

# Service Manual

Ver. 1.1



**MINARC**  
**150**

**MINARC**  
**150** VRD

**MINARC**  
**151**

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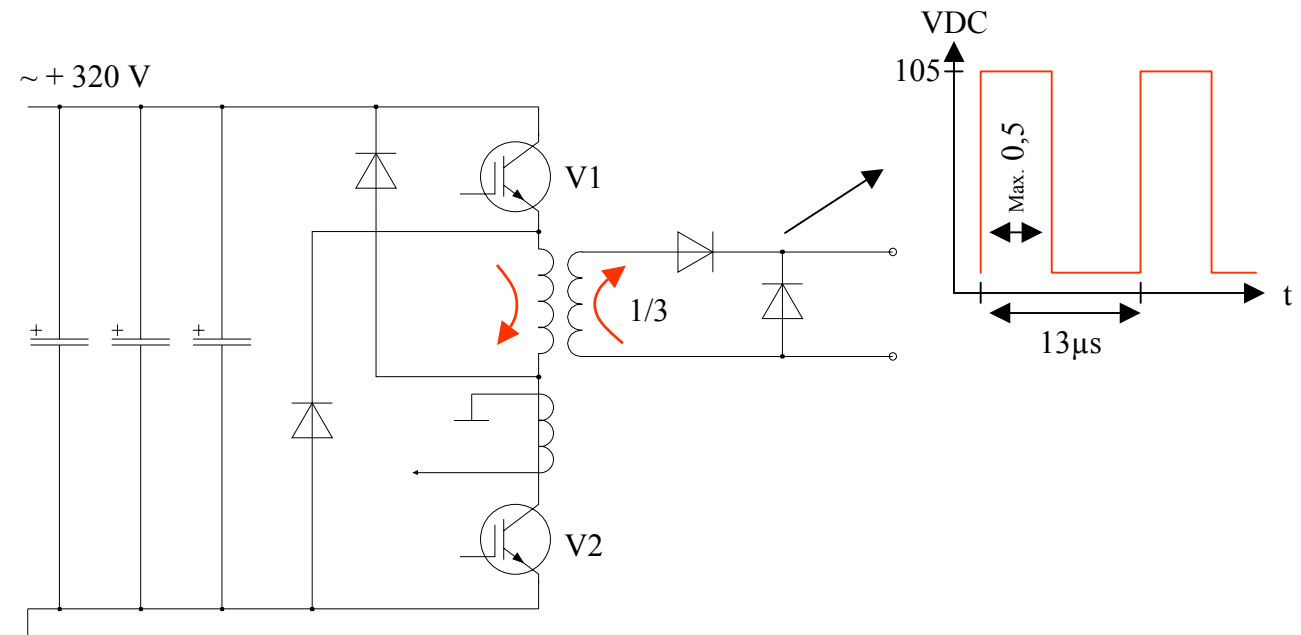
## Technical data

	Minarc 150	Minarc 150 VRD	Minarc 151
Supply voltage, 1~ 50/60 Hz	230 V ± 15%	230 V ± 15%	110 V ± 15%
Loadability			
35% ED (MMA)	140 A (7,5 kVA)	140 A (7,5 kVA)	140 A (7,5 kVA)
100% ED (MMA)	100 A (5,1 kVA)	100 A (5,1 kVA)	100 A (5,1 kVA)
35% ED (TIG)	150 A (5,0 kVA)	150 A (5,0 kVA)	150 A (5,0 kVA)
100% ED (TIG)	110 A (3,3 kVA)	110 A (3,3 kVA)	110 A (3,3 kVA)
Supply cable / fuses	2,5 mm <sup>2</sup> S / 3,3 m 16 A	2,5 mm <sup>2</sup> S / 3,3 m 16 A	6 mm <sup>2</sup> S / 2,0 m 32 A
Welding current range (MMA)	10 A / 20,5 V...140 A / 25,6 V	10 A / 20,5 V...140 A / 25,6 V	10 A / 20,5 V...140 A / 25,6 V
Suitable stick sizes	ø 1,5...3,25 mm	ø 1,5...3,25 mm	ø 1,5...3,25 mm
Welding power adj.	Stepless	Stepless	Stepless
OCV	~ + 85 V	~ + 30 V	~ + 85 V
Idling power	< 10W	< 10W	< 10W
Efficiency	0,8	0,8	0,8
Power factor	0,60 (140 A / 25.5 V)	0,60 (140 A / 25.5 V)	0,60 (140 A / 25.5 V)
Temperature class	B (130°C) / H (180°C)	B (130°C) / H (180°C)	B (130°C) / H (180°C)
Operation temperature range	-20...+40°C	-20...+40°C	-20...+40°C
Stock temperature range	-40...+60°C	-40...+60°C	-40...+60°C
Casing class	IP 23C	IP 23C	IP 23C
Norms	IEC 60974-1, -10 EN 50199	IEC 60974-1, -10 EN 50199	IEC 60974-1 EN 50199
Dimensions			
Length	320 mm	320 mm	320 mm
Width	123 mm	123 mm	123 mm
Height	265 mm	265 mm	265 mm
Weight	4,0 (4,6) kg	4,0 (4,6) kg	4,4 (5,2) kg



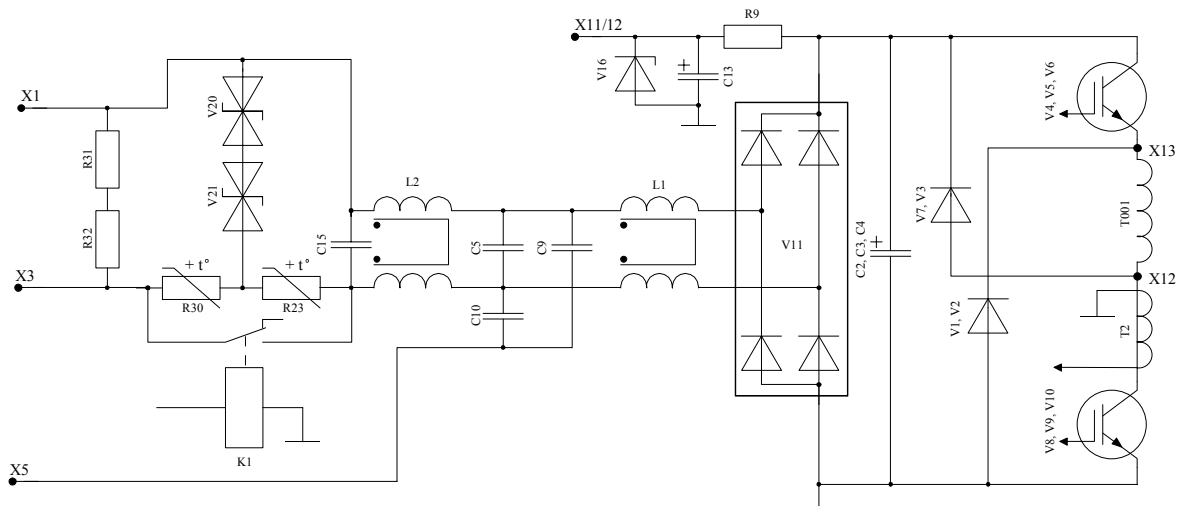
## Operation principle

Minarc power sources are "dual-Forward" inverters, controlled by PWM technology. Switching components are IGBT transistors. The operation frequency is ~ 80 kHz. Below is a picture of the "dual-forward" inverter operation principle.



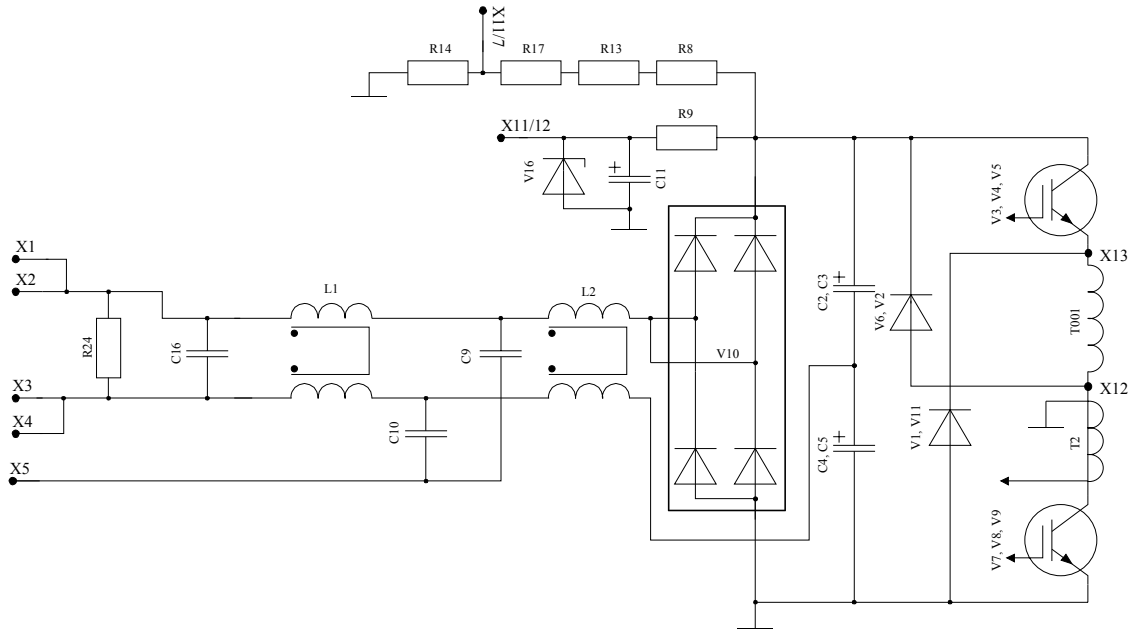
When IGBTs V1 and V2 are non-conductive no power is transferred. Power is altered by changing the transistor's timing (PWM).

## Main circuit

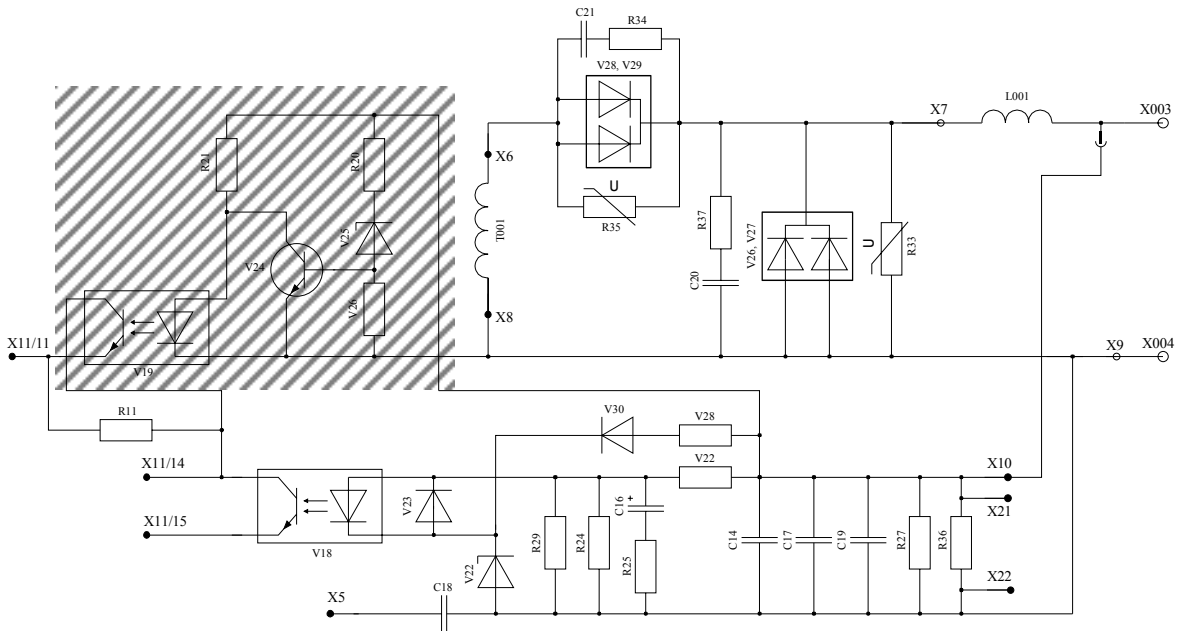


Primary circuit connection, Minarc 150/150 VRD.

# Main circuit

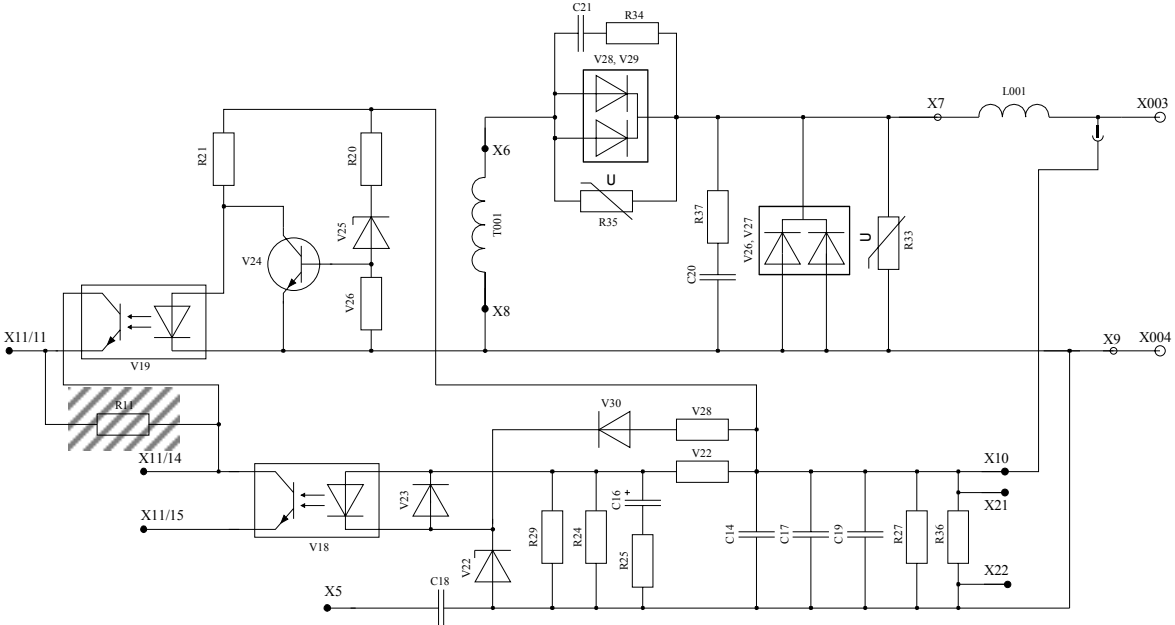


Primary circuit connection, Minarc 151.



Secondary circuit connection, Minarc 150/151.

# Main circuit



Secondary circuit connection, Minarc 150 VRD.



## General

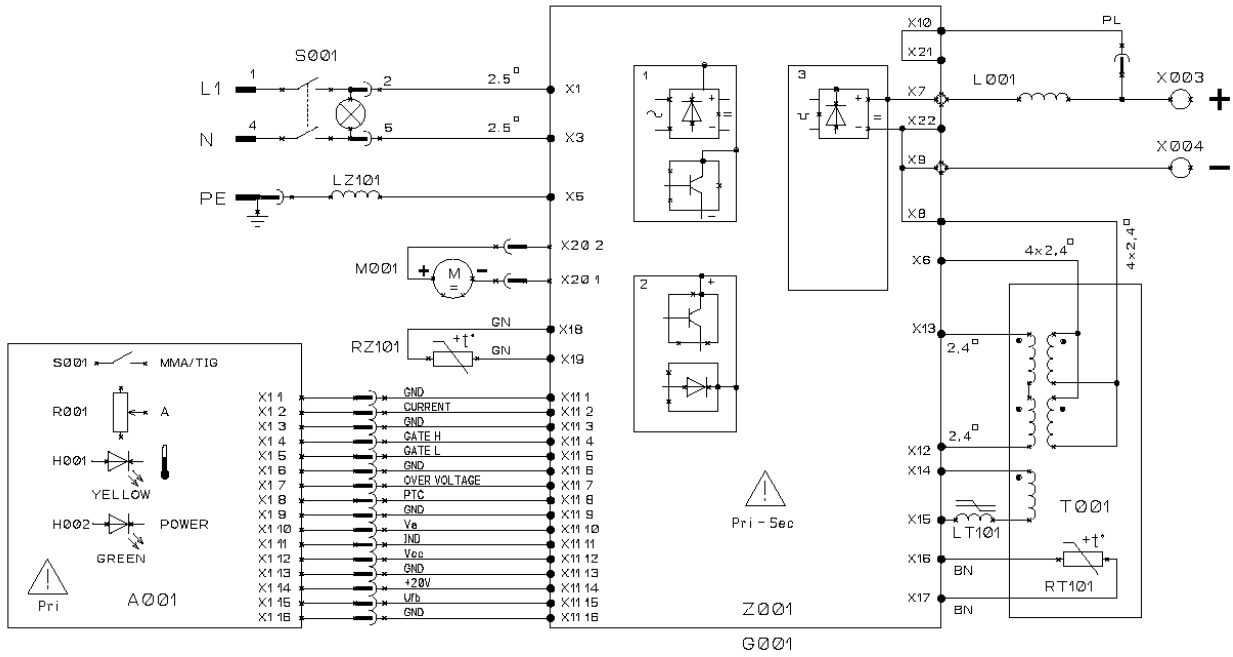
*This machine may be repaired only by authorized repair shops and persons!*

The visual check must be done first, to find possible damages; loose wires, breaks and signs of overheating.

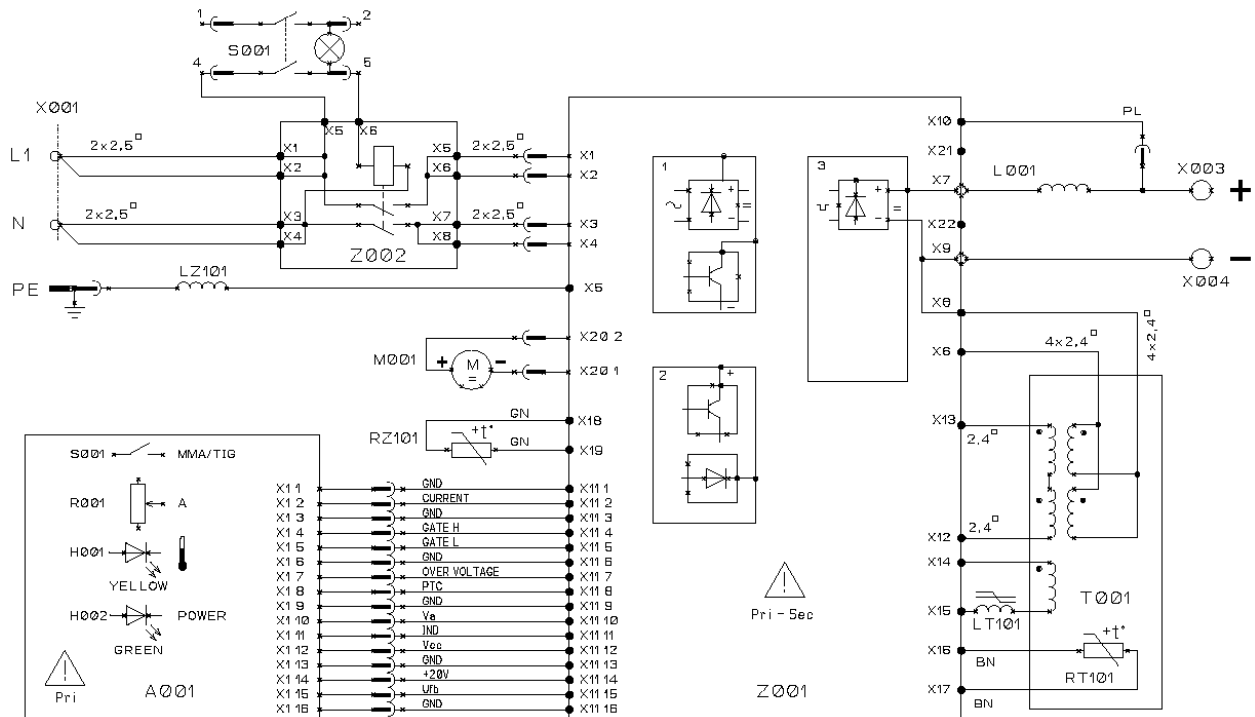
## Troubleshooting diagram

DISTURBANCE	POSSIBLE CAUSE	REMEDY
Power source doesn't start; OCV ~ 0 V;	Cooling fan M001	Disconnect the fan connector X20 and start the power source again. If the power source starts and the OCV is ok, change the fan.
	The rectifier diodes are in short circuit.	Check the secondary diodes condition and change if needed. See the changing of secondary diodes, page 26.
	Faulty primary circuit power semiconductor.	Check the primary side power semiconductors. If the voltage over the PTC R30 is more than ~ 230 Vac then there is a short circuit in the primary circuit. Change the faulty power semiconductor. See the IGBT transistor testing on page 26.
	Faulty control card A001.	Change the control card A001.
The power source starts and the OCV rises up to ~85 V, after which the power source shuts down. The power source can not be loaded. The automatic fuses are blown during start up.	Relay K1	Check the relay operation.
Welding current can't be adjusted by potentiometer R001.	Faulty power adjustment potentiometer R001.	Check the potentiometer condition (R001 = 10 kΩ)
	Faulty control card A001.	Change control card A001.

# Main circuit diagrams



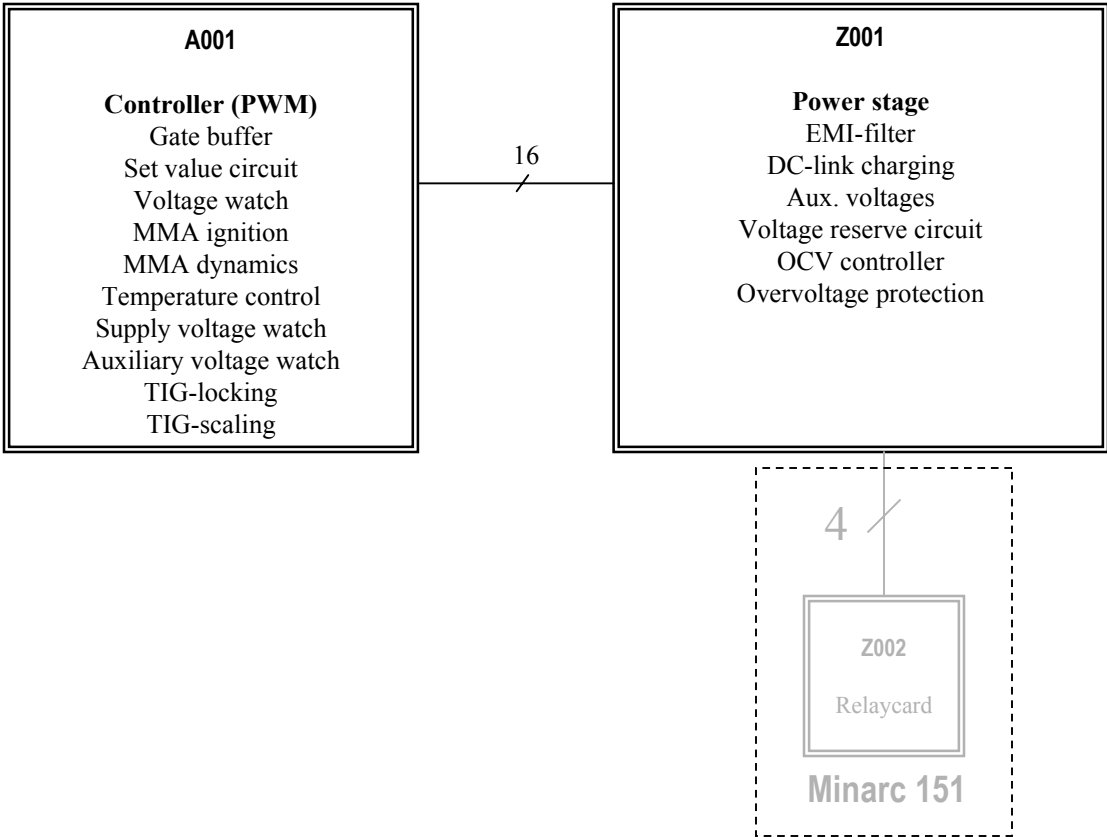
## Minarc 150/150 VRD



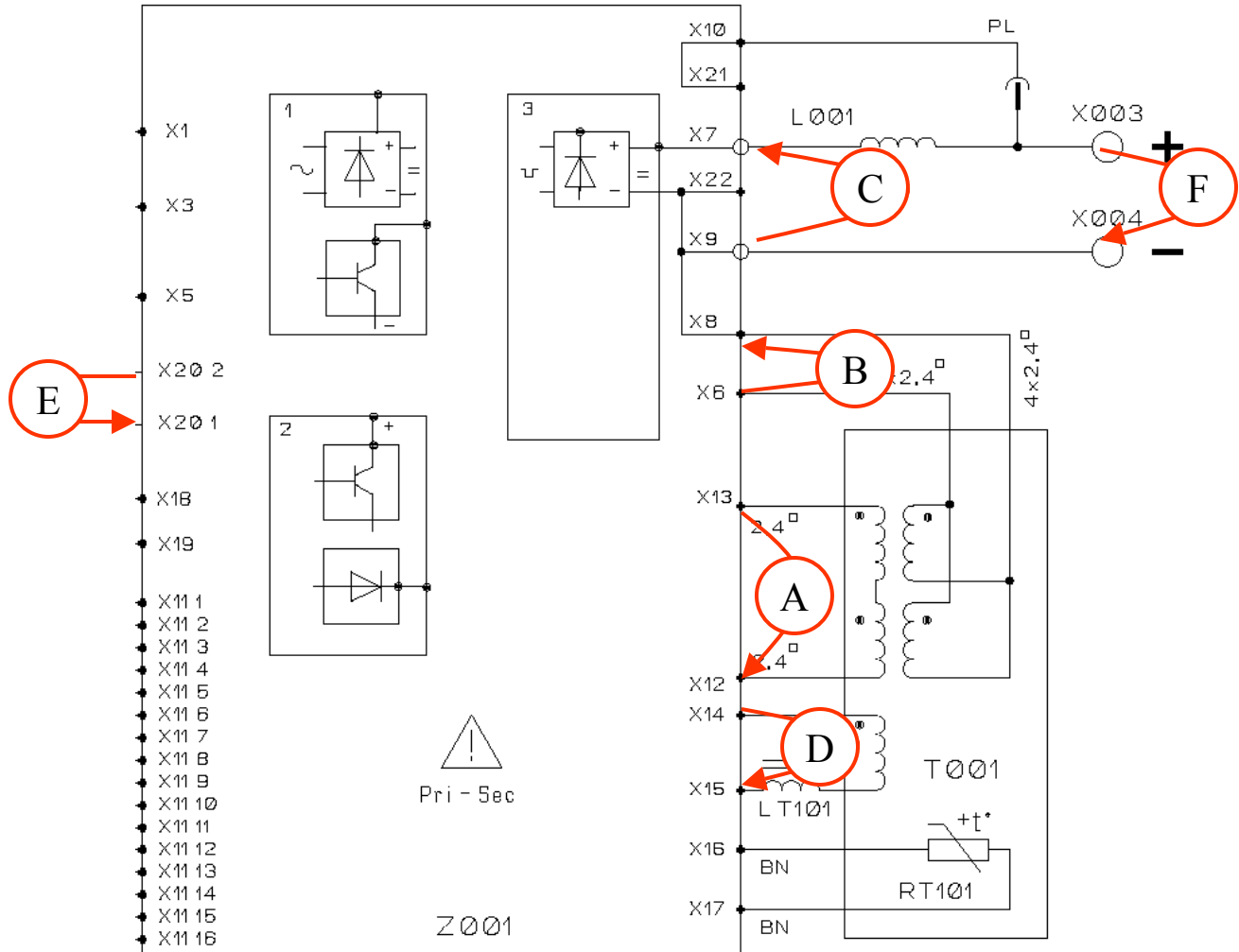
## Minarc 151



# Block diagram

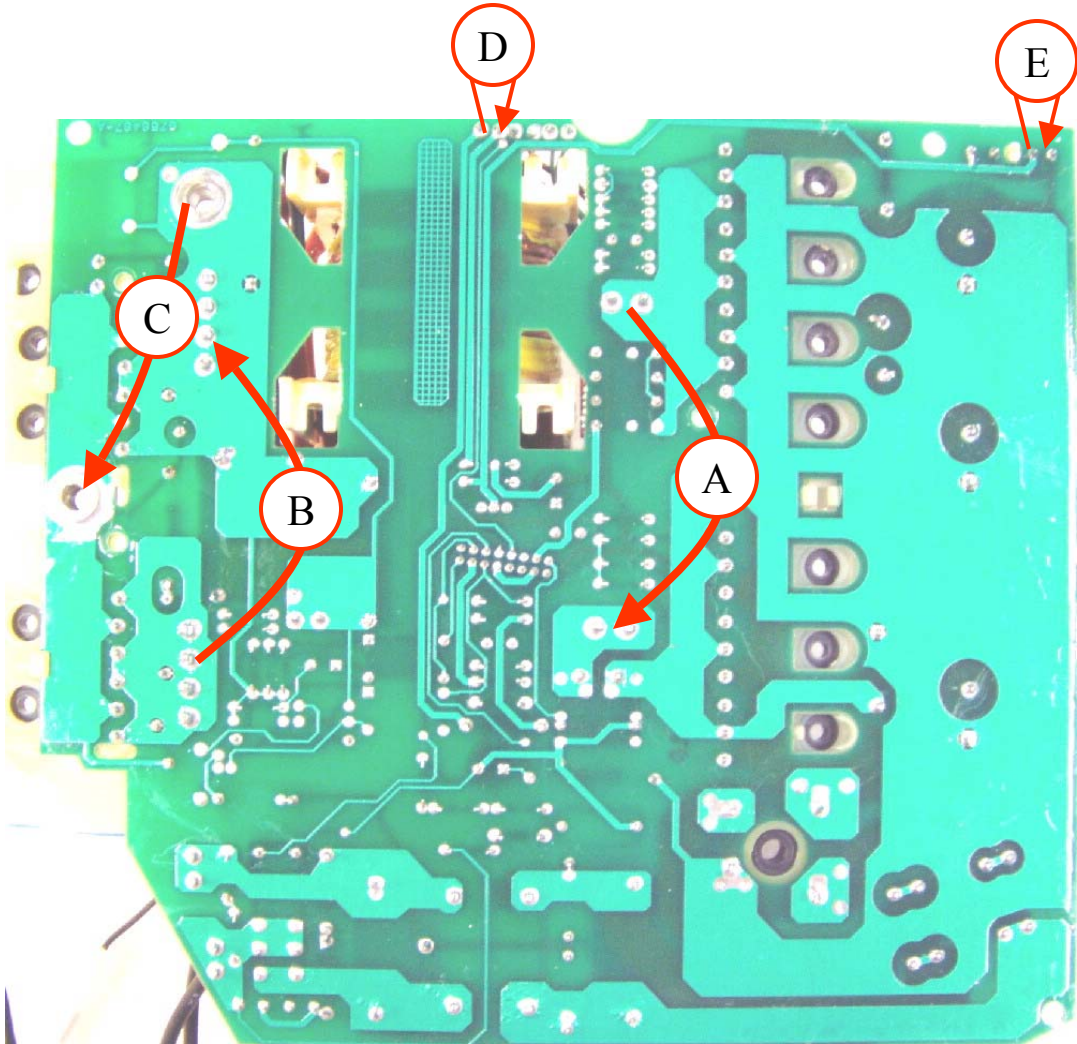


## Operational tests / measurements



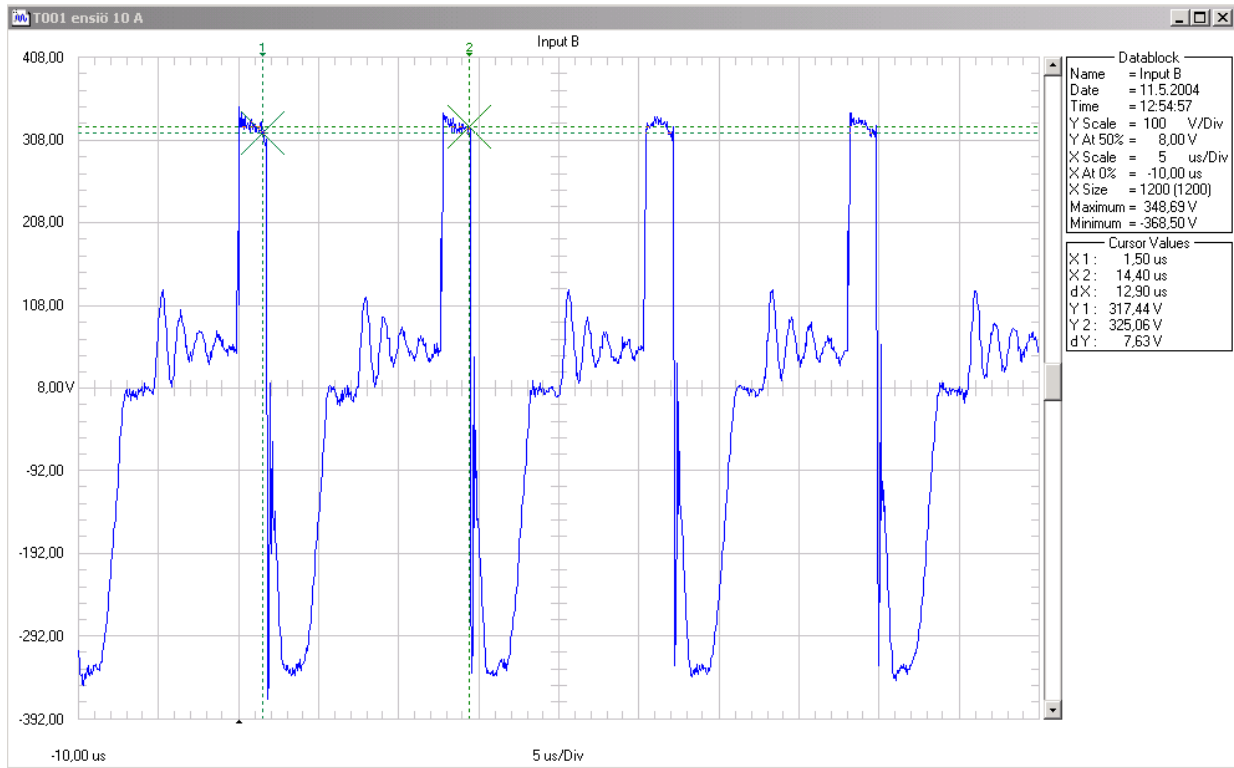
- Measuring point A. Main transformer T001 primary voltage
- Measuring point B. Main transformer T001 secondary voltage
- Measuring point C. Voltage after secondary rectifier
- Measuring point D. Aux. coil voltage
- Measuring point E. Fan M001 voltage
- Measuring point F. Pole voltage

Measuring points on main circuit card Z001 (Minarc 150)

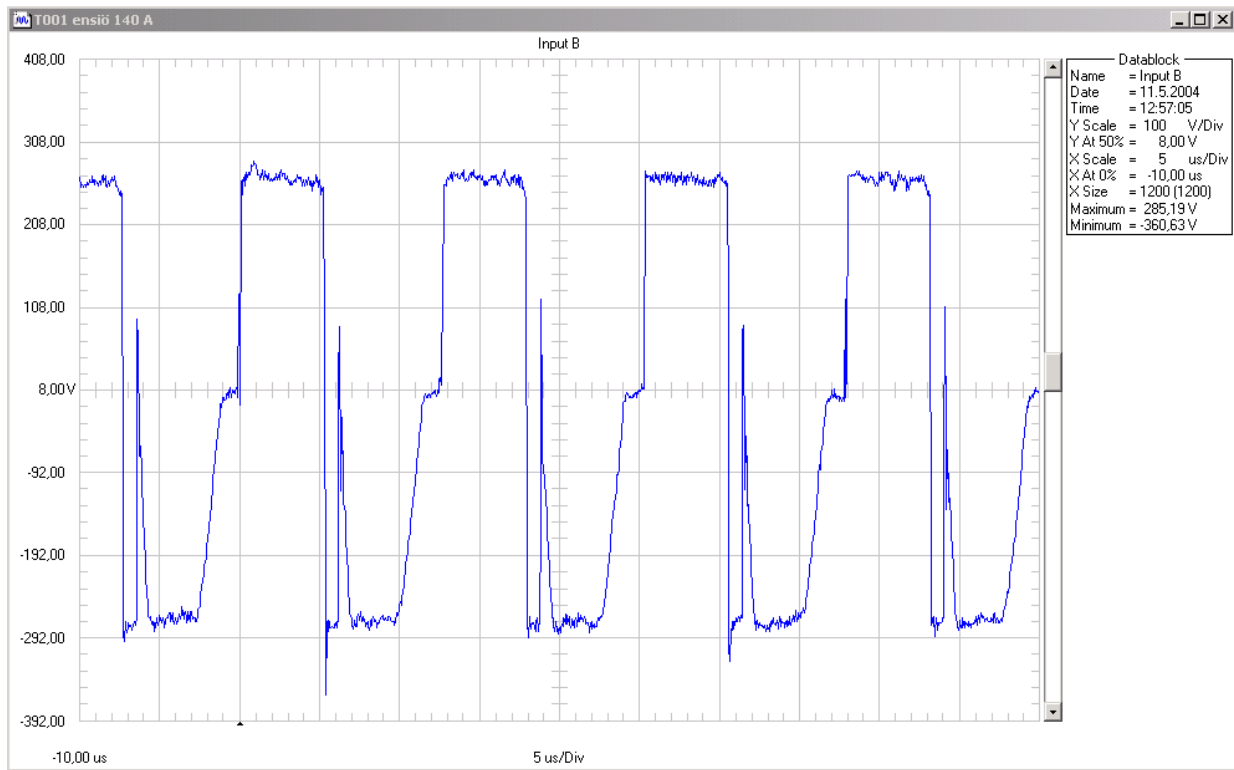


A	Main transformer T001 primary
B	Main transformer T001 secondary
C	After the rectifier
D	Main transformer auxiliary coil
E	Fan M001

# Measuring point A. Main transformer T001 primary voltage

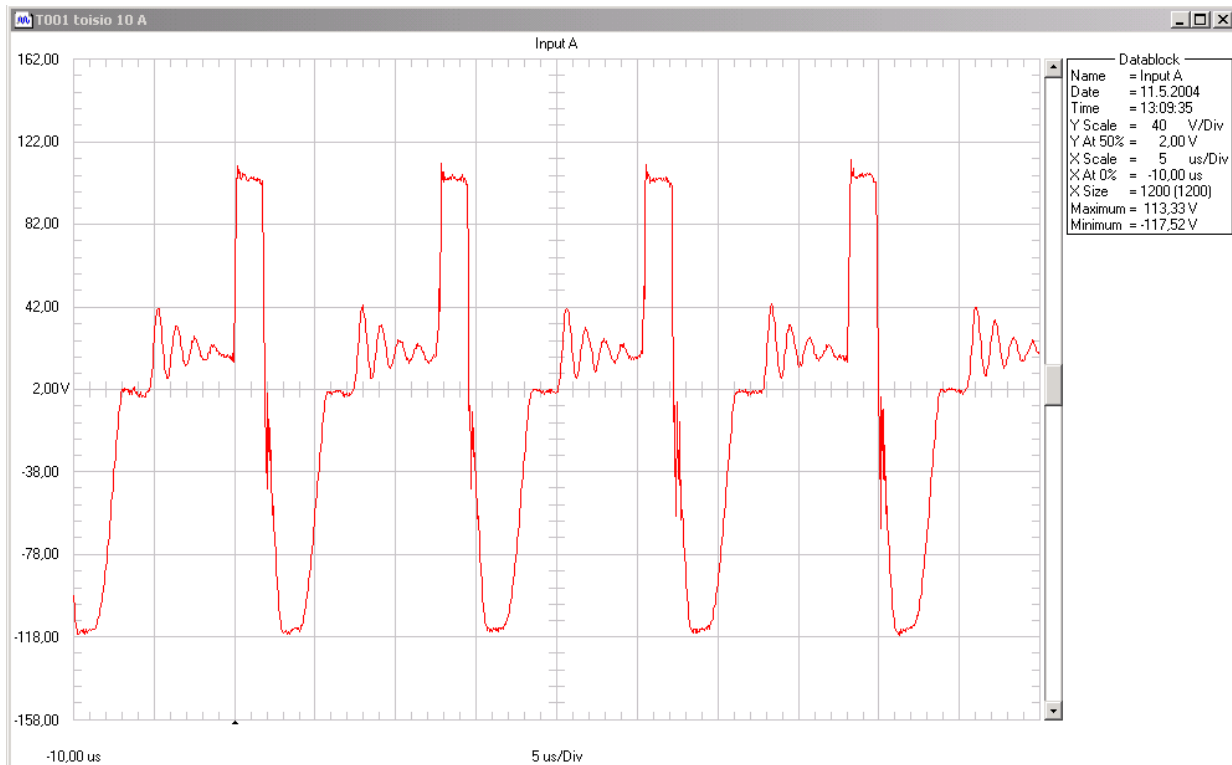


Main transformer T001 primary voltage, min. (MMA)

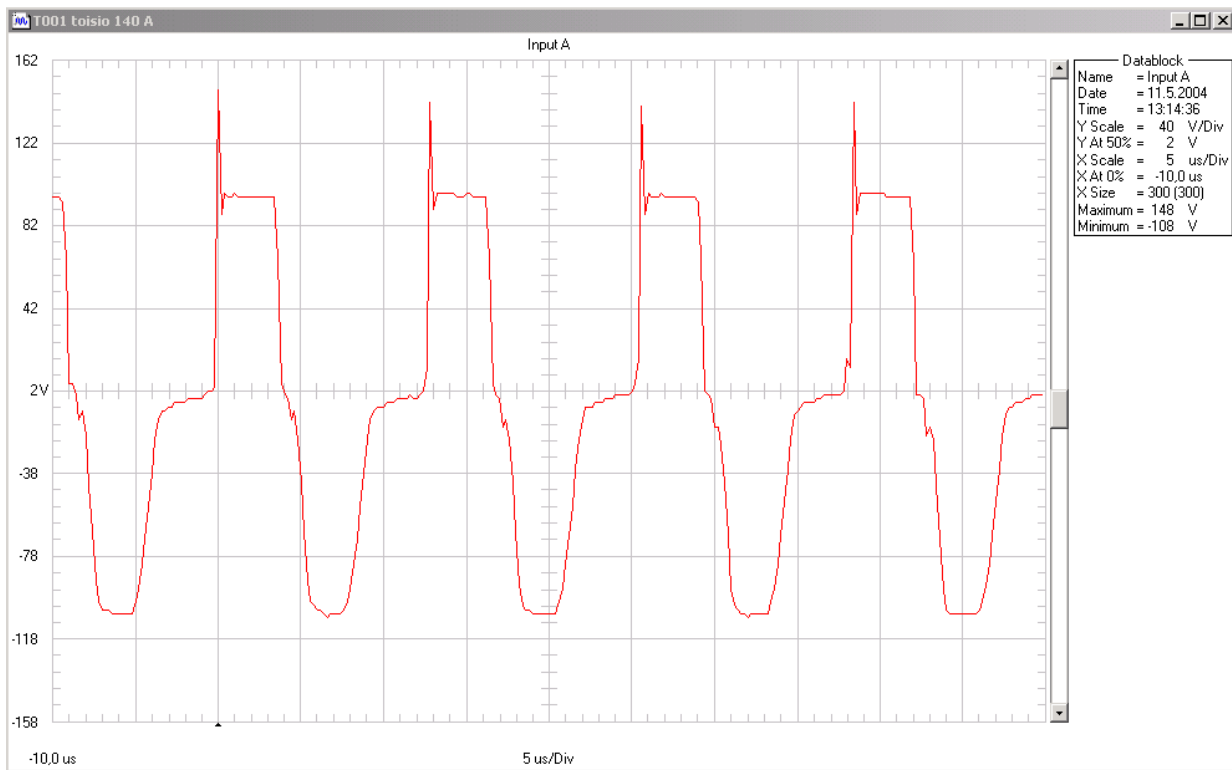


Main transformer T001 primary voltage, max. (MMA)

## Measuring point B. Main transformer T001 secondary voltage

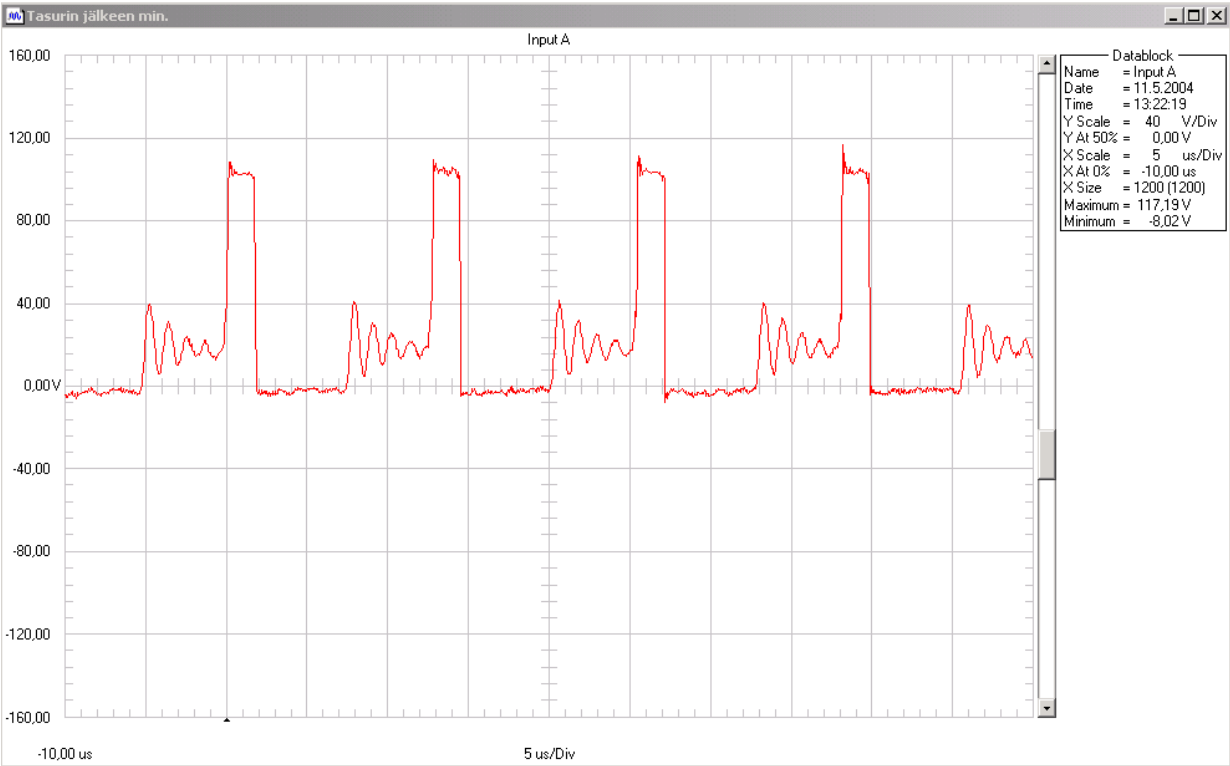


Main transformer T001 secondary voltage, min. (MMA)

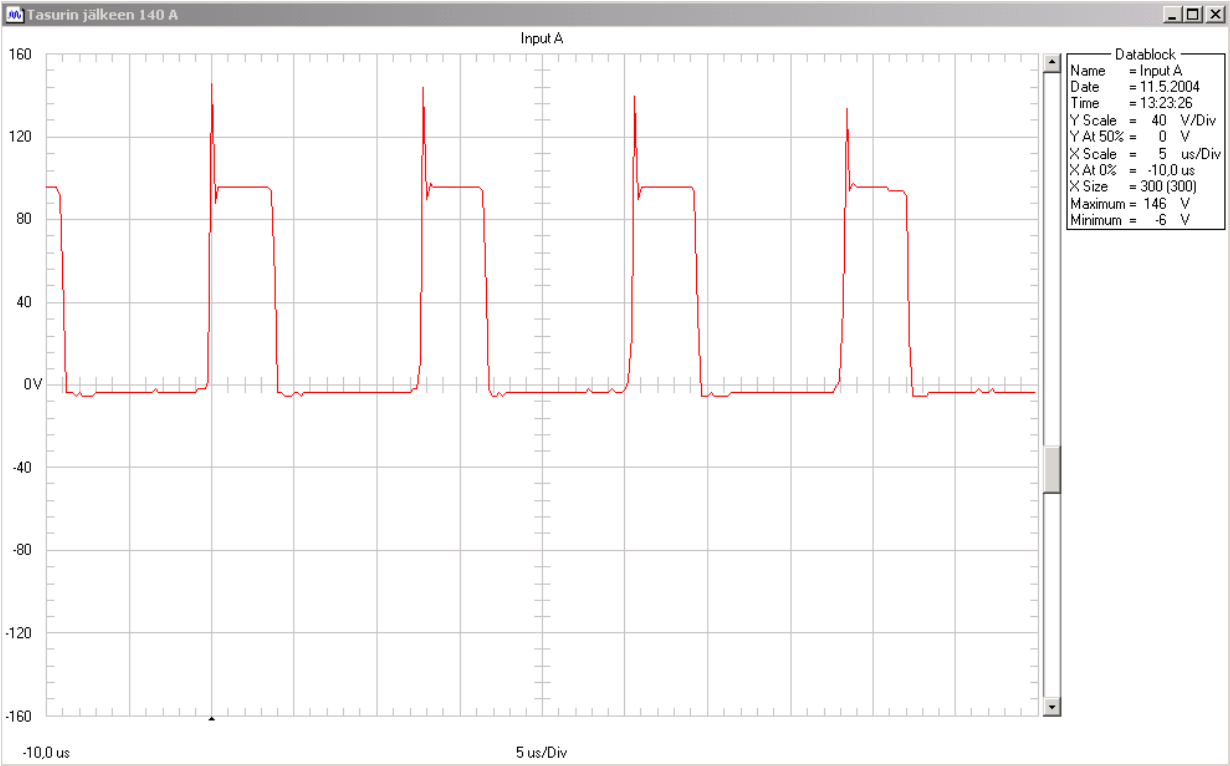


Main transformer T001 secondary voltage, max. (MMA)

# Measuring point C. Voltage after secondary rectifier

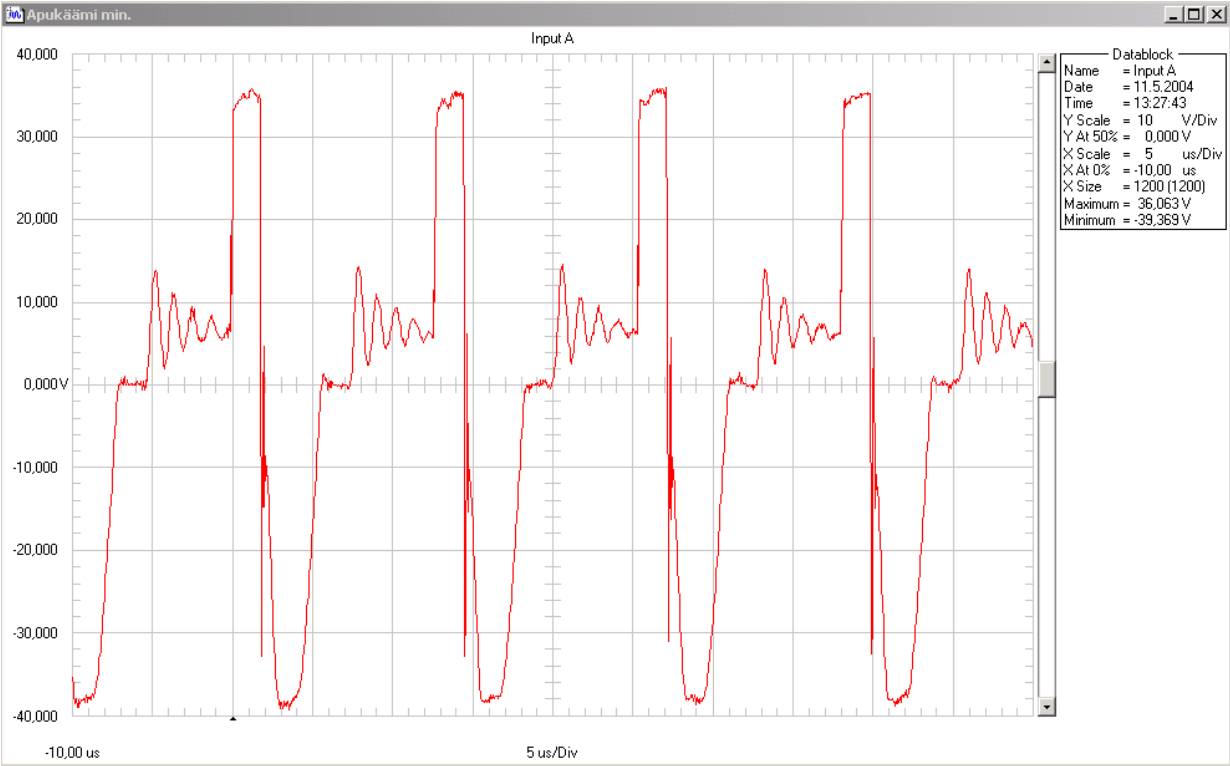


Voltage after secondary rectifier, min. (MMA)

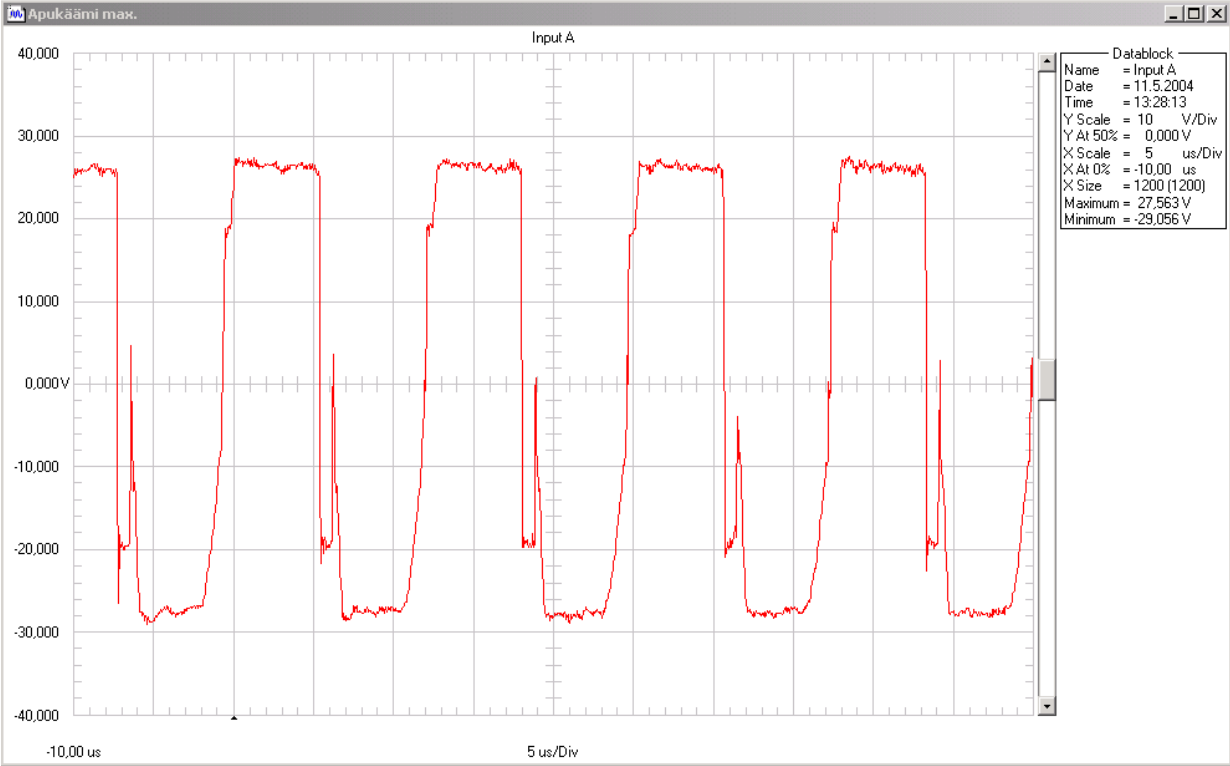


Voltage after secondary rectifier, max. (puikko)

# Measuring point D. Auxiliary coil voltage

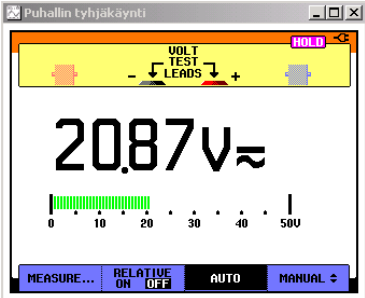


Auxiliary coil voltage, min. (MMA)

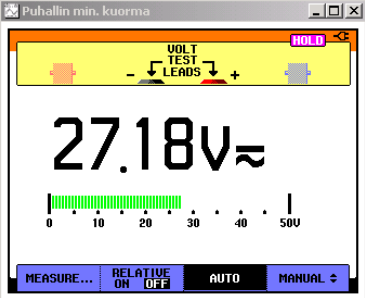


Auxiliary coil voltage, max. (MMA)

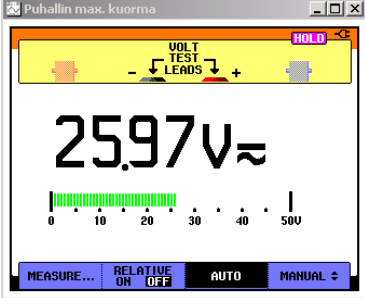
Measuring point E. Fan voltage



Idling

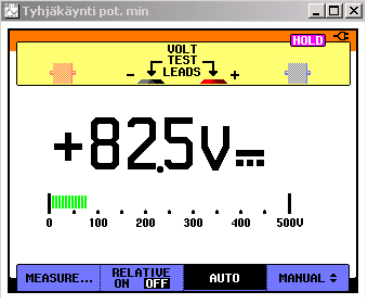


Min. load

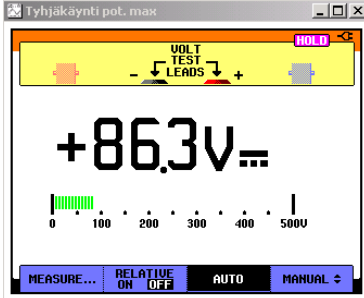


Max. load

Measuring point F. Pole voltage on idling



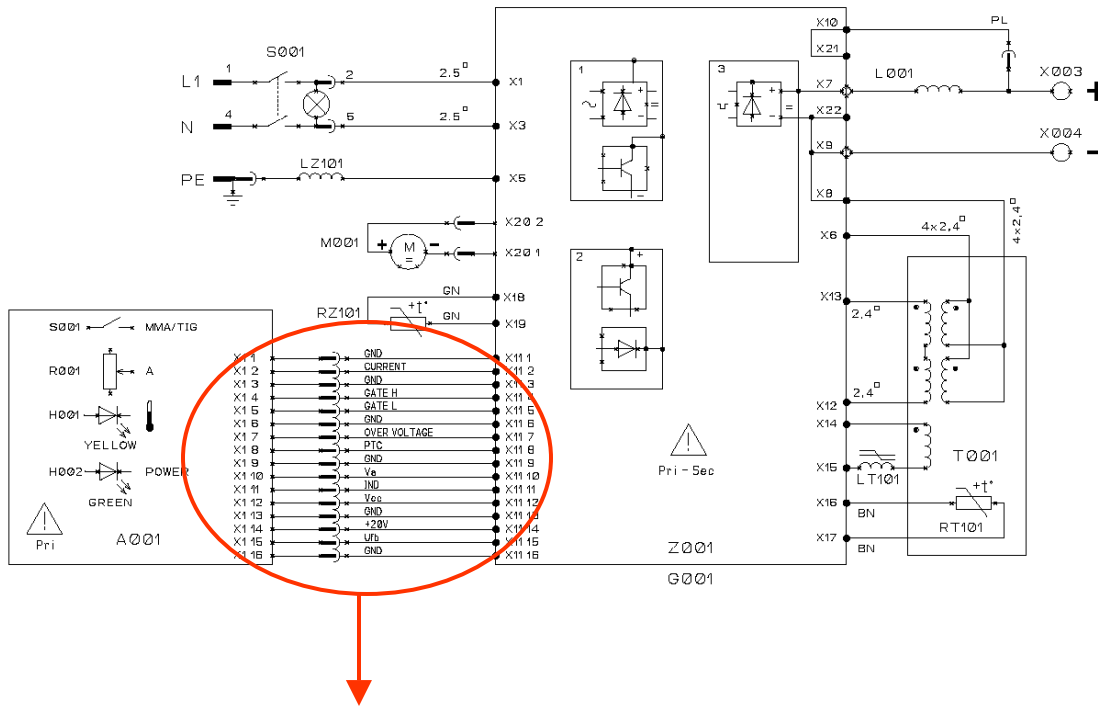
Power adj. Potentiometer, min.



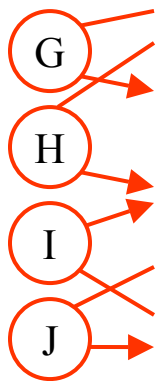
Power adj. Potentiometer, max.



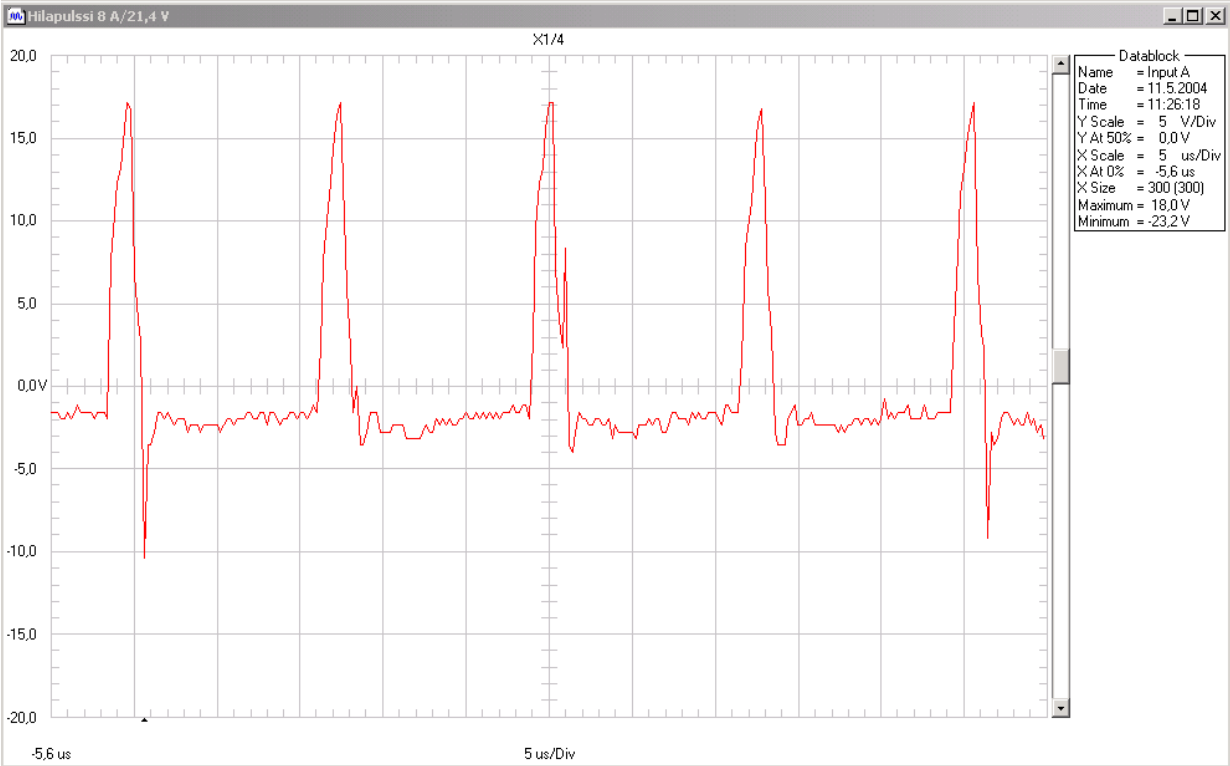
# Measuring point on the flat cable



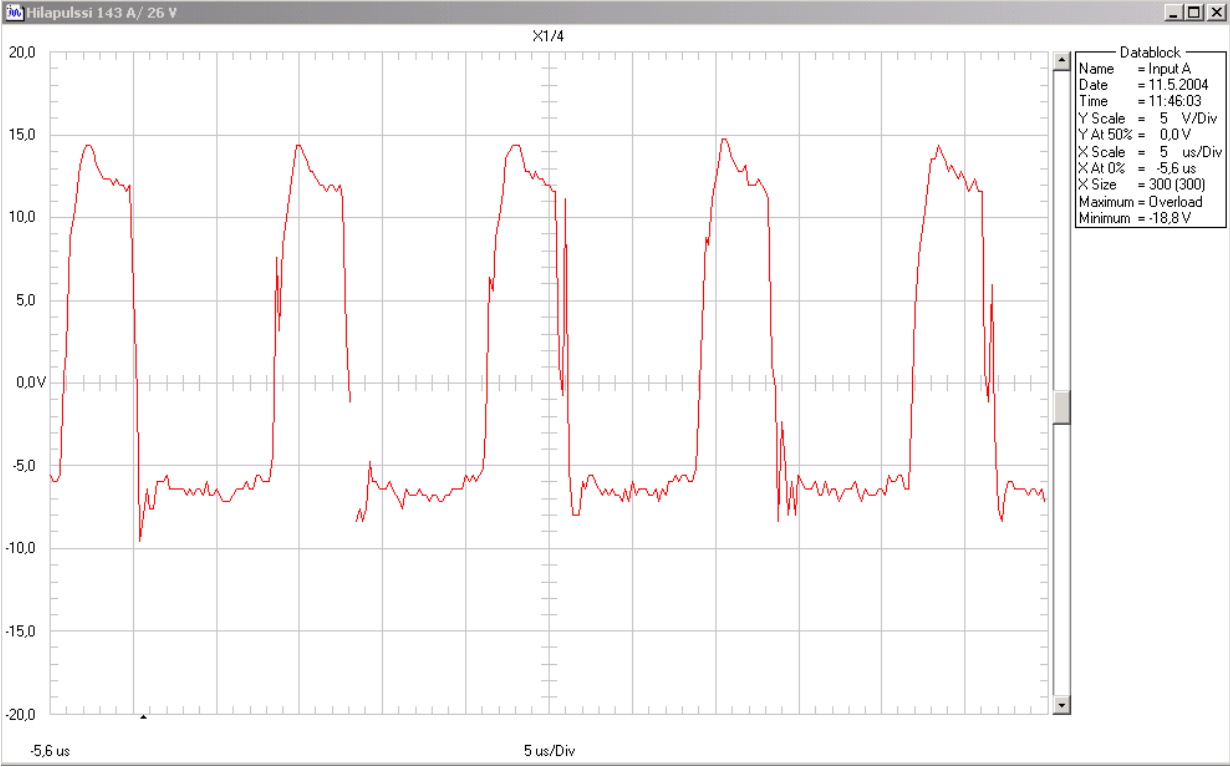
X1/1	GND
X1/2	Current info from primary
X1/3	GND
X1/4	Gate control, upper IGBTs
X1/5	Gate control, lower IGBTs
X1/6	GND
X1/7	Supply voltage watch
X1/8	Temperature watch (PTC:t)
X1/9	GND
X1/10	Auxiliary voltage (+20...30 V)
X1/11	Signal lamp H2 control / VRD
X1/12	Auxiliary voltage from DC-link
X1/13	GND
X1/14	Auxiliary voltage +20 V
X1/15	OCV control (~ +85 V)
X1/16	GND



# Measuring point G. Gate control, upper IGBTs

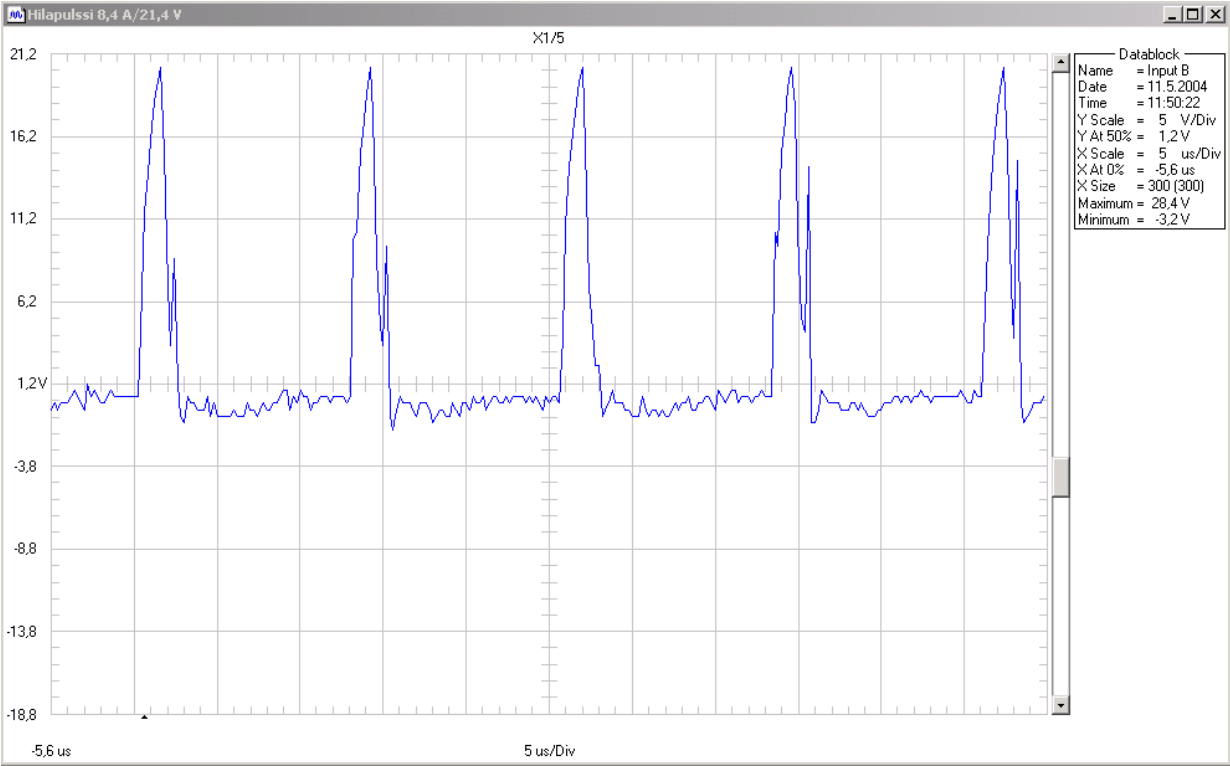


Gate pulse, min. (MMA)

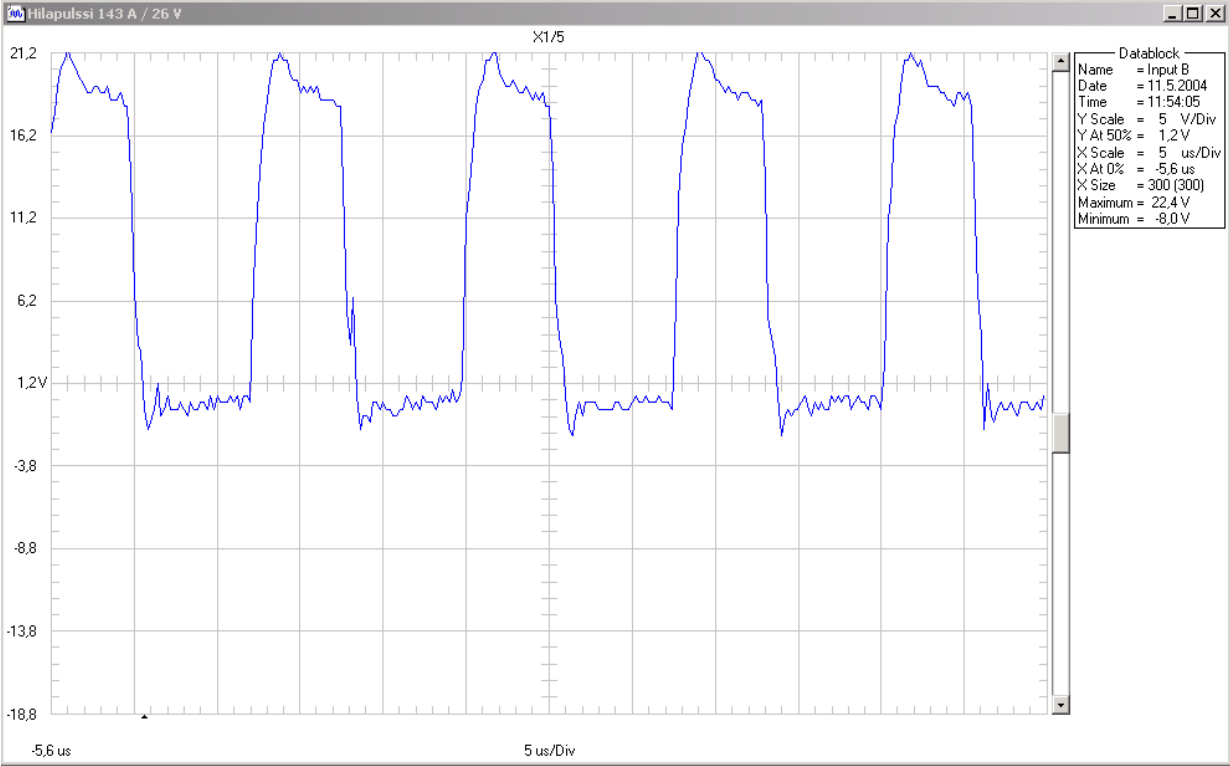


Gate pulse, max. (MMA)

# Measuring point H. Gate control, lower IGBTs

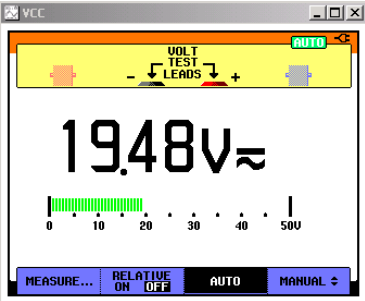


Gate pulse, min. (MMA)

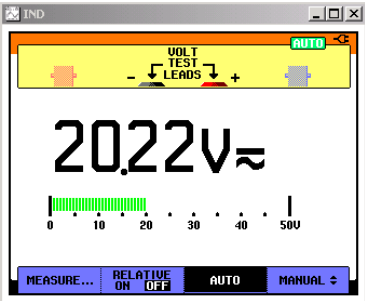


Gate pulse, max. (MMA)

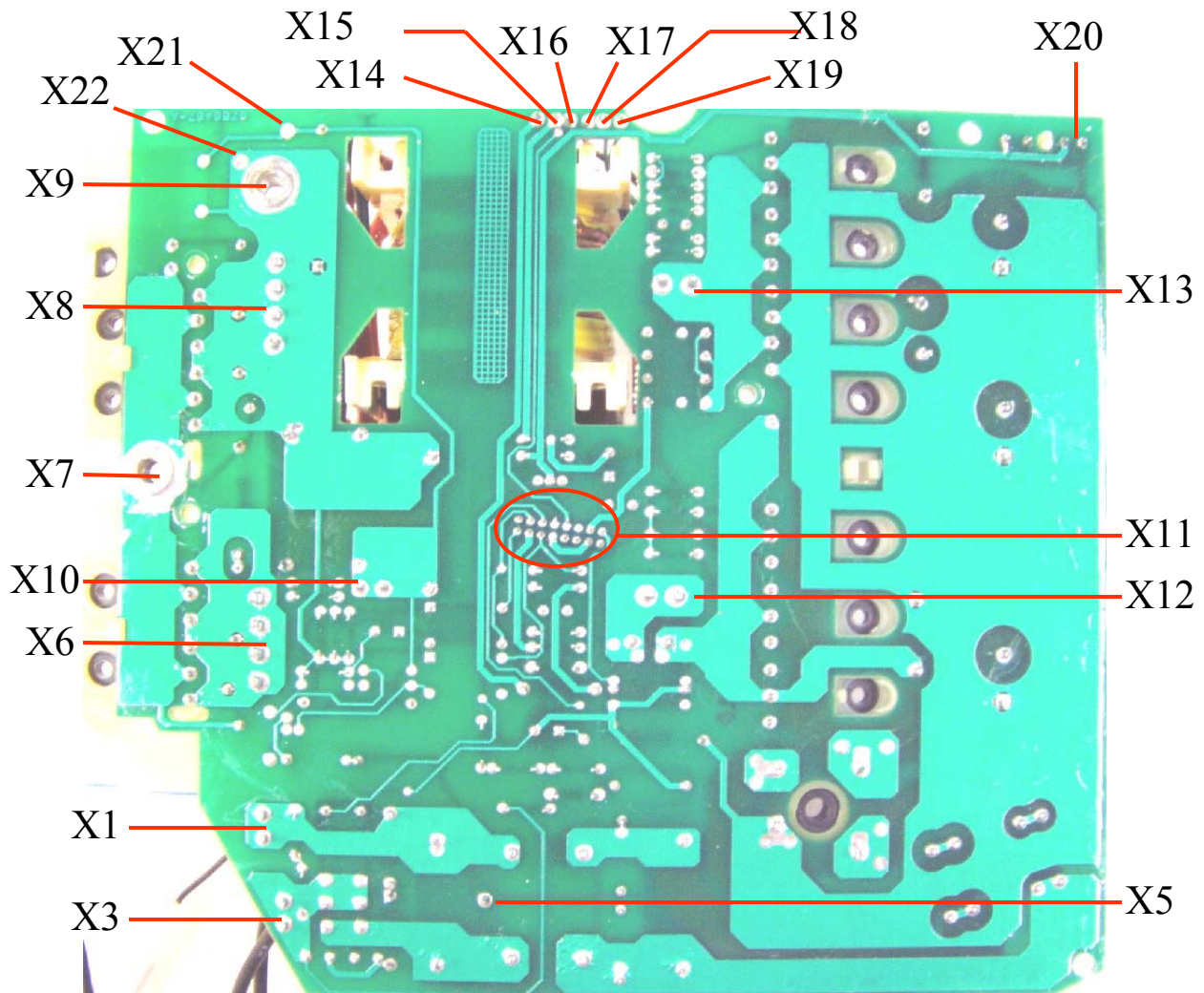
Measuring point I. Auxiliary voltage from DC-link



Measuring point J. Signal lamp H2 control / VRD ON

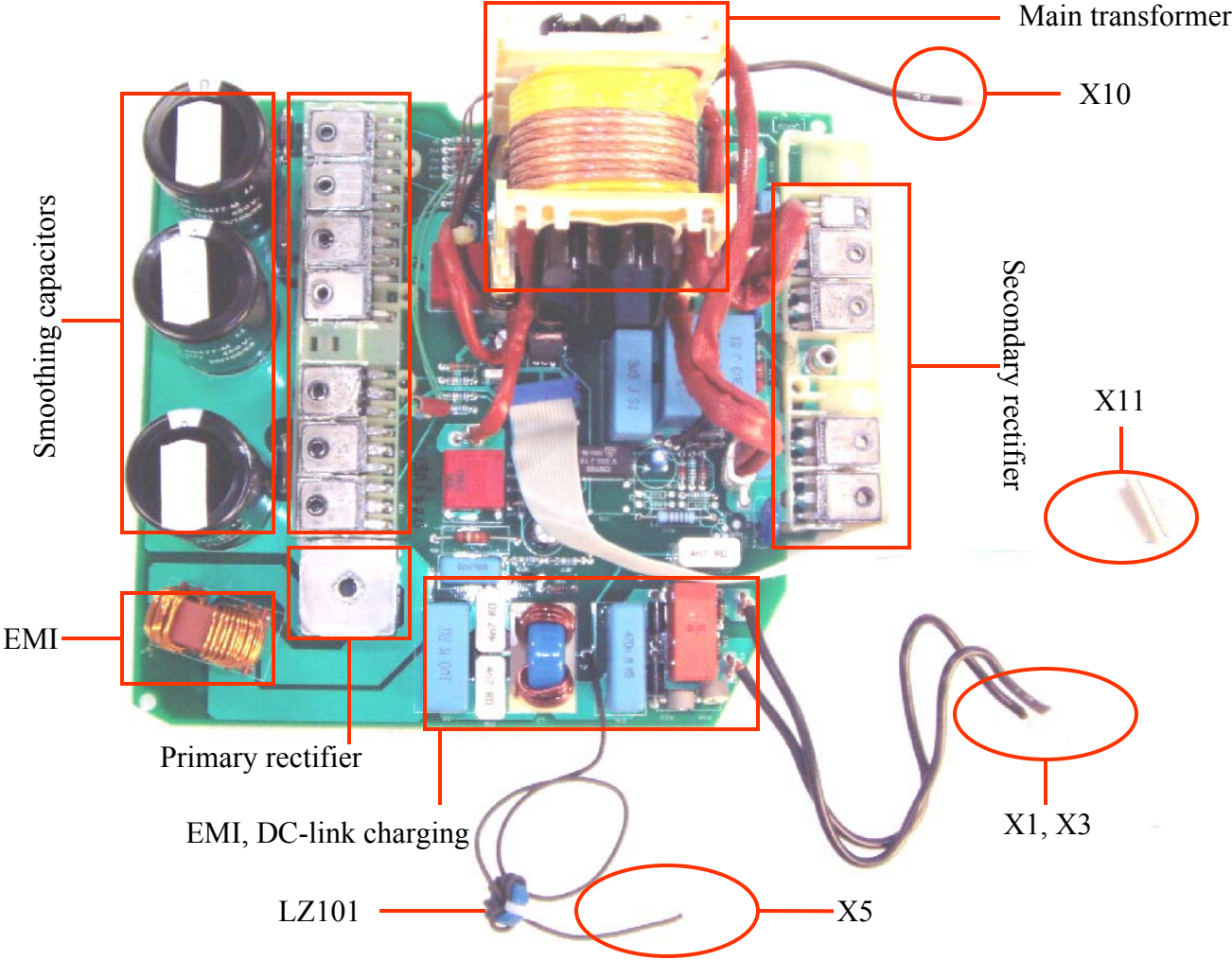


## Main circuit card Z001 connectors (Minarc 150)



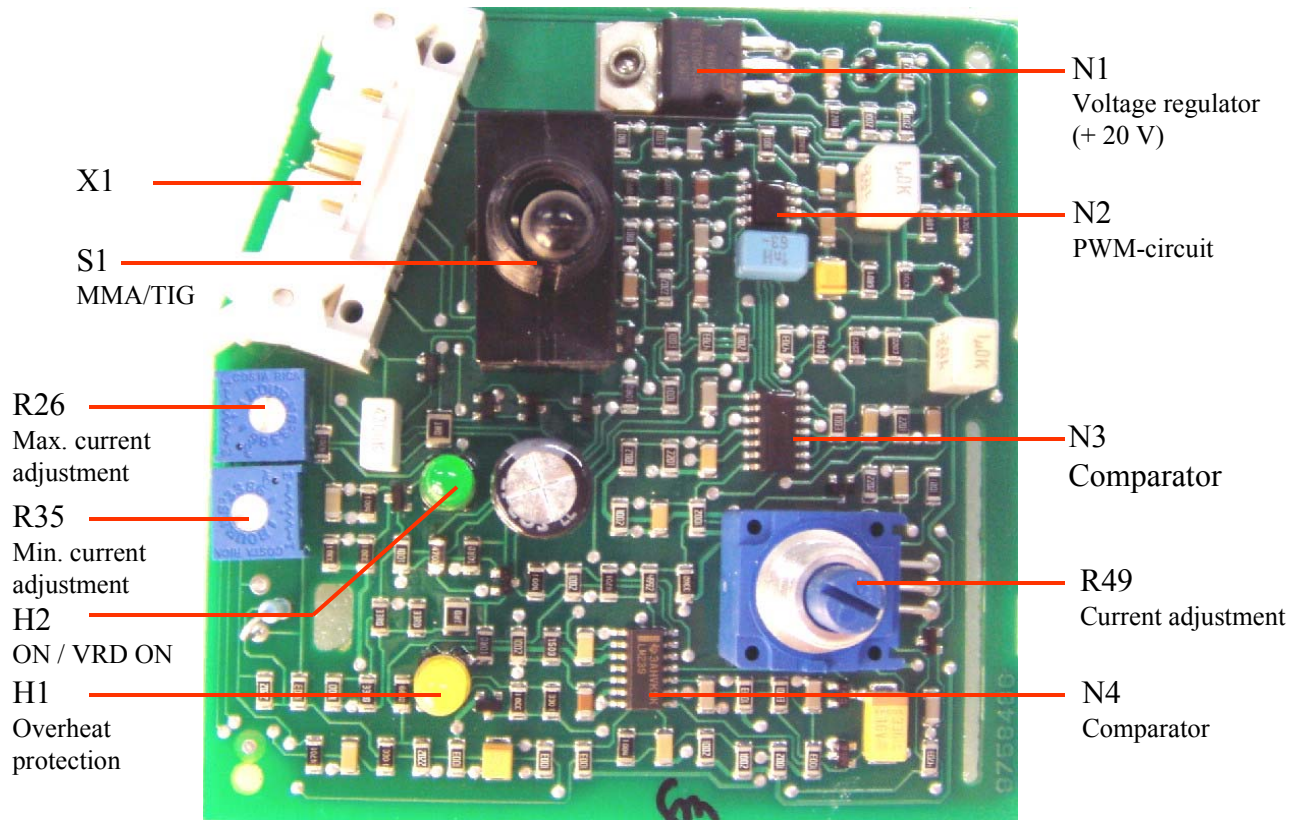
X1, X3	Supply voltage
X5	Protective earth
X6, X8	Main transformer T001 sec.
X7	Sec. Choke L001 (+)
X9	X004 (-)
X10	X003 (+)
X11	Connection, A001
X12, X13	Main transformer T001 primary
X14, X15	Main transformer T001 auxiliary coil
X16, X17	PTC RT101
X18, X19	PTC RZ101
X20/1, 2	Fan M001
X21	X003 (+)
X22	X004 (-)

# Main circuit card Z001 layout (Minarc 150)

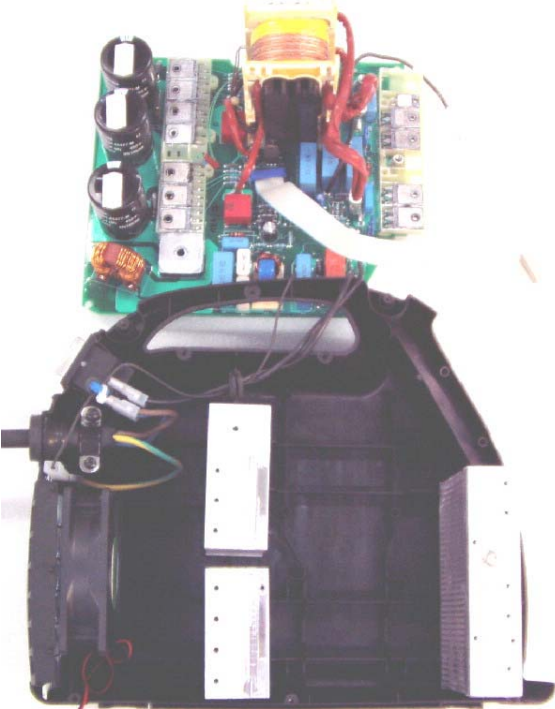
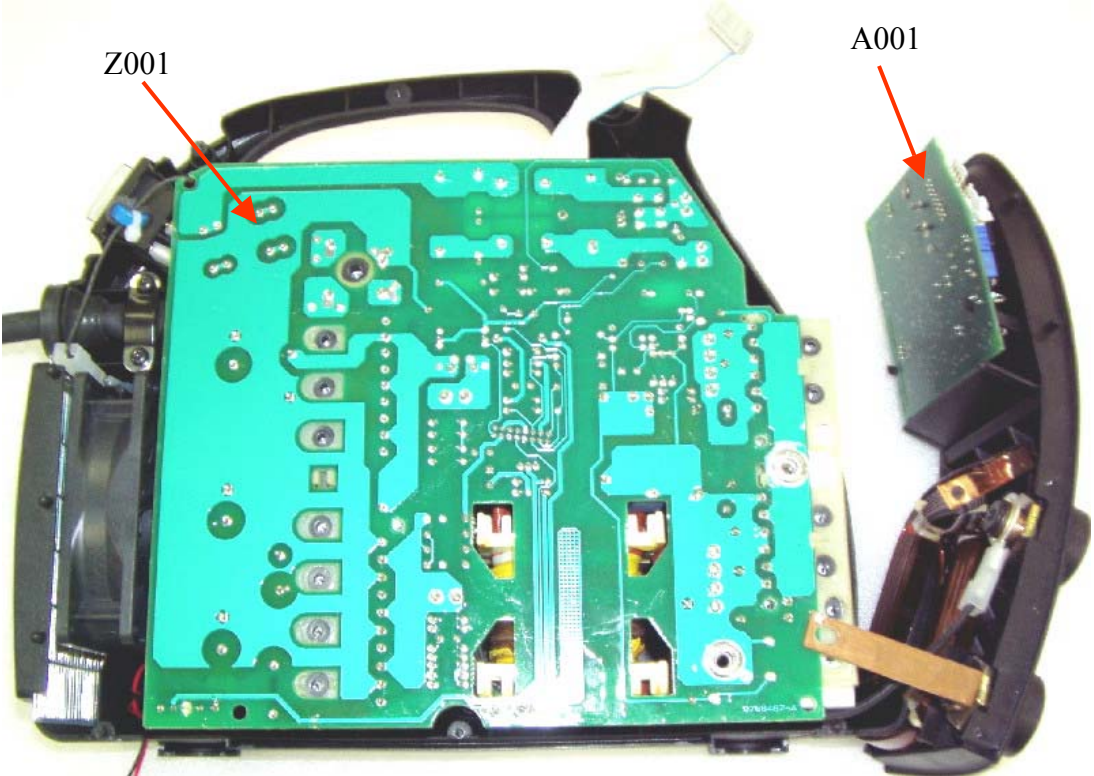




# Control card A001 layout

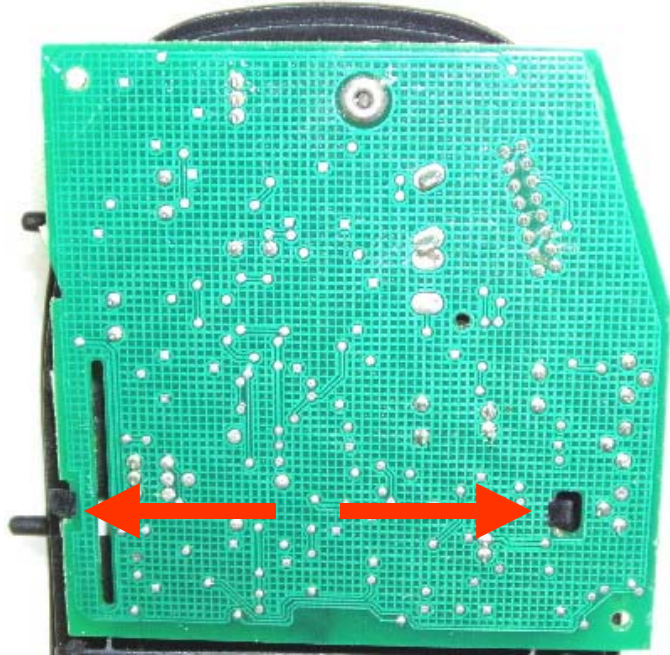


# Structure





Structure



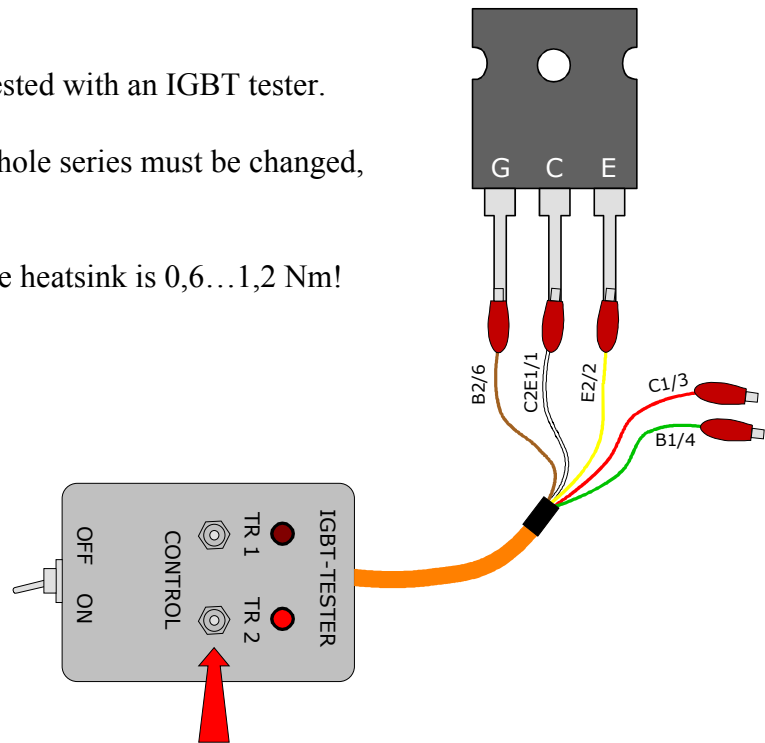
Extracting the control card A001

## IGBT-transistor testing

Discrete-IGBTs (50 A, 600 V) can be tested with an IGBT tester.

When changing damaged IGBTs, the whole series must be changed, plus the gate resistors (10Ω)!!

Discrete-IGBT's tightening torque to the heatsink is 0,6...1,2 Nm!



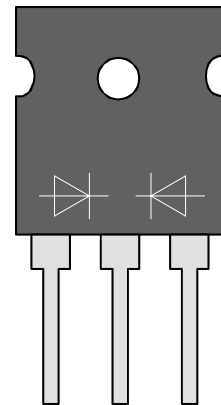
## Secondary diode testing

When testing secondary diodes the other coil end of the main transformer (T001) must be disconnected. Main transformer cable connector's may break if bent!

If secondary diodes are in short circuit, then the power source will not start.

The tightening torque for the secondary diodes is 0,6...1,2 Nm!

The soldering must be done carefully, because they are stressed with high current, approximately 30 A/ leg!



Notes

