SVM 800036913
Rev.00 08-2018

INVERTEC® 165SX

For use with machines having code numbers: 50395

SERVICE MANUAL

LINCOLN ELECTRIC EUROPE
www.lincolnelectric.eu

INDEX OF CONTENTS

1.0 TECHNICAL DESCRIPTION

1.1 DESCRIPTION

The system consists of a modern direct current generator for the welding of metals, developed via application of the inverter. This special technology allows for the construction of compact light weight generators with high performance. it's adjust ability, efficiency and energy consumption make it an excellent work tool suitable for coated electrode and GTAW (TIG) welding.

1.2 TECHNICAL SPECIFICATIONS

DATA PLATE

PRIMARY			
	160A		
Single phase supply	230 V		
Frequency	50/60 Hz		
Effective consumption	15 A		
Maximum consumption	21,5 A		
Fuse	16A		
SECONDARY			
Open circuit voltage	48,4 V		
Welding current	10 A ÷ 160 A		
Duty cycle 30%	160 A		
Duty cycle 60%	140 A		
Duty cycle 100%	120 A		
Protection class	IP 23		
Insulation class	H		
Weight	6,6 Kg		
Dimensions	170 x 320 x 395 mm		
European Standards	EN 60974.1 / EN 60974.10		

The machine can be connected to a motor generator of power meeting the dataplate specifications and having the following characteristics:

- Output voltage between 185 and 275 Vac.
- Frequency between 50 and 60 Hz.

IMPORTANT: MAKE SURE THE POWER SOURCE MEETS THE ABOVE REQUISITES. EXCEEDING THE SPECIFIED VOLTAGE CAN DAMAGE THE WELDING MACHINE AND INVALIDATE THE WARRANTY.

1.3 ACCESSORIES (OPTIONALS)

Consult the area agents or the dealer.

1.4 DUTY CYCLE AND OVERHEATING

Duty cycle is the percentage of 10 minutes at 40°C ambient temperature that the unit can weld at its rated output without overheating . If the unit overheats, the output stops and the over temperature light comes On. To correct the situation, wait fifteen minutes for unit to cool. Reduce amperage, voltage or duty cycle before starting to weld again (See page III).

1.5 VOLT - AMPERE CURVES

Volt-ampere curves show the maximum voltage and amperage output capabilities of the welding power source. Curves of other settings fall under curves shown (See page III).

2.0 INSTALLATION

IMPORTANT: BEFORE CONNECTING, PREPARING OR USING EQUIPMENT, READ SAFETY PRECAUTIONS.

2.1 CONNECTING THE POWER SOURCE TO THE MAINS ELECTRICITY SUPPLY.

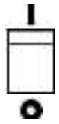
SERIOUS DAMAGE TO THE EQUIPMENT MAY RESULT IF THE POWER SOURCE IS SWITCHED OFF DURING WELDING OPERATIONS.

Check that the power socket is equipped with the fuse indicated in the features label on the power source. All power source models are designed to compensate power supply variations. For variations of + 15% a welding current variation of +- 0,2% is created.

BEFORE INSERTING THE MAINS PLUG, IN ORDER TO AVOID THE FAIL OF POWER SOURCE, CHECK IF THE MAINS CORRESPONDS TO THE WISHED MAIN SUPPLY.

ON - OFF SWITCH :

This switch has two positions: ON = I and OFF = O.



THIS CLASS A EQUIPMENT IS NOT INTENDED FOR USE IN RESIDENTIAL LOCATIONS WHERE THE ELECTRICAL POWER IS PROVIDED BY THE PUBLIC LOW-VOLTAGE SUPPLY SYSTEM. THERE MAY BE POTENTIAL DIFFICULTIES IN ENSURING ELECTROMAGNETIC COMPATIBILITY IN THOSE LOCATIONS, DUE TO CONDUCTED AS WELL AS RADIATED DISTURBANCES.

2.2 HANDLING AND TRANSPORTING THE POWER SOURCE

OPERATOR SAFETY: WELDER'S HELMET-GLOWES-SHOES WITH HIGH INSTEPS.

THE WELDING POWER SOURCE DO NOT WEIGHT MORE THAN 25 KG AND CAN BE HANDLED BY THE OPERATOR. READ WELL THE FOLLOWING PRECAUTIONS.

The machine is easy to lift, transport and handle, though the following procedures must always be observed:

1. The operations mentioned above can be operated by the handle on the power source.
2. Always disconnect the power source and accessories from main supply before lifting or handling operations.
3. Do not drag, pull or lift equipment by the cables.

2.3 CONNECTION AND PREPARATION OF EQUIPMENT FOR STICK WELDING.

• TURN OFF WELDER BEFORE MAKING CONNECTIONS.

Connect all welding accessories securely to prevent power loss. Carefully follow safety precautions described.

1. Fit the selected electrode to the electrode clamp.
2. Connect the ground cable quick connection to the negative (-) receptacle and locate the clamp near the welding zone.
3. Connect the electrode cable quick connection to the positive (+) receptacle.

Use the above connection for straight polarity welding; for reverse polarity turn the connection.

4. On the unit preset for coated electrode welding

(Rif.1 - Pic. 1 page 3.).

5. Adjust welding current with ampere selector (Rif.3 - Pic. 1 page 3.).
6. Turn on the power source

2.4 CONNECTION AND PREPARATION OF EQUIPMENT FOR GAS TUNGSTEN ARC WELDING (TIG) LIFT.

• TURN OFF WELDER BEFORE MAKING CONNECTIONS.

Connect all welding accessories securely to prevent power loss. Carefully follow safety precautions described.

1. On the unit preset Lift TIG welding (Rif.1 - Pic. 1 page 3.).

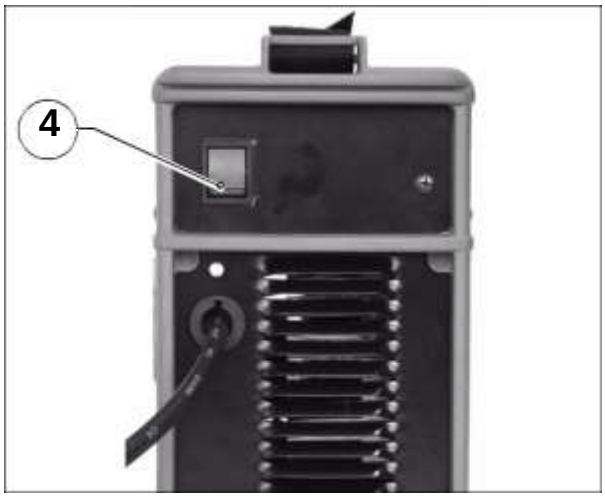
2. Fit the required electrode and nozzle to the electrode holder (Check the protrusion and state of the electrode tip).
3. Connect the ground cable quick connection to the positive (+) receptacle and the clamp near the welding zone.
4. Connect the torch power cable connector to the negative receptacle. (-).
5. Connect the gas hose to the regulator located on the gas cylinder.
6. Adjust welding current with ampere selector (Rif.3 - Pic. 1 page 3.).
7. Open the gas valve on the torch.
8. Turn ON the power source.

3.0 CONTROLS

3.1 FRONT PANEL - REAR PANEL

Picture 1.

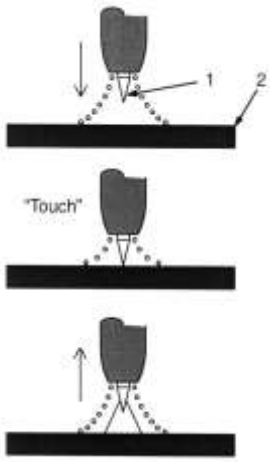
Picture 2.



1 - PROCESS SELECTOR (Rif.1 - Pic. 1 page 3.) : In this position welding can be used with rutile, basic electrodes, and specially coated electrodes.

LIFT TIG PROCEDURE

In this position the TIG welding process with lift mode ignition can be selected, as described previously.



TO IGNITE THE ARC , when TIG welding, proceed as follows: Touch the welding piece with the electrode; this will cause a short-circuit between the piece (2) and the electrode (1). Lift off the electrode; the arc will ignite. The integrity of the electrode tip is guaranteed by the low ignition current during short-circuiting between the welding piece and the electrode ignition is guaranteed even at minimum welding current settings; the operator can therefore work without contaminating the ambient with electromagnetic disturbance, normally caused by high frequency discharges.

The advantages can be this summarized:

1. l no need for high-frequency startups;
2. l no damage to the electrode tip during start-ups, regardless of ampere setting, thereby avoiding the presence of tungsten in the welding piece, common during scratch starting.

2 - FAULT LED (Yellow) (Rif.2 - Pic. 1 page 3.) : When the fault led lights on, the overheating occurs inside the unit due to the exceding the rated duty cycle. Happening that the welding operations have to be stopped, the welding power source has to be kept on until the led lights off so the unit is ready to weld again.

3 - CURRENT REGULATION (Rif.3 - Pic. 1 page 3.) : this potentiometer adjust the welding current range.

4 - ON - OFF SWITCH: This switch (Rif. 4 - Pic. 2 page 3.) has two positions: ON= I and OFF = O

5 - ARC LED ILLUMINATED (Green) (Rif.5 - Pic. 1 page 3.) : this led lights when the machine is turn on.

N.B: the power source is fitted with an anti-sticking device that disables power if output short circuiting occurs or if the electrode sticks, allowing it to be easily detached from the work piece. This device enters into operation when power is supplied to the generator, even during the initial checking period, therefore any load in-put or short circuit that occurs during this phase is treated as a fault and will cause the output power to be disabled.

4.0 MAINTENANCE

IMPORTANT: DISCONNECT THE POWER PLUG AND WAIT AT LEAST 5 MINUTES BEFORE CARRYING OUT ANY MAINTENANCE. MAINTENANCE MUST BE CARRIED OUT MORE FREQUENTLY IN HEAVY OPERATING CONDITIONS.

Carry out the following operations every three (3) months:

- Replace any illegible labels.
- Clean and tighten the welding terminals.
- Repair or replace damaged welding cables.
- Have specialized personnel replace the power cable if damaged.

Carry out the following operations every six (6) months:

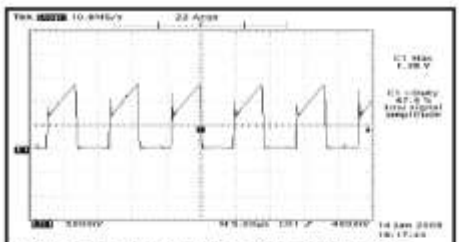
Remove any dust inside the generator using a jet of dry air.

Carry out this operation more frequently when working in very dusty places.

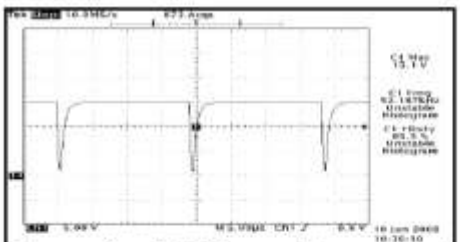
5.0 TYPES OF MALFUNCTIONING / WELDING FAULTS – CAUSES – REMEDIES

TYPES OF MALFUNCTIONING WELDING FAULTS		
The generator does not weld.	A) The main switch is off. B) The power lead is interrupted (lack of one or two phases). C) Other.	A) Switch on mains. B) Verify and repair. C) Ask for the intervention of the Assistance Centre.
During welding suddenly the outgoing current is interrupted, the green led is off and the yellow led goes on.	Overheating has occurred and the automatic protection has come on. (See work cycles).	Keep generator switched on and wait till temperature has dropped again (10-15 minutes) to the point where the yellow switch goes off again.
Welding power reduced.	Outgoing wires are not correctly attached. A phase is missing.	Check that wires are intact, that the pliers are sufficient and that they are applied to welding surface clean from rust, paint or oils.
Excessive jets.	Welding arc too long. Welding current too high.	Wrong torch polarity, lower the current values.
Craters.	Fast removal of the electrodes.	
Inclusions.	Inadequate cleaning and bad distribution of coating. Faulty movement of the electrodes.	
Inadequate penetration.	Forward speed too high. Welding current too low.	
Sticking.	Welding arc too short. Current too low.	Increase current values.
Blowing and porosity.	Damp electrodes. Arch too long. Wrong torch polarity.	
Jacks.	Currents too high. Dirty materials.	
The electrode fuses in TIG.	Wrong torch polarity. Type of gas not suitable.	

REPAIR PROCEDURE- MAIN TEST POINTS

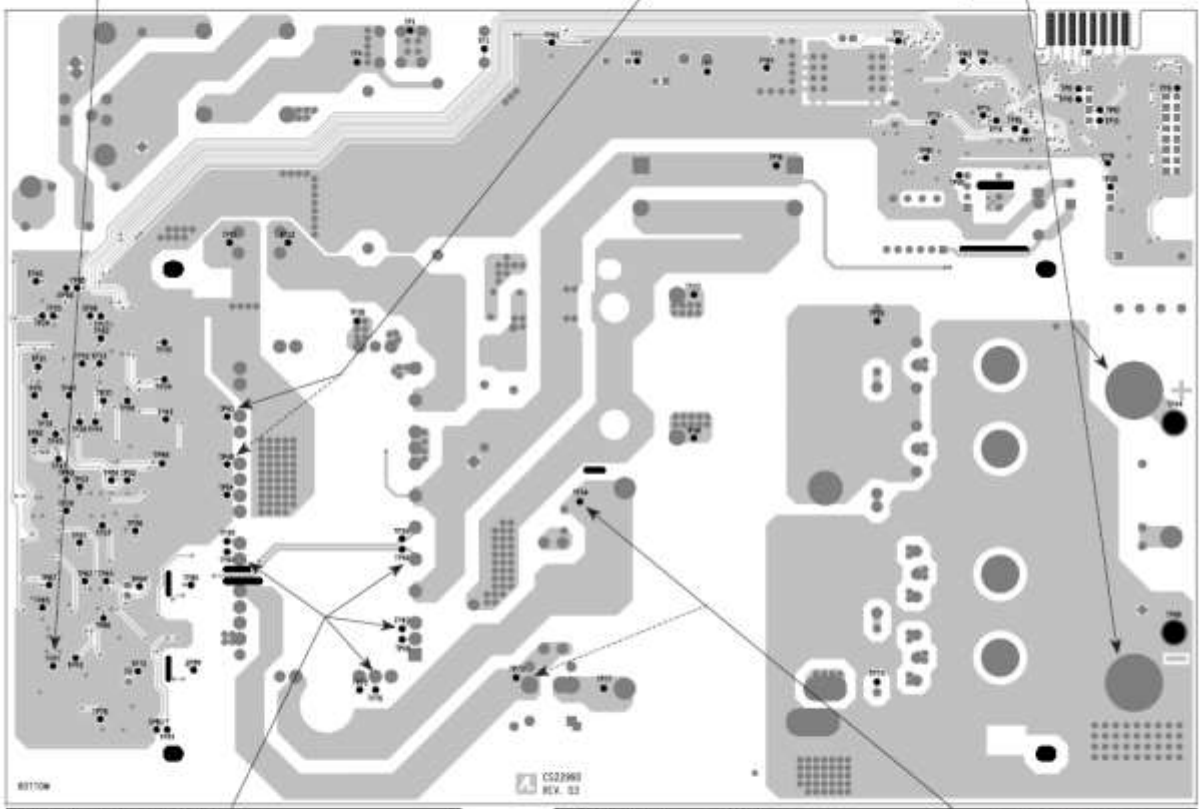


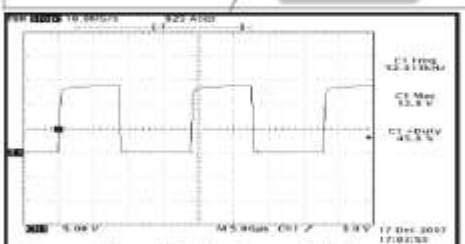
Under-Load primary side transduced current (measured between TP71 and GND1)



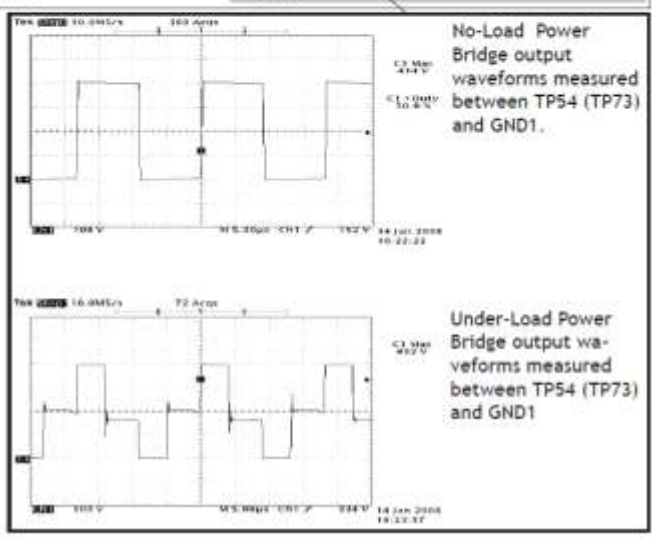
Gate waveform of PFC Power switches measured between TP43 (and TP49) and GND.

Check the output (with diodes test on the tester - no short circuit)





Gate waveform of Bridge Power Switches measured between the below couples of TP:
TP59 with respect TP61
TP58 with respect TP60
TP69 with respect TP67
TP75 with respect TP76



No-Load Power Bridge output waveforms measured between TP54 (TP73) and GND1.

Under-Load Power Bridge output waveforms measured between TP54 (TP73) and GND1

REPAIR PROCEDURE (continue)

STEP	OPERATION
1.	**Test Equipment Setup** a. Place an ultra-fast protection diode between TP9 (+15V) and TP18 (PFC_V). Use an 1A 600V rectifier (BYV26C) and dispose the anode on TP9. b. Place three 220ohm 1/4W resistors between GND1 and the following pins of X2 connector: i. X2-2 (LD1/TH_ALR) ii. X2-3 (LD2/LINE_ALR) iii. X2-7 (LD3/PWR_EN) c. Place a 4,7Kohm 1/4W resistor between CN1-2 (programming connector) and CN1-1. d. Place three 47Kohm 1/4W resistors between GND1 and the following pins of X2 connector: i. X2-12 (SDA) ii. X2-13 (SCL) iii. X2-14 (FREE_3) e. Place three 100nF 50V film capacitors between the same pins and GND1. f. Place a 22ohm 10W resistor between M1-1 (+FAN) and M1-2 (-FAN). g. Place a 0,56ohm 1000W resistor. (as load for the inverter power test). This load, during the test procedure, will be connected between BS1 (using a series smoothing inductor (ns. code 800045013) placed between BS1 and the load) and BS2. The power resistor can be arranged away from the Test Equipment (max 4 meters) using as connecting cable two strictly coupled insulated wires (in order to limit the radiated EMI). In case of fault during the on-line test, the load has to be able to support 3KW for three seconds minimum. 7. Place a stable connection bridge between X1-3 and GND1 (S.C. X1-3 with GND1 in order to enter the "Service Mode") 8. Place a stable connection bridge between CN1-8 and GND1 (S.C. CN1-8 with GND1 in order to enter the "Test Module") **Notes.** 1. When not specified, all the below voltages are referred to GND1. 2. The pass condition for all the below tests is indicated in brackets. 3. Input Impedance for the ATE acquisition unit has to be ≥ 1Mohm. 4. X2-10 signal has a certain amount of superimposed AC noise. Use a 500uS low pass filter to avoid acquiring problems (1Kohm, 470nF). 5. Perform the (On Line Test) (230Vac) using all the safety rules for an Equipment Under Voltage. As Power Supply AC Source use the secondary side of a suitable power insulation transformer. 6. Remember that in case of failure or interrupted test, before to move or manage the board, always discharge the main bulk capacitors (i.e. connecting a suitable 100ohm resistor between TP18 and a dedicated GND1 connection for at least 500mS). Alternatively monitor the bulk capacitor voltage and await until it reaches a voltage less than TBD voltage DC. 7. In case of failure, to avoid Test Equipment or DUT (Device Under Test) damage due to Power Supply short circuit or an appreciable input overcurrent during the "On Line Test", place a suitable and fast interrupting device between the AC power source and the DUT.
2.	**Visual Check** **Perform an accurate visual control of the assembled PCB; make sure there are no visible assembly errors, short-circuits or other discrepancies.**
3.	**Firmware Upload** **Using the programming connector (CN1) upload the 2.0 (soft00023_rev.01) firmware version on the microcontroller.**

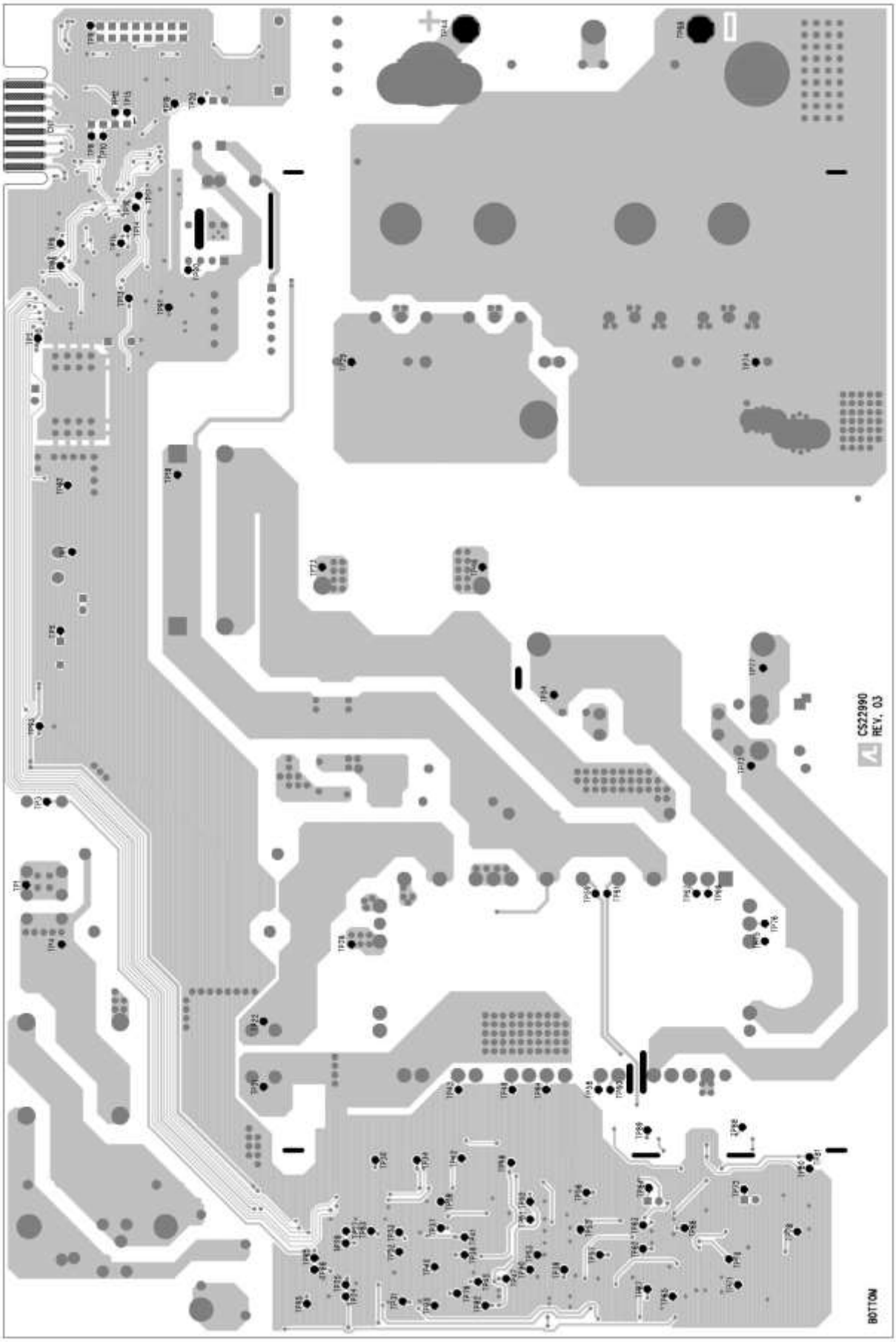
4.	**Off Line General Check** **Connect a suitable source of regulated voltage 15,8 Vdc (tolerance +/- 0,30Vdc ≈ 1.0 Amp of limiting current) between the test point TP9 (or/and X2-16) and grounding plane (GND1).** **Perform the following operations:** ○ **Current absorption. Verify the sourced current is less than 150 mA.** ○ **Regulated +5V. Verify the TP2 voltage (4,80 – 5,15 Vdc)** ○ **Test routine activity. Verify the CN1-2 voltage (Low Logic Level - ≤ 0,40 Vdc)** ○ **PFC Controller reference. Verify the TP52 voltage (7,38-7,61 Vdc)** ○ **PWM Controller reference. Verify the TP65 voltage (5,05-5,15 Vdc)** ○ **NTC reference. Verify the TP17 voltage (3,84-4,65 Vdc)** **Note: the TP17 voltage range refers to a Power Module temperature in the range 10-40 °C.** **If the PM_AA temperature is above 40 °C due to a repeated functional test, skip this step or wait for the module cooling.**
5.	**Off Line Interface Connector and µC Activity Check (Part 1)** **Connect to X2-4 a source of regulated DC voltage (0,77Vdc +/- 3%)** **Using a 1Kohm serial current limiting resistor connect to TP35 a source of regulated DC voltage (5,0 Vdc).** **Perform the following operations:** ○ **Ports Status 1. Verify the X2-5 and X2-8 voltage (High Logic Level - ≥ 4,65 Vdc)** ○ **Ports Status 2. Verify the X2-2, X2-3 and X2-7 voltage (near zero Vdc)** ○ **Relay Status. Verify the TP3 voltage (≥ 14,1Vdc)** ○ **Fan Status. Verify the TP7 voltage (≥ 13,1Vdc)** ○ **PFC Activity (SW gate). Verify the absence of activity on TP43 (near zero Vdc)** ○
6. 1/2	**Off Line Interface Connector and µC Activity Check (Part 2 - PFC Check)** **Connect TP17 to GND1.** **Connect X2-14 and X2-12 to GND1 (µC Ports Enable).** **Connect a suitable source of regulated voltage 3 Vdc (tolerance +/- 0,5 Vdc 1,0Amp of limiting current) between the test point TP51 and grounding plane (GND1)** **Await 800mS minimum.** **Proceed with the following tests:** ○ **PFC Activity (QP1 and QP2 gate). Acquire the gate waveform on the power switches (TP43 and TP49).** **Verify as follows:** ○ **Frequency of signal (37,0 – 44,0KHz)** ○ **Amplitude of signal (between 14,0 and 16,0 Vdc)** ○ **Absence of overshoots** ○ **Duty cycle (about 95%)** ○ **Leading and trailing edge of the signal as exemplified in Fig.1** **Please refer to Fig.1 for a shape comparison of the waveform.** **Note: Frequency of signal can be checked for one switch gate only.**

6 2/2	**-Ports Status 1. Verify the X2-5 and X2-8 voltage (0,75-1,05Vdc)** **-Ports Status 2. Verify the X2-2 voltage (1,60-2,30Vdc)** **-Relay Status. Verify the TP3 voltage (≤ 0,20Vdc)** **-Fan Status . Verify the TP7 voltage (≤ 0,85Vdc)**
7	**Off Line Interface Connector and µC Activity Check (Part 3 – Inverter Check)** **Remove the short circuit between TP17 and GND1.** **Short circuit X2-13 to GND1 (Inverter Enable).** **Using a suitable differential probe, proceed with the following tests:** o **SW1 gate WF. Acquire the gate waveform on TP59 with respect TP61.** o **SW2 gate WF. Acquire the gate waveform on TP58 with respect TP60.** o **SW3 gate WF. Acquire the gate waveform on TP69 with respect TP67.** o **SW4 gate WF. Acquire the gate waveform on TP75 with respect TP76.** **On the acquired waveforms verify as follows:** **- Amplitude of signal (between 13,0 and 15,0 Vdc)** **- Absence of overshoots** **- Duty cycle (45,0 – 47,0%)** **- Trailing and leading edge of the signal as exemplified in Fig.2** **Please refer to Fig.2 for a shape comparison of the waveform.** **Note: Frequency of signal is in the range 55,0 – 60,0 KHz**
8	**On Line Test (General Check)** **Remove the three connections between X2-13, X2-12, X2-14 and GND1.** **Disconnect the source of regulated DC voltage from X2-4.** **Disconnect the DC regulated source from TP9.** **Disconnect the DC regulated source from TP35.** **Disconnect the DC regulated source from TP51** **Warning: all the following tests will be made using the mains line voltage.** **Follow all the safety rules for the working on an Equipment Under Voltage.** **In case of failure or interrupted test, before to manage the DUT, always check for the main bulk** **capacitor voltage and wait his voltage reaches a level less than 30 Vdc.** **Connect the nominal power supply voltage (230Vac +/- 5% – 50Hz) between the pins PZ1 and PZ2.** **Await 400mS minimum.** o **Aux Power Supply (+15V under Light Load). Verify the TP9 voltage (14,7 – 16,9 Vdc)** o **Test routine activity. Verify the CN1-2 voltage (Low Logic Level - ≤ 0,40 Vdc)** o **PFC OFF Status Check. Verify the X2-7 voltage (near zero Vdc)**

9	**On Line Test (PFC block)** **Connect to X2-4 a source of regulated DC voltage (0,77Vdc +/- 3%).** **Connect X2-14 to GND1 (µC Ports Enable/PFC enable).** **Await 2,5 sec. minimum.** **Proceed with the following tests:** o **Line Status / Port Status. Verify the X2-3 voltage (1,60-2,30Vdc)** o **PFC Regulated Voltage Pass Flag / Port Status. Verify the X2-7 voltage (1,60-2,30Vdc)**
10	**On Line Test (Inverter NoLoad Check)** **Connect X2-12 and X2-13 to GND1 (+15V Loading and Inverter Enable)** **Proceed with the following tests:** o **Aux Power Supply (+15V under Nominal Load). Verify the TP9 voltage (14,5 – 16,7 Vdc)** o **V_OUT. Verify the X2-9 voltage (3,0 – 3,94 Vdc)** o **Power Bridge output waveforms. Using a suitable oscilloscope voltage probe acquire the waveforms on TP54 and TP73 (with respect GND1).** **Verify as follows:** **- Amplitude of signal about 400Vdc.** **- Duty cycle about 50%** **- Frequency of signal (47,0 – 61,0KHz)** **- Trailing and leading edge of the signal as exemplified in Fig.3.** **Note: the above signal is frequency modulated with a delta f of about 6,5KHz.** **Please refer to Fig.3 for the waveform comparison.**
11 1/2	***On Line Test (Inverter OnLoad Check)*** ***Warning. To avoid thermal protection action, the "ON Line Test" step (the following step) has to*** ***be closed in a maximum time of about 60 sec. In case of a failed measure , as first action, remove*** ***the connection between X2-13 and GND1. This, shutdowns the power stage.*** ***Connect the Power Load (0,56ohm, 1000W) as indicated in the "Test Equipment Setup".***

11 2/2	**Proceed with the following tests:** o **Power Bridge output waveforms. Using a suitable oscilloscope voltage probe acquire the waveforms on TP54 and TP73 (with respect GND1).** **Verify as follows:** **- Amplitude of signal: near 400Vdc.** **- Duty cycle about 50%. This means that the powering phase duration (the time slot where voltage is near 400 or 0Vdc) is comparable with the free weeling phase duration (the time slot where the voltage is near 200Vdc).** **- Trailing and leading edge of the signal as exemplified in Fig.4.** **Please refer to Fig.4 for the waveform comparison.** **Note 1: voltage during the free wheeling phase is near 200Vdc. A bit of discrepancy from this value is normal.** **Note 2: the acquired signal is frequency modulated with a delta f of about 6,5KHz.** - **V_OUT. Verify the X2-9 voltage (1,0 - 2,11 Vdc)** - **CUR_OUT (averaged output current). Verify the X2-10 voltage (0,92 – 1,06Vdc)** - **Transduced current. Acquire the waveform between TP71 and GND1.** **V** **Verify as follows:** **1. Peak of signal about 1,40Vdc.** **2. Duty cycle near 50%.** **Note: the signal is frequency modulated with a delta f of about 6,5KHz.** **Please refer to Fig.5 for the waveform comparison.**
12.	**Waiting for the capacitor bank discharge.** Remove the connection between X2-13 and GND1. Disconnect the power source (230Vac +/- 5% – 50Hz) from the pins PZ1 and PZ2. Await TP18 voltage falls below 30 Vdc. (estimated time about 7 sec.) Note: to speed up the discharge cycle, connect a 47R, 10W wire wound resistor between TP18 and a reserved GND1 reference point.
13.	**End of the Procedure** **Remove all the measurement equipment connected to the PCB and remove the DUT.**

REPAIR PROCEDURE – TEST POINTS



REPAIR PROCEDURE – REFERENCE WAVEFORMS

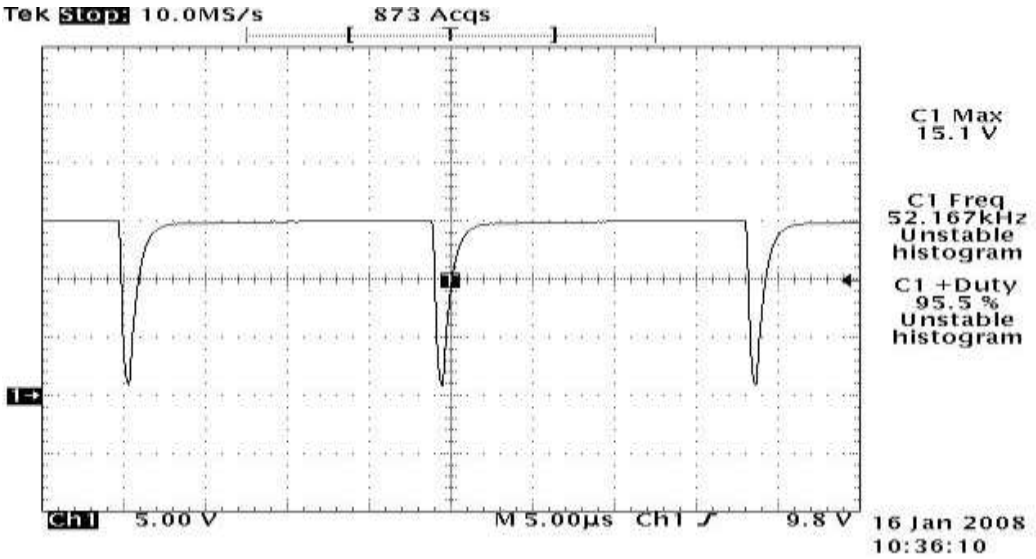


Fig. 1: Gate waveform of PFC Power switches measured between TP43 (and TP49) and GND.

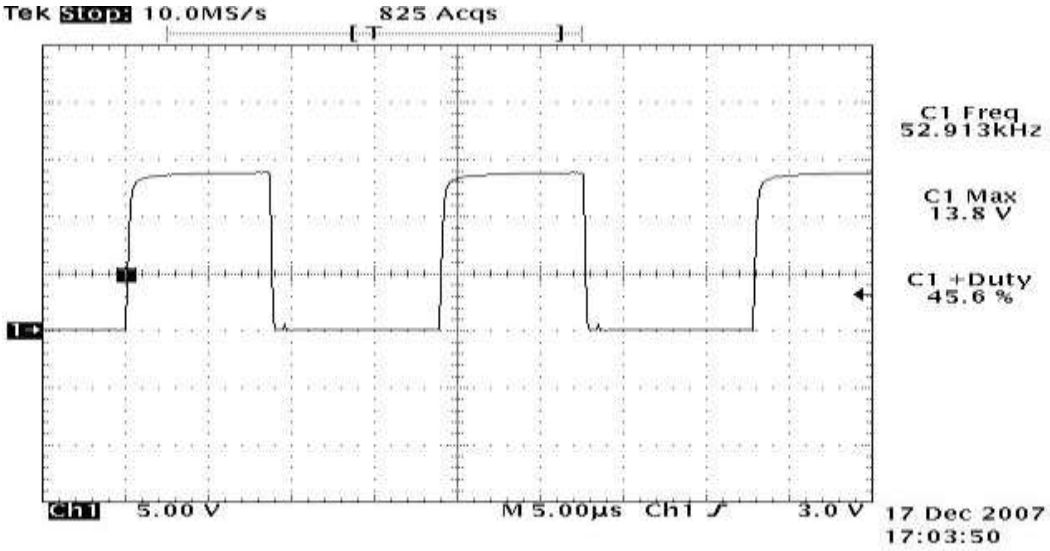


Fig. 2: Gate waveform of Bridge Power Switches measured between the below couples of TP:

TP59 with respect TP61
TP58 with respect TP60
TP69 with respect TP67
TP75 with respect TP76

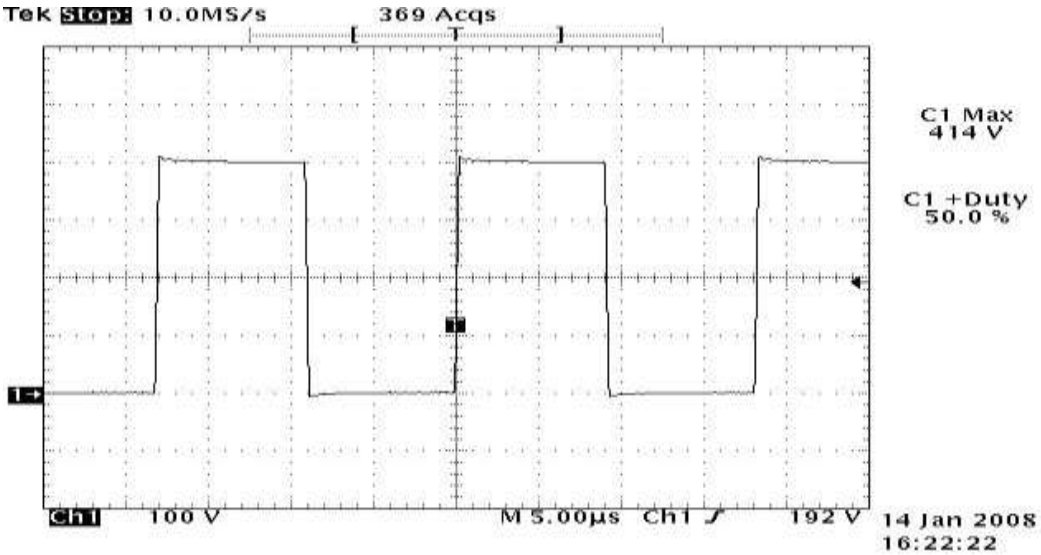


Fig. 3: No-Load Power Bridge output waveforms measured between TP54 (TP73) and GND1.

REPAIR PROCEDURE – REFERENCE WAVEFORMS

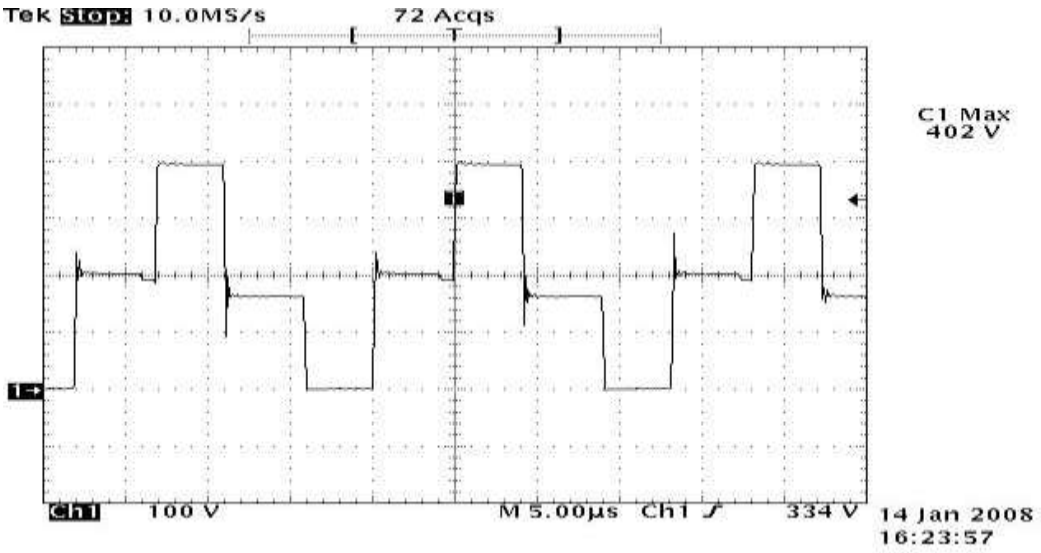


Fig. 4: Under-Load Power Bridge output waveforms measured between TP54 (TP73) and GND1

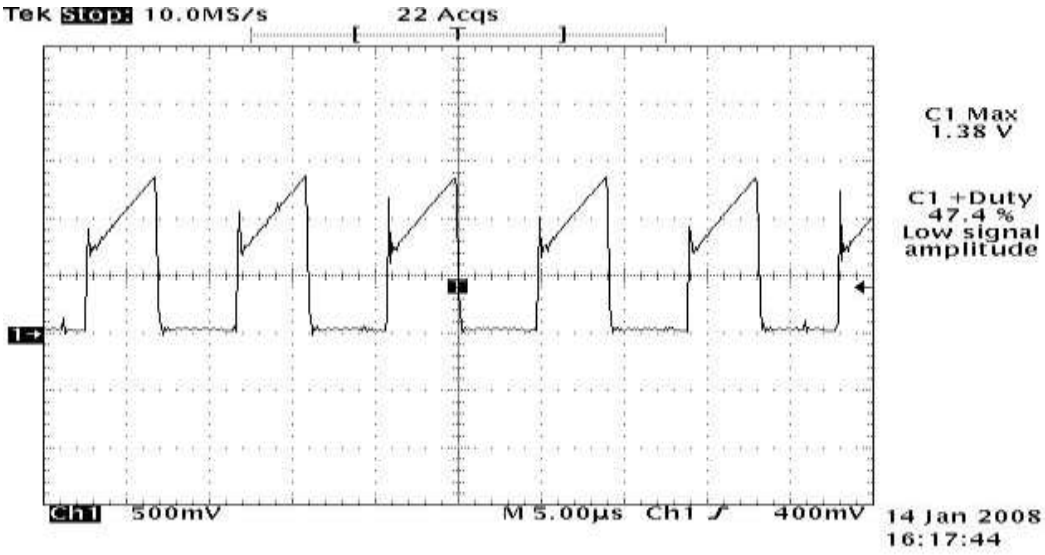


Fig. 5: Under-Load primary side transduced current (measured between TP71 and GND1)

REPAIR PROCEDURE – QUICK REPAIR REVIEW

- Check output BS1 - BS2 with diode tester, no short circuit.
  Action - change output diodes DO1 ÷ DO4 (must be paired) or change whole PCB.
- Check resistor R60, value 47R by ohmmeter.
  Action - change resistor with new one and check relay RL1 whether working properly.
- Check rectifier - module IG1 (IG1-A), pins 17,19,20,22, no short circuit.
  Action – change the whole PCB.
- Check full bridge transistor module IG1 (IG1-D), pins 7 - 9, 2 - 3, 48 - 49, 37 - 38, no short circuit.
  Action - check and change corresponding diodes Z5, Z6, Z7, Z8. If at module short circuit still remains, change whole PCB.
- Check PFC transistor in module - pin 29 - pin 30 and pin 30 - pin 32 (IG1-C).
  Action - check Z3, Z4, no short circuit. Change Z3, Z4 - if short circuit still remains, change whole PCB.
- Connect a suitable source of regulated voltage 15,3 VDC (tolerance ±0,30VDC ≈ 1.0 Amp of limiting current) between the test point TP9 (or/and X2-16) and grounding plane (GND1).

  Perform the following operations:
  6a. Current absorption - verify the sourced current is less than 120mA.
  Action - check too hot components (temporary increase current limitation) and change it.
  6b. Regulated +5V - verify the TP2 voltage (4,80 - 5,15 VDC). Check IC1, pin 1 - GND1, no short circuit.
  Action - Check temperature of processor, probably is damaged, change whole PCB.
  6c. PWM Controller reference - verify the TP65 voltage (5VDC, +-0.3V).
  Action - change IC6 or whole PCB.
  6d. NTC reference - verify the TP17 voltage (3,84 - 4,65VDC).
  Action - check corresponding components around TP17.
- Check soft start - verify presence of 14-15VDC, TP3 - GND1.
  Action - check corresponding components around TP3.
- Check fan status - verify presence of 13VDC, M1-1 - M1-2.
  Action - check corresponding components around TP5.
- PFC activity - verify the absence of activity on TP43 (near zero VDC).
- On Line test
  10a. Connect fan (M1).
  10b. Connect input (230VAC, PZ1-PZ2), after 2s relay RL1 must be ON.
  10c. Check the functionality of the fan.
  10d. Check C41 and C42, presence of 400VDC (be careful, high voltage!).
  If 400VDC is not present, probably PFC is faulty.
  10e. Check output voltage between BS1 - BS2, presence of 50VDC.
  Note: If you measured 40VDC probably PFC malfunction.

Check voltage between ground GND1 and TP9 15VDC and TP2 5VDC. Action - check IC3 and IC1, capacitors in corresponding ways check too.

RETEST AFTER REPAIR

Should a machine under test be rejected for any reason requiring the removal of any mechanical part that could affect the machine's electrical characteristics, or if any electrical components are repaired or replaced, the machine must be retested.

Machine input and output

INVERTEC 165SX

Input Voltage	Input Current	Rated Output
230Vac/1ph/50Hz	21,5A max	160A@30%

Output current range SMAW	**10 – 160 Amps**

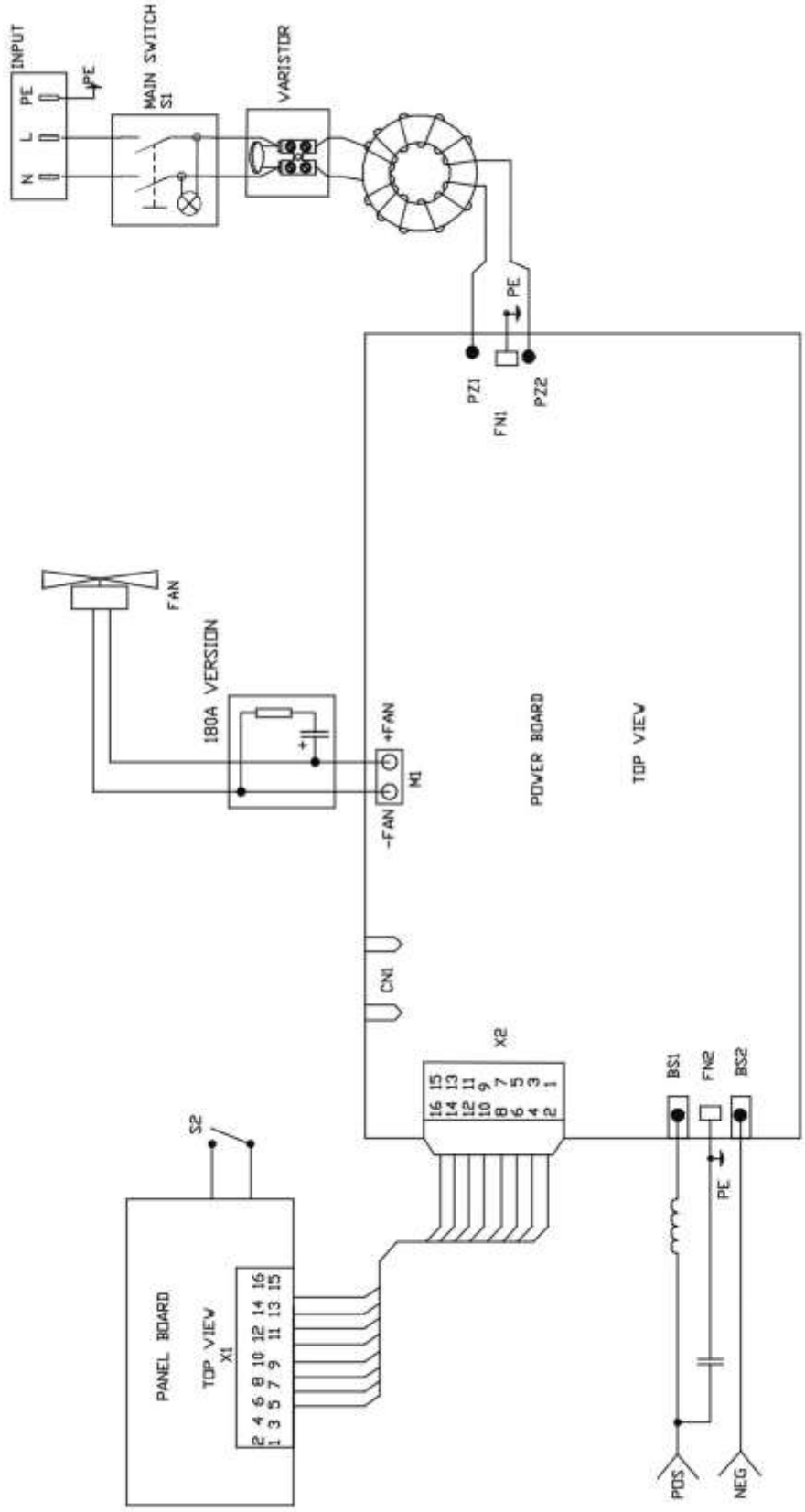
Maximum Open Circuit Voltage	**48,4 Vdc**

IMPORTANT !

After the repair the unit has to be tested accordingly to the norm **EN60974-4 Arc welding equipment "In-service inspection and testing"**

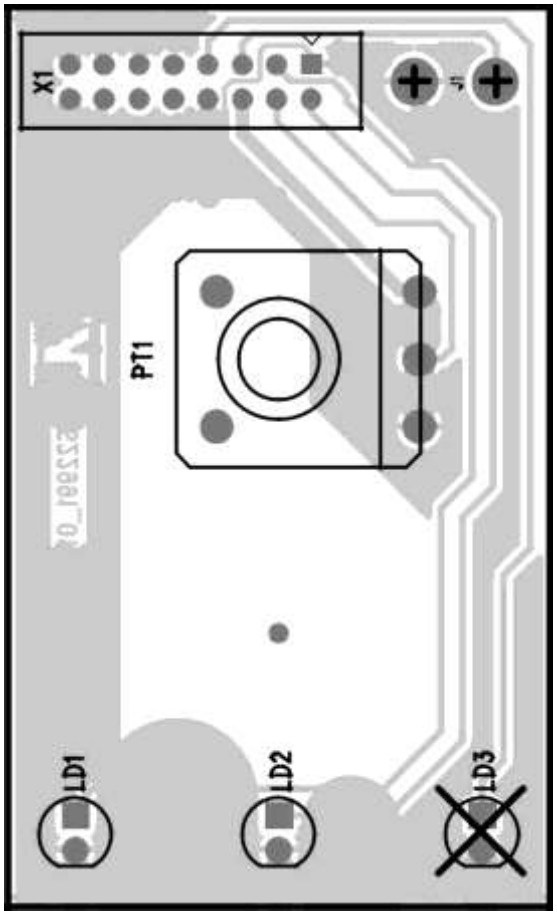
ELECTRICAL SCHEMATICS

Block Diagram



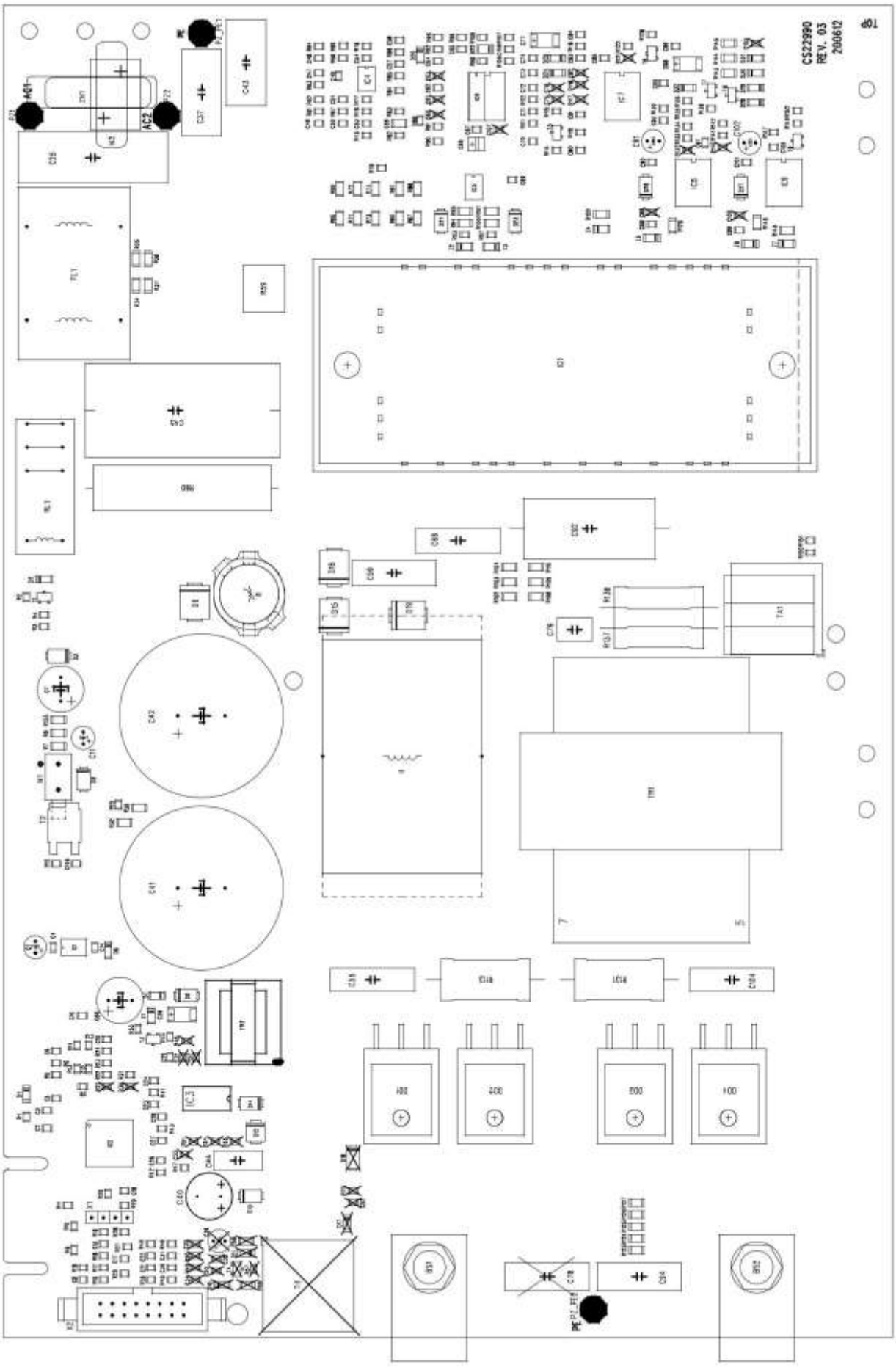
ELECTRICAL SCHEMATICS

Front Board W000270548



ELECTRICAL SCHEMATICS

Inverter Board W000277812



NOTE

Lincoln Electric Europe