Service manual

Ver. 1.0

WELDFORCE KPS 3500

WELDFORCE KPS 4500

WELDFORCE KPS 5500

KEMPPI
The Joy of Welding

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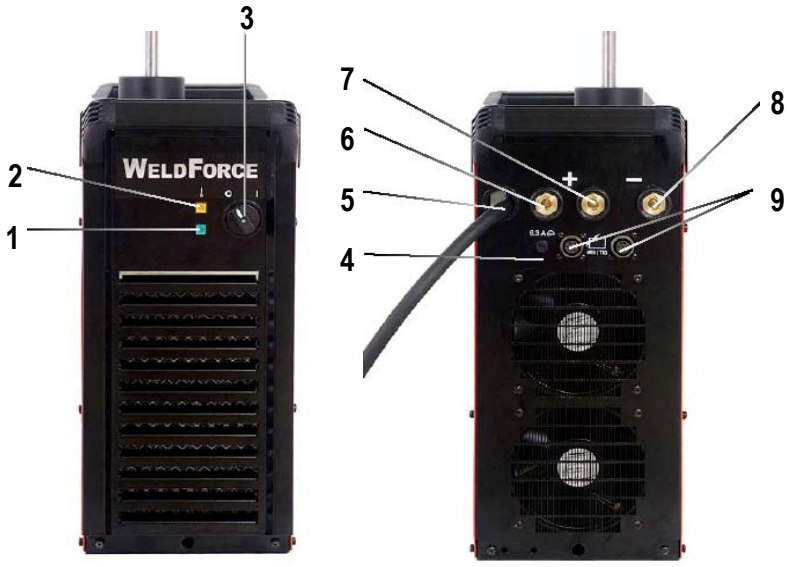
Technical data

	KPS 3500	KPS 4500	KPS 5500
Supply voltage 3~50/60 Hz	400 V –15…+20 %	400 V –15…+20 %	400 V –15…+20 %
Loadability (+ 40° C) 60 % ED 80 % ED 100 % ED	 350 A (15 kVA) 320 A (13,5 kVA)	 450 A (21,5 kVA) 420 A (20 kVA) 380 A (18,5 kVA)	 550 A (28 kVA) 500 A (24,5 kVA) 440 A (21 kVA)
Supply cable / Fuses	4 x 6 S – 5 m 25 A slow	4 x 6 S – 5 m 35 A slow	4 x 6 S – 5 m 35 A slow
Adjustment range of welding current and voltage MMA MIG	 10 A…320 A 12 V… 37 V	 10 A…420 A 12 V… 39 V	 10 A…520 A 12 V… 42 V
Max. welding voltage	46 V / 300 A	46 V / 400 A	50 V / 500 A
OCV	appr. 65 V	appr. 65 V	Appr. 65 V
Idling power	< 75 W	< 75 W	< 75 W
Efficiency on nominal values	Appr. 85 %	appr. 85 %	appr. 85 %
Power factor on nominal values	appr. 0,93	appr. 0,93	appr. 0,93
Degree of protection	IP 23 C	IP 23 C	IP 23 C
Weight	37 kg	41 kg	48 kg
Auxiliary units power supply	50 VDC (6,3 AT)	50 VDC (6,3 AT)	50 VDC (6,3 AT)

Switches and connectors



1	I/0-signal lamp
2	Overheat protection lamp
3	Main switch
4	control cable connection fuse 6,3 A slow
5	Supply cable
6,7	Welding current connections
8	Return current connection
9	Control cable connections

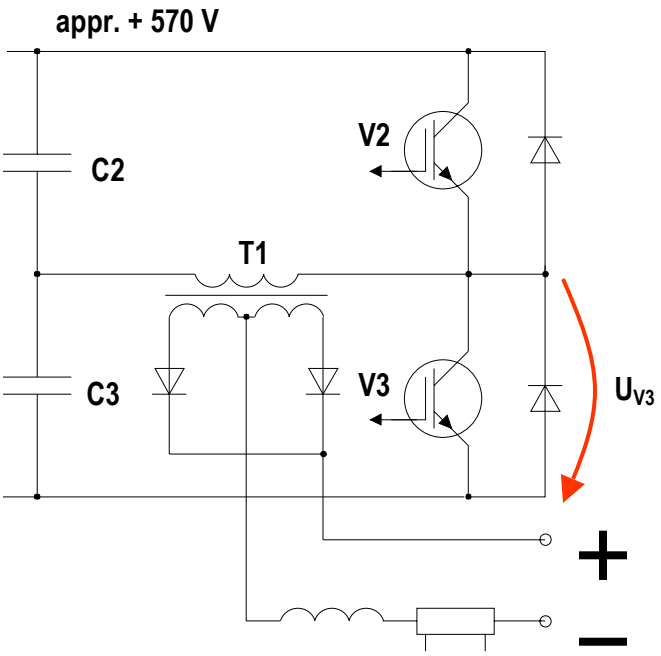
Operation principle

KEMPPI **WELDFORCE**™-power sources are versatile, MIG/MAG- and MMA-suitable inverters.

KEMPPI **WELDFORCE**™-power sources are based on IGBT technology and controlled by PWM principle. The inverter frequency changes by the load, in range of 14 - 24 kHz.

KEMPPI **WELDFORCE**™-power sources are microprocessor controlled, so all welding characteristics are programmatically generated.

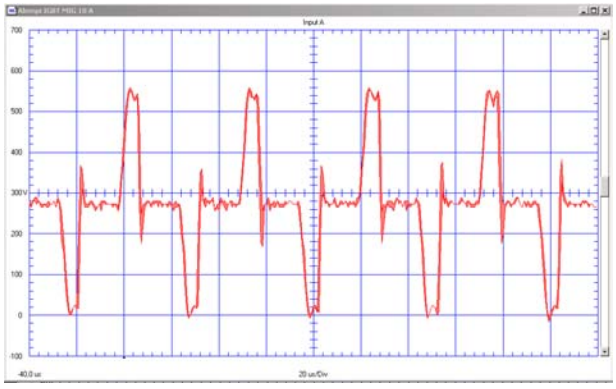
KEMPPI **WELDFORCE**™-power source´s operation principle is shown below:



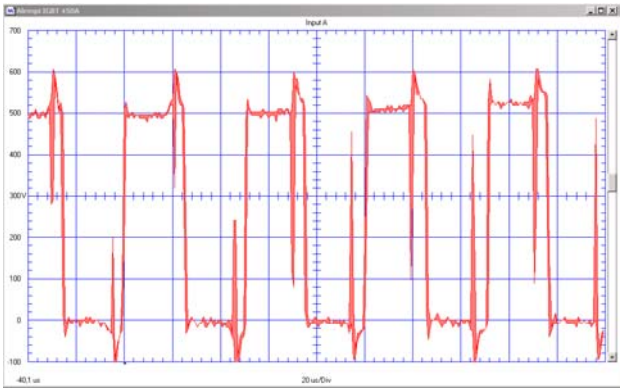
KEMPPI **WELDFORCE**™-power source´s power stage is a traditional half bridge, where the intermediate circuit DC-voltage is halved by working capacitors C2 and C3. IGBT-transistors work as power switches.

When both IGBTs are non-conductive, no power is transferred.

When the upper IGBT V2 is conductive, the main transformer T1´s primary side has positive voltage. When the lower IGBT is conductive, there is negative voltage. Power is adjusted by altering the IGBT-transistors conductive timings (PWM). The main transformer T1´s secondary voltages are rectified by a full-wave rectifier.

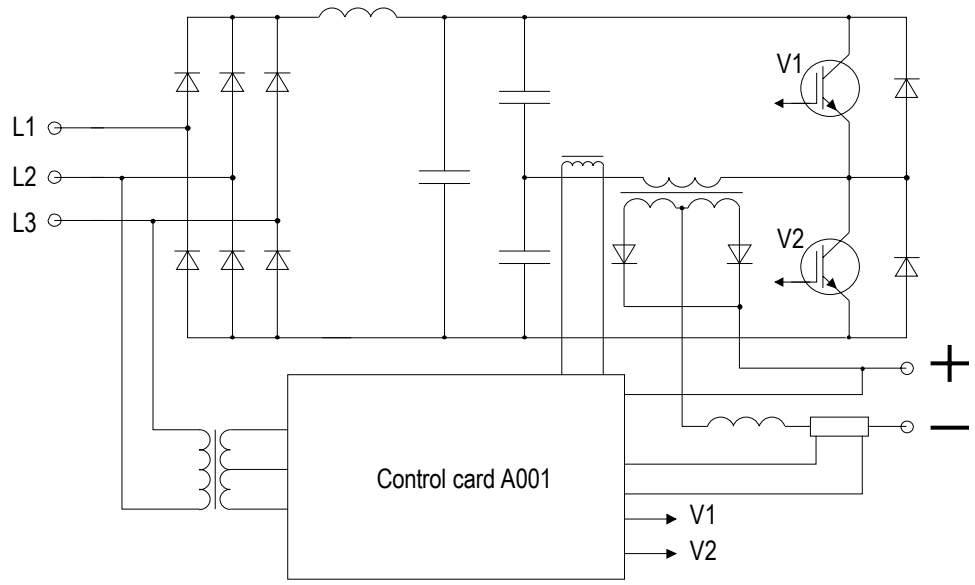


Voltage over the lower IGBT with minimum values.
(MIG 10A/14,5V)
100V, 20µs/DIV

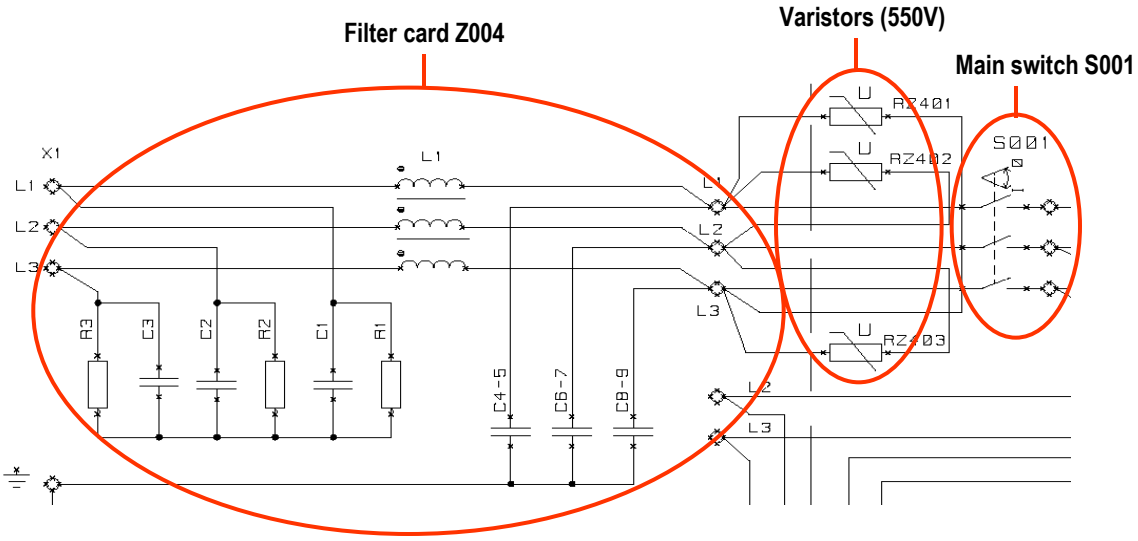


Voltage over the lower IGBT with maximum values
(MIG 450A/36,5V)
100V, 20µs/DIV

Simplified main circuit diagram

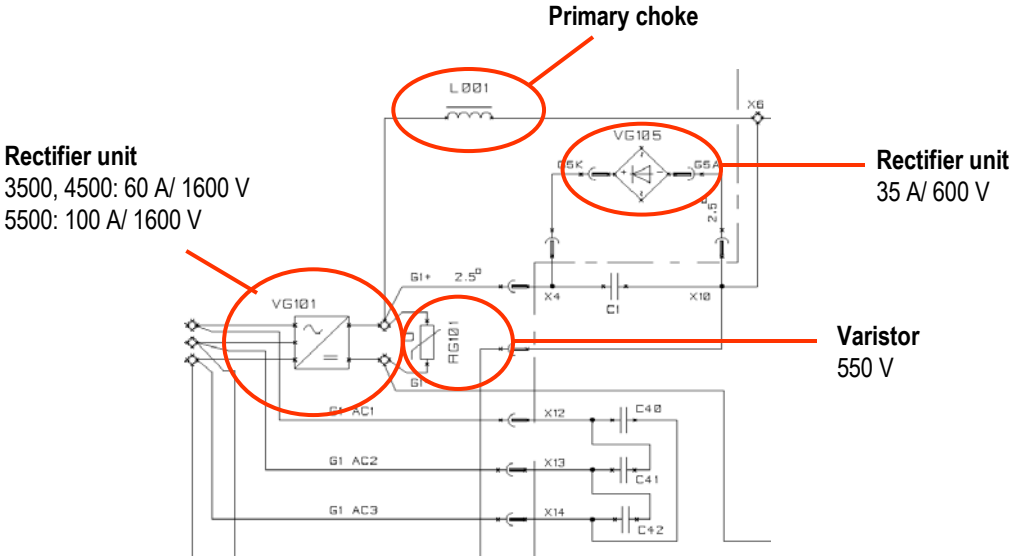


Main circuit components

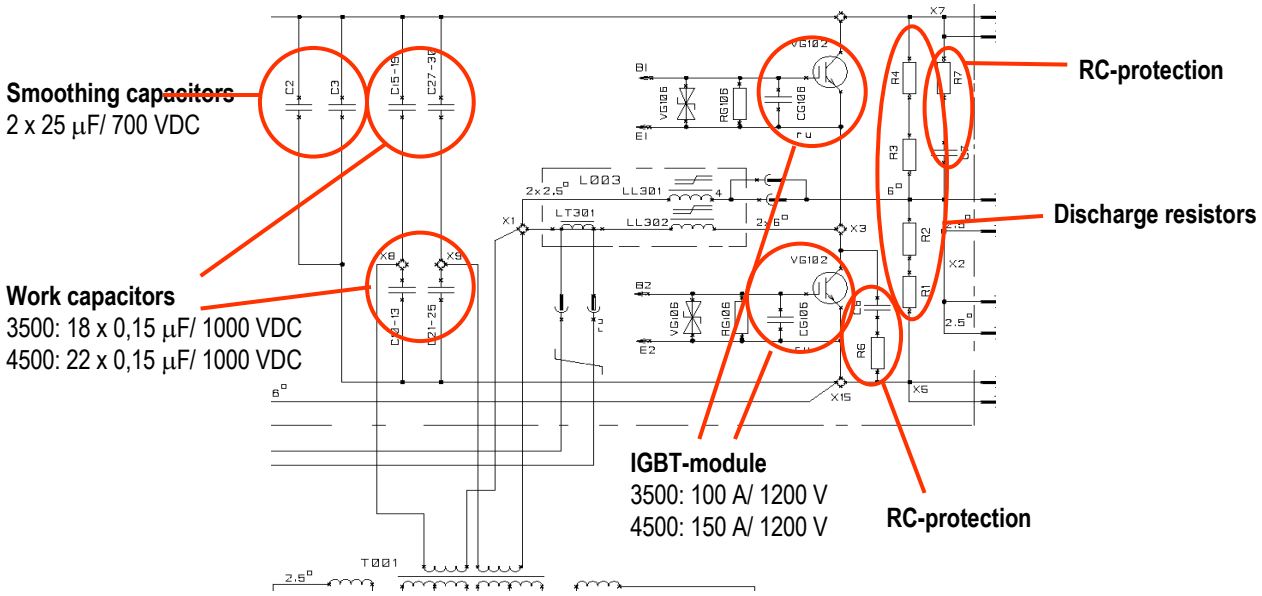


The filter card Z004 dampens the electromagnetic disturbances conducting to the net (EMI). Varistors (550 V) form an overvoltage protection against low energy voltage spikes. Note! Filter card Z004 and varistors are mounted before the main switch S001!

Main circuit components

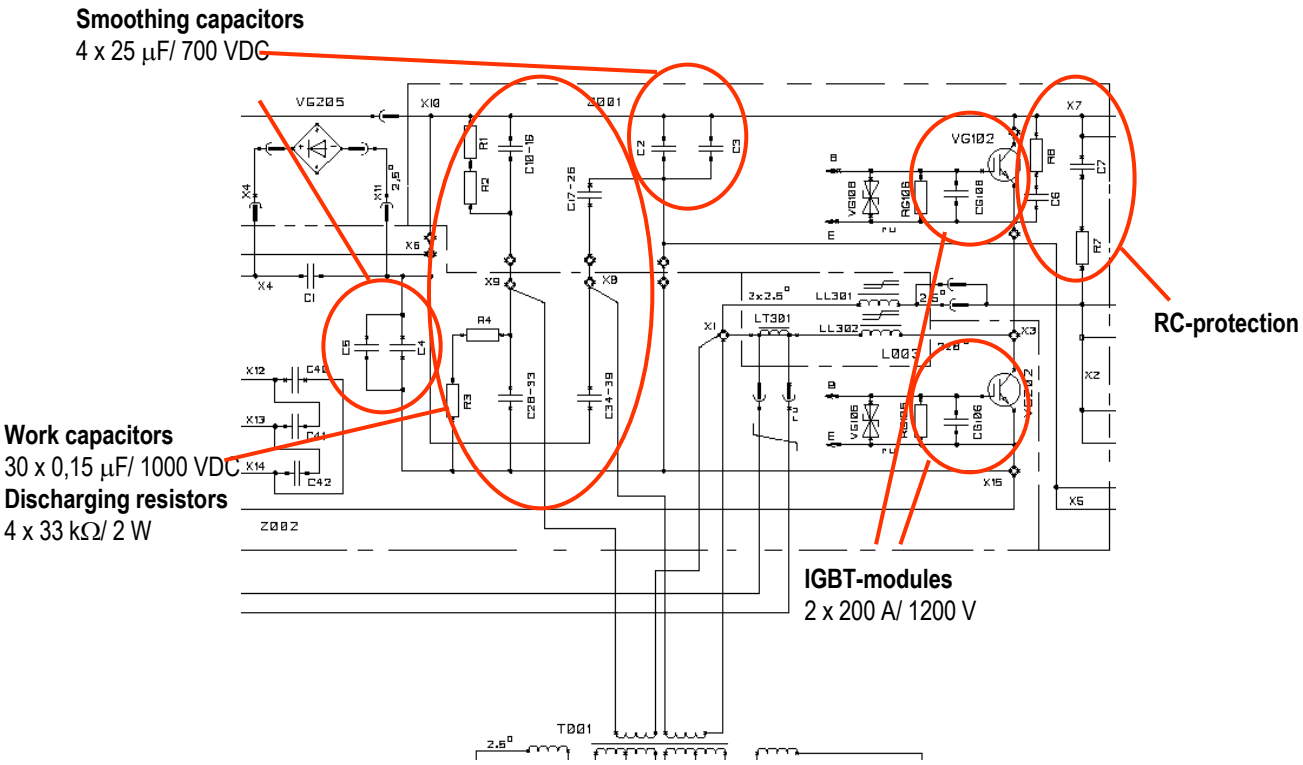


The primary rectifier VG101 rectifies the net voltage. The primary choke L001 limits the in-rush current during switching and filters the DC-voltage together with the smoothing capacitors.



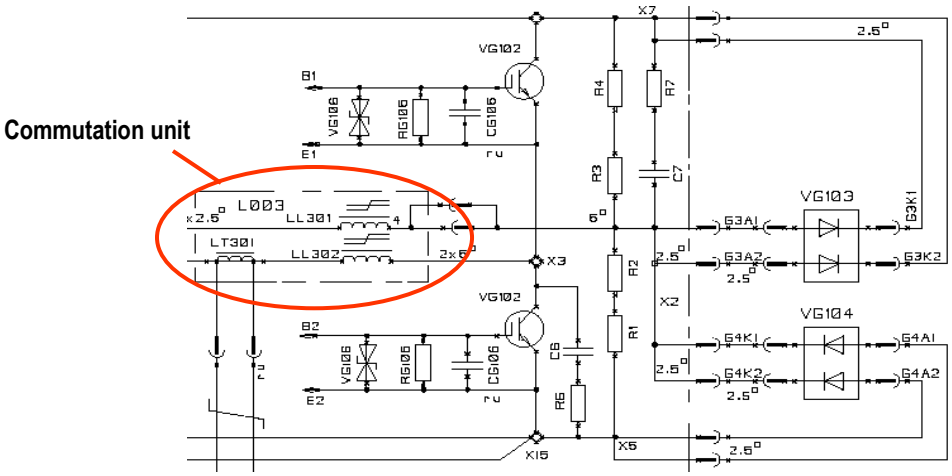
(KEMPPI **WELDFORCE**™ 3500and 4500)

Main circuit components



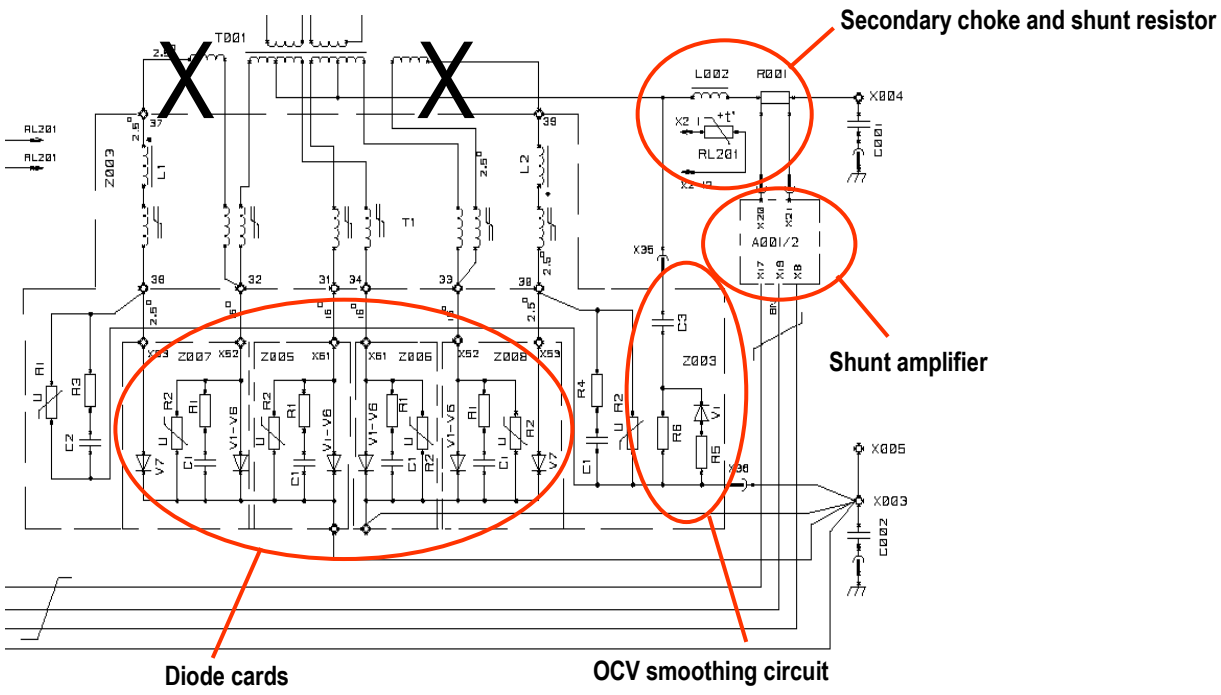
(KEMPPI **WELDFORCE**™ 5500)

Inverter´s main parts are the workcapacitors, IGBT-transistors and the main transformer T001. Inverter´s power adjustment is based on pulse width modulation (PWM). RC-protections ease the stress on the semiconductors.

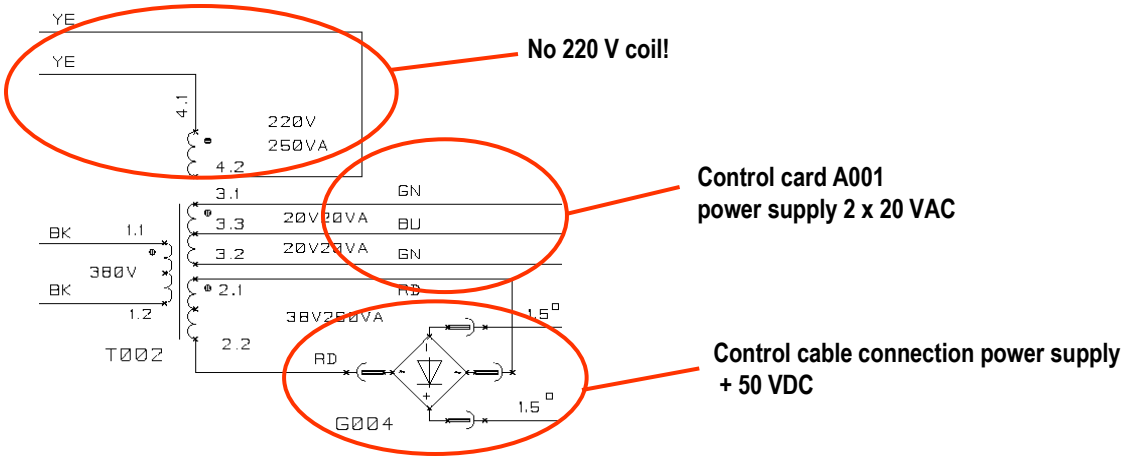


The chokes LL301 and LL302 of the commutation unit reduce the losses of the IGBTs during the switching. The current transformer LT301 monitors the primary side current. According to it´s measurement the frequency of the power source is adjusted (14… 24 kHz).

Main circuit components

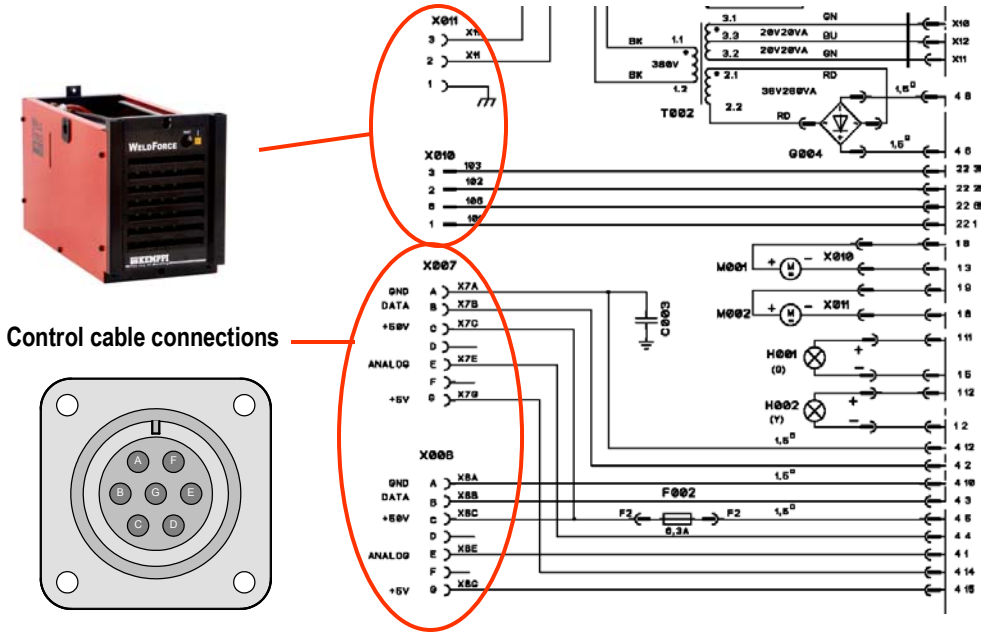


The main transformer T001 secondary voltages are full-wave rectified by the diode cards. The secondary voltage waves are dampened by secondary choke L002. The secondary circuit current is measured by a shunt resistor. The shunt´s voltage is amplified by shunt amplifier A001/2 and taken to control card A001´s PWM-adjuster.

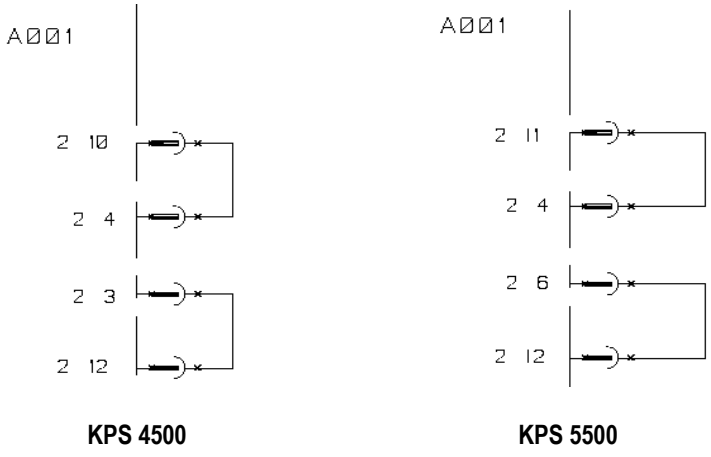


From auxiliary transformer T002 secondary voltages are formed the supply voltages for A001 and control cable connection´s auxiliary units.

Control cable connections



The auxiliary units are connected to power source´s control cable connectors X006 and X007. The cooling unit KWU-10 is connected to connectors X010 and X011.



KPS 4500 **KPS 5500**

The control card A001 is similar in all Kemppi **WELDFORCE**™ -power sources. The machine size is coded with short circuit loops, except in Kemppi **WELDFORCE**™ 3500, which has no short circuit loops.

Troubleshooting

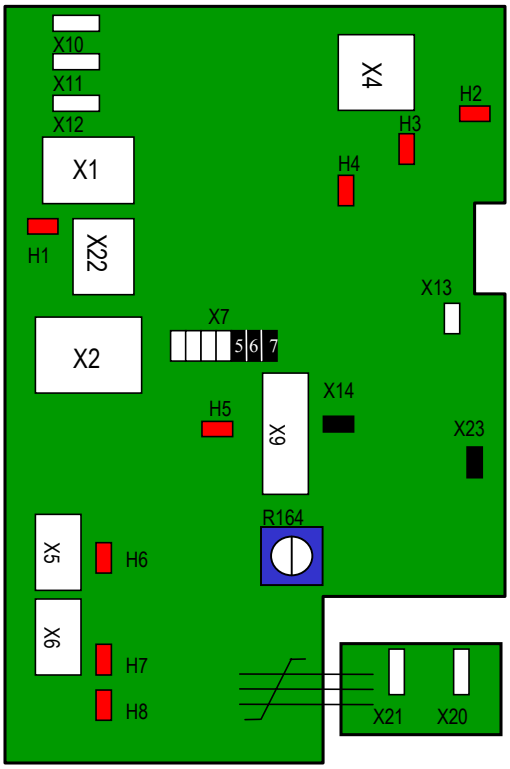
The machine may only be repaired by a technician or a workshop licensed and authorized to do the job!

First do a visual check to find any possible loose connectors, broken wires or signs of overheating.

Troubleshooting diagram

PROBLEM	POSSIBLE CAUSE	REMEDY
The power source will not start. The signal lamps remain blank.	The net fuse has burnt. A faulty supply cable.	Check the net fuses. Check the 3 phases coming to power source´s connector X1.
	A faulty auxiliary transformer T002.	Check the auxiliary transformer´s secondary voltages from control card A001, between connectors X12 - X11 and X12 - X10 (appr. 20 VAC).
	A faulty control card A001.	Update the control card´s flash memory program. If reprogramming will not solve the problem, replace the control card A001.
Net fuses blow immediately when the power source is switched on.	A faulty primary circuit semiconductor.	Check the semiconductors on the primary side.
The power source doesn´t reach maximum power.	The net fuses has blown. A faulty supply cable. A faulty primary rectifier VG101. A faulty secondary diode card.	Check the net fuses, supply cable and the primary rectifier VG101. Check the condition of the secondary diode cards.
The fans remain rotating after power source startup.	A faulty control card A001.	Reprogram the control card A001 flash-memory. If reprogramming will not solve the problem, then replace control card A001.

Control card A001 layout



R164 Inverter frequency

Control card A001 jumper functions

X7 5 6 7 Factory setting

1 MIG, wire feeder is other than KWF

2 Scratch-TIG enabled

3 OCV approx.. + 16 V (VRD)

4 Not in use

5 Factory setting

6 If the arc is not lit in 2 seconds, the inverter is stopped.(MIG)

7 Factory setting

1 MIG, wire feeder is KWF

2 Scratch-TIG disabled

3 OCV is approx. + 65 V

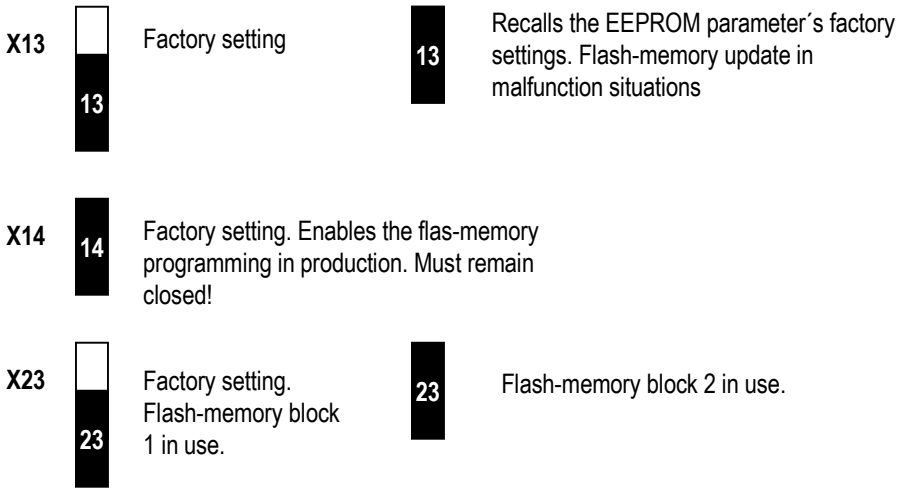
4 Factory setting

5 Not in use

6 If the arc is not lit in 2 seconds, the inverter & wire feeding are stopped.(MIG)

7 Not in use

Control card A001 jumper functions



Control card A001 LEDs

H1 LED: *FANS,* LED is on, when fans aren´t rotating and vice versa. If fans never rotate, check the fan supply voltage from connector X, between pins 3 - 8 and 6 - 9 (24 VDC).

H2 LED: *BUS POWER SUPPLY*, while the LED is on, it indicates th e50 VDC voltage present in the bus connection. If the LED is off, then check the voltage from connector X4 between pins 6 - 8. Check the fuse F002, diode bridge G004 and auxiliary transformer T002.

H3 LED: *SERIAL COMMUNICATION*, while the LED is on, it indicates the presence of serial communication. If the H2 is on, but H3 is off, most likely there is something wrong with the program on the control card.

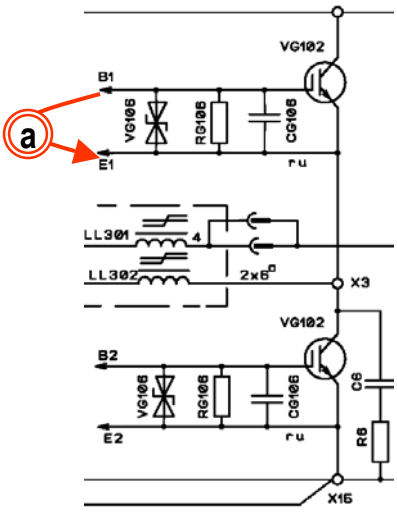
H4 LED: REMOTE CONTROLLER, while the LED is on, it indicates a connected remote controller R10 or R20.

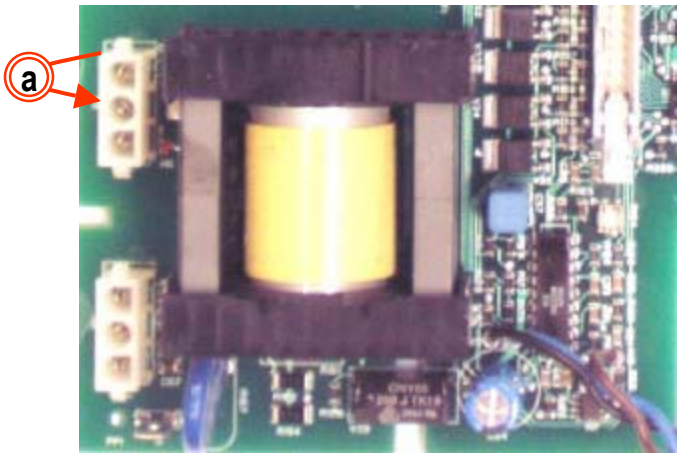
H5 LED: *GATE PULSES*, while the LED is on, it indicates the presence of the gate pulses. LED´s brightness depends on pulse width and the power under load.

H6 LED: *X5- AND X6-CONNECTORS ARE CROSS-CONNECTED,* while on, the LED indicates the cross-connection of IGBT gate connectors X5 and X6. Shut the machine down and connect the gates correctly!

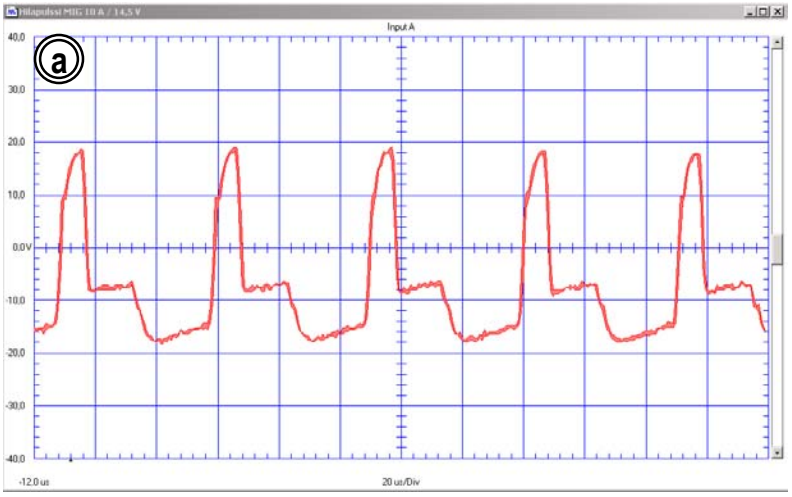
H7/H8: *GATE PULSES:* while on, the LEDs indicate the presence of gate pulses. Brightness of the LEDs depends on pulse width. If H5 is on, but H67 and H8 are off, then the gate circuit is damaged (pulse transformer, FETs etc..

IGBT gate pulse

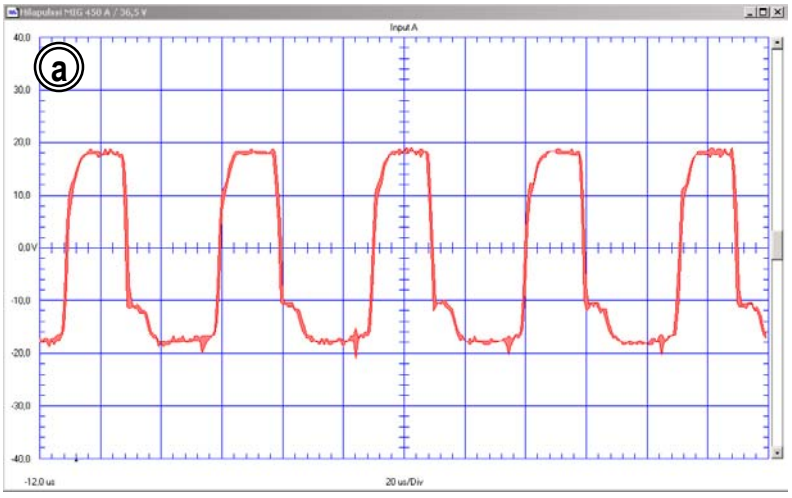




Control cardi A001

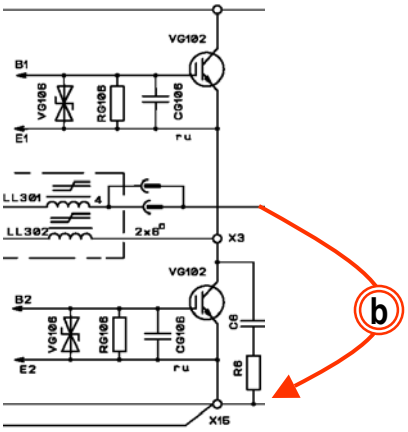


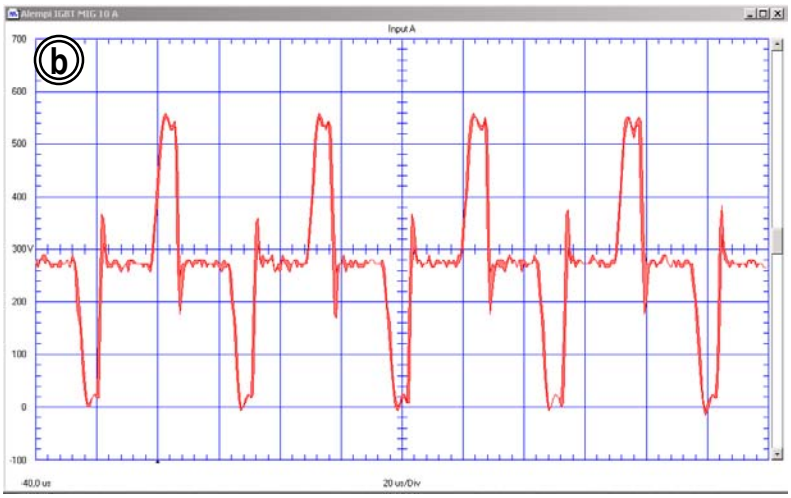
The gate pulse on values 10A/14,5V (MIG), meas. point **a**
10V, 20µs/DIV



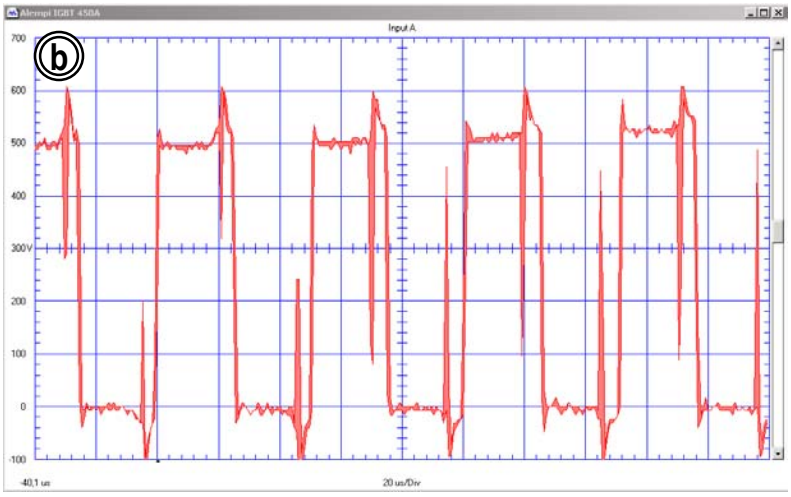
The gate pulse on values 450A/36,5V (MIG), meas. point **a**
10V, 20µs/DIV

Voltage over the lower IGBT



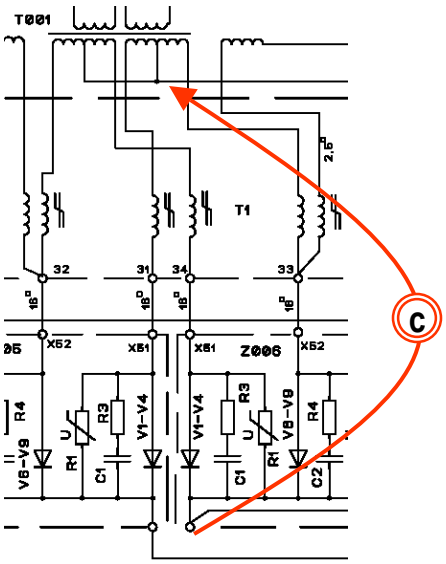


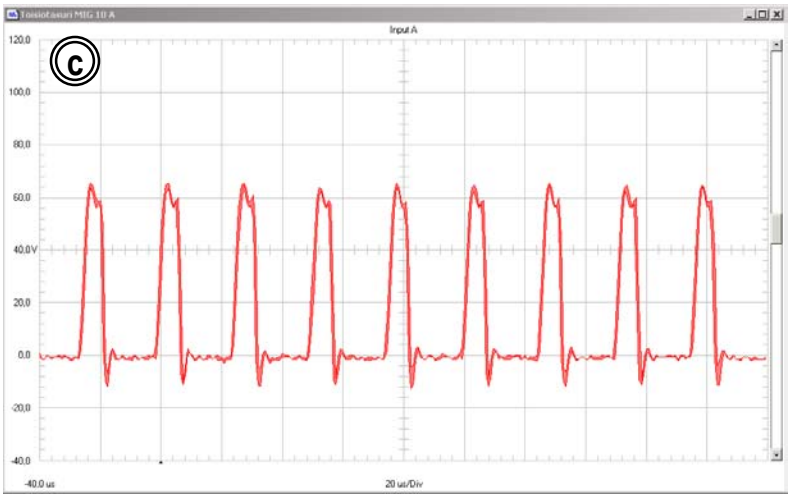
Voltage over the lower IGBT on values 10A/14,5V (MIG), meas. point **b**
100V, 20µs/DIV



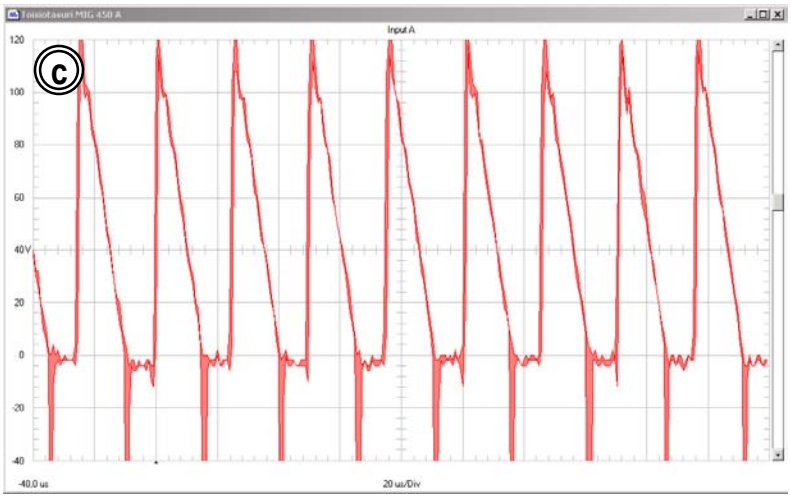
Voltage over the lower IGBT on values 450A/36,5V (MIG), meas. point **b**
100V, 20µs/DIV

Voltage after the secondary diode cards



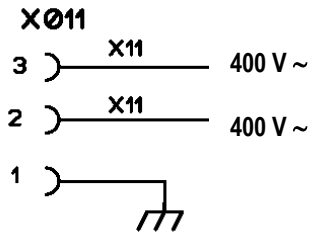


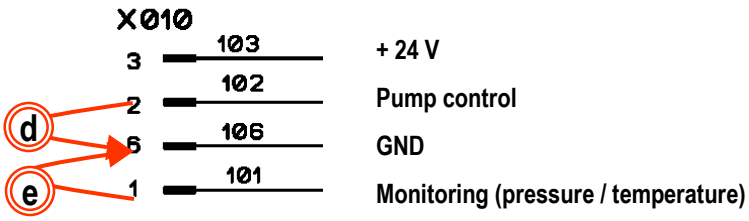
Voltage after the secondary diode cards on values 10A/14,5V (MIG), measuring point **c**
20V, 20µs/DIV

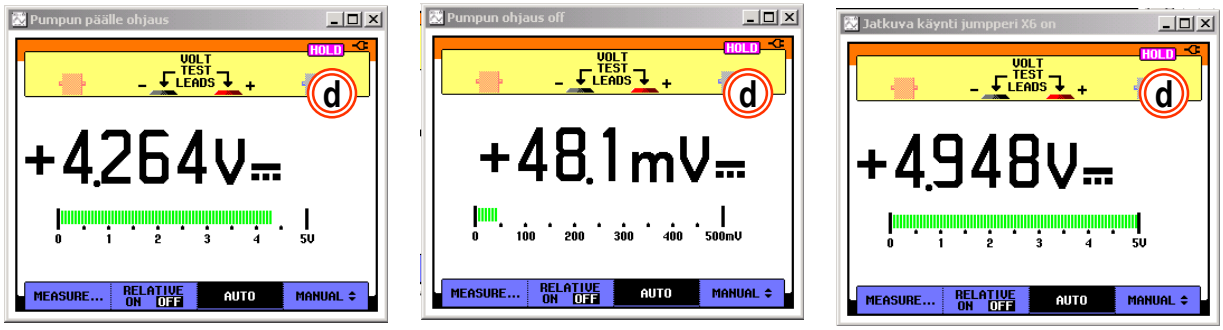


Voltage after the diode cards on values 450A/36,5V (MIG), measuring point **c**
20V, 20µs/DIV

Cooling unit control



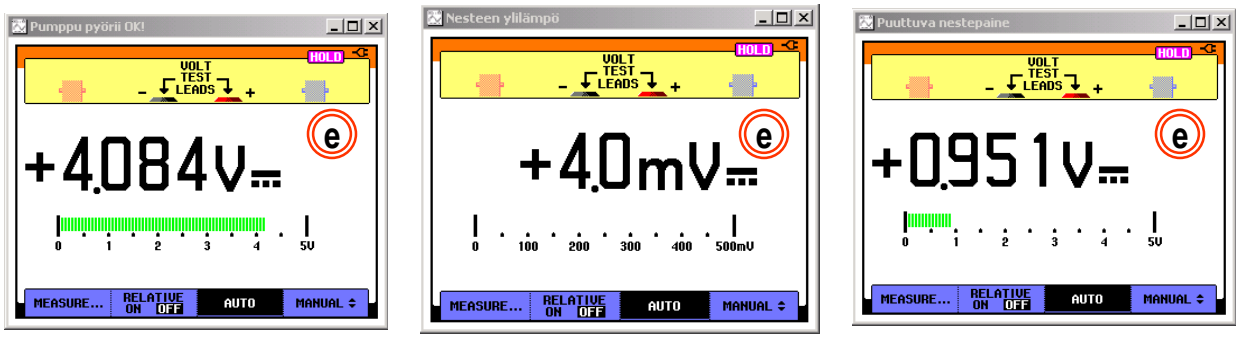




a) b) c)

Voltage on connector X010 between pins 2-6, measuring point **d**:

a) Pump motor ON
b) Pump motor OFF
c) Pump motor continous run selected

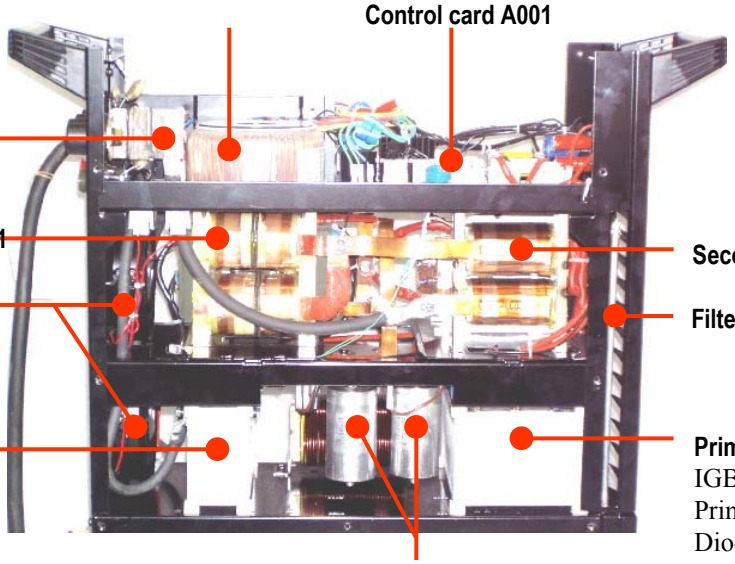


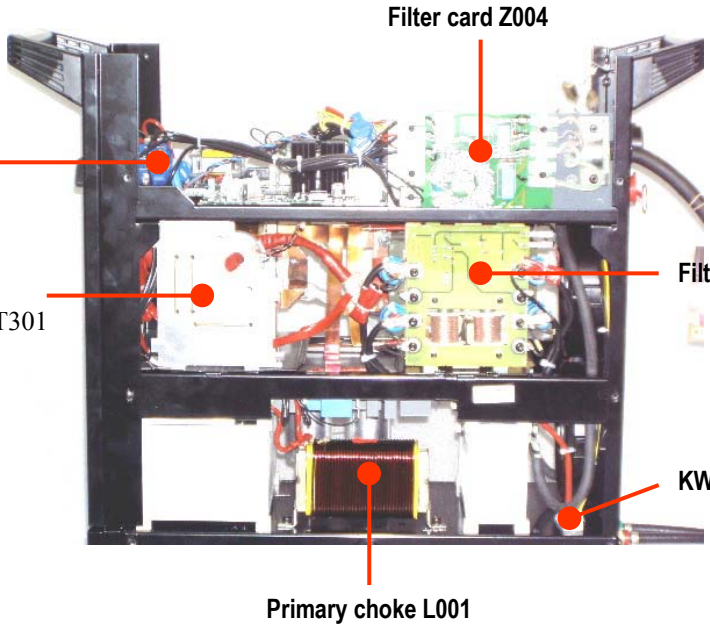
a) b) c)

Voltage on connector X010 between pins 1-6, measuring point **e**:

a) Pump motor is ON, monitoring OK
b) Coolant has overheated > + 60° C
c) Coolant pressure < 1 bar.

Structure





(KEMPPI **WELDFORCE**™ 4500)

Notes