SVM 2030
04-2011

INVERTEC® 270-320T ac/dc

For use with machines having code numbers: 52092, 52093

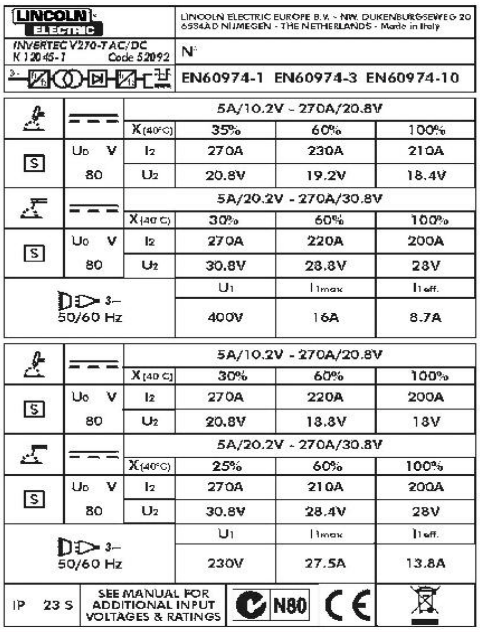
SERVICE MANUAL

LINCOLN ELECTRIC EUROPE
www.lincolnelectric.eu

1) PURPOSE OF THE MANUAL

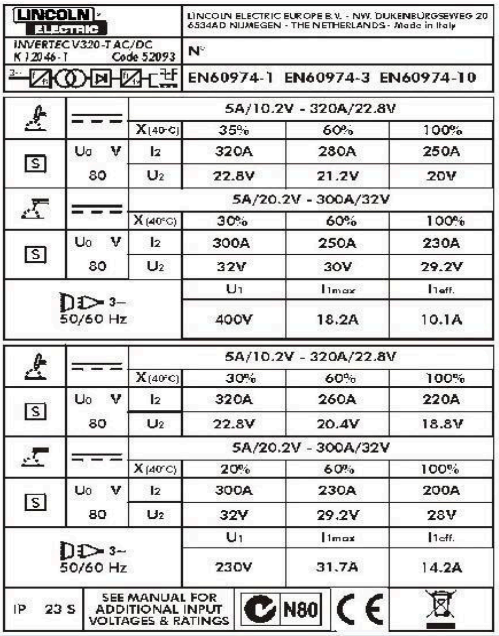
The purpose of this manual is to provide authorised technical servicing centres the information required for repairing INVERTEC V270T AC/DC and V320-T AC/DC. To avoid serious damage to people and things, this manual must be used strictly by qualified technicians. What is involved in a repair job: identifying the faulty part – as this part is included in the list of available spare parts – and replacing it according to the procedures described below. If an electronic P.C. board is faulty, repair entails replacing the P.C. board and not replacing the faulty electronic component on the P.C. board itself.

2) MACHINE TECHNICAL SPECIFICATIONS



LINCOLN ELECTRIC	LINCOLN ELECTRIC EUROPE B.V. - NW. DUKENBURGSEWEG 20 6534AD NIJMEGEN - THE NETHERLANDS - Made in Italy
INVERTEC V270-T AC/DC K12045-1 Code 52092	N°
	EN60974-1 EN60974-3 EN60974-10

		5A/10.2V - 270A/20.8V			
		X (40°C)	35%	60%	100%
S	Uo V 80	I2	270A	230A	210A
		U2	20.8V	19.2V	18.4V
		5A/20.2V - 270A/30.8V			
		X (40°C)	30%	60%	100%
S	Uo V 80	I2	270A	220A	200A
		U2	30.8V	28.8V	28V
3~ 50/60 Hz		U1	I1max	I1eff.	
		400V	16A	8.7A	
		5A/10.2V - 270A/20.8V			
		X (40°C)	30%	60%	100%
S	Uo V 80	I2	270A	220A	200A
		U2	20.8V	18.8V	18V
		5A/20.2V - 270A/30.8V			
		X (40°C)	25%	60%	100%
S	Uo V 80	I2	270A	210A	200A
		U2	30.8V	28.4V	28V
3~ 50/60 Hz		U1	I1max	I1eff.	
		230V	27.5A	13.8A	
IP 23 S	SEE MANUAL FOR ADDITIONAL INPUT VOLTAGES & RATINGS	N80	CE		

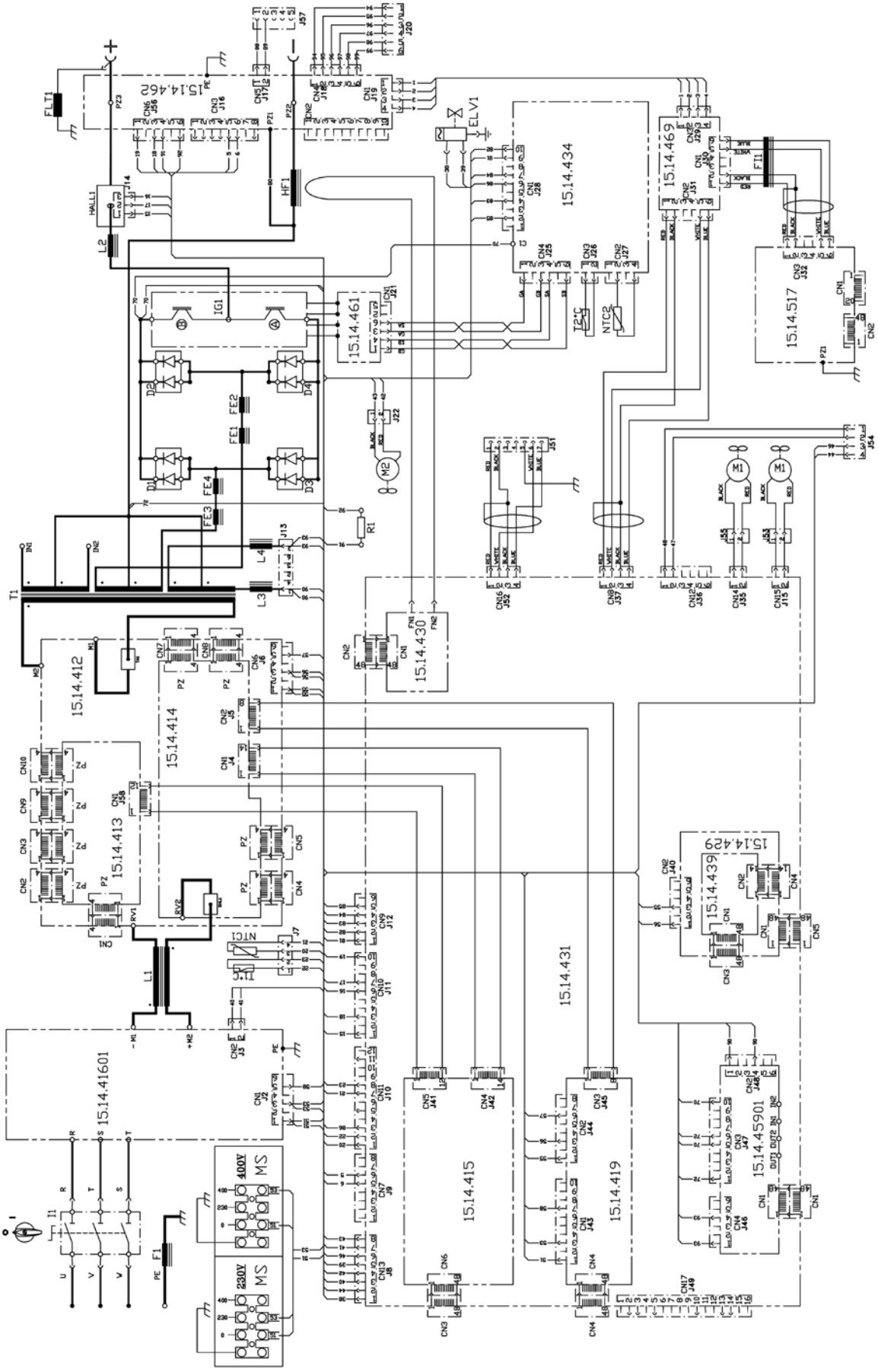


LINCOLN ELECTRIC	LINCOLN ELECTRIC EUROPE B.V. - NW. DUKENBURGSEWEG 20 6534AD NIJMEGEN - THE NETHERLANDS - Made in Italy
INVERTEC V320-T AC/DC K12046-1 Code 52093	N°
	EN60974-1 EN60974-3 EN60974-10

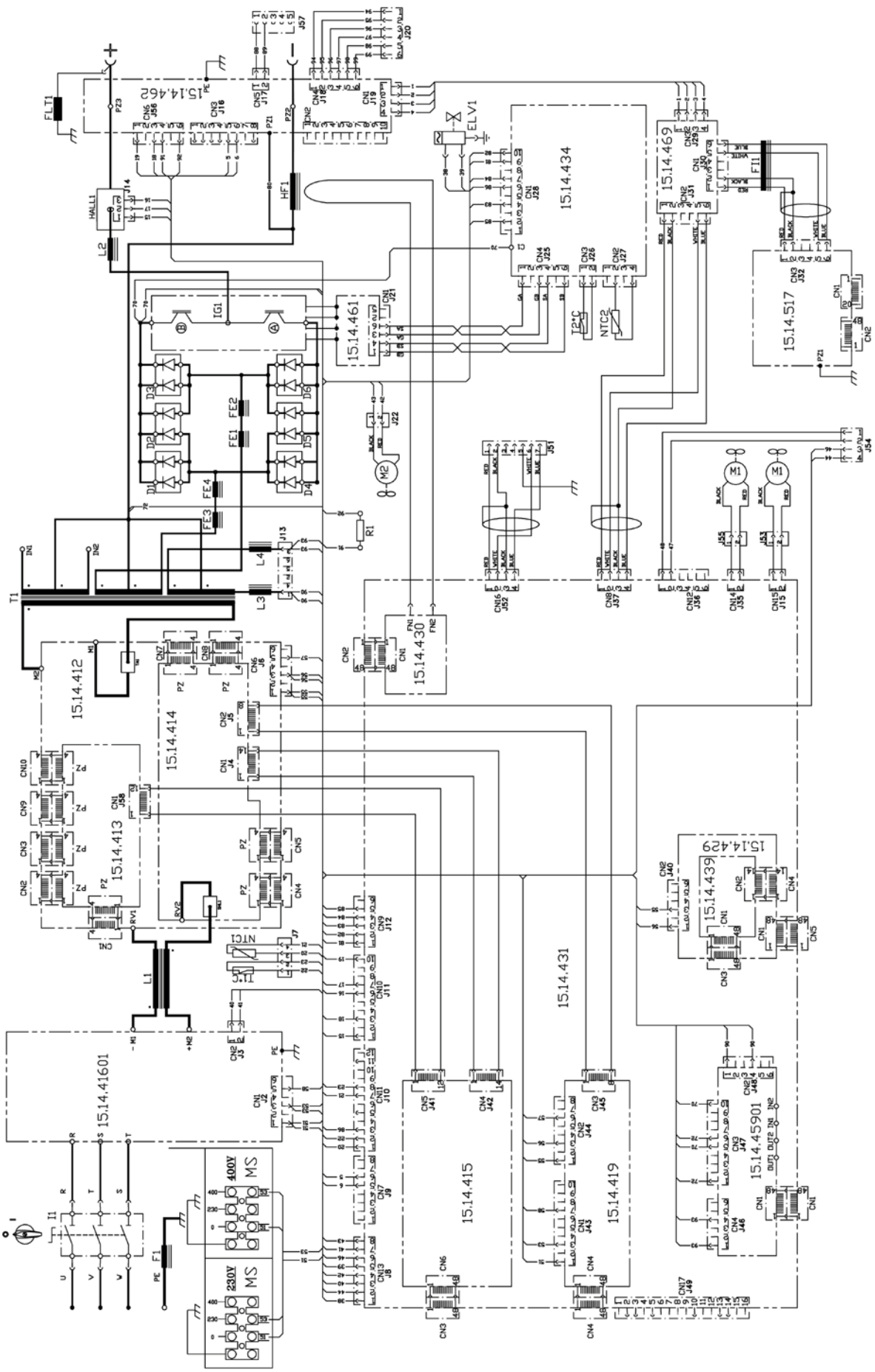
		5A/10.2V - 320A/22.8V			
		X (40°C)	35%	60%	100%
S	Uo V 80	I2	320A	280A	250A
		U2	22.8V	21.2V	20V
		5A/20.2V - 300A/32V			
		X (40°C)	30%	60%	100%
S	Uo V 80	I2	300A	250A	230A
		U2	32V	30V	29.2V
3~ 50/60 Hz		U1	I1max	I1eff.	
		400V	18.2A	10.1A	
		5A/10.2V - 320A/22.8V			
		X (40°C)	30%	60%	100%
S	Uo V 80	I2	320A	260A	220A
		U2	22.8V	20.4V	18.8V
		5A/20.2V - 300A/32V			
		X (40°C)	20%	60%	100%
S	Uo V 80	I2	300A	230A	200A
		U2	32V	29.2V	28V
3~ 50/60 Hz		U1	I1max	I1eff.	
		230V	31.7A	14.2A	
IP 23 S	SEE MANUAL FOR ADDITIONAL INPUT VOLTAGES & RATINGS	N80	CE		

3) WIRING DIAGRAM

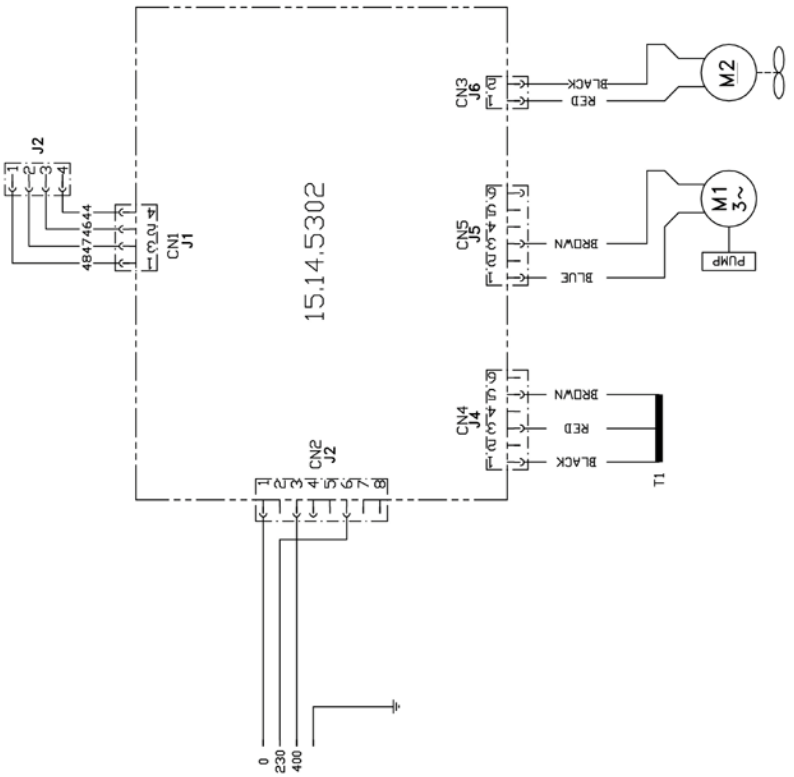
3.1) INVERTEC V270T- AC/DC



3.2) INVERTEC V320T - AC/DC

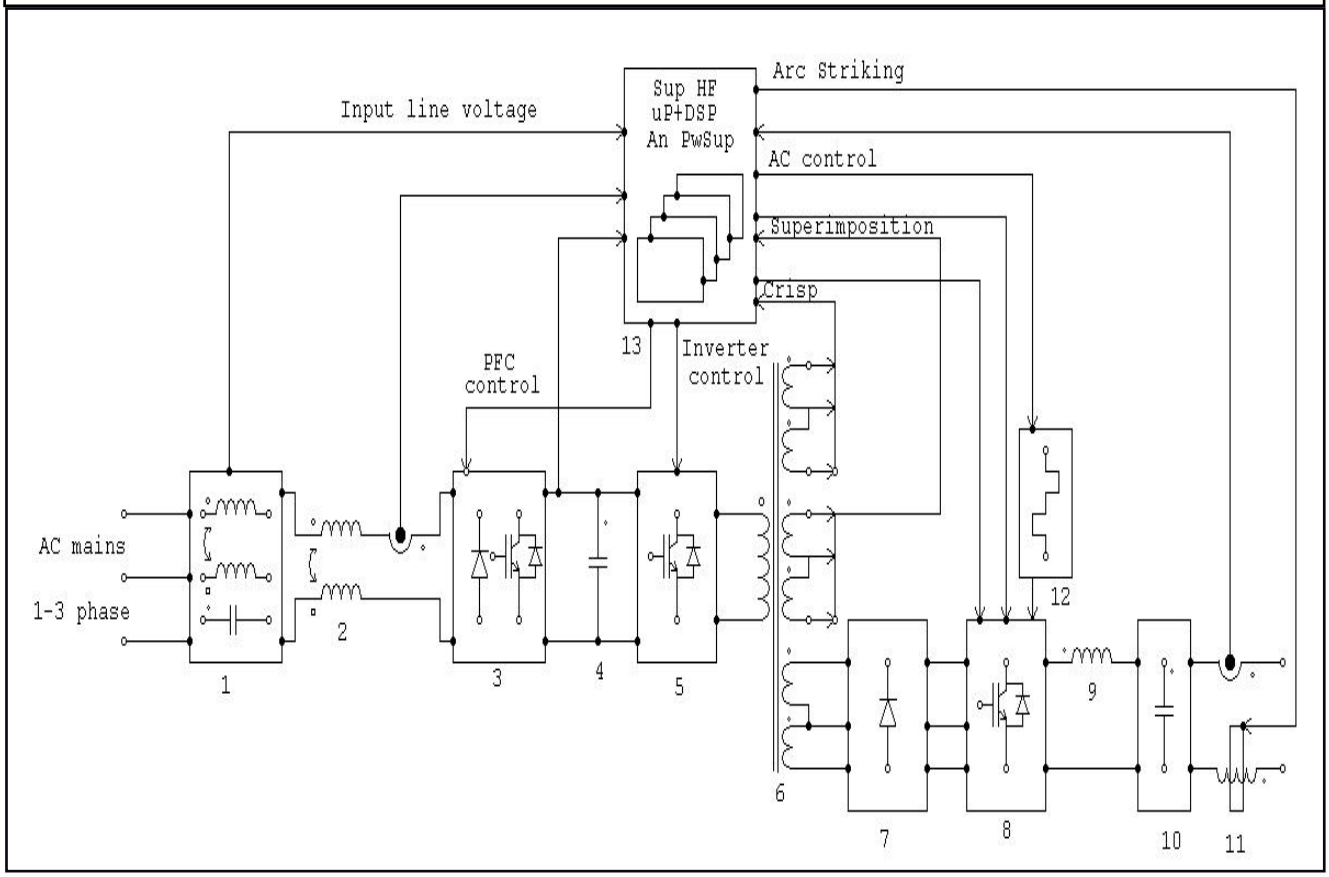


3.3) COOLARC 34



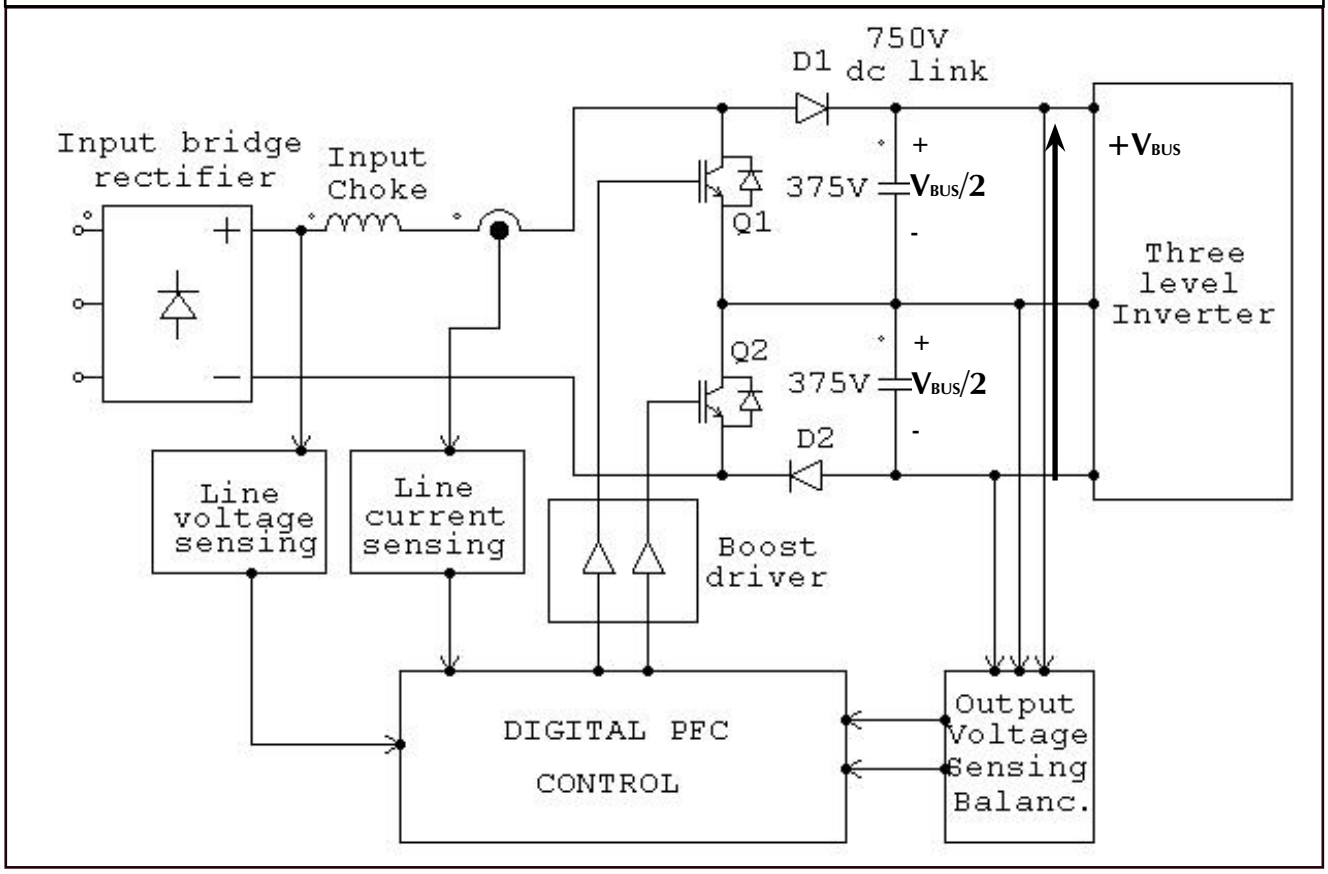
4) DESCRIPTION OF MACHINE OPERATION

POWER SOURCE BLOCK DIAGRAM



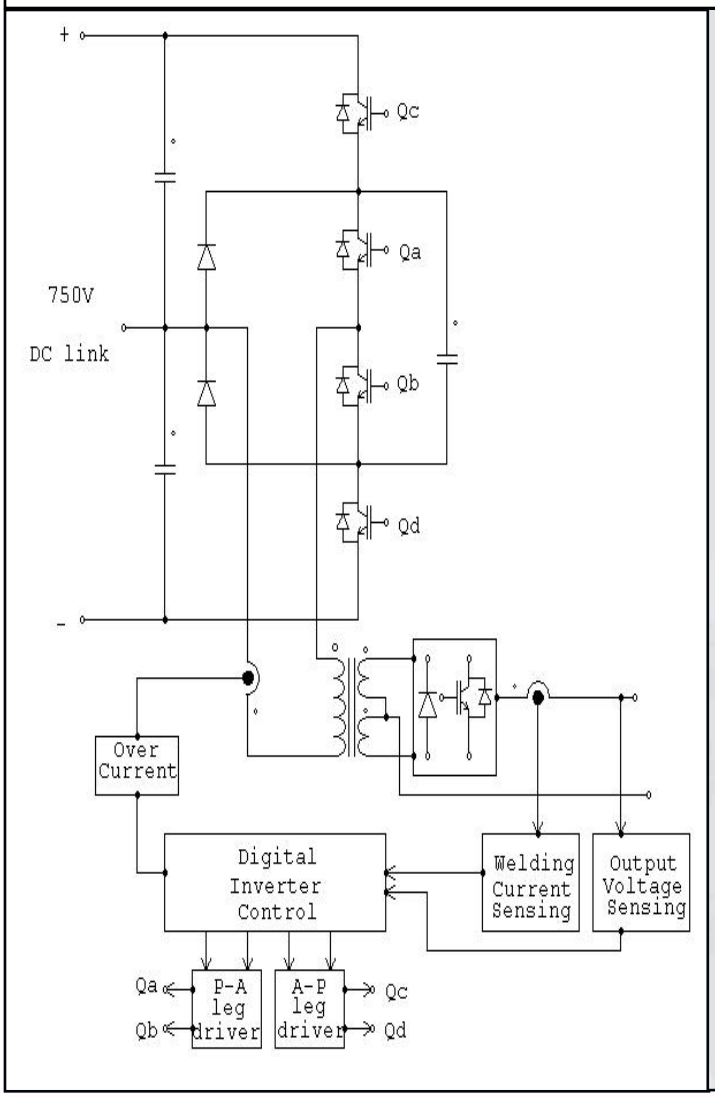
1 – EMI INPUT FILTER
2 – INPUT CHOKE + RECTIFIER
3 – P.F.C. (POWER FACTOR CORRECTOR)
4 – DC LINK CAPACITORS
5 – ZVS PHASE SHIFTED THREE LEVEL INVERTER
6 – HIGH FREQUENCY POWER TRANSFORMER
7 – OUTPUT RECTIFIER
8 – OUTPUT AC INVERTER
9 – OUTPUT CHOKE
10– OUTPUT FILTER
11– H.F. TRANSFORMER
12– AC CONTROL & SUPERIMPOSITION UNIT
13 – CONTROL RACK

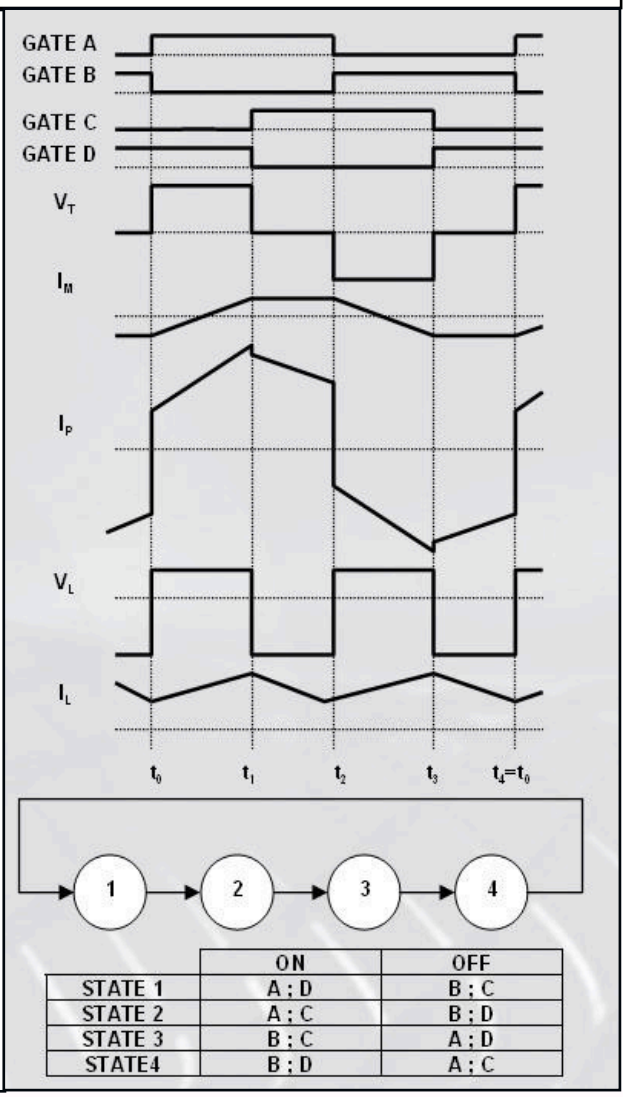
UNITY POWER FACTOR RECTIFIER



- Input current shaping by Q1 & Q2 PWM modulation
- Balancing half-bus voltage by Q1 & Q2 PWM modulation
- Constant DC link voltage under line voltage and load variations
- Output overvoltage and input overcurrent protections
- 40kHz switching frequency
- Fast digital average current mode input current control loop by DSP
- 750V regulated DC link

ZVS PHASE SHIFTED FB INVERTER





	ON	OFF
STATE 1	A ; D	B ; C
STATE 2	A ; C	B ; D
STATE 3	B ; C	A ; D
STATE4	B ; D	A ; C

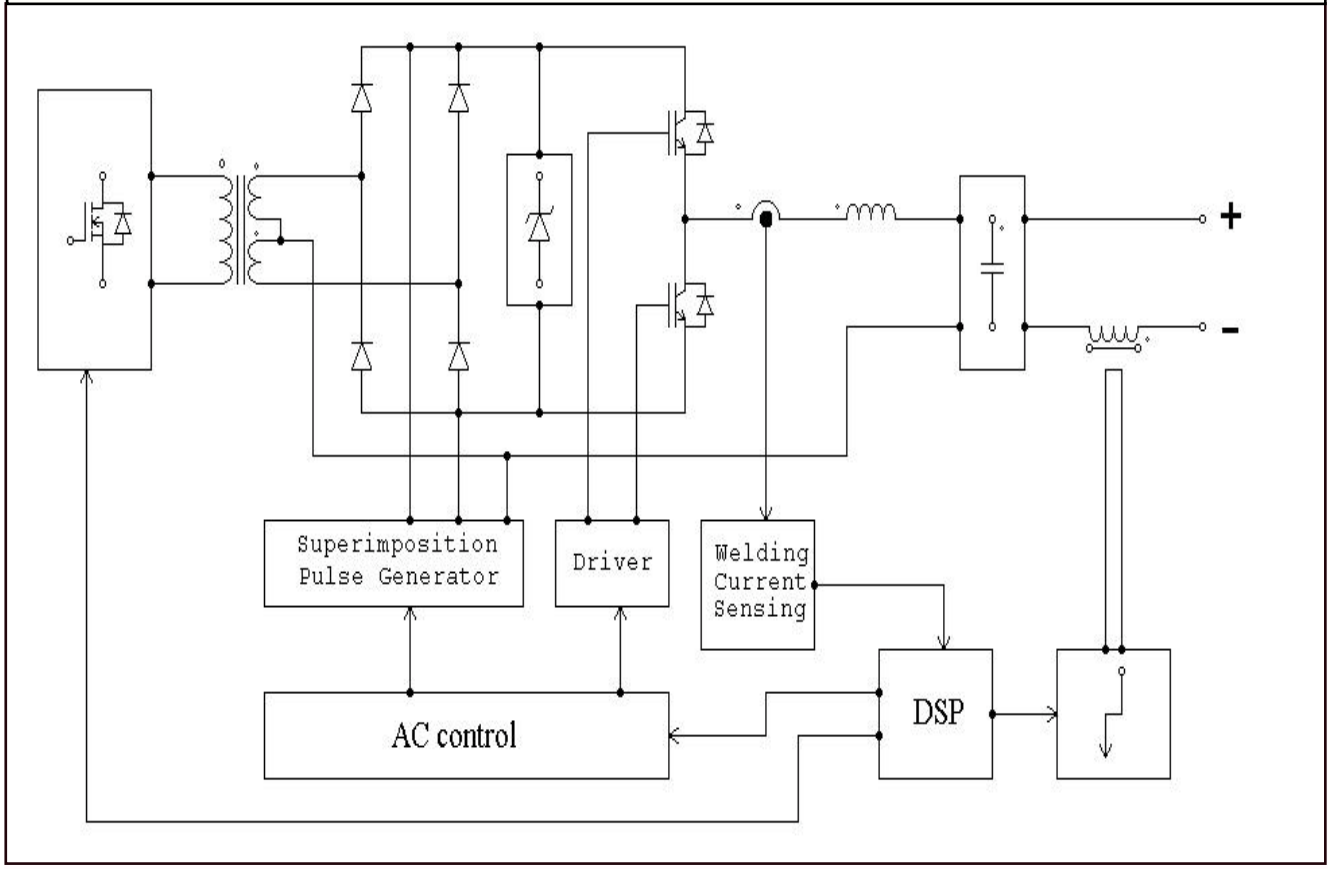
• 80kHz switching frequency
- Fast response welding current loop
- High stability welding arc

• Digital control by DSP

• ZVS for IGBTs
- Improved efficiency and reduced EMI

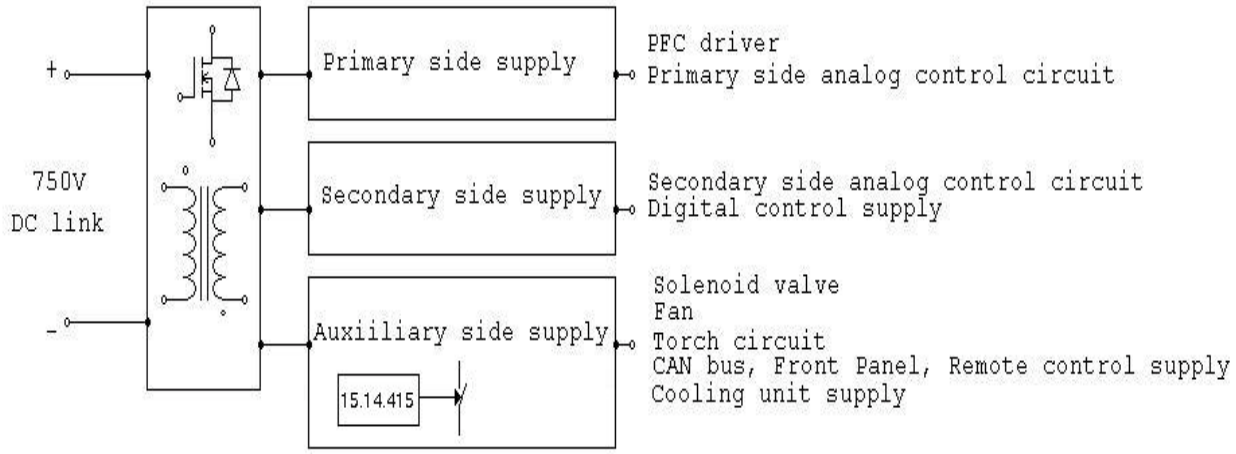
• Primary overcurrent fast protection circuit

OUTPUT RECTIFIER & AC INVERTER



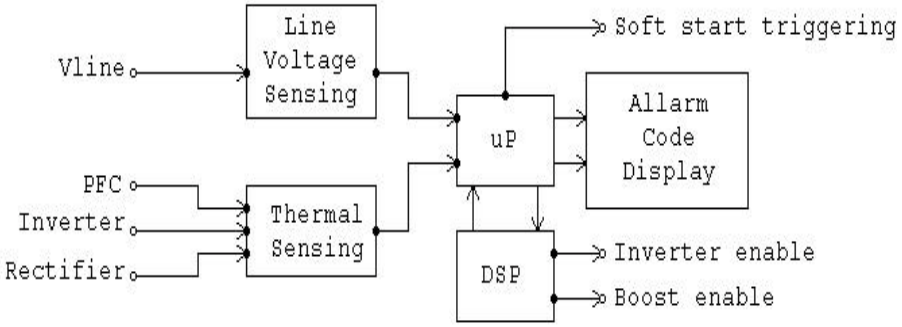
- Full bridge FRED rectifier magnetic snubbered.
- DSP AC current shaping.
- DSP controlled inversion.
  Minimized voltage clamp.
- Superimposition pulse generator.
  Easy arc inversion and stable arc in AC welding.
- DSP triggered arc stiking circuit
- Superimposition pulse and arc striking pulse
  Very easy arc striking even in worst operational contidions (heavy oxidized workpiece).

AUXILIARY POWER SUPPLY



- Parallel resonant (ZVS) topology working @ 80-110kHz switching frequency.
- Directly derived from 750V DC link.
- Inductance coupling primary-secondary-auxiliary supplies (no post regulations).

uP SUPERVISON



- Start-up network
  Safety start for PFC and inverter stages

- Overvoltage & undervoltage allarms in both 230/400Vac single and three-phase input voltage ranges for safety operational mode

- Thermal protections management for power stages: PFC, inverter, output rectifier & AC inverter

- Microprocessor recognized allarm events.
  Allarm code displayed on front panel.

5) BOARD

Convention

By convention, when a measurement has to be taken between two points, for example a⟵b, the arrow point indicates where to apply the red tip of the multimeter (a),while the black tip is applied at the other end (b).

When a double arrow appears between two measuring points (e.g.: c⟷d), the voltage to be measured is alternating (normally at 50 Hz), therefore it does not matter in which order the multimeter terminals are applied.

In drawings and tables, when a voltage measurement appears referring to terminals of components such as DIODES, BJT, MOSFET and IGBT, the multimeter is used in “diode test” mode (these measurements are always taken with the machine switched off and normally give values in the range +0.10 … +0.90Vdc). In this case the following symbol is affixed beside the value to be measured


Junction measurement (multimeter in “diode test” mode).

The following symbols will be used in the same way:


AC or DC voltage measurement (multimeter in voltmeter mode)


Resistance measurement (multimeter in ohmmeter mode)


Current measurement (ammeter clamp or shunt + multimeter in millivoltmeter mode)

The measuring conditions (power source on/off etc.) are always clearly indicated beside the values to be measured.

The connector terminals are indicated by the name of the connector followed by a slash and the number of the terminal; for example CN1/2 indicates terminal 2 of connector CN1.

POSITION OF THE BOARD INSIDE THE INVERTEC V270 - V320T

15.14.459
AC superimposition P.C. Board

15.14.430
H.F. P.C. Board

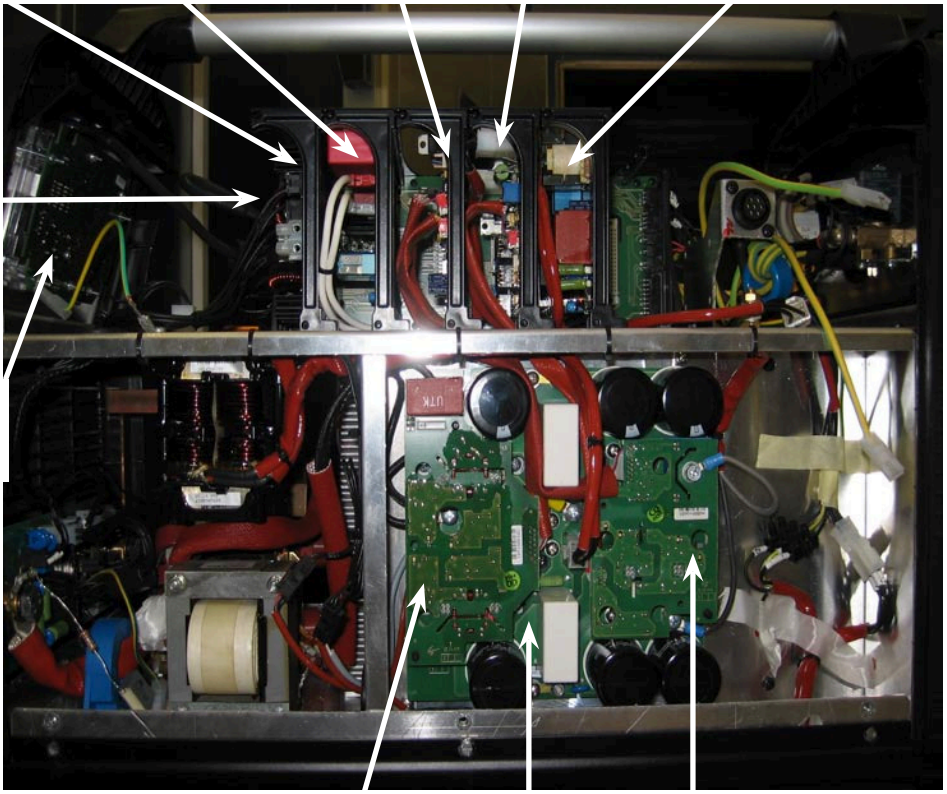
15.14.415
Digital Control P.C. Board

15.14.419
Analog Signal P.C. Board

15.14.429 and 15.14.439
Switching Power Supply P.C. Boards

15.14.431
Rack/Bus P.C. Board

15.14.517
Front Panel Board

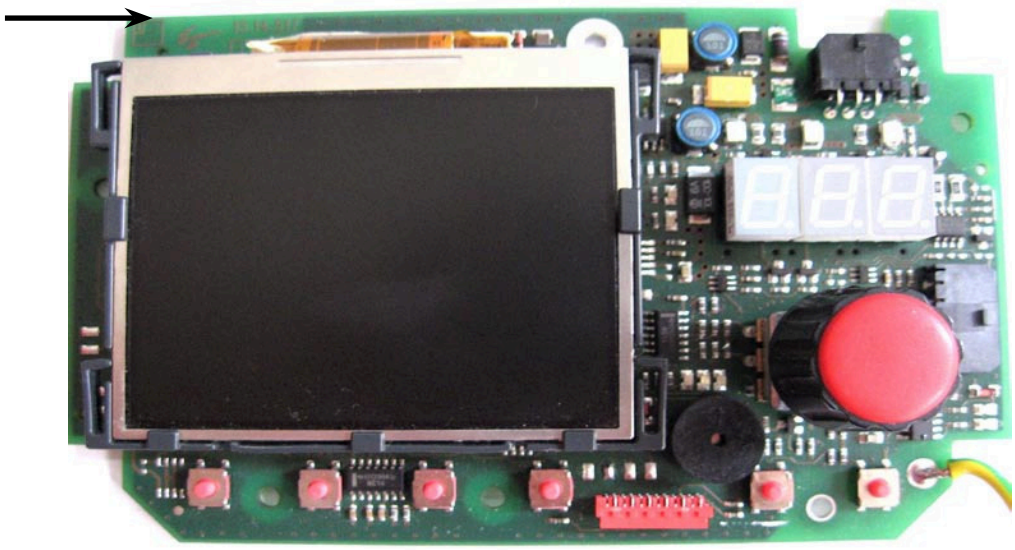


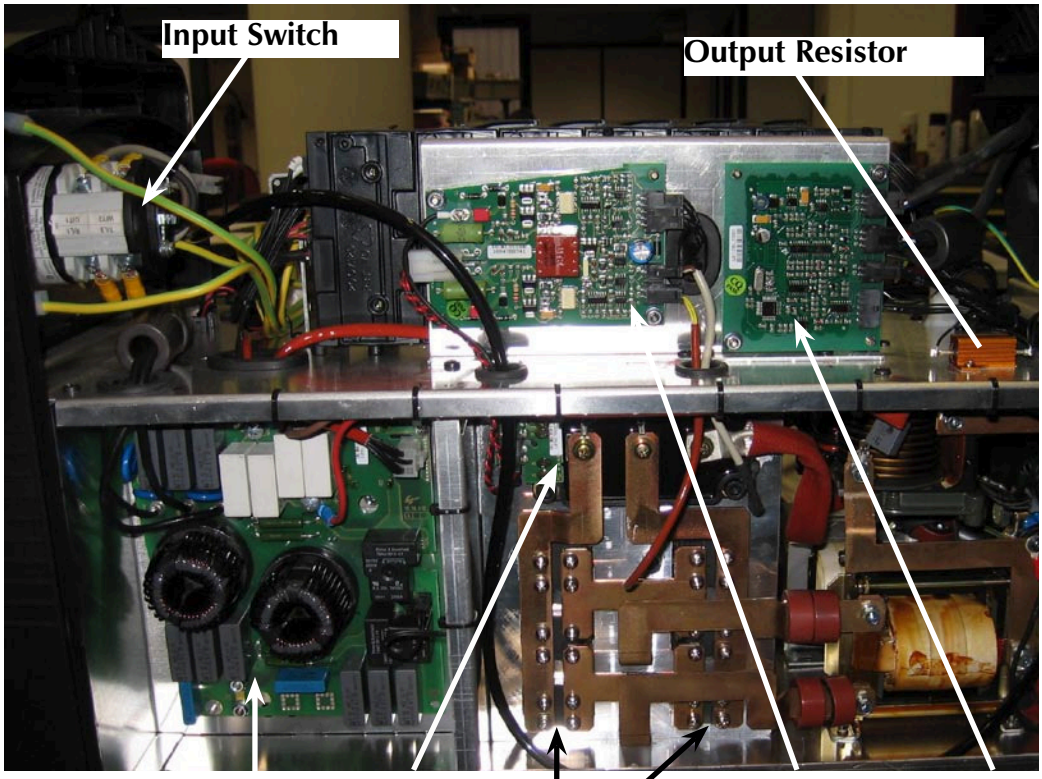
15.14.413
IGBT gate drive P.C. Boards

15.14.412
Base Power IGBT P.C. Board

15.14.414
PFC Gate Drive P.C. Board

15.14.517
Control/Display P.C. Board





15.14.416
Input Filter P.C. Board

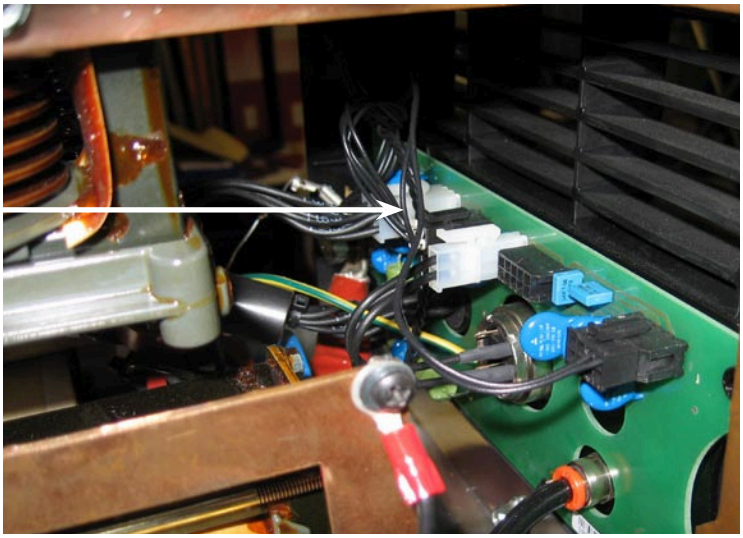
15.14.461
Connector Board

Secondary Diode

15.14.434
Output Module Driver P.C. Board

15.14.469
A/D Remote Control conversion Board

15.14.462
Output Filter P.C. Board

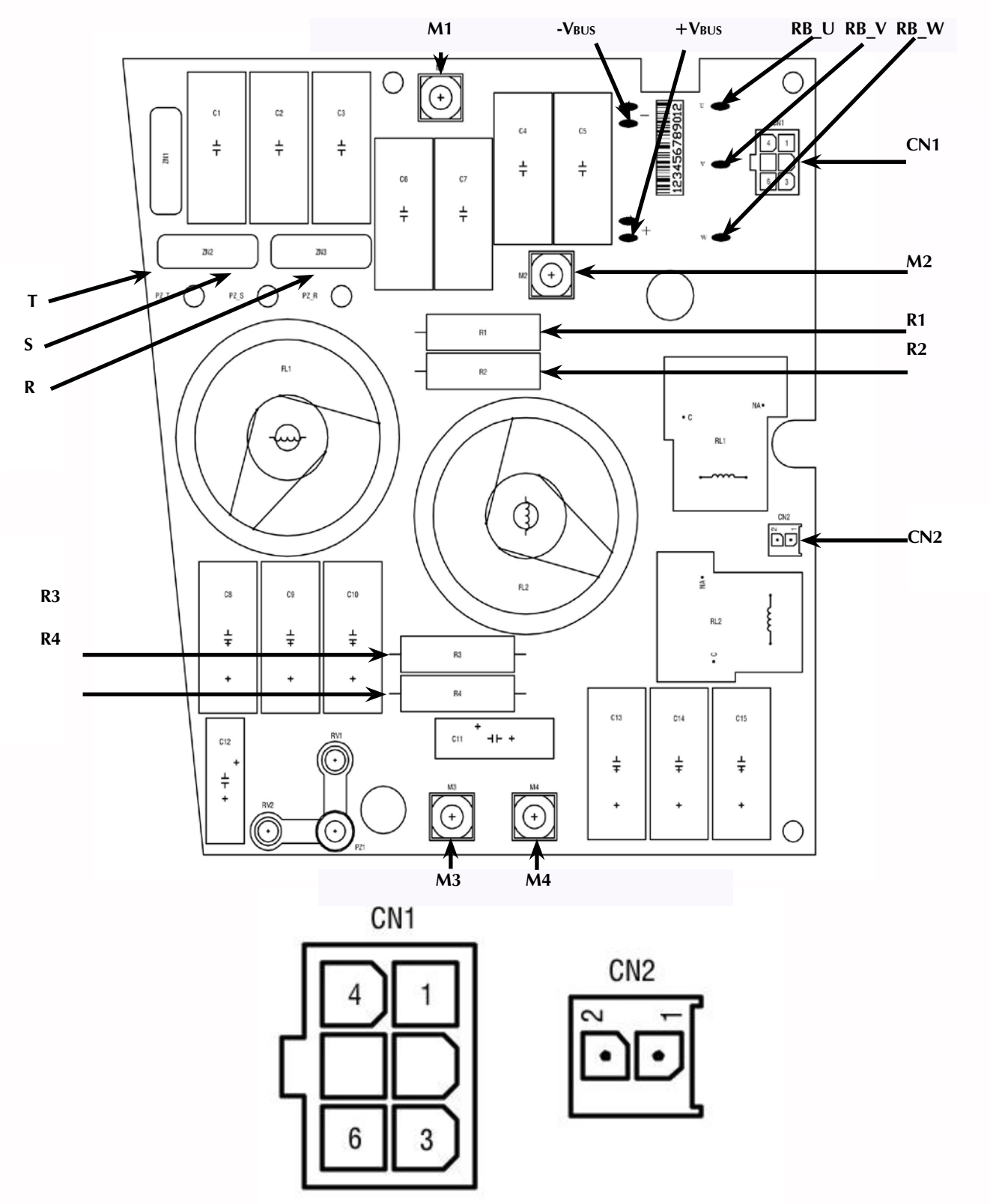


5.1) INPUT FILTER P.C. BOARD 15.14.416

Board function: The pc board receive the three input phase AC and rectifier at DC value. Before pre-charge relay closing ,pre-charge the DC bus trough three resistance 15 ohm each that keeps the input power supply from main switch. The three phase are connected on this card using big size diameter for main current, for the pre-charge use smaller wires diameter . Two thoroidal inductors and passive components make EMI filter action on input powering.

Location: The pc board is one of the first parts after the main switch and before the main PFC bus control. The output go into L1, main input double inductor.

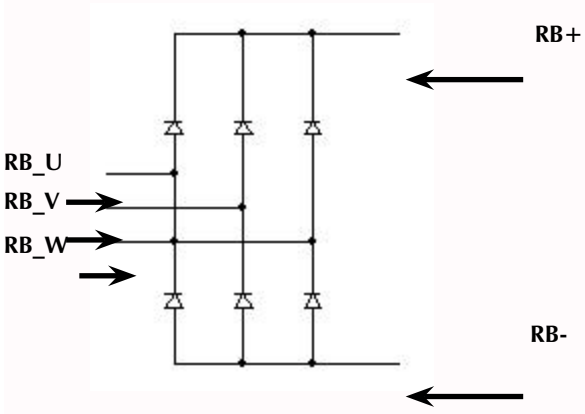
Note: The pc board is integrated with a three phase bridge assembled on bottom and screw fixed.

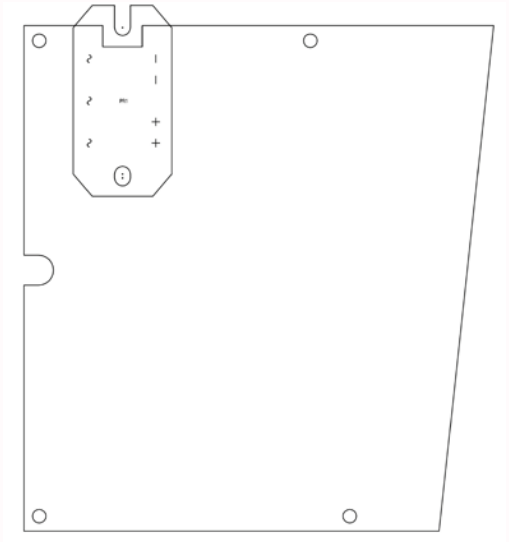


Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Supplies voltage	ON	---	R ⟷ S	400Vac*	Ⓥ	From input switch
			R ⟷ T	400Vac*	Ⓥ	* 400Vac supply voltage. (230Vac in the case of 230Vac supply voltage)
			S ⟷ T	400Vac*	Ⓥ	
			RB_U ⟷ RB_V	400Vac*	Ⓥ	* Rectifier Bridge (RB) input voltage. 400Vac supply voltage. (230Vac in the case of 230Vac supply voltage)
			RB_U ⟷ RB_W	400Vac*	Ⓥ	
			RB_V ⟷ RB_W	400Vac*	Ⓥ	
			CN1/1⟷CN1/3	400Vac*	Ⓥ	*To 15.14.419 Analog Signal P.C. Board. 400Vac supply voltage. (230Vac in the case of 230Vac supply voltage)
			CN1/1⟷CN1/5	400Vac*	Ⓥ	
			CN1/3⟷CN1/5	400Vac*	Ⓥ	
Rectifier Voltage	ON	---	+VBUS ⟵ -VBUS	+565Vdc*	Ⓥ	*400Vac supply voltage
Input Bridge Rectifier	OFF	RB	RB_U ⟵ RB+	+0.5Vdc	⏚	
			RB_V ⟵ RB+	+0.5Vdc	⏚	
			RBW_ ⟵ RB+	+0.5Vdc	⏚	
			RB- ⟵ RB_U	+0.5Vdc	⏚	
			RB- ⟵ RB_V	+0.5Vdc	⏚	
			RB- ⟵ RB_W	+0.5Vdc	⏚	
Pre-load resistance	OFF	R1	R1/1⟷R1/2	15ohm	Ω	
		R2	R2/1⟷R2/2	15ohm	Ω	
		R3	R3/1⟷R3/2	15ohm	Ω	
		R4	R4/1⟷R4/2	15ohm	Ω	

Note:

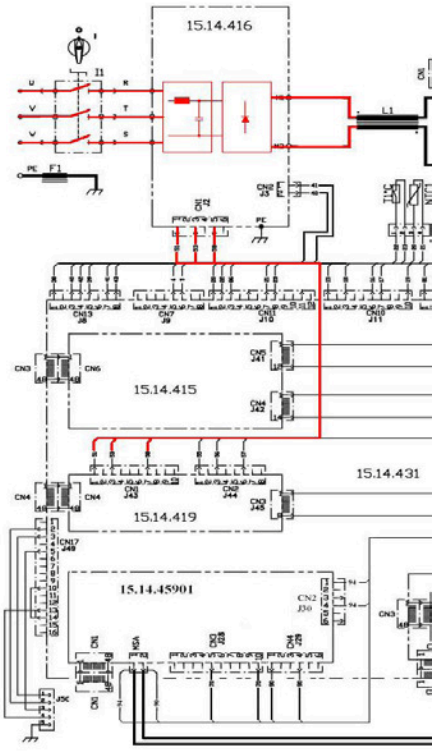
*** Rectifier Bridge**

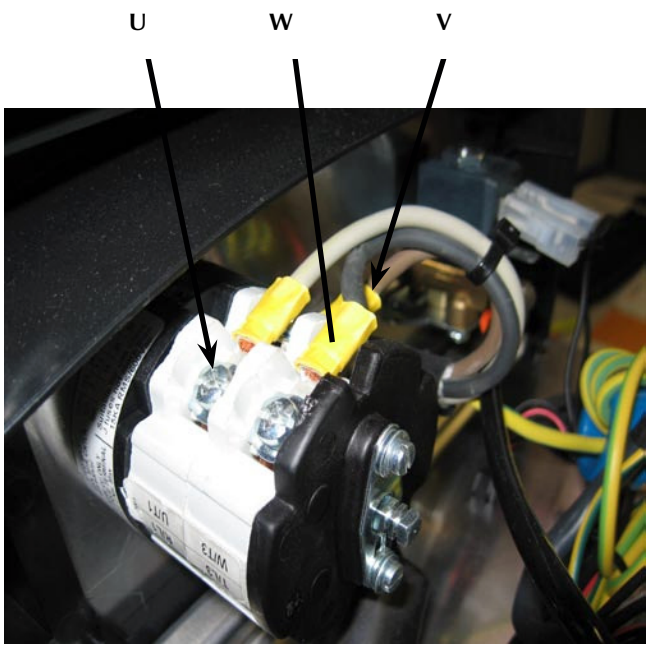


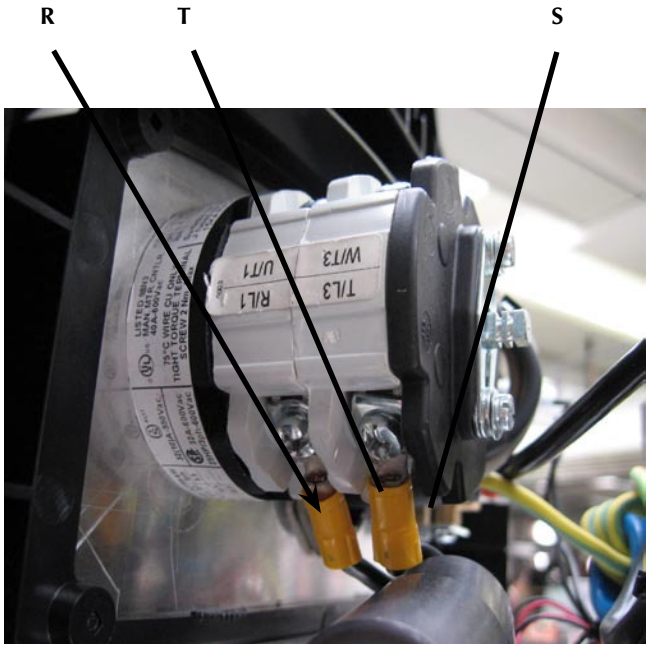


Soldering side

Input switch







WARNING

If plug is connected between U, V and W there is the input voltage independently from input switch state (0 or 1).

Disconnect the input plug.

Input switch (IS)

WARNING

With plug connects between U, V and W there is the input voltage independently from input switch state (0 or 1).

Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Supplies voltage	OFF (IS=0)	---	U ⟷ V	400Vac	Ⓥ	
			U ⟷ W	400Vac	Ⓥ	
			V ⟷ W	400Vac	Ⓥ	
			R⟷S	0Vac	Ⓥ	
			R⟷T	0Vac	Ⓥ	
			S⟷T	0Vac	Ⓥ	
	ON (IS=1)	---	U ⟷ V	400Vac	Ⓥ	
			U ⟷ W	400Vac	Ⓥ	
			V ⟷ W	400Vac	Ⓥ	
			R⟷S	400Vac	Ⓥ	
			R⟷T	400Vac	Ⓥ	
			S⟷T	400Vac	Ⓥ	

PRE-LOAD CONTROL

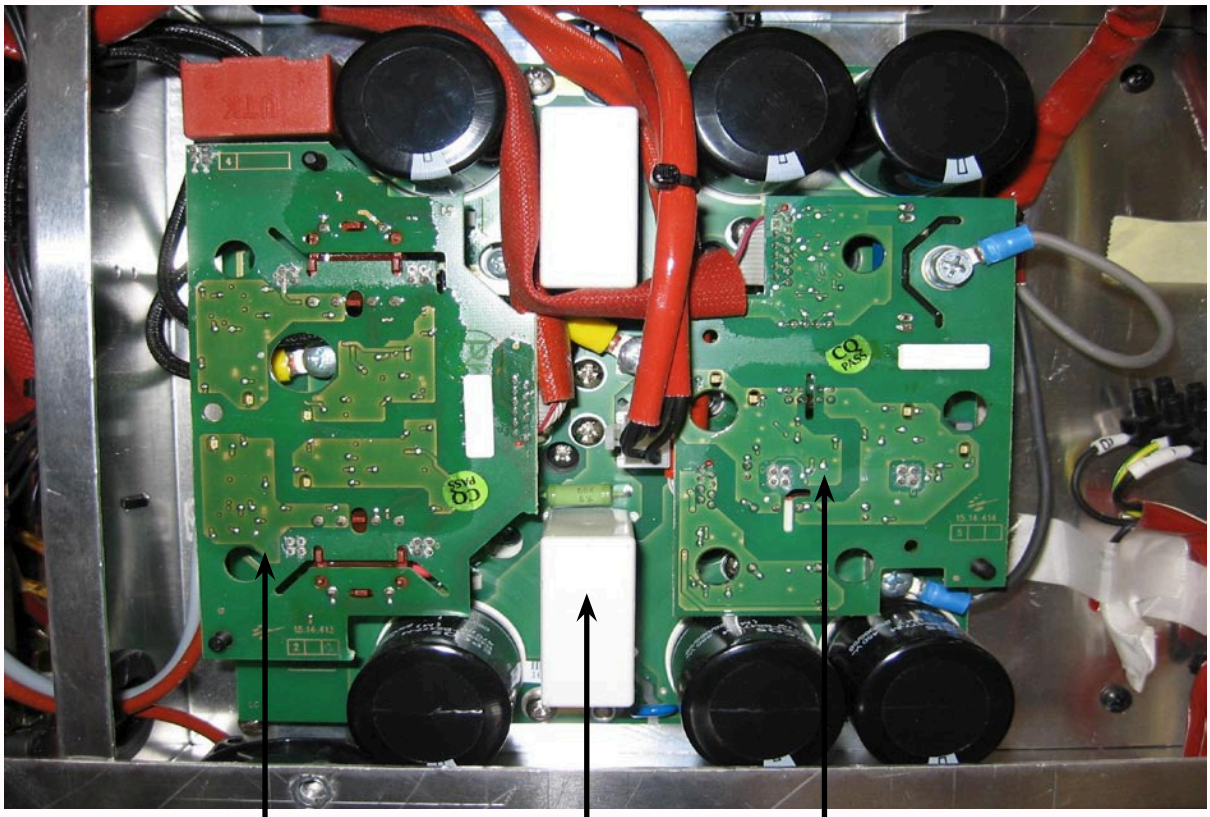
Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Pre-Load Relay command	ON	---	Wire 40⟵ Wire41	+24Vdc*	Ⓥ	* After some ms

5.2) POWER MODULE
- 15.14.412 POWER P.C. BOARD
- 15.14.413 INVERTER DRIVER P.C. BOARD
- 15.14.414 BOOST DRIVER P.C. BOARD

Board function: This card contains all the power components and in particularly three are used for inverter stage, three for PFC stage. All the components (three diodes and three IGBT) are Isotop type, this ensure total ground isolation with coolers and reduced EMI disturbances. The pc board control the Vbus/2 status ,means that the total DC LINK is divided into two equal and balanced part. Other function is to control the inverter switching depending on current demand. The status for what concern the Vbus and the main transformer current, is read from analogic card 15.14.419 that isolated and derate the signal and inform the digital card 15.14.415 and this one trough two gate's signal card 15.14.414&413 drive all the power components in order to keep Vbus /2 in one side and on the other the inverter control. A double dc capacitors link is present.

Location: At bottom of card 15.14.413 and 414,right low rear. It is connect between the main power transformer and receive the power from input card.

Note: It is supply as kit togheter with power components just soldered on it and togheter with the other driving card. Pay attention on dismounting and assembling to the right connection of + and – leads from input stage and to pass trough the TA one of the two transformer leads. The power components are assembled on heat skin with use of thermic grease(thermic composed) .

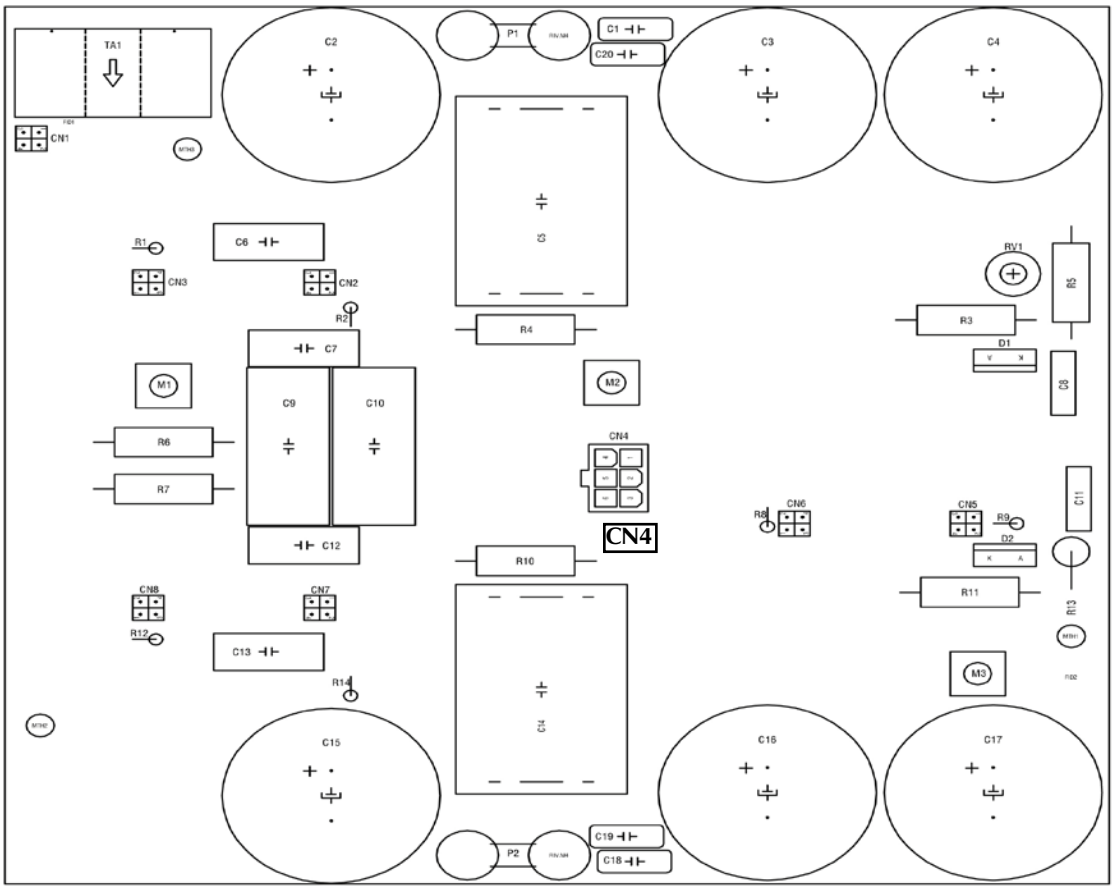


15.14.412
POWER P.C. BOARD

15.14.413
INVERTER DRIVER P.C. BOARD

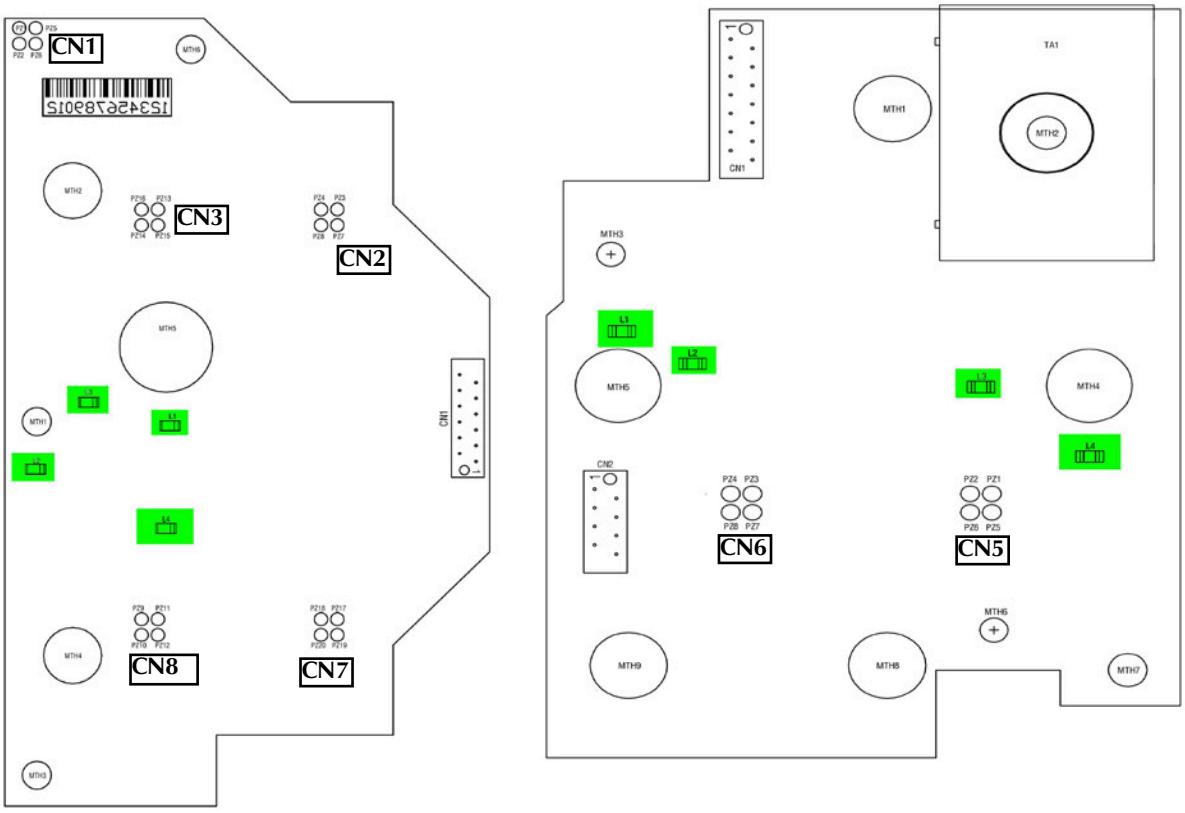
15.14.414
BOOST DRIVER P.C. BOARD

15.14.412

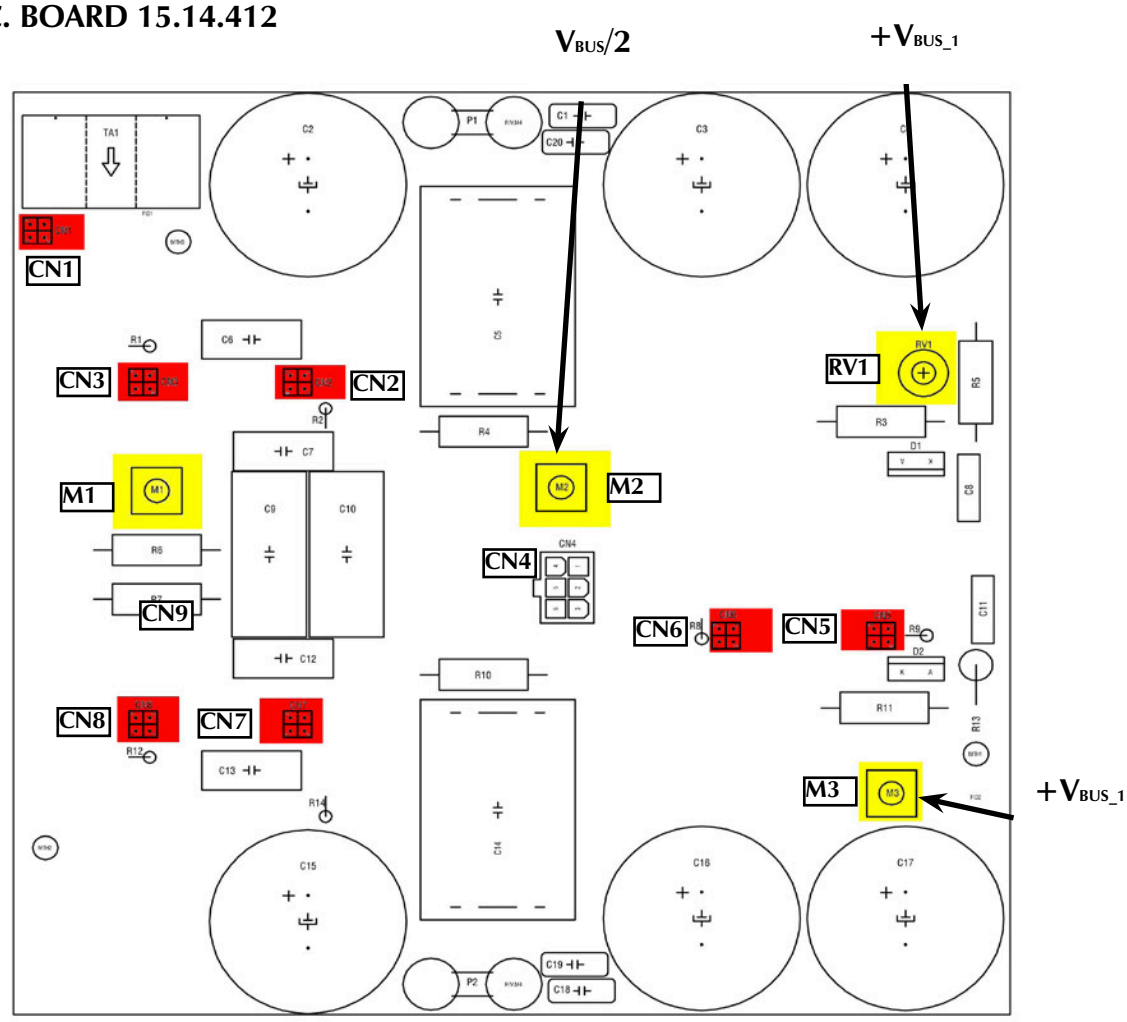


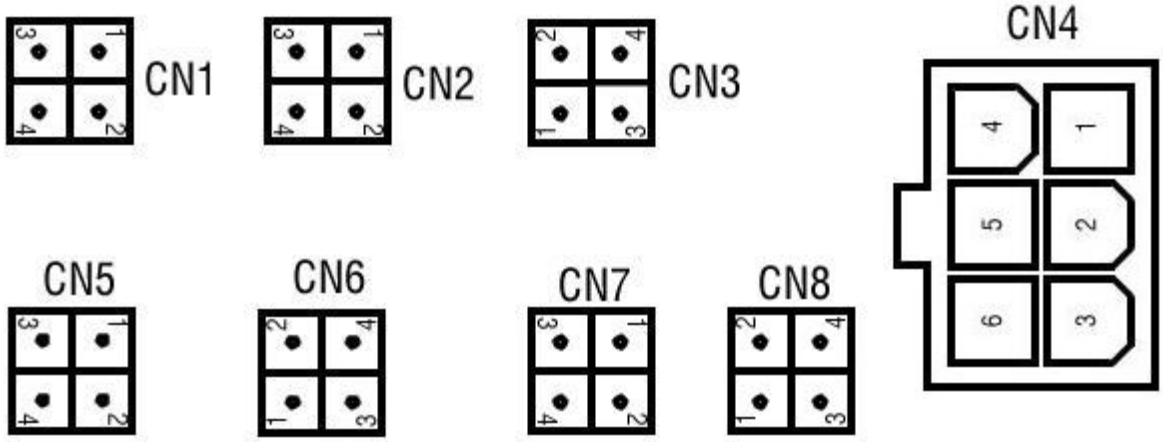
15.14.413 **15.14.414**

The number of connector is related to 15.14.412 power board



POWER P.C. BOARD 15.14.412

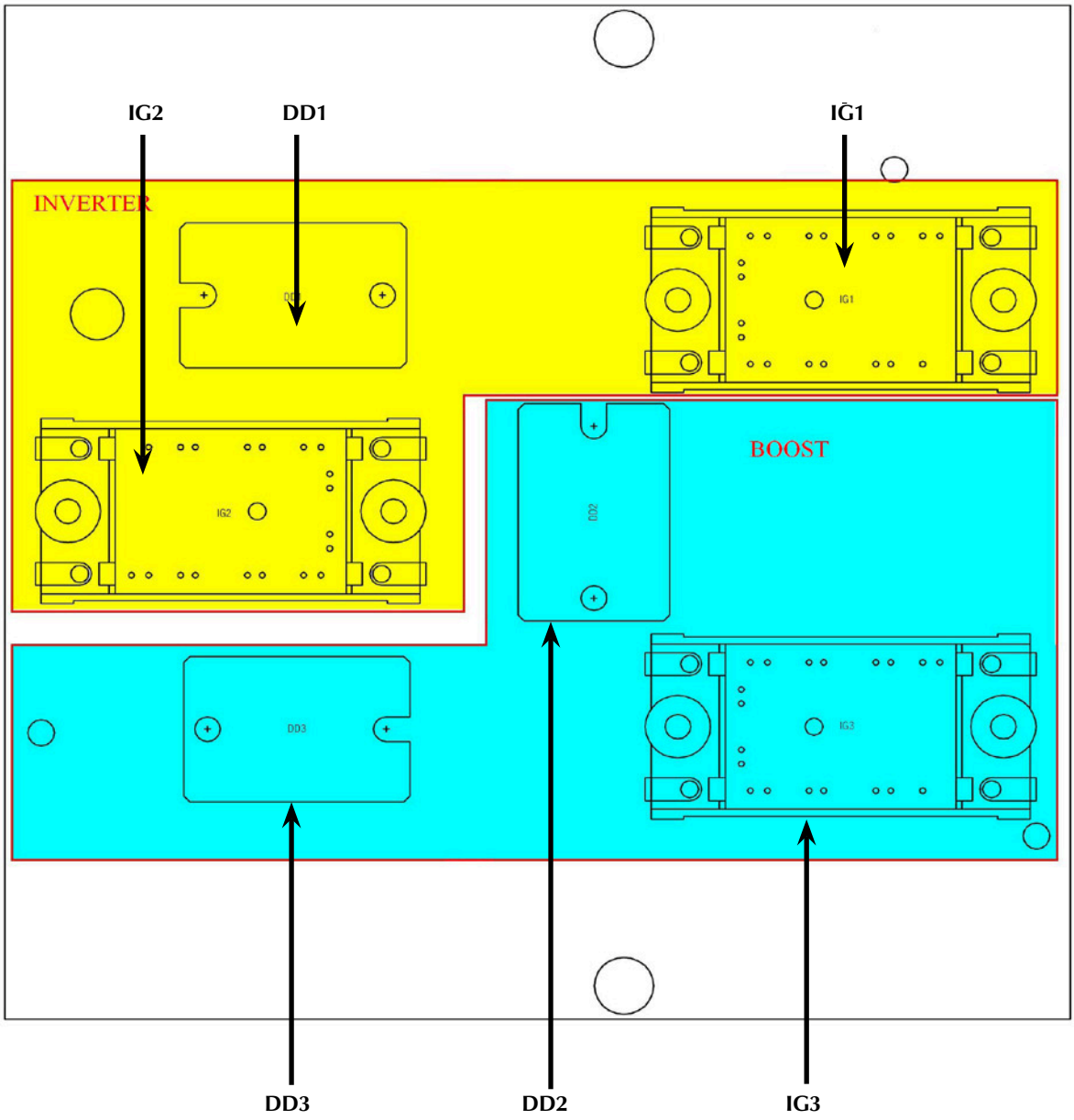




CN4/1 = $+V_{BUS}$
CN4/3 = $- V_{BUS}$
CN4/5 = $V_{BUS}/2$

Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Boost	OFF	IG2	CN6/1 ⟷ CN6/3	3.2kohm*	Ω	3.2kohm is obtained with the parallel of 10kohm resistor on 15.14.412 PC board with 4.7kohm on PC board 15.14.414
			CN6/3 ⟵ RIV1	+0.4Vdc	⏚	
			CN5/1 ⟷ CN5/3	3.2kohm**	Ω	**Boost command from 15.14.415 Digital Processor P.C. Board FLAT cable B
			CN5/3 ⟵ CN6/3	+0.4Vdc	⏚	
		DD1	RIV1 ⟵ CN4/1	+0.36Vdc	⏚	
		DD3	CN4/3 ⟵ M3	+0.36Vdc	⏚	
Inverter	OFF	IG1	CN2/1 ⟷ CN2/3	1.79kohm	Ω	1.8kohm is obtained with the parallel of 10kohm resistor on 15.14.412 PC board with 2.2kohm on PC board 15.14.413
			CN2/3 ⟵ CN4/1	+0.4Vdc	⏚	
			CN3/1 ⟷ CN3/3	1.79kohm	Ω	
			CN3/3 ⟵ CN2/3	+0.4Vdc	⏚	
		IG3	CN7/1 ⟷ CN7/3	1.79kohm	Ω	**Inverter command from 15.14.415 Digital Processor P.C. Board FLAT cable A
			CN7/3 ⟵ CN3/3	+0.4Vdc	⏚	
			CN8/1 ⟷ CN8/3	1.79kohm	Ω	
			CN8/3 ⟵ CN7/3	+0.4Vdc	⏚	
		DD2	M2 ⟵ CN2/3	+0.36Vdc	⏚	
			CN7/3 ⟵ M2	+0.36Vdc	⏚	
DC LINK Voltage	ON	---	$+V_{BUS}$ ⟵ $-V_{BUS}$	+750Vdc	V	From CN4 connector to: 15.14.419 Analog Signal P.C. Board
			CN4/1 ⟵ CN4/3			
			$+V_{BUS}$ ⟵ $V_{BUS}/2$	+375Vdc	V	15.14.429 Switching Power Supply P.C. Board
			CN4/1 ⟵ CN4/5			
			$V_{BUS}/2$ ⟵ $-V_{BUS}$	+375Vdc	V	
			CN4/5 ⟵ CN4/3			

Power Modules

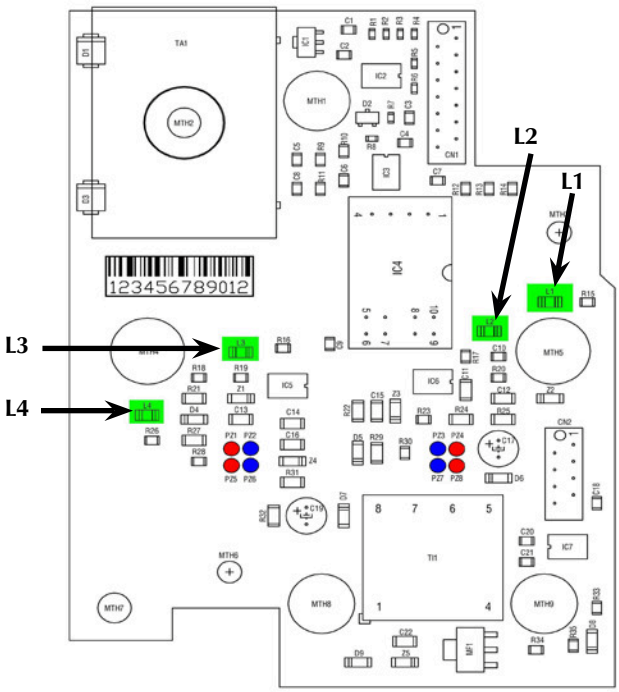


Boost Driver P.C. Board 15.14.414

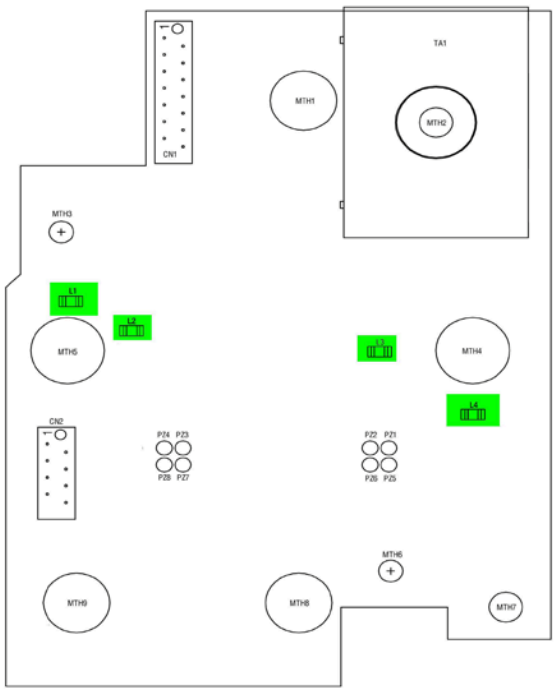
Board function: the pcb is the driver for boost-pfc. The positive cord enter on RV2 for input current measurement (it has inside a T.A.) . Mainly this card is driving from 15.14.415 (digital processor board) and trough CN1 generate the 2 gate's signal for boost control. From card 15.14.419 (analogic card) received on CN2 + 15Vdc and internally generate + 5Vdc isolated also for gate's signal control. This card inform trough CN1 the 15.14.415 about input current sensing.

Location: after input inductance, before main pfc-boost power control group. Bottom right part of main inverter group.

Note: The pc board use two green leds for show the powering of two gate and two green led for + 15Vdc presence. Is physically soldered on top of main card trough pin strip. Is not supply separately from main group.



Component side



Soldering side

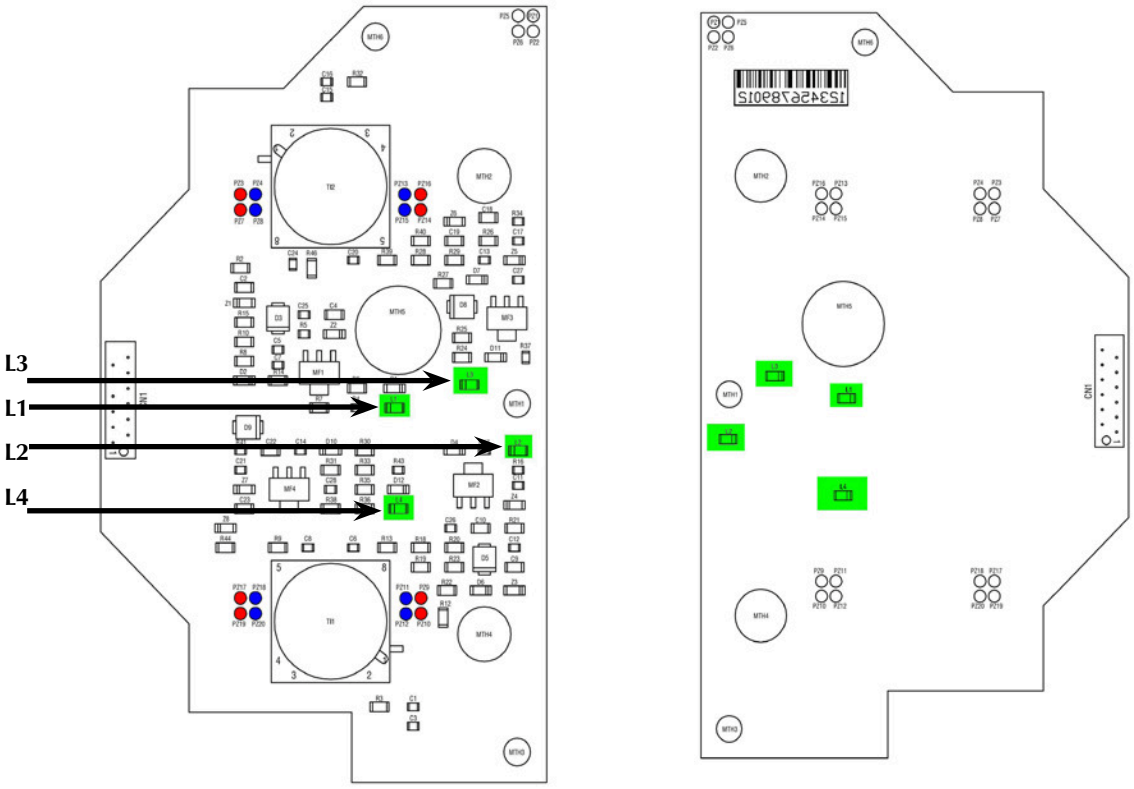
Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Driver Boost Power Supply	ON	L1=ON L3=ON	--- ---	--- ---	--- ---	Voltage supplies for boost command
Driver Boost	ON	L2=ON L4=ON	--- ---	--- ---	--- ---	Boost command through Flat B 15.14.415. V_{BUS}=750V

Inverter Driver P.C. Board 15.14.413

Board function: As the pfc gate signal pcb, this card generate the gate signal for the four igbt gates. At the same the signal start from digital card 15.14.451 trough CN1 ribbon cable to the driver card that manage the signal with pulse trans and relative circuit.

Location: At left side of pfc driver card,on top of main inverter group.the pcb is connected between 15.14.415 and inverter power switch.

Note: this card is supplied into main kit, not available separately. The pcb is soldered trough pin strip to the main card.
Four led show the right igbt driving (one for each port, total four).



Component side **Soldering side**

Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Inverter Driver	ON	L1=ON*	---	---	---	*Stick mode
		L2=ON*	---	---	---	Inverter command through 15.14.415 FLAT cable A
		L3=ON*	---	---	---	
		L4=ON*	---	---	---	

PRIMARY SIDE THERMAL PROTECTIONS CONTROL

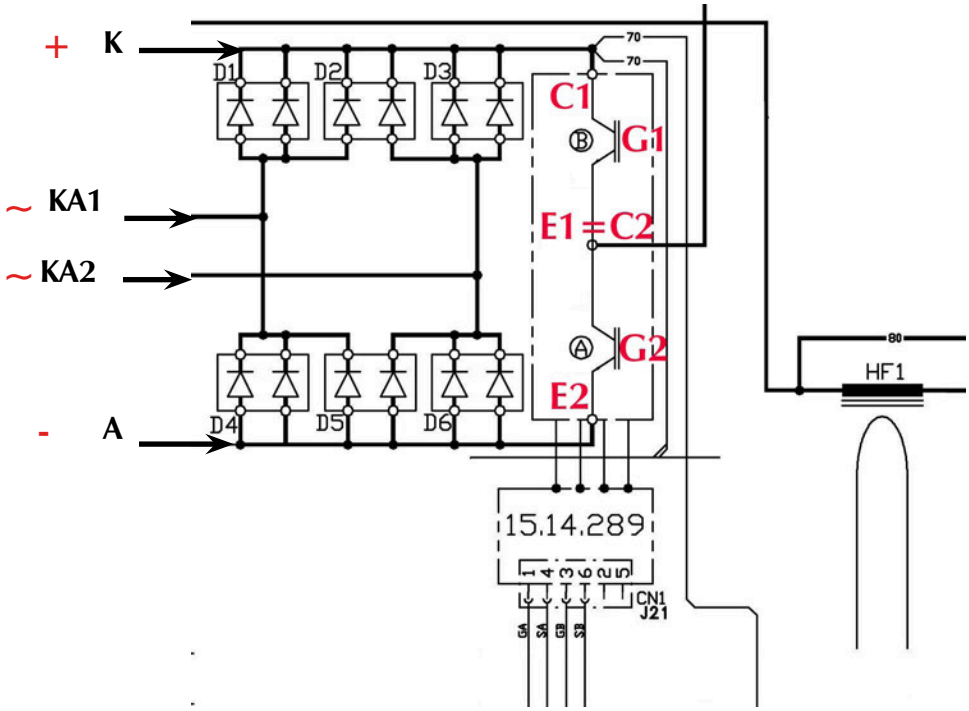
Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Thermostat & NTC Probe Inverter and PFC	OFF	T1	J7/1 ⟷ J7/2	0ohm	Ω	*
		NTC1	J7/3⟷J7/4	12kohm	Ω	@T=25°C**

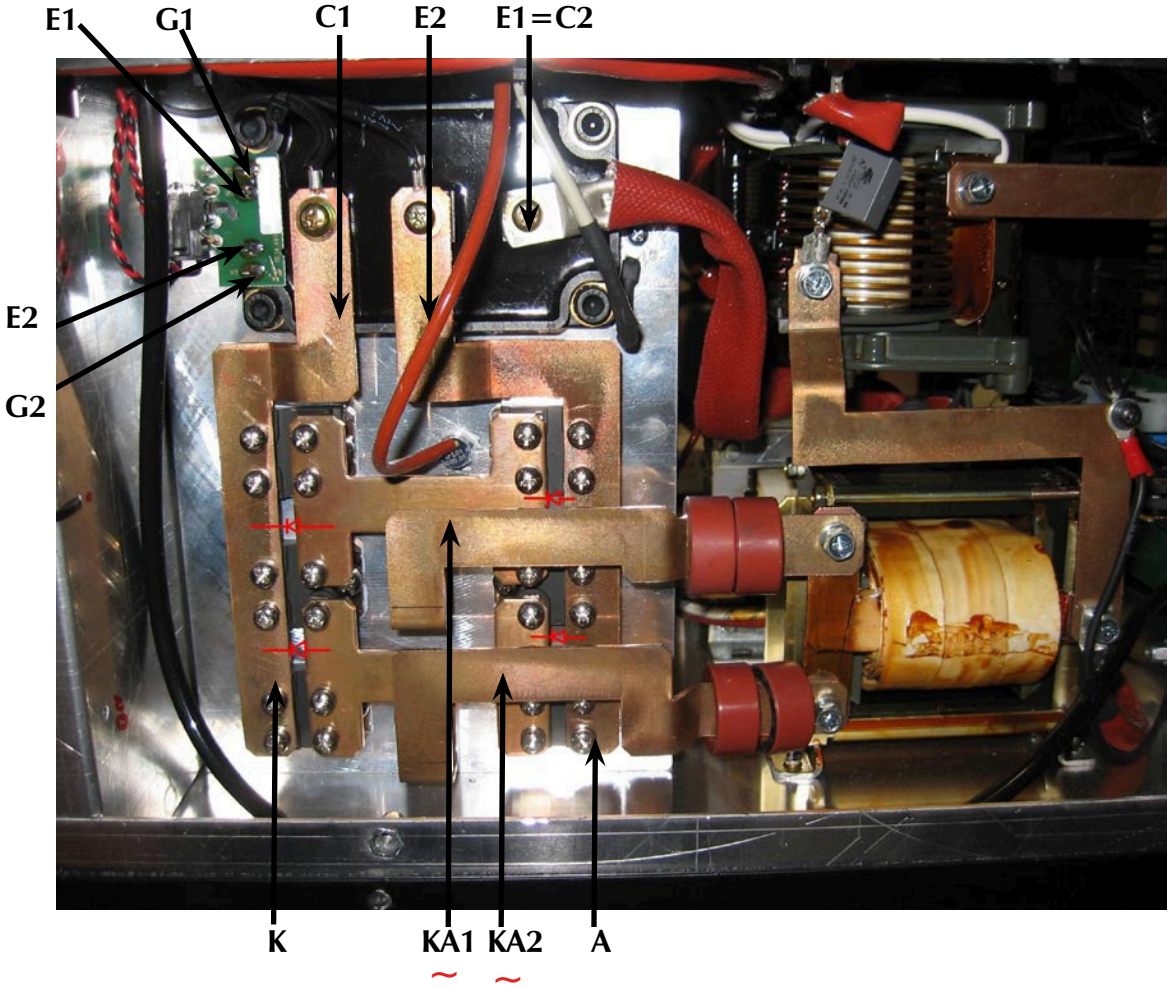
Notes:

* T1 -> Wire 22 and 23 -> To CN11/2 and CN11/8 of 15.14.431 BUS P.C. Board -> To 15.14.419 Analog Signal P.C. Board -> To 15.14.415 Digital Processor P.C. Board (manage from uC).

* NTC1 -> Wire 20 and 21 -> To CN11/1 and CN11/4 of 15.14.431 BUS P.C. Board -> To 15.14.419 Analog Signal P.C. Board -> To 15.14.415 Digital Processor P.C. Board (manage from uC)

5.3) OUTPUT RECTIFIER DIODES





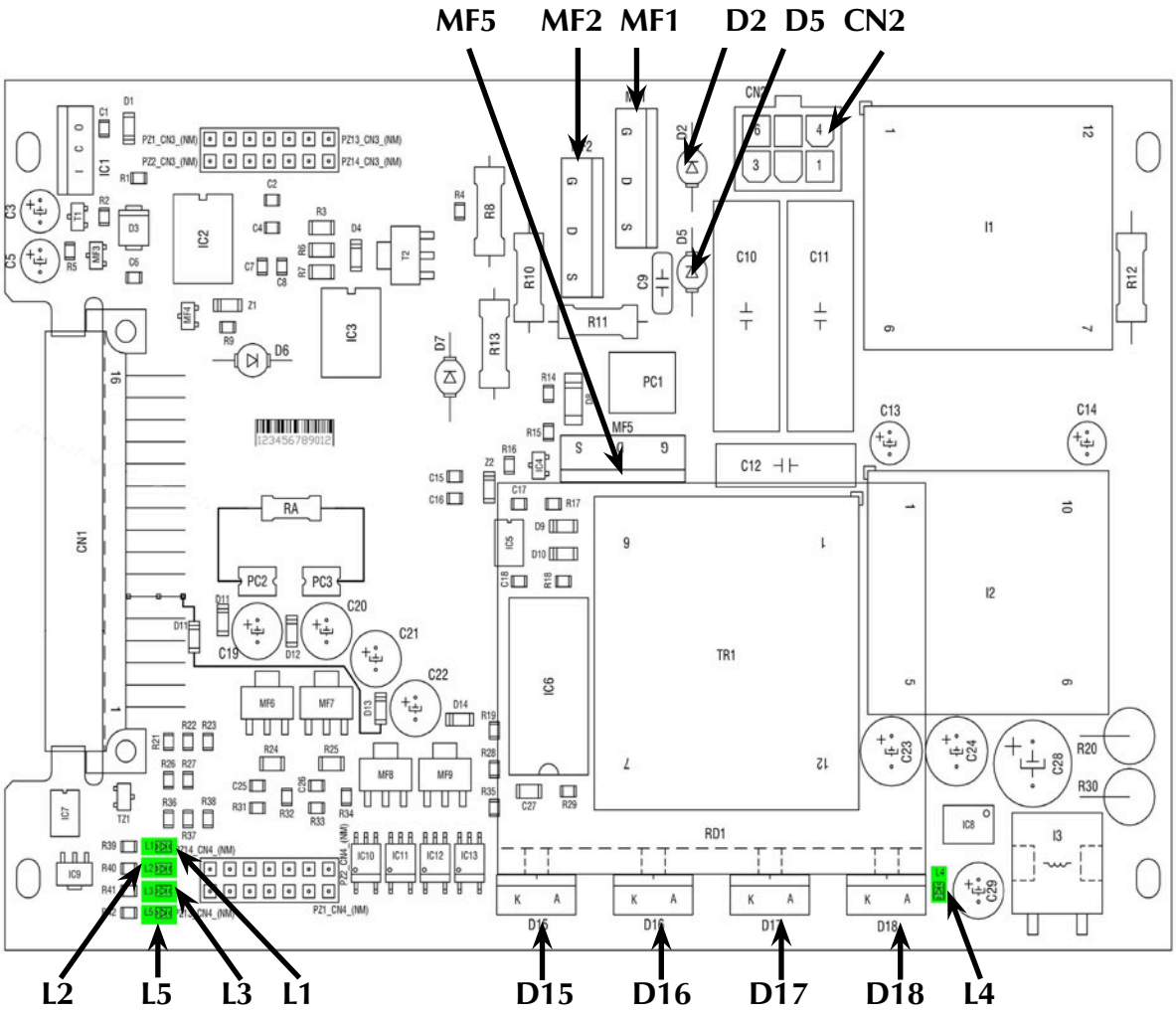
Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Rectifier diodes	OFF Copper bar connected	D1,D2,D3 D4,D5,D6	KA1 ← K KA2 ← K A ← KA1 A ← KA2	+0.16Vdc +0.16Vdc +0.16Vdc +0.16Vdc	⏚ ⏚ ⏚ ⏚	* V270 has only D1, D2, D3 and D4.
Superimposition switch	OFF	IGA	G2 ← E2 E2 ← C2	8.2kohm +0.34Vdc	Ω ⏚	
		IGB	G1 ← E1 E1 ← C1	8.2kohm +0.34Vdc	Ω ⏚	

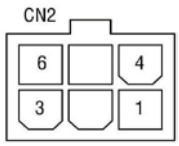
5.4) SWITCHING POWER SUPPLY P.C. BOARD 15.14.429

Board function: From power PFC regulator stage keeps the VBus and generate all the necessary auxiliary power supply. Controlled from digital card 15.14.415 ,permit to control with relative electronic switch the main contactor, the fan the gas valve . Powering also R.F. ignition card 15.14.430. Direct and not modulate powering also to the small fan placed on bottom close to the inverter power switch.

Location: 5th position on rack system from left, between the analogic card and water unit control card.

Note: The pc board is composed by a sandwich of two card fixed one to the other trough pin strip. A small fan is integrated in order to keep cooled this pc board.

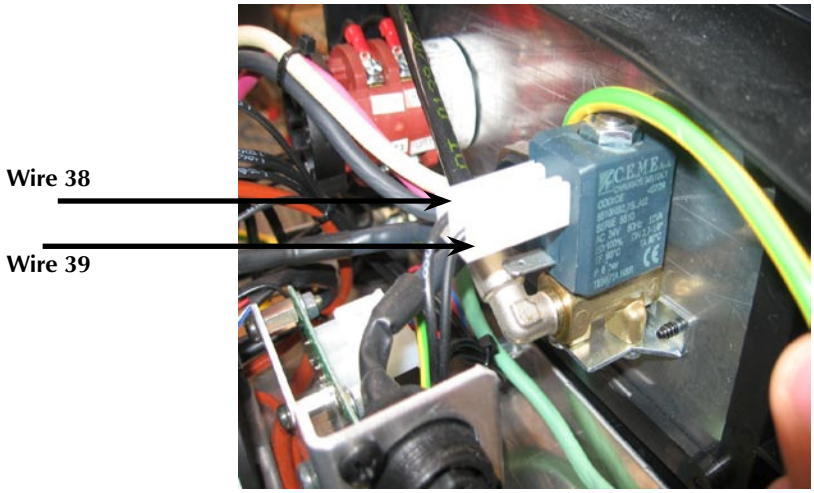




Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Power Mosfet	OFF	MF1	G ← S	10kohm	Ω	
		D2	A ← K	+0.45Vdc	⏚	
		MF2	G ← S	10kohm	Ω	
		D5	A ← K	+0.45Vdc	⏚	
		MF5	S ← D	+0.45Vdc	⏚	
Diodes	OFF	D15	A ← K	+0.25Vdc	⏚	
		D16	A ← K	+0.25Vdc	⏚	
		D17	A ← K	+0.25Vdc	⏚	
		D18	A ← K	+0.25Vdc	⏚	
DC LINK	ON		CN2/3 ← CN2/1	+750Vdc	V	
			CN2/5 ← CN2/1	+375Vdc	V	
Fan (M1) command*	ON	L3=ON	---	---	---	
Solenoid valve command ELV1**	ON	L2=ON	---	---	---	ON when solenoid valve is ON
+15Vdc voltage supply	ON	L4=ON				
ELV 2	ON	L1=OFF				V270T and V320T has only one ELV

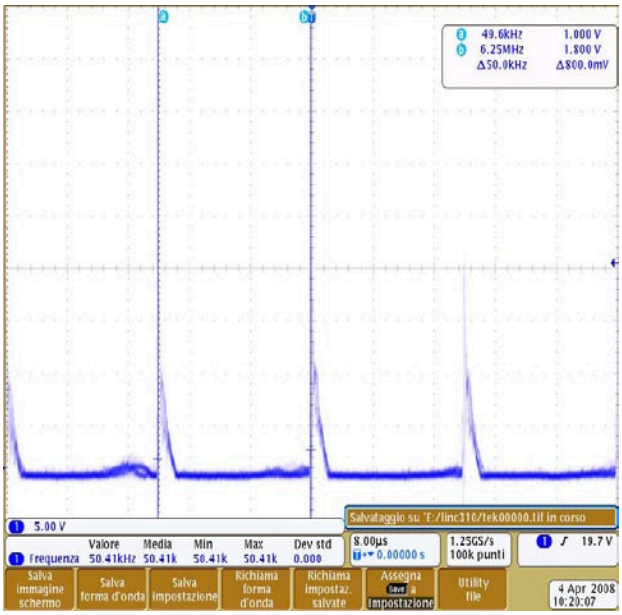
Notes:
* Command from 15.14.415 P.C. Board -> 15.14.429 -> Connector CN12/1 (60) and CN12/2 (50) 15.14.431
** Command from 15.14.415 P.C. Board -> 15.14.429 -> Connector CN13/1 (38) and CN13/5 (39) 15.14.431

SOLENOID VALVE

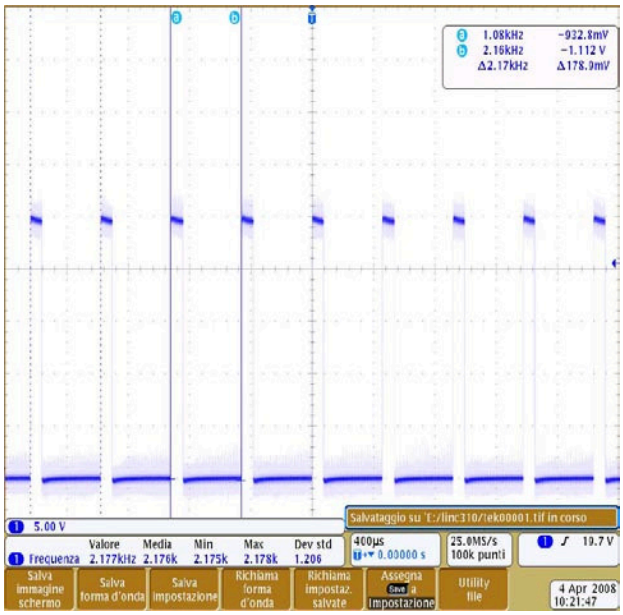


Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Solenoid valve command	ON	ELV1	38 ⟵ 39	150mVac* 60kHz*	V Hz	* ELV1 OFF Torch button released
Solenoid valve command	ON	ELV1	38 ⟵ 39	8.5Vac** 2.1kHz**	V Hz	**ELV1 ON Torch button pressed
Coil	OFF	ELV1	38 ⟷ 39	25ohm	Ω	

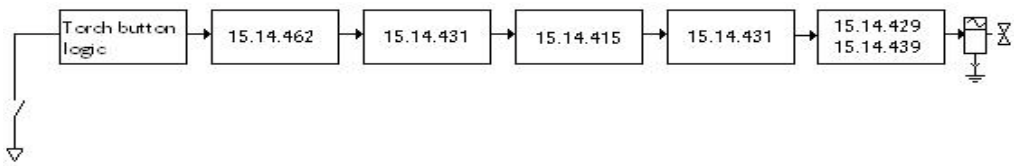
ELV1 OFF - Voltage signal between wire 38 and wire 39



ELV1 ON - Voltage signal between wire 38 and wire 39



Note: Solenoid Valve command. The enable occurs after torch button pressed.

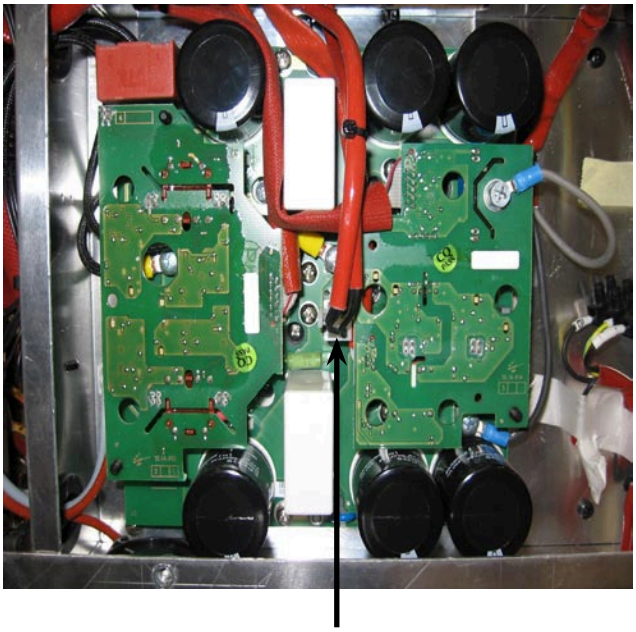


CHECK POWER SUPPLY

Check DC LINK voltage on 15.14.412 PC board and check the link between 15.14.412-15.14.429 PC boards

WARNING

HIGH VOLTAGE

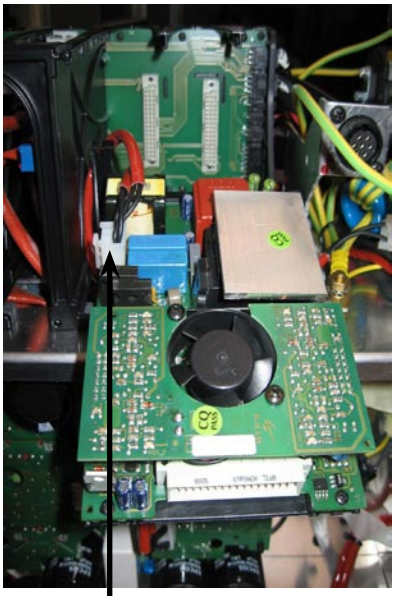


Connector CN6 on 15.14.412 PC board

CN4/1 = Wire 55 = +V_{BUS}

CN4/3 = Wire 56 = -V_{BUS}

CN4/5 = Wire 57 = $V_{BUS}/2$



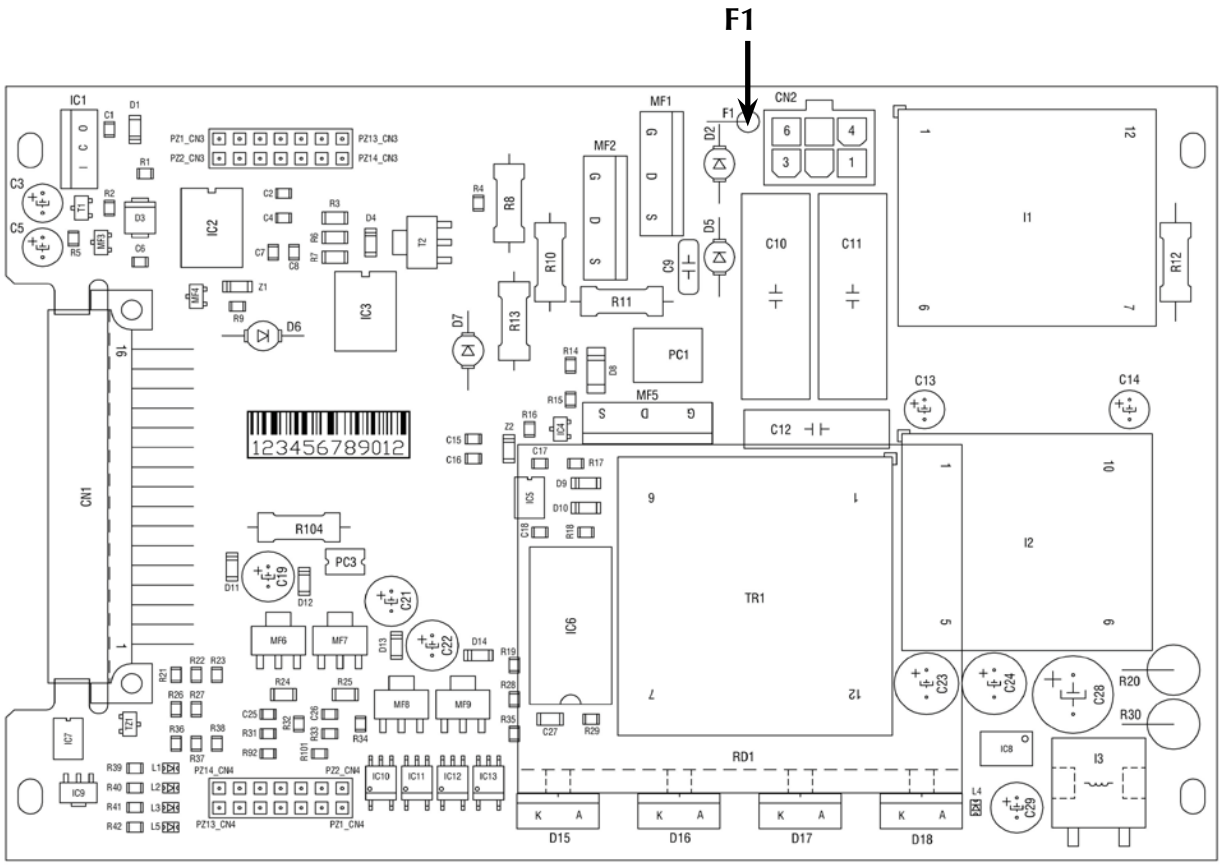
CN2 on 15.14.429 PC board

Connector CN2

CN2/1 = Wire 56 = -V_{BUS}

CN2/3 = Wire 55 = +V_{BUS}

Check Fuse F1 on P.C. board 15.14.429v3



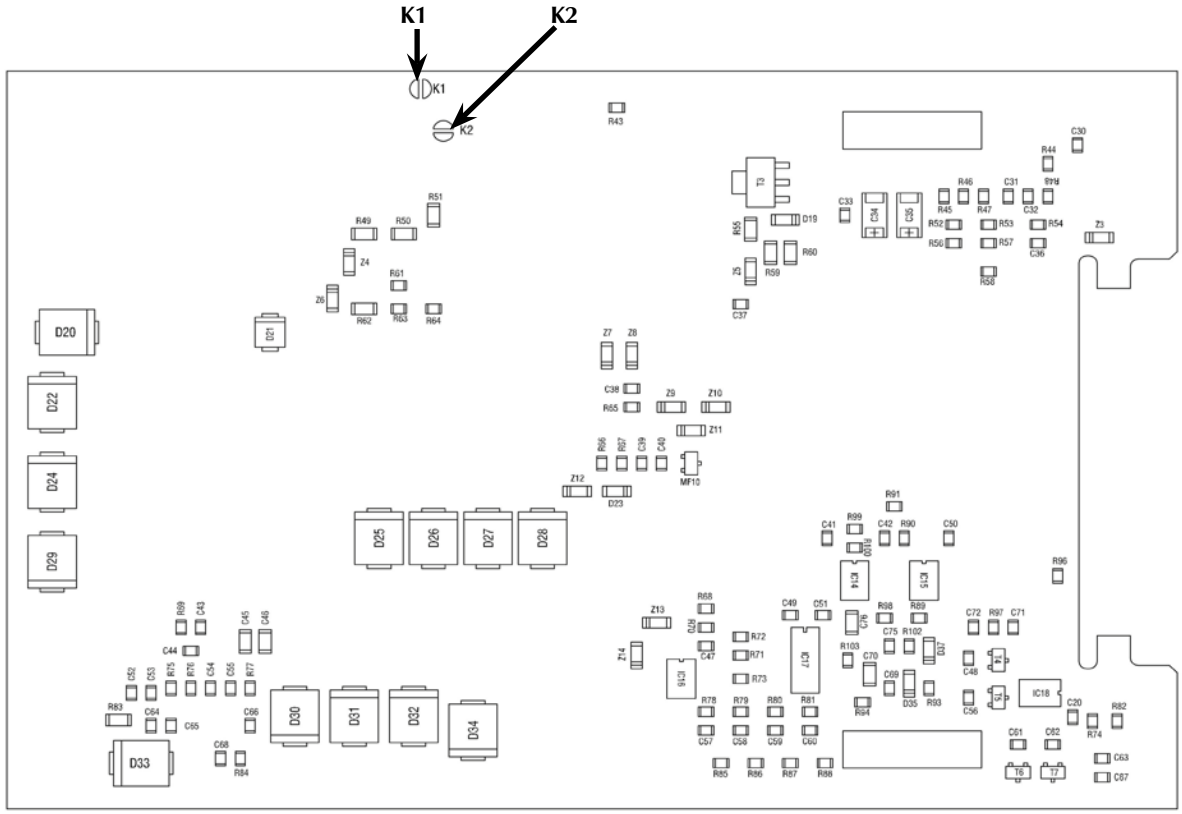
Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Fuse	OFF	F1	F1/1 ⟵ F1/2	+0Vdc	⏚	

Note:

* Fuse F1: The PINs of fuse are interchangeable.

F1/1 —▭— F1/2 or F1/2 —▭— F1/1

15.14.429 BOTTOM VIEW

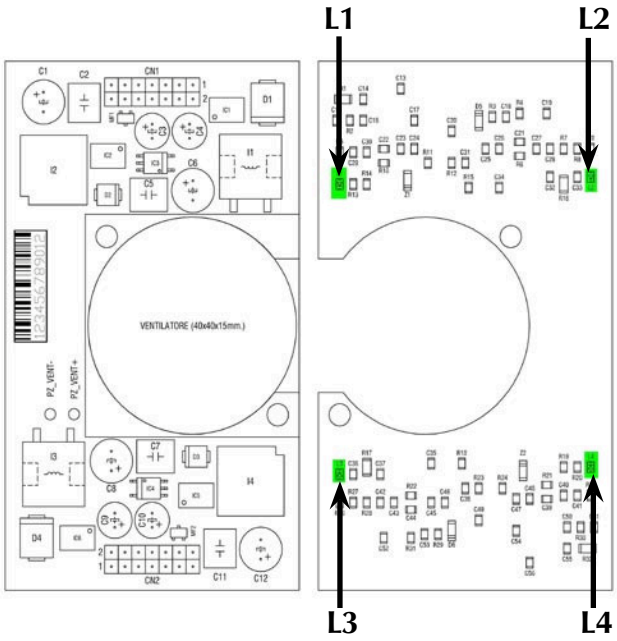


JUMPERS STATE

K1 = OPENED

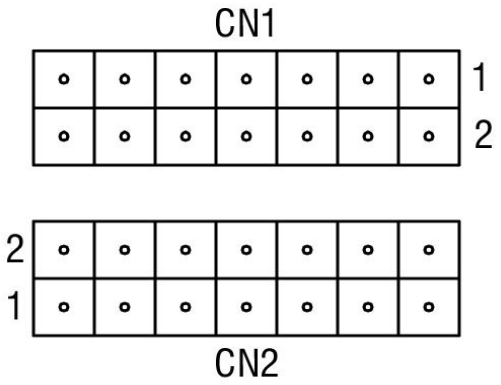
K2 = CLOSED

5.5) AUXILIARY SWITCHING POWER SUPPLY P.C. BOARD 15.14.439



Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
+15Vdc secondary side	ON	L1 = ON	---	---	---	
-15Vdc secondary side	ON	L2 = ON	---	---	---	
-15Vdc primary side	ON	L3 = ON	---	---	---	
+15Vdc primary side	ON	L4 = ON	---	---	---	

Note:



CN1/1 -> +15Vdc_sec	CN1/8 -> GND_sec	CN2/1 -> +15Vdc_pri	CN2/8 -> GND_pri
CN1/2 -> +15Vdc_sec	CN1/9 -> Not connected	CN2/2 -> +15Vdc_pri	CN2/9 -> Not connected
CN1/3 -> - 15Vdc_sec	CN1/10 -> Not connected	CN2/3 -> - 15Vdc_pri	CN2/10 -> Not connected
CN1/4 -> - 15Vdc_sec	CN1/11 -> +18Vdc_sec	CN2/4 -> - 15Vdc_pri	CN2/11 -> +18Vdc_pri
CN1/5 -> GND_sec	CN1/12 -> +18Vdc_sec	CN2/5 -> GND_pri	CN2/12 -> +18Vdc_pri
CN1/6 -> GND_sec	CN1/13 -> +18Vdc_sec	CN2/6 -> GND_pri	CN2/13 -> +18Vdc_pri
CN1/7 -> GND_sec	CN1/14 -> +18Vdc_sec	CN2/7 -> GND_pri	CN2/14 -> +18Vdc_pri

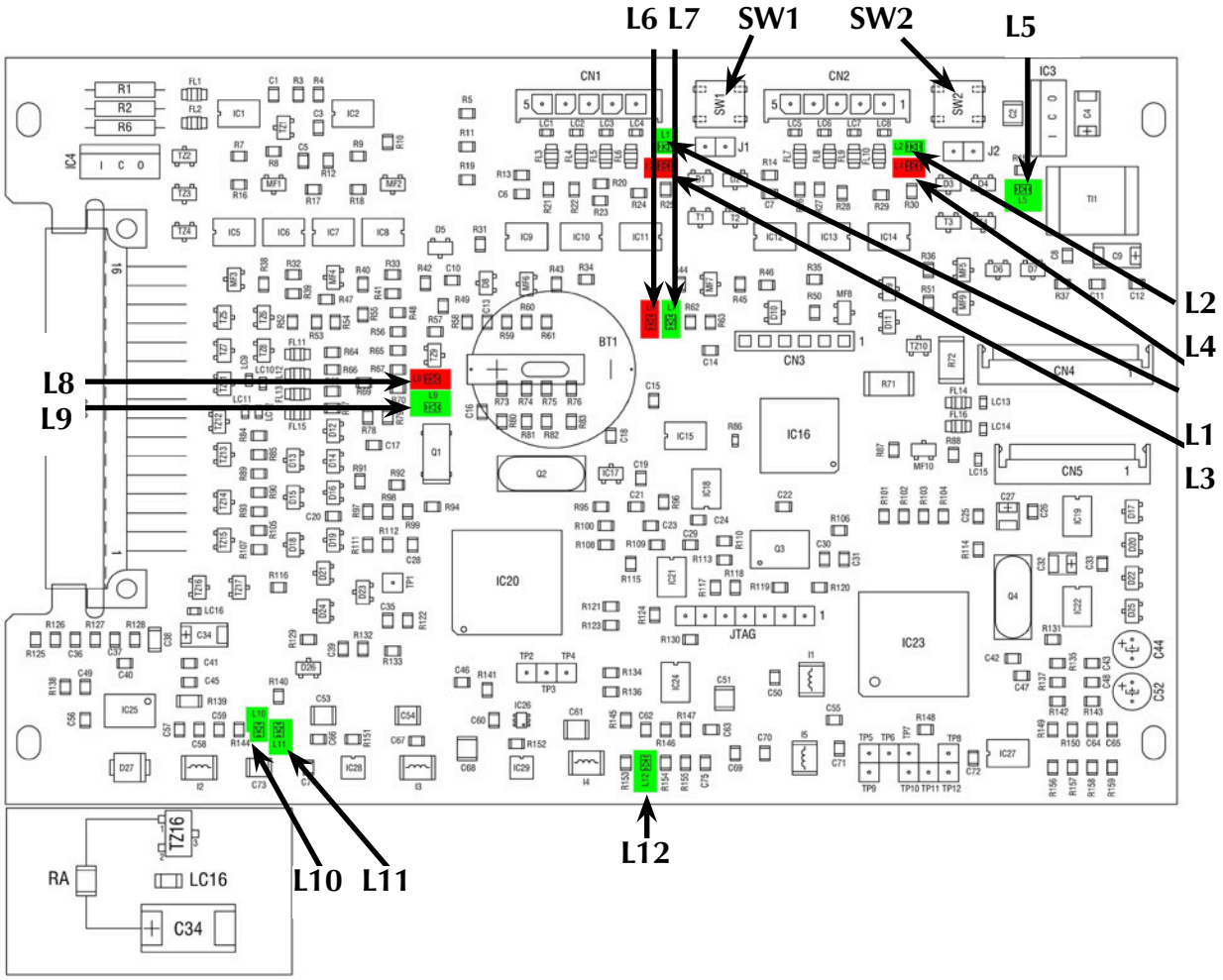
5.6) DIGITAL P.C. BOARD 15.14.4153

DESCRIPTION

Board function: Is the main control board. Manage different signal and have inside two microprocessor for main program that permit to control all the internal function , welding menu parameter and DSP(digital signal processor) for control the input stage PFC and the inverter stage.
The board control:
1) Gas valve
2) Main fan M1 in on-off system
3) Auxiliary inverter fan M2 always on
4) Can bus communication with all units connected on internal can bus net (front panel, remote control card, internal connector).
5) HF trigger signal
6) AC-DC plus Superposition effect.
Moreover receive the signal for logic and dsp control as:
1) Vline from card 15.14.419
2) Vbus from card 15.14.419
3) Vbus/2 zero ref. point from card 15.14.419
4) Welding current from card 15.14.419
5) NTC and thermic caps from card 15.14.419
6) Switch start buttom from output filter card 15.14.462>bus card 15.14.431 > 15.14.415

Location: 3rd position in rack system from front panel, between hf card and analog card. Connected on bus board 15.14.431 and via ribbon cable to the main inverter.

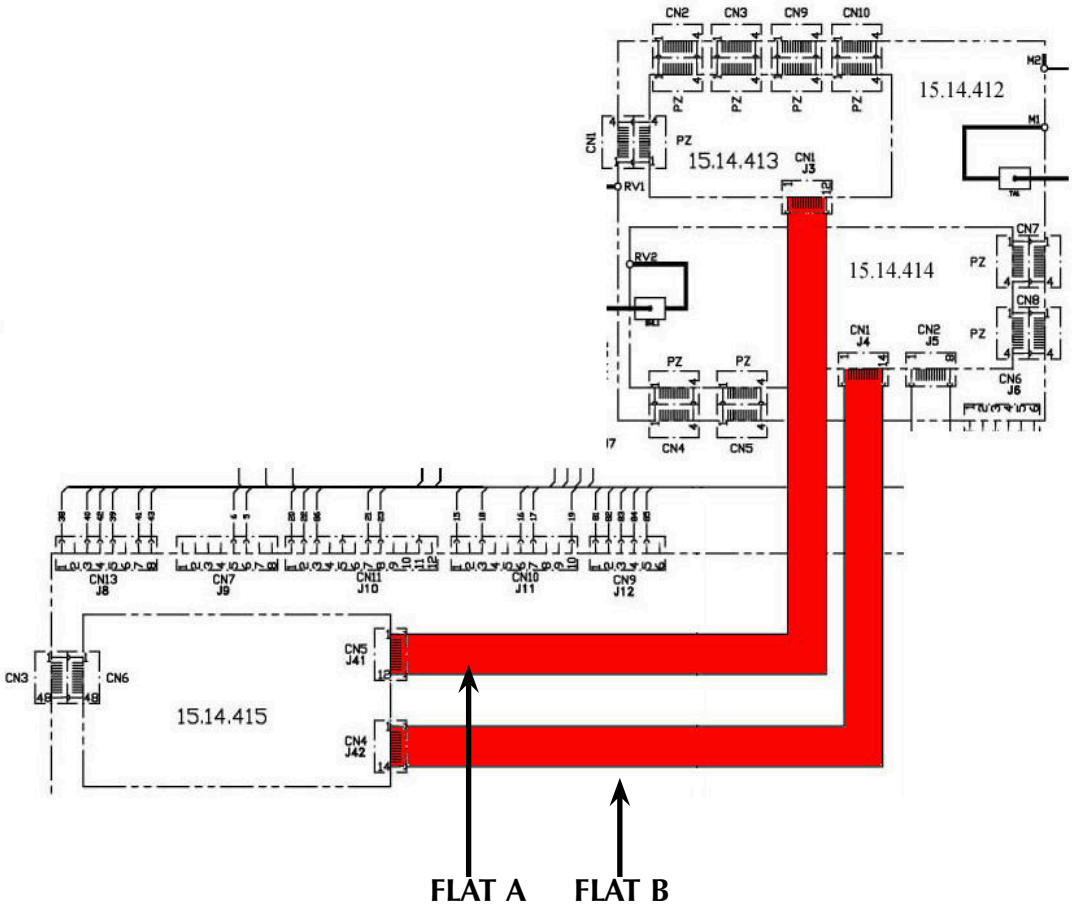
Note: Pay attention during dismantling and reassembling of two ribbon cable to the hot glue present. For remove the pcb is sufficient first the flat, screw on plastic profile ,than pull the pc board. Each pcb on rack have his right position, not possible wrong placing.



Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Machine identification (V270T & V320T) DSP	ON	L6 = ON* L7 = ON**	---	---	---	NEW VERSION *This diodes is blinking. Correct comunication DSP-uC ** This diodes is blinking slowly.
Machine identification (V270T & 320T) uC		L8 = ON* L9 = ON**				NEW VERSION *This diodes is blinking. Correct comunication DSP-uC. ** This diodes is blinking slowly.
+5Vdc voltage supply	ON	L10 = ON	---	---	---	
+3.3Vdc voltage supply	ON	L11 = ON	---	---	---	
+1.9Vdc voltage supply	ON	L12 = ON	---	---	---	
+5Vdc isolated voltage supply	ON	L5 = ON	---	---	---	
Firmware updated	ON	L1=OFF L2=OFF L3=OFF L4=OFF				These diodes are blinking when firware is upda-ting
Hardware reset uC***	ON	SW1=Pressed				
Hardware reset DSP***	ON	SW2=Pressed				

*** When SW1(or SW2) is pressed uC (or DSP) is reset.

Flat cable connection



FLAT A

Driver inverter command

CN5/1 and CN5/2 -> COM_SIG 1

CN5/3 and CN5/4 -> COM_SIG 2

CN5/5 and CN5/6 -> COM_SIG 3

CN5/7 and CN5/8 -> COM_SIG 4

CN5/9 and CN5/11 -> TA+

CN5/8 and CN5/12 -> TA-

FLAT B

Driver boost command

CN4/1 and CN4/2 -> +15Vdc

CN4/3 and CN4/4 -> GND

CN4/5 and CN4/6 -> -15Vdc

CN4/7 and CN4/8 -> I_{BOOST}

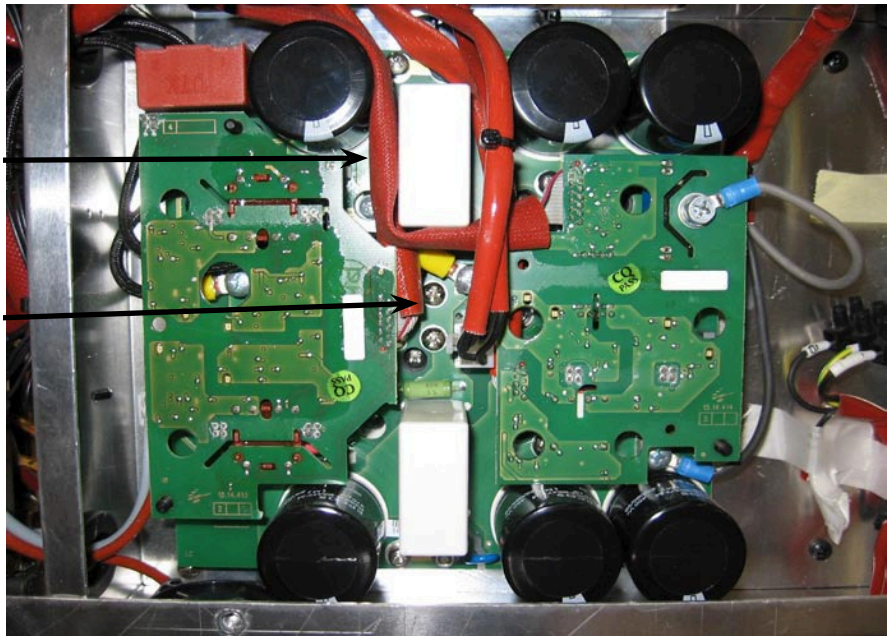
CN4/9 and CN4/10 -> COM_BOOST 1

CN4/11 and CN4/12 -> COM_BOOST 2

CN4/13 and CN4/14 -> Not use

FLAT B

FLAT A

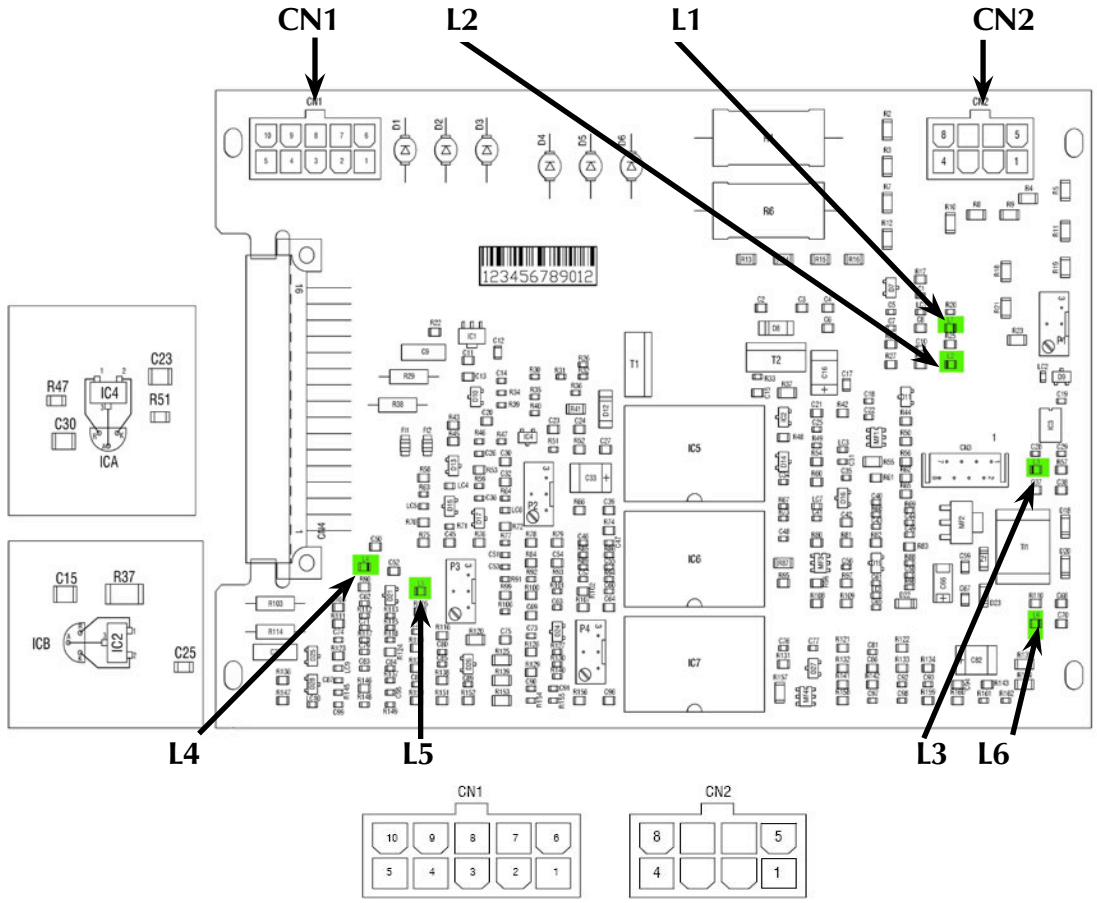


5.7) ANALOG SIGNAL P.C. BOARD 15.14.419

Board function: Is the analog card, means that internally his purpose is to manage all the input and output reading (volt and ampere) in order to isolate and derate the different signal , permitting the management of these signals for the other control unit. Receive Vbus positive and negative and Vbus/2,input voltage, thermic and ntc sensor, output current, output voltage. The pcb works in relation with digital card.

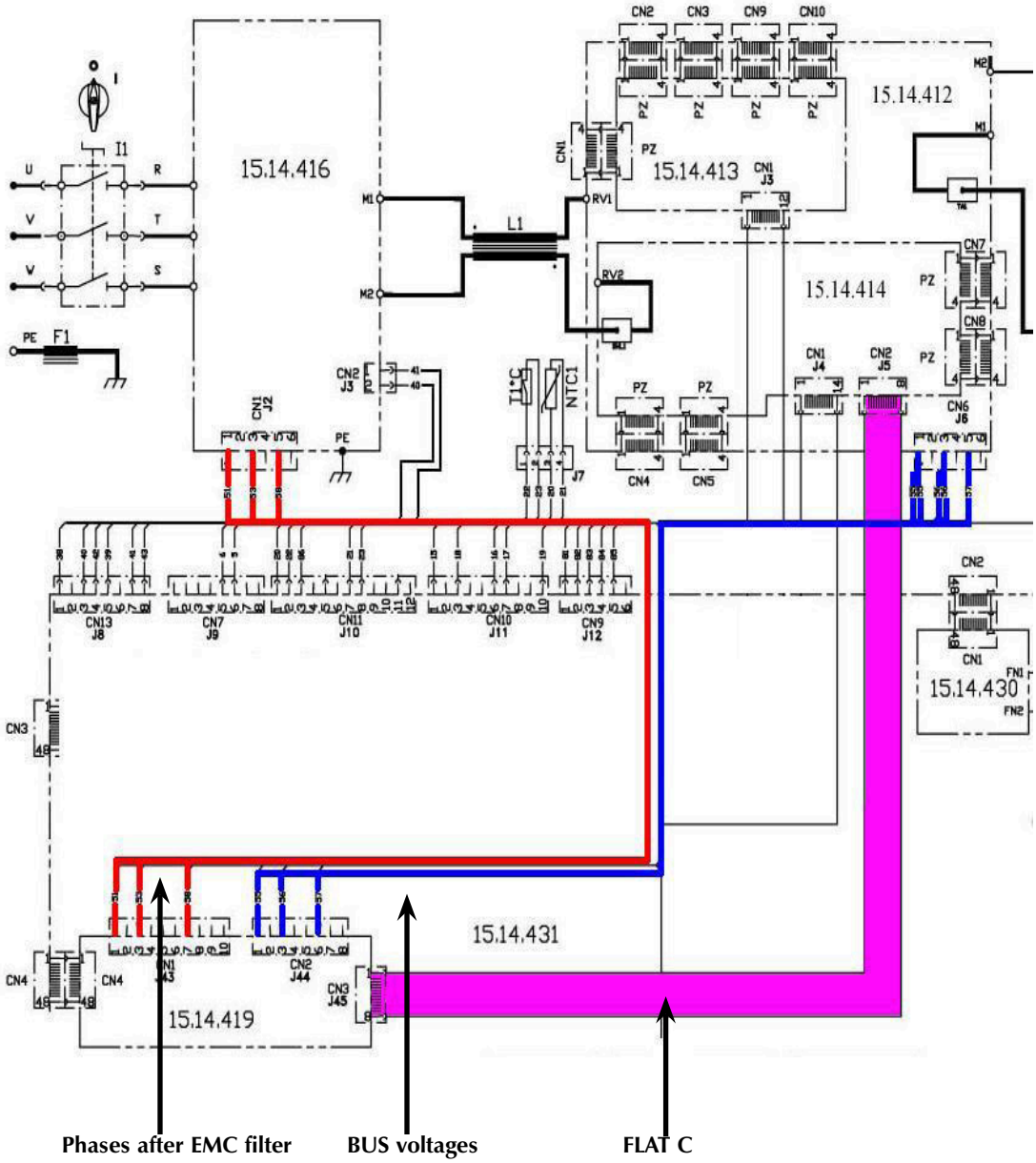
Location: 4th position in rack system from front, between the digital card 15.14.415 and the power card 15.14.439&429 .Via ribbon cable it's connect with pfc power stage.

Note: As the digital card also here pay attention to the dismantling of ribbon cable. The pc board has got few trimmer pre-adjusted: don't move from factory position as they manage important power threshold.



Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
+15Vdc voltage supply	ON	L6 = ON	---	---	---	
-15Vdc voltage supply	ON	L3 = ON	---	---	---	
+15Vdc voltage supply primary side	ON	L2 = ON	---	---	---	
-15Vdc voltage supply primary side	ON	L1 = ON	---	---	---	
+15Vdc voltage supply secondary side	ON	L4 = ON	---	---	---	
-15Vdc voltage supply secondary side	ON	L5 = ON	---	---	---	
Input voltage after EMC filter	ON		CN1/1 ⟷ CN1/3 CN1/1 ⟷ CN1/7 CN1/3 ⟷ CN1/7	400Vac 400Vac 400Vac	Ⓥ Ⓥ Ⓥ	
DC LINK	ON		CN2/1 ⟷ CN2/3 CN2/1 ⟷ CN2/6	+375Vdc +750Vdc	Ⓥ Ⓥ	

This board senses the input voltage phases and the DC LINK (+750Vdc) voltage.
Check the links between 15.14.419-15.14.416 and 15.14.419-15.14.414 PC boards.



CN1/1 - Wire 51 - Phase S after EMC filter
CN1/3 - Wire 53 - Phase T after EMC filter
CN1/7 - Wire 58 - Phase R after EMC filter

CN2/1 - Wire 55 - +VBUS
CN2/3 - Wire 56 - - VBUS
CN2/6 - Wire 57 - VBUS/2

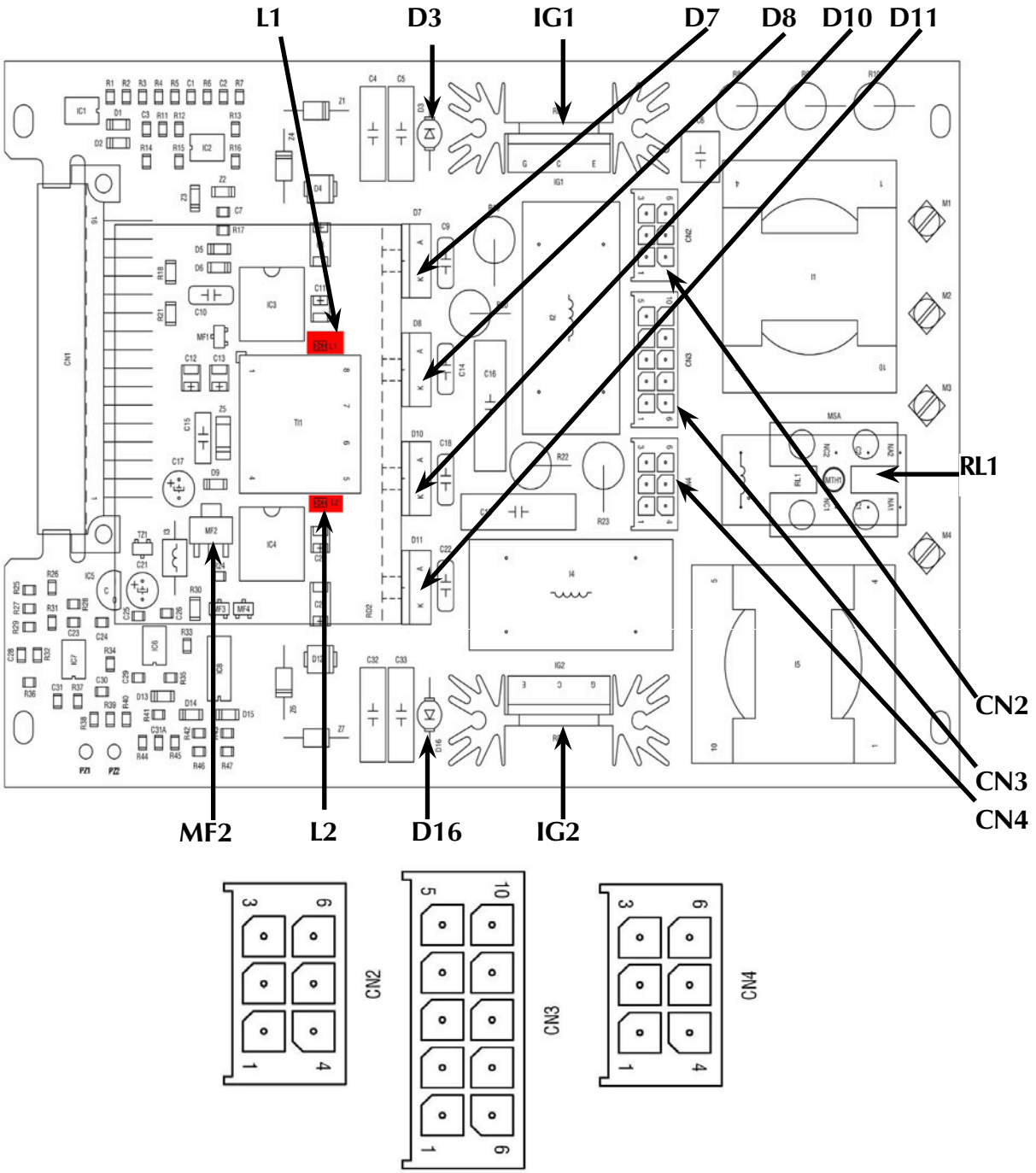
FLAT C
CN3/1 and CN3/2 -> +15Vdc_PRY
CN3/3 and CN3/4 -> GND_PRY
CN3/5 and CN3/6 -> -15Vdc_PRY
CN3/7 and CN3/8 -> Not use

5.8) AC SUPERIMPOSITION & BOOST CIRCUIT P.C. BOARD 15.14.459

Board function: The pc board receive from digital card the information about the ac-dc driving for secondary power switch. Manage also the Crisp function and the superimposition effect. The ac-dc command is coming first from the digital card and then this ac-dc pcb control the signal in order to synchronize the crisp circuit and superimposition effect and driving to the ac-dc gate signal pc board (15.14.434) that finally realize the real gate wave for ac power module switch.
The crisp circuit is really simple and is composed by a secondary winding on power transformer that generate an ac signal that will be rectifier from this card , switched by two relay on output : the purpose is to guarantee with extremely welding condition to keep the arc stable also at low ampere and long arc.
The superimposition effect permit to manage the AC switching around the 0 crossing point, against the stopping effect. Trough short volt impulse permit the helping ignition in the sense the arc is moving.

Location: At 1st position in rack system from left , the first one after the front panel.

Note: The pc board use different pin connectors for common signal in order to avoid wrong fitting ; about the wires connected with screws pay attention to not mix colour sense into OUT 1-2 and IN 1-2 but don't care if the wire in OUT 1 is placed wrongly in OUT 2 due to the AC signal present (is not a dc volt with positive and negative polarity to respect).



Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Power IGBT	OFF	IG1	E ⟵ G	2.2kohm	Ω	
		D3	A ⟵ K	+0.45Vdc	⏚	
		IG2	E ⟵ G	2.2kohm	Ω	
		D16	A ⟵ K	+0.45Vdc	⏚	
		MF2*	G ⟵ S	100kohm	Ω	
			S ⟵ D	+0.5Vdc	⏚	*MF2 Pin 
Diodes	OFF	D7	A ⟵ K	+0.4Vdc	⏚	
		D8	A ⟵ K	+0.4Vdc	⏚	
		D10	A ⟵ K	+0.4Vdc	⏚	
		D11	A ⟵ K	+0.4Vdc	⏚	
Superimposition +	ON	L1=ON*				*ON when superimposition + is enabled. Command from 15.14.415 DSP.
Superimposition -	ON	L1=ON**				*ON when superimposition - is enabled. Command from 15.14.415 DSP.

CN2/1 and CN2/4 (wire 90)
-> Input supply for superimposition in AC mode from auxiliary winding transformer.
CN4/1 and CN4/4 (wire 93)

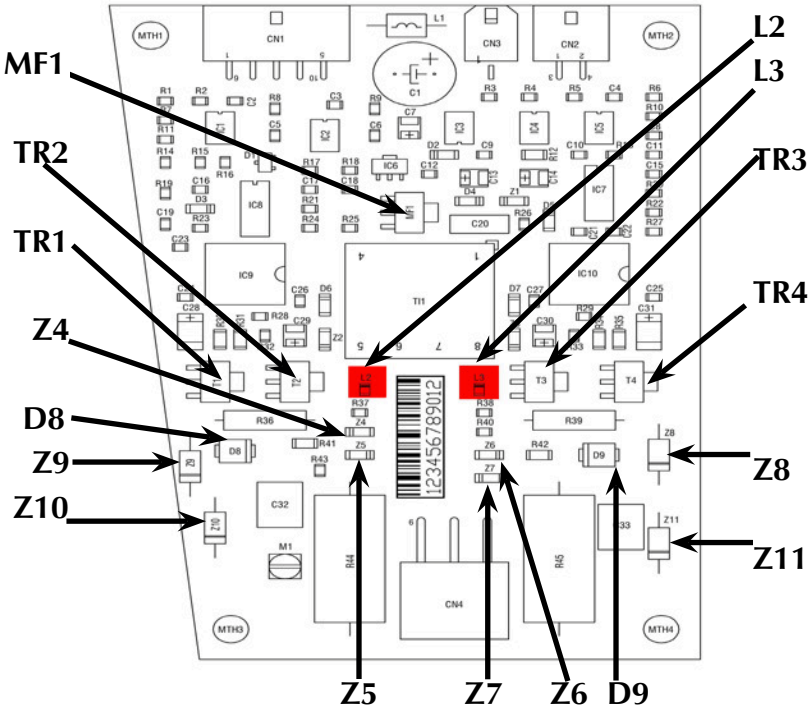
CN3/1 and CN3/6 (wire 72)
-> Output supply for superimposition in AC mode.
CN3/5 and CN3/10 (wire 70)

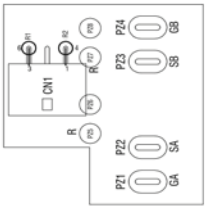
5.9) OUTPUT MODULE DRIVER P.C. BOARD 15.14.434 AND CONNECTOR BOARD 15.14.461

Board function: This card realize the final gate's signal for both power switch of ac-dc module. This card is informed about which bridge to close from digital card.
Internal circuit in order to clamp overvoltage during ac-dc switching.
Receive also the secondary thermostat and NTC ,and transmit the thermic status via bus board to the analogic card then to the digital control card.

Location: Left upper section, the pc board has got a trapezoidal shaping.

Note: Two leds shown which diagonal is switched on or off.





Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Diodes	OFF	Z4	A ← K	+0.7Vdc	⏚	
		Z5	A ← K	+0.7Vdc	⏚	
		Z6	A ← K	+0.7Vdc	⏚	
		Z7	A ← K	+0.7Vdc	⏚	
		Z8	A ← K	+0.6Vdc	⏚	
		Z9	A ← K	+0.6Vdc	⏚	
		Z10	A ← K	+0.6Vdc	⏚	
		Z11	A ← K	+0.6Vdc	⏚	
		D8	A ← K	+0.5Vdc	⏚	
		D9	A ← K	+0.5Vdc	⏚	

Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Secondary side thermal protection	OFF	T2	T2/1 ⟷ T2/2	0Vdc	⏚	
		NTC2	NTC2/1 ⟷ NTC2/2	12kohm*	Ω	*@T=25°C
Mosfet MF1	OFF	MF1	S ⟵ D	+0.7Vdc	⏚	
Transistor	OFF	TR1 and TR4	B ⟵ C B ⟵ E	+0.6Vdc +0.6Vdc	⏚ ⏚	
		TR1 and TR4	E ⟵ B C ⟵ B	+0.6Vdc +0.6Vdc	⏚ ⏚	
Led	ON	L2=ON L3=OFF				This LED is ON in: - Sitck DC+ - TIG DC - TIG AC part +
		L2=OFF L3=ON				This LED is ON in: - Sitck DC- - TIG AC part -
		L2=ON L3=ON				This Leds blinking in: Stick AC TIG AC Before welding, in Stick AC is only L2=ON whereas in TIG AC is only L3=ON.

CN1/1 -> Not use
CN1/2 -> COM AC
CN1/3 -> GND_S
CN1/4 ->+15Vdc
CN1/5 -> Output Ther 2 (15.14.419)
CN1/6 -> Output Ther 1 (15.14.419)
CN1/7 -> GND_S
CN1/8 -> Not Use
CN1/9 -> Not Use
CN1/10 -> Not Use

CN2/1 and CN2/4 -> Input NTC

CN3/1 and CN3/2 -> Thermostat input

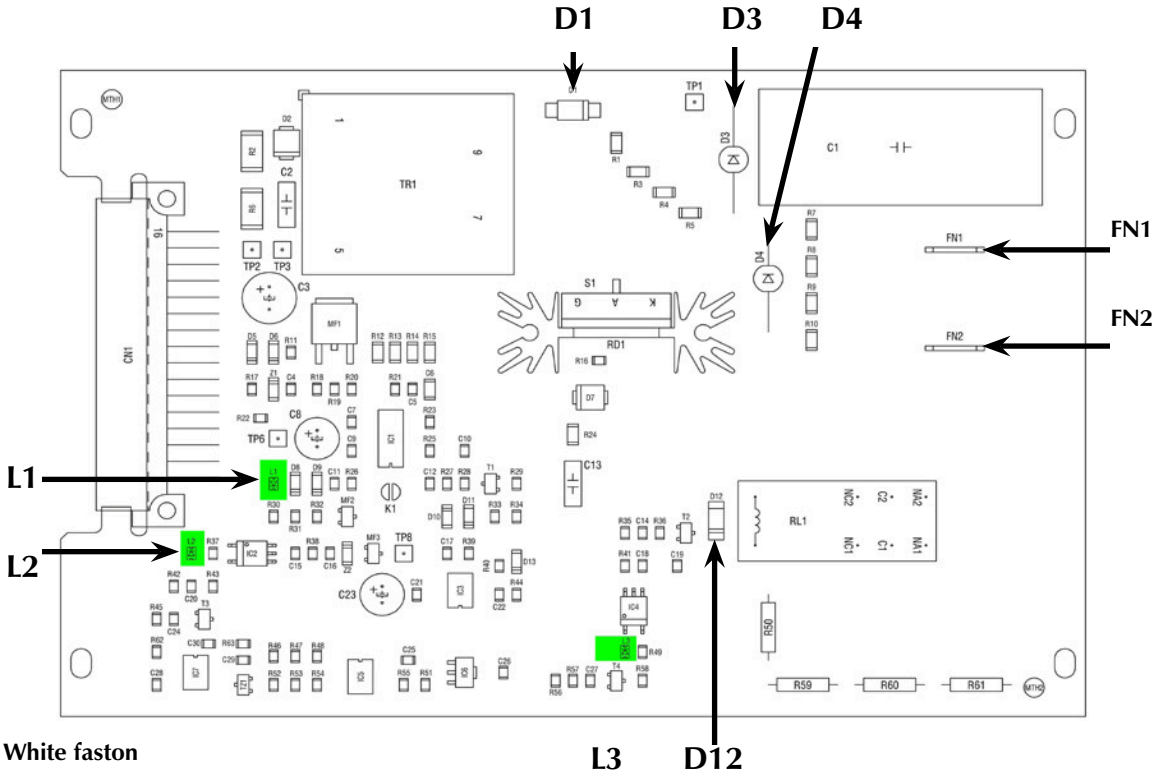
CN4/1-> COM_AC_GA
CN4/3-> COM_AC_GB
CN4/4-> RIF_COM_AC_SA
CN4/6-> RIF_COM_AC_SB

5.10) HF P.C. BOARD 15.14.430

Board function: Supply of H.F. for tig arc ignition. The H.F. is capacitive discharging type. The pc board is powered with 24vdc from auxiliary supply card and controlled from digital card.

Location: 2nd rack system position, between the ac-dc & superimposition card and digital card.

Note: A relay reverse the polarity sense in order to improve the striking in DC as well AC. Three leds shown: L1=VCC, L2=RF TURN ON, L3=POLARITY RELAY COMMAND



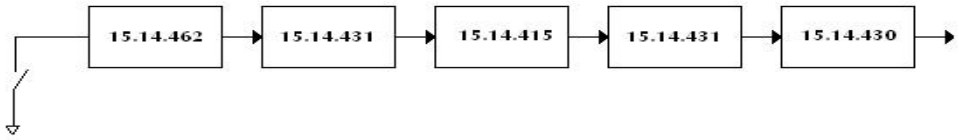
FN1= White faston

FN2= Red faston

Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Diodes	OFF	D1	A ⟵ K	+0.9Vdc	⏛	
		D3	A ⟵ K	+0.45Vdc	⏛	
		D4	A ⟵ K	+0.45Vdc	⏛	
Relay coil	OFF	D12	K ⟵ A	870ohm	Ω	The relay switches over when change from HF+ to HF- mode.
+20Vdc voltage supply	ON	L1=ON				
HF command*	ON	L2=ON				Only with HF command.
HF-	ON	L3=ON				Only with HF-TIG DC L3=OFF in TIG AC. Generate from 15.14.415

Notes:

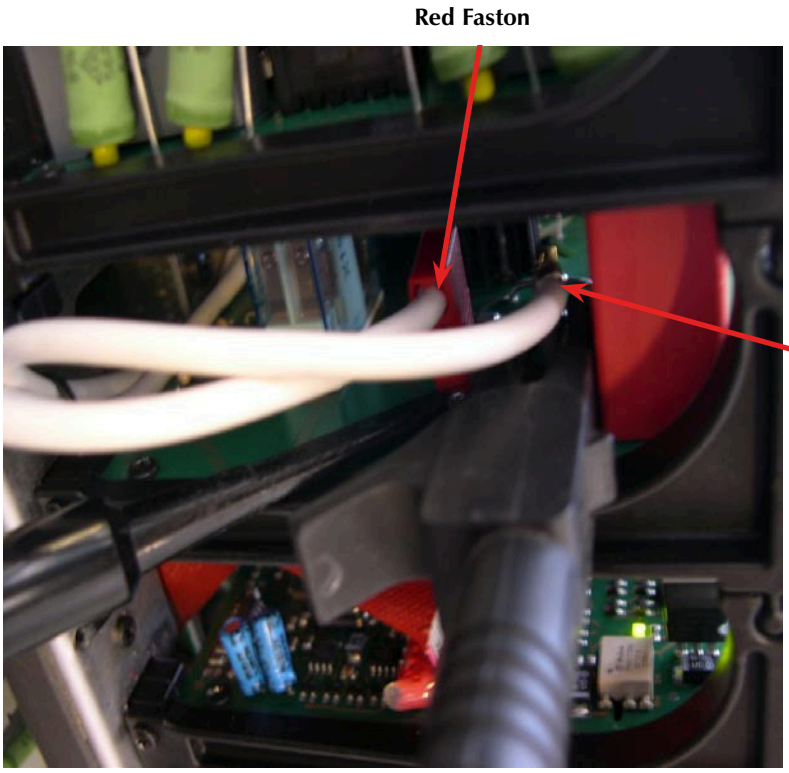
*** Command generates from 15.14.415 -> 15.14.430. The enable occurs after torch button pressed.**



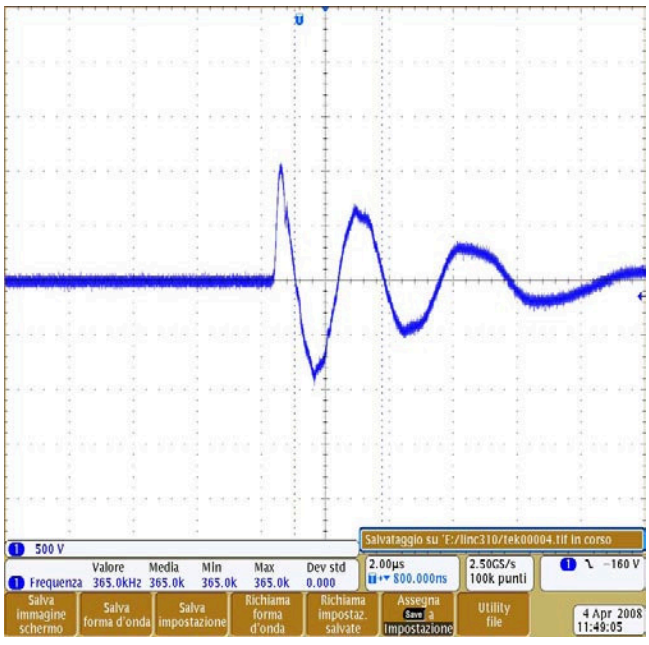
HF waveform

WARNING

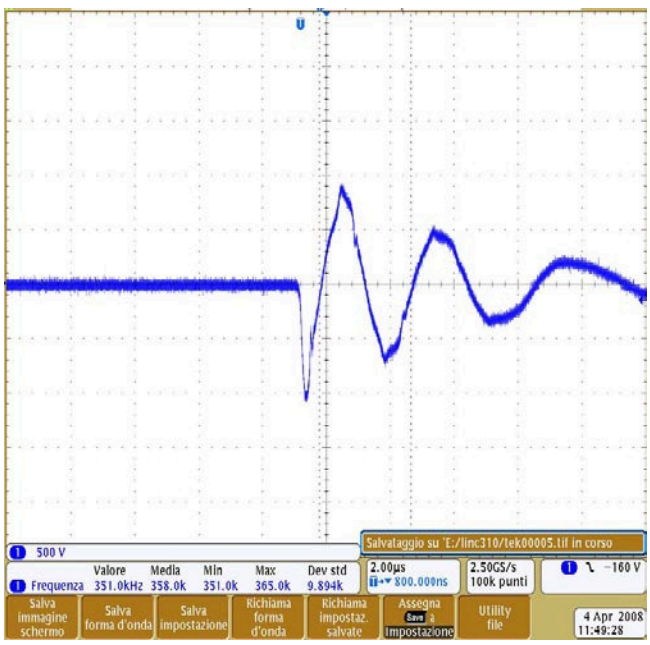
Use a probe with a minimum attenuation of x100



HF pulse in TIG AC



HF pulse in TIG DC

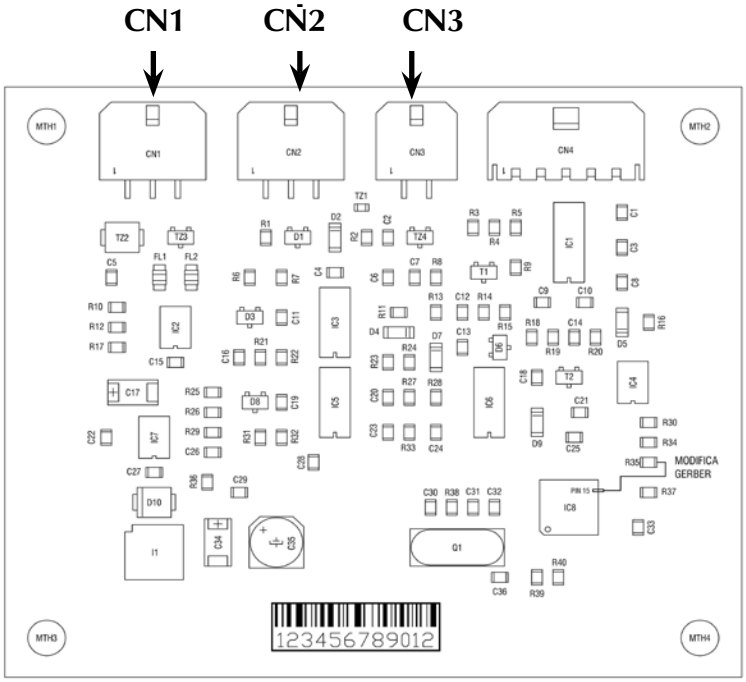


5.11) A/D REMOTE CONTROL CONVERSION P.C. BOARD 15.14.469

Board function: The purpose is to manage the foot control analogic remote control and converse the analog signal into digital signal. The switch from remote is also given directly to the digital card and remote card.

Location: Next to the AC/DC module board ,left upper section.

Note: the can bus signal is bridge in parallel CN2-CN1 in order to connect the front panel.



Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
+15Vdc voltage supply	ON	CN1	CN1/1 ⟵ CN1/2	+15Vdc	Ⓥ	
		CN2	CN2/1 ⟵ CN2/2	+15Vdc	Ⓥ	
Torch trigger	ON	CN3	CN3/3 ⟵ CN3/4	0Vdc	Ⓥ	Torch trigger pressed
			CN3/3 ⟵ CN3/4	+5Vdc	Ⓥ	Torch trigger released
Foot amptrol voltage supply	ON	CN3	CN3/1 ⟵ CN3/4	+15Vdc*	Ⓥ	*Foot amptrol not connected

CN2 -> CAN BUS Communication

CN1 -> CAN BUS Communication

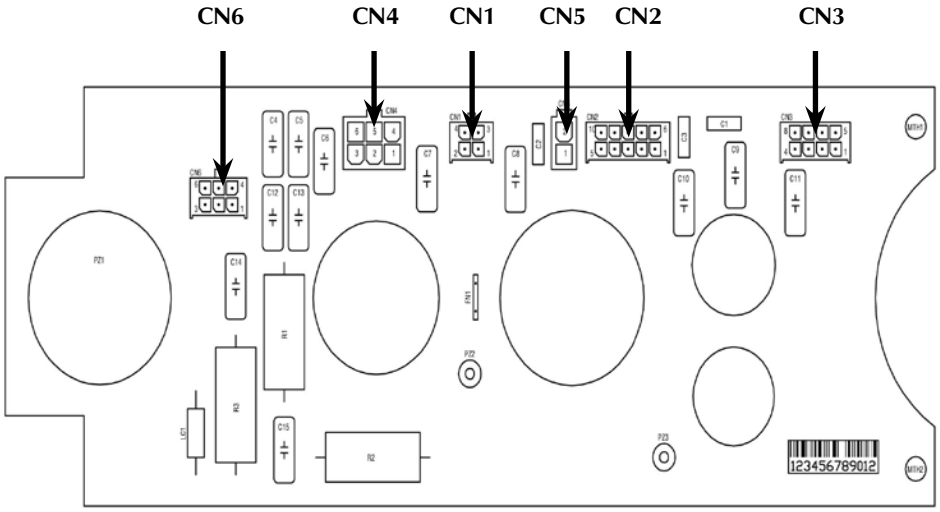
CN3 -> Remote control input from 15.14.462

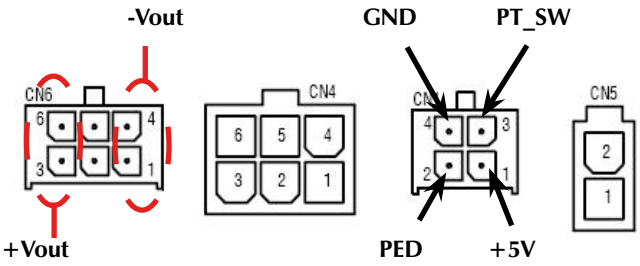
5.12) OUTPUT FILTER P.C. BOARD 15.14.462

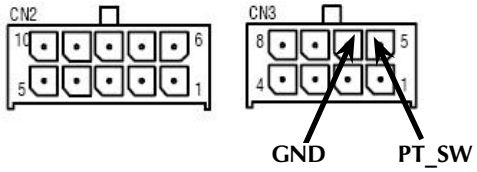
Board function: Filtering and bypassing for: output studs, input remote amphenol. Source for the voltage feedback via analogic board. Source for dummy load resistor.

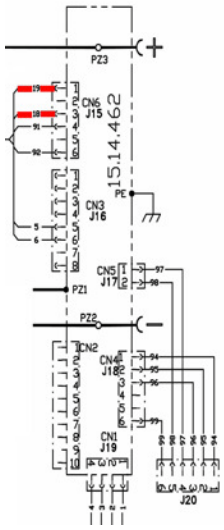
Location: Bottom front, fixed with stud.

Note: A RF bypassing cable is connected on PZ1.









Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Impedence	OFF	---	OUT+ ⟵ OUT-	380ohm	Ω	OUT+ and OUT- are the output bushings
Connections	OFF	---	OUT+ ⟵ Wire 18 OUT- ⟵ Wire 19	0Vdc 0Vdc	⏚ ⏚	
Open circuit voltage	ON	---	OUT+ ⟵ OUT-	+80Vdc	V	*On stick mode

CN6/3 and CN6/6 -> +VOUT
-> 15.14.431 -> 15.14.419 -> 15.14.415 and R2
CN6/1 and CN6/4 -> -VOUT

CN1 -> CN1 manages RC and Foot Amprol signal to 15.14.469 P.C. board.

CN4 and CN5 manage the input signals from RC and Foot Amprol.

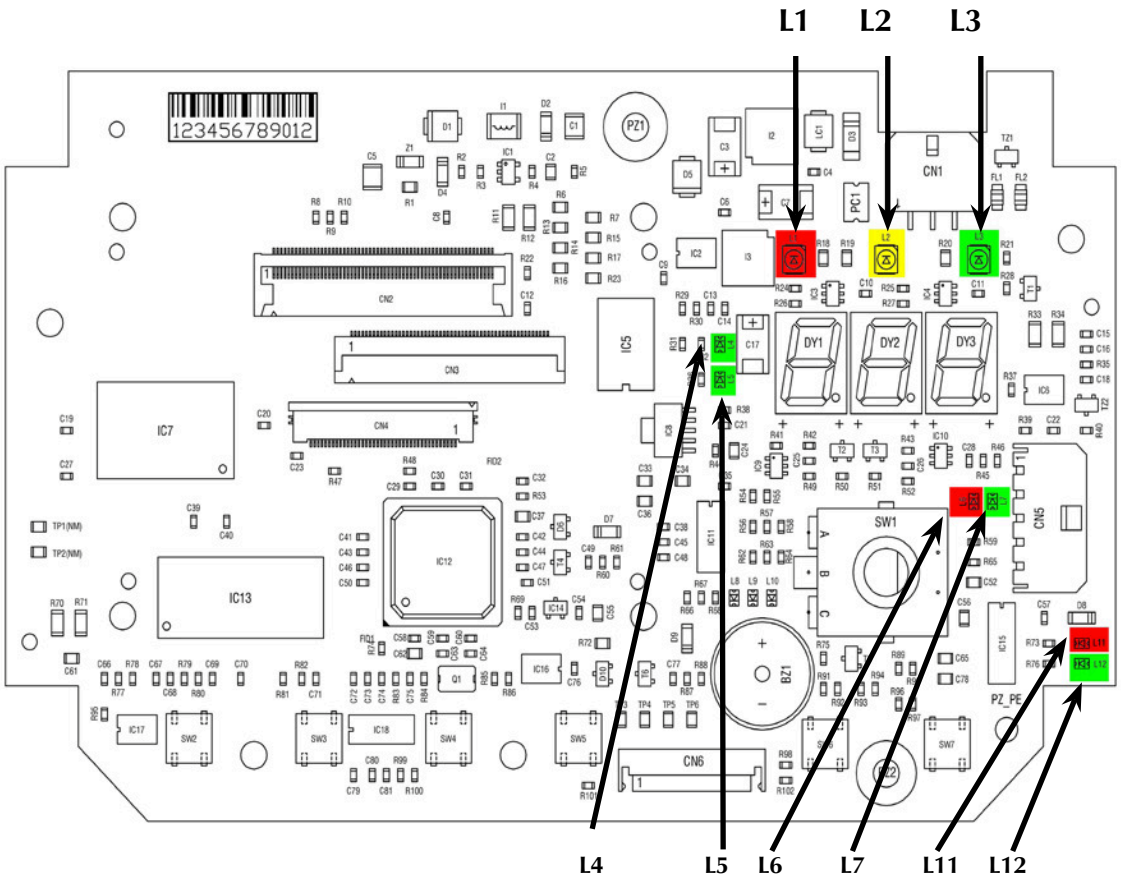
CN3/5 and CN3/6 -> Torch button (Wire 5 and 6) -> 15.14.431 -> 15.14.415

5.13) CONTROL PANEL P.C. BOARD 15.14.517

Board function: Passive remote control, could be consider as the extension of digital card microprocessor. Show the different parameter and internal set-up menu. The front panel include:
Dynamic LCD display, Status Leds, Seven segments display, Push button and rotary encoder , four push button used for different enable/disabled function based on display's contest, two button for store and recall programs .

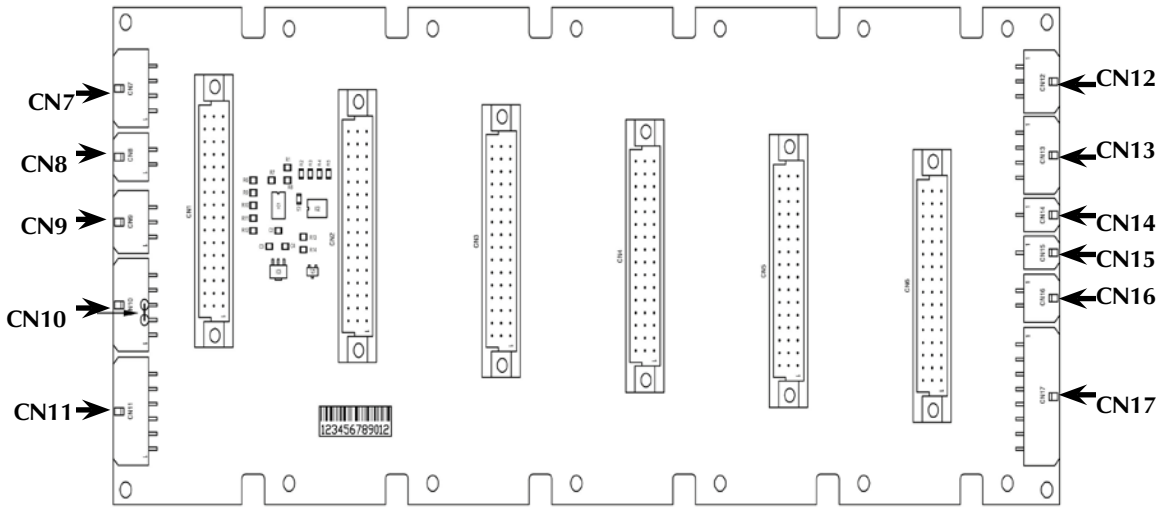
Location: At top front side.

Note: A piezo buzzer present for button pressing. The panel is given assembled complete with pc board ,display, and metal aluminium serigraphy.



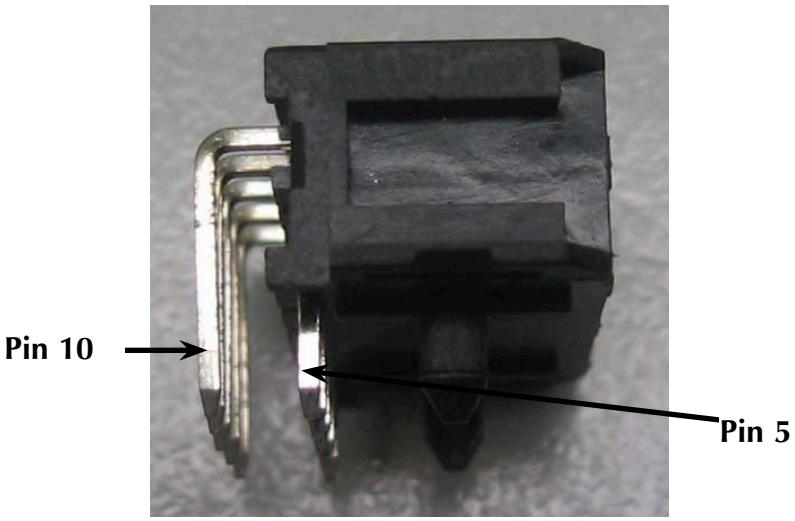
Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Power supply	ON	L1=ON				
Alarms	ON	L2=OFF				L2=ON in alarm state
Output power enable with open circuit voltage limitation	ON	L3=ON				
+5Vdc voltage supply	ON	L4=ON				
+3.3Vdc voltage supply	ON	L5=ON				
CAN BUS comunications	ON	L6=ON* L7=ON*				* Blinking when there is a CAN BUS comunications
Serial Comunications	ON	L11=ON* L12=ON*				* Blinking when there is a serial comunication.

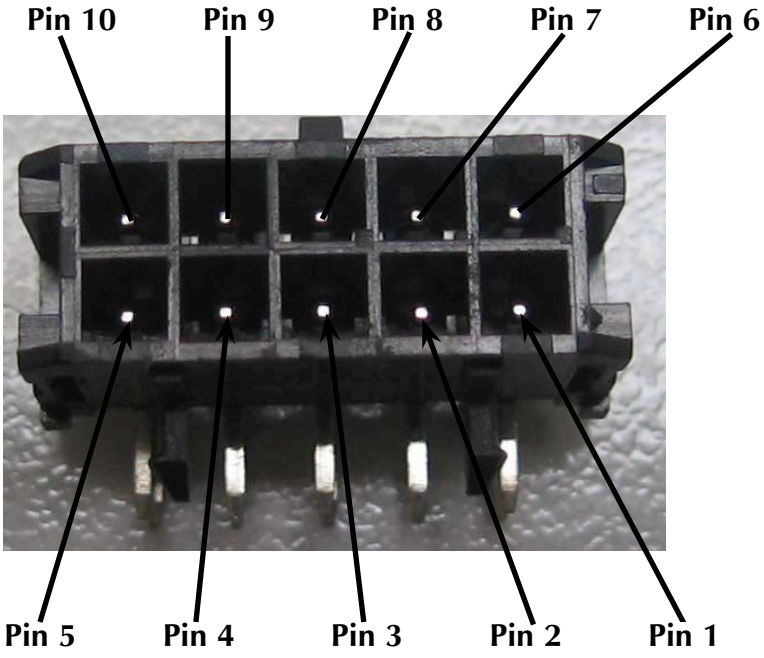
5.14) BUS P.C. BOARD 15.14.431



Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
+15Vdc CAN bus voltage supply	ON	CN8	CN8/1 ⟵ CN8/2	+15Vdc	Ⓥ	
Supply voltage	ON	CN9	CN9/3 ⟵ CN9/4 CN9/6 ⟵ CN9/4	+15Vdc +5Vdc	Ⓥ Ⓥ	
Hall sensor	ON	CN10	CN10/7 ⟵ CN10/2	0.68@50A 1.37@100A 2.02@150A 2.71@200A 3.38@250A	Ⓥ Ⓥ Ⓥ Ⓥ Ⓥ	Stick mode
NTC1	ON	CN11	CN11/1 ⟵ CN11/7	12kohm	Ⓞ	@T=25°C
T1	ON	CN11	CN11/2 ⟵ CN11/8	0ohm	Ⓞ	
+48Vdc CAN bus voltage supply	ON	CN12	CN12/1 ⟵ CN12/5	+48Vdc	Ⓥ	
+24Vdc CAN bus voltage supply	ON	CN13	CN13/5 ⟵ CN13/8	+24Vdc	Ⓥ	
Remote switch control command	ON	CN13	CN13/5 ⟵ CN13/4	+24Vdc* 0Vdc**	Ⓥ Ⓥ	*When is ON **When is OFF
Inverter Fan supply M2	ON	CN13	CN13/4 ⟵ CN13/8	+24Vdc	Ⓥ	
+15Vdc CAN bus voltage supply	ON	CN16	CN16/1 ⟵ CN16/3	+15Vdc	Ⓥ	

Connectors

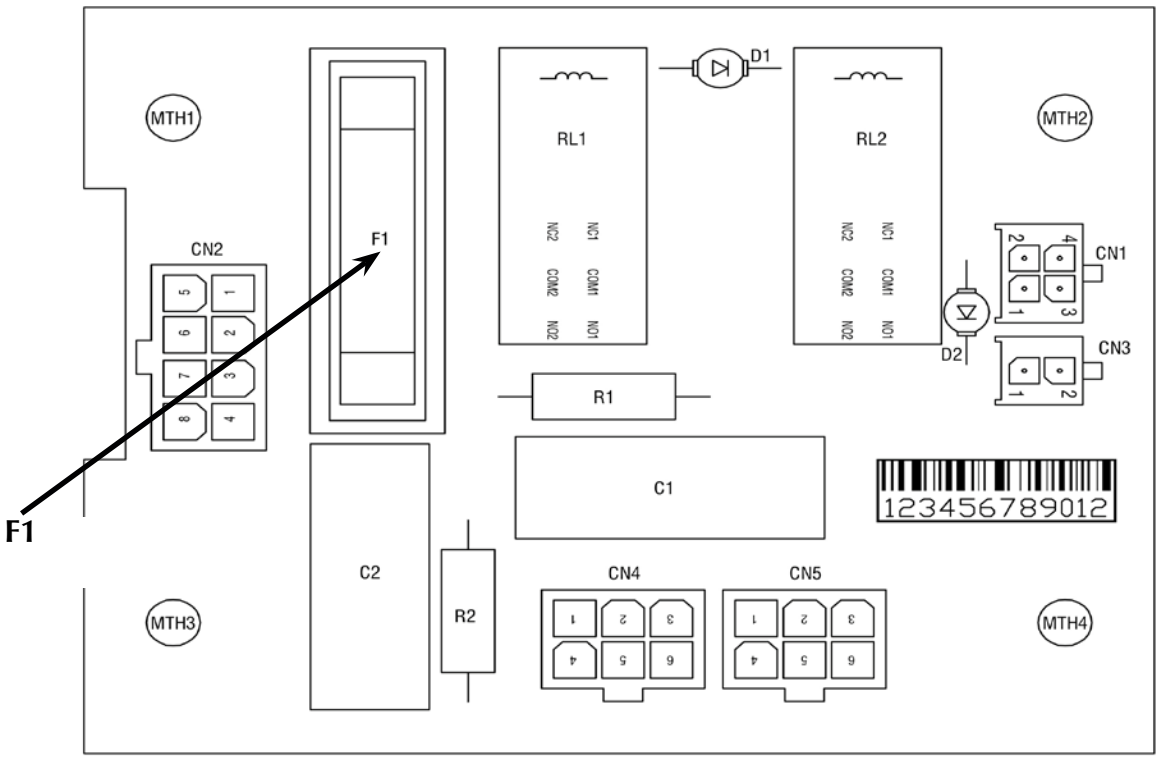

Pin 10
Pin 5


Pin 10
Pin 9
Pin 8
Pin 7
Pin 6
Pin 5
Pin 4
Pin 3
Pin 2
Pin 1

5.15) COOL ARC 34 - PUMP CONTROL P.C. BOARD 15.14.530

Board Function: Cooling unit system control. If the welding maching is supplied with 400Vac the voltage supplies directly the pump, else the machine is supplied with 230Vac and this voltage is the input voltage of the transformer that produces the 400Vac to supply the pump.

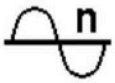
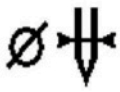
Location: Left side of CoolArc 34



Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Fuse	OFF	F1	F1/1 ⟷ F1/2	0ohm	Ω	
Cooling Unit Command	ON		CN1/2 ⟵ CN1/4	+24Vdc*	V	* When the cooling unit is ON
Power Supply	ON		CN2/3 ⟵ CN2/1 CN2/6 ⟵ CN2/1	400Vac 230Vac	V V	The supply voltage is 400Vac OR 230Vac
Power Supply after Relay and Fuse	ON		CN4/3 ⟵ CN4/1 CN4/5 ⟵ CN4/1	400Vac** 230Vac**	V V	** If relays or fuse are broken there aren't this voltage.

6) MENU INVERTEC V270T - V320T

Parameter Symbol	Selection/ * Default Value	Parameter Number	Description
See Figure B.7		0	Set Up menu Exit
0	NA	1	Reset All Parameters
A	% * Amps	3	Start Current Set Unit
A2	% Amps*	8	Bi-Level Current 2 Set Unit
A	% * Amps	10	Pulse Background Current Units
A	% Amps*	17	Finish Current Set Unit
A HF DC	15 amps*	307	DC TIG HF STRIKE CURRENT
A DC	60 amps*	306	DC LIFT TIG STRIKE CURRENT
A HF AC	30 amps*	307	AC TIG HF TIG STRIKE CURRENT
2S	Enabled* Disabled	214	2-Step trigger re-start
4S	Enabled Disabled*	215	4-Step trigger re-start
	Square* Sine Triangle	101	AC Waveform Shape
A1/A2	Enabled Disabled *	998	Bi-Level Trigger
	Enabled Disabled *	999	Spot Timer Trigger
VRD	0ff* Enabled to 12V Enabled to 20V Enabled to 30V	201	VRD Limit
		500	Not Used
	0 to 10 10*	552	Speaker Volume
	English* French Spanish	554	Display Language

Parameter Symbol	Selection/ * Default Value	Parameter Number	Description
	Display Off Display in 7 Segment LED Display*	751	Output Current Displayed
	Display Off* Display in 7 Segment LED Display	752	Output Voltage Displayed
	Display Off* Display in 7 Segment LED Display	753	Input Phase Displayed
	Display Off* Display in 7 Segment LED Display	754	Input Voltage Displayed
	Cooling Unit	995	
	This function sets the initial start energy limit. Set this number to a higher setting than the factory default if needed to improve starting of large diameter tungsten electrodes. 0.5 to 1.0 manual start energy setting. 1.2 to 5.0 = max. Incrementing limit. (See Note) **Note:** The machine will try to start the arc at a start power of 1. If the arc does not establish it will incrementally increase the start power and try to restrike up to the set limit.	104	AC TIG Start Power (for AC TIG only)