker on the housing.

Until the motor characteristic is reached, the built-in electronics readjust to the set speed.

5.3.1 Speed setting in PV design

In “portal mode”, the position of the setting wheel **X** (Fig. 2) for the speed setting is ignored. The speed can only be changed by the voltage at the pin “**Us**“. If you wish to set the speed by means of the setting wheel **X** (Fig. 2), “portal mode” must first be deactivated by switching off the power supply at the pin “**Upv**“ or by removing the PV control cable.

The correlation between speed and control voltage is illustrated in formulae (1) and (2).

$$U_s = \frac{n - 4000 \text{ min}^{-1}}{2100 \frac{\text{min}^{-1}}{\text{V}}} \quad (1)$$

$$n = U_s * 2100 \frac{\text{min}^{-1}}{\text{V}} + 4000 \text{ min}^{-1} \quad (2)$$

5.4 Overload protection



Danger

If you carry out any work on the working spindle after the overload protection has triggered, the mains plug must first be removed.

To protect the milling motor, the operating parameters current, speed and temperature are dynamically monitored and the power tool is switched off if necessary. Shortly before the overload protection is tripped, the illumination of the setting wheel **X** (Fig. 2) changes to a permanent red (RD).

To put the milling motor back into operation, you must open and close power switch 5 (Fig. 1). The milling motor goes into operation and the illumination of the setting wheel **X** (Fig. 2) changes to blue (BU).

5.4.1 Optical display of the remaining runtime

Triggering of the overload protection during operation leads to breakage of the milling tool, damage to the workpiece or even damage to the portal system. You can prevent this by paying attention to the visual output signals at the setting wheel **X** (Fig. 2).

As long as the milling motor is **not** overloaded in terms of performance, the setting wheel lights up permanently in blue (BU).

If the milling motor is overloaded, the calculated remaining runtime is displayed flashing in red (RD). On page 6 (Fig. 7) you can see the temporal arrangement of the pulses in overload mode. The correlation between the flashing behaviour and the associated remaining runtime is shown in the bottom table 4 on page 31.

If the remaining runtime is not sufficient for your application, reduce the load or feed rate to be able to switch back to continuous operation.

5.4.2 Display of the remaining runtime in the PV design

If the milling motor is in “portal mode”, the remaining runtime can be queried via the PV interface in addition to the visual display.

The bottom table shows the correlation between the remaining runtime and the associated output variables.

| Operating mode | Remaining runtime / s | Display remaining runtime U_o / V | Setting wheel illumination |
|-------------------------------------|-----------------------|-------------------------------------|----------------------------|
| Continuous operation | unlimited | 0 | Blue (BU), permanent |
| Overload mode (motor is running) | < 160 | 1.5 | 1 x red pulse (RD) |
| | < 80 | 2.5 | |
| | < 40 | 3 | 2 x red pulse (RD) |
| | < 20 | 4 | |
| | < 10 | 4.5 | 3 x red pulse (RD) |
| | < 5 | 5 | Red (RD), permanent |
| Switch-off | 0 | 5 | |

Table 4: Correlation between the remaining runtime and the associated output variables

6 Service and maintenance



Danger

Pull the power plug during all service work.

MAFELL machines are designed to be low in maintenance.

Replace the carbon brushes at the latest after 125 - 150 operating hours. The spare parts can be referenced in chapter 9.

The ball bearings used are greased for life. When the machine has been in operation for a longer period of time, we recommend to hand the machine in at an authorised MAFELL customer service shop for inspection.

6.1 Storage

If the milling motor is out of service for a lengthy period of time, it should be thoroughly cleaned. Spray bright metal parts with a rust inhibitor. Close the portal connector with the supplied covering cap Z (Fig. 4).

7 Troubleshooting



Danger

Determining the causes for existing defects and eliminating these always requires increased attention and caution. Pull the mains plug beforehand!

Some of the most frequent defects and their causes are listed in the following chart. In case of other defects, please contact your dealer or the MAFELL customer service directly.

| Defect | Cause | Elimination |
|---|-----------------------------|------------------------|
| The milling motor cannot be switched on The setting wheel does not light up | There is no mains voltage | Check the power supply |
| | The mains fuse is defective | Replace the mains fuse |

| Defect | Cause | Elimination |
|--|--|--|
| The milling motor cannot be switched on. The setting wheel lights up in blue (BU) | The carbon brushes are worn | Take the milling motor to the MAFELL customer service |
| The milling motor stops during operation. The setting wheel does not light up | Mains failure | Check the mains back-up fuses |
| The milling motor stops during operation. The setting wheel lights up in red (RD) | The overload protection was triggered | Switch off the power switch. Clear the working spindle before initial operation Switch on the power switch and continue operation with reduced load/feed rate |
| The speed cannot be adjusted at the setting wheel | The milling motor is in portal mode | Switch off the power supply of the PV interface Remove the external connection of the PV interface |
| The speed cannot be controlled via the PV interface | The power supply of the PV interface is missing / is inadequate | Switch on the power supply of the PV interface in accordance with the specification |
| | The contacting to the portal connector is insufficient | Check the contacting |
| | The PV control cable is defective | Replace the PV control cable |
| | The assignment of the PV interface is incorrectly connected with the portal system | Connect the PV control cable according to chapter "Assignment portal connector" |

8 Optional accessories

| | |
|--|------------------|
| - Collet OZ \varnothing 3 mm | Order No. 093731 |
| - Collet OZ \varnothing 4 mm | Order No. 093732 |
| - Collet OZ \varnothing 6 mm | Order No. 093733 |
| - Collet OZ \varnothing 8 mm | Order No. 093734 |
| - Collet \varnothing 1/8" (3.175 mm) | Order No. 093735 |
| - Collet \varnothing 1/4" (6.35 mm) | Order No. 093736 |
| - Collet OZ \varnothing 3 mm + union nut | Order No. 093737 |
| - Collet \varnothing 1/8" (3.175 mm) + union nut | Order No. 093738 |
| - Collet ER 16 \varnothing 3 mm | Order No. 093753 |
| - Collet ER 16 \varnothing 4 mm | Order No. 093754 |
| - Collet ER 16 \varnothing 6 mm | Order No. 093755 |
| - Collet ER 16 \varnothing 8 mm | Order No. 093756 |
| - Collet ER 16 \varnothing 3.175 mm (1/8") | Order No. 093757 |
| - Union nut OZ | Order No. 093729 |
| - Union nut ER 16 M | Order No. 093758 |
| - Adapter sleeve \varnothing 3 mm | Order No. 207944 |
| - Adapter sleeve \varnothing 1/8" (3.175 mm) | Order No. 207945 |
| - Adapter sleeve \varnothing 4 mm | Order No. 207949 |
| - Adapter sleeve \varnothing 6 mm | Order No. 207946 |
| - Collet adapter OZ incl. union nut OZ | Order No. 207943 |
| - Collect adapter ER 16 incl. union nut ER 16 | Order No. 208109 |
| - PV control cable M8 / 4-pol, 5 m | Order No. 208311 |

9 Exploded drawing and spare parts list

The corresponding information in respect of spare parts can be found on our homepage: www.mafell.com