Castolin Eutectic®
Eutectic Castolin

POWER max²

BETRIEBSANLEITUNG und ERSATZTEILLISTE

OPERATING MANUAL and SPARE PARTS LIST

MANUEL D'UTILISATION et LISTE DE PIÈCES DE RECHANGE

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Operating Manual

Description

POWERmax^2 is a powerful, primary-switched welding rectifier with a drooping characteristic and very low upper rippling of the welding current to manual metal arc (MMA) and TIG welding on direct current.

The electronic structure of the product facilitates spatter-free MMA welding with a high degree of arc stability even with basic and high-alloy electrodes. The built-in hot start device provides problem-free ignition of all electrodes.

The welding rectifier POWERmax^2 has been designed in compliance with the guidelines of Euro-standard EN 60974-1 and carries the CE conformity symbol.

Use of the product is permissible for welding work places with increased electrical hazard and as such is labelled with the symbol S.

In the event of a short-circuit at the output, an integrated safety switch cuts off the power within approximately 1 second.

Safety Precautions

- **Before opening up any machine, always pull out the mains plug first, or otherwise ensure that the machine is "dead".**

- **Components, assemblies or other units may only be started up once they have been installed inside a shockproof housing. They must be "dead" *(i. e. without current)* while being installed.**

- **Tools may only be used on units, components or assemblies once it has been ensured that the units are disconnected from the voltage supply and that any electrical charges stored in components inside the machine have been discharged.**

- **Live cables or leads connected to units, components or assemblies must be checked regularly for signs of insulation faults or breaks.**

  If any defect is found in the power supply lead, the unit must be withdrawn from service immediately, until the defective power lead has been replaced.

- **Where new components and assemblies are fitted, attention must constantly be drawn to the importance of adhering strictly to the characteristic data for electrical quantities given in the accompanying descriptions.**

  If the descriptions provided for the non-industrial final user do not make clear what electrical characteristic values apply to a component, advice must be sought from a qualified expert.

Electrical Safety Measures when Arc-welding

Hazards from electric current
Both mains and welding current can be hazardous. It is forbidden by law for anyone but a qualified electrician to do anything with any parts which are in contact with mains voltage. The only exception to this applies, of course, to the power plug and the mains switch. When repair or maintenance work is being carried out on the power source, the machine must first be completely disconnected from the mains. For all but the most minor jobs on the machine in the course of which the operator may have to leave the room, even if only briefly, the plug socket(s) should be clearly blocked.

Protective earth conductor
Every 3-phase power supply system will have a PE conductor. This is a non-live, earthed conductor and connected with the housing of the machine. If an earth fault occurs on the machine there is an immediate short circuit between the PE conductor and phase, causing the fuse on the corresponding phase conductor to blow, and/or tripping the fault-current breaker *(FI)*.

Both the mains and the machine supply leads should be regularly checked by a qualified electrician to ensure that the PE conductor is functioning correctly.

Open-circuit voltage
The highest - and thus the most dangerous - voltage in the welding current circuit is the open-circuit voltage. The maximum permissible open-circuit voltages are stipulated in national and international regulations according to the type of welding current, the design of the current source and the extent of the specifically electrical danger posed to the workplace.

Rectifier power sources
A DC welding power source should be constructed in such a way that if there is a fault in a rectifier *(e.g. open-circuit, short-circuit or phase fault)*, the permissible AC-values cannot be exceeded. Below, the open-circuit voltage ratings to IEC 974 *(1.1.90)* for working under normal conditions and for working under conditions of increased electrical danger.

Working under normal conditions
For welding jobs done under normal conditions and using simple equipment, the following open-circuit voltage ratings apply:

- for DC - peak value 113 V
- for AC - peak value 113 V, effective value 80 V

These max. voltages may be exceeded on appliances equipped with an RC circuit, so long as - with the arc unlit - the higher voltage does not occur for longer than 0.2 seconds.

Exceptions may apply in the case of fully mechanised, automatic or other special procedures. For welding current sources capable of delivering either DC or AC, the respective regulations apply to whichever operational mode the machine is switched to.

Working under conditions of increased electrical danger
Welding work in confined spaces, in cramped surroundings, on or between electrically conductive parts, in damp or hot spaces.

For welding jobs done under conditions of increased electrical danger, the following open-circuit voltage ratings apply:

- for DC - peak value 113 V,
- for AC - peak value 68 V, effective value 48 V.

An AC voltage occurring in the welding circuit may not exceed 48V. This also applies to welding rectifiers being used for welding purposes when the equipment is used e.g. inside a boiler or tank etc. Welding rectifiers for use inside boilers, tanks and the like must always be clearly marked with the letter S *(safety)*.

Workpiece clamp

If the electric flex of the workpiece clamp is shorter than the torch hose pack or the manual electrode cable - meaning that the clamp cannot be fixed anywhere immediately near the welding zone - then the welding current will find its own way back. It may do this via machine parts *(e.g. during repair work)*, ball-bearings, electric switches etc. This may then cause certain parts to become red-hot, make chains and steel cables snap, and even cause the PE conductor to melt through.

All this can also happen if the workpiece clamp has simply not been fastened properly, or only laid on the surface of the workpiece, in which case the course taken by the current will depend on the presence of “bridges” or angle bars and the like *(Fig. **1**)*.

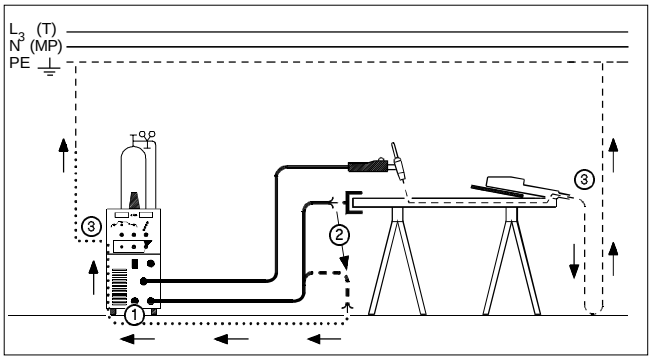


Fig. 1: ① Power source may never stand on electrically conductive ground!
② Connection to workpiece: NEVER like this! Use a firmly connected clamp.
③ PE conductors will be destroyed if the welding current ever has to find its own way back.

Personal protection

- As a basic safeguard, insulating gloves should be worn on both hands when welding. These protect against electric shocks *(from the open-circuit voltage of the welding current circuit)*, harmful rays *(heat and ultra-violet rays)*, and against splashes of red-hot metal or slag.
- Solid, insulating footwear should be worn, which should also insulate the wearer in wet conditions. Ordinary shoes are not suitable as falling globules of molten metal can cause burns.
- Suitable clothing must be worn - NO synthetics!
- Do not look at the arc with unprotected eyes. Use only protective welding shields with the prescribed type of safety glass. As well as heat and light rays, which may cause dazzling or burns, the arc also gives off ultra-violet rays. These are invisible, and if the welder is insufficiently protected against them they can cause conjunctivitis, which only makes itself felt several hours later and is extremely painful. Quite apart from this, ultra-violet rays have the same effect as sunburn on unprotected parts of the body.
- Welder´s mates or persons in the immediate vicinity of the arc must also be made aware of the danger and provided with the necessary protective apparatus; if necessary, protective screens must be erected.
- Care must always be taken to provide sufficient fresh air, especially when welding in enclosed spaces, since smoke and harmful gases are produced during the welding process.
- Containers which have been used to store gas, fuel, mineral oils or other such substances must not be welded, even if they have been standing empty for a long time, since there is a high risk of explosion from any residue.
- Special regulations apply to enclosed spaces where there is a danger of explosion.
- Welds which are exposed to heavy stresses and which have to fulfil strict safety requirements must only be performed by particularly well-trained and experienced welders. Examples include things such as pressurised containers, track rails, trailer couplings, and so on.

Welding with coated electrodes

Commissioning

- Follow safety recommendations.
- Connect mains plug.
- Insert welding and ground cable in sockets according to the polarity recommended for the type of electrode ⑥ and ⑦ and turn right to lock.
- Turn on main switch ①.
  The diode ② lights up.
- Turn selector switch ④ to manual electrode operation.
- Select welding current strength on read-out potentiometer ⑤.
- Start welding.

In the event of thermal overload the diode ③ lights up and the equipment is automatically switched to standby mode.
When the temperature level falls below the temperature limit, the product is operational once more.

In practice

Possible causes for unexpected machine cut-off:

- soiled or concealed ventilation slits,
- defective fan,
- ambient temperature exceeding 40°C,
- duty cycle is exceeded (sequence duration, or current amperage).

The POWERmax² compensates mains voltage fluctuations of ± 10% avoiding secondary current fluctuations.

TIG welding

TIG welding can be carried out using a gas-cooled TIG welding torch G 140 RA (140 A / 60% duty cycle DC) or G 220 RA (220 A / 40% duty cycle DC) with a 4 or 8 m long cable assembly and an additional adapter cable. The welding current setting is carried out on the equipment (read-out potentiometer ⑤).

The ignition of the arc is carried out by means of contact ignition.

Commissioning

- ☐ Follow safety instructions.
- ☐ Connect mains plug.
- ☐ Connect TIG welding torch cable to adapter cable, attach the cable to the minus terminal ⑦ of the equipment and lock by turning to the right.
- ☐ Insert earth cable in plus terminal ⑥ and lock by turning to the right.
- ☐ Attach gas tube to argon welding regulator. The required rate of flow is 3 - 10 l/min.
- ☐ Turn on main switch.
- ☐ Tilt selector switch ④ to TIG operation.
- ☐ Adjust welding current (the standard value may be found in the table) on the welding current potentiometer ⑤.
- ☐ Open gas valve on torch.
- ☐ Place torch with gas nozzle on the workpiece so that a distance of 2 - 3 mm is maintained between the electrode end and the workpiece.
- ☐ Tilt the torch with the gas nozzle slowly until the tungsten needle touches the workpiece.
- ☐ Ignite the arc by carefully lifting the torch.
- ☐ Start welding.
- ☐ Stop welding by increasing the distance between the torch and the workpiece, thereby breaking the arc.

Technical data

Welding current range:	5 A - 140 A
Welding current	
at 35 % duty cycle [1]):	140 A
at 60 % duty cycle [1]):	120 A
at 100 % duty cycle [1]):	100 A
No-load voltage (electrode):	93 V
Mains voltage:	230 V
	single phase
	50/60 Hz
Max. input power	
at 100 % duty cycle [1]):	3,8 kVA
Power factor cos. φ:	0,99
Efficiency at 100 % duty cycle [1]):	88 %
Mains fuse rating:	16 A slow blow
Supply line cross section:	3 x 2.5 mm²
Enclosure protection class:	IP 23
Cooling system:	AF
Insulation class:	B
Dimensions L x W x H (mm):	312 x 109 x 196
Weight (excluding mains cable):	4.2 kg

[1]) 10 min. cycle, 40° C ambient temperature to comply with EN 60974-1 european standard

Standard values for setting parameters for thoriated (2%) and ceriated (2%) tungsten electrodes

Tungsten electrode Ø/mm	= (-) Ampere	Argon flow l/min	Gas nozzle size (G 140 RA)
1,0	< 80	3 - 4	4
1,6	70 - 140	4 - 5	6
2,4	130 - 230	4 - 6	8

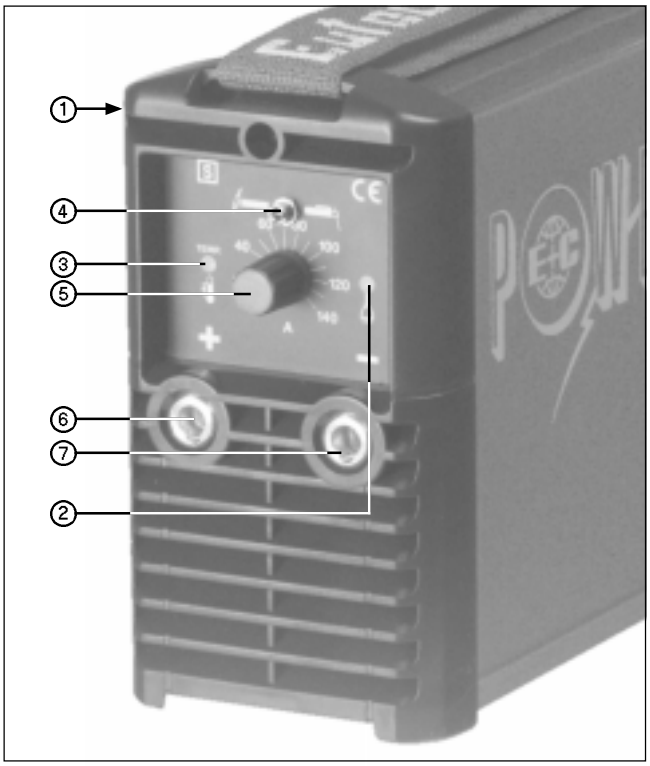


Fig. 2: Front view of POWERmax²

1) Main ON/OFF switch (at the back)
2) Control diode for operation
3) Control diode for thermal overload
4) Selector switch for MMA / TIG
5) Read-out potentiometer for welding current (5 - 140 A)
6) Plus output terminal
7) Minus output terminal

Troubleshooting

Trouble	Cause	Remedy
1. **No welding current** Mains switch ① connected, green LED ② does not light up	Mains line interrupted	Inspect mains line and mains voltage
2. **No welding current** Mains switch ① connected, green LED ② lights up	Welding cable connections interrupted	Check connectors
	Poor, or no earth	Create connection to workpiece
3. **No welding current** Mains switch ① connected, green LED ② lights up, over-temperature yellow LED lights up ③	Operating time exceeded Equipment overloaded	Adhere to duty cycle allowed
	Automatic thermal safety device is disconnected - Fan continues to operate Thermal sensor is defective	Wait until cooling period is over Equipment will switch on independently after a short time; IF NOT: return equipment to service dept.
	Cooling air flow is insufficient	Ensure sufficient flow of cooling air
	Power component very dirty	Open equipment and blow out with dry compressed air
Over-temperature indicator ③ flashes	Fault in power section	Switch machine off and back on again. If fault recurs -> send machine in for service
4. **Arc breaks** during welding	Arc drop voltage of electrode too high (eg. electrode for gouging)	Use alternative electrode if possible or a welder with a higher welding output
5. **Mains fuse or automatic circuit breaker fails**	Insufficiently fused Wrong safety device	Fuse mains correctly (see technical data)
	Mains fuse fails during no-load operation	Return equipment to service dept.
6. **Poor welding quality** (heavy spatter formation)	Wrong polarity of electrode	Change poles on electrode, Follow manufacturer's instructions
	Poor earth connection	Attach earth terminal directly to work piece

ATTENTION! Replaced fuses must be identical in terms of capacity. The use of fuses which are too powerful invalidates any guarantee claim in the event of damage!

Care and maintenance

Thanks to its simple, efficient structure the rectifier requires only a minimum amount of care and maintenance. To ensure long-term, trouble-free service, the following checks are recommended:

In the event of heavy dust accumulation, cleaning the cooling air shafts is recommended from time to time. Disconnect equipment from the mains before opening.

Repairs

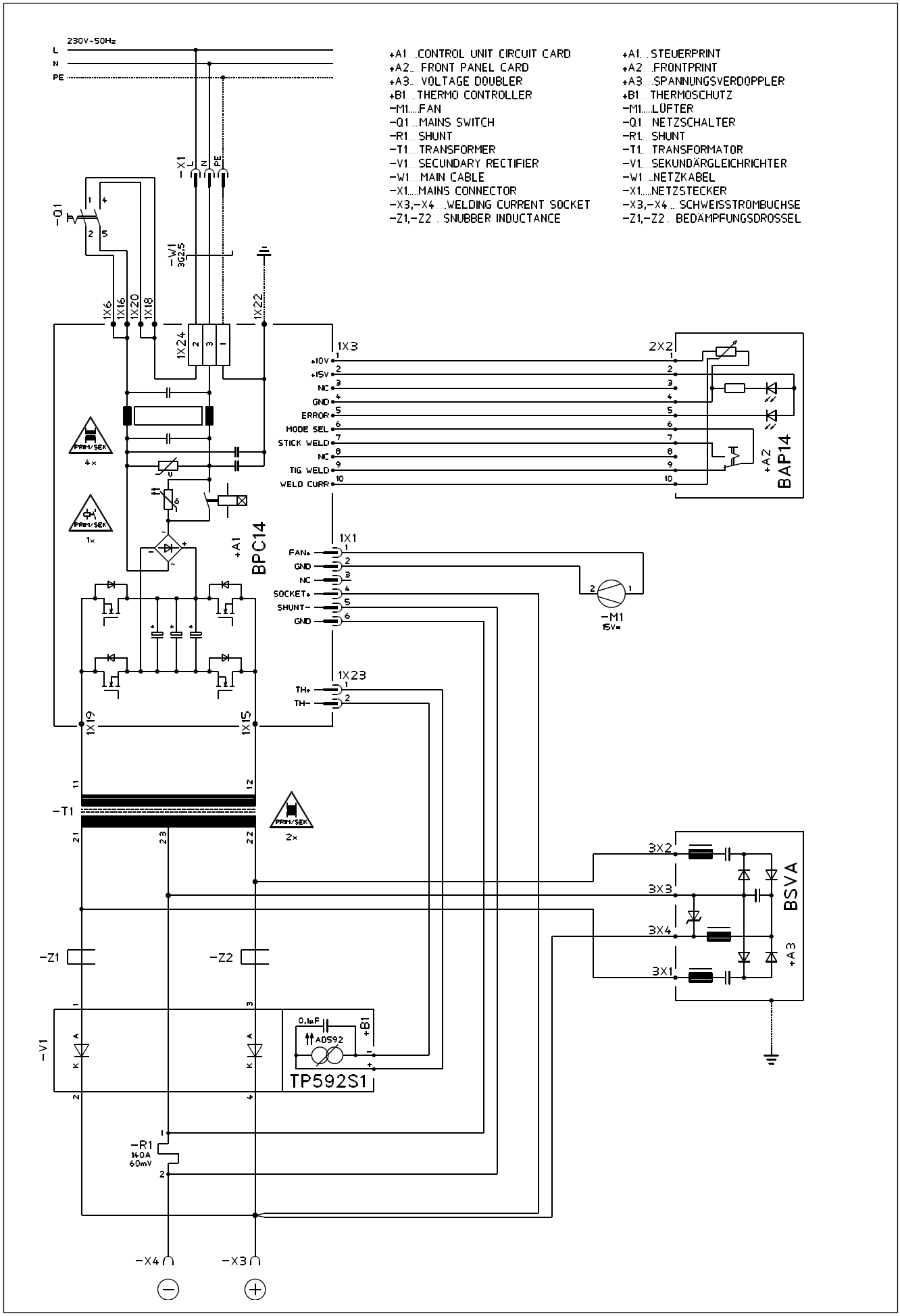
Repairs to the equipment may only be carried out by our service department or by persons authorised by E+C.

Guarantee

The guarantee period is 12 months and applies to single-shift operation, provided that the equipment is used properly.

The guarantee covers the costs for replacement parts and component groups including assembly time.
The guarantee does not cover wear and tear of components due to operation. Improper use of the equipment including damage caused by force invalidates the guarantee.
Please forward the **serial number** of the equipment in the event of any guarantee claim.
Return of the equipment requires our prior consent. Transportation and related costs will be at the expense of the purchaser (please refer to the General Sales Conditions).

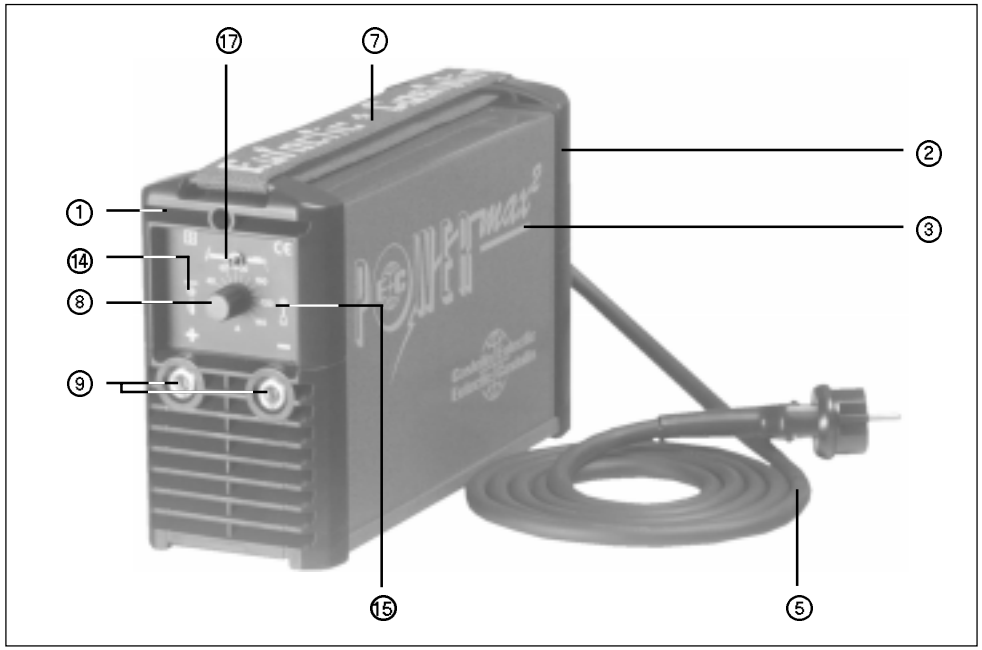
Schaltplan/Circuit diagram/Schéma électrique POWERmax²

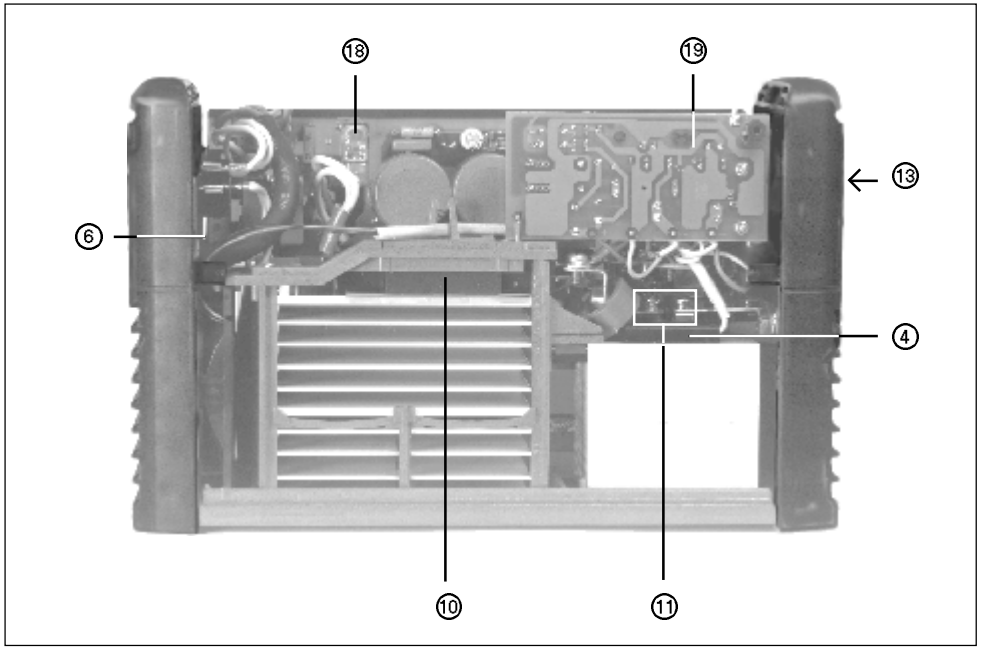


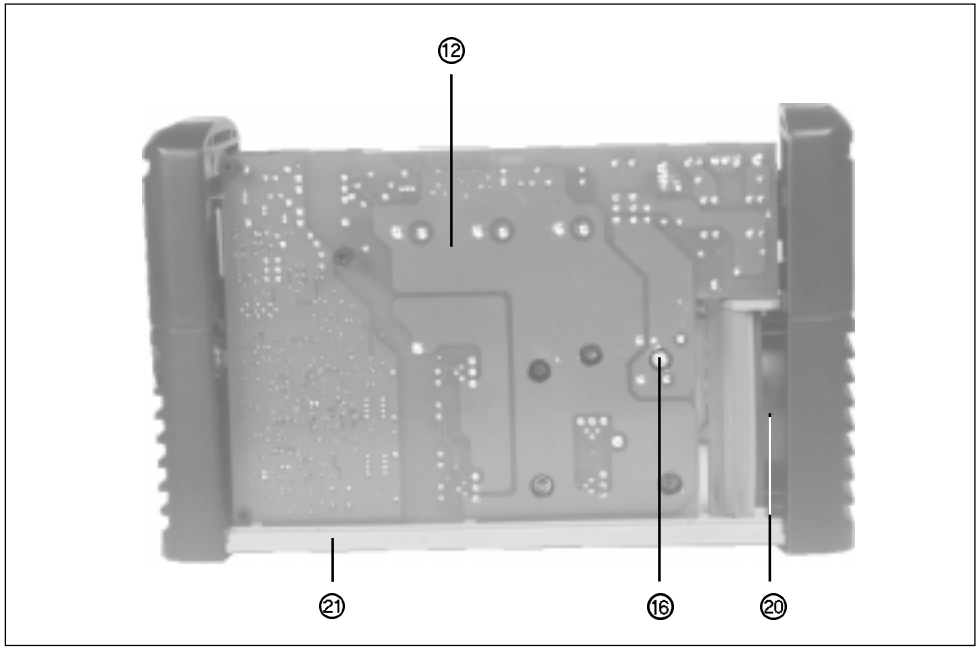
Ersatzteilliste

List of Spare Parts

Liste de pièces de rechange







Pos.-Nr.	Artikel-Nr.	Ersatzteilliste Bezeichnung	List of spare parts Designation	Liste de pièces de rechange Désignation
	43200	POWERmax² Kompaktsystem, primär-getakteter Schweißgleichrichter mit Masse- und Elektrodenhandkabel	POWERmax² compact system, primary-switched welding rectifier with earth and welding cable	Système compact POWERmax², redresseur de soudage cadencé au primaire, avec câbles de masse et de soudage
		bestehend aus:	comprising:	comprenant:
	43203	POWERmax²	POWERmax²	POWERmax²
1)	43210	Vorderfront, POWERmax²	Front panel, POWERmax²	Panneau frontale, POWERmax²
2)	43211	Rückwand	Rear panel	Panneau arrière
3)	43212	Mantel, POWERmax²	Jacket, POWERmax²	Capot , POWERmax²
4)	42206	Thermoelement Print TP 592S/1	Temperature sensor TP 592S/1	Sonde de température TP 592S/1
5)	48548 02	Netzkabel 3G 2.5, 2,5m, mit Stecker	Mains cable 3G 2.5, 2.5 m, with plug	Câble alimentation 3G 2.5, 2,5 m, avec fiche
6)	42304	Wippschalter, grün, 2-polig, 16 A	Main switch, green, 16 A, 2 poles	Interrupteur principal, vert, 16 A, 2 pôles
7)	43213	Tragegurt, rot	Shoulder strap, red	Sangle de portage, rouge
8)	42041	Drehknopf, Ø 16 mm, rot/schwarz/rot	Turning knob, Ø 16 mm, red/black/red	Bouton, Ø 16 mm, rouge/noir/rouge
9)	43214 [1])	Buchse EB 25 SW14x22 (2x)	Socket EB 25 SW14x22 (2x)	Prise EB 25 SW14x22 (2x)
10)	43215	Planartrafo 300 2500VA 45V	Planar transformer 300 2500VA 45 V	Transformateur plan 300 2500VA 45 V
11)	43216	Diode, DIOSIL 300 200 200 ISOTO SX	Diode, DIOSIL 300 200 200 ISOTO SX	Diode, DIOSIL 300 200 200 ISOTO SX
12)	43217	Print BPC 14	Circuit board BPC 14	Circuit BPC 14
13)	43237	Potentiometer, WIDPOT 25K 20 PC16VM6 300	Potentiometer, WIDPOT 25K 20 PC16VM6 300	Potentiomètre, WIDPOT 25K 20 PC16VM6 300
14)	43219	Leuchtdiode, gelb, 1.5 Y 5 P	LED, yellow, 1.5 Y 5 P	Diode de signalisation, jaune, 1,5 Y 5P
15)	43220	Leuchtdiode, grün, 1.5 G 5 P	LED, green, 1.5 G 5 P	Diode de signalisation, verte, 1,5 G 5P
16)	43221	Gleichrichter, GLESIL 1K 35 W S 1	Rectifier, GLESIL 1K 35 W S1	Redresseur, GLESIL 1K 35 W S1
17)	43222	Kippschalter, 5236CD-16 1	Toggle switch 5236CD-16 1	Interrupteur à bascule 5236CD-16 1
18)	43223	Relaisprint 14 1S 16	Relay-PC-Board 14 1S 16	Circuit relais 14 1S 16
19)	43236	Print BSV A	Circuit board BSV A	Circuit BSV A
20)	43225	Ventilator MF2.4, 92 x 92 x 25,4	Ventilator MF2.4, 92 x 92 x 25.4	Ventilateur MF2.4, 92 x 92 x 25,4
21)	43228	Bodenplatte	Bottom plate	Plaque de fond
	42351 03	Massekabel, 3 m, 16 mm² (SKM 25)	Earth cable, 3 m, 16 mm² (SKM 25)	Câble de masse, 3 m, 16mm² (SKM25)
	41932 01 [1])	Kabel, 1 m, 16 mm² (3x)	Cable, 1 m, 16 mm² (3x)	Câble, 1 m, 16 mm² (3x)
	42033	Masseklemme 200 A	Earth terminal 200 A	Pince de masse 200 A
	41941	Kabelschuh für 16 mm²	Cable lug for 16 mm²	Cosse de câble 16 mm²
	42383	Stecker DIX SKM 25	Plug DIX SKM 25	Fiche DIX SKM 25

[1]) Diese Artikel-Nr. beinhaltet nur 1 Stück bzw. 1 m

[1]) This item code includes only one piece, i.e. 1 m

[1]) Ce numéro d'article contient 1 seule pièce, ou 1 m

Pos.-Nr.	Artikel-Nr.	Bezeichnung	Designation	Désignation
	43201 04	Elektrodenhandkabel, 4 m, 16 mm² (SKM 25)	Welding cable, 4 m, 16 mm² (SKM 25)	Câble de soudage, 4 m, 16mm² (SKM 25)
	41932 01 [1])	Kabel, 1 m, 16 mm² (4x)	Cable, 1 m, 16 mm² (4x)	Câble, 1 m, 16 mm² (4x)
	43226	Elektrodenhalter 200 A	Electrode holder 200 A	Porte-électrode 200A
	43227 [1])	Spannbackenisolator, rot (2x)	Jaw insulator, red (2x)	Isolateur de mâchoire, rouge (2x)
	42383	Stecker DIX SKM 25	Plug DIX SKM 25	Fiche DIX SKM 25

Zubehör / Accessories / Accessoires

	42386	Adapter-Kabel zum Anschluß der WIG-Brenner G 140 RA und G 240 RA	Cable adapter for connection of TIG torch G 140 RA and G 240 RA	Câble adaptateur pour raccordement aux torches TIG G 140 RA et G 240 RA
	42383	Stecker DIX SKM 25	Plug DIX SKM 25	Fiche DIX SKM 25
	42387	Kupplung DIX BK 35	Coupler DIX BK 35	Coupleur DIX BK 35
	41932 01 [1])	Kabel, 1 m, 16 mm² (0,5x)	Cable, 1 m, 16 mm² (0.5x)	Câble, 1 m, 16 mm² (0,5x)
	41909	Polprüfer	Polarity indicator	Testeur de polarité

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Schaltplan/Circuit diagram/Schéma électrique POWERmax²

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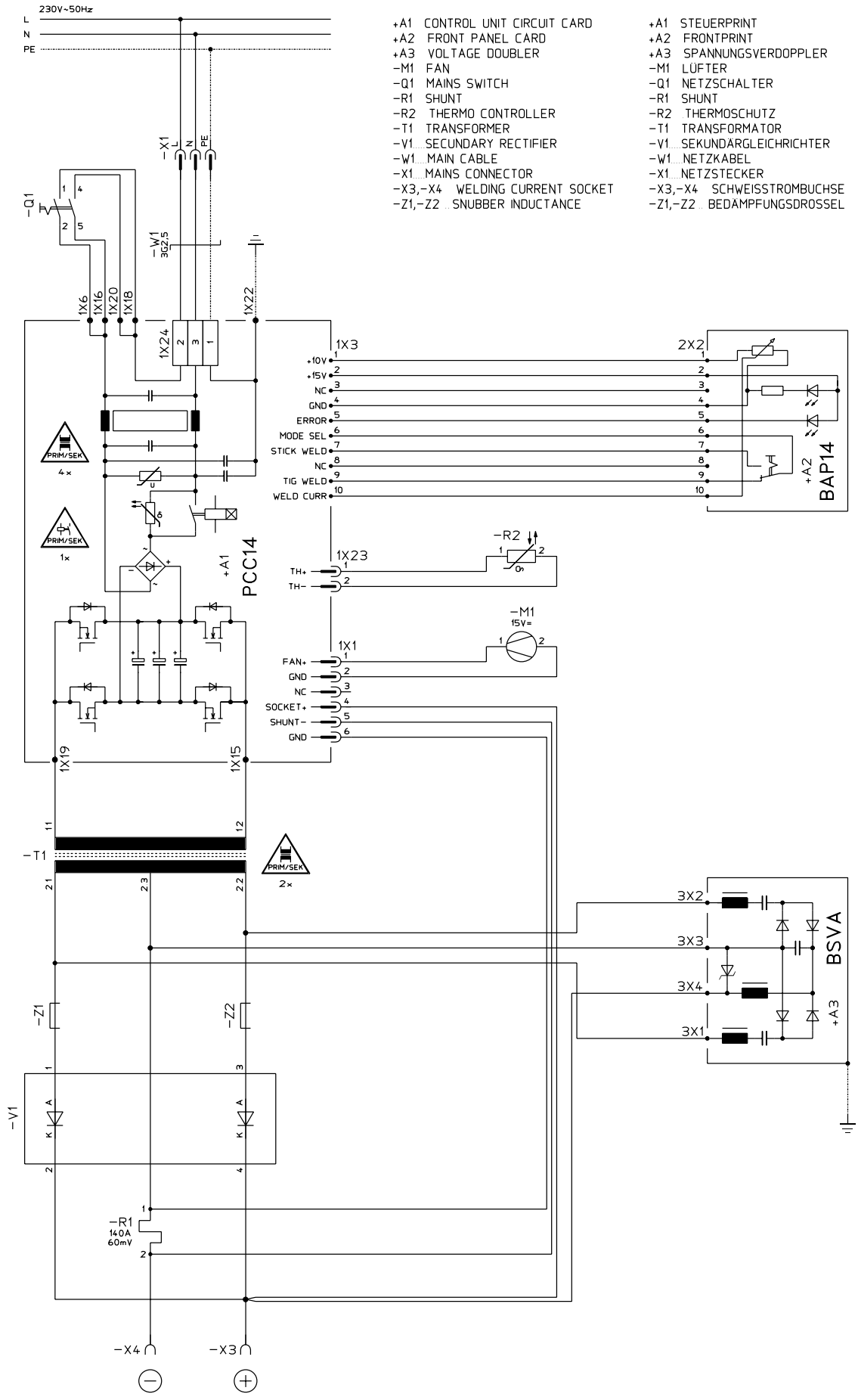

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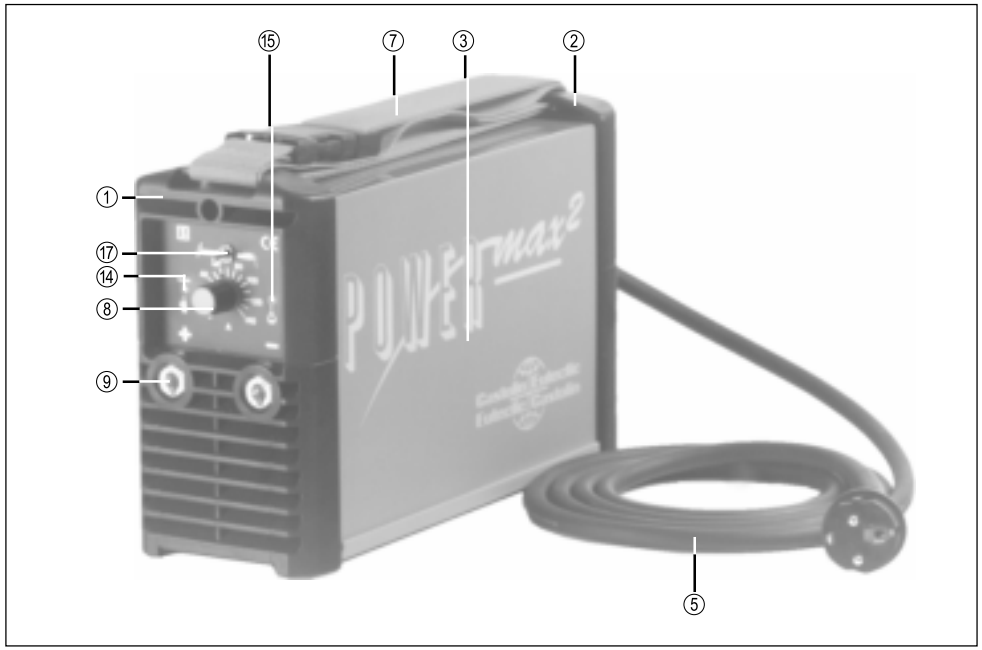

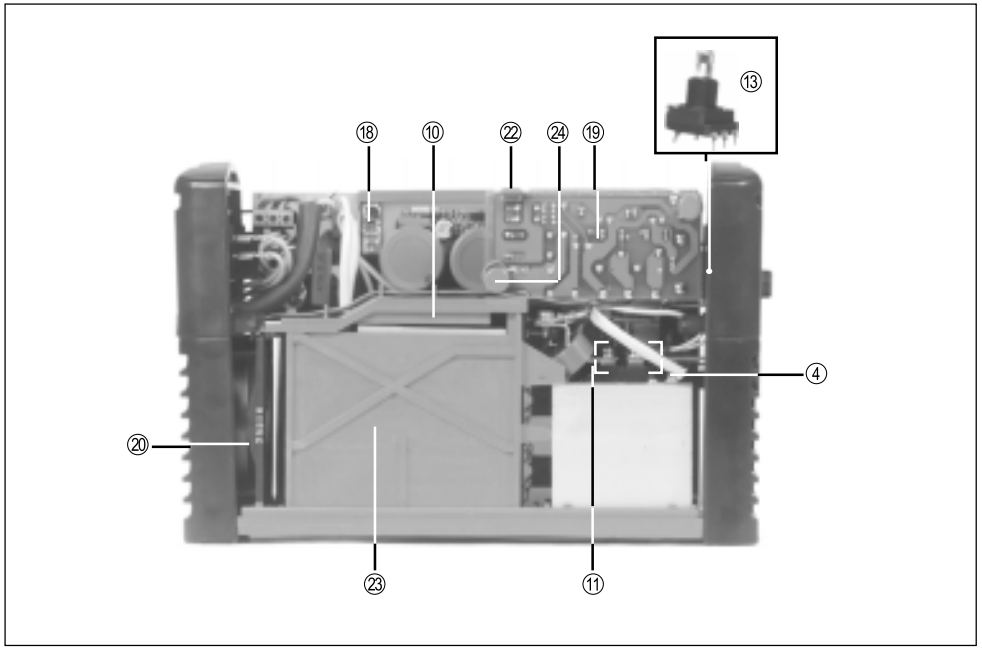

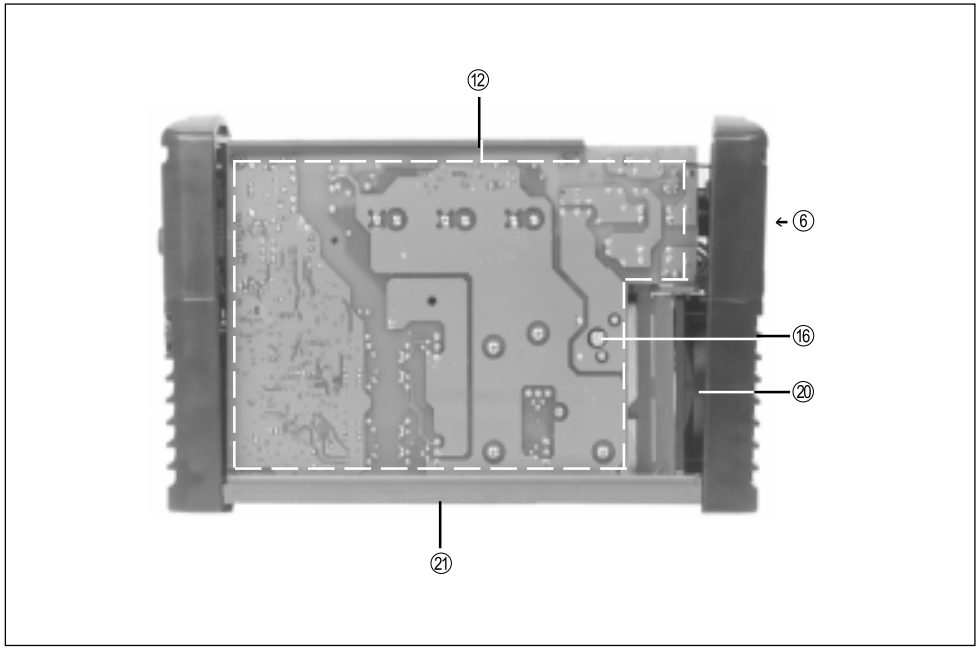

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3)	43212	Mantel, POWERmax²	Jacket, POWERmax²	Capot , POWERmax²
4)	42392	Thermoelement Print	Temperature sensor	Sonde de température
5)	48548 02	Netzkabel 3G 2.5, 2,5m, mit Stecker	Mains cable 3G 2.5, 2.5 m, with plug	Câble alimentation 3G 2.5, 2,5 m, avec fiche
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12)	42391	Print PCC 14	Circuit board PCC 14	Circuit PCC 14
13)	43237	Potentiometer, WIDPOT 25K 20 PC16VM6 300	Potentiometer, WIDPOT 25K 20 PC16VM6 300	Potentiomètre, WIDPOT 25K 20 PC16VM6 300
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21)	43228	Bodenplatte	Bottom plate	Plaque de fond
22)	42395	Basisprintversteifung	Strut halcor	Equerre guide halcor
23)	42397	Kühlkörperhalterung li.	Heat sink-mounting l.	Montage piece thermo à gauche
24)	42396	Klemmbefestigung	Clamp fitting	Dispositif de serrage
	42351 03	Massekabel, 3 m, 16 mm² (SKM 25)	Earth cable, 3 m, 16 mm² (SKM 25)	Câble de masse, 3 m, 16mm² (SKM25)
	41932 01 [1])	Kabel, 1 m, 16 mm² (3x)	Cable, 1 m, 16 mm² (3x)	Câble, 1 m, 16 mm² (3x)
	42033	Masseklemme 200 A	Earth terminal 200 A	Pince de masse 200 A
	41941	Kabelschuh für 16 mm²	Cable lug for 16 mm²	Cosse de câble 16 mm²
	42383	Stecker DIX SKM 25	Plug DIX SKM 25	Fiche DIX SKM 25

[1]) Diese Artikel-Nr. beinhaltet nur 1 Stück bzw. 1 m

[1]) This item code includes only one piece, i.e. 1 m

[1]) Ce numéro d'article contient 1 seule pièce, ou 1 m

Pos.-Nr.	Artikel-Nr.	Bezeichnung	Designation	Désignation
	43201 04	Elektrodenhandkabel, 4 m, 16 mm² (SKM 25)	Welding cable, 4 m, 16 mm² (SKM 25)	Câble de soudage, 4 m, 16mm² (SKM 25)
	41932 01 [1])	Kabel, 1 m, 16 mm² (4x)	Cable, 1 m, 16 mm² (4x)	Câble, 1 m, 16 mm² (4x)
	43226	Elektrodenhalter 200 A	Electrode holder 200 A	Porte-électrode 200A
	43227 [1])	Spannbackenisolator, rot (2x)	Jaw insulator, red (2x)	Isolateur de mâchoire, rouge (2x)
	42383	Stecker DIX SKM 25	Plug DIX SKM 25	Fiche DIX SKM 25

Zubehör / Accessories / Accessoires

	42386	Adapter-Kabel zum Anschluß der WIG-Brenner G 140 RA und G 240 RA	Cable adapter for connection of TIG torch G 140 RA and G 240 RA	Câble adaptateur pour raccordement aux torches TIG G 140 RA et G 240 RA
	42383	Stecker DIX SKM 25	Plug DIX SKM 25	Fiche DIX SKM 25
	42387	Kupplung DIX BK 35	Coupler DIX BK 35	Coupleur DIX BK 35
	41932 01 [1])	Kabel, 1 m, 16 mm² (0,5x)	Cable, 1 m, 16 mm² (0.5x)	Câble, 1 m, 16 mm² (0,5x)
	41909	Polprüfer	Polarity indicator	Testeur de polarité

[1]) Diese Artikel-Nr. beinhaltet nur 1 Stück bzw. 1 m

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Achtung! Verwenden Sie dieses Schweißgerät im Generatorbetrieb nur an einem geregelten und spannungsstabilisierten Synchrongenerator mit einer Leistung von mindestens 6 kVA an 230 V.

Caution! For generator-powered use, make sure generator is a regulated and voltage-stabilized synchronous alternator and welding equipment is powered with 6 kVA minimum power at 230 V voltage.

Attention! En service par générateur, il faut veiller à ce que le générateur soit un alternateur synchrone réglé et à tension stabilisée et que l'appareil de soudage soit alimenté en une puissance minimale de 6 kVA et 230 V.

Atención! En servicio generador hay que asegurarse que el generador sea un alternador sincrónico regulado y estabilizado de tensión y que el equipo de soldadura sea alimentado en una potencia mínima de 6 kVA y 230 V.

Attenzione! Per farla funzionare tramite generatore, questa saldatrice va collegata soltanto ad un generatore regolamentato e sincrono con stabilizzazione di tensione e potenza pari ad almeno 6 kVA per 230 V.

Atenção! Utilize este aparelho de soldagem durante a operação do gerador apenas com um gerador sincronizado regulado e com tensão estável, com uma potência mínima de 6 kVA a 230 V.