SVM 2041
Rev.02 09-2015

INVERTEC®300TPX & 400TPX
COOLARC® 21 & 46

For use with machines having code numbers: 52109, 52110, 52083, 52084
For use with cooler units having code numbers: 50267 and 50263

SERVICE MANUAL

LINCOLN ELECTRIC EUROPE
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TECHNICAL SPECIFICATIONS

INPUT				
Input Voltage 400V ± 15% Three Phase	Input Power at Rated Output		EMC Class	Frequency 50/60Hz
	300TPX	6.5kW @ 100% Duty Cycle (Stick) 5.1kW @ 100% Duty Cycle (TIG) 9.8kW @ 40% Duty Cycle (Stick) 8.1kW @ 40% Duty Cycle (TIG)	A	
	400TPX	10.8kW @ 100% Duty Cycle (Stick) 7.6kW @ 100% Duty Cycle (TIG) 16.4kW @ 35% Duty Cycle (Stick) 11.9kW @ 35% Duty Cycle (TIG)	A	

RATED OUTPUT AT 40°C			
	Duty Cycle (Based on a 10 min. period)	Output Current	Output Voltage
300TPX	100% (Stick)	200A	28.0Vdc
	100% (TIG)	220A	18.8Vdc
	40% (Stick)	270A	30.8Vdc
	40% (TIG)	300A	22.0Vdc
400TPX	100% (Stick)	300A	32.0Vdc
	100% (TIG)	300A	22.0Vdc
	35% (Stick)	400A	36.0Vdc
	35% (TIG)	400A	26.0Vdc

OUTPUT RANGE		
	Welding Current Range	Maximum Open Circuit Voltage
300TPX	5 – 270A (Stick) / 5 – 300A (TIG)	65Vdc (CE model)
400TPX	5 – 400A	12Vdc (AUSTRALIA model)

RECOMMENDED INPUT CABLE AND FUSE SIZES		
	Fuse (delayed) or Circuit Breaker ("D" characteristic) Size	Input Power Cable
300TPX	20A	$4x2.5mm^2$
400TPX	30A	$4x4mm^2$

PHYSICAL DIMENSIONS				
	Height	Width	Length	Weight
300TPX	389mm	247mm	502mm	21kg
400TPX	455mm	301mm	632mm	35kg

Operating Temperature	Storage Temperature
-10°C to +40°C	-25°C to +55°C

Accessories

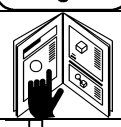
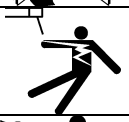
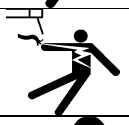
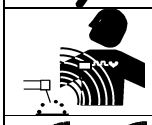
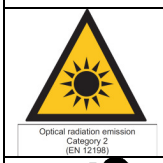
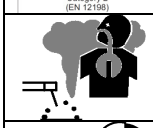
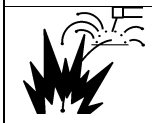
W6100316R	300TPX / 400TPX	Trigger Connector (5 pins).
W6100317R	300TPX / 400TPX	Remote Connector (6 pins).
W8800072R	300TPX / 400TPX	Male Quick Connect Gas Fitting.
K10095-1-15M	300TPX / 400TPX	Hand Amptrol.
K870	300TPX / 400TPX	Foot Amptrol.
KIT-250A-25-3M	300TPX	Cable kit 250A, 25mm^2, 3m
KIT-250A-35-5M	300TPX	Cable kit 250A, 35mm^2, 5m
KIT-300A-50-5M	300TPX	Cable kit 300A, 50mm^2, 5m
KIT-400A-70-5M	400TPX	Cable kit 400A, 70mm^2, 5m
GRD-300A-50-5M	300TPX	Ground cable 300A, 50mm^2, 5m
GRD-300A-50-10M	300TPX	Ground cable 300A, 50mm^2, 10m
GRD-400A-70-5M	400TPX	Ground cable 400A, 70mm^2, 5m
GRD-400A-70-10M	400TPX	Ground cable 400A, 70mm^2, 10m
GRD-400A-70-15M	400TPX	Ground cable 400A, 70mm^2, 15m
K10513-26-4	300TPX/400TPX	Air cooled TIG torch LT 26 G, 180A, 4m
K10513-26-8	300TPX/400TPX	Air cooled TIG torch LT 26 G, 180A, 8m
K10513-18-4	300TPX/400TPX	Water cooled TIG torch LT 18 W, 320A, 4m
K10513-18-8	300TPX/400TPX	Water cooled TIG torch LT 18 W, 320A, 8m
K10513-20-4	300TPX/400TPX	Water cooled TIG torch LT 20 W, 220A, 4m
K10513-20-8	300TPX/400TPX	Water cooled TIG torch LT 20 W, 220A, 8m
K10513-18SC-4	400TPX	Water cooled TIG torch LT 18SC W, 400A, 4m
K10513-18SC-8	400TPX	Water cooled TIG torch LT 18SC W, 400A, 8m
K14103-1	300TPX	Water cooler COOLARC-21
K14105-1	400TPX	Water cooler COOLARC-46
K10420-1	CA-21 /-46	Coolant ACOROX (2x5l)

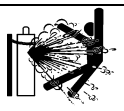
SAFETY

11/04

WARNING

This equipment must be used by qualified personnel. Be sure that all installation, operation, maintenance and repair procedures are performed only by qualified person. Read and understand this manual before operating this equipment. Failure to follow the instructions in this manual could cause serious personal injury, loss of life, or damage to this equipment. Read and understand the following explanations of the warning symbols. Lincoln Electric is not responsible for damages caused by improper installation, improper care or abnormal operation.

	WARNING: This symbol indicates that instructions must be followed to avoid serious personal injury, loss of life, or damage to this equipment. Protect yourself and others from possible serious injury or death.
	READ AND UNDERSTAND INSTRUCTIONS: Read and understand this manual before operating this equipment. Arc welding can be hazardous. Failure to follow the instructions in this manual could cause serious personal injury, loss of life, or damage to this equipment.
	ELECTRIC SHOCK CAN KILL: Welding equipment generates high voltages. Do not touch the electrode, work clamp, or connected work pieces when this equipment is on. Insulate yourself from the electrode, work clamp, and connected work pieces.
	ELECTRICALLY POWERED EQUIPMENT: Turn off input power using the disconnect switch at the fuse box before working on this equipment. Ground this equipment in accordance with local electrical regulations.
	ELECTRICALLY POWERED EQUIPMENT: Regularly inspect the input, electrode, and work clamp cables. If any insulation damage exists replace the cable immediately. Do not place the electrode holder directly on the welding table or any other surface in contact with the work clamp to avoid the risk of accidental arc ignition.
	ELECTRIC AND MAGNETIC FIELDS MAY BE DANGEROUS: Electric current flowing through any conductor creates electric and magnetic fields (EMF). EMF fields may interfere with some pacemakers, and welders having a pacemaker shall consult their physician before operating this equipment.
	CE COMPLIANCE: This equipment complies with the European Community Directives.
	ARTIFICIAL OPTICAL RADIATION: According with the requirements in 2006/25/EC Directive and EN 12198 Standard, the equipment is a category 2. It makes mandatory the adoption of Personal Protective Equipments (PPE) having filter with a protection degree up to a maximum of 15, as required by EN169 Standard.
	FUMES AND GASES CAN BE DANGEROUS: Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. To avoid these dangers the operator must use enough ventilation or exhaust to keep fumes and gases away from the breathing zone.
	ARC RAYS CAN BURN: Use a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when welding or observing. Use suitable clothing made from durable flame-resistant material to protect you skin and that of your helpers. Protect other nearby personnel with suitable, non-flammable screening and warn them not to watch the arc nor expose themselves to the arc.
	WELDING SPARKS CAN CAUSE FIRE OR EXPLOSION: Remove fire hazards from the welding area and have a fire extinguisher readily available. Welding sparks and hot materials from the welding process can easily go through small cracks and openings to adjacent areas. Do not weld on any tanks, drums, containers, or material until the proper steps have been taken to insure that no flammable or toxic vapors will be present. Never operate this equipment when flammable gases, vapors or liquid combustibles are present.
	WELDED MATERIALS CAN BURN: Welding generates a large amount of heat. Hot surfaces and materials in work area can cause serious burns. Use gloves and pliers when touching or moving materials in the work area.

	SAFETY MARK: This equipment is suitable for supplying power for welding operations carried out in an environment with increased hazard of electric shock.
	EQUIPMENT WEIGHT OVER 30kg: Move this equipment with care and with the help of another person. Lifting may be dangerous for your physical health.
	CYLINDER MAY EXPLODE IF DAMAGED: Use only compressed gas cylinders containing the correct shielding gas for the process used and properly operating regulators designed for the gas and pressure used. Always keep cylinders in an upright position securely chained to a fixed support. Do not move or transport gas cylinders with the protection cap removed. Do not allow the electrode, electrode holder, work clamp or any other electrically live part to touch a gas cylinder. Gas cylinders must be located away from areas where they may be subjected to physical damage or the welding process including sparks and heat sources.
	CAUTION: The high frequency used for contact-free ignition with TIG (GTAW) welding, can interfere with the operation of insufficiently shielded computer equipment, EDP centers and industrial robots, even causing complete system breakdown. TIG (GTAW) welding may interfere with electronic telephone networks and with radio and TV reception.

The manufacturer reserves the right to make changes and/or improvements in design without upgrade at the same time the operator's manual.

Installation and Operator Instructions

Read this entire section before installation or operation of the machine.

Location and Environment

This machine will operate in harsh environments. However, it is important that simple preventative measures are followed to assure long life and reliable operation.

- Do not place or operate this machine on a surface with an incline greater than 15° from horizontal.
- Do not use this machine for pipe thawing.
- This machine must be located where there is free circulation of clean air without restrictions for air movement to and from the air vents. Do not cover the machine with paper, cloth or rags when switched on.
- Dirt and dust that can be drawn into the machine should be kept to a minimum.
- This machine has a protection rating of IP23. Keep it dry when possible and do not place it on wet ground or in puddles.
- Locate the machine away from radio controlled machinery. Normal operation may adversely affect the operation of nearby radio controlled machinery, which may result in injury or equipment damage. Read the section on electromagnetic compatibility in this manual.
- Do not operate in areas with an ambient temperature greater than 40°C.

Input Supply Connection

Check the input voltage, phase, and frequency supplied to this machine before turning it on. The allowable input voltage is indicated in the technical specification section of this manual and on the rating plate of the machine. Be sure that the machine is grounded.

Make sure the amount of power available from the input connection is adequate for normal operation of the machine. The fuse rating and cable sizes are both indicated in the "Technical Specification" section of this manual.

The machines are designed to operate on engine driven generators as long as the auxiliary can supply adequate voltage, frequency and power as indicated in the "Technical Specification" section of this manual. The auxiliary supply of the generator must also meet the following conditions:

- Vac peak voltage: below 670V
- Vac frequency: in the range of 50 and 60Hz
- RMS voltage of the AC waveform: 400Vac ± 15%

It is important to check these conditions because many engine driven generators produce high voltage spikes. Operation of this machine on engine driven generators not conforming to these conditions is not recommended and may damage the machine.

Output Connections

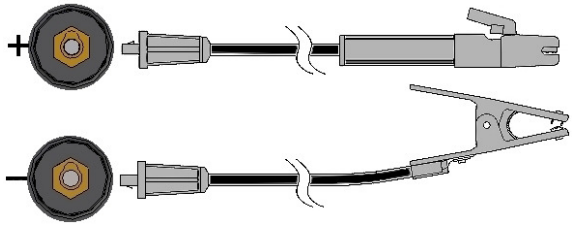
A quick disconnect system using Twist-Mate™ cable plugs is used for the welding cable connections. Refer to the following sections for more information on connecting the machine for operation of stick welding (MMA) or TIG welding (GTAW).

- (+) Positive Quick Disconnect: Positive output connector for the welding circuit.
- (-) Negative Quick Disconnect: Negative output connector for the welding circuit.

Stick Welding (MMA)

This machine does not include a MMA welding kit cables, but may be purchased separately. Refer to the accessories section for more information.

First determine the proper electrode polarity for the electrode to be used. Consult the electrode data for this information. Then connect the output cables to the output terminals of the machine for the selected polarity. Shown here is the connection method for DC(+) welding.



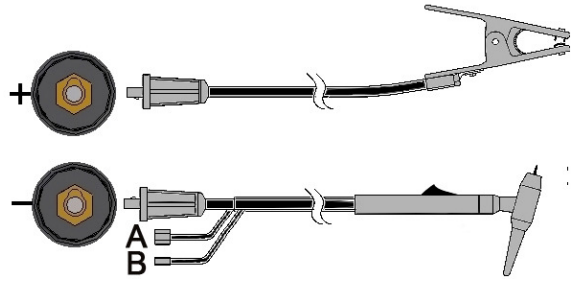
Connect the electrode cable to the (+) terminal and the work clamp to the (-) terminal. Insert the connector with the key lining up with the keyway and rotate approximately ¼ turn clockwise. Do not over tighten.

For DC(-) welding, switch the cable connections at the machine so that the electrode cable is connected to (-) and the work clamp is connected to (+).

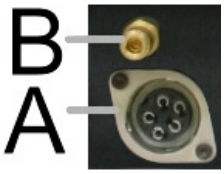
TIG Welding (GTAW)

This machine does not include a TIG torch necessary for TIG welding, but one may be purchased separately. Refer to the accessories section for more information.

Most TIG welding is done with DC(-) polarity shown here. If DC(+) polarity is necessary switch the cable connections at the machine.



Connect the torch cable to the (-) terminal of the machine and the work clamp to the (+) terminal. Insert the connector with the key lining up with the keyway and rotate approximately ¼ turn clockwise. Do not over tighten.



Finally, connect the gas hose from the TIG torch to the gas connector (B) on the front of the machine. If necessary, an extra gas connector for the fitting on the front of the machine is included in the package. Next, connect the fitting on the back of the machine to a gas regulator on the cylinder of gas to be used. An input gas line and the required fittings are also included in the package. Connect the TIG torch trigger to the trigger connector (A) on the front of the machine.

TIG Welding with a Water Cooled Torch

A cooling unit can be applied to the Machine:

- COOLARC-21 for 300TPX
- COOLARC-46 for 400TPX

If a Coolarc unit listed above is connected to the Machine, it will be automatically turned ON and OFF in order to ensure the torch cooling. When Stick welding mode is used the cooler will be OFF.

This machine does not include a cooled TIG torch, but one may be purchased separately. Refer to the accessories section for more information.

⚠ WARNING

The Machine is provided with an electrical connection for the Coolarc unit on its rear side. This socket is ONLY for the connection of the Coolarc unit listed above.

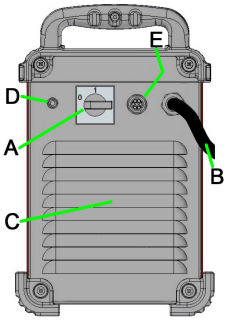
⚠ WARNING

Before connecting the cooler unit to the Machine and operate, read and understand the Instruction Manual supplied with the cooling unit.

Remote Control Connection

Refer to the accessories section for a list of remote controls. If a remote control is used, it will be connected to the remote connector on the front of the machine. The machine will automatically detect the remote control, turn on the REMOTE LED, and switch to remote control mode. More information on this mode of operation will be given in the next section.

Rear Panel



A. Power Switch: It turns ON / OFF the input power to the machine.

B. Input cable: Connect it to the mains.

C. Fan: Do not obstruct or filter the fan inlet. The "F.A.N." (Fan As Needed) feature automatically turns OFF/ON the fan. When the Machine is turned ON the fan is turned ON only for the startup time (few seconds). The fan will start with welding operations and will continue to run whenever the Machine is welding. If the Machine doesn't weld for more than 10minutes, it will go in Green Mode.

Green Mode

The Green Mode is a feature that puts the machine in a stand-by condition:

- The output is disabled
- The fan is turned OFF
- Only the Power ON LED remains ON.
- A moving red dash is shown in the "V" and "A" displays

This reduces the amount of dirt that can be drawn inside the Machine and the power consumption.

To restore the Machine simply restart to weld.

NOTE: Green Mode long time condition: each 10min of continuous Green Mode the fan runs for 1min.

NOTE: If a COOLARC TIG torch cooling unit is connected to the machine, it will be turned ON/OFF by the Green Mode feature.

D. Gas Inlet: Connector for the TIG shielding gas. Use the supplied gas line and connector to connect the machine to the gas source. The gas source must have a pressure regulator and flow gage installed.

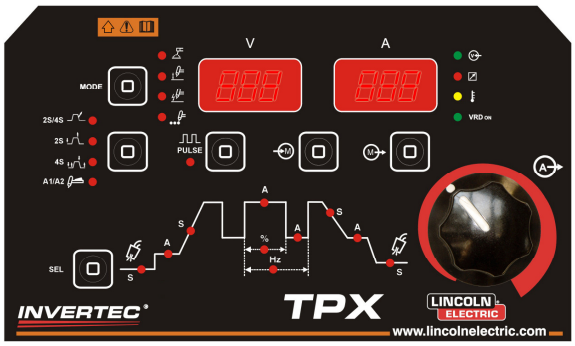
E. Power supply socket for Coolarc: 400Vac socket. Connect here the Coolarc cooling unit.

Controls and Operational Features

Machine Start-Up:

When the machine is turned ON an auto-test is executed: during this test all the LEDs turn ON for a moment; at the same time the displays shown “333” and then “888”. During the start-up the fan is activated for a short time, then it will restart with welding operations.

- The Machine is ready to operate when on the Front Control Panel lights up the “Power ON” LED, the “A” LED (placed on the middle of the synoptic) with one of the LED of the Welding “MODE” command. This is the minimum condition: depending by the welding selection others LEDs may be ON.



Front Panel Indicators and Controls

Power ON LED:

This LED blinks during the machine start-up and lights up steadily when the machine is ready to operate.

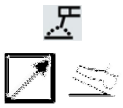
If the Input Voltage Over-range protection becomes active, the Power ON LED starts blinking and an error code is shown on the displays. The machine restarts automatically when the Input Voltage returns in the correct range. For further detail read the Error Codes and Troubleshooting section.

Remote LED:

This indicator will turn on when a Remote command is connected to the machine via the remote control connector.

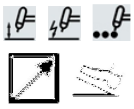
If a Remote command is connected to the Machine, the Output Current knob operates in two different modes: STICK and TIG:

- **STICK mode:** with a Remote command connected the output of the machine is ON. A Remote Amptrol or Pedal are allowed (trigger is ignored).



Connecting the Remote command excludes the Output Current Knob of the Machine’s user interface. Through the Remote command is available the full Output Current Range.

- **TIG mode:** in Local and remote mode the output of the machine is OFF. A Trigger is necessary to enable the output.



The Output Current range selectable from the Remote command depends by the Machine’s user interface Output Current Knob. Eg.: if the Output Current is set to 100A with the Machine’s user interface Output Current Knob, the Remote command will adjust the Output Current from a minimum of 5A to a maximum of 100A.

Remote Pedal: For a correct use, the “option 30” must be enabled in the setup menu:

- 2-step sequence is automatically selected
- Upslope / Down-slope ramps and Restart are disabled.
- Spot, Bi-Level and 4-step functions aren’t selectable

(Normal operation is restored when the Remote command is disconnected.)

Thermal LED:

This indicator will turn on when the machine is overheated and the output has been disabled. This normally occurs when the duty cycle of the machine has been exceeded. Leave the machine on to allow the internal components to cool. When the indicator turns off, normal operation is again possible.

VRD LED (enabled on Australian Machines only):

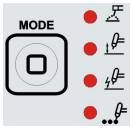
This machine is provided by VRD (Voltage Reduction Device) function: this reduces the voltage at the output leads.

The VRD function is enabled by factory default only on machines that meet the AS 1674.2 Australian Standards. (C-Tick logo "✓" on/near the Rating Plate applied on the machine).

The VRD LED is ON when the Output Voltage is below 12V with the Machine at idle (no welding time).

For others machines this function is disabled (the LED is always OFF).

Mode Pushbutton:

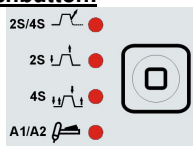


This pushbutton changes the welding modes of the machine:

- Stick (SMAW)
- Lift TIG (GTAW)
- HF TIG (GTAW)
- Spot TIG (GTAW)
  The Spot TIG feature is selectable only if the “option 10” is previously enabled in the Setup Menu. See “Setup menu” section for options enabling / disabling.

Each welding mode is is detailed in the Operating instruction section.

Trigger Mode Pushbutton:



This pushbutton changes the trigger sequence in TIG welding mode:

- 2-step / 4-step with restart This option is not selectable by the Trigger Pushbutton and, if enabled, operates with 2 or 4 step mode:

  This indicator will turn on if the restart option is enabled for the current TIG trigger mode. Restart can be enabled separately for 2-step and 4-step modes from the Setup Menu. More information about restart is available in the Operating instruction section.
- 2-step
- 4-step
- Bi-Level

Each trigger mode is detailed in the Operating instruction section.

SEL Pushbutton:

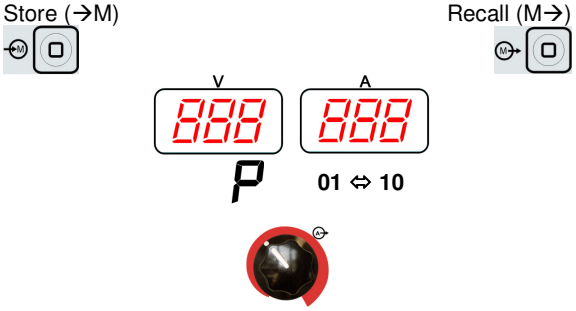
The SELect pushbutton is used to scroll the TIG welding parameters. At each pressure the relevant led is switched on and the displays show the current value of the parameter. If a parameter is disabled for the current mode of working it will be skipped. The user can then modify this value turning the Output Current knob. If no change is made after a timeout (4s), the displays and LEDs will revert to the default state, where the Output Current knob sets the output current.

Memory Pushbuttons:

These push buttons allows to store (→M) or recall (M→) TIG welding programs. 10 memory records (P01 to P10) are available for the user.

To store [or recall] a record:

Store (→M) Recall (M→)



Store (→M) Recall (M→)

Keep pushed for 4s

The Memory pushbuttons are disabled during welding.

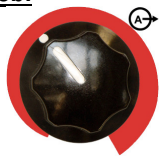
See “List of parameters and Factory stored programs” section below for a complete list of factory stored programs.

Pulsing Mode Pushbutton:

In the TIG welding modes, this pusbutton turns the pulsing function ON. When active, the LED next to the pushbutton is turned ON. In Stick welding mode, this command is disabled.

When Pulse is active is possible to set Duty cycle (%), Frequency (Hz) and Background (%) parameters. During TIG welding is not possible switch ON or OFF the Pulse command: if ON, during welding is possible operates on the values of Duty, Frequency and Background current.

Output Current Knob:



It is used to set the Output Current used during welding.

This knob is also a multi-purpose command: see the “Operating Instruction” section for a description of how to use this command for parameter selection.

V & A Display:

The right meter displays the preset welding current (A) before welding and the actual welding current during welding, and the left meter shown the voltage (V) at the output leads.

A flashing dot on the Display indicates that the value read is the average value of the previous welding time. This feature shown the average value for 5seconds after every welding time.

If a remote control is connected (the Remote LED is ON), the left meter (A) indicates the preset and the

actual welding current following the instruction explained in the “Remote LED” description above.

The left (V) Display can also shown the following set of characters:

V 888	
PrE PREFLOW	SrA START CURRENT
UPS UPSLOPE	A2 BI-LEVEL
FrE FREQUENCY	dUC DUTY CYCLE
bAC BACKGROUND	dOU DOWNSLOPE
CrA CRATER	POS POSTFLOW
SPO SPOT WELDING	Err ERROR
SrO STORE	rEC RECALL
SOF SOFT	Cri CRISP
P PROGRAM	

The right (A) Display can also shown the following set of characters:

A 888	
01, ...10	For program records
01, ...99	For error codes

See “Operating Instruction” section for a detailed description of the functions described by these indications.

Operating Instruction

Stick (SMAW) Welding

To select Stick welding:

Action	Visualization
MODE	

Press MODE several times until the LED above lights up

When the Stick position is selected, the following welding features are enabled:

- Hot Start: This is a temporary increase in the output current during the start of the stick welding process. This helps ignite the arc quickly and reliably.
- Anti-Sticking: This is a function which decreases the output current of the machine to a low level when the operator makes an error and sticks the electrode to the work piece. This decrease in current allows the operator to remove the electrode from the electrode holder without creating large sparks which can damage the electrode holder.
- Auto Adaptive Arc Force: this function increases temporary the output current, used to clear intermittent connections between the electrode and the weld puddle that occur during stick welding.

  This is an active control feature that guarantees the best arrangement between the arc stability and spatter presence. The feature "Auto Adaptive Arc Force" has instead of a fixed or manual regulation, an automatic and multilevel setting: its intensity depends by the output voltage and it is calculated in real time by the microprocessor where are also mapped the Arc Force levels. The control measure in each instant the output voltage and it determines the amount of the peak of current to apply; that value is enough to breaks the metal drop that is being transferred from the electrode to the workpiece as to guarantee the arc stability, but not too high to avoid spatters around the welding puddle. That means:
  - Electrode / workpiece sticking prevention, also with low current values.
  - Spatters reduction.

  The welding operations are simplified and the welded joins looks better, also if not brushed after the welding.

In Stick mode, two different setup are available:

- SOFT Stick: For a welding with a low spatter presence.
- CRISP Stick (Factory Default): For an aggressive welding, with an increased Arc stability.

To switch between Soft and Crisp:

Action	V 888 Visualization
At idle, before welding	Voltage
Press SEL	Cri → SOF
Press SEL	SOF → Cri
Wait 4s or start welding to store the changes	Cri → Voltage

Lift TIG (GTAW welding)

To select Lift TIG welding:

Action	Visualization
MODE	

Press MODE several times until the LED above lights up

When the mode pusbutton is in the Lift TIG position, the stick welding functions are disabled and the machine is ready for Lift TIG welding. Lift TIG is a method of starting a TIG weld by first pressing the TIG torch electrode on the work piece in order to create a low current short circuit. Then, the electrode is lifted from the work piece to start the TIG arc.

HF TIG (GTAW welding)

To select HF TIG welding:

Action	Visualization
MODE	

Press MODE several times until the LED above lights up

When the mode pushbutton is in HF TIG position, the stick welding functions are disabled and the machine is ready for HF TIG welding. During the HF TIG mode, the TIG arc is started by HF without pressing the electrode on the work piece. The HF used for starting the TIG arc will remain on for 3 seconds; if the arc is not started in this time limit, the trigger sequence must be restarted.

The HF arc start strength can be adjusted in the setup menu by changing the value of option 40. Four arc start strengths are available, ranging from 1 (smooth, suitable for thin electrodes) to 4 (strong, suitable for thick electrodes). The default value for this option is 3.

Spot TIG (GTAW welding)

The Spot TIG feature is selectable only if the “option 10” is previously enabled in the Setup Menu.

To select Spot TIG welding:

Action	Visualization
MODE	

Press MODE several times until the LED above lights up

This welding mode is especially thought to tack or weld thin materials. It uses HF start and immediately delivers the set current without any upslope/downslope. The welding time can be either linked to the trigger or set with the spot time control.

If the spot time (“option 11” of the Setup Menu) is enabled from the setup menu, in order to change the spot time:

Action	Visualization
	V 888
At idle, before welding	Voltage
Press SEL	SPO

At this point the spot time can be adjusted by turning the Output Current knob. Setting the spot time to 0 will disable the fixed time function and the welding time will be linked to the TIG torch trigger.

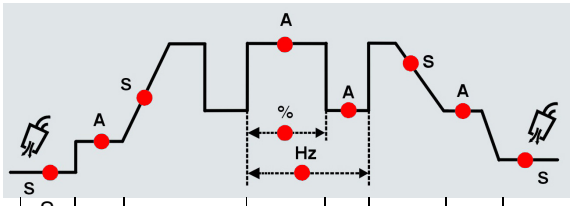
NOTE: The HF start strength is adjusted by setup option 40, as described in the HF Tig section above.

See “Setup menu” section for options enabling / disabling.

Tig Welding Sequences

SEL

At each pressure of the SEL pusbutton the LEDs lights up in the following order:



1	S							
2		A						
3			S					
4				A				
4a				%				
4b				Hz				
4d					A			
5						S		
6							A	
7								S

1	PREFLOW In the TIG welding modes, this function controls the shielding gas Preflow time. In Stick welding mode, this is not used.
2	START CURRENT This function controls the initial current when a TIG welding is started. For an explanation of the Start operation, refer to the trigger sequences explained below.
3	UPSLOPE In the TIG welding modes, this function controls the linear increase of the current from Start to Set Current. Refer to the trigger sequence section below to understand how Upslope is activated. In Stick welding mode, this is not used.
4	SET CURRENT This function is used to set the Output Current used during welding.
4a	DUTY CYCLE (PULSING ON-TIME) When the pulse feature is ON, this function controls the pulsing on-time. During the on-time the output current is equal to the Set Current.
4b	FREQUENCY When the pulse feature is ON, this function controls the pulsing frequency, that is the square wave represented in the diagram above (Hz).
4d	BACKGROUND When the pulse feature is ON, this function controls the pulsing Background current. This is the current during the low portion of the pulse waveform.
5	DOWNSLOPE In the TIG welding modes, this function controls the linear decrease of the current from Set to Crater Current. Refer to the trigger sequence section below to understand how Downslope is activated. In Stick welding mode, this is not used.
6	CRATER This function controls the final current value after the Downslope. For an explanation of the Crater operation, refer to the trigger sequences explained below.
7	POSTFLOW In the TIG welding modes, this function controls the shielding gas Postflow time. In Stick welding mode, this is not used.

During welding the Sel pushbutton is enabled for the following functions:

- Output current
- Only if Pulse Function is active: is possible operates on the values of Duty (%), Frequency (Hz) and Background current (A).

The new parameter value is automatically saved.

TIG Trigger Sequences

TIG welding can be done in either the 2-step or 4-step mode. The specific sequences of operation for the trigger modes are explained below.

Legenda of the symbols used:

	Torch Pushbutton
	Output Current
	Gas Pre-flow
	Gas
	Gas Post-flow

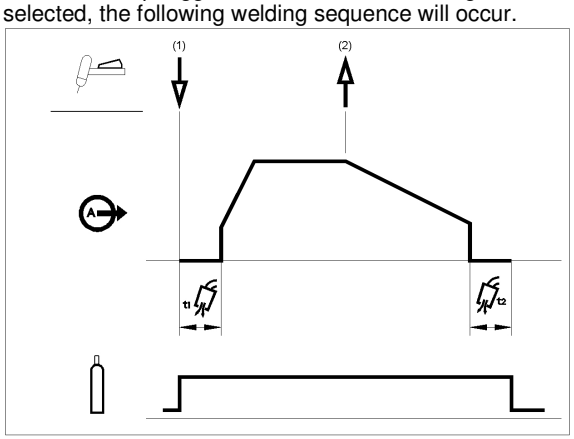
2-Step Trigger Sequence

To select 2-Step sequence:

Action	Visualization
	2S

Press several times until the LED above lights up

With the 2-step trigger mode and a TIG welding mode selected, the following welding sequence will occur.

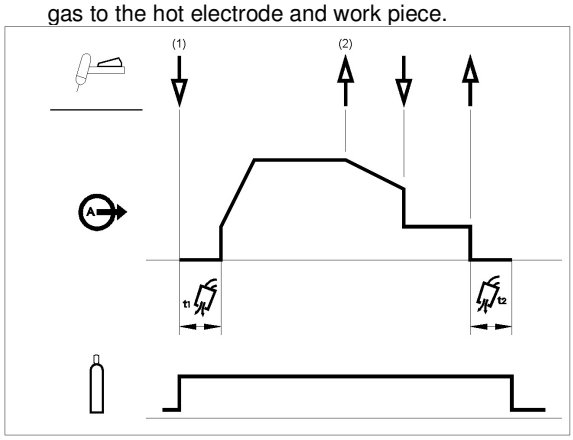


1. Press and hold the TIG torch trigger to start the sequence. The machine will open the gas valve to start the flow of the shielding gas. After the preflow time, to purge air from the torch hose, the output of the machine is turned ON. At this time the arc is started according to the selected welding mode. After the arc is started the output current will be increased at a controlled rate, or upslope time, until the Welding current is reached.

   If the torch trigger is released during the upslope time the arc will stop immediately and the output of the machine is turned OFF.

2. Release the TIG torch trigger to stop welding. The machine will now decrease the output current at a controlled rate, or downslope time, until the Crater current is reached and the output of the machine is turned OFF.

   After the arc is turned OFF, the gas valve will remain open to continue the flow of the shielding gas to the hot electrode and work piece.



As shown above, it is possible to press and hold the TIG torch trigger a second time during downslope to end the downslope function and maintain the output current at the Crater current. When the TIG torch trigger is released the output will turn OFF and the postflow time will start. This operation sequence, 2-step with restart disabled, is the default setting from the factory.

2-Step Trigger Sequence with Restart Option

To select 2-Step with restart sequence:

Action	Visualization
SEL + MODE	2S/4S

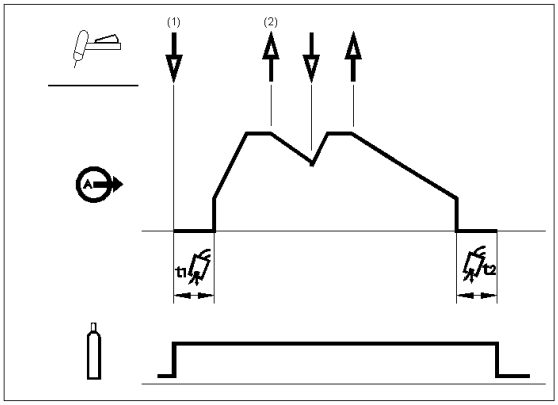
See "**Setup menu**" section below

then:

	2S

Press several times until the LED above lights up

If the 2-step restart option is enabled from the setup menu the following sequence will occur:



1. Press and hold the TIG torch trigger to start the sequence as described above.

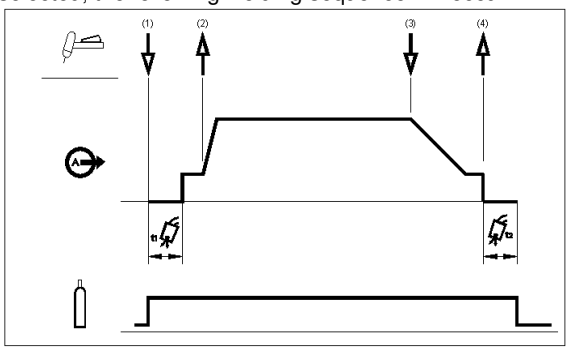
2. Release the TIG torch trigger to start the downslope. During this time press and hold the TIG torch trigger to restart welding. The output current will increase again at a controlled rate until the Welding current is reached. This sequence can be repeated as many times as necessary. When the welding is complete release the TIG torch trigger. When the Crater current is reached the output of the machine is turned OFF.

4-Step Trigger Sequence

To select 4-Step sequence:

Action	Visualization
	
Press several times until the LED above lights up	

With the 4-step trigger mode and a TIG welding mode selected, the following welding sequence will occur.



1. Press and hold the TIG torch trigger to start the sequence. The machine will open the gas valve to start the flow of the shielding gas. After the preflow time, to purge air from the torch hose, the output of the machine is turned ON. At this time the arc is started according to the selected welding mode. After the arc is started the output current will be at the Start current. This condition can be maintained as long as necessary.

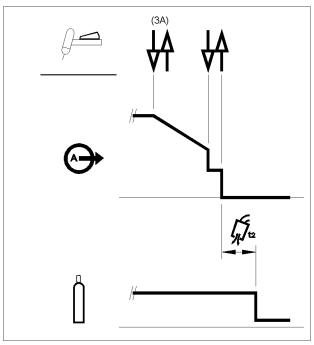
   If the Start current is not necessary, do not hold the TIG torch trigger as described at the beginning of this step. In this condition, the machine will pass from Step 1 to Step 2 when the arc is started.

2. Releasing the TIG torch trigger starts the upslope function. The output current will be increased at a controlled rate, or upslope time, until the Welding current is reached. If the torch trigger is pushed during the upslope time the arc will stop immediately and the output of the machine is turned OFF.

3. Press and hold the TIG torch trigger when the main part of the weld is complete. The machine will now decrease the output current at a controlled rate, or downslope time, until the Crater current is reached.

4. This Crater current can be maintained as long as necessary. When the TIG torch trigger is released the output of the machine is turned OFF and the postflow time will start.

As shown here, after the TIG torch trigger is quickly pressed and released from step 3A, it is possible to press and hold the TIG torch trigger another time to end the downslope time and maintain the output current at the Crater current. When the TIG torch trigger is released the output will turn OFF.



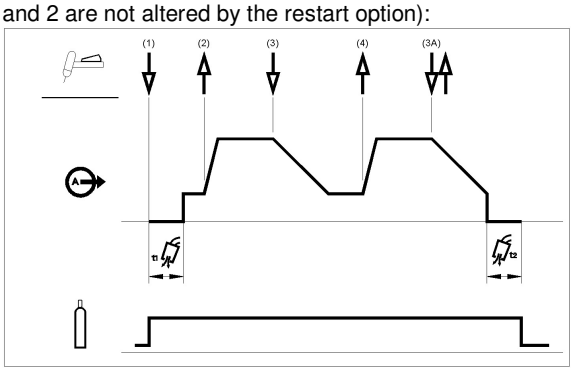
This sequence operation, 4-step with restart disabled, is the default setting from the factory.

4-Step Trigger Sequence with Restart Option

To select 4-Step with restart sequence:

Action	Visualization
	
See "**Setup menu**" section below	
then:	
	
Press several times until the LED above lights up	

If 4-step restart is enabled from the setup menu the following sequence will occur for steps 3 and 4 (steps 1 and 2 are not altered by the restart option):

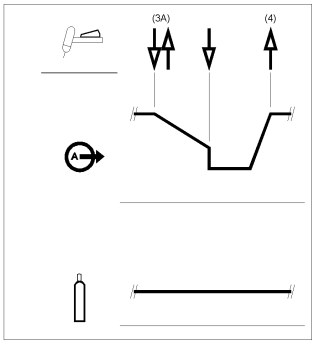


3. Press and hold the TIG torch trigger. The machine will now decrease the output current at a controlled rate, or downslope time, until the Crater current is reached.

4. Release the TIG torch trigger. The output current will again increase to the Welding current, like in step 2, to continue welding.

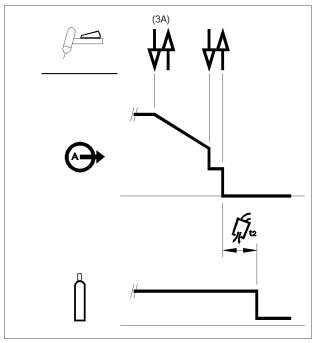
If the weld is completely finished, use the following sequence instead of step 3 described above.

3A. Quickly press and release the TIG torch trigger. The machine will now decrease the output current at a controlled rate, or downslope time, until the Crater current is reached and the output of the machine is turned OFF. After the arc is turned OFF the postflow time will start.



As shown here, after the TIG torch trigger is quickly pressed and released from step 3A, it is possible to press and hold the TIG torch trigger another time to end the downslope time and maintain the output current at the Crater current. When the TIG torch trigger is released the output will again increase to the Welding current, like in step 4, to continue welding. When the main part of the weld is complete go to step 3.

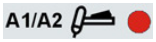
As shown here, again after the TIG torch trigger is quickly pressed and released from step 3A, it is possible to quickly press and release the TIG torch trigger a second time to end the downslope time and stop welding.



Bi-Level (A1/A2) Trigger sequence

The Bi-Level feature is selectable only if the “option 20” is previously enabled in the Setup Menu.

To select Bi-Level sequence:

Action	Visualization
	
Press several times until the LED above lights up	

With this sequence the arc is started as in the 4S sequence, this means that steps 1 and 2 are the same.

3. Quickly press and release the TIG torch trigger. The machine will switch the current level from A1 to A2 (background current). Each time this trigger action is repeated the current level will switch between the two levels.

   3A. Press and hold the TIG torch trigger when the main part of the weld is complete. The machine will now decrease the output current at a controlled rate, or downslope time, until the Crater current is reached. This Crater current can be maintained as long as necessary.

NOTE: The Restart option and the Pulse function are not available for Bi-Level Trigger sequence.

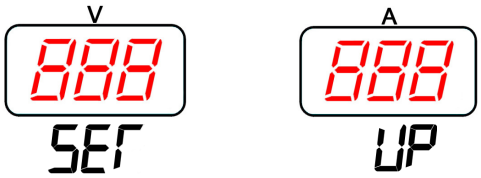
Setup menu

The setup menu contains more parameters that are hidden from the main control panel functionality.

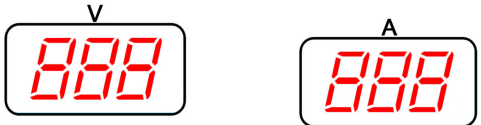
To enter the Setup menu:

Push and hold “SEL” and “MODE” pushbuttons

Keep “SEL” + “MODE” pushed until the displays show “SET UP”

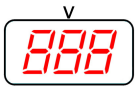


Then release the SEL” pushbutton



now is shown the **option number “00”**

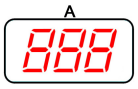
emtpy display



01 ⇔ 99

Select the desired option: on the left display is shown the option number

then press “SEL” to confirm



ON / OFF

ON / OFF (or 1 / 2 / 3 / 4 only for option 40)

Now enable, disable or change the option value: on the right display is shown the option status

Save the desired option by pressing the “SEL” pushbutton

To exit the setup menu select the 00 option and keep the SEL button pushed for 5 seconds until normal operation is resumed.

List of menu options

00	Exit point
01	2-step restart
02	4-step restart
10	Spot welding
11	Spot fixed time
20	Bi-Level
30	Foot Pedal
40	Arc start strenght
99	Reset to factory default

To change a setting push SEL, then rotate the encoder (Output Current Knob) to modify the setting, and push SEL again to confirm the new value.

Error Codes and troubleshoting.

If an error occurs, turn Off the machine, wait for a few seconds, then turn ON again. If the error remains, a maintenance is required. Please contact the nearest technical service center or Lincoln Electric and report the error code displayed on the meter of the Front Panel.

Err	Error code table
01	**Input out of range** LED is blinking Indicates that an Input Voltage Overrange protection is active; the Machine restarts automatically when the Input Voltage returns in the correct range.
06	**Inverter voltage lock out** LEDs blink alternatively. Indicates that an Internal Auxiliary Voltage fault condition is detected. To restore the machine: • Turn OFF then ON the Mains Switch to restart the machine.
10	**Fan fault** The cooling fan is blocked or faulty. To restore the machine: • Turn OFF the Mains Switch then and check if the fan is being blocked by something that stops the blades. **WARNING** • **DO NOT OPEN THE MACHINE!** Perform the check through the air inlet louvers placed in the machine rear side. • **DO NOT INTRODUCE OBJECTS INSIDE OF THE LOUVERS!** Danger of electric shock. • Turn ON the Mains Switch to restart the machine and make a short weld, in order to verify that the fan is restarted. If the fan remains inactive a maintenance from a Service is necessary.
11	**Water cooler fault** Cooler fluid is not correctly flowing through the torch. See the water cooler instruction manual for more details.

Maintenance

WARNING

For any maintenance or repair operations it is recommended to contact the nearest technical service center or Lincoln Electric. Maintenance or repairs performed by unauthorized service centers or personnel will null and void the manufacturers warranty.

The frequency of the maintenance operations may vary in accordance with the working environment. Any noticeable damage should be reported immediately.

- Check cables and connections integrity. Replace, if necessary.

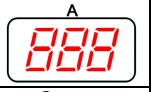
  - Keep clean the machine. Use a soft dry cloth to clean the external case, especially the airflow inlet / outlet louvers.

WARNING

Do not open this machine and do not introduce anything into its openings. Power supply must be disconnected from the machine before each maintenance and service. After each repair, perform proper tests to ensure safety.

List of parameters and Factory stored programs

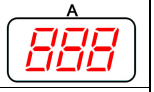
List of parameters and Factory Configuration program:

Parameter	Factory Configuration (P99)	Selectable Value Range 	Displayed parameter name V 	Displayed value A 
Preflow	0.1s	0 - 5s (step 0.1s)	PrE	Current selected value (s)
Start Current	Lift TIG 2-step: 22A Lift TIG 4-step: 30% HF TIG 2-step: 30% HF TIG 4-step: 30%	Not adjustable 5 - 200%	SrA	Current selected value (A)
Upslope	0.5s	0 - 5s (step 0.1s)	UPS	Current selected value (s)
Set Current	5A	5 - 270A (Stick) (300TPX) 5 - 300A (TIG) (300TPX) 5 - 400A (400TPX)	Voltage at output studs	Current selected value (A)
Duty Cycle	50%	10 - 90% (step 5%) (f>300Hz Duty=50% 300TPX) (f>200Hz Duty=50% 400TPX)	dUC	Current selected value (%)
Frequency (f)	0.1Hz	0.1 - 10Hz (step 0.1Hz) 10 - 300Hz (step 1Hz) 300 - 500Hz (step 10Hz)	FrE	Current selected value (Hz)
Background	30%	10 - 90% (step 1%)	bAC	Current selected value (%)
Downslope	0s	0 - 20s (step 0.1s)	dOU	Current selected value (s)
Crater	30%	5 - 100%	CrA	Current selected value (A)
Postflow	10s	0 - 30s (step 1s)	POS	Current selected value (s)

Stick Welding: SOFT and CRISP programs

Parameter	Features	Selectable Value Range 	Displayed parameter name V 	Displayed value A 
Soft Stick	Hot start, Anti-Sticking and Arc Force are automatically adjusted by the machine	Set Current With SOFT / CRISP Stick, this is the unique parameter adjustable by the user.	SOF	Current selected value (A)
Crisp Stick	Hot start, Anti-Sticking and Arc Force are automatically adjusted by the machine		CrI	Current selected value (A)

TIG SPOT WELDING (to previously enable with option 10 in Setup menu)

Parameter	Features	Selectable Value Range 	Displayed parameter name V 	Displayed value A 
Spot Current	Trigger = 2-step No restart function enabled Preflow time = 0s Upslope time = 0s Downslope time = 0s Postflow time = 0s	5 - 300A (300TPX) 5 - 400A (400TPX)	Voltage at output studs	Current selected value (A)

TIG SPOT FIXED TIME (to previously enable with option 11 in Setup menu)

Parameter	Features	Selectable Value Range 	Displayed parameter name V 	Displayed value A 
Spot Time	0 (manual trigger)	0 - 5s (step 0.1s)		Welding time (s)

Electromagnetic Compatibility (EMC)

01/11

This machine has been designed in accordance with all relevant directives and standards. However, it may still generate electromagnetic disturbances that can affect other systems like telecommunications (telephone, radio, and television) or other safety systems. These disturbances can cause safety problems in the affected systems. Read and understand this section to eliminate or reduce the amount of electromagnetic disturbance generated by this machine.

This machine has been designed to operate in an industrial area. The operator must install and operate this equipment as described in this manual. If any electromagnetic disturbances are detected the operator must put in place corrective actions to eliminate these disturbances with, if necessary, assistance from Lincoln Electric. The 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. This equipment does not comply with IEC 61000-3-12. If it is connected to a public low-voltage system, it is 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.

Before installing the machine, the operator must check the work area for any devices that may malfunction because of electromagnetic disturbances. Consider the following.

- Input and output cables, control cables, and telephone cables that are in or adjacent to the work area and the machine.
- Radio and/or television transmitters and receivers. Computers or computer controlled equipment.
- Safety and control equipment for industrial processes. Equipment for calibration and measurement.
- Personal medical devices like pacemakers and hearing aids.
- Check the electromagnetic immunity for equipment operating in or near the work area. The operator must be sure that all equipment in the area is compatible. This may require additional protection measures.
- The dimensions of the work area to consider will depend on the construction of the area and other activities that are taking place.

Consider the following guidelines to reduce electromagnetic emissions from the machine.

- Connect the machine to the input supply according to this manual. If disturbances occur if may be necessary to take additional precautions such as filtering the input supply.
- The output cables should be kept as short as possible and should be positioned together. If possible connect the work piece to ground in order to reduce the electromagnetic emissions. The operator must check that connecting the work piece to ground does not cause problems or unsafe operating conditions for personnel and equipment.
- Shielding of cables in the work area can reduce electromagnetic emissions. This may be necessary for special applications.

MAINTENANCE

WARNING

For any repair operations, modifications or maintenances, it is recommended to contact the nearest Technical Service Center or Lincoln Electric. Repairs and modifications performed by unauthorized service or personnel will cause, that the manufacturer's warranty will become null and void.

Any noticeable damage should be reported immediately and repaired.

Routine maintenance (everyday)

- Check condition of insulation and connections of the work leads and insulation of power lead. If any insulation damage exists replace the lead immediately.
- Check condition and operation of the cooling fan. Keep clean its airflow slots.

Periodic maintenance (every 200 working hours but at list once every year)

Perform the routine maintenance and, in addition:

- Keep the machine clean. Using a dry (and low pressure) airflow, remove the dust from the external case and from the cabinet inside.
- If it is required, clean and tighten all weld terminals.

The frequency of the maintenance operations may vary in accordance with the working environment where the machine is placed.

WARNING

Do not touch electrically live parts.

WARNING

Before the case of welding machine will be removed, the welding machine had to be turned off and the power lead had to be disconnected from mains socket.

WARNING

Mains supply network must be disconnected from the machine before each maintenance and service. After each repair, perform proper tests to ensure safety.

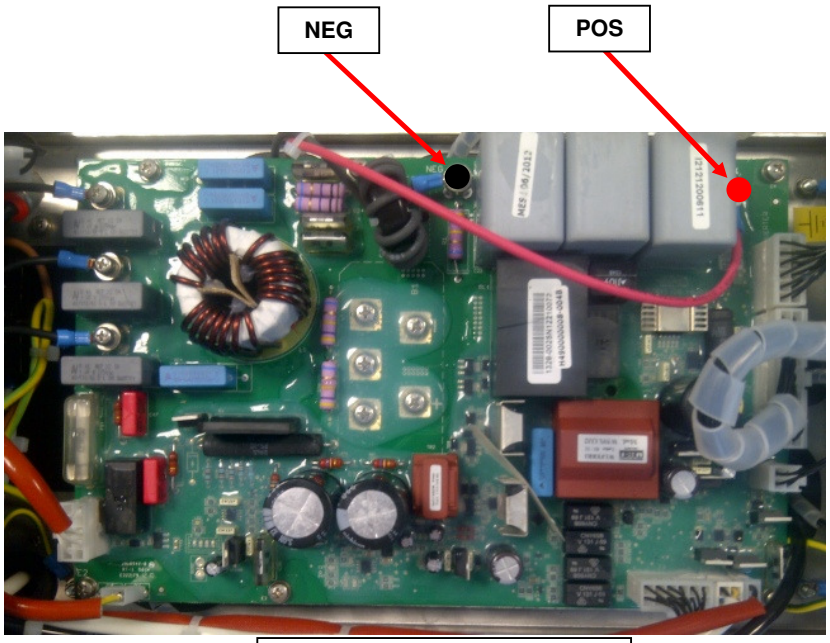
WARNING

ELECTRIC SHOCK can kill

Have an electrician install and service this equipment
Turn the input power off at the fuse box before working on equipment
Do not touch electrically hot parts
Prior to performing preventive maintenance, perform the following capacitor discharge procedure to avoid electric shock.

INPUT FILTER CAPACITOR DISCHARGE PROCEDURE

1. Remove main input power to the INVERTEC® 300TPX or 400TPX
2. Remove the cover following the case removal procedure available in this Service manual.
3. The capacitors are discharged by discharge resistors integrated into the input board in about 5 (five) minutes.
4. Locate the two points **POS** and **NEG** on the Input Board. **See Figure 1**
5. Connect your multimeter positive probe to **POS** point and your negative probe to **NEG** point and check the voltage accross DC bus capacitors.
6. In case of presence of any residual voltage follow the next steps
7. Obtain a high resistance and high wattage resistor (500-1000 ohms and 25 watts minimum). This resistor is NOT supplied with the machine. NEVER USE A SHORTING STRAP FOR THIS PROCEDURE.
8. Use electrically insulate gloves and insulated pliers. Hold the body of the resistor and connect the resistor leads across the two points **POS** and **NEG**. **See Figure 1**. Hold the resistor in place for 10 seconds. DO NOT TOUCH CAPACITOR TERMINALS WITH YOUR BARE HANDS.
9. Check again the voltage across the two terminals (**POS** and **NEG**). Voltage should be zero. If any voltage remains, repeat this procedure.



INPUT BOARD - Figure 1
Showing 300TPX input board

THERMAL PROTECTION

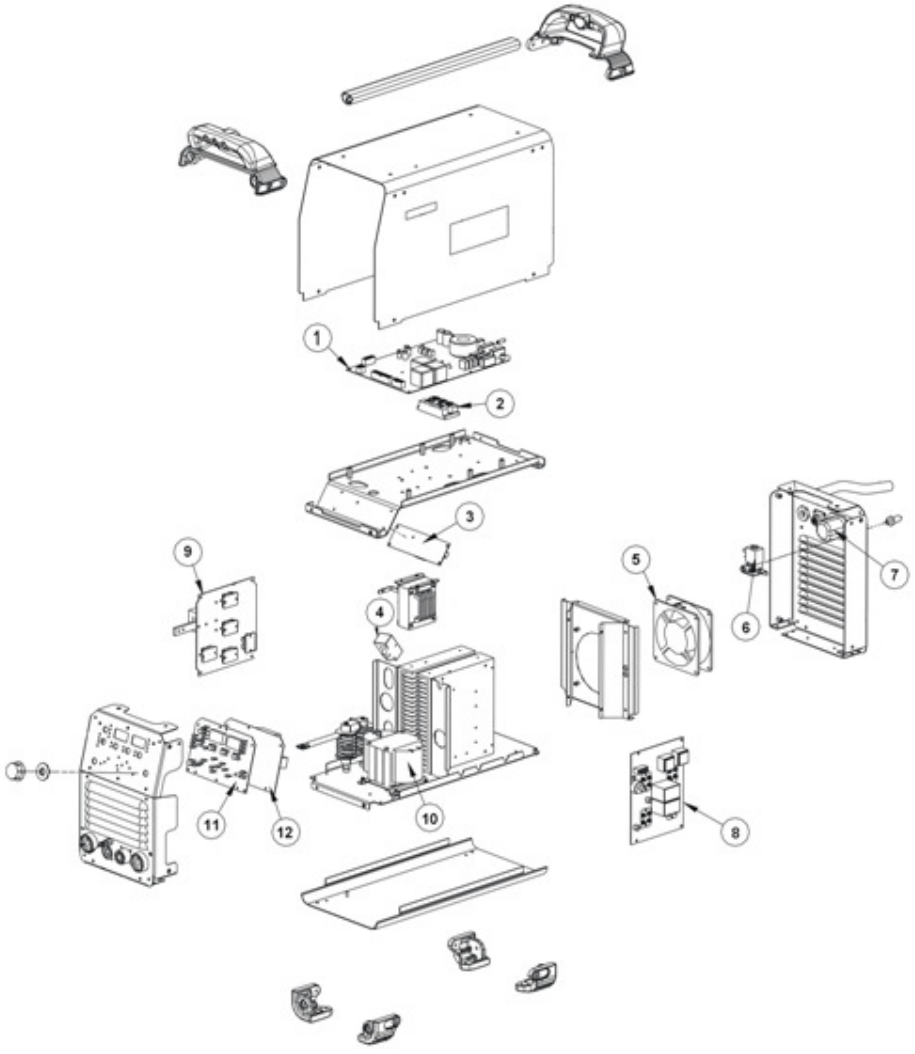
Thermal detection device protect the machine from excessive operating temperatures. Excessive temperatures may be caused by a lack of cooling air or operating the machine beyond the duty cycle and output rating. If excessive operating temperatures should occur, the yellow LED will light and the detection device will prevent output voltage or current.

These detection device are self-resetting once the machine cools sufficiently. If the thermostat shutdown was caused by excessive output or duty cycle and the fan is operating normally, the power switch may be left on and the reset should occur within a 15 minute period. If the fan is not turning or the air intake louvers were obstructed , then the power must be switched off and the fan problem or air obstruction must be corrected.

MAJOR COMPONENTS LOCATION

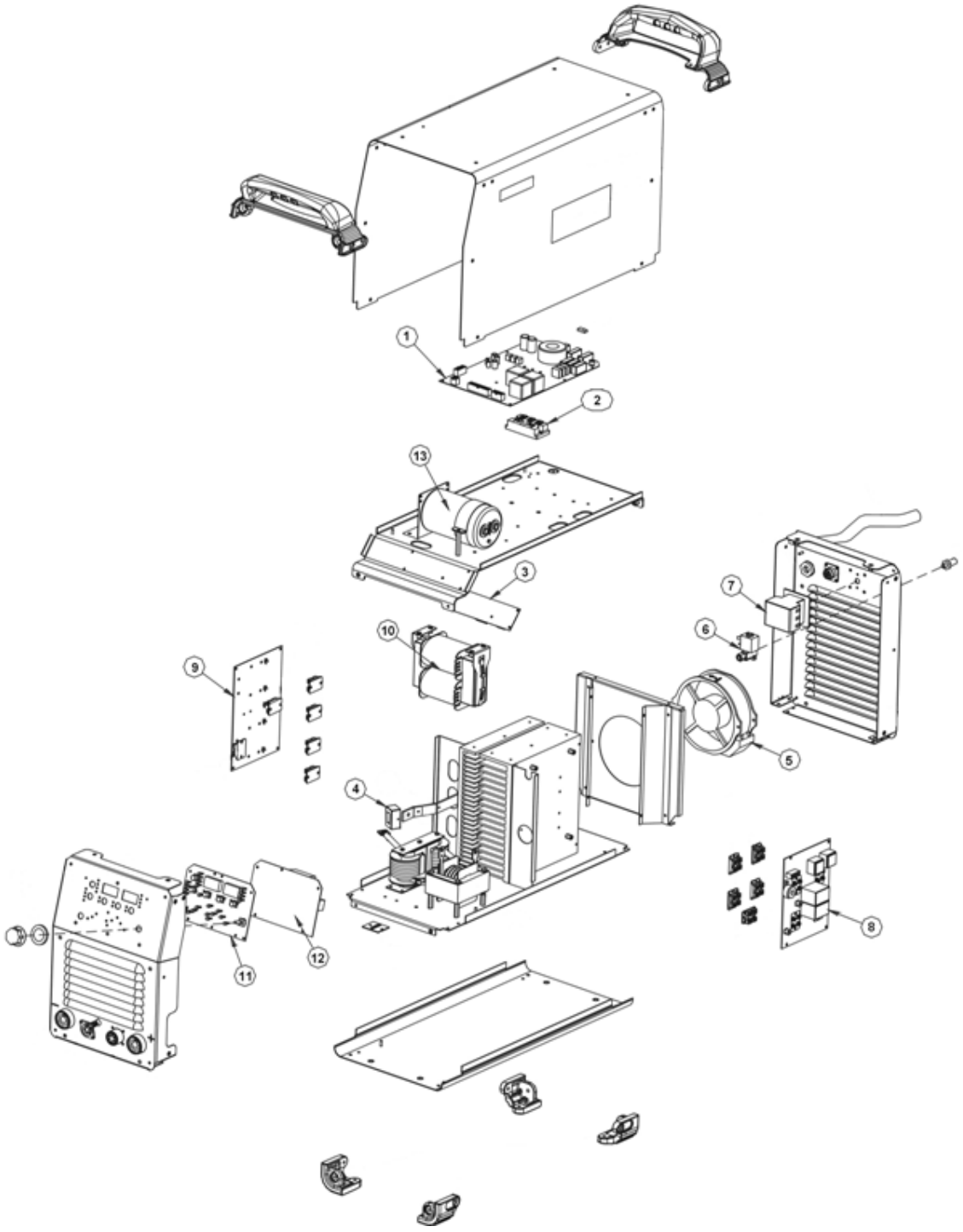
INVERTEC® 300TPX

1. Input Board
2. Input rectifier
3. HF Board
4. Hall Current Sensor
5. Fan
6. Gas Solenoid
7. Switch
8. Inverter Board
9. Output Board
10. Output Transformer
11. Display Board
12. Control Board



INVERTEC® 400TPX

1. Input Board
2. Input rectifier
3. HF Board
4. Hall Current Sensor
5. Fan
6. Gas Solenoid
7. Switch
8. Inverter Board
9. Output Board
10. Output Transformer
11. Display Board
12. Control Board
13. DC BUS Capacitor

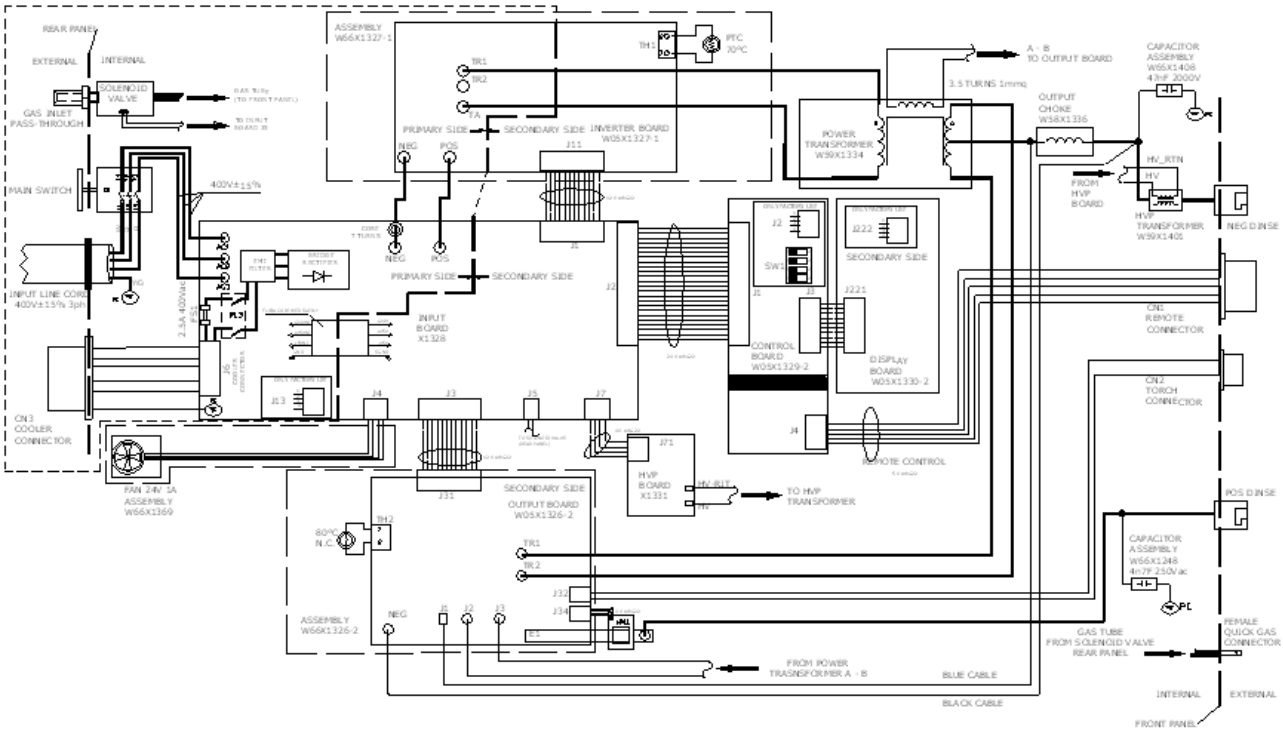


THEORY OF OPERATION

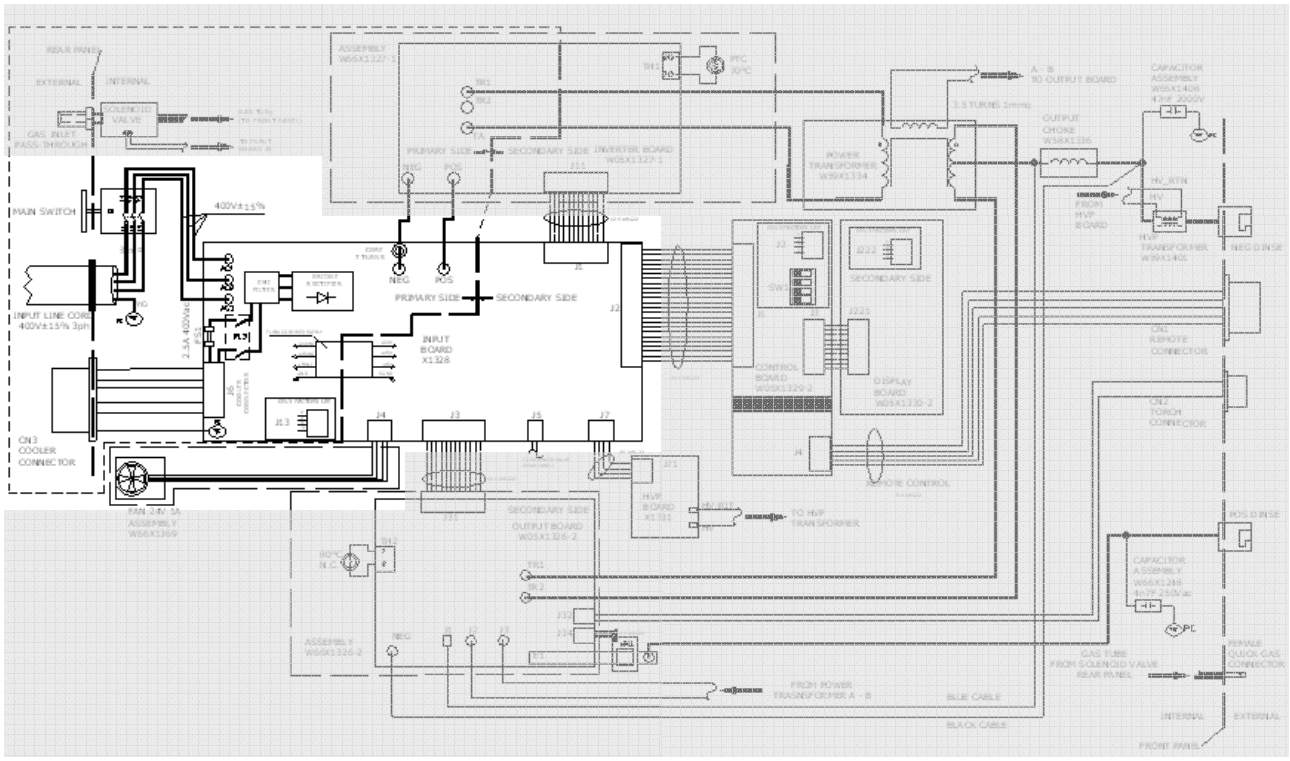
- General description
- Input Line Voltage, Auxiliary Voltage, Pre-charge
- Inverter Board and Main Transformer
- Output Board and Output Choke
- Control Board, Display Board and HF Board
- Protection Circuits
- IGBT operation

BLOCK DIAGRAM

(showing 300TPX block diagram)



INPUT SECTION



GENERAL DESCRIPTION

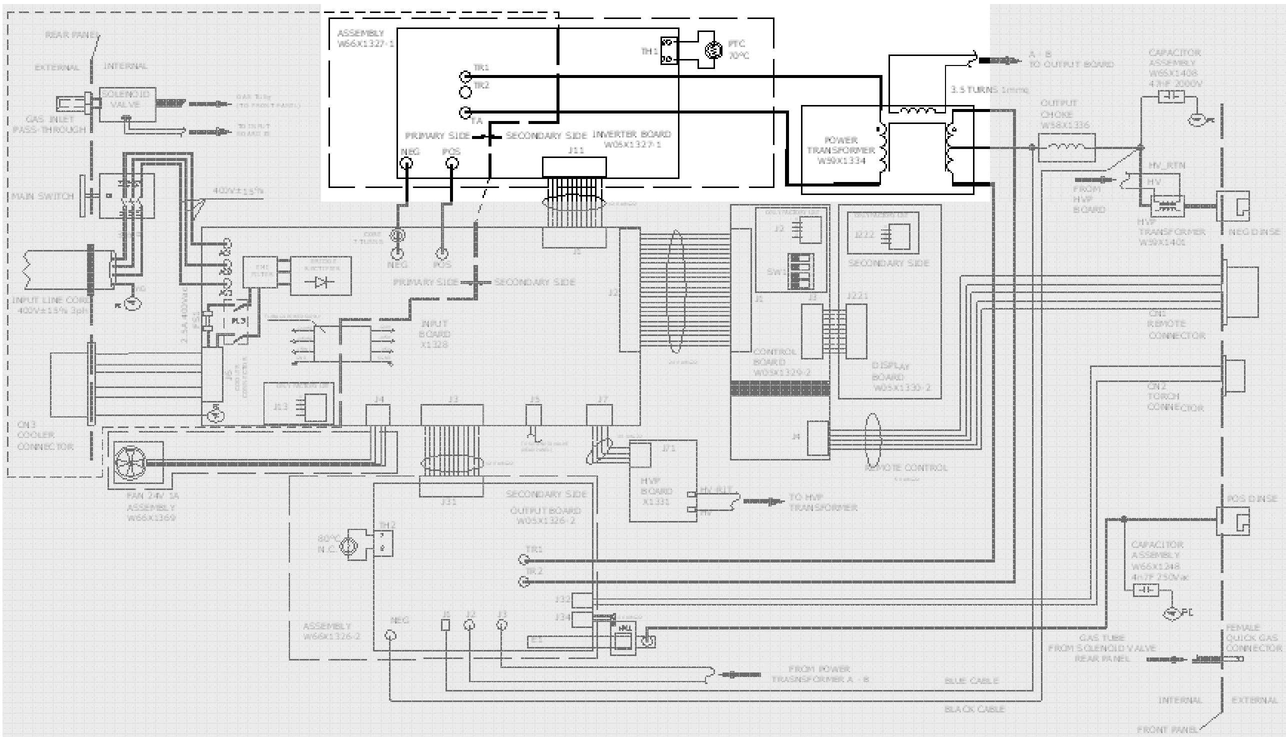
The INVERTEC® 300TPX & 400TPX are inverter based welding power sources that offers multi-mode (TIG and Stick) constant current welding. The machines can be operated on three phase input power 400Vac. The welding response of these INVERTECs® has been optimized for the stick (SMAW) and TIG (GTAW) welding processes with and without HF ignition.

INPUT LINE VOLTAGE, AUXILIARY VOLTAGE AND PRECHARGE

The 400V 3phases input power AC is connected to the machine, through an input cable, to the main switch located on the back of the power source. Once 400 Vac +/- 15% voltage is applied to the machine via the input switch, the following activities will be managed by the input board W05X1328 (-2 version for the 400TPX):

- The auxiliary power supplies (+24, +15V, -5V) to all the boards will be generated.
- A uController on the input board manages the soft stat and pre-charge operation. If the uController is correctly programmed LED LD2 on the input board is turned ON.
  - During this phase a signal called READY_OK signals to the control board that the machine is not still working; the green led on the front panel is blinking during this phase.
  - If the input power supply is in the correct range, the uController on the input board wait about 4 seconds before to short the pre-charge relay that shorts the pre-charge power resistance (PTC) to let the pre-charge of the input capacitors.
- After the pre-charge phase, another 1 second is necessary for the uController to release the READY_OK signal to the control board. After that, the control board signals to the user that the machine is ready to go keeping the from panel green led always turned ON.
- Under and over voltage control and alarm
- Fan and Water Cooler supply, when activation signals arrive from the control board

INVERTER AND MAIN TRANSFORMER



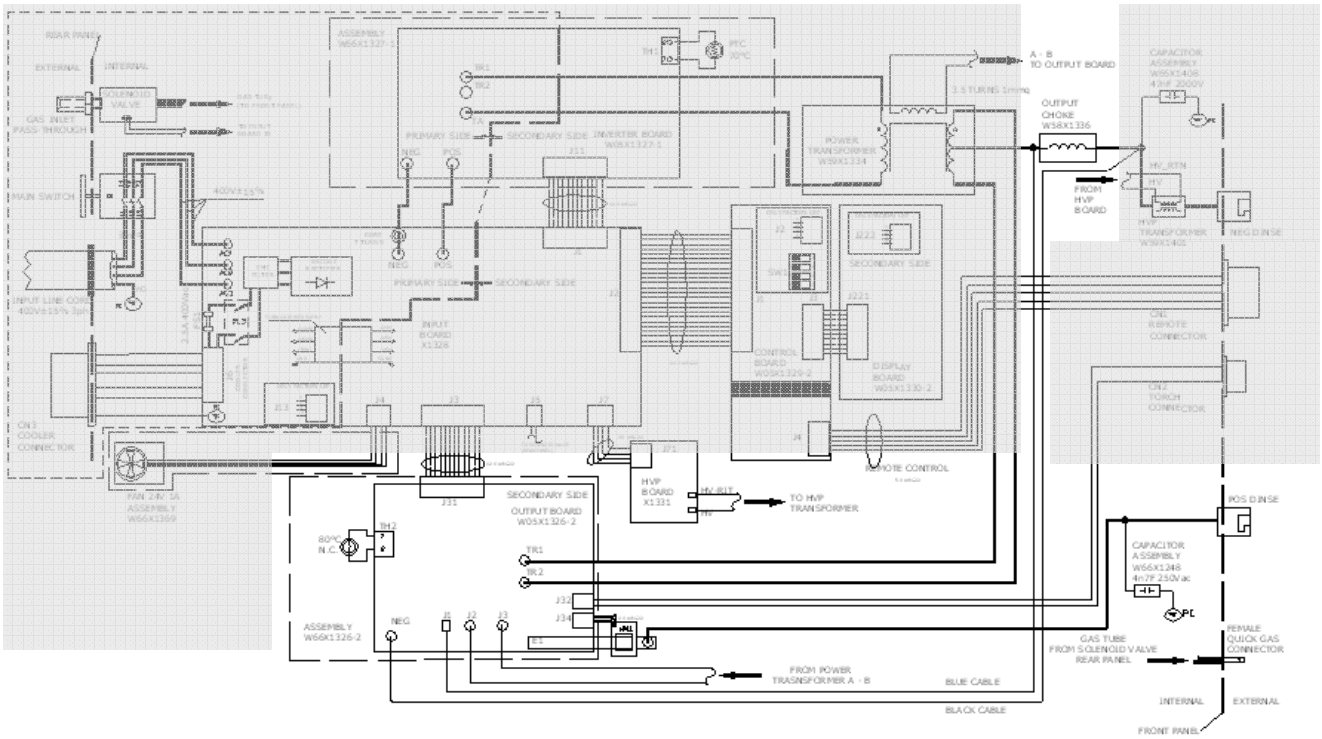
INVERTER AND MAIN TRANSFORMER

When the input filter capacitors are fully charged they act as power supplies for the IGBT switching circuit.

The IGBT switch the DC power from the input capacitors "on and off," thus supplying pulsed DC current to the main transformer primary windings. The full bridge inverter switching frequency is 25-30KHz. Current transformer located on the inverter board monitor the primary current. If the primary current become abnormally high, the inverter control circuit will shut off the IGBTs, thus disabling the machine's output. A thermal protector is also present, to the inverter heat-sink, to protect the IGBTs from overheating conditions.

The main transformer insulate the primary circuit from the secondary circuit; this secondary winding supplies the welding voltages and the welding currents. This high current winding is capable of supplying maximum output current during the cutting process. An auxiliary main transformer winding, provides to the output circuit the extra voltage required when special stick electrodes, like cellulosic, are used with the machine.

OUTPUT BOARD AND OUTPUT CHOKE



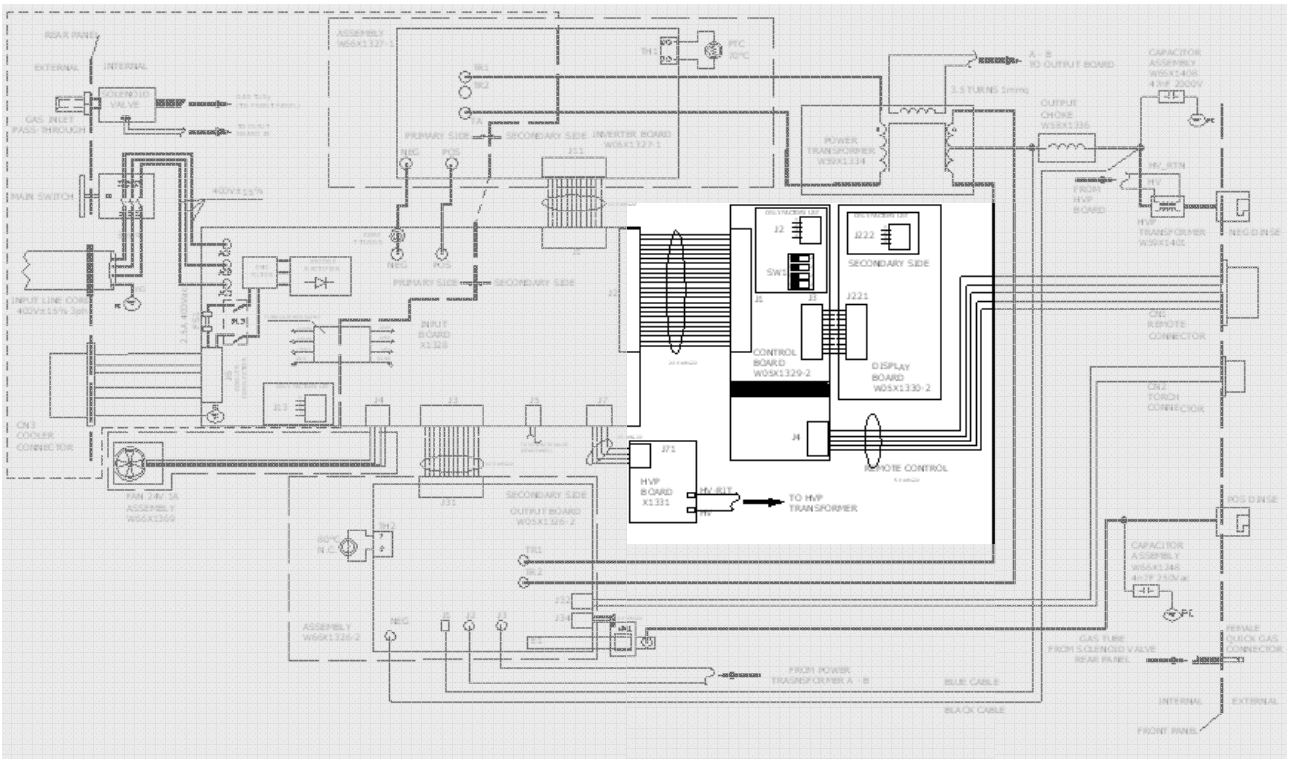
OUTPUT BOARD AND OUTPUT CHOKE

The output board receives the AC output waveform from the main transformer secondary winding and rectifies it to a DC voltage level.

Since the output choke is in series with the positive leg of the output rectifier and also in series with the welding load, a filtered DC output current is applied through the machine's output terminals.
Current sensor to the output board gives current feedback to the control board.

A thermal protector is also present, to the output board heat-sink, to protect the output diodes modules from overheating conditions.

CONTROL BOARD, DISPLAY BOARD AND HF BOARD



CONTROL BOARD , DISPLAY BOARD AND HF BOARD

The control board receives status and feedback signals from the input board, inverter board, output board and various sensors.

It receives also commands from the user-operated controls that are connected to the control board. These push buttons and potentiometer's allow the operator to set the current output of the machine. Other controls allow for the adjusting all the parameters for the TIG and Stick welding processes.

The control board processes and compares these commands with the voltage and current feedback information it receives from the output current sensor and the output voltage sensing leads.

Control board also gives error codes, using its LEDs, to the user, see dedicated section, later on this service manual.

On the Display board are located the displays, LEDs, push buttons and output encoders. The Display Boards functions as the interface between the user and the machine.

The HF Board generates a set of 40-60Hz pulses of about 800V-900V. These pulses are applied to the high frequency transformer that is located in the negative welding output leg of the machine and are amplified to about 10KV. This high frequency/voltage pulse is transferred to the TIG torch via the high frequency transformer. This allows the remote starting of the TIG arc without the need for the tungsten electrode to touch the work.
This high frequency pulse is switched off when the welding arc is established.
The HF command signals are received from the microprocessor on the Control Board and stays on, if the welding arc is not established for about 3 seconds maximum. The HF Board is supplied from the input board with 24Vdc and 15Vdc. HF is not working in Stick and Lift TIG modes.

OVERLOAD PROTECTION

INVERTEC® 300TPX & 400TPX are electrically protected from producing higher than normal output currents. An electronic protection circuit limits the current to within the capabilities of the machine.

THERMAL PROTECTION

There is one thermal device located on the output diodes heat-sink; it protects the machine from excessive operating temperature.
Excessive temperature may be caused by a lack of cooling air or by operating the machine beyond the duty cycle and output rating. If excessive operating temperature should occur, the Thermal LED indicator on the control board, will turn ON and the thermostat will prevent output current. The thermal protection devices are self-resetting once the machine cools sufficiently. If the shutdown was caused by excessive output or duty cycle and the fan is operating normally, the power switch may be left on and the reset should occur within about 8 minutes period. If the fan is not turning or the air intake louvers are obstructed, the input power must be removed and the fan problem or air obstruction must be corrected.

PROTECTIVE CIRCUITS

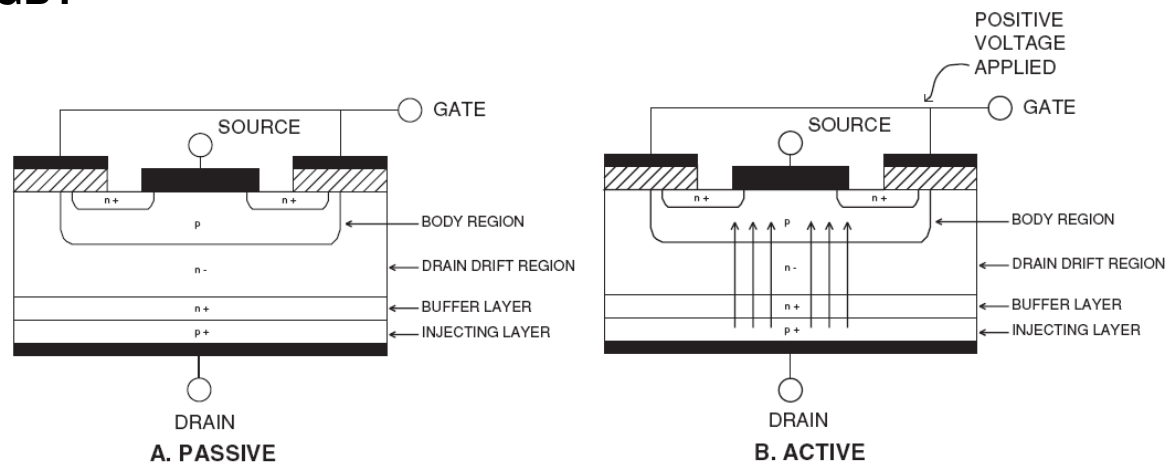
Protective circuits are designed into the 300TPX and 400TPX to sense trouble and shut down the machine before damage occurs to the machine's internal components.

INSULATED GATE BIPOLAR TRANSISTOR (IGBT) OPERATION

An IGBT is a type of transistor. IGBTs are semiconductors well suited for high frequency switching and high current applications.
Drawing A shows an IGBT in a passive mode. There is no gate signal, zero volts relative to the source, and therefore, no current flow. The drain terminal of the IGBT may be connected to a voltage supply; but since there is no conduction the circuit will not supply current to components connected to the source. The circuit is turned off like a light switch in the OFF position.

Drawing B shows the IGBT in an active mode. When the gate signal, a positive DC voltage relative to the source, is applied to the gate terminal of the IGBT, it is capable of conducting current. A voltage supply connected to the drain terminal will allow the IGBT to conduct and supply current to circuit components coupled to the source. Current will flow through the conducting IGBT to downstream components as long as the positive gate signal is present. This is similar to turning ON a light switch.

IGBT



TROUBLESHOOTING AND REPAIR SECTION

- How to use troubleshooting Guide
- Troubleshooting Guide
- Case cover removal and capacitor discharge procedure

HOW TO USE TROUBLESHOOTING GUIDE

Service and repair should be performed by only Lincoln Electric Factory Trained Personnel. Unauthorized repairs performed on this equipment may result in danger to the technician and machine operator and will invalidate your factory warranty. For your safety and to avoid Electrical Shock, please observe all safety notes and precautions detailed throughout this manual.

This Troubleshooting Guide is provided to help you locate and repair possible machine malfunctions. Simply follow the three-step procedure listed below.

Step 1. LOCATE PROBLEM (SYMPTOM). Look under the column labeled "PROBLEMS". This column describes possible symptoms that the machine may exhibit. Find the listing that best describes the symptom that the machine is exhibiting. Symptoms are grouped into three main categories: Output Problems, Function Problems, and LED Function Problems.

Step 2. PERFORM EXTERNAL TESTS. The second column, labeled "CHECKS", lists the obvious external possibilities that may contribute to the machine symptom. Perform these tests/checks in the order listed. In general, these tests can be conducted without removing the case wrap-around cover.

Step 3. PERFORM COMPONENT TESTS. The last column, labeled "RECOMMENDED COURSE OF ACTION " lists the most likely components that may have failed in your machine. It also specifies the appropriate test procedure to verify that the subject component is either good or bad. If there are a number of possible components, check the components in the order listed to eliminate one possibility at a time until you locate the cause of your problem.

All of the referenced test procedures referred to in the Troubleshooting Guide are described in detail at the end of this chapter. Refer to the Troubleshooting and Repair Table of Contents to locate each specific Test Procedure. All of the referred to test points, components, terminal strips, etc., can be found on the referenced electrical wiring diagrams and schematics. Refer to the Wiring Diagrams Section Table of Contents to locate the appropriate diagram.

WARNING

ELECTRIC SHOCK can kill

- Have an electrician install and service this equipment
- Turn the input power off at the fuse box before working on equipment
- Do not touch electrically hot parts
- Prior to performing preventive maintenance, perform the following capacitor discharge procedure to avoid electric shock

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Sometimes machine failures appear to be due to PC board failures. These problems can sometimes be traced to poor electrical connections. To avoid problems when troubleshooting and replacing PC boards, please use the following procedure:

1. Determine to the best of your technical ability that the PC board is the most likely component causing the failure symptom.
2. Check for loose connections at the PC board to assure that the PC board is properly connected.
3. If the problem persists, replace the suspect PC board using standard practices to avoid static electrical damage and electrical shock.
4. Test the machine to determine if the failure symptom has been corrected by the replacement PC board.

NOTE: Allow the machine to heat up so that all electrical components can reach their operating temperature.

5. Remove the replacement PC board and substitute it with the original PC board to recreate the original problem.
   - If the original problem does not reappear by substituting the original board, then the PC board was not the problem. Continue to look for bad connections in the control wiring harness, junction blocks, and terminal strips.
   - If the original problem is recreated by the substitution of the original board, then the PC board was the problem. Reinstall the replacement PC board and test the machine.
6. Always indicate that this procedure was followed when warranty reports are to be submitted.

NOTE: Following this procedure and writing on the warranty report, “INSTALLED AND SWITCHED PC BOARDS TO VERIFY PROBLEM,” will help avoid denial of legitimate PC board warranty claims.

TROUBLESHOOTING

!! WARNING !! **BEFORE CONNECT POWER SUPPLY, MAKE A CAREFUL VISUAL INSPECTION INSIDE THE MACHINE , CHECK ALL THE BOARDS AND HARNESSES.**

PROBLEMS / SYMPTOMS	POSSIBLE AREAS OF MISADJUSTMENT(S)	CHECK	RECOMMENDED COURSE OF ACTION
THE LINE CIRCUIT BREAKER TRIPS WHEN POWER SWITCH IS " ON"	• INPUT POWER BRIDGE IS IN SHORT CIRCUIT • ELECTROLYTIC CAPACITORS FAILURE • INVERTER IGBTs SHORT CIRCUITED	• PERFORM INPUT BOARD RESISTANCE TEST • PERFORM THE INVERTER RESISTANCE TEST	• REPLACE THE DEFECTIVE BOARD
THE MACHINE IS DEAD, NO OUTPUT, NO LEDs, NO DISPLAY, NO FAN	• THERE IS NO POWER SUPPLY VOLTAGE • THE POWER SUPPLY CABLE IS INTERRUPTED • LINE SWITCH FAILURE • THE INPUT BOARD IS DAMAGED	• CHECK THE PHASE INPUT VOLTAGE ON THE MACHINE • CHECK THE POWER SUPPLY CABLE • CHECK THE LINE SWITCH • PERFORM THE INPUT BOARD RESISTANCE AND VOLTAGE TEST	• RECONNECT THE POWER SUPPLY • REPLACE THE INPUT POWER CABLE • REPLACE THE LINE SWITCH • REPLACE THE INPUT BOARD
THE GREEN POWER ON LED ON THE FRONT PANEL IS BLINKING ALL THE TIME	• THE INPUT VOLTAGE IS OVER THE RANGE (CHECK FOR ERROR 01 ON DISPLAY) • THE INPUT BOARD IS DEFECT	• CHECK THE INPUT VOLTAGE • TURN OFF AND ON AGAIN THE MACHINE TO RESET THE ERROR CONDITION • PERFORM THE INPUT BOARD VOLTAGE TEST	• CONNECT THE MACHINE TO A PROPER VOLTAGE SUPPLY RANGE • REPLACE THE INPUT BOARD
HF IS NOT PRESENT WHEN TIG HF MODE IS SELECTED	• THE HF BOARD IS DEFECT • CONTROL BOARD IS DEFECT	• PERFORM THE HF TEST • PERFORM THE CONTROL BOARD TEST	• REPLACE THE HF BOARD • REPLACE THE CONTROL BOARD
THE MACHINE REGULARLY OVERHEATS, THE YELLOW THERMAL LIGHT IS ON INDICATING A THERMAL OVERLOAD AND ERROR 10 IS DISPLAYED	• THE WELDING APPLICATION MAY BE EXCEEDING THE RECOMMENDED DUTY CYCLE OF THE 300TPX OR 400TPX • DIRT AND DUST MAY HAVE CLOGGED THE COOLING CHANNELS INSIDE THE MACHINE • THE AIR INTAKE AND EXHAUST LOUVERS MAY BE BLOCKED DUE TO INADEQUATE CLEARANCE AROUND THE MACHINE • MAKE CERTAIN THE FAN AS NEEDED (F.A.N.) CIRCUIT IS OPERATING PROPERLY (SEE USER MANUAL F.A.N. SECTION).	• CHECK AND RESPECT THE RECOMMENDED DUTY CYCLE • CLEAN WITH LOW PRESSURE DRY AIR THE COOLING CHANNEL INSIDE THE MACHINE • MAKE SURE TO HAVE ADEQUATE CLEARANCE AROUND THE MACHINE • ONE OF THE THERMOSTATS MAY BE FAULTY. • CHECK THE FAN	• REPLACE THE FAULTY TERMOSTAT • REPLACE THE FAN
THE MACHINE HAS ALWAYS FULL OUTPUT CURRENT	• THE CONTROL BOARD IS DEFECT • THE HALL EFFECT PROBE IS DEFECT OR NOT CORRECTLY SUPPLIED	• PERFORM THE CONTROL BOARD TEST • PERFORM THE OUTPUT BOARD TEST	• REPLACE THE CONTROL BOARD • REPLACE THE OUTPUT BOARD OR THE HALL EFFECT PROBE
ERROR 11 ON DISPLAY	• THE WATER COOLER IS NOT WORKING PROPERLY • THE INPUT BOARD IS DEFECT • THE CONTROL BOARD IS DEFECT	• CHECK THE WATER COOLER PRESSURE SWITCH AND PUMP • PERFORM THE INPUT BOARD VOLTAGE TEST. CHECK THE WATER COOLER VOLTAGE SUPPLY AND THE WATER ERROR SIGNAL CIRCUIT • PERFORM THE CONTROL BOARD VOLTAGE TEST	• REPLACE THE PRESSURE SWTCH OR THE PUMP DEPENDING OF THE CHECK RESULT DONE ON THE WATER COOLER • REPLACE THE INPUT BOARD • REPLACE THE CONTROL BOARD
ERROR 06 ON DISPLAY - GREEN AND YELLOW LEDS ARE BLINKING ALTERNATIVELY	• INVERTER AUXILIARY VOLTAGE FAULT CONDITION DETECTED	• PERFORM THE INPUT VOLTAGE TEST (FOCUS ON AUXILIARY VOLTAGE +15VDC) • PERFORM THE INVERTER VOLTAGE TEST	• REPLACE THE INPUT BOARD • REPLACE THE INVERTER BOARD

CASE COVER REMOVAL AND DC LINK CAPACITOR DISCHARGE PROCEDURE

WARNING

Service and repair should be performed only by Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual.

If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact your Local Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed.

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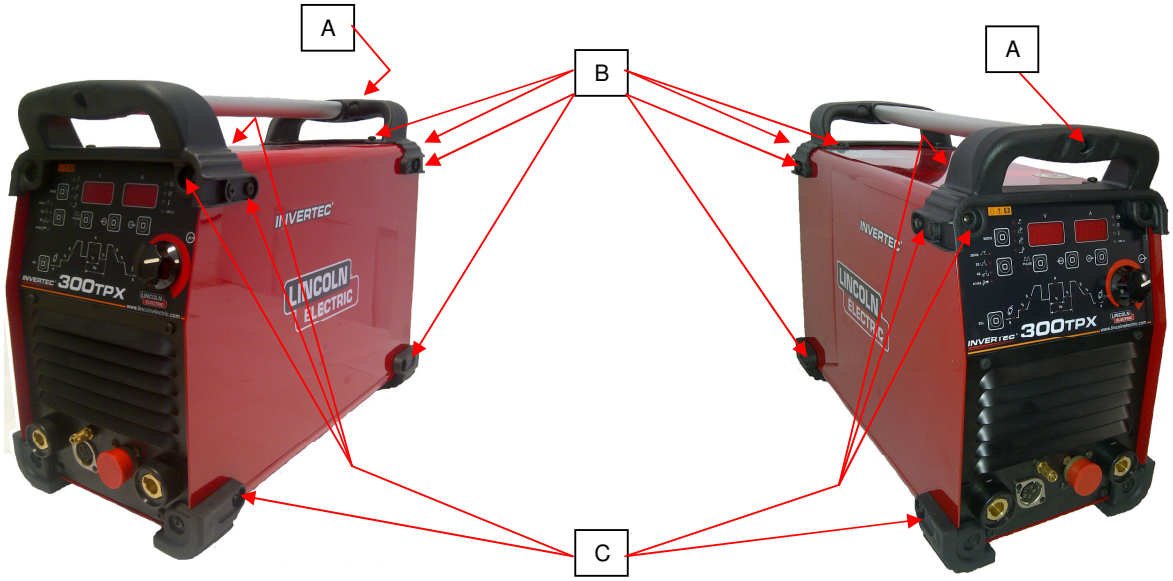
DESCRIPTION

This procedure will aid the technician in the removal and replacement of the case sheet metal cover and discharging the DC link capacitor making it safe for the technician to work on the machine.

MATERIALS NEEDED

Phillips screwdriver PH02

INVERTEC® 300TPX - CASE COVER REMOVAL



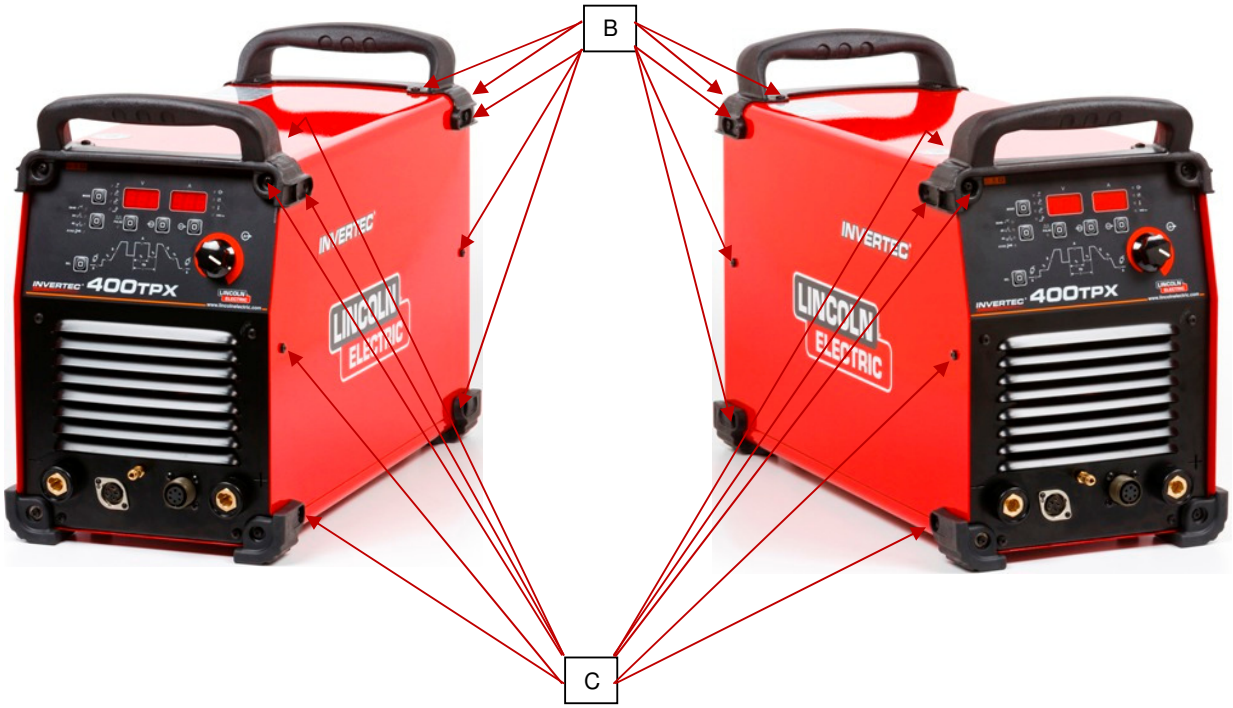
Necessary tool:

- Phillips PH2 screwdriver

Procedure:

1. Turn on/off switch to off position.
2. Disconnect Input Power from the machine !
3. Remove the 2 screws of the aluminum handle (A).
4. Remove the 8 screws of the rear plastic handle and the 2 screws of the rear rubber corners (B).
5. Remove the 8 screws of the front plastic handle and the 2 screws of the front rubber corners (C).
6. Don't remove the 4 bottom rubber corners
7. Pull up the red case cover.
8. Follow the **input filter discharge procedure !**

INVERTEC® 400TPX - CASE COVER REMOVAL



Necessary tool:

- Phillips PH2 screwdriver

Procedure:

1. Turn on/off switch to off position.
2. Disconnect Input Power from the machine !
3. Remove the 12 screws on the rear plastic handle, rear rubber corners and cover (B).
4. Remove the 12 screws of the front plastic handle and the 2 screws of the front rubber corners (C).
5. Don't remove the 4 bottom rubber corners
6. Pull up the red case cover.
7. Follow the **input filter discharge procedure !**

DISCHARGE PROCEDURE

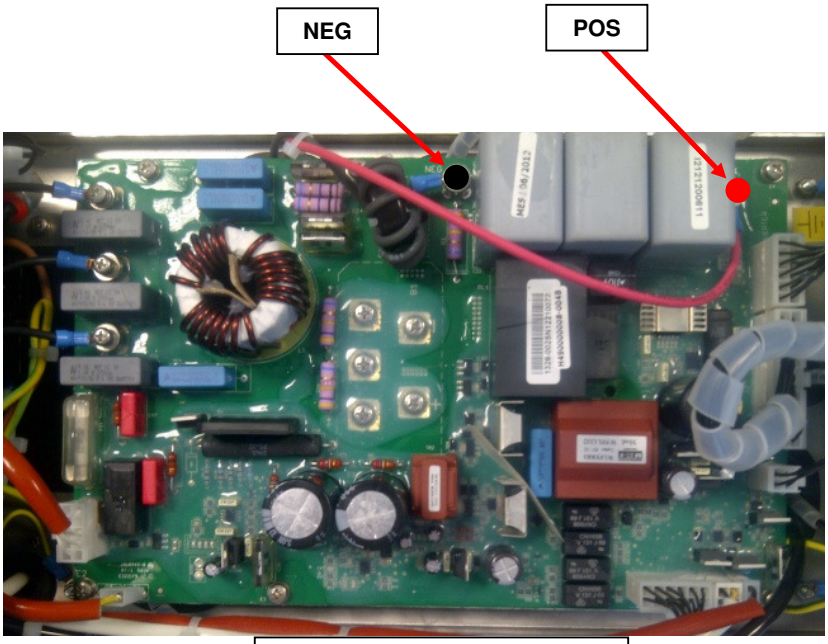
WARNING

ELECTRIC SHOCK can kill

Have an electrician install and service this equipment
Turn the input power off at the fuse box before working on equipment
Do not touch electrically hot parts
Prior to performing preventive maintenance, perform the following capacitor discharge procedure to avoid electric shock.

INPUT FILTER CAPACITOR DISCHARGE PROCEDURE

1. Remove main input power to the INVERTEC® 300TPX or 400TPX
2. Remove the cover following the case removal procedure available in this Service manual.
3. The capacitors are discharged by discharge resistors integrated into the input board in about 5 (five) minutes.
4. Locate the two points **POS** and **NEG** on the Input Board. **See Figure 1**
5. Connect your multimeter positive probe to **POS** point and your negative probe to **NEG** point and check the voltage accross DC bus capacitors.
6. In case of presence of any residual voltage follow the next steps
7. Obtain a high resistance and high wattage resistor (500-1000 ohms and 25 watts minimum). This resistor is NOT supplied with the machine. NEVER USE A SHORTING STRAP FOR THIS PROCEDURE.
8. Use electrically insulate gloves and insulated pliers. Hold the body of the resistor and connect the resistor leads across the two points **POS** and **NEG**. **See Figure 1**. Hold the resistor in place for 10 seconds. DO NOT TOUCH CAPACITOR TERMINALS WITH YOUR BARE HANDS.
9. Check again the voltage across the two terminals (**POS** and **NEG**). Voltage should be zero. If any voltage remains, repeat this procedure.



INPUT BOARD - Figure 1
Showing 300TPX input board

INPUT BOARD RESISTANCE TEST

WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact your Local Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed.

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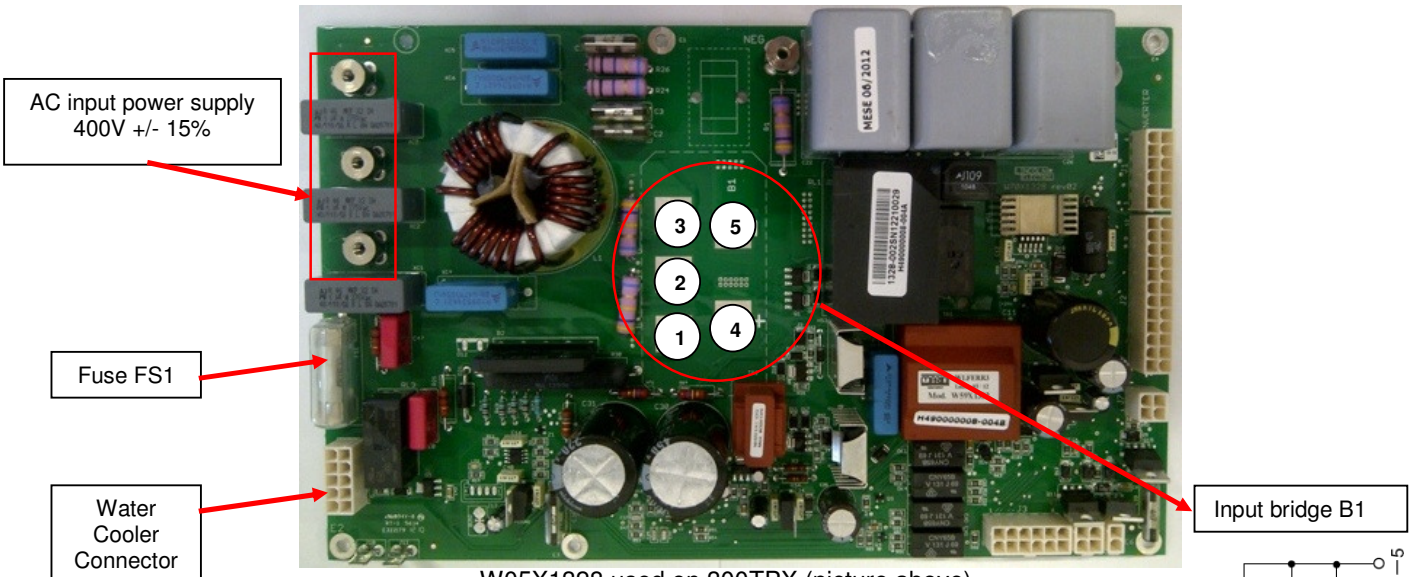
TEST DESCRIPTION

This test will determine if the input board has any " shorted " or "open" components.

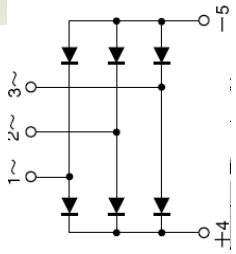
MATERIALS NEEDED

Volt/Ohmmeter
Schematic X1328

INPUT BOARD RESISTANCE TEST (continued)



W05X1328 used on 300TPX (picture above)
W05X1328-2 used on 400TPX



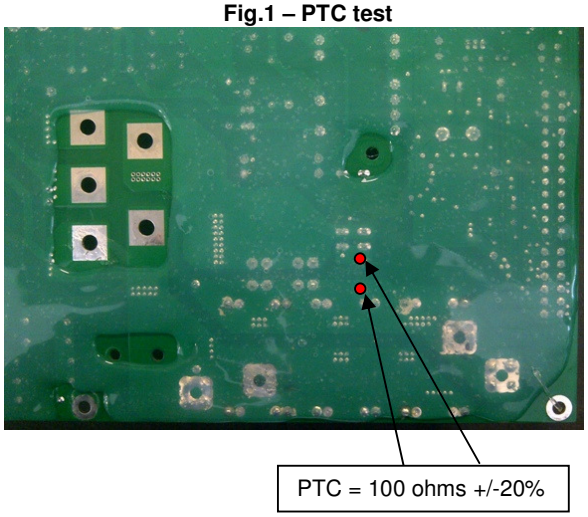
TEST PROCEDURE

1. Remove main input power to the INVERTEC® 300TPX or 400TPX
2. Perform the **Discharge procedure**
3. Visually check for burned or damaged components. If any components are physically damaged the input board should be replaced
4. Using the Volt-Ohmmeter (diode test mode) check the fuse **FS1**
5. Using the Volt-Ohmmeter (diode test mode) check the Input Rectifier **D1** (see **Table tests 1**)
6. Using the Volt-Ohmmeter check **PTC** for 100 ohms +/- 20%. If PTC does not pass the test may be a failure (short) on capacitors or IGBT is present (this check must be done from the input board solder side, see Fig.1)

Input Bridge - Table tests 1

Positive Probe (RED)	*Negative Probe (BLACK)*	*Value*
1 (AC)	**4** (+)	*0.3V - 0.7V*
2 (AC)	**4**(+)	*0.3V - 0.7V*
3 (AC)	**4**(+)	*0.3V - 0.7V*
4 (+)	**1** (AC)	*OPEN*
4(+)	**2** (AC)	*OPEN*
4(+)	**3** (AC)	*OPEN*
5 (-)	**1**(AC)	*0.3V - 0.7V*
5 (-)	**2** (AC)	*0.3V - 0.7V*
5 (-)	**3** (AC)	*0.3V - 0.7V*
1 (AC)	**5** (-)	*OPEN*
2 (AC)	**5** (-)	*OPEN*
3 (AC)	**5** (-)	*OPEN*

Fig.1 – PTC test



INVERTER BOARD RESISTANCE TEST

WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact your Local Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed.

……..

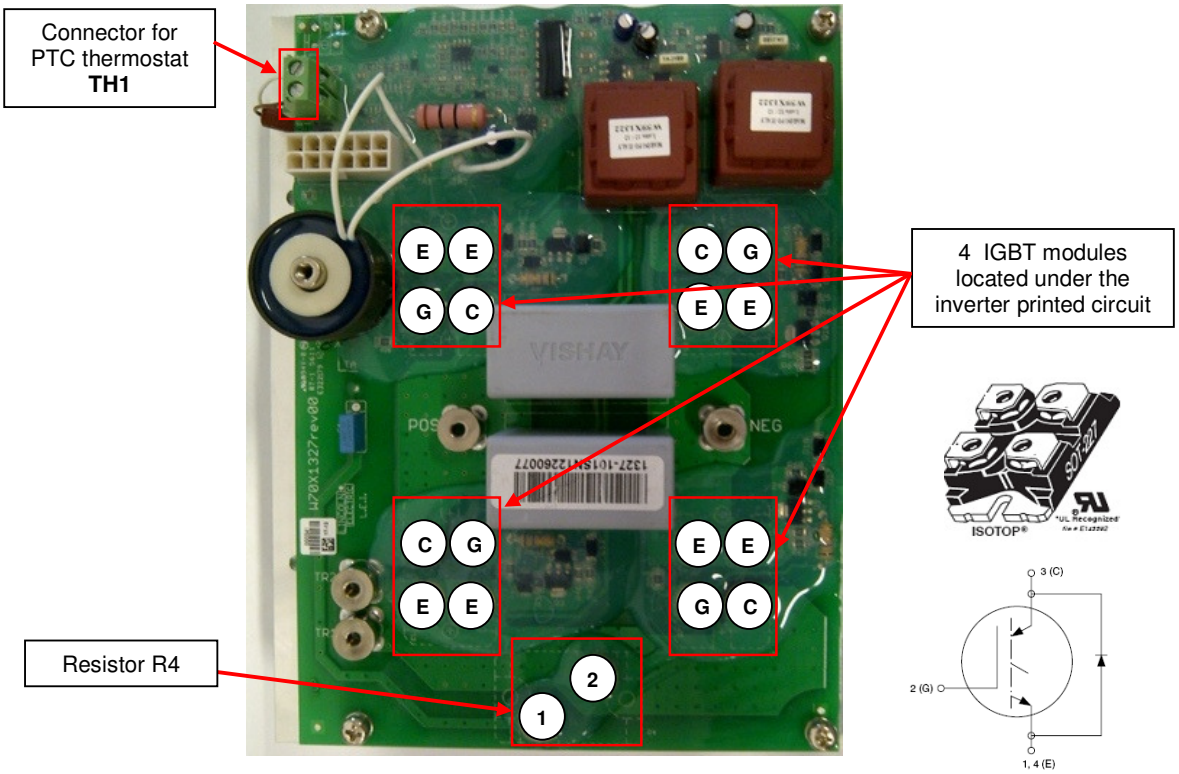
TEST DESCRIPTION

This test will help determine if the “power section” of the inverter board are functioning correctly. This test will NOT indicate if the entire PC board is functional. This resistance test is preferable to a voltage test with the machine energized because this board can be damaged easily. In addition, it is dangerous to work on this board with the machine energized.

MATERIALS NEEDED

Volt/Ohmmeter
Schematic X1327

INVERTER BOARD RESISTANCE TEST (continued)



W05X1327-1 used on 300TPX
W05X1327-2 used on 400TPX

TEST PROCEDURE

1. Remove main input power to the INVERTEC® 300TPX or 400TPX
2. Perform the **Discharge procedure**
3. Visually check for burned or damaged components. If any components are physically damaged the inverter board and damaged components should be replaced
4. Check the PTC thermostat TH1, connected to the green connector (see picture above), with ohmmeter; correct value should be 57ohms +/- 20% @ 25°C
5. Check the resistor R4 between points 1 &2 (see picture above), correct value should be 100 ohms +/- 20%, when inverter is fully connected to the machine harnesses.
6. Check each IGBT module (Q1,Q2,Q7,Q8), with multimeter in diode test mode, following the table below:

IGBT modules - table tests

Positive Probe (RED)	***Negative Probe (BLACK)***	***Value***
Emitter (E)	Collector (C)	*0.3V - 0.7V*
Collector (C)	Emitter (E)	Open
Emitter (E)	Gate (G)	*0.2V - 0.7V*

OUTPUT BOARD RESISTANCE TEST

WARNING

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TEST DESCRIPTION

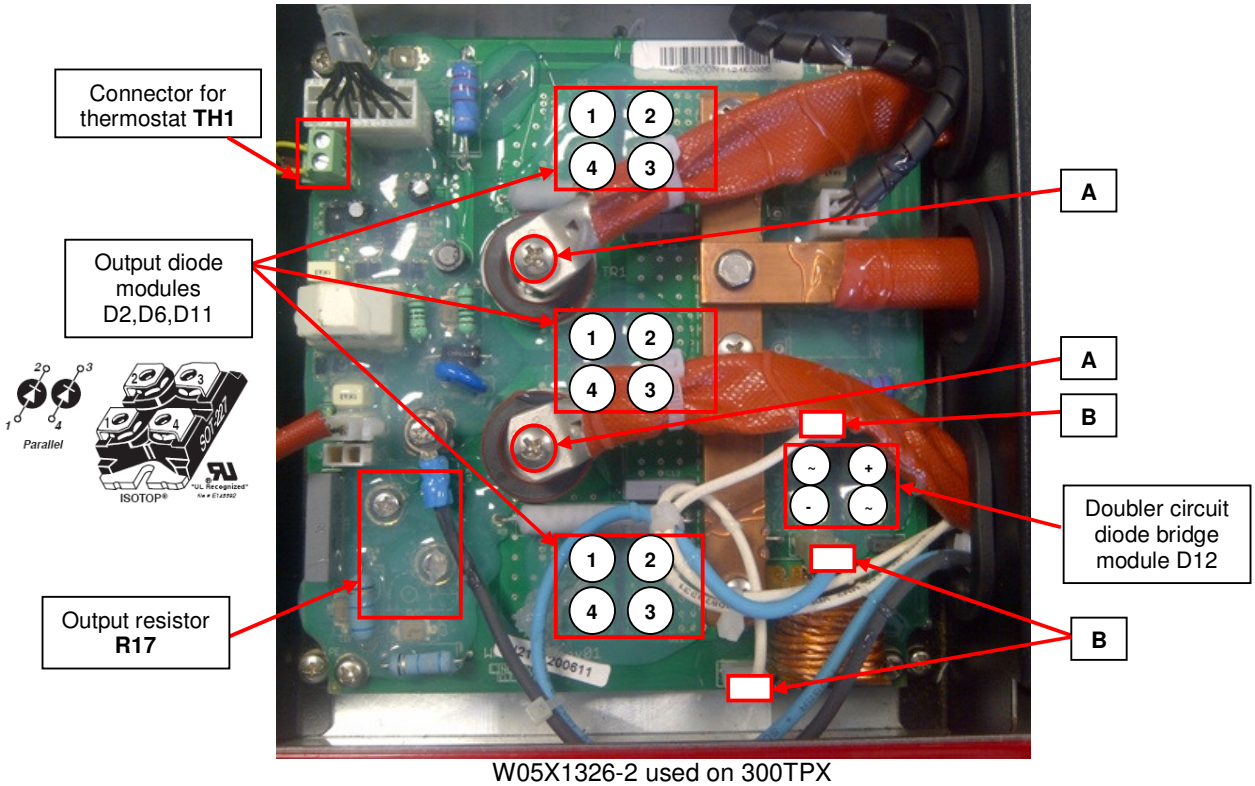
This test will help determine if the “power section” of the output board are functioning correctly. This test will NOT indicate if the entire PC board is functional but will give you the first feedback regarding the status of the output power components.

MATERIALS NEEDED

Volt/Ohmmeter
Wiring Diagram X1326 (for 300TPX) and X1442 (for 400TPX)

OUTPUT BOARD RESISTANCE TEST (continued)

for INVERTEC® 300TPX



W05X1326-2 used on 300TPX

TEST PROCEDURE

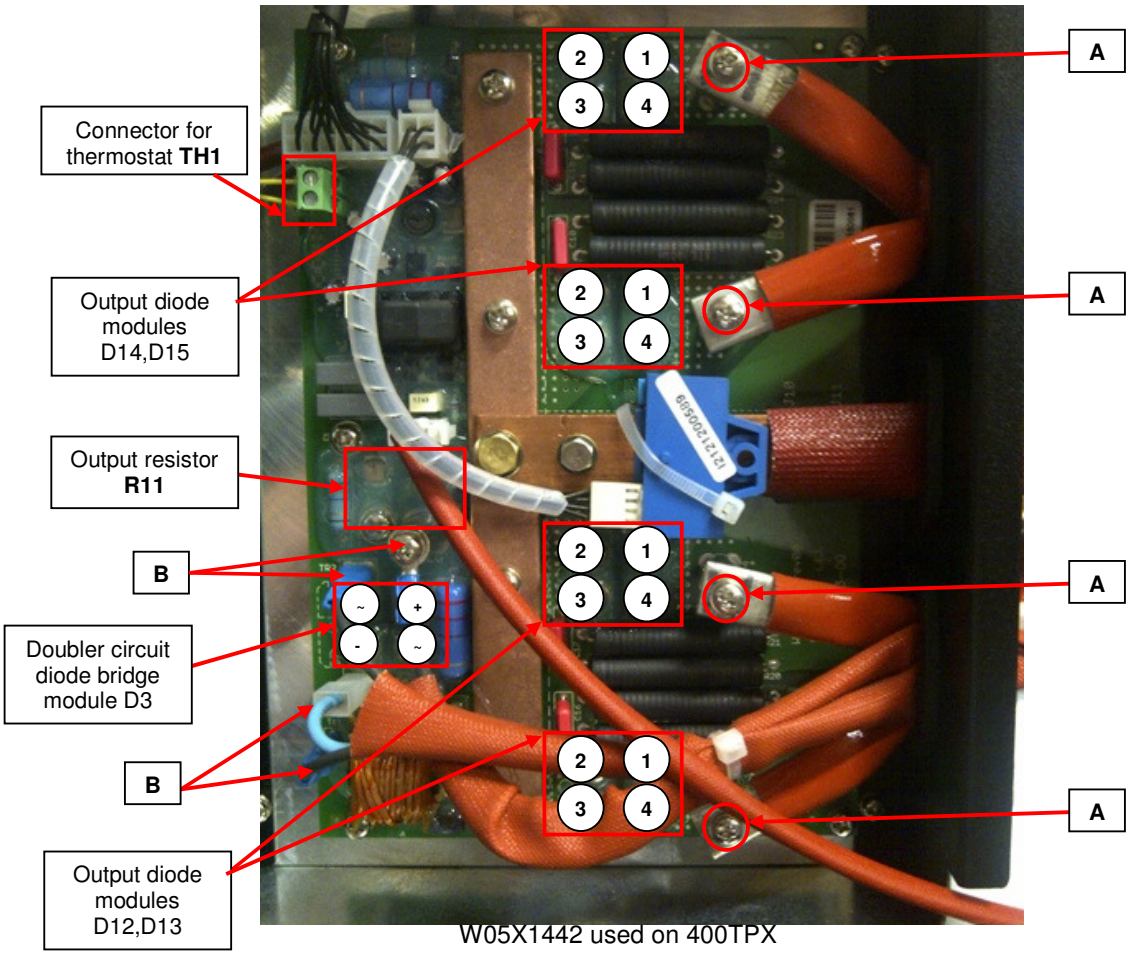
1. Remove main input power to the INVERTEC® 300TPX
2. Perform the **Discharge procedure**
3. Visually check for burned or damaged components. If any components are physically damaged the output board should be replaced
4. Check the thermostat **TH1**, connected to the green connector (see picture above), with ohmmeter; correct value is 0 (zero) ohms (short)
5. Check the Output Resistor **R17** using ohmmeter, value shall be 100 ohms +/- 20%
6. Disconnect the two power cables removing the two screws (**A**)
7. Disconnect the three terminals (**B**)
8. Check the rectifier bridge D12
9. Follow the below table to perform the remaining tests:

Output Diode modules (D2 – D6 – D11)

Positive Probe (RED)	Negative Probe (BLACK)	Value
4 (anode)	**3** (cathode)	0.3V - 0.7V
3 (cathode)	**4** (anode)	OPEN
1 (anode)	**2** (cathode)	0.3V - 0.7V
2 (cathode)	**1** (anode)	OPEN

OUTPUT BOARD RESISTANCE TEST (continued)

for INVERTEC® 400TPX



W05X1442 used on 400TPX

TEST PROCEDURE

1. Remove main input power to the INVERTEC® 400TPX
2. Perform the **Discharge procedure**
3. Visually check for burned or damaged components. If any components are physically damaged the input board should be replaced
4. Check the thermostat **TH1**, connected to the green connector (see picture above), with ohmmeter; correct value is 0 (zero) ohms (short)
5. Check the Output Resistor **R11** using ohmmeter, value shall be 100 ohms +/- 20%
6. Disconnect the four power cables removing the four screws (**A**)
7. Disconnect the four terminals (**B**)
8. Check the rectifier bridge D3
9. Follow the below table to perform the remaining tests:

Output Diode modules (D12 – D13 – D14 – D15)

Positive Probe (RED)	Negative Probe (BLACK)	Value
4 (anode)	**3** (cathode)	0.3V - 0.7V
3 (cathode)	**4** (anode)	OPEN
1 (anode)	**2** (cathode)	0.3V - 0.7V
2 (cathode)	**1** (anode)	OPEN

INPUT BOARD VOLTAGE TEST

WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact your Local Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed.

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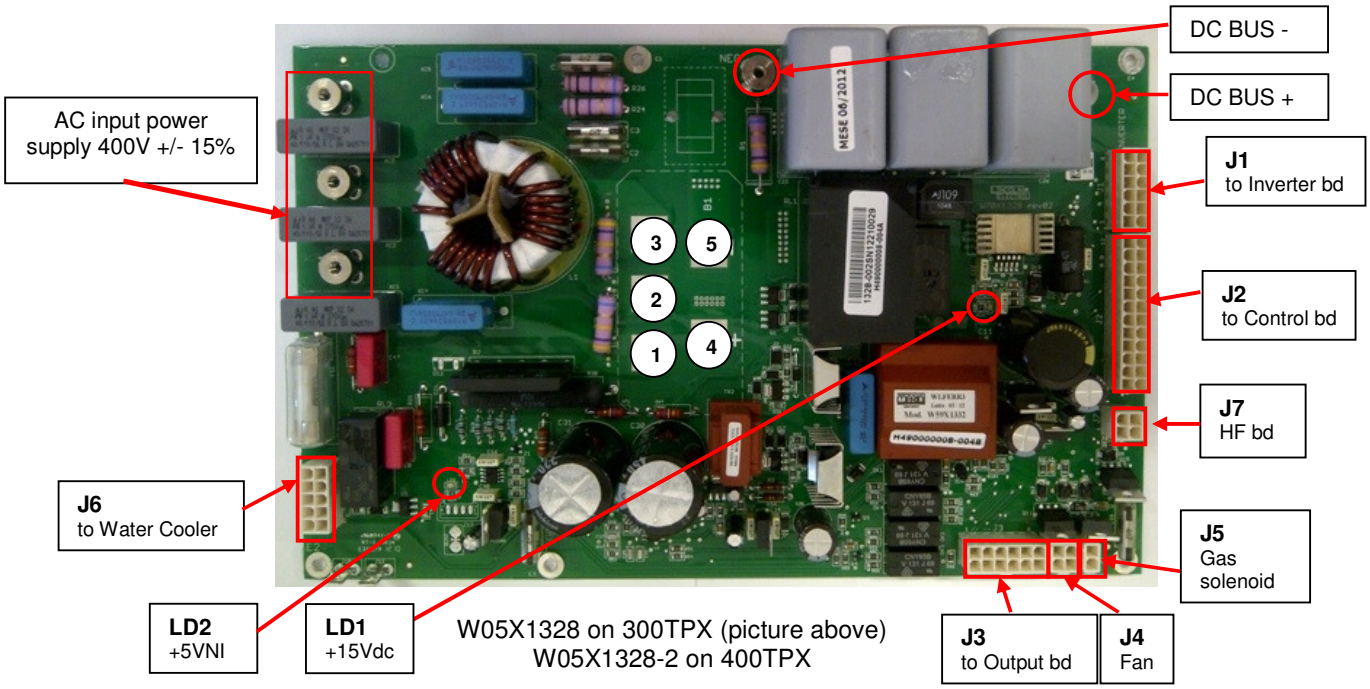
TEST DESCRIPTION

This test will help to determine if the correct input voltage is being applied to the input board and also if the correct voltages are being processed on the input board.

MATERIALS NEEDED

Volt/Ohmmeter
Schematic X1328

INPUT BOARD VOLTAGE TEST (continued)

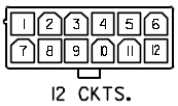


TEST PROCEDURE

⚠ **Use always electrically insulate gloves during this test procedure**

1. Apply 400Vac +/- 15% to the INVERTEC® 300TPX or 400TPX
2. Turn the machine input switch to ON position, soft start operation starts and power LED on front panel starts to blink.
3. Verify that the green LD1, on input board is lit and that, after 5 seconds, the power LED on front panel is steady green. This means that the input voltage is in the correct range and the capacitors pre-charge phase is finish.
4. Check for 564Vdc +/-15% between terminals DC BUS+ and DC BUS-.
5. Follow the below tables test to perform the voltage tests on connectors:

J1: Input/Inverter connector



Pin#	Description	Value (use SGND as 0V ref.)	Notes
1	VREG	• +12Vdc +/- 10% in Lift TIG mode, stand-by condition (no OCV, no fan), thermal and any overload condition. • 0,6Vdc +/- 10% in stick mode during OCV condition **for 300TPX** • 0,4Vdc in stick mode during OCV condition **for 400TPX**	+12Vdc = inverter OFF
2	DUTY	• **For 300TPX:** 50A=1Vdc_150A=3Vdc_300A=6Vdc • **For 400TPX:** 50A=0,75Vdc_150A=2,2Vdc_400A=6Vdc	Output current set signal
3	VRIF		
4	-5V	-5Vdc	-5V power supply generated by the input board.
5	HFON-PK	• 0V= in stick mode • 7,5Vdc +/- 10% in LIFT and HF mode	Signal for starting peak current in HF (Peak visible only with oscilloscope at arc start)
6	SGND	SGND	Secondary GND for power supply (0V ref.)
7	MIS_V	• 6Vdc +/- 10% in stick mode in OCV condition • 0,6 Vdc +/- 10% TIG modes in OCV condition	Output voltage feedback
8	I_LIM	Not Used	Not used
9	300/400	0Vdc=300A 5Vdc +/- 10% =400A	Control board machine identification
10	MIS_I	• 2Vdc=150A – 3,6Vdc=270A **for 300TPX** • 1Vdc=100A – 4Vdc=400A **for 400TPX**	Output current feedback
11	TH1	• 0V=normal value • 14,5Vdc +/- 10% = thermic activated on inverter board	Thermostat on the inverter heat sink signal
12	+15V	+15Vdc	+15V power supply generated by the input board.

INPUT BOARD VOLTAGE TEST (continued)

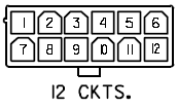
J2: Input/Control connector

Pin#	Description	Value (use SGND as 0V ref.)	Notes
1	+15V	+15Vdc	+15Vdc generated by input board
2	SGND	SGND	Secondary GND for power supply (0V ref.)
3	FLOW	• 0Vdc=Water flow OK • 15Vdc= Water flow KO (Err 11 on display)	Water flow signal from coolarc->input board
4	MIS_I	• 2Vdc=150A – 3,6Vdc=270A **for 300TPX** • 1Vdc=100A – 4Vdc=400A **for 400TPX**	Output current feedback
5	MIS_V	• 6Vdc +/- 10% in stick mode in OCV condition • 0,6 Vdc +/- 10% TIG modes in OCV condition	Output voltage feedback
6	HFON-PK	• 0V= in stick mode • 7,5Vdc +/- 10% in LIFT and HF mode	Signal for starting peak current in HF (visible only with oscilloscope)
7	VREG	• +12Vdc +/- 10% in Lift TIG mode, stand-by condition (no OCV, no fan), thermal and any overload condition. • 0,6Vdc +/- 10% in stick mode during OCV condition **for 300TPX** • 0,4Vdc in stick mode during OCV condition **for 400TPX**	+12Vdc = inverter OFF
8	HVPON	• +15Vdc in Stick and Lift TIG mode • 0Vdc in TIG HF mode	Only when in TIG HF mode +15Vdc are applied to pin 1 of HF connector
9	READY_OK	• +5Vdc only during Power Up sequence • 0V during normal operation condition	
10	COOLER	• +15Vdc in Stick mode • 0V in both TIG modes	Cooler ON/OFF
11	TH1	• 0V=normal value • 15Vdc +/- 10% = thermic activated on inverter board	Thermostat on the inverter heat sink signal
12	DUTY	• **For 300TPX:** 50A=1Vdc_150A=3Vdc_300A=6Vdc • **For 400TPX:** 50A=0,75Vdc_150A=2,2Vdc_400A=6Vdc	Output current set signal
13	LS	23Vdc +/- 10% in OCV condition	Lift TIG mode detection signal
14	ILIM	Not Used	Not Used
15	TH2	• 0V=normal value • 15Vdc +/- 10% = thermic activated on output board	Thermostat on the output heat sink signal
16	/TR	• 13Vdc +/- 10% any modes in stand-by • 0Vdc = trigger pushed	Trigger signal
17	SOL	• 24Vdc +/- 10% = gas solenoid OFF • 0Vdc = Gas solenoid ON	Gas solenoid ON/OFF
18	HF	• 0V=HF OFF • 15Vdc +/- 10% = HF ON (only for 3 seconds after trigger pushed)	HF ON/OFF
19	SGND	SGND	
20	300/400	0Vdc=300A 5Vdc +/- 10% =400A	Control board machine identification
21	FAN	• +24Vdc +/- 10% = FAN OFF • 0Vdc = FAN ON	FAN ON/OFF
22	FAN DRIVE	+5V any condition	
23	FAN SPEED	• +5Vdc +/- 10% with FAN OFF • 0Vdc with FAN ON	
24	VRIF	Not Used	Not used

INPUT BOARD VOLTAGE TEST (continued)

J3: Input/Output connector

Pin#	Description	Value (use SGND as 0V ref.)	Notes
1	MIS_V	• 6Vdc +/- 10% in stick mode in OCV condition • 0,6 Vdc +/- 10% TIG modes in OCV condition	Output voltage feedback
2	Not used	Not used	Not Used
3	-5V	-5Vdc	-5Vdc
4	MIS_I	• 2Vdc=150A – 3,6Vdc=270A **for 300TPX** • 1Vdc=100A – 4Vdc=400A **for 400TPX**	Output current feedback
5	SGND	SGND	Secondary GND for power supply (0V ref.)
6	+24	+24Vdc	+24Vdc
7	/TR	• 13Vdc +/- 10% any modes in stand-by • 0Vdc = trigger pushed	Trigger signal
8	LS	23Vdc +/- 10% in OCV condition	Lift TIG mode detection signal
9	Not used	Not used	Not Used
10	TH2	• 0V=normal value • 15Vdc +/- 10% = thermic activated on output board	Thermostat on the output heat sink signal
11	+15V	+15Vdc	+15Vdc
12	Not used	Not used	Not used



J4: Fan

Pin#	Description	Idle Value/Ref (use SGND as 0V ref.)	Notes
1	SGND	SGND	Secondary GND for power supply (0V ref.)
2	FAN DRIVE	+5V any condition	
3	FAN SPEED	• +5Vdc +/- 10% with FAN OFF • 0Vdc with FAN ON	
4	FAN COM	• +24Vdc +/- 10% = FAN ON • 0Vdc = FAN OFF	FAN ON/OFF command

J5: Gas solenoid

Pin#	Description	Idle Value/Ref (use GND as 0V ref.)	Notes
1	SGND	SGND	Secondary GND for power supply (0V ref.)
2	GAS COM	• +24Vdc +/- 10% = Gas Solenoid ON • 0Vdc = Gas Solenoid OFF	Gas Solenoid ON/OFF command

J6: Water Cooler

Pin#	Description	Value	Notes
1	RS1	• 400Vac with pin 8 “RCOOLER”	Coolarc supply voltage
2	Not used	Not used	Not used
3	GND	GND (non insulated)	
4	+24VNI	• +12Vdc(non insulated) with COOLARC connected • +24Vdc(non insulated) with COOLARC disconnected	
5	Not used	Not used	Not used
6	Not used	Not used	Not used
7	Not used	Not used	Not used
8	RCOOLER	• 400Vac with pin 1 “RS1”	Coolarc supply voltage
9	Not used	Not used	Not used
10	WATERERR	• 0V= normal value • +12Vdc(non insulated) = water flow sensor alarm	Water flow sensor signal

J7: HF Board

Pin#	Description	Idle Value/Ref (use GND as 0V ref.)	Notes
1	HF COM	+15Vdc	only when TIG HF is selected
2	+24Vdc	+24Vdc	Always in any modes
3	HF	• 0V= HF OFF • +15Vdc= HF ON (only for 3 seconds after trigger pushed)	HF ON/OFF Command
4	SGND	SGND	Secondary GND for power supply (0V ref.)

INVERTER BOARD VOLTAGE TEST

WARNING

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detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact your Local Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed.

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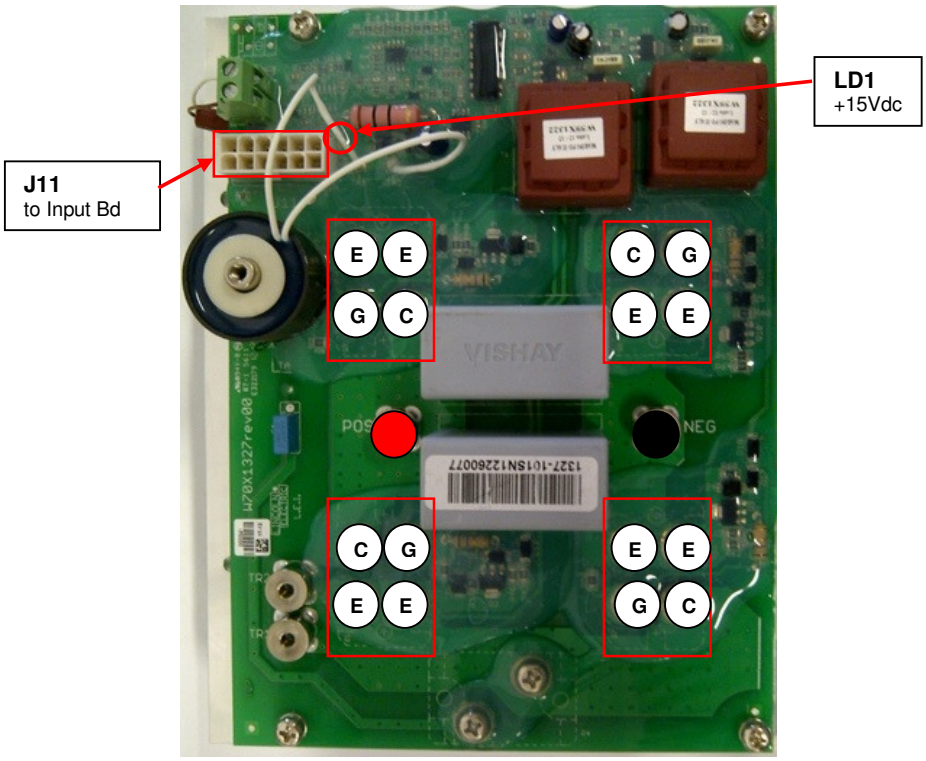
TEST DESCRIPTION

This test will help to determine if the main inverter board is receiving the correct input voltages and if the correct regulated voltages are being processed and maintained by the inverter.

MATERIALS NEEDED

Volt/Ohmmeter
Schematic X1327

INVERTER BOARD VOLTAGE TEST (continued)



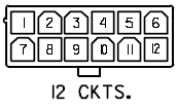
W05X1327-1 on 300TPX
W05X1327-2 on 400TPX

TEST PROCEDURE

⚠ **Use always electrically insulate gloves during this test procedure**

1. Apply 400Vac +/- 15% to the INVERTEC® 300TPX or 400TPX
2. Turn the machine input switch to ON position, and wait till the power LED on front panel is steady green.
3. Check for 564Vdc +/-15% between terminals POS and NEG to be sure that the inverter is correctly supplied from the input board.
4. Follow the below tables test to perform the voltage tests on connectors:

J11: Inverter/Input connector



Pin#	Description	Value (use SGND as 0V ref.)	Notes
1	VREG	• +12Vdc +/- 10% in Lift TIG mode, stand-by condition (no OCV, no fan), thermal and any overload condition. • 0,6Vdc +/- 10% in stick mode during OCV condition **for 300TPX** • 0,4Vdc in stick mode during OCV condition **for 400TPX**	+12Vdc = inverter OFF
2	DUTY	• **For 300TPX:** 50A=1Vdc_150A=3Vdc_300A=6Vdc • **For 400TPX:** 50A=0,75Vdc_150A=2,2Vdc_400A=6Vdc	Output current set signal
3	VRIF	Not used	Not used
4	-5V	-5Vdc	-5V power supply generated by the input board.
5	HFON-PK	• 0V= in stick mode • 7,5Vdc +/- 10% in LIFT and HF mode	Signal for starting peak current in HF (visible only with oscilloscope)
6	SGND	SGND	Secondary GND for power supply (0V ref.)
7	MIS_V	• 6Vdc +/- 10% in stick mode in OCV condition • 0,6 Vdc +/- 10% TIG modes in OCV condition	Output voltage feedback
8	I_LIM	Not Used	Not used
9	300/400	0Vdc=300A 5Vdc +/- 10% =400A	Control board machine identification
10	MIS_I	• 2Vdc=150A – 3,6Vdc=270A **for 300TPX** • 1Vdc=100A – 4Vdc=400A **for 400TPX**	Output current feedback
11	TH1	• 0V=normal value • 14,5Vdc +/- 10% = thermic activated on inverter board	Thermostat on the inverter heat sink signal
12	+15V	+15Vdc	+15V power supply generated by the input board.

OUTPUT BOARD VOLTAGE TEST

WARNING

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detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact your Local Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed.

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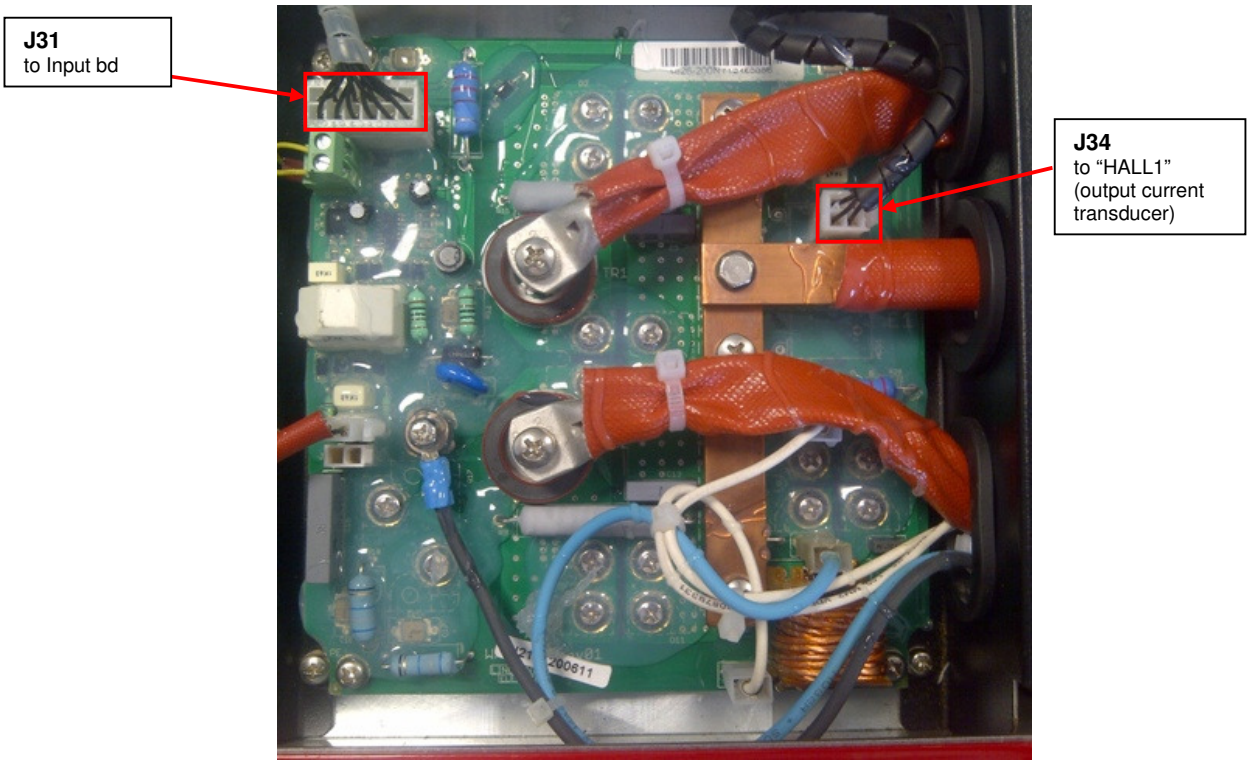
TEST DESCRIPTION

This test will help to determine if the output module is faulty.

MATERIALS NEEDED

Volt/Ohmmeter
Schematic X1327 for INVERTEC® 300TPX
Schematic X1442 for INVERTEC® 400TPX

OUTPUT BOARD VOLTAGE TEST (continued)
for INVERTEC® 300TPX



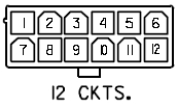
TEST PROCEDURE

⚠ **Use always electrically insulate gloves during this test procedure**

1. Apply 400V +/- 15% to the INVERTEC® 300TPX
2. Turn the machine input switch to ON position, and wait till the power LED on front panel is steady green.
3. Follow the below tables test to perform the voltage tests on connectors and Static Switch IGBT:

J31: Output/Input connector

Pin#	Description	Value (use SGND as 0V ref.)	Notes
1	MIS_V	• 6Vdc +/- 10% in stick mode in OCV condition • 0,6 Vdc +/- 10% TIG modes in OCV condition	Output voltage feedback
2	Not used	Not used	Not Used
3	-5V	-5Vdc	-5Vdc
4	MIS_I	• 2Vdc=150A – 3,6Vdc=270A **for 300TPX**	Output current feedback
5	SGND	SGND	Secondary GND for power supply (0V ref.)
6	+24	+24Vdc	+24Vdc
7	/TR	• 13Vdc +/- 10% any modes in stand-by • 0Vdc = trigger pushed	Trigger signal
8	LS	23Vdc +/- 10% in OCV condition	Lift TIG mode detection signal
9	Not used	Not used	Not Used
10	TH2	• 0V=normal value • 15Vdc +/- 10% = thermic activated on output board	Thermostat on the output heat sink signal
11	+15V	+15Vdc	+15Vdc
12	Not used	Not used	Not used

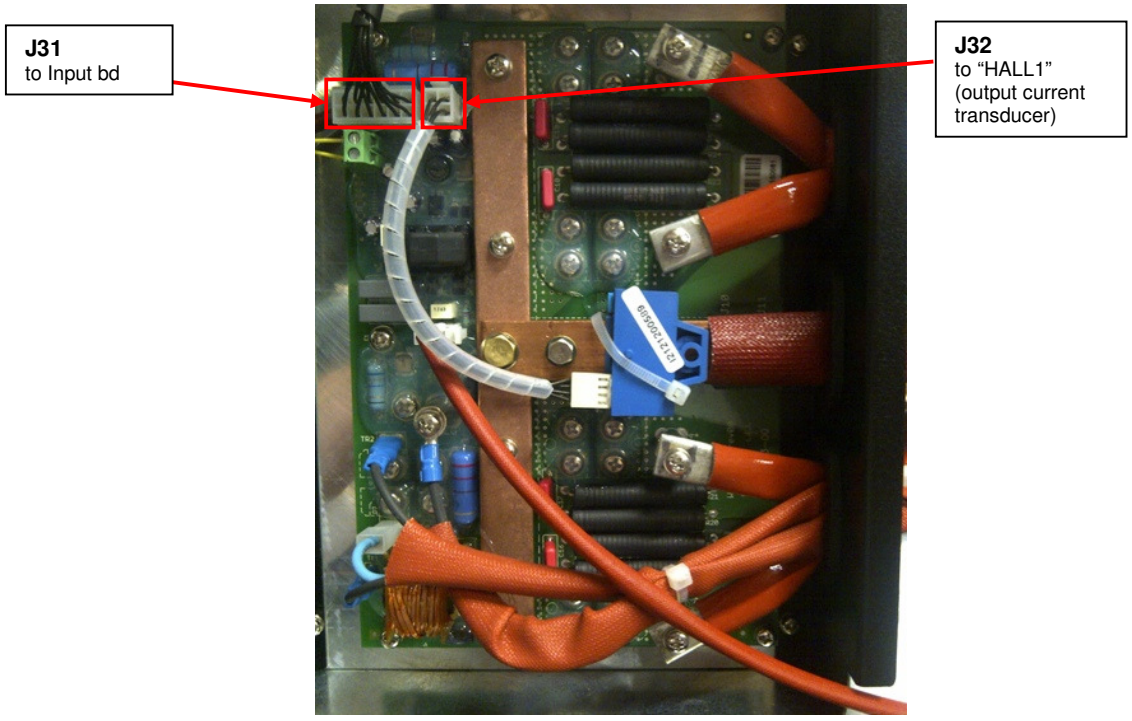


J34: Output Current Transducer

Pin#	Description	Idle Value/Ref (use GND as 0V ref.)	Notes
1	+15V	+ 15V	+ 15V power supply for the hall sensor probe
2	-5V	-5V	-5V power supply for the hall sensor probe
3	I OUT	50A= 0,7 Vdc 150A= 2 Vdc 270A= 3,6 Vdc	Output current reference
4	SGND	SGND	Secondary GND for power supply (0V ref.)

OUTPUT BOARD VOLTAGE TEST (continued)

for INVERTEC® 400TPX



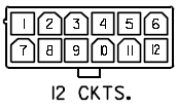
TEST PROCEDURE

⚠ **Use always electrically insulate gloves during this test procedure**

1. Apply 400V +/- 15% to the INVERTEC® 400TPX
2. Turn the machine input switch to ON position, and wait till the power LED on front panel is steady green.
3. Follow the below tables test to perform the voltage tests on connectors and Static Switch IGBT:

J31: Output/Input connector

Pin#	Description	Value (use SGND as 0V ref.)	Notes
1	MIS_V	• 6Vdc +/- 10% in stick mode in OCV condition • 0,6 Vdc +/- 10% TIG modes in OCV condition	Output voltage feedback
2	Not used	Not used	Not Used
3	-5V	-5Vdc	-5Vdc
4	MIS_I	• 1Vdc=100A – 4Vdc=400A **for 400TPX**	Output current feedback
5	SGND	SGND	Secondary GND for power supply (0V ref.)
6	+24	+24Vdc	+24Vdc
7	/TR	• 13Vdc +/- 10% any modes in stand-by • 0Vdc = trigger pushed	Trigger signal
8	LS	23Vdc +/- 10% in OCV condition	Lift TIG mode detection signal
9	Not used	Not used	Not Used
10	TH2	• 0V=normal value • 15Vdc +/- 10% = thermic activated on output board	Thermostat on the output heat sink signal
11	+15V	+15Vdc	+15Vdc
12	Not used	Not used	Not used



J32: Output Current Transducer

Pin#	Description	Idle Value/Ref (use GND as 0V ref.)	Notes
1	+15V	+ 15V	+ 15V power supply for the hall sensor probe
2	-5V	-5V	-5V power supply for the hall sensor probe
3	I OUT	50A=0,7 Vdc 200A=2,6 Vdc 400A=5,2Vdc	Output current reference
4	SGND	SGND	Secondary GND for power supply (0V ref.)

HF BOARD TEST – W05X1331

WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions
detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact your Local Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed.

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TEST DESCRIPTION

This test will help to determine if the HF (High Frequency) board is faulty.

MATERIALS NEEDED

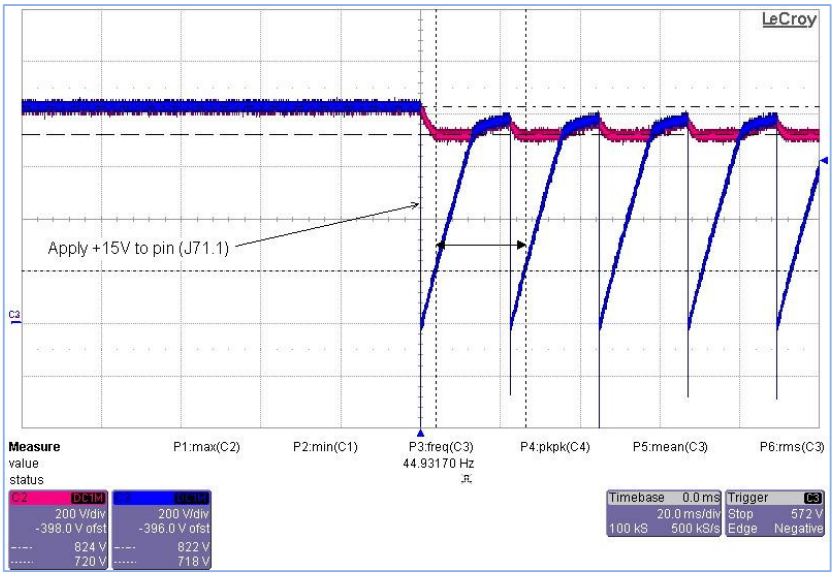
Volt/Ohmmeter
Oscilloscope
Schematic X1331

HF BOARD TEST – W05X1331 (continued)

TEST PROCEDURE

⚠ **Use always electrically insulate gloves during this test procedure**

1. Apply 400V +/- 15% to the INVERTEC® 300TPX or 400TPX
2. Turn the machine input switch to ON position, and wait till the power LED on front panel is steady green.
3. Set the machine to TIG HF welding mode and connect the TIG torch to the machine.
4. Check between pin 2 & 4 of **J71** connector for 24Vdc always present
5. Check between pin 1 & 4 of J71 connector for 15Vdc always present (if machine is in TIG HF mode)
6. Check between HV-RTN and cathode of diode D10 for 900V
7. Check between pin 3 & 4 of **J71** for 15Vdc when trigger is pressed (only for 3 seconds)
8. When 15Vdc are present between pin 3 & 4 of **J71** check waveform as indicated on the FIG.1 (blue waveform) between cathode of diode D10 and HV terminal.



HF BOARD TEST - W05X1615

WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact your Local Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed.

……

TEST DESCRIPTION

This test will help to determine if the HF (High Frequency) board (w05X1615) is faulty.

MATERIALS NEEDED

Volt/Ohmmeter
Oscilloscope
Schematic X1615

HF BOARD TEST - W05X1615 (continued)

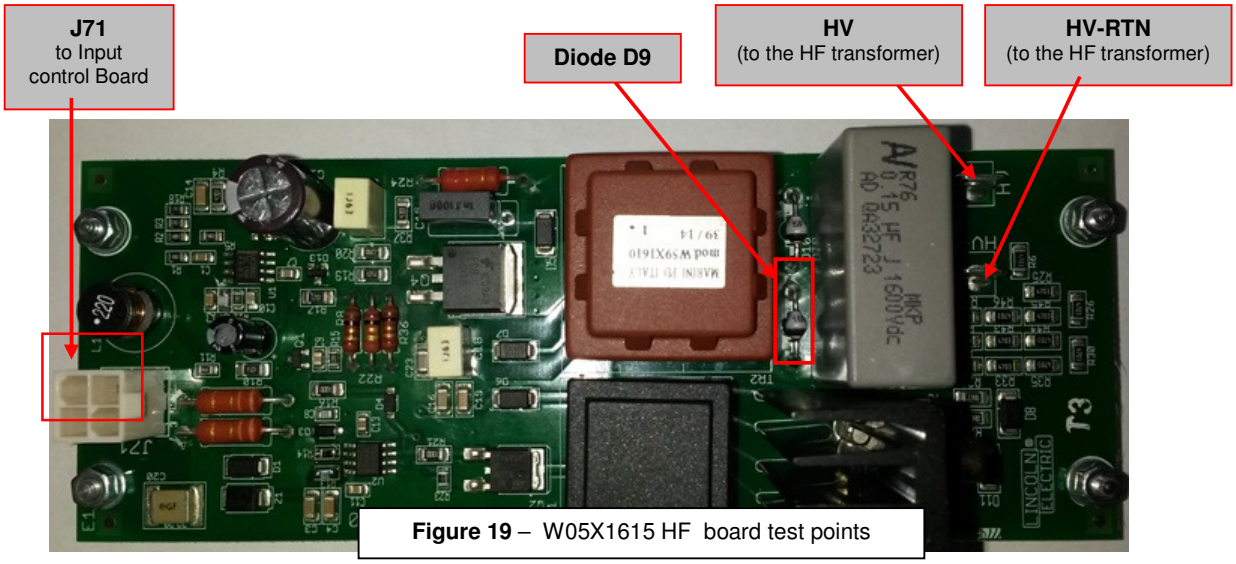
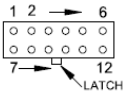


Figure 19 – W05X1615 HF board test points

CONNECTOR PIN NUMBERS:

EX. 12 PIN CONNECTOR

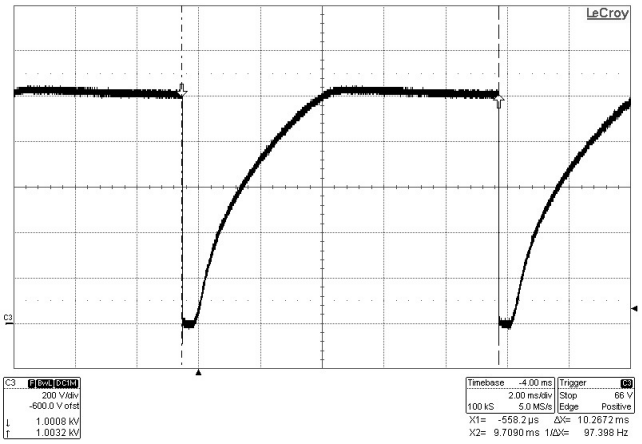


VIEW OF CONNECTOR ON PC BOARD

TEST PROCEDURE

⚠ **Use always electrically insulate gloves during this test procedure**

9. Carefully apply 400Vac +/- 15% or 230Vac-3ph +/-15% to the INVERTEC 300TPX or 400TPX
10. Turn the machine input switch to ON position and wait till the power LED on front panel is steady green.
11. Set the machine to TIG DC or AC HF welding mode and connect the TIG torch to the machine.
12. Check between **J71** pin 2 & pin 4 for 24Vdc always present
13. Check between **HV-RTN** and **cathode of diode D10** for 1000V +/- 40V
14. Press the trigger and check between **J71** pin 3 & pin 4 for 15Vdc (only for 3 seconds)
15. When 15Vdc are present between **J71** pin 3 & pin 4 check waveform, as indicated on the figure below, between cathode and anode of **D12**. NOTE: HV and HV-RTN have to be connected to the HF transformer during this test.



CONTROL BOARD TEST

WARNING

Service and repair should be performed by only Lincoln Electric factory trained personnel. Unauthorized repairs performed on this equipment may result in danger to the technician or machine operator and will invalidate your factory warranty. For your safety and to avoid electrical shock, please observe all safety notes and precautions
detailed throughout this manual. If for any reason you do not understand the test procedures or are unable to perform the test/repairs safely, contact your Local Lincoln Electric Service Department for electrical troubleshooting assistance before you proceed.

……

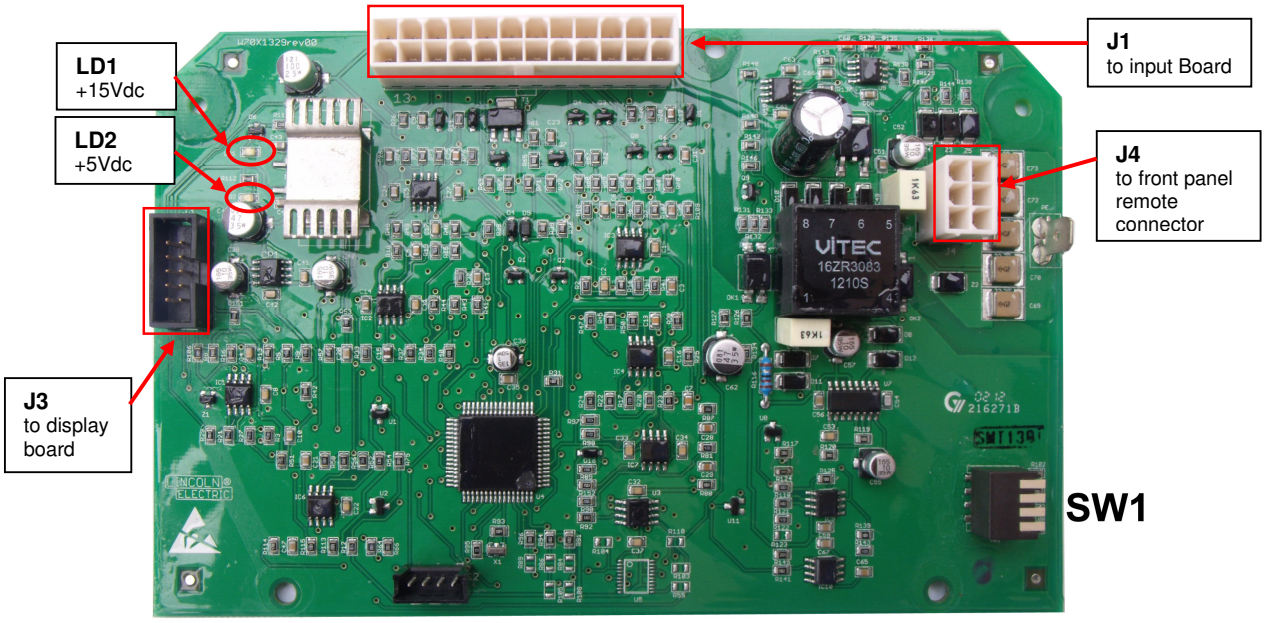
TEST DESCRIPTION

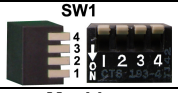
The control board is not easy to be checked, as it works mainly with software; this section will help, as best as possible, to determine if the control board is faulty and how to interpret error codes.

MATERIALS NEEDED

Volt/Ohmmeter
Schematic X1330 (Display Board)
Schematic X1329 (Control Board)

CONTROL BOARD TEST (continued)



SW1 				
Machine:	**1**	**2**	**3**	**4**
INVERTEC 300TPX CE Part number: K12060-1, Code: 52109	Off	Off	Off	Off
INVERTEC 400TPX CE Part number: K12043-1, Code: 52083	Off	Off	Off	Off
INVERTEC 300TPX AUS Part number: K12060-2, Code: 52110	Off	**ON**	Off	Off
INVERTEC 400TPX AUS Part number: K12043-2, Code: 52084	Off	**ON**	Off	Off

TEST PROCEDURE

⚠ **Use always electrically insulate gloves during this test procedure**
⚠ **The following tests must be performed with the control board installed inside the machine and with all harnesses connected.**

1. Apply 400V +/- 15% to the INVERTEC® 300TPX or 400TPX
2. Turn the machine input switch to ON position, and wait till the power LED on front panel is steady green.
3. Check LD1 and LD2, they must be lit all the time.
4. Follow the below tables to perform the control board test :

J2: Control/Input connector

Pin#	Description	Value (use SGND as 0V ref.)	Notes
1	+15V	+15Vdc	+15Vdc generated by input board
2	SGND	SGND	Secondary GND for power supply (0V ref.)
3	FLOW	• 0Vdc=Water flow OK • 15Vdc= Water flow KO (Err 11 on display)	Water flow signal from coolarc->input board
4	MIS_I	• 2Vdc=150A – 3,6Vdc=270A **for 300TPX** • 1Vdc=100A – 4Vdc=400A **for 400TPX**	Output current feedback
5	MIS_V	• 6Vdc +/- 10% in stick mode in OCV condition • 0,6 Vdc +/- 10% TIG modes in OCV condition	Output voltage feedback
6	HFON-PK	• 0V= in stick mode	Signal for starting peak current in HF

		• 7,5Vdc +/- 10% in LIFT and HF mode	(visible only with oscilloscope)
7	VREG	• +12Vdc +/- 10% in Lift TIG mode, stand-by condition (no OCV, no fan), thermal and any overload condition. • 0,6Vdc +/- 10% in stick mode during OCV condition **for 300TPX** • 0,4Vdc in stick mode during OCV condition **for 400TPX**	+12Vdc = inverter OFF
8	HVPON	• +15Vdc in Stick and Lift TIG mode • 0Vdc in TIG HF mode	Only when in TIG HF mode +15Vdc are applied to pin 1 of HF connector
9	READY_OK	• +5Vdc only during Power Up sequence • 0V during normal operation condition	
10	COOLER	• +15Vdc in Stick mode • 0V in both TIG modes	Cooler ON/OFF
11	TH1	• 0V=normal value • 15Vdc +/- 10% = thermic activated on inverter board	Thermostat on the inverter heat sink signal
12	DUTY	• **For 300TPX:** 50A=1Vdc_150A=3Vdc_300A=6Vdc • **For 400TPX:** 50A=0,75Vdc_150A=2,2Vdc_400A=6Vdc	Output current set signal
13	LS	23Vdc +/- 10% in OCV condition	Lift TIG mode detection signal
14	ILIM	Not Used	Not Used
15	TH2	• 0V=normal value • 15Vdc +/- 10% = thermic activated on output board	Thermostat on the output heat sink signal
16	/TR	• 13Vdc +/- 10% any modes in stand-by • 0Vdc = trigger pushed	Trigger signal
17	SOL	• 24Vdc +/- 10% = gas solenoid OFF • 0Vdc = Gas solenoid ON	Gas solenoid ON/OFF
18	HF	• 0V=HF OFF • 15Vdc +/- 10% = HF ON (only for 3 seconds after trigger pushed)	HF ON/OFF
19	SGND	SGND	
20	300/400	0Vdc=300A 5Vdc +/- 10% =400A	Control board machine identification
21	FAN	• +24Vdc +/- 10% = FAN OFF • 0Vdc = FAN ON	FAN ON/OFF
22	FAN DRIVE	+5V any condition	
23	FAN SPEED	• +5Vdc +/- 10% with FAN OFF • 0Vdc with FAN ON	
24	VRIF	Not Used	Not used

J4: To Remote connector (front Panel)

Pin#	Description	Value (use GNDA as 0V ref.)	Notes
1	SGNDA	SGNDA	Insulated from the SGND
2	TR		Remote Trigger
3	POTW	From 0 VDC to 10Vdc	Remote Potentiometer Wiper
4	REMD	+15Vdc	
5	POTL	0Vdc	Remote Potentiometer Low
6	Not used	Not used	Not used

DISASSEMBLY OPERATIONS

INPUT BOARD REMOVAL AND REPLACEMENT PROCEDURE

for INVERTEC® 300TPX & 400TPX

(pictures shown 300TPX input board)

⚠ WARNING

ELECTRIC SHOCK CAN KILL

- Disconnect input power before servicing.
- Do not operate with covers removed.
- Do not touch electrically live parts.
- Only qualified persons should install, use or service this equipment.

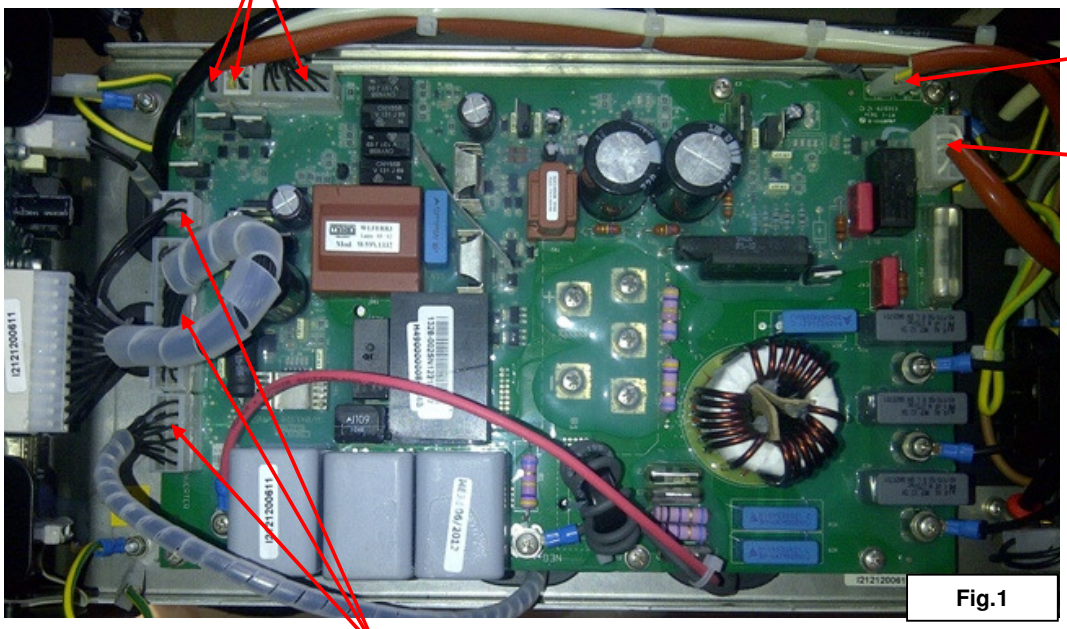


Fig.1

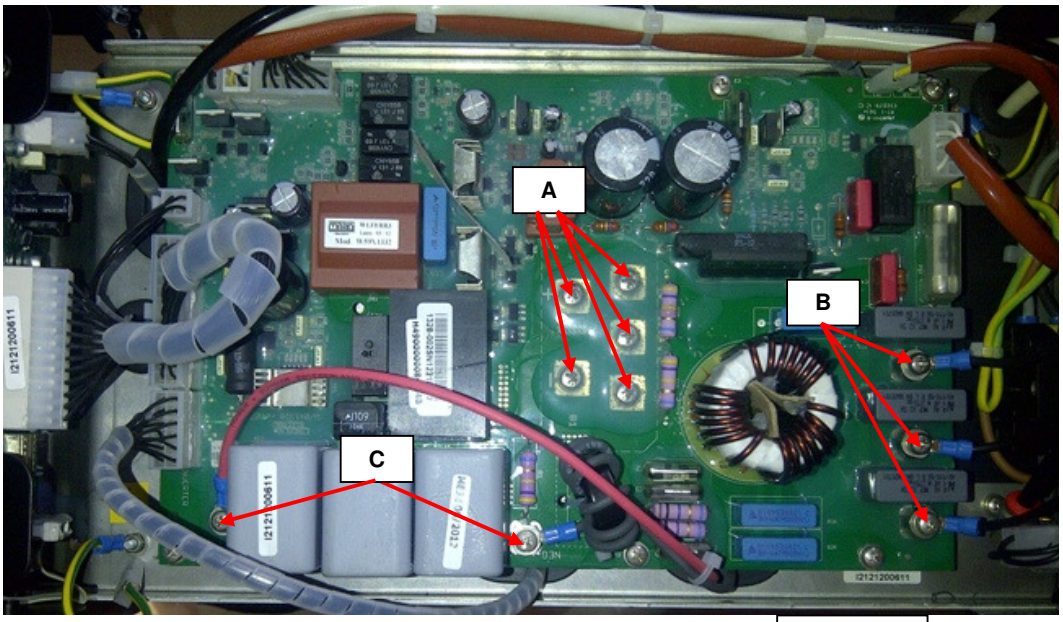


Fig.2

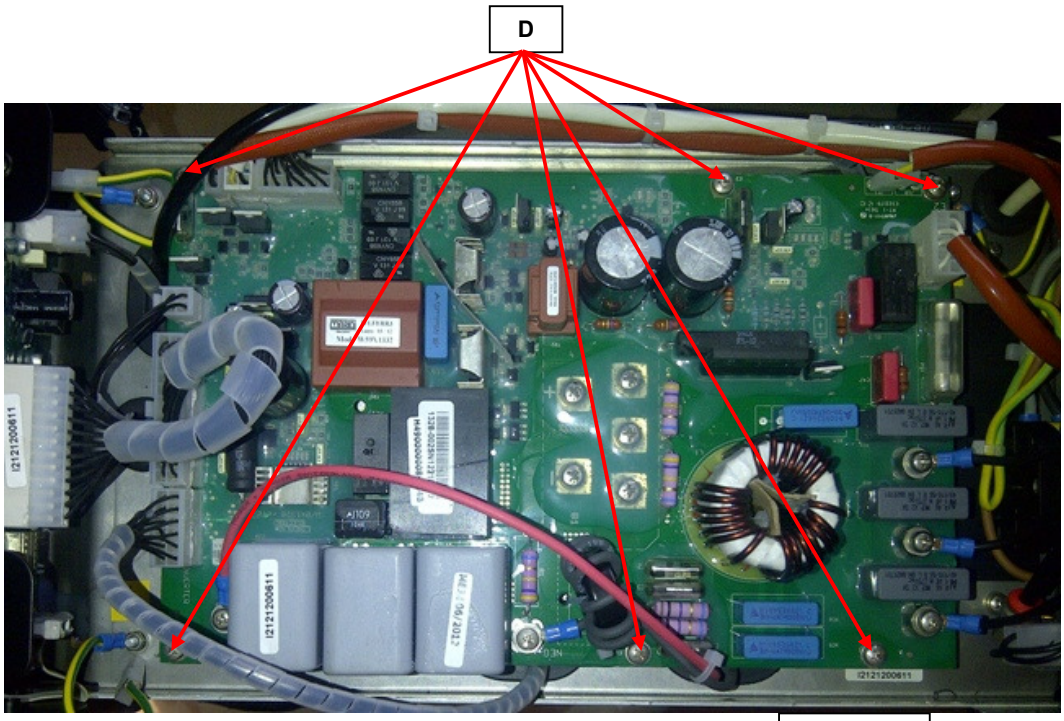


Fig.3

REMOVAL PROCEDURE

Necessary tool:

- Phillips screwdriver PH02

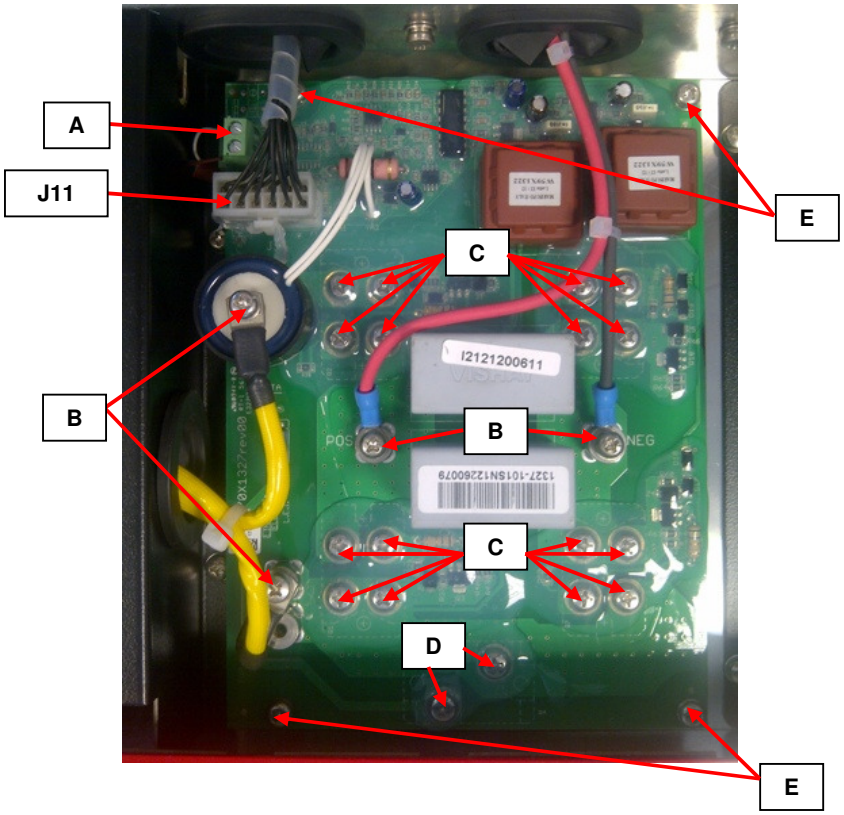
1. Remove main input power to the INVERTEC® 300TPX or 400TPX
2. Follow the case removal procedure available in this Service Manual
3. Perform the **Discharge procedure**
4. Disconnect the connectors **J1,J2,J3,J4,J5,J6**,**J7** and the ground connection from the input board. See **Fig.1**
5. Using a Phillips screwdriver PH02 remove the 6 screws (A) that fix the input bridge on the input board, the 3 screws that fix the three phases input cables (B) and the 2 screws that fix the DC+ and DC- cables (C) . See **Fig.2**.
6. Using a Phillips screwdriver remove the 6 screws (D) that fix the input board to the machine central frame. See **Fig.3**.
7. Remove the input board from the machine.
8. If the input bridge needs to be replaced remove the 2 screws that fix it to the machine frame and replace it taking care to clean very well the machine frame from the old thermal compound and any dirty. To re-assembly correctly the new input bridge, follow the instruction that are inside the new input bridge box.
9. **For the Input Board re-assembly operations,** make the previous steps in the reverse order and add silicon to the zones where the potting protection was removed. ATTENTION ! : use silicon type with low acetic, viscosity and adhesive grade.

WARNING !
Remember to connect ground lead to the male terminal on the input board corner.

DO NOT USE CORDLESS SCREWDRIVERS FOR THE POWER MODULEs!

DISASSEMBLY OPERATIONS

INVERTER BOARD REMOVAL AND REPLACEMENT PROCEDURE



WARNING

ELECTRIC SHOCK CAN KILL

- Disconnect input power before servicing.
- Do not operate with covers removed.
- Do not touch electrically live parts.
- Only qualified persons should install, use or service this equipment.

REMOVAL PROCEDURE

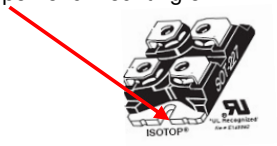
Necessary tool:

- Phillips screwdriver PH02
- A small flat bladed screwdriver

1. Remove main input power to the INVERTEC® 300TPX or 400TPX
2. Follow the case removal procedure available in this Service Manual
3. Perform the **Discharge procedure**
4. Disconnect the connector **J11**
5. Using the small flat bladed screwdriver remove the two thermostat wires from connector (**A**)
6. Using the Phillips screwdriver PH02 remove the four (4) power harnesses screws (**B**)
7. Remove the potting protection and unscrew the 16 screws (**C**) that fix the board to the IGBT modules
8. Remove the potting protection and unscrew the 2 screws (**D**) that fix the board to the resistor R4
9. Unscrew the 4 screws in the corners of the inverter PCB (**E**)
10. Remove the inverter PCB from the machine.
11. If the IGBT modules need to be replaced remove the 2 screws that fix each of them to the inverter heat-sink and replace them taking care to clean very well the heat-sink from the old thermal compound and any dirty. To re-assembly correctly the new IGBT modules apply the thermal compound thin layer (0,1-0,2 mm) under each ISOTOP component. Screw torque 1,2/1,4 N/m (0.030/0.033 N/inch)
12. **For the Inverter Board re-assembly operations,** make the previous steps in the reverse order and add silicon to the zones where the potting protection was removed. **ATTENTION !** : use silicon type with low acetic, viscosity and adhesive grade.

DO NOT USE CORDLESS SCREWDRIVERS FOR THE POWER MODULEs!

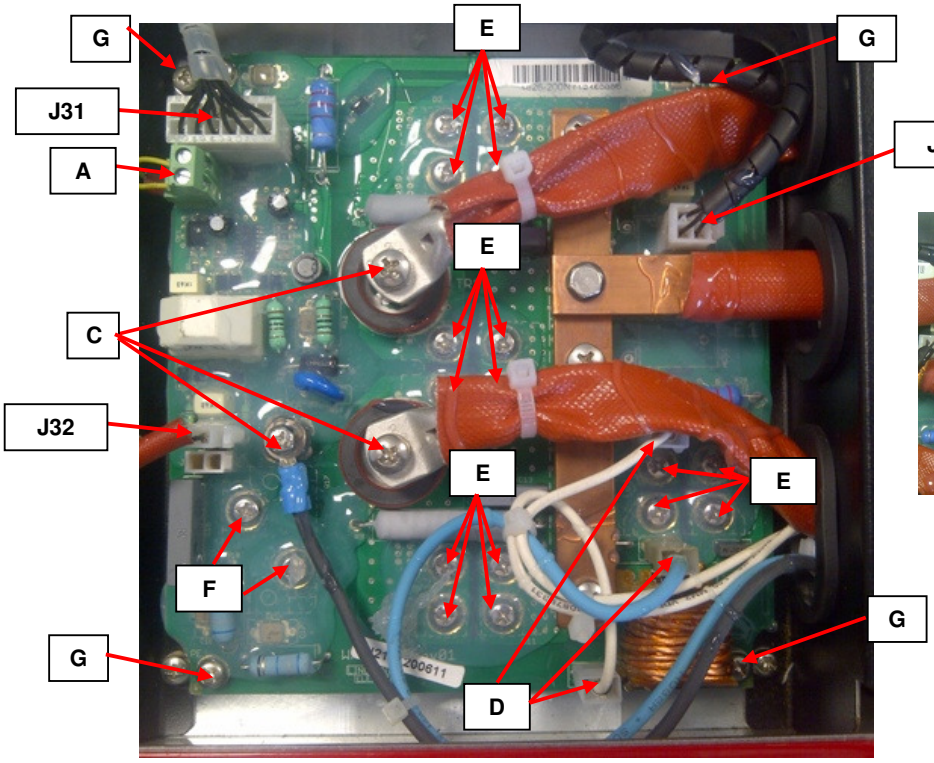
PAY ATTENTION ! of how to position the open end mounting of modules to heat-sink.
See printed circuit board for reference.

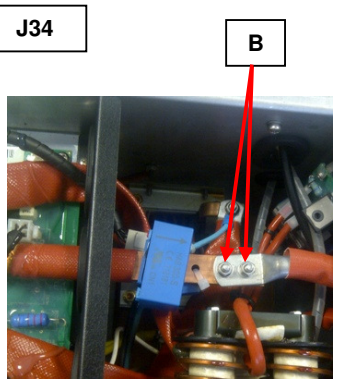


DISASSEMBLY OPERATIONS

OUTPUT BOARD REMOVAL AND REPLACEMENT PROCEDURE

W05X1327 for INVERTEC® 300TPX





REMOVAL PROCEDURE

Necessary tool:

- Phillips screwdriver PH02
- A small flat bladed screwdriver
- 7 mm nut driver

PAY ATTENTION ! of how to position the open end mounting of modules to heat-sink.

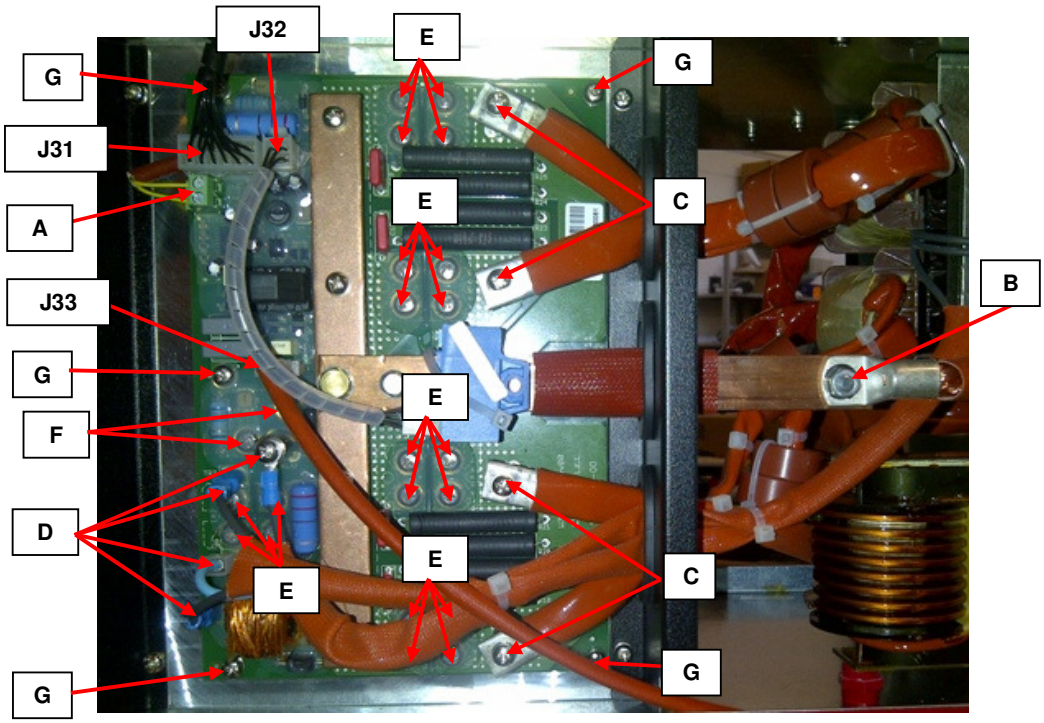
See printed circuit board for reference

1. Remove main input power to the INVERTEC® 300TPX
2. Follow the case removal procedure available in this Service Manual
3. Perform the **Discharge procedure**
4. Disconnect the connectors **J31, J32 and J34**
5. Using the small flat bladed screwdriver remove the two thermostat wires from connector (**A**)
6. Using the 7 mm nut driver remove the two (2) nuts (**B**) and the related bolts. Remove the plastic tie that fix the Hall sensor probe and remove it from the copper bar.
7. Using the Phillips screwdriver PH02 remove the three (3) power harnesses screws (**C**)
8. Remove the three (3) terminals (**D**)
9. Remove the potting protection and unscrew the 16 screws (**E**) that fix the board to the output diode modules
10. Remove the potting protection and unscrew the 2 screws (**F**) that fix the board to the power resistor **R17**
11. Unscrew the 4 screws in the corners of the output PCB (**G**)
12. Remove the output PCB from the machine.
13. Remove and use on the new output board the copper bars.
14. If one or more diode modules need to be replaced remove the 2 screws that fix each of them to the output heat-sink and replace them taking care to clean very well the heat-sink from the old thermal compound and any dirty. To re-assembly correctly the new diode modules apply the thermal compound thin layer (0,1-0,2 mm) under each ISOTOP component. Screw torque 1,2/1,4 N/m (0.030/0.033 N/inch)
15. **For the output Board re-assembly operations,** make the previous steps in the reverse order and add silicon to the zones where the potting protection was removed. **ATTENTION !** : use silicon type with low acetic, viscosity and adhesive grade.

DISASSEMBLY OPERATIONS

OUTPUT BOARD REMOVAL AND REPLACEMENT PROCEDURE

W05X1442 for INVERTEC® 400TPX



PAY ATTENTION ! of how to position the open end mounting of modules to heat-sink.

See printed circuit board for reference

REMOVAL PROCEDURE

Necessary tool:

- Phillips screwdriver PH02
- A small flat bladed screwdriver
- 7 mm nut driver

1. Remove main input power to the INVERTEC® 400TPX
2. Follow the case removal procedure available in this Service Manual
3. Perform the **Discharge procedure**
4. Disconnect the connectors **J31, J32 and J33**
5. Using the small flat bladed screwdriver remove the two thermostat wires from connector (**A**)
6. Using the 7 mm nut driver remove the nut (**B**) and the related bolt.
7. Using the Phillips screwdriver PH02 remove the four (4) power harnesses screws (**C**). Take note about the position of each cable, they must be reassembled in the original position.
8. Remove the four (4) terminals (**D**)
9. Remove the potting protection and unscrew the 20 screws (**E**) that fix the board to the output diode modules
10. Remove the potting protection and unscrew the 2 screws (**F**) that fix the board to the power resistor **R11**
11. Unscrew the 5 screws (**G**) that fix the output PCB on the heat-sink
12. Remove carefully the output PCB from the machine.
13. Remove and use on the new output board the copper bars and the Current sensor.
14. If one or more diode modules need to be replaced remove the 2 screws that fix each of them to the output heat-sink and replace them taking care to clean very well the heat-sink from the old thermal compound and any dirty. To re-assembly correctly the new diode modules apply the thermal compound thin layer (0,1-0,2 mm) under each ISOTOP component. Screw torque 1,2/1,4 N/m (0.030/0.033 N/inch)
15. **For the output Board re-assembly operations,** make the previous steps in the reverse order and add silicon to the zones where the potting protection was removed. **ATTENTION !** : use silicon type with low acetic, viscosity and adhesive grade.

DISASSEMBLY OPERATIONS

HIGH FREQUENCY BOARD REMOVAL AND REPLACEMENT PROCEDURE

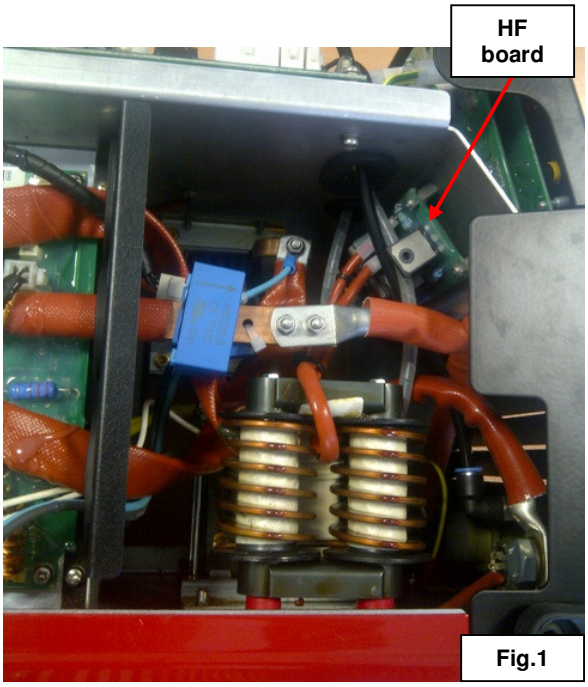


Fig.1

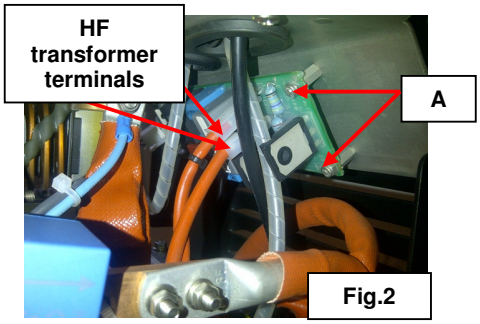


Fig.2

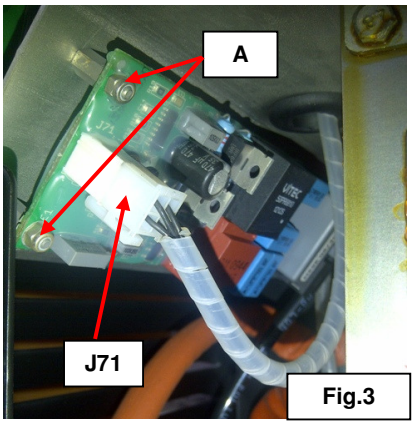


Fig.3

REMOVAL PROCEDURE

Necessary tool:

- 5,5 mm wrench

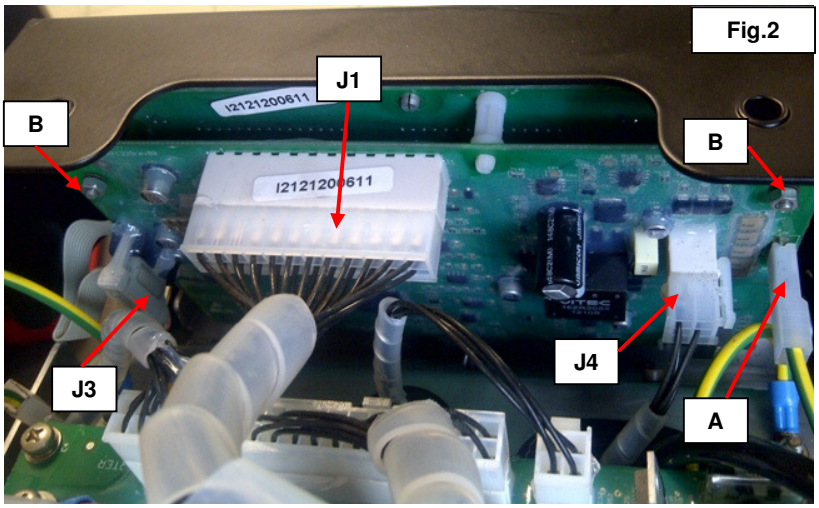
1. Remove main input power to the INVERTEC® 300TPX or 400TPX
2. Follow the case removal procedure available in this Service Manual
3. Perform the **Discharge procedure**
4. Locate the HF board (see **Fig.1**)
5. Disconnect the two HF transformer terminals as indicated in **Fig.2** (take note about the black tie cable position, it must be connected in the same place)
6. Disconnect the connector **J71** (see **Fig.3**)
7. Using the 5,5 mm wrench remove the four (4) nuts (**A**) that fix the HF board to the machine frame (see **Fig.2** and **Fig.3**)
8. Remove the HF board from the machine.
9. **For the HF board re-assembly operations,** make the previous steps in the reverse order. **Pay attention** to position of the two HF transformer terminals. The transformer cable with plastic tie must be connected to “HV” terminal on the HF board.

DISASSEMBLY OPERATIONS

DISPLAY AND CONTROL BOARD REMOVAL AND REPLACEMENT PROCEDURE

Fig.1

Fig.2



REMOVAL PROCEDURE

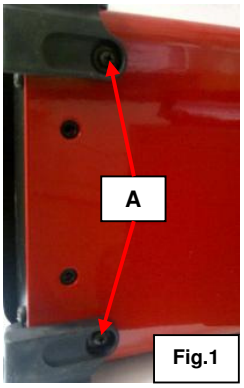
Necessary tool:

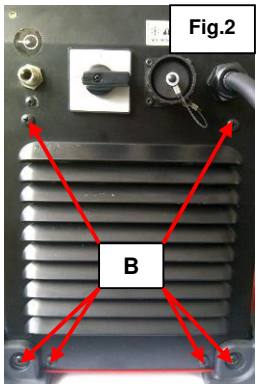
- 2 mm Allen wrench
- 5,5 mm short Nut driver or wrench

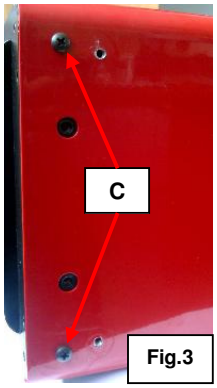
1. Remove main input power to the INVERTEC® 300TPX or 400TPX
2. Follow the case removal procedure available in this Service Manual
3. Perform the **Discharge procedure**
4. With the 2 mm Allen Wrench loosen the Allen screws until you'll be able to remove the knob (see **Fig.1**)
5. Disconnect the connector **J1**, **J3** and **J4**, plus the earth connector (**A**) (see **Fig.2**)
6. Remove the two (2) small bolts (**B**) using the 5,5mm Nut driver or wrench
7. Remove the control board applying a small force to be able to disconnect it from the three plastic locking pins
8. Once the control board is removed, also the Display board can be removed applying a small force to be able to disconnect it from the four metal locking pins.

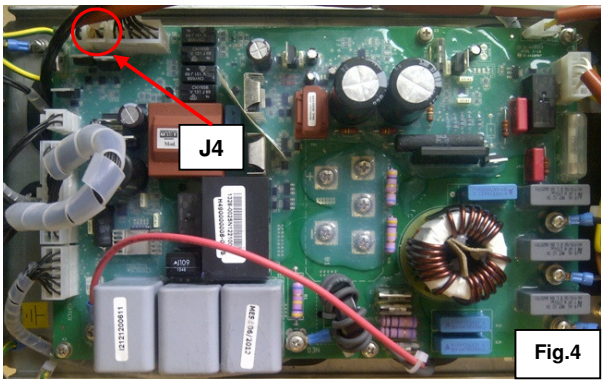
DISASSEMBLY OPERATIONS

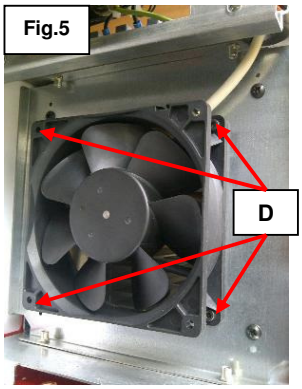
FAN REMOVAL AND REPLACEMENT PROCEDURE











REMOVAL PROCEDURE

Necessary tool:

- Phillips screwdriver PH02
- 3 mm Allen wrench

1. Remove main input power to the INVERTEC® 300TPX or 400TPX
2. Follow the case removal procedure available in this Service Manual
3. Perform the **Discharge procedure**
4. Using the PH02 Phillips screwdriver remove the two (2) screws (**A**), as indicated by **Fig.1,** located on the bottom of the unit.
5. Using the PH02 Phillips screwdriver remove the six (6) screws (**B**), as indicated by **Fig.2,** located on the rear panel of the unit.
6. Remove the two rubber corners and using the PH02 Phillips screwdriver remove the two (2) screws (**C**), as indicated by **Fig.3,** located on the bottom panel of the unit.
7. Disconnect the fan harness from the Input Board connector **J4** (see **Fig.4**)
8. Pull and rotate the rear panel to be able to have access to the fan location (see **Fig.5**)
9. Using the 3 mm Allen wrench remove the four (4) screws (**D**) at the fan corners and remove the fan
10. **For the Fan re-assembly operations,** make the previous steps in the reverse order.

DISASSEMBLY OPERATIONS

GAS SOLENOID REMOVAL AND REPLACEMENT PROCEDURE

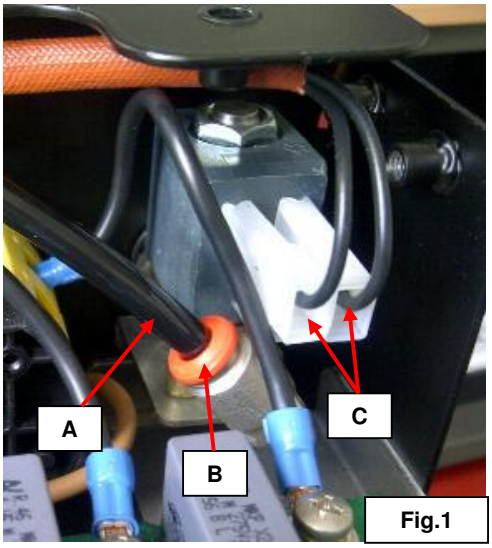


Fig.1

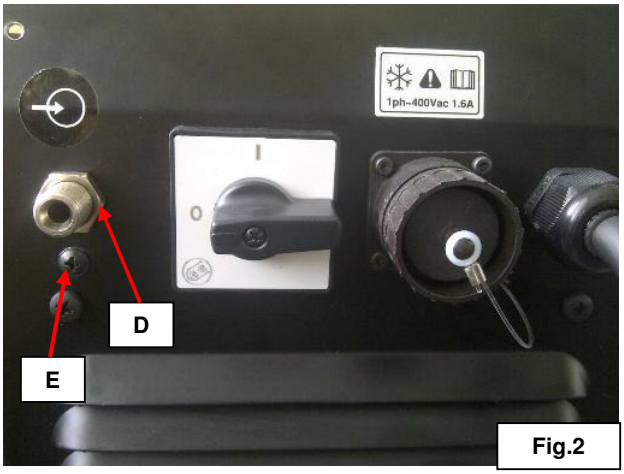


Fig.2

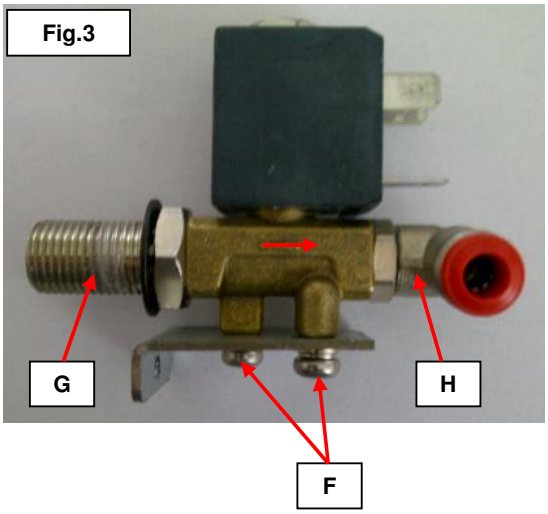


Fig.3

REMOVAL PROCEDURE

Necessary tool:

- Phillips screwdriver PH02
- 13 mm wrench
- 17 mm wrench

1. Remove main input power to the INVERTEC® 300TPX or 400TPX
2. Follow the case removal procedure available in this Service Manual
3. Perform the **Discharge procedure**
4. Remove the gas pipe (**A**) pressing the red part (**B**) of the gas connector and pulling the gas pipe (see **Fig.1**)
5. Disconnect the two faston connectors (**C**) from the gas solenoid (see **Fig.1**)
6. Using the 17mm wrench unscrew and remove the nut (**D**) (see **Fig.2**)
7. Using the Phillips scredriver PH02 remove the screw (**E**) (see **Fig.2**)
8. Remove the gas solenoid from the rear panel of the machine.
9. Using the Phillips scredriver PH02 remove the two screws (**F**) that fix the gas solenoid to the metal support (see **Fig.3**)
10. Using the 17 mm wrench remove from the solenoid the fitting 1/8-1/4 (**G**) (see **Fig.3**)
11. Using the 13 mm wrench remove from the solenoid the fitting quick connection 1/8 (**H**) (see **Fig.3**)
12. **For the Gas Solenoid re-assembly operations,** make the previous steps in the reverse order taking care of the sense of the arrow (see **Fig.3**).

INVERTEC® 300TPX & 400TPX

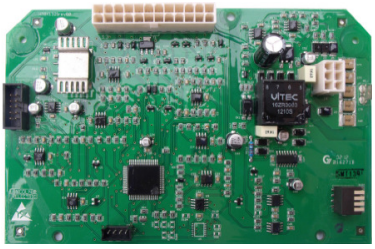
CALIBRATION PROCEDURE AFTER CONTROL P.C. BOARD REPLACEMENT

⚠ WARNING

For any maintenance or repair operations it is recommended to contact the nearest technical service center or Lincoln Electric. Maintenance or repairs performed by unauthorized service centers or personnel will null and void the manufacturers warranty. Lincoln Electric is not responsible for damages caused by improper installation, improper care or abnormal operation.

⚠ WARNING

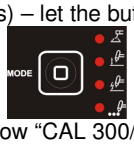
Do not open this machine and do not introduce anything into its openings. Power supply must be disconnected from the machine before each maintenance and service. After each repair, perform proper tests to ensure safety.



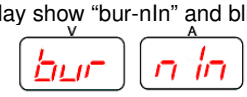
To start with calibration, the machine has to be connected to the maximum charge to let the weld in STICK mode.
The load and the voltage have to be: 270A/30,8V (R=0,11Ω) for 300TPX and 400A/36V (R=0,09Ω) for 400TPX.

Calibration procedure:

1. Push and hold down MODE button and switch on the machine.
2. When four LEDs on front panel light (MODE LEDs) – let the button go.

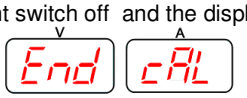


3. After, only one – first LED light and the display show “CAL 300/CAL 400”, on the output current is not present.
4. Push the MODE button (two first LEDs lights) – on the output current is change from 240/330A the display still show “CAL 300/CAL 400”.
5. Push the MODE button, on the output current is change from 240/330A and grow up to 270/400A, the display still show “CAL 300/CAL 400”, the yellow THERMAL LED light up.
6. When the yellow THERMAL LED turns off, the output current is 270A/30,8V (±2A) for 300TPX and 400A/36V (±2A) for 400TPX, there is confirmation that calibration process is finish.
7. Push the MODE button (four LEDs light) – on the output current is 270A/30,8V for 300TPX and 400A/36V for 400TPX, the BURN IN process start - display show “bur-nIn” and blink, fan is not working.



The BURN IN process schould take few minutes (6÷7).

8. When yellow THERMAL LED is light, start cooling of the machine – fan is working for 4-5 minutes.
9. After that the THERMAL LED go out, on the output current is 270A/30,8V for 300TPX and 400A/36V for 400TPX, for a few secondsthe output current switch off and the display show “End cAL”



10. Switch off the machine. Machine is ready to work.

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® 300TPX

Input Voltage	Input Current	Rated Output
400Vac/3ph/50Hz	16.9A	270A - 30,8V@40% Stick 300A - 22V@40% TIG

Output current range	5-270A Stick	5-300A TIG

Maximum Open Circuit Voltage	65Vdc (CE model)

INVERTEC® 400TPX

Input Voltage	Input Current	Rated Output
400Vac/3ph/50Hz	35A	400A – 36V@35% Stick 400A – 26V@35% TIG

Output current range	5 - 400A

Maximum Open Circuit Voltage	65Vdc (CE model)

COOLARC® 21 & COOLARC® 46

TECHNICAL SPECIFICATIONS

COOLARC® 21:

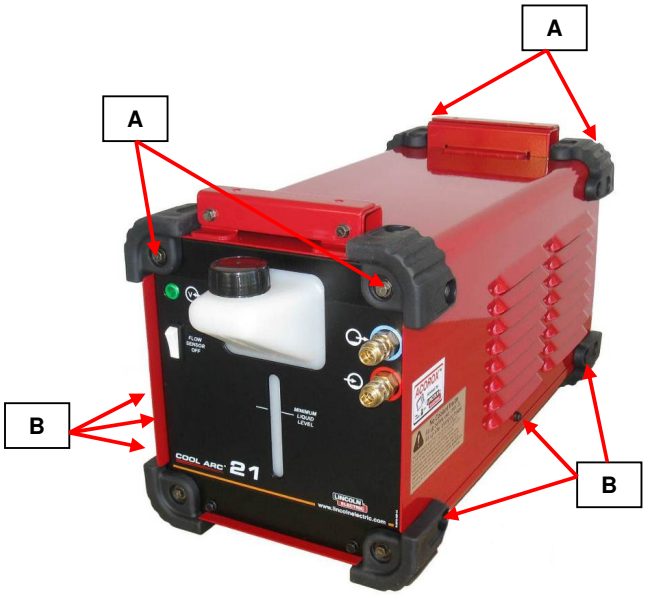
NAME				INDEX
COOLARC 21				K14103-1
INPUT				
	Input Voltage U_1			Input amperes I_{1max}
COOLARC 21	400 V ± 10% / 3-phase			0,6 A
	Frequency			EMC Group / Class
COOLARC 21	50/60 Hz			II / A
PARAMETERS RATING				
	The cooling power of flow 1liter per minute at temperature of 25°C			Maximum pressure rate
COOLARC 21	0,75 kW			0,4 MPa
PARAMETERS O FTHE COOLER'S RESERVOIR				
	Maximum reservoir capacity			Minimum required reservoir capacity
COOLARC 21	3,6 l			2,5 l
COOLANT				
COOLARC 21	Recommended coolant	Acorox		
COOLARC 21	Do not use!!	Pre-packaged welding industry coolants. These coolants may contain oil-based substances, which attack the plastic components of the cooler. Once added to the cooler, these substances are impossible to purge from the water lines and heat exchanger.		
		Automotive anti-freeze. These coolant will damage the pump and block of the heat exchanger, affecting cooling performance.		
PHYSICAL DIMENSIONS				
	Weight	Height	Width	Lenght
COOLARC 21	18 kg	276 mm	246 mm	540 mm
Protectiom Rating	Operating Humidity (t=20°C)	Operating Temperature	Storage Temperature	
IP23	≤ 90 %	from -10 °C to +40 °C	od -25 °C do +55 °C	

COOLARC® 46:

NAME				INDEX
COOLARC 46				K14105-1
INPUT				
	Input Voltage U_1			Input Amperes I_{1max}
COOLARC 46	230 V ± 10%			0,65 A
	400 V ± 10%			
	Frequency			EMC Group / Class
COOLARC 46	50/60 Hz			II / A
PARAMETERS RATING				
	The cooling power of flow 1liter per minute at temperature of 25°C			Maximum pressure rate
COOLARC 46	1 kW			0,4 MPa
PARAMETERS O FTHE COOLER'S RESERVOIR				
	Maximum reservoir capacity			Minimum required reservoir capacity
COOLARC 46	6 l			4 l
COOLANT				
COOLARC 46	Recommended coolant	Acorox		
COOLARC 46	Do not use!!	Pre-packaged welding industry coolants. These coolants may contain oil-based substances, which attack the plastic components of the cooler. Once added to the cooler, these substances are impossible to purge from the water lines and heat exchanger.		
		Automotive anti-freeze. These coolants will damage the pump and block of the heat exchanger, affecting cooling performance.		
PHYSICAL DIMENSIONS				
	Weight	Height	Width	Length
COOLARC 46	22,7 kg	255 mm	300 mm	700 mm
Protection Rating	Operating Humidity (t=20°C)	Operating Temperature	Storage Temperature	
IP23	≤ 90 %	from -10 °C to +40 °C	from -25 °C to +55 °C	

COOLARC® 21

CASE REMOVAL



CASE REMOVAL PROCEDURE

Necessary tool:

- 8 mm nut driver

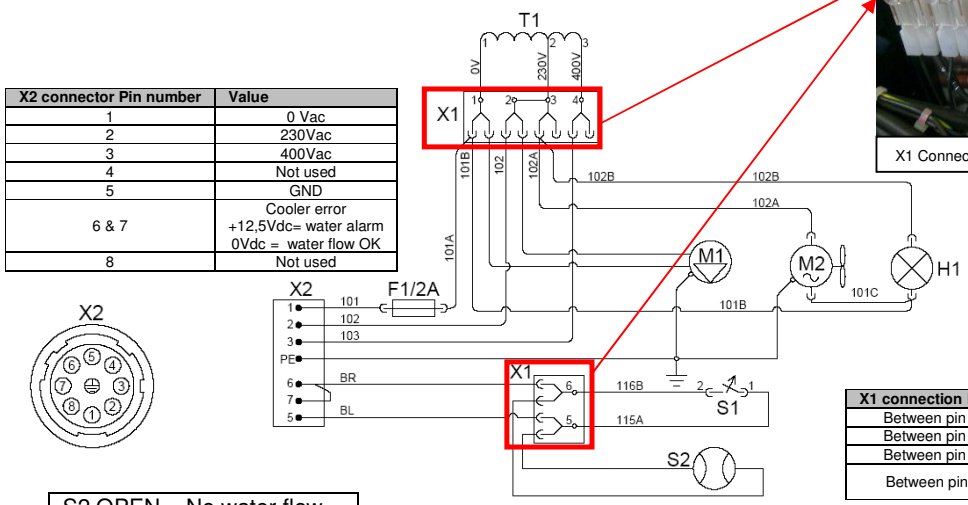
1. Disconnect electrically and mechanically the Coolarc 21 from the INVERTEC® 300TPX
2. Using a 8mm nut driver remove the 4 screws (**A**), two on the front and two on the back of the Coolarc 21 unit
3. Remove the 6 screws (**B**), 3 on the right side and 3 on the left side, using a 8 mm nut driver
4. Remove the Coolarc 21 cover.
5. For cover re-assembly make the previous steps in reverse order.

COOLARC® 21

VOLTAGE TEST

X1 Connection

X2 connector Pin number	Value
1	0 Vac
2	230Vac
3	400Vac
4	Not used
5	GND
6 & 7	Cooler error +12,5Vdc= water alarm 0Vdc = water flow OK
8	Not used



X1 connection Pin number	Value
Between pin 1 and 2	230Vac
Between pin 1 and 3	230Vac
Between pin 1 and 4	400Vac
Between pin 5 and 6	12,5Vdc = water alarm 0Vdc = water flow OK

S2 OPEN = No water flow
S2 CLOSE = Water flow OK

S1 = Prime circuit switch

COOLARC® 46

CASE REMOVAL

CASE REMOVAL PROCEDURE

Necessary tool:

- 8 mm nut driver

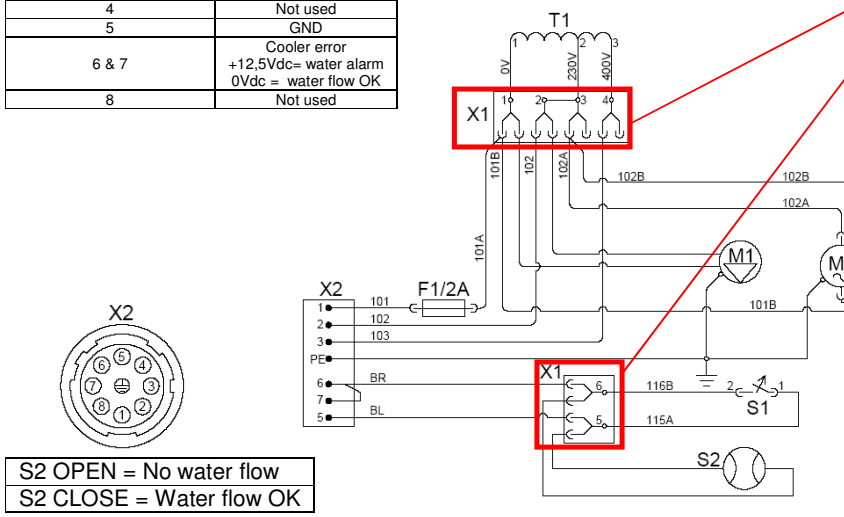
1. Disconnect electrically and mechanically the Coolarc 46 from the INVERTEC® 400TPX
2. Using a 8mm nut driver remove the 4 screws (**A**), two on the front and two on the back of the Coolarc 46 unit
3. Remove the 6 screws (**B**), 3 on the right side and 3 on the left side, using a 8 mm nut driver
4. Remove the Coolarc 46 cover.
5. For cover re-assembly make the previous steps in reverse order.

COOLARC® 46

VOLTAGE TEST

X2 connector Pin number	Value
1	0 Vac
2	230Vac
3	400Vac
4	Not used
5	GND
6 & 7	Cooler error +12,5Vdc= water alarm 0Vdc = water flow OK
8	Not used

X1 Connection



X2

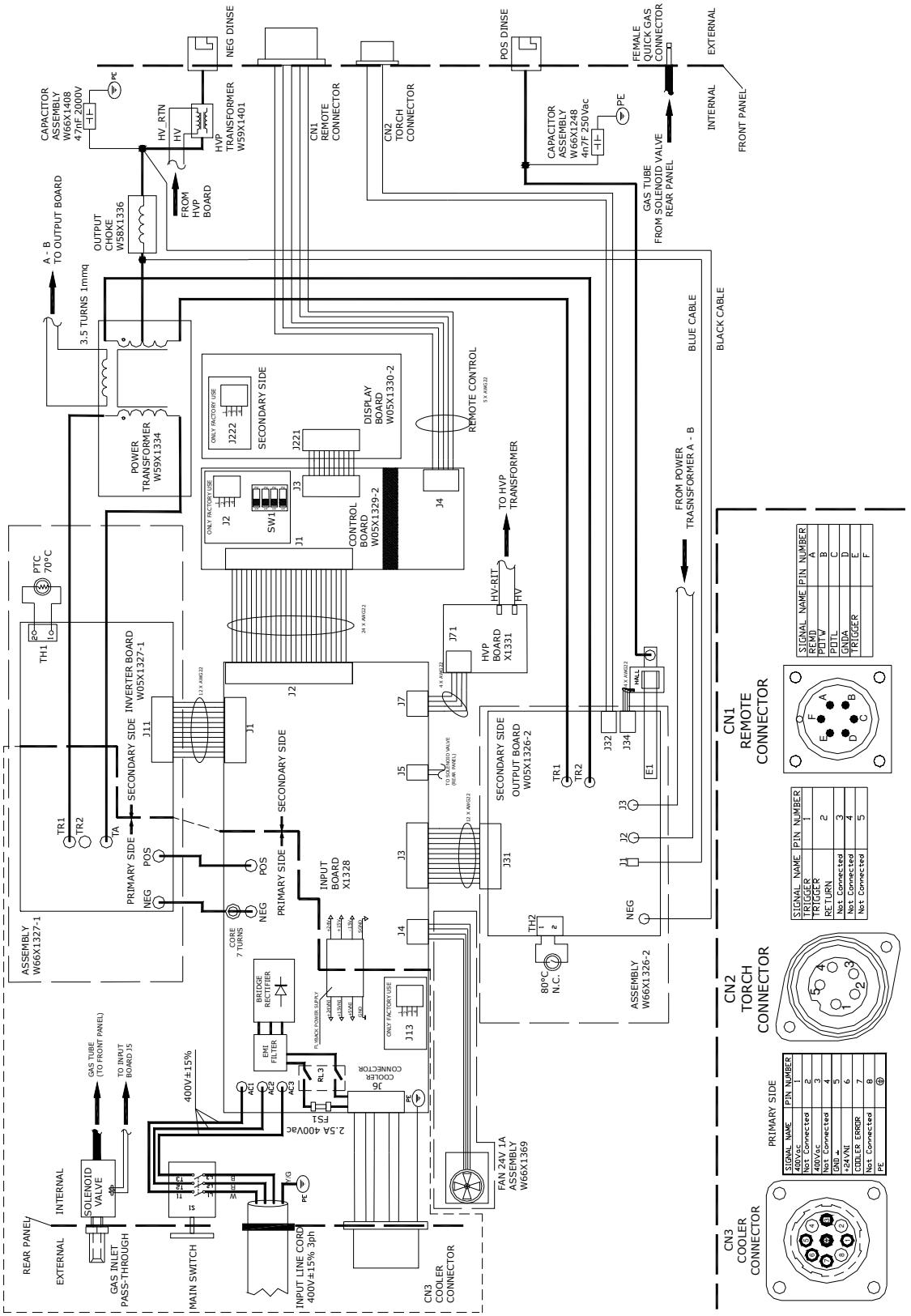
X1 connection Pin number	Value
Between pin 1 and 2	230Vac
Between pin 1 and 3	230Vac
Between pin 1 and 4	400Vac
Between pin 5 and 6	12,5Vdc = water alarm 0Vdc = water flow OK

S2 OPEN = No water flow
S2 CLOSE = Water flow OK

S1 = Prime circuit switch

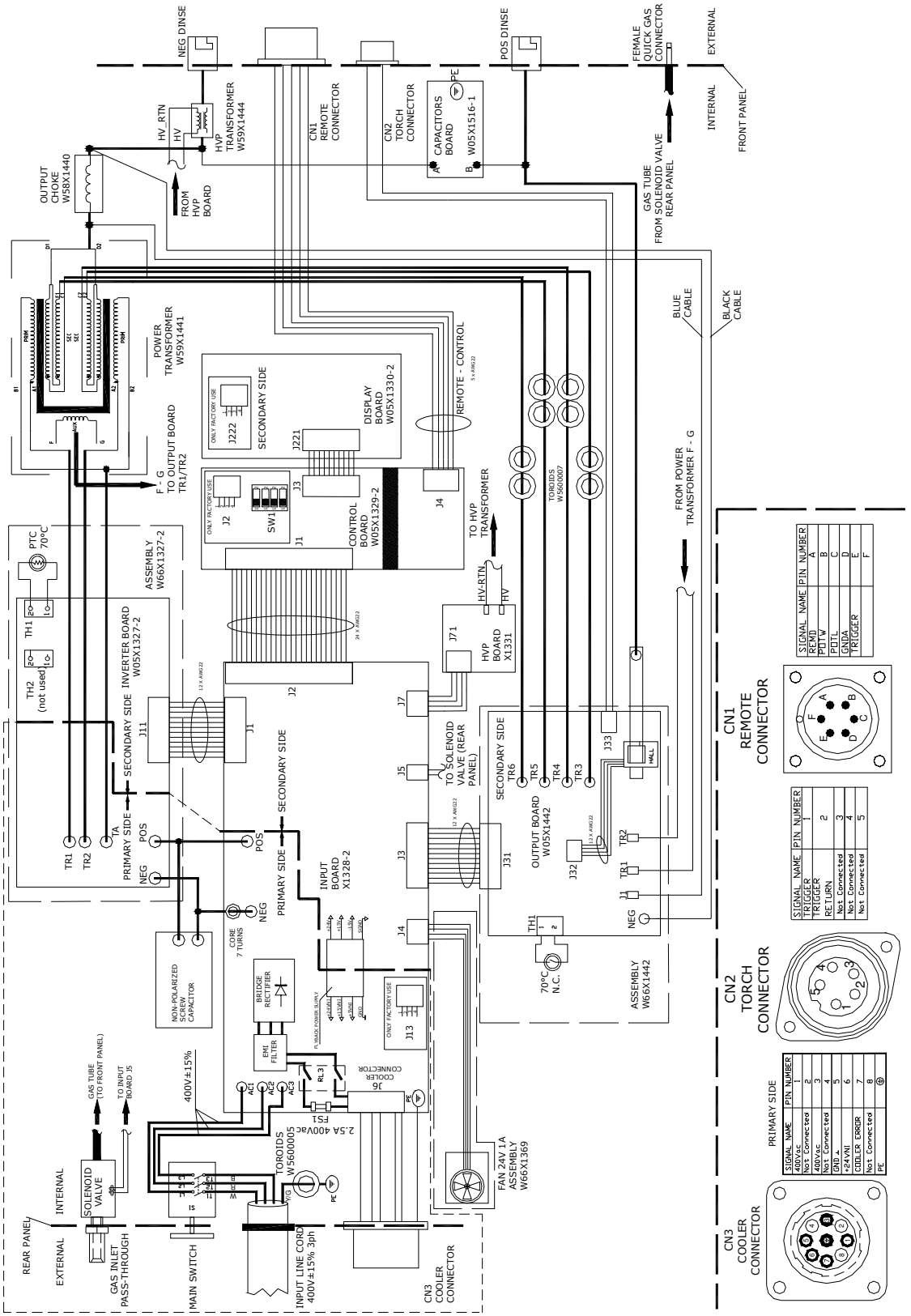
ELECTRICAL SCHEMATICS

Block Diagram : INVERTEC® 300TPX code 52109, 52110

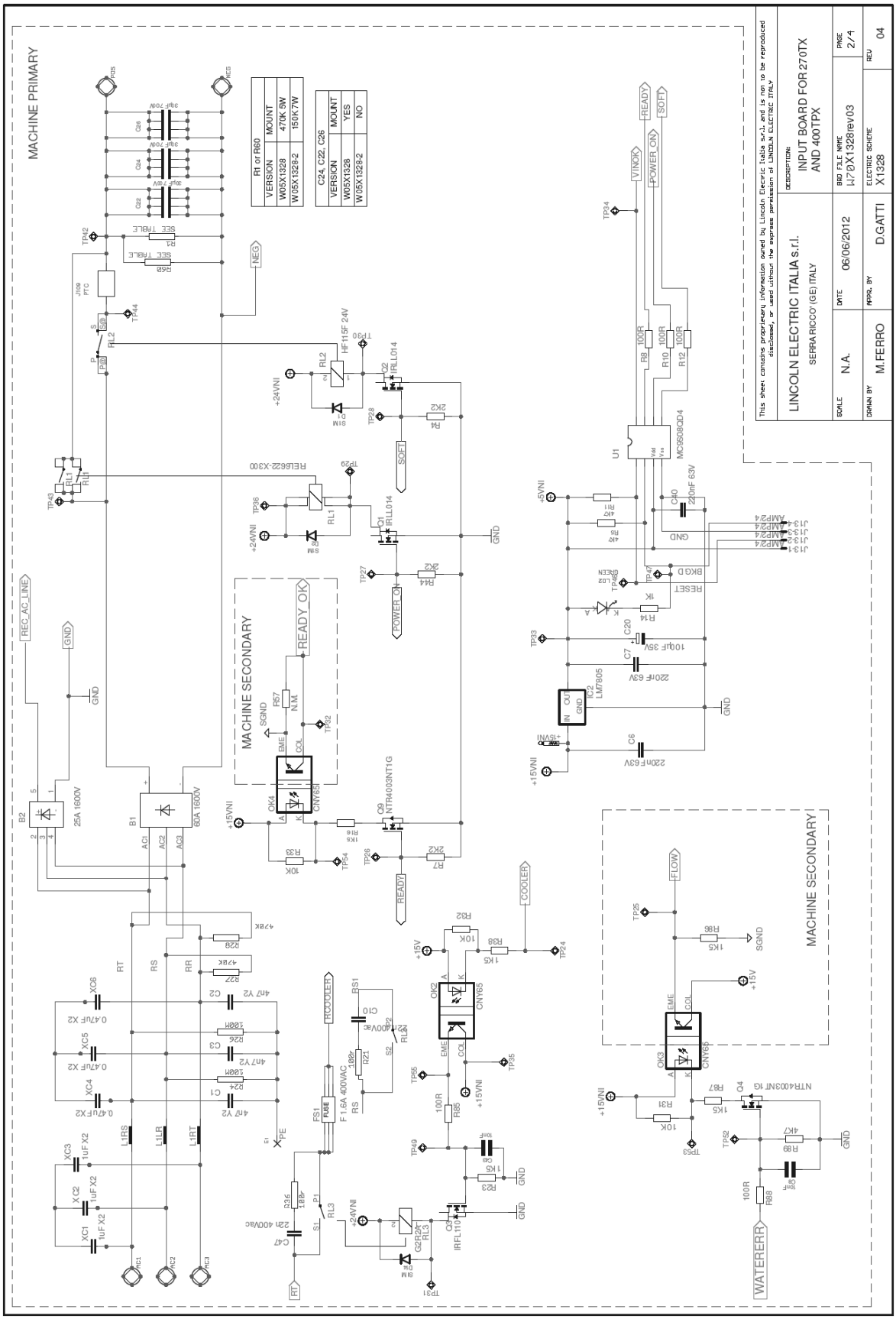


ELECTRICAL SCHEMATICS

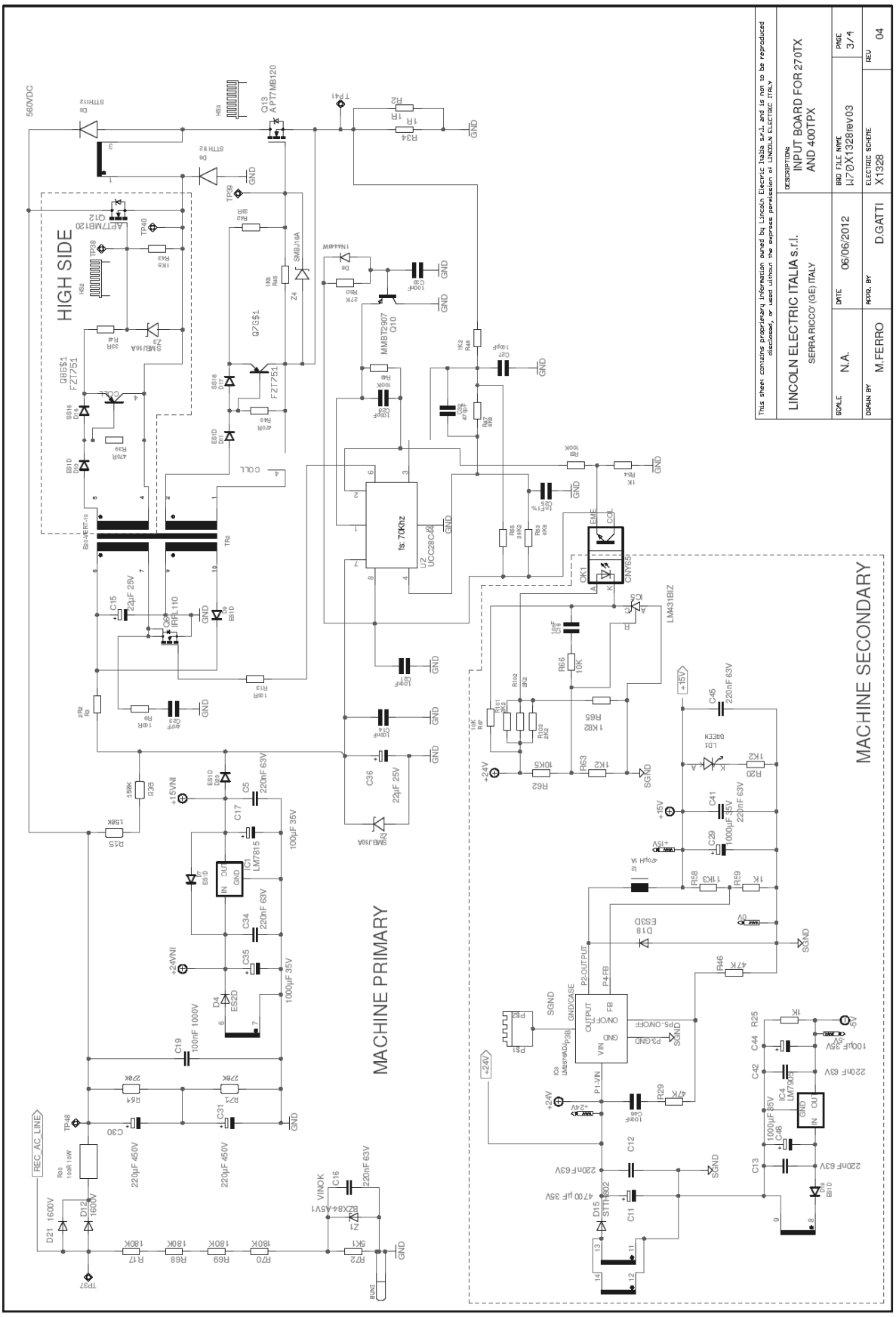
Block Diagram : INVERTEC® 400TPX code 52083, 52084

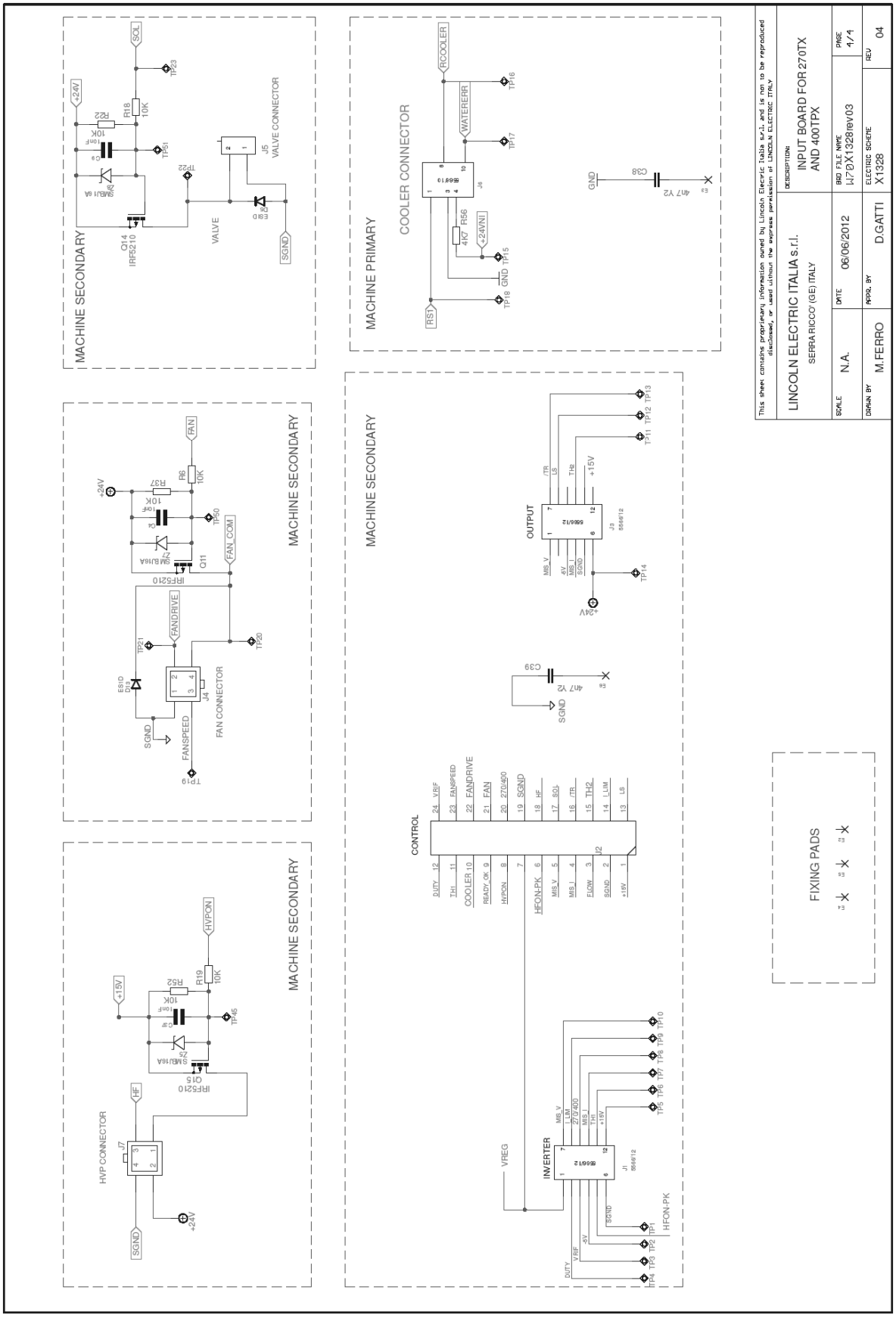


INPUT BOARD SCHEMATIC X1328 - Page 1



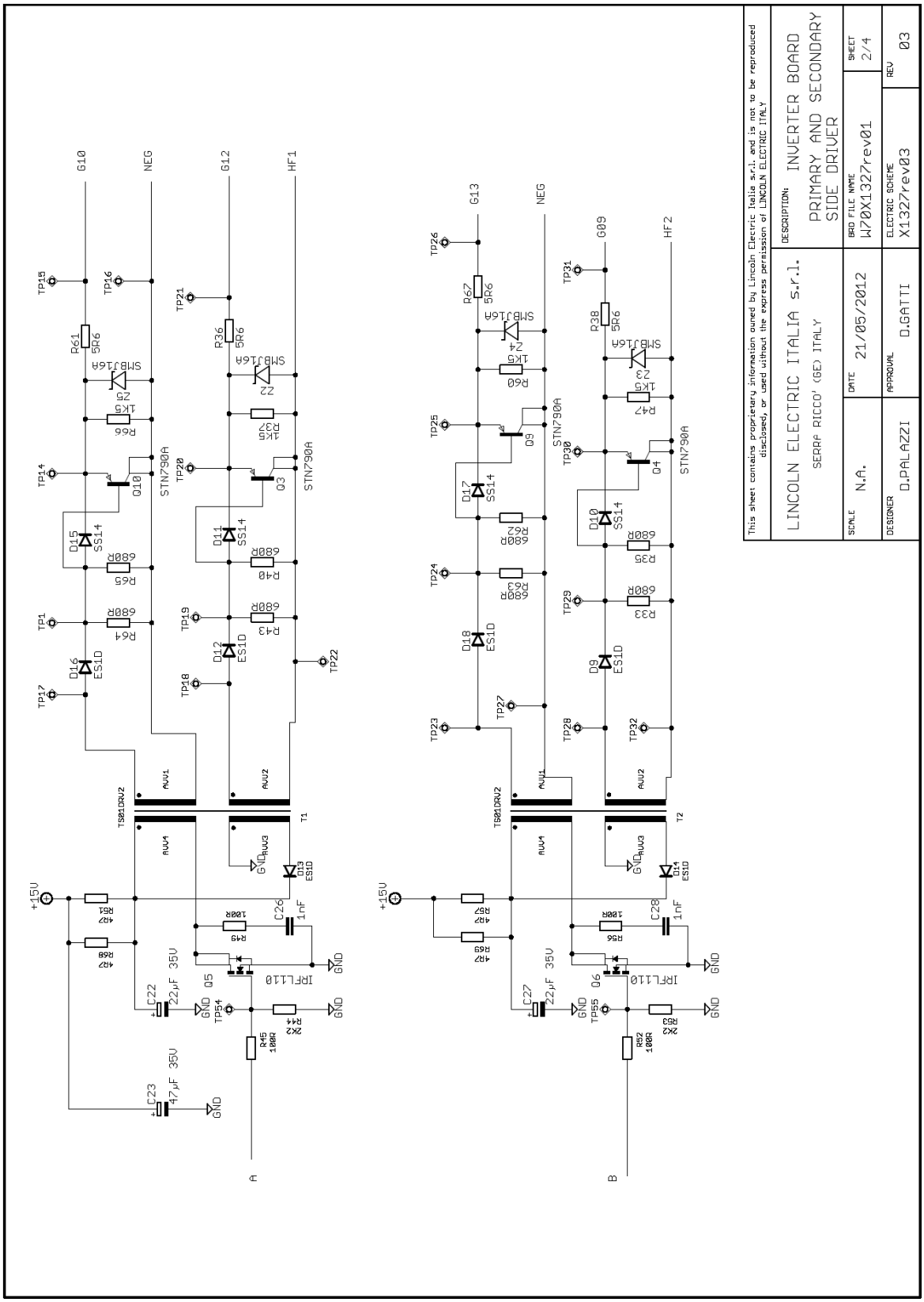
INPUT BOARD SCHEMATIC X1328 - Page 2




MACHINE SECONDARY
MACHINE PRIMARY
COOLER CONNECTOR
VALVE CONNECTOR
VALVE
FAN CONNECTOR
HVP CONNECTOR
CONTROL
INVERTER
OUTPUT
FIXING PADS
LINCOLN ELECTRIC ITALIA s.r.l.
SERRA RICCO' (GE) ITALY
INPUT BOARD FOR 270TX AND 400TPX
BID FILE NAME: LI70X1328rev03
ELECTRIC SCHEME: X1328
DRAWN BY: M.FERRO
DATE: 06/06/2012
APPR. BY: D.GATTI
SCALE: N.A.
PAGE: 4/4
REV: 04

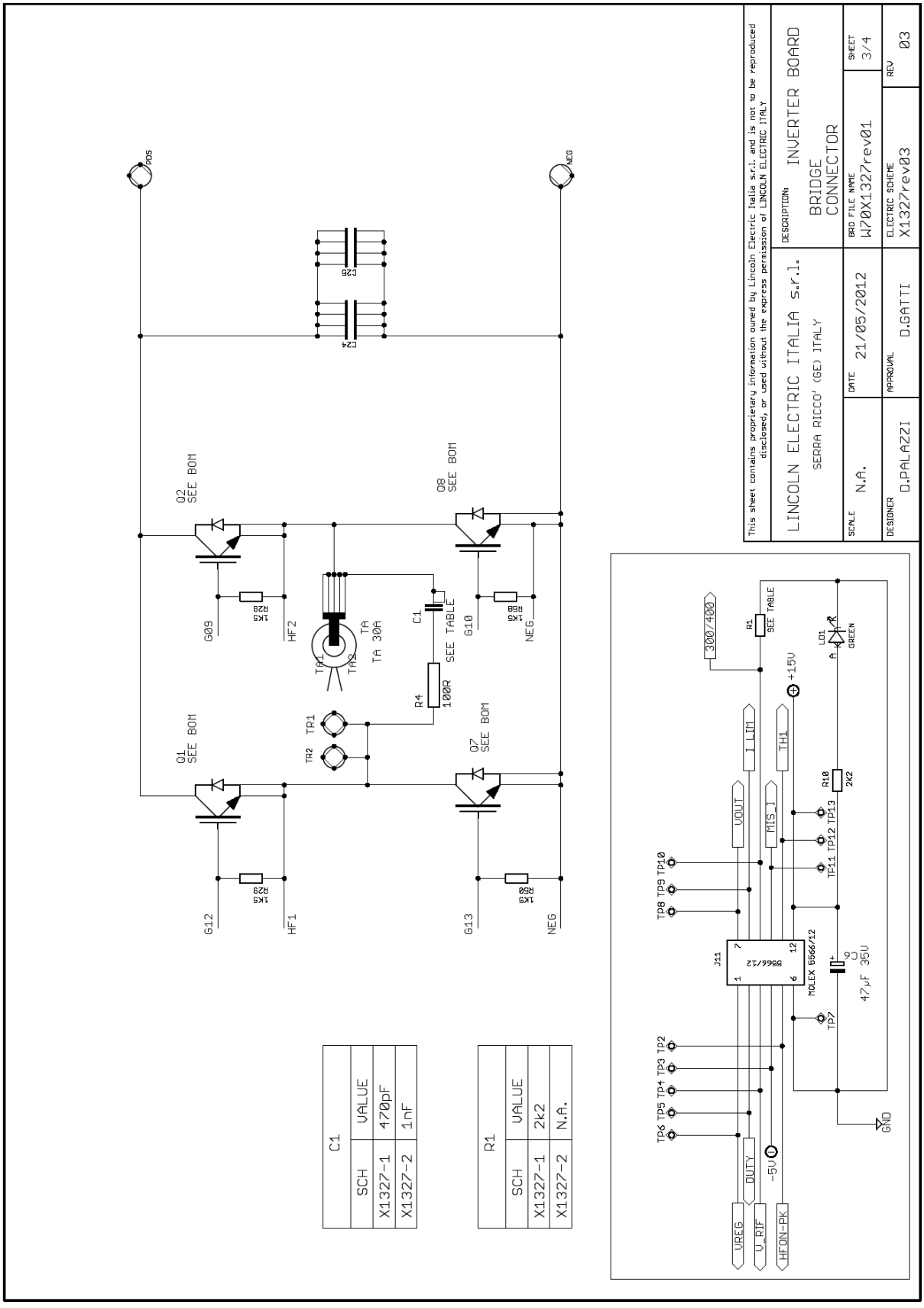
ELECTRICAL DIAGRAMS – INVERTEC® 300TPX- 400TPX

INVERTER BOARD SCHEMATIC X1327 -– IGBT DRIVER SECTION



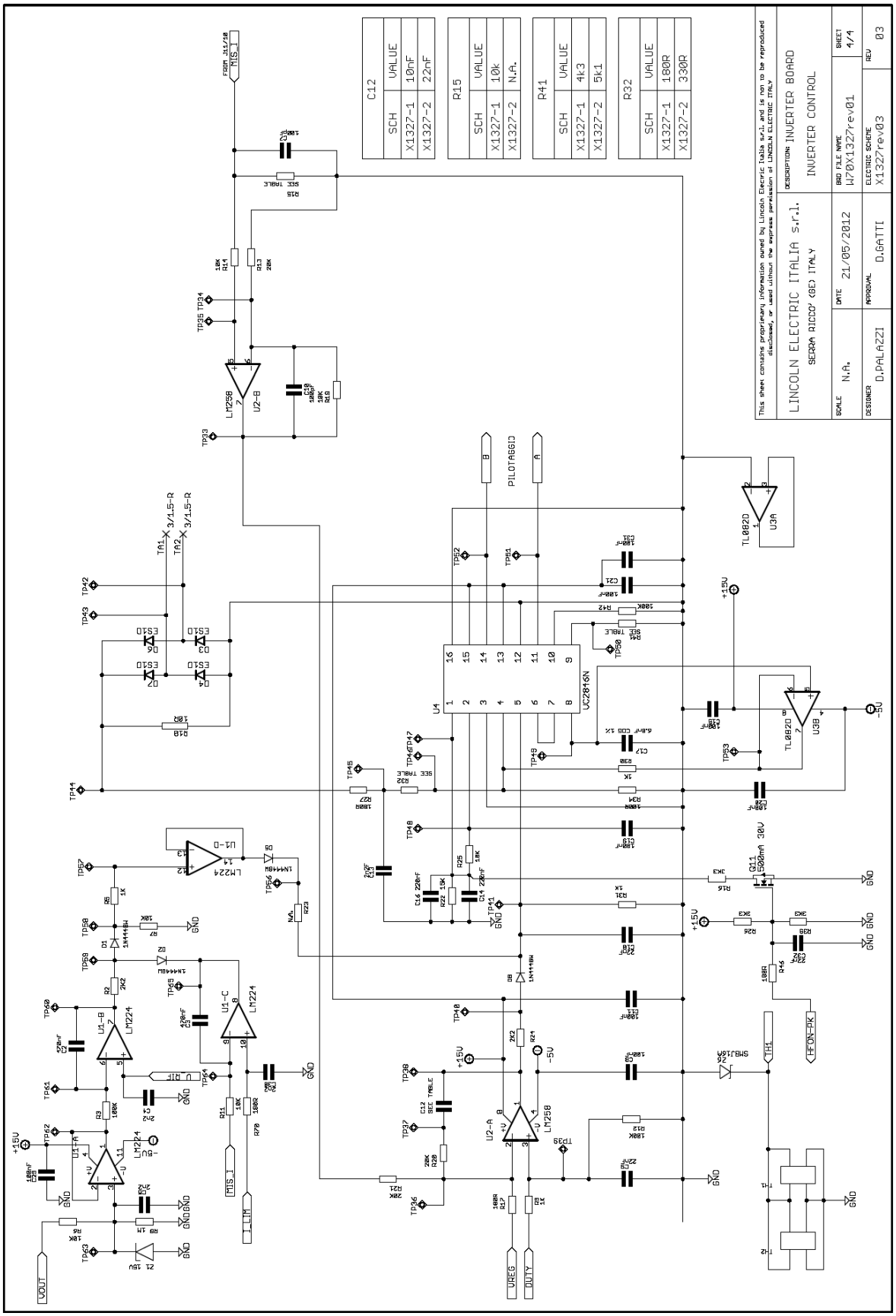
ELECTRICAL DIAGRAMS – INVERTEC® 300TPX- 400TPX

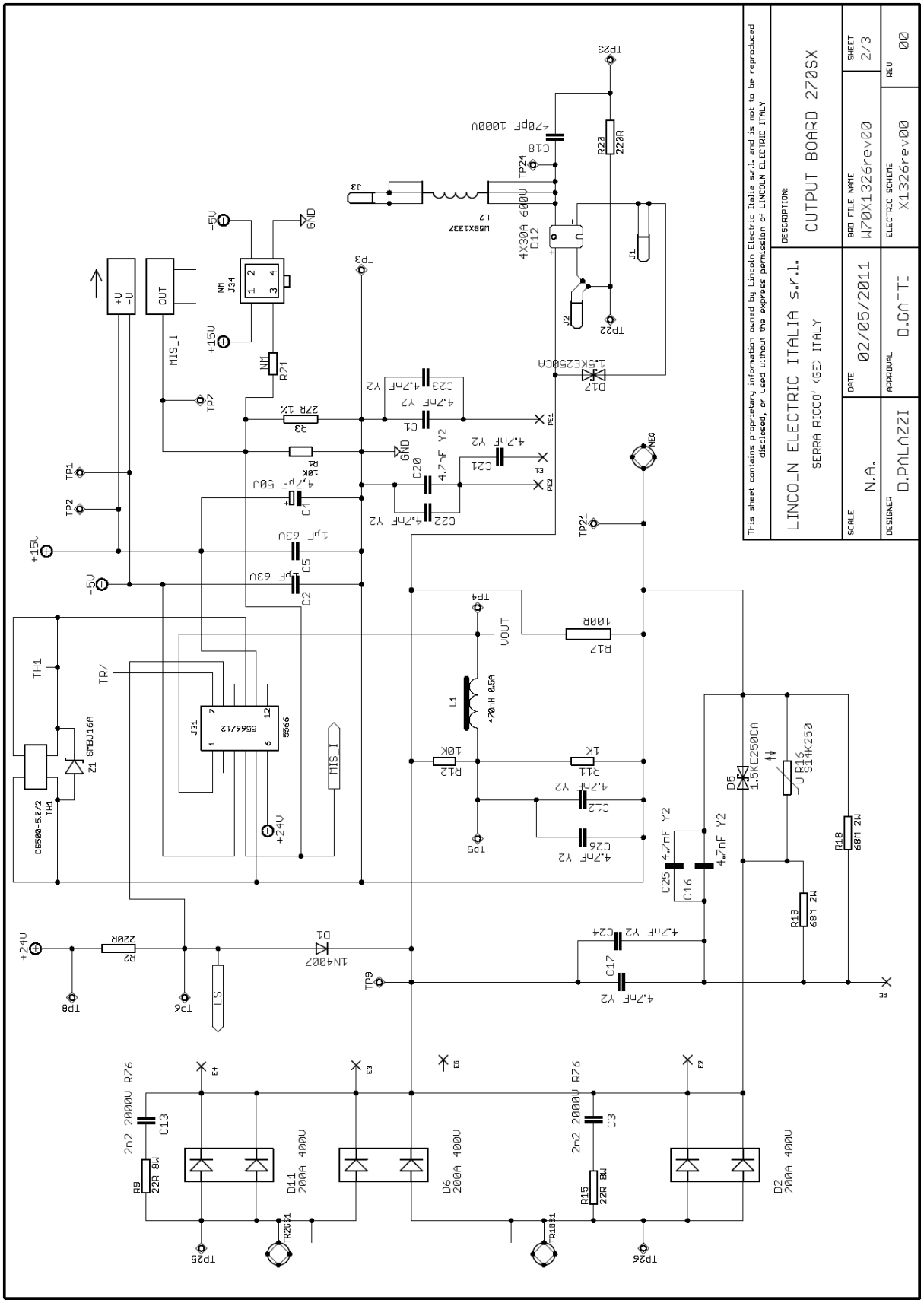
INVERTER BOARD SCHEMATIC X1327 –– IGBT SECTION



ELECTRICAL DIAGRAMS – INVERTEC® 300TPX- 400TPX

INVERTER BOARD SCHEMATIC X1327 – CONTROL CIRCUIT SECTION

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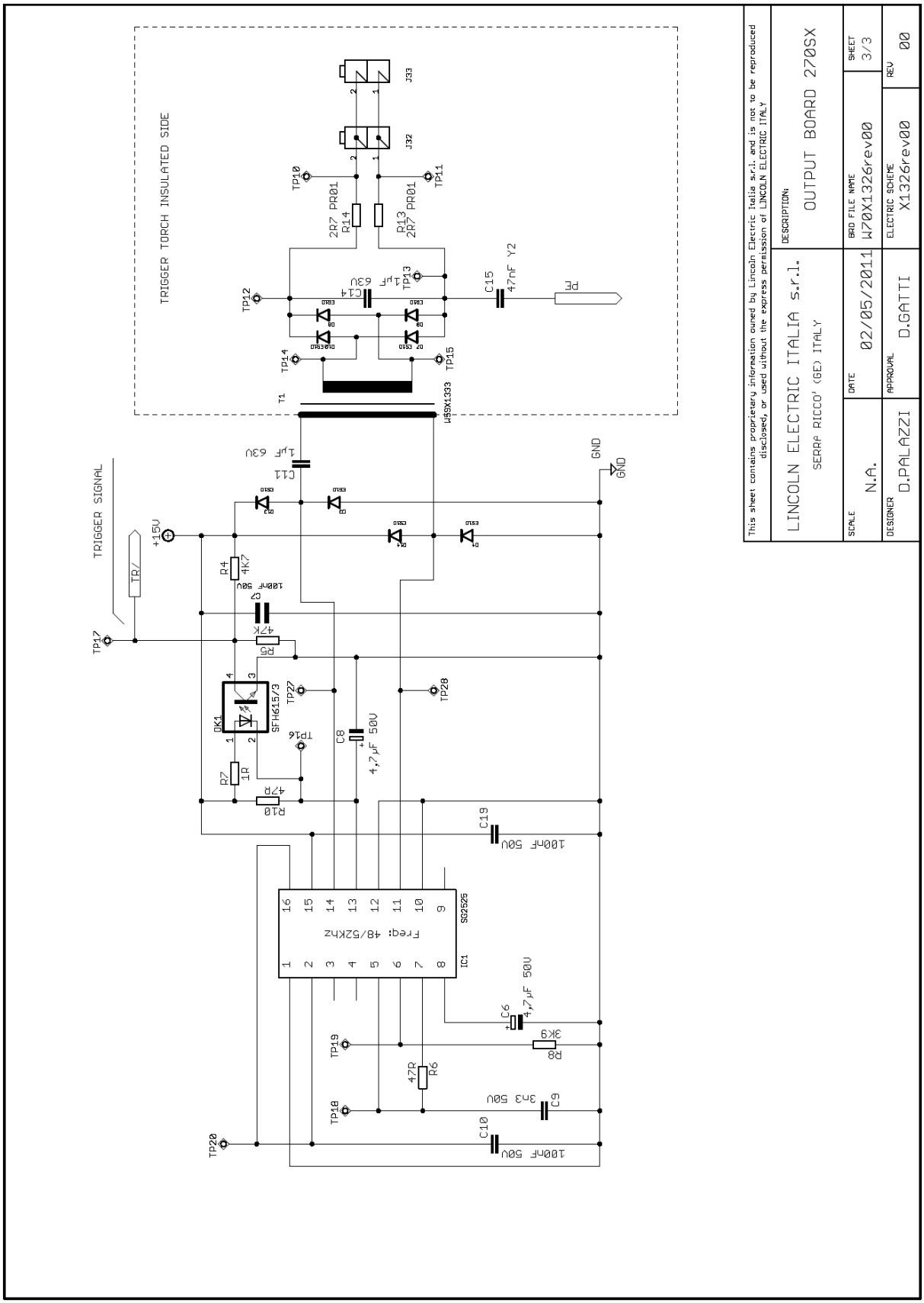
LINCOLN ELECTRIC ITALIA s.r.l.
SERRA RICCO' (GE) ITALY
DESCRIPTION: OUTPUT BOARD 270SX
SCALE N.A.
DATE 02/05/2011
APPROVAL D.GATTI
DESIGNER D.PALAZZI
BRD FILE NAME W70X1326rev00
ELECTRIC SCHEME X1326rev00
SHEET 2/3
REV 00
+15V
-5V
+24V
OUT
MIS_I
TR/
VOUT
GND
TH1
SMBJ16A
D5500-5.8/2
5566/12
1N4007
1.5KE250CA
S14K250
470nH 0.5A
4x30A 600V
LS
TR1GS1
TR2GS1



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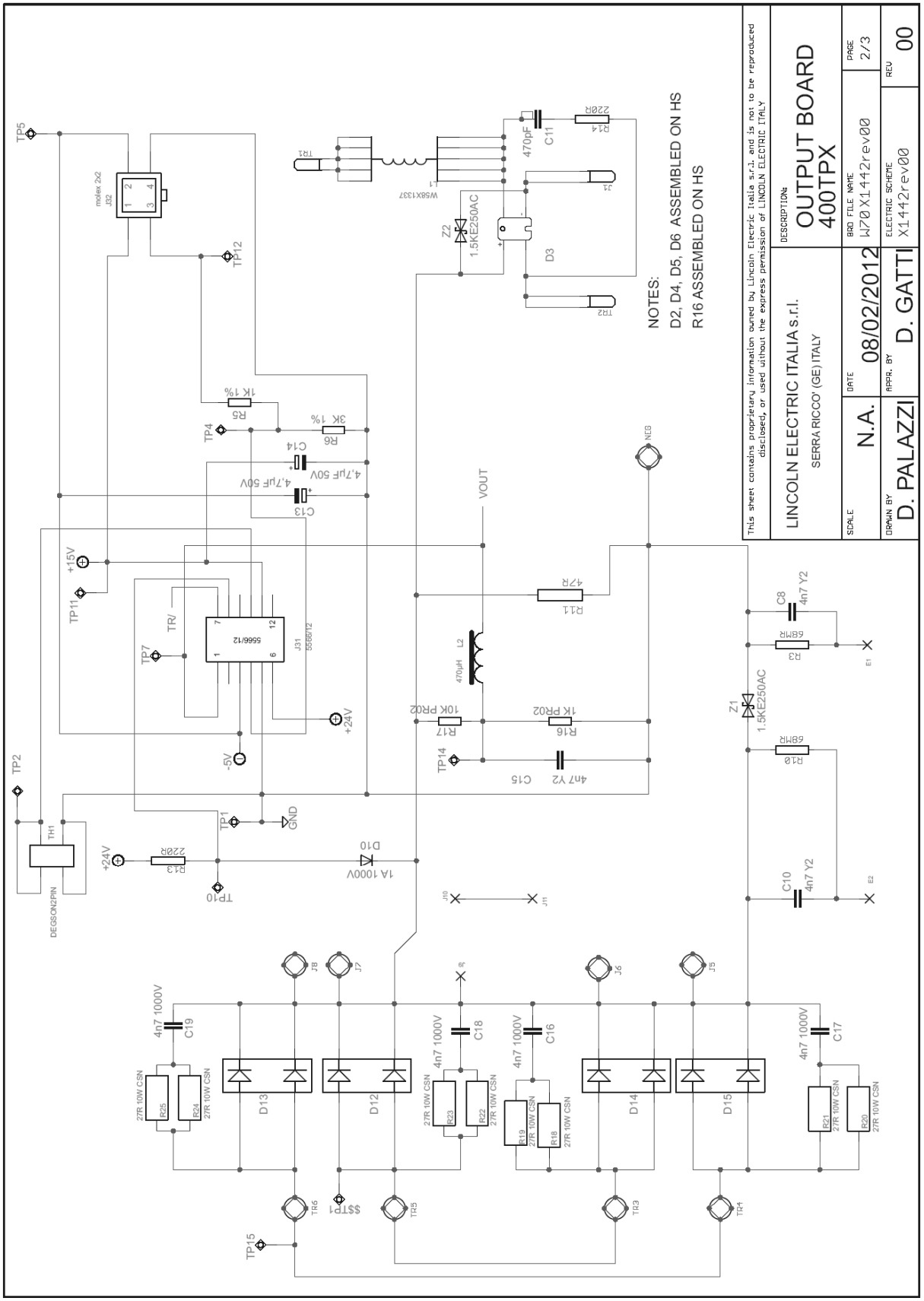
LINCOLN ELECTRIC ITALIA s.r.l.
SERRA RICCO' (GE) ITALY

DESCRIPTION: OUTPUT BOARD 270SX

SCALE	DATE	BRD FILE NAME	SHEET
N.A.	02/05/2011	W70X1326rev00	3/3

DESIGNER	APPROVAL	ELECTRIC SCHEME	REV
D.PALAZZI	D.GATTI	X1326rev00	00


NOTES:
D2, D4, D5, D6 ASSEMBLED ON HS
R16 ASSEMBLED ON HS
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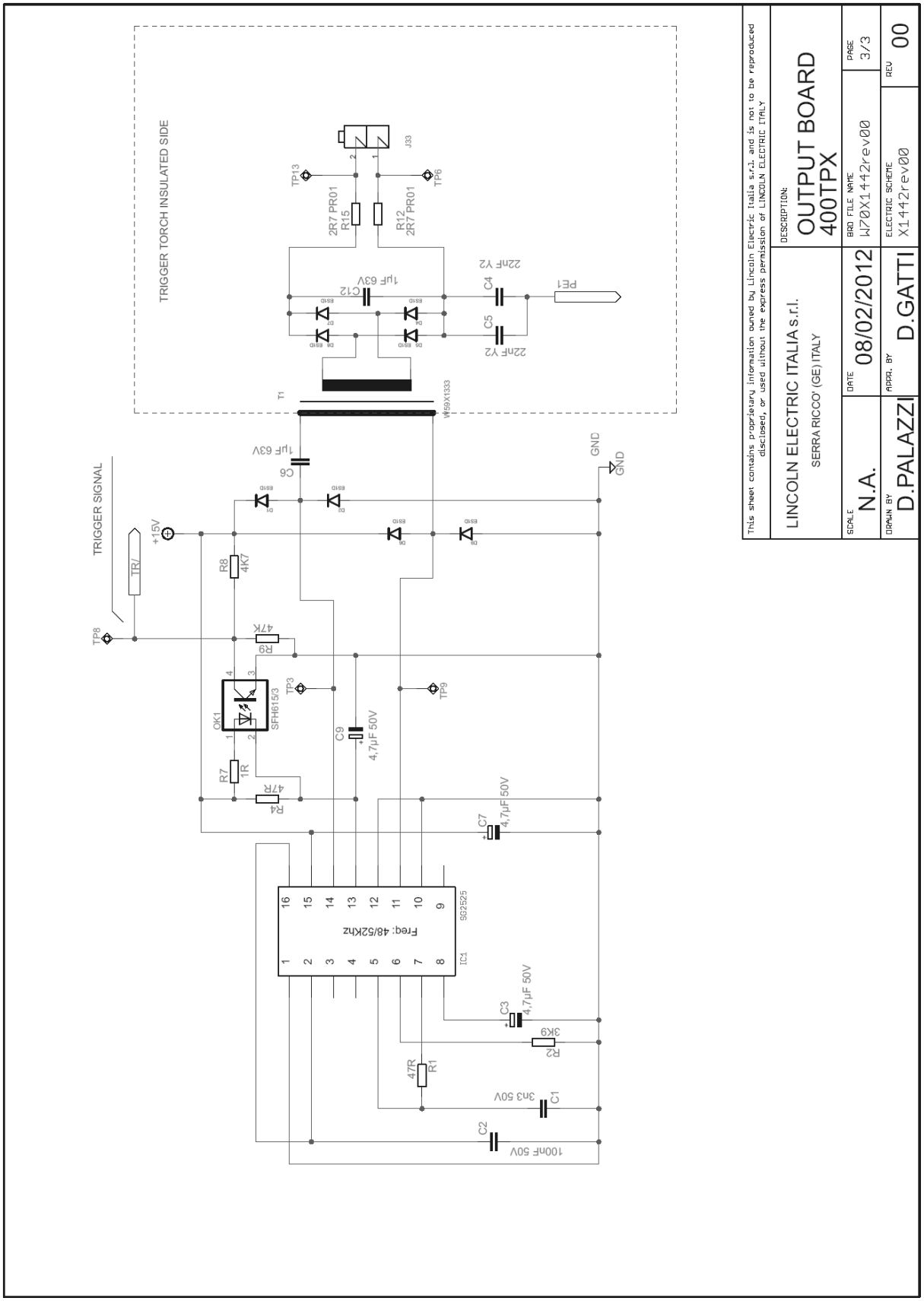
LINCOLN ELECTRIC ITALIA s.r.l.
SERRA RICCO' (GE) ITALY
DESCRIPTION: OUTPUT BOARD 400TPX
SCALE N.A.
DATE 08/02/2012
BRD FILE NAME W70X1442rev00
PAGE 2/3
DRAWN BY D. PALAZZI
APPR. BY D. GATTI
ELECTRIC SCHEME X1442rev00
REV 00
TP5
TP12
TP4
TP11
TP7
TP2
TP1
TP14
TP15
TP10
R5 1K 1%
R6 3K 1%
C14 4,7µF 50V
C13 4,7µF 50V
+15V
-5V
+24V
GND
VOUT
NEG
R11 47R
R17 10K PR02
R16 1K PR02
L2 470µH
C15 4n7 Y2
C8 4n7 Y2
C10 4n7 Y2
R3 68MR
R10 68MR
Z1 1.5KE250AC
Z2 1.5KE250AC
C11 470pF
R14 220R
R13 220R
D10 1A 1000V
D3
TH1
DEGSON2PIN
J31 5568/12
C19 4n7 1000V
C18 4n7 1000V
C16 4n7 1000V
C17 4n7 1000V
R25 27R 10W CSN
R24 27R 10W CSN
R23 27R 10W CSN
R22 27R 10W CSN
R19 27R 10W CSN
R18 27R 10W CSN
R21 27R 10W CSN
R20 27R 10W CSN
D13
D12
D14
D15
TR6
TR5
TR3
TR4
J8
J7
J6
J5
J9
J10
J11
E1
E2

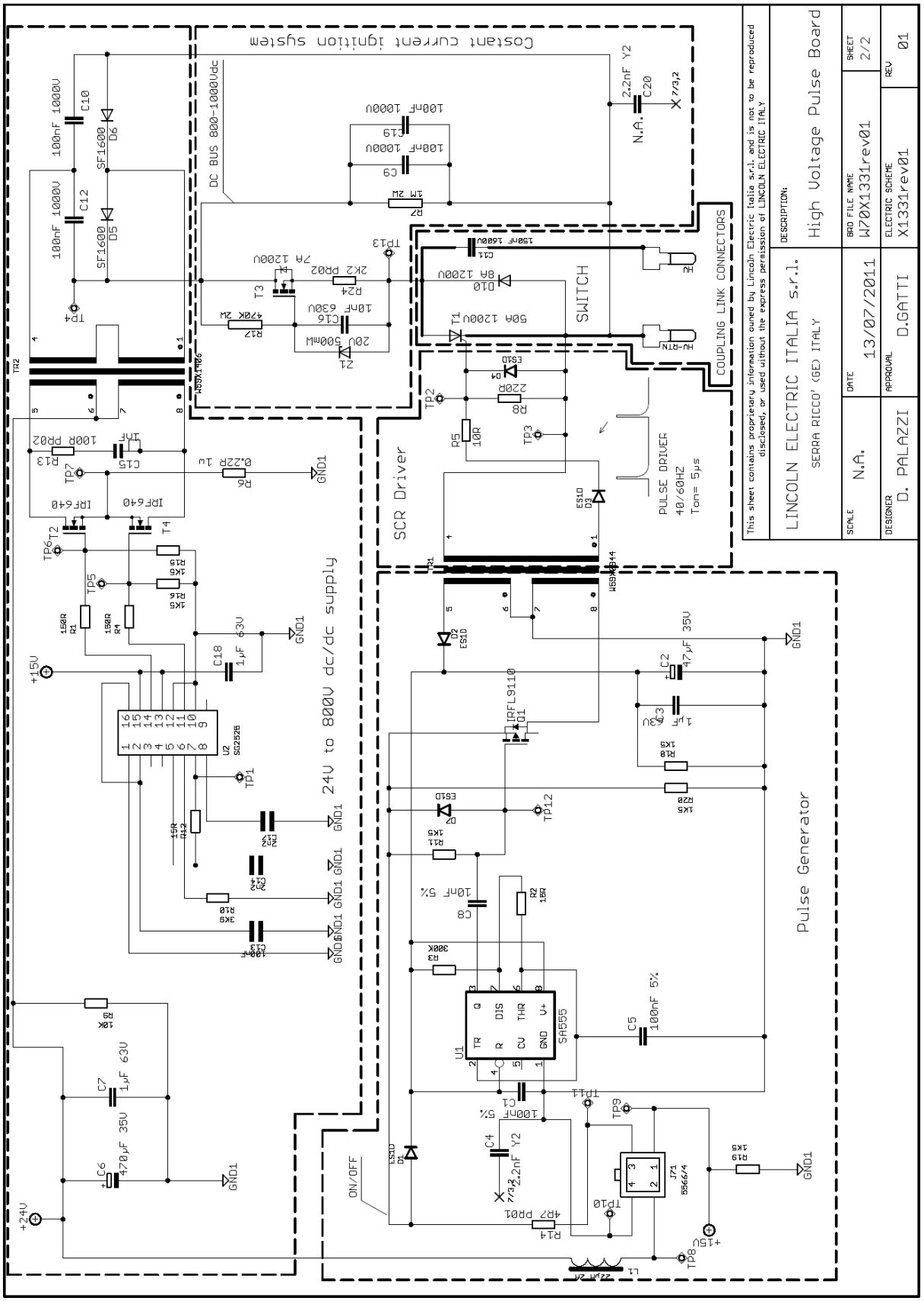
ELECTRICAL DIAGRAMS – INVERTEC® 400TPX

OUTPUT BOARD SCHEMATIC X1442 - Page 2/2



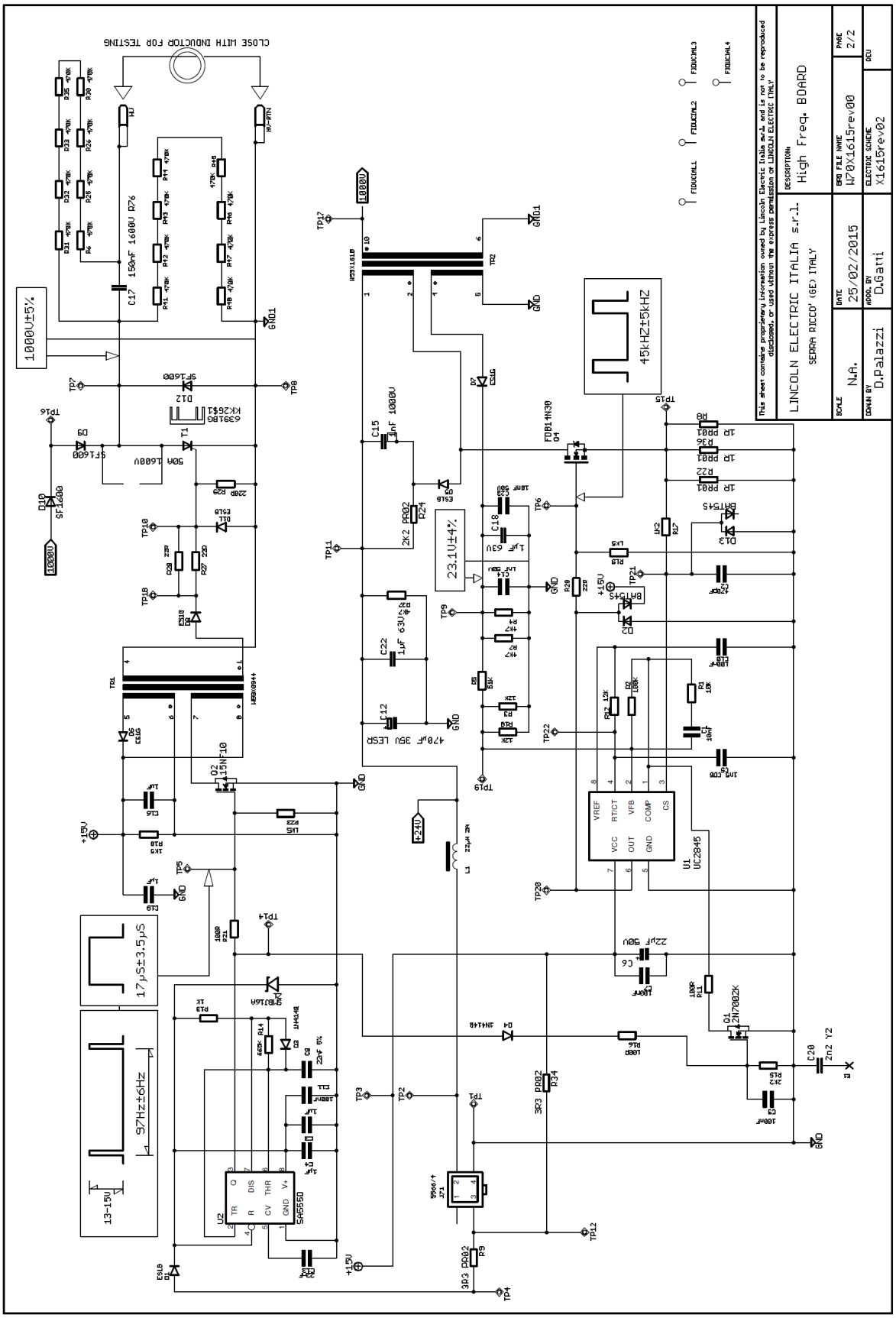
ELECTRICAL DIAGRAMS – INVERTEC® 300TPX - 400TPX

HF BOARD SCHEMATIC X1331



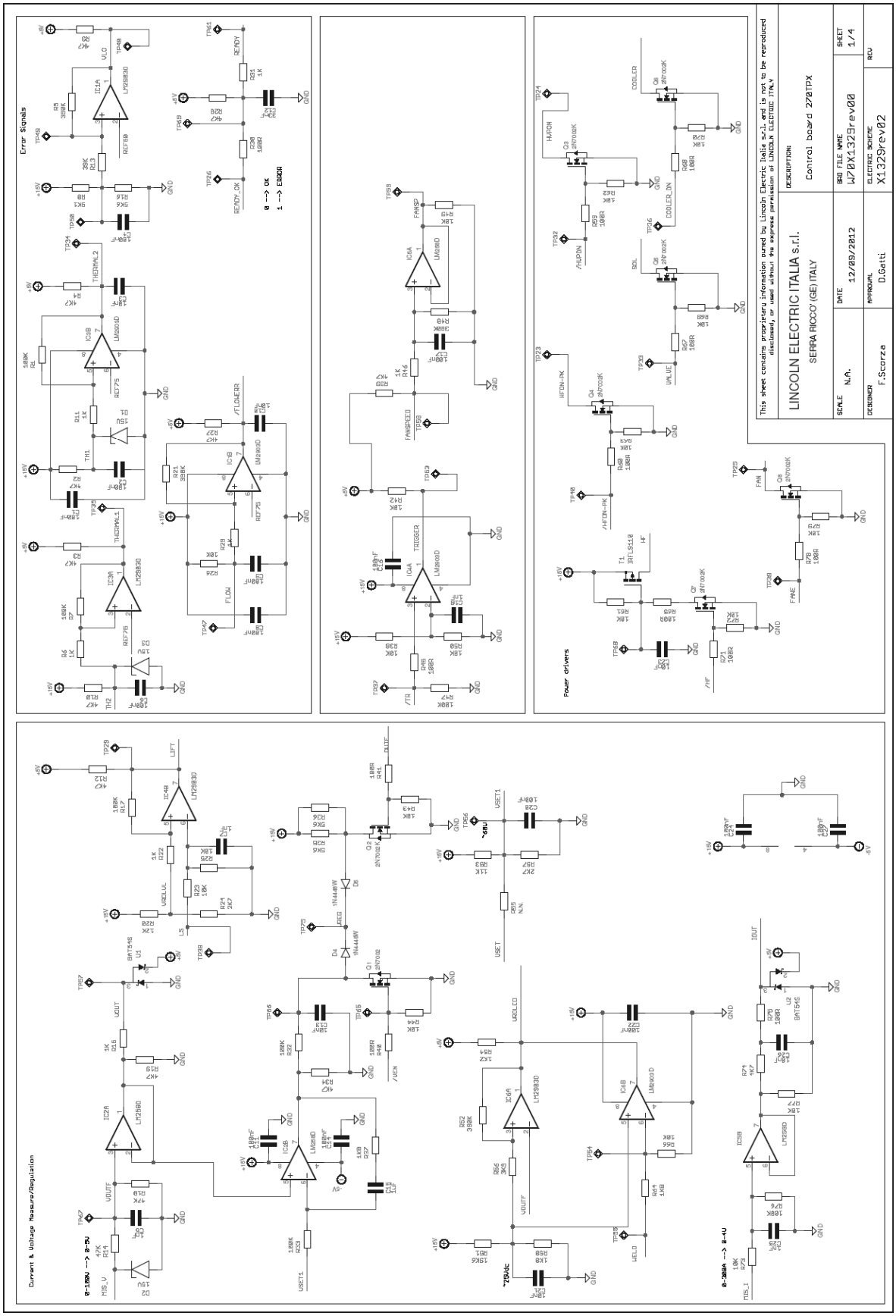
ELECTRICAL DIAGRAMS – INVERTEC® 300TPX - 400TPX

HF BOARD SCHEMATIC X1615



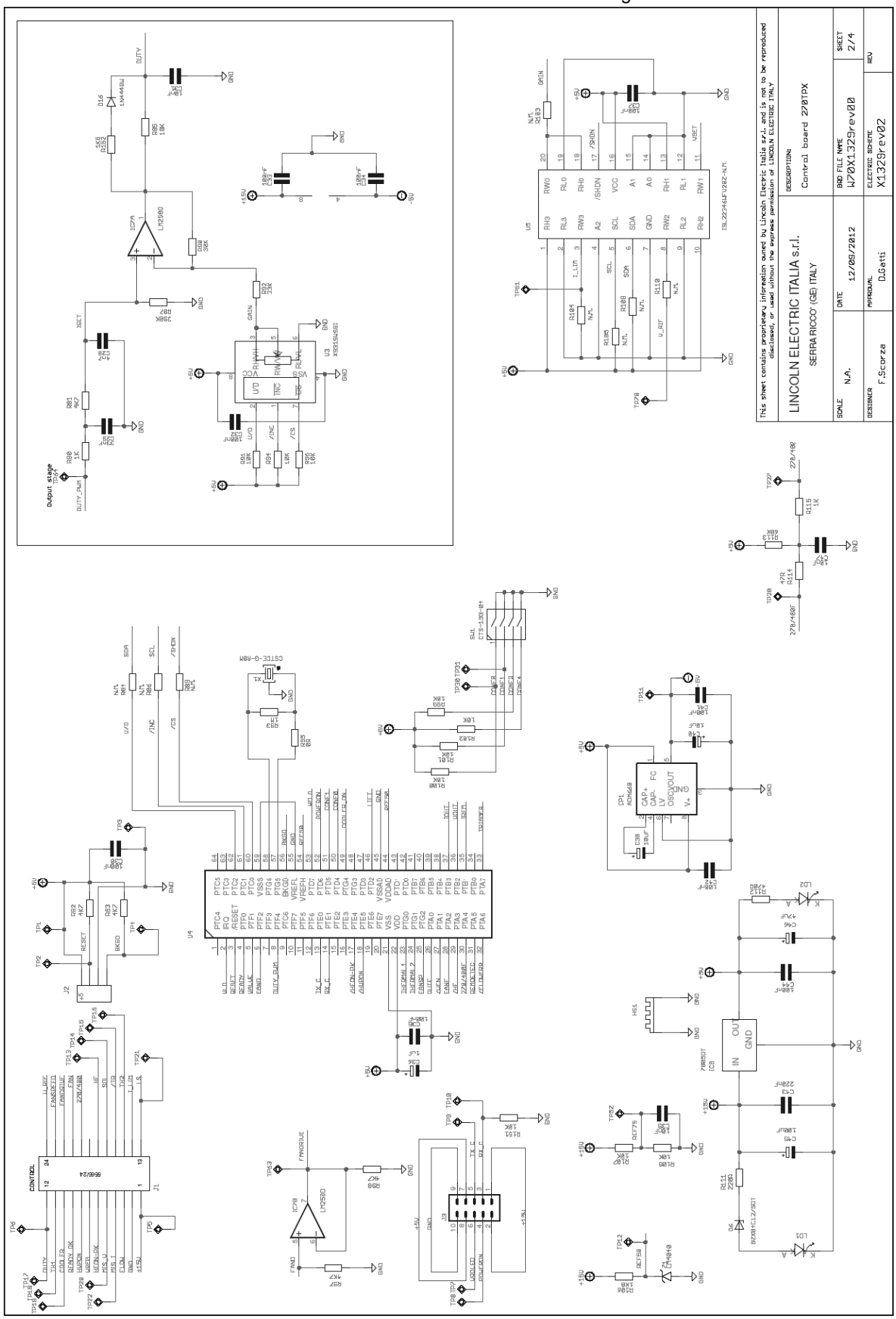
ELECTRICAL DIAGRAMS – INVERTEC® 300TPX - 400TPX

CONTROL BOARD SCHEMATIC X1329 Page 1/3



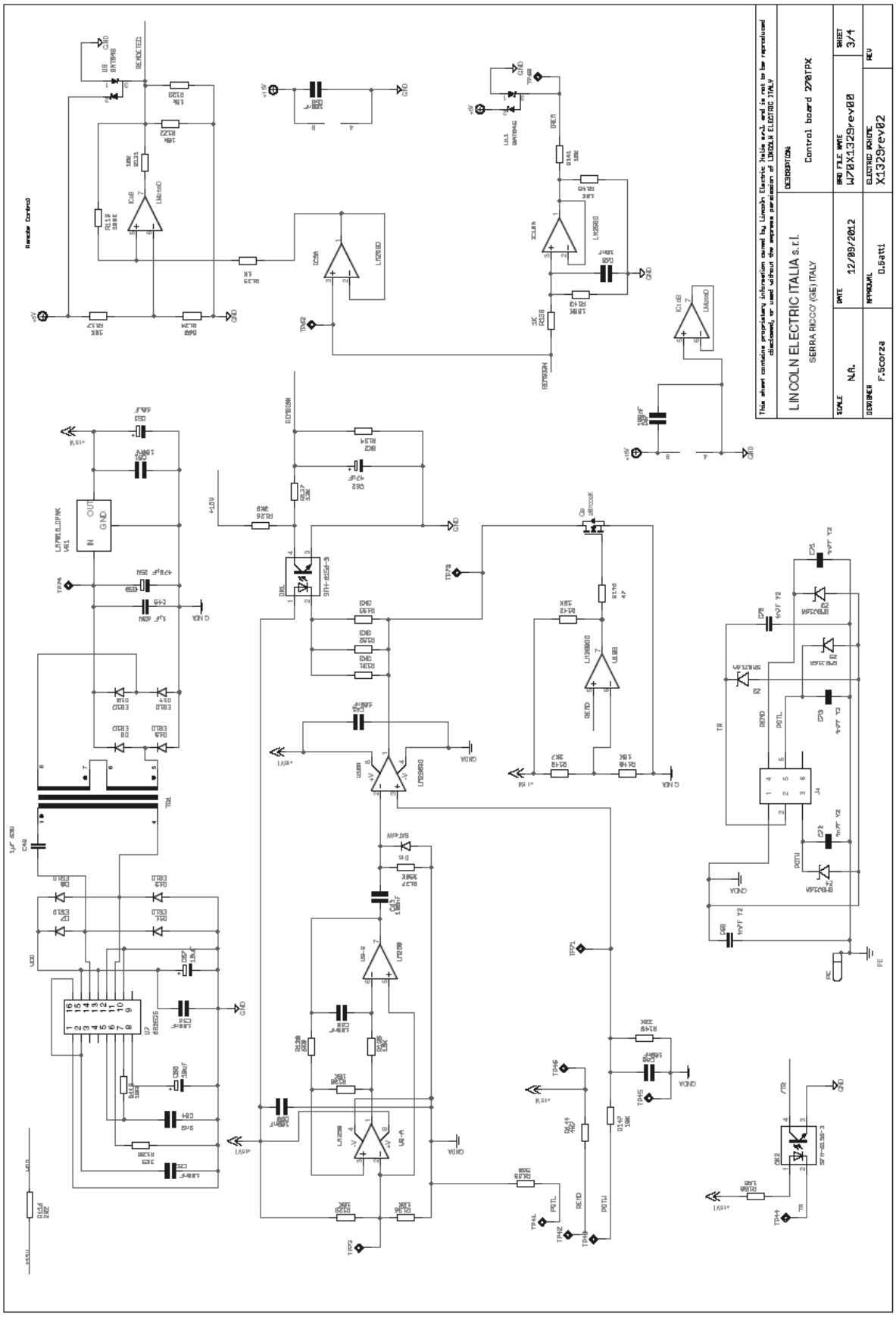
ELECTRICAL DIAGRAMS – INVERTEC® 300TPX - 400TPX

CONTROL BOARD SCHEMATIC X1329 Page 2/3



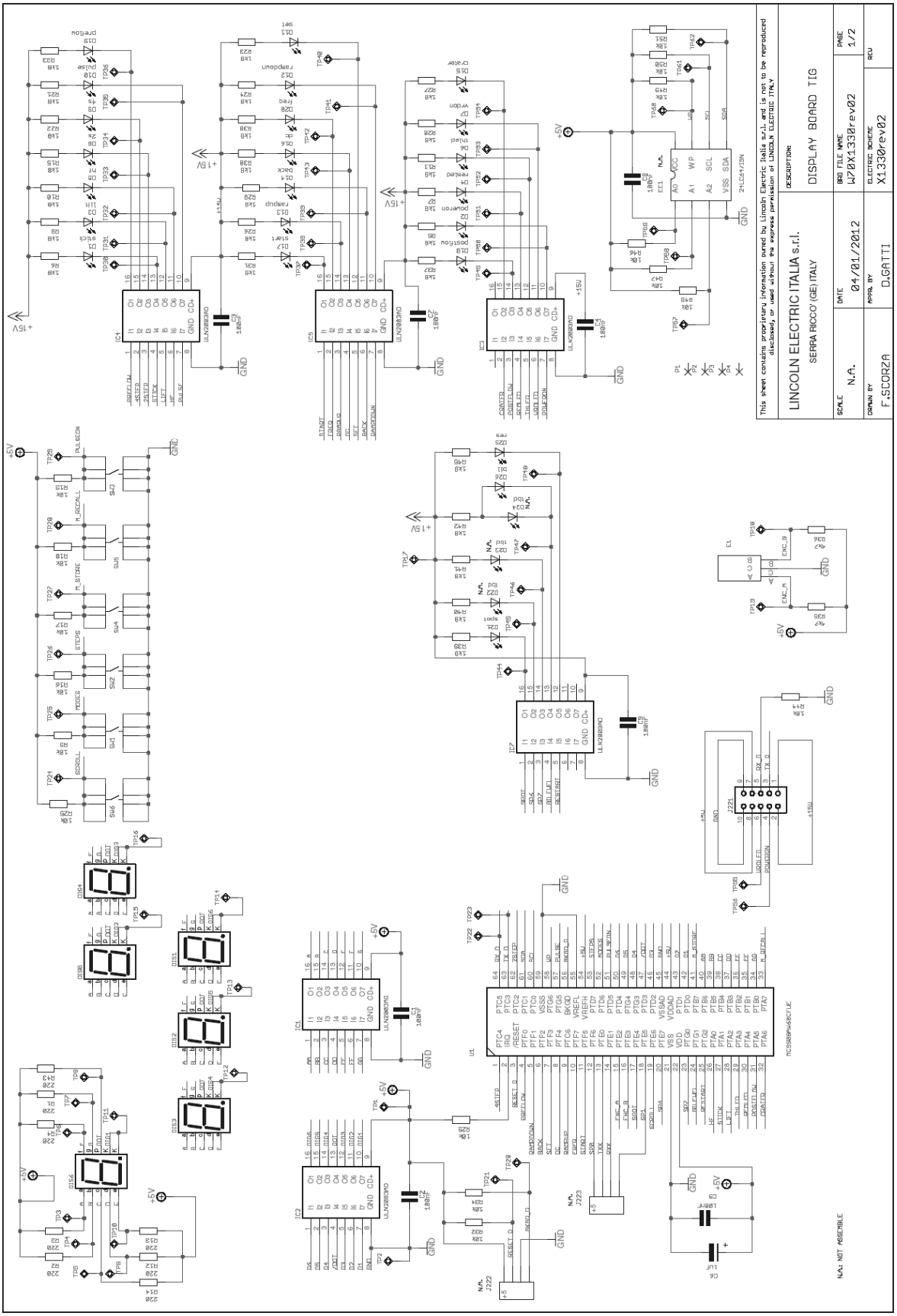
ELECTRICAL DIAGRAMS – INVERTEC® 300TPX - 400TPX

CONTROL BOARD SCHEMATIC X1329 Page 3/3



ELECTRICAL DIAGRAMS – INVERTEC® 300TPX - 400TPX

DISPLAY BOARD SCHEMATIC X1330



NOTE

LINCOLN® ELECTRIC

Lincoln Electric Europe