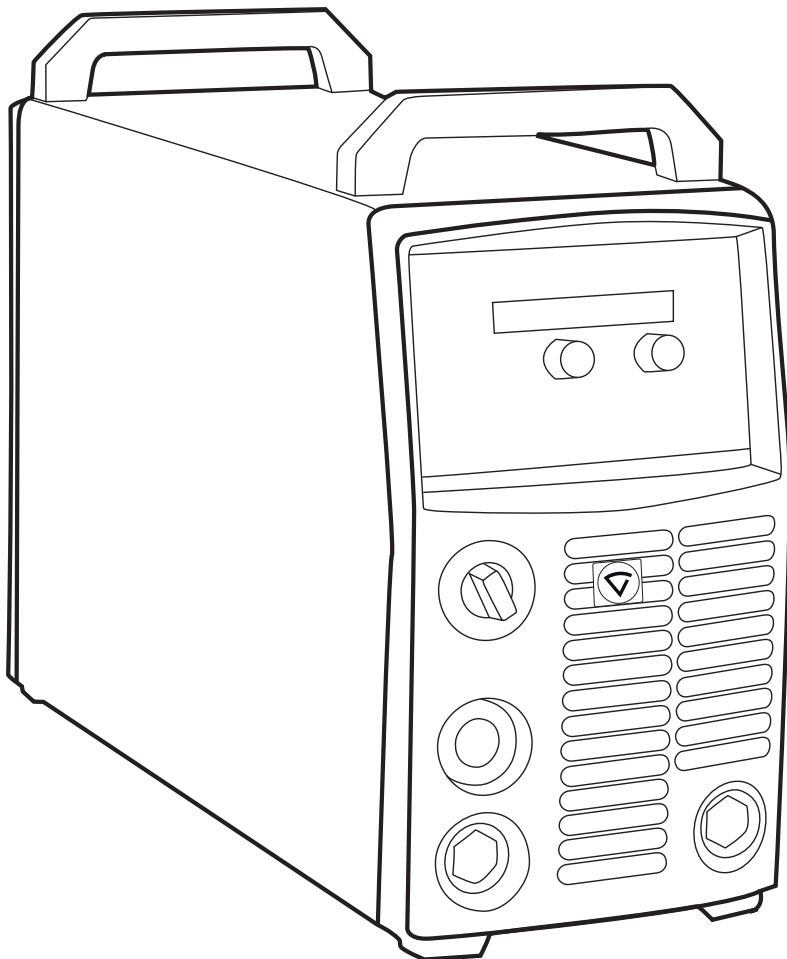


# FastMig

KM 300, 400, 500



|                            |           |
|----------------------------|-----------|
| Operating manual           | <b>EN</b> |
| Bruksanvisning             | <b>DA</b> |
| Gebrauchsanweisung         | <b>DE</b> |
| Manual de instrucciones    | <b>ES</b> |
| Käyttöohje                 | <b>FI</b> |
| Manuel d'utilisation       | <b>FR</b> |
| Manuale d'uso              | <b>IT</b> |
| Gebruiksaanwijzing         | <b>NL</b> |
| Brugsanvisning             | <b>NO</b> |
| Instrukcja obsługi         | <b>PL</b> |
| Manual de utilização       | <b>PT</b> |
| Инструкции по эксплуатации | <b>RU</b> |
| Bruksanvisning             | <b>SV</b> |
| 操作手册                       | <b>ZH</b> |



# **OPERATING MANUAL**

**English**

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# 1. PREFACE

## 1.1 General

Congratulations on choosing the FastMig™ KM equipment. Used correctly, Kemppi products can significantly increase the productivity of your welding, and provide years of economical service.

This operating manual contains important information on the use, maintenance and safety of your Kemppi product. The technical specifications of the equipment can be found at the end of the manual.

Please read the manual carefully before using the equipment for the first time. For your own safety and that of your working environment, pay particular attention to the safety instructions in the manual.

For more information on Kemppi products, contact Kemppi Oy, consult an authorised Kemppi dealer, or visit the Kemppi web site at [www.kemppi.com](http://www.kemppi.com).

The specifications presented in this manual are subject to change without prior notice.

### **Important notes**

Items in the manual that require particular attention in order to minimise damage and personal harm are indicated with the '**NOTE!**' notation. Read these sections carefully and follow their instructions.

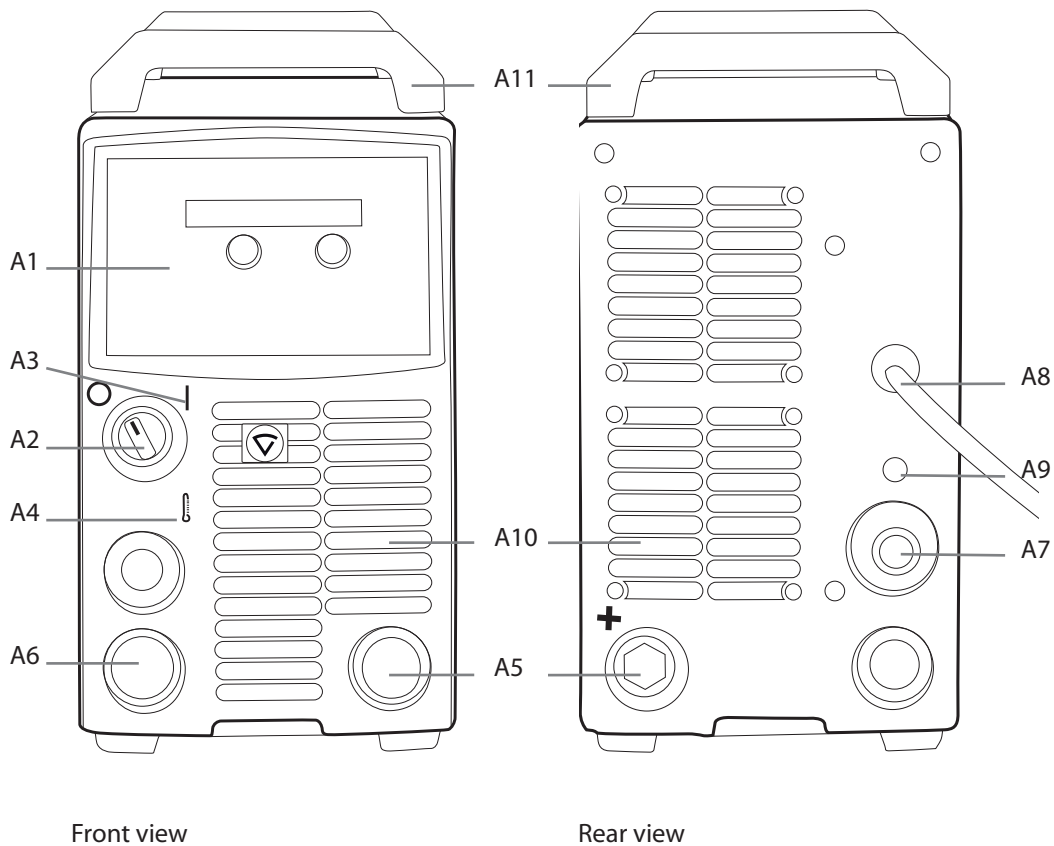
### **Disclaimer**

While every effort has been made to ensure that the information contained in this guide is accurate and complete, no liability can be accepted for any errors or omissions. Kemppi reserves the right to change the specification of the product described at any time without prior notice. Do not copy, record, reproduce or transmit the contents of this guide without prior permission from Kemppi.

## 1.2 Introduction

The FastMig KM-series power sources 300, 400, and 500 are MIG power sources designed for demanding professional use in the three-phase network. The power source has a control panel that allows ready control of the functions of the power source and the wire feeder.

### Overview of the power source



- A1 Control panel
- A2 Main switch
- A3 Signal light (I/O)
- A4 Thermal warning light
- A5 Welding cable connection
- A6 Earth connection
- A7 Control cable connection
- A8 Mains cable input
- A9 Fuse for control cable connection (6.3 A slow)
- A10 Fan grills
- A11 Carrying handles

## 2. INSTALLATION

### 2.1 Positioning of the machine

Place the machine on a firm, dry and level surface. Where possible, do not allow dust or other impurities to enter the machine's cooling air flow. Preferably site the machine above floor level; for example on a suitable carriage unit.

Notes for positioning the machine

- The surface inclination should not exceed 15 degrees.
- Ensure the free circulation of the cooling air. There must be at least 20 cm of free space in front of and behind the machine for cooling air to circulate.
- Protect the machine against heavy rain and direct sunshine.

*NOTE! The machine should not be operated in the rain as the protection class of the machine, IP23S, allows for outside preserving and storage only.*

*NOTE! Never aim metallic grinding spray/sparks towards the equipment.*

### 2.2 Distribution network

All regular electrical devices without special circuits generate harmonic currents into distribution network. High rates of harmonic current may cause losses and disturbance to some equipment.

#### **FastMig KM 500:**

This equipment complies with IEC 61000-3-12 provided that the short-circuit power  $S_{sc}$  is greater than or equal to 4.6 MVA at the interface point between the user's supply and the public supply network. It is the responsibility of the installer or user of the equipment to ensure, by consultation with the distribution network operator if necessary, that the equipment is connected only to a supply with a short-circuit power  $S_{sc}$  greater than or equal to 4.6 MVA.

#### **FastMig KM 400:**

This equipment complies with IEC 61000-3-12 provided that the short-circuit power  $S_{sc}$  is greater than or equal to 4.7 MVA at the interface point between the user's supply and the public supply network. It is the responsibility of the installer or user of the equipment to ensure, by consultation with the distribution network operator if necessary, that the equipment is connected only to a supply with a short-circuit power  $S_{sc}$  greater than or equal to 4.7 MVA.

#### **FastMig KM 300:**

**WARNING:** This equipment does not comply with IEC 61000-3-12. If it is connected to a public low voltage system, it is the responsibility of the installer or user of the equipment to ensure, by consultation with the distribution network operator if necessary, that the equipment may be connected.

## 2.3 Connection to mains

FastMig KM power sources are connected to the 400-V three-phase network using the mains cable supplied with the machine.

The machine is equipped with a five-metre mains cable that does not have a plug. Before use, check the mains cable and install a mains plug. If the cable does not comply with the local electrical regulations, replace it with a compliant cable. See 'Technical specifications'.

**NOTE!** The mains cable or plug may be installed or replaced by only an electrical contractor or installer authorised to perform such operations.

### Replacement of the mains cable

1. Unscrew the mounting screws on the top and sides of the machine, and remove the case by lifting it.
2. Disconnect the phase leads from connectors L1, L2, and L3, and disconnect the protective earth lead.
3. Pass the cable to the machine through the inlet ring at the rear of the machine, and secure the cable with a cable clamp.
4. Connect the cable's phase leads to connectors L1, L2, and L3.
5. Connect the yellow-green protective earth lead to its connector ⊕.

**NOTE!** Do not connect the zero lead if you are using a five-lead cable.

The table below lists the fuse sizes for 100% load in a 400-V three-phase network with 4 x 10-mm<sup>2</sup> cable for different power source models.

| Model  | Fuse         |
|--------|--------------|
| KM 300 | 20 A delayed |
| KM 400 | 25 A delayed |
| KM 500 | 35 A delayed |

## 2.4 Welding and earthing cables

The device has a welding cable connection both in the front and in the rear. The positions of the welding and earthing cable connections are shown earlier in section 'Introduction'.

The welding cable type to be used is rubber-insulated copper cable. The recommended cross-sections of the cables for different power source models are as follows:

| Model  | Cross-section           |
|--------|-------------------------|
| KM 300 | 50 – 70 mm <sup>2</sup> |
| KM 400 | 70 – 90 mm <sup>2</sup> |
| KM 500 | 70 – 90 mm <sup>2</sup> |

The table below shows the typical load capacities of the cables when the ambient temperature is 25 °C and the lead temperature is 85 °C.

| Cable               | Duty cycle (ED) |       |       |       | Voltage loss / 10 m |
|---------------------|-----------------|-------|-------|-------|---------------------|
|                     | 100 %           | 60 %  | 35 %  | 20 %  |                     |
| 50 mm <sup>2</sup>  | 285 A           | 316 A | 371 A | 458 A | 0,35 V / 100 A      |
| 70 mm <sup>2</sup>  | 355 A           | 403 A | 482 A | 602 A | 0,25 V / 100 A      |
| 95 mm <sup>2</sup>  | 430 A           | 498 A | 606 A | 765 A | 0,18 V / 100 A      |
| 120 mm <sup>2</sup> | 500 A           | 587 A | 721 A | 917 A | 0,21 V / 100 A      |

**NOTE!** Do not overload the welding cables, as an overload may cause voltage loss and overheating.

Connect the earth clamp directly to the work piece in such a way as to maximise the contact surface of the clamp. The point of connection must be unpainted and free of corrosion.



## 3. MACHINE USE

### 3.1 Starting of the power source

Start the power source by turning the main switch (A2) on the front panel to the 'I' position. The standby indicator (A3) turns on. The control panel and wire feeder are not operational yet, and the text 'OFF' is shown on the control panel display.

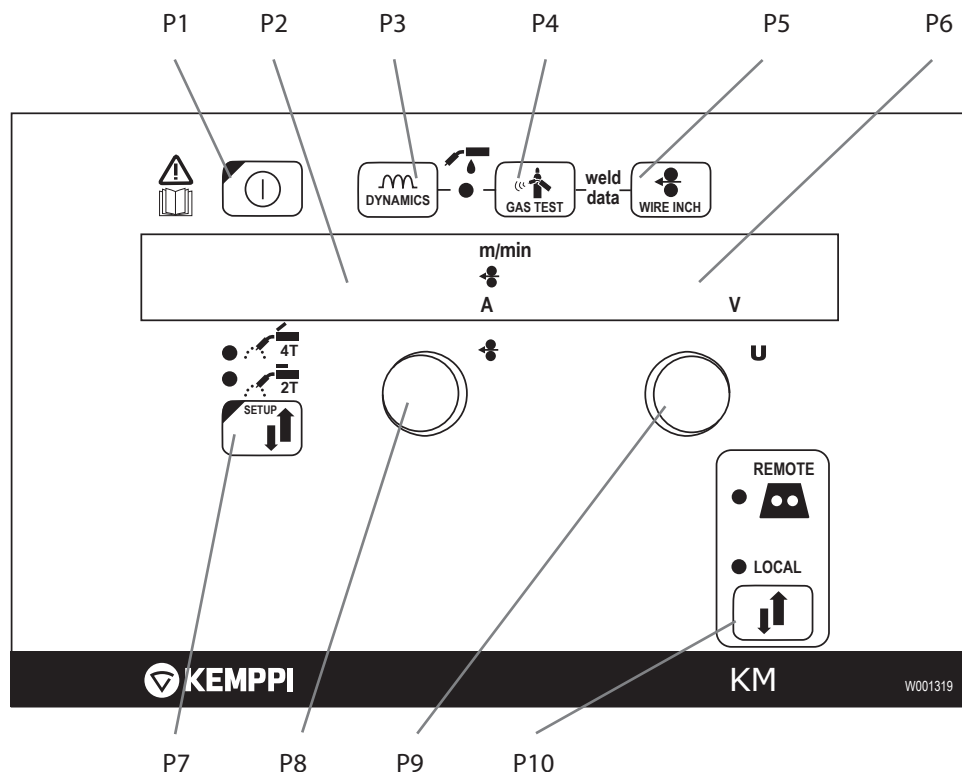
**NOTE!** Always turn the device on and off using the main switch, not via the mains socket.

The cooling fan is started for a moment when the main switch is turned to the 'I' position. The fan turns off after a while and then restarts during welding when the machine has warmed up sufficiently. The fan continues running even after up to 10 minutes of welding, depending on the temperature of the machine.

### 3.2 Front panel indicators

The following indicators can be found on the front panel of the device:

- When the green indicator, A3, is on, the power source is in standby mode. This indicator is on when the machine is connected to the mains supply with the main switch in the 'I' position.
- When the yellow overheating indicator (A4) is on, the machine has overheated. The fan then starts. When the indicator turns off, the machine can be used again.
- When indicator A4 blinks, the machine has experienced a failure. Attempt to remedy the problem according to the instructions in Section 4, 'Troubleshooting'. If the failure cannot be eliminated, turn off the machine, and turn it on again. If the failure persists, write down any fault code that may be shown on the display and contact authorised Kemppi service agent.



### 3.3 Use of the control panel

The control panel is used for controlling and monitoring the operation of the power source and the wire feeder. The buttons are used for adjusting functions. The displays and indicators reflect the operating modes of the machine.

#### 3.3.1 Starting of the control panel

- When you start the power source with the main switch (A2), the control panel remains in OFF mode and the wire feeder is not operational. The display shows the text 'OFF'.
- When you depress the start button P1 for at least one second, the control panel starts. The unit is now ready for welding and enters the mode that was active before the power was cut off.
- You can also start the control panel by quickly pressing the welding gun switch three times.

#### 3.3.2 Displays

- When you are adjusting the machine settings, the control panel displays show adjustable operation parameters, their values, and the units of measure.
- During welding, display P2 shows the welding current value that is currently in use, while display P6 shows the welding voltage.

#### 3.3.3 Control knobs

- The left-hand control knob (P8) allows adjustment of the speed of wire feeding. The selected speed is shown on the display on the left-hand side (P2).
- The control knob on the right-hand side (P9) allows you to adjust the welding voltage. The selected voltage is shown on the right-hand display (P6).

These adjusters are used also for selecting the values of the machine's operational parameters, such as the MIG mode and set-up features. A parameter for adjustment is selected with the left-hand knob (P8), while the value of the parameter is selected with the right-hand knob (P9).

#### 3.3.4 Adjustment of MIG dynamics (arc force)

When you press button P3, you can adjust the MIG welding dynamics of the machine by means of the right-hand knob, P9. The welding dynamics setting affects the properties of the welding arc and the amount of spatter as follows:

- The value 0 is the recommended basic setting.
- Use values -9 ... -1 if you want a softer arc and less spatter.
- Use values 1 – 9 if you want a rougher and more stable arc. This setting is useful when you are using 100% CO<sub>2</sub>-shielding gas when welding steel.

#### 3.3.5 Gas test

The gas test button (P4) opens the gas valve without activating the wire feed or power source. By default, gas flows for 20 seconds. The gas flow time remaining is shown on the display.

The right-hand knob (P9) allows you to set the default gas flow time, between 10 – 60 seconds, and store the new default value in the machine's memory. To abort the gas test, press the start button or gun switch.

#### 3.3.6 Wire Inch

When you press the Wire inch button, P5, the wire feeder engine starts but the gas valve does not open and the power source is not activated. The default wire feed speed is 5 m/min, and you can adjust the speed with the right-hand knob. When the button is released, the wire feeding stops. The machine automatically goes back to the normal state after approximately five seconds from release of the button or immediately when you press the start button.

### 3.3.7 Selection of liquid- or gas-cooled MIG gun

You can select a MIG gun cooled with liquid or gas by pressing buttons P3 and P4 simultaneously and holding them down for at least one second.

- When the display reads 'GAS', you can use a gas-cooled MIG gun with the equipment.
- When the display reads 'COOLER', you can use a liquid-cooled MIG gun with the equipment.

You can change the gun selection by pressing buttons P3 and P4 again, as above. With a liquid-cooled gun selected, the liquid cooling function is started when the power source is started the next time.

### 3.3.8 Retrieval of weld data

The weld data function allows you to return to the welding current and voltage used during the previous session, with the weld data feature. To use the feature, press buttons P4 and P5 simultaneously.

### 3.3.9 Selection of control panel

Button P10 allows you to switch control between the control panels in the power source and wire feeder. The indicator shows which of the control panels is in use.

- When the 'LOCAL' light is on, the wire feeding speed and welding current are set using knobs P8 and P9 of the power source control panel.
- When the 'REMOTE' light is on, the wire feed speed and welding current are set using the control panel of the wire feeder. Control knobs of the power source are disabled in this mode.

### 3.3.10 Setting of the MIG operating mode

Button P7 allows you to set the MIG welding gun to either two-sequence or four-sequence mode. The indicator shows the mode selected.

- In two-sequence mode (2T), welding is started by pressing the gun switch and stopped by releasing the switch.
- In four-sequence mode (4T), the following actions take place:
  1. When you press the gun switch, the shielding gas starts to flow.
  2. When you release the switch, welding starts.
  3. When you press the switch again, welding ends.
  4. When you release the switch again, the flow of the shielding gas ends.

### 3.3.11 Setting of operation parameters

Button P7 also is used for changing welding parameters as follows:

- Depress button P7 for at least five seconds. The set-up menu appears on display P2.
- Select the parameter to adjust with the left-hand knob (P8) so that the name of the parameter you want to adjust is shown on display P2.
- Set a value for the parameter by using the right-hand knob (P9) such that the value you want is shown on display P2. The value you selected is recorded in the control panel memory.
- Exit the set-up menu by pressing button P7 again and holding for at least five seconds or by briefly pressing the control panel start button (P1).

The table below lists the operation parameters and their possible values.

| Name of parameter        | Name displayed | Parameter values  | Factory values | Description  |
|--------------------------|----------------|-------------------|----------------|--|
| Pre Gas Time             | PrG            | 0.0 – 9.9 s       | 0.1 s          | Pre-welding gas time in seconds  |
| Post Gas Time            | PoG            | Aut, 0.1 – 32.0 s | Aut            | Post-welding gas time in seconds or automatically according to welding current 1 s / 100 A (Aut)                                     |
| Creep Start Level        | CrE            | 10 – 170 %        | 50 %           | Initial wire feeding speed as a percentage of the pre-set value:<br>10% = slowed start<br>100% = no creep start<br>170% = rush start |
| Start power              | StA            | -9 ... +9         | 0              | Strength of initial pulse  |
| Post Current Time        | PoC            | -9 ... +9         | 0              | Post-welding current time  |
| Remote Switch            | rS             | 2t4, Inc          | 2t4            | Selection of wire feed device switch operation   |
| Calibration Menu         | CAL            | ---, Ent          | ---            | Wire feed speed calibration (see instructions in sub-section 3.3.12)   |
| LongSystem Mode          | LSy            | on, OFF           | OFF            | Select 'ON' if you are using long (>40 m) connector cables   |
| Restore Factory Settings | FAC            | OFF, PAn, All     | OFF            | Restore factory settings; exit the menu by selecting 'All'   |
| Water Cooler             | COO            | on, OFF           | on             | Enables water cooler   |
| Wire Inc Stop            | Inc            | on, OFF           | OFF            | Safety function. Stops wire inch in case arc does not ignite.  |

### 3.3.12 Calibration of the wire feed speed

When factory settings are used, the wire feed speed can be adjusted to between 4 and 100 without a unit of measurement. Only the LED symbol indicates that wire feed speed is the parameter to be set.

The unit of the wire feed speed (m/min) is shown once the wire feed speed of the device has been calibrated. To programmatically calibrate the wire feed speed:

- To prepare the welding equipment for calibrating, do the following:
  - Connect the wire feeder to the power source with the control cable.
  - Insert the filler wire in the gun, and run the wire out of the contact tip.
  - Adjust the feeder wheels so that they are sufficiently tight.
  - Start the power source and turn on the control panel with the start button, P1.
- Depress button P7 (SETUP) for at least five seconds. The set-up menu appears on the display.
- Select the calibration menu (CAL) by rotating the left-hand knob, and then select the value 'Enter' (Ent) with the right-hand knob. Accept your selection by pressing button P10 (REMOTE/LOCAL) briefly.
- Use the right-hand knob to select 'm/min' as the value of measure for the quantity to be calibrated, and accept your selection by briefly pressing button P10 (REMOTE/LOCAL).
- Use the left-hand knob to set the lower calibration point to the desired value (e.g., 2.0 m/min).
- Cut the filler wire at the contact tip end. Press the trigger, and let the wire run until it stops automatically. If the wire is not moving when calibrating the lower point, increase the wire feed speed value, e.g. to 4.0m/min.
- Measure the length of the loose wire end to an accuracy of 1 cm.
- Enter the measurement with the right-hand knob, and accept your selection by pressing button P10 (REMOTE/LOCAL) briefly.
- Use the left-hand knob to set the higher calibration point to an appropriate value (e.g.,

- 18.0 m/min).
10. Repeat steps 6 – 8 for this higher calibration point.
  11. The message 'Suc cES' appears on the display to indicate that calibration has ended successfully. At the same time, the device exits calibration mode and returns to basic operation mode.
  12. In order to increase the accuracy of the calibration, calibration process should be done twice. Therefore, repeat steps 2 – 11 and then device is ready for welding.

## 4. TROUBLESHOOTING

In the event of a failure of the machine, contact an authorised Kemppi service agent. Before taking your unit for servicing, check the list below.

### 4.1 Overload (yellow indicator lit)

Two simultaneously operating fans cool the power source. The machine may, however, overheat if continuously loaded above the rated values or if the circulation of cooling air is prevented.

The yellow indicator (A10) is lit in the event of overheating. You then need to stop welding and let the machine cool down. The indicator light turns off when welding can be resumed.

### 4.2 Control cable connector fuse

The rear wall of the power source contains fuse A9, which protects the control cable connector, A7. Using an incorrect fuse may cause damage to the power source. It is important that you always use the right kind of fuse. The type and size of the fuse are indicated next to the fuse socket.

### 4.3 Electric network overvoltage or undervoltage

If the power source is used in an electric network with insufficient voltage (less than 300 V), the control features of the device are disabled automatically.

The primary circuits of the power source are protected against power spikes. The product's mains voltage range is broad enough to prevent overvoltage problems at up to 440 V (see Section 8, 'Technical specifications'). Make sure that the voltage remains within the allowed range, especially if the operating power is supplied by a generator set.

### 4.4 Missing phase in the electric network

If a phase is missing from the mains current, the welding features will be adversely affected or the machine may have problems starting. Loss of a phase can be caused by a:

- Blown mains fuse.
- Damaged mains cable.
- Poor mains cable connection in the machine's terminal block or mains socket.

## 4.5 Machine error codes

The machine always checks its operation automatically during start-up and reports any failures detected. If failures are detected during start-up, they are shown as error codes on the control panel display.

### Power source error codes

#### Err3 Power source overvoltage

The machine has stopped the welding because it has detected momentary voltage spikes or continuous overvoltage dangerous to the machine in the electric network. Check the quality of the supply network.

#### Err4 Power source overheating

The power source has overheated. The cause may be one of the following:

1. The power source has been used for a long time at maximum power.
2. The circulation of cooling air to the power source is blocked.
3. The cooling system has experienced a failure.

Remove any obstacle to air circulation, and wait until the power source fan has cooled down the machine.

#### Err5 Water unit alarm

The water circulation is blocked. The cause may be one of the following:

1. Congestion or disconnection in the cooling pipeline.
2. Insufficient cooling liquid.
3. Excessive cooling liquid temperature.

Check the circulation of the cooling liquid and the air circulation of the water unit.

#### Err23 Power source overvoltage warning

The power source has detected voltage spikes in the electric network. Short power spikes can be managed. They do not lead to interruptions in welding but may decrease the welding quality. Check the quality of the supply network.

#### Err61 The water unit is not found

The water unit is not connected to the equipment, or the connection has failed.

Set the machine to gas cooling (3.3.7) if you are using a gas-cooled welding gun, or connect a water unit.

#### Err154 Overloading of the wire feed motor

The welding has been interrupted because the wire feeding engine power has risen to a high level. The cause may be congestion in the wire line. Check the wire lead, contact tip, and feed rollers.

#### Err155 Warning of the wire feed unit overheating

The voltage level of the wire feeding engine has increased. The cause may be a stained wire lead or a gun cable that is twisted at a sharp angle. Check the state of the gun, and clean the wire line if this is necessary.

#### Err201 Use of PMT gun is prevented

The machine is intended for use with MMT guns. When a PMT gun is used, the gun's jumpers must be set to 'FU'. This error code may appear also if the contacts of the gun trigger are stained or there are problems with the trigger leads. Check the trigger's leads.

#### Other error codes:

The machine can show codes not listed here. In the event of an unlisted code appearing, contact an authorised Kemppi service agent and report the error code shown.

## 5. MAINTENANCE

The utilisation level of the power source and its working environment should be taken into consideration in planning the frequency of maintenance of the machine. Appropriate use and preventive maintenance guarantee the trouble-freest use of the equipment. This allows you to avoid interruptions in use and increases the productivity of the machine.

### 5.1 Cables

Check the condition of welding and mains cables daily. Do not use damaged cables. Also make sure that all extension cables used in the mains connection are in proper condition and compliant with regulations.

**NOTE!** *The mains cables may be repaired and installed only by electrical contractors and installers authorised to perform such operations.*

### 5.2 Power source

Before cleaning the interior of the machine, you need to remove the case by unscrewing the mounting screws at the top and sides of the machine.

**NOTE!** *To prevent damage, wait approximately two minutes after disconnecting the mains cable before removing the machine's case.*

Perform the following cleaning and maintenance at least every six months:

1. Clean the interior of the machine and the fan grill's net of any dust and stains – for example, with a soft brush and vacuum cleaner.
  - Do not use pressurised air. The stain may become compressed into the grooves of the coolers.
  - Do not use a pressure-washing device.
2. Check the electrical connections of the machine. Clean any oxidised connections, and tighten the loosened ones.
  - Check for the right tension before you start repairing the connections.

**NOTE!** *Remember that the machine may be repaired only by an electrical contractor or installer authorised to perform such operations.*

### 5.3 Regular maintenance

Authorised Kemppi service agents perform regular maintenance by agreement.

#### **Tasks included in regular maintenance:**

- Cleaning of equipment.
- Inspection and maintenance of the welding gun.
- Checking of connectors, switches, and control knobs.
- Checking of electrical connections.
- Checking of the mains cable and plug.
- Replacement of damaged or worn parts.
- Calibration testing, with adjustment of the functions and operational values of the machine, if necessary.

## 6. DISPOSAL OF THE MACHINE



Do not dispose of electrical equipment with normal waste!

In observance of European Directive 2002/96/EC on waste electrical and electronic equipment, and its implementation in accordance with national law, electrical equipment that has reached the end of its life must be collected separately and taken to an appropriate environmentally responsible recycling facility.

The owner of the equipment is obliged to deliver a decommissioned unit to a regional collection centre, per the instructions of local authorities or a Kemppi representative. By applying this European Directive you will improve the environment and human health.

## 7. ORDERING NUMBERS

| Item                     | Size                    | Part number |
|--------------------------|-------------------------|-------------|
| FastMig™ KM 300          |                         | 6033000     |
| FastMig™ KM 400          |                         | 6034000     |
| FastMig™ KM 500          |                         | 6035000     |
| Earthing cable           | 5 m, 50 mm <sup>2</sup> | 6184511     |
| Earthing cable           | 5 m, 70 mm <sup>2</sup> | 6184711     |
| Cooling unit Fastcool 10 |                         | 6068100     |
| Transport unit PM500     |                         | 6185291     |
| Gun holder GH 30         |                         | 6256030     |



## 8. TECHNICAL SPECIFICATIONS

| FastMig™  | KM 300              | KM 400              | KM 500              |
|---|---------------------|---------------------|---------------------|
| Connection voltage, 3~50/60 Hz                          | 400 V, -15 ... +20% | 400 V, -15 ... +20% | 400 V, -15 ... +20% |
| <b>Rated power</b>                                      |                     |                     |                     |
| 60 % ED   | -                   | -                   | 25.9 kVA            |
| 80 % ED   | -                   | 18.5 kVA            | -                   |
| 100% ED   | 12.9 kVA            | 16.9 kVA            | 20.1 kVA            |
| Connection cable  | H07RN-F 4G6 (5 m)   | H07RN-F 4G6 (5 m)   | H07RN-F 4G6 (5 m)   |
| Fuse (delayed)  | 25 A                | 35 A                | 35 A                |
| <b>Output 40 °C</b>                                     |                     |                     |                     |
| 60 % ED   | -                   | -                   | 500 A               |
| 80 % ED   | -                   | 400 A               | -                   |
| 100% ED   | 300 A               | 380 A               | 430 A               |
| Max. welding voltage                                    | 48 V                | 48 V                | 48 V                |
| Open circuit voltage                                    | 65 V                | 65 V                | 65 V                |
| Idle power  | 25 W                | 25 W                | 25 W                |
| Efficiency at max. current                              | 87 %                | 87 %                | 87 %                |
| Power factor at max. current                            | 0.9                 | 0.9                 | 0.9                 |
| Storage temperature range                               | -40 ... +60 °C      | -40 ... +60 °C      | -40 ... +60 °C      |
| Operating temperature range                             | -20 ... 40 °C       | -20 ... 40 °C       | -20 ... 40 °C       |
| Degree of protection                                    | IP23S               | IP23S               | IP23S               |
| EMC class   | A                   | A                   | A                   |
| Minimum short circuit power $S_{sc}$ of supply network* | -                   | 4.7 MVA             | 4.6 MVA             |
| <b>External dimensions</b>                              |                     |                     |                     |
| Length  | 590 mm              | 590 mm              | 590 mm              |
| Width   | 230 mm              | 230 mm              | 230 mm              |
| Height  | 430 mm              | 430 mm              | 430 mm              |
| Weight  | 34 kg               | 35 kg               | 36 kg               |
| Operating voltage                                       | 400 V, -15 ... +20% | 400 V, -1 ... +20%  | 400 V, -15 ... +20% |
| Voltage supply for cooling unit                         | 1~ 400 V AC         | 1~ 400 V AC         | 1~ 400 V AC         |

\* See paragraph 2.2.

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