03-2009

INVERTEC® 310T ac/dc

For use with machines having code numbers: 10493

SERVICE MANUAL

LINCOLN® ELECTRIC

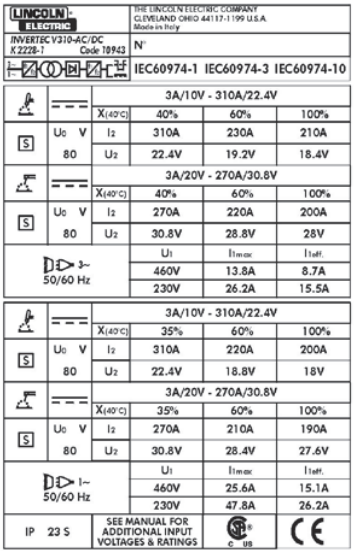
LINCOLN ELECTRIC EUROPE
www.lincolnelectric.eu

INDEX:

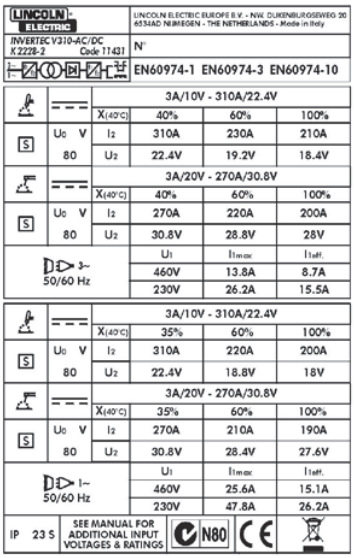
1) PURPOSE OF THE MANUAL

The purpose of this manual is to provide authorised technical servicing centres the information required for repairing INVERTEC V310-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.

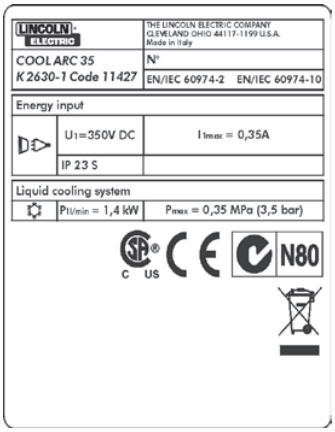
2) MACHINE TECHNICAL SPECIFICATIONS



LINCOLN ELECTRIC	THE LINCOLN ELECTRIC COMPANY CLEVELAND OHIO 44117-1199 U.S.A. Made in Italy			
INVERTEC V310-AC/DC K2228-1 Code 10943	N°			
	IEC60974-1 IEC60974-3 IEC60974-10			
	3A/10V - 310A/22.4V			
	X(40°C)	40%	60%	100%
Uo V 80	I2	310A	230A	210A
	U2	22.4V	19.2V	18.4V
	3A/20V - 270A/30.8V			
	X(40°C)	40%	60%	100%
Uo V 80	I2	270A	220A	200A
	U2	30.8V	28.8V	28V
3~ 50/60 Hz	U1	I1max	I1eff.	
	460V	13.8A	8.7A	
	230V	26.2A	15.5A	
	3A/10V - 310A/22.4V			
	X(40°C)	35%	60%	100%
Uo V 80	I2	310A	220A	200A
	U2	22.4V	18.8V	18V
	3A/20V - 270A/30.8V			
	X(40°C)	35%	60%	100%
Uo V 80	I2	270A	210A	190A
	U2	30.8V	28.4V	27.6V
1~ 50/60 Hz	U1	I1max	I1eff.	
	460V	25.6A	15.1A	
	230V	47.8A	26.2A	
IP 23 S	SEE MANUAL FOR ADDITIONAL INPUT VOLTAGES & RATINGS	C US	CE	



LINCOLN ELECTRIC	LINCOLN ELECTRIC EUROPE B.V. - NWE. DIJKENBURGWEG 20 6534AD NIJMEGEN - THE NETHERLANDS - Made in Italy			
INVERTEC V310-AC/DC K2228-2 Code 11431	N°			
	EN60974-1 EN60974-3 EN60974-10			
	3A/10V - 310A/22.4V			
	X(40°C)	40%	60%	100%
Uo V 80	I2	310A	230A	210A
	U2	22.4V	19.2V	18.4V
	3A/20V - 270A/30.8V			
	X(40°C)	40%	60%	100%
Uo V 80	I2	270A	220A	200A
	U2	30.8V	28.8V	28V
3~ 50/60 Hz	U1	I1max	I1eff.	
	460V	13.8A	8.7A	
	230V	26.2A	15.5A	
	3A/10V - 310A/22.4V			
	X(40°C)	35%	60%	100%
Uo V 80	I2	310A	220A	200A
	U2	22.4V	18.8V	18V
	3A/20V - 270A/30.8V			
	X(40°C)	35%	60%	100%
Uo V 80	I2	270A	210A	190A
	U2	30.8V	28.4V	27.6V
1~ 50/60 Hz	U1	I1max	I1eff.	
	460V	25.6A	15.1A	
	230V	47.8A	26.2A	
IP 23 S	SEE MANUAL FOR ADDITIONAL INPUT VOLTAGES & RATINGS	N80	CE	

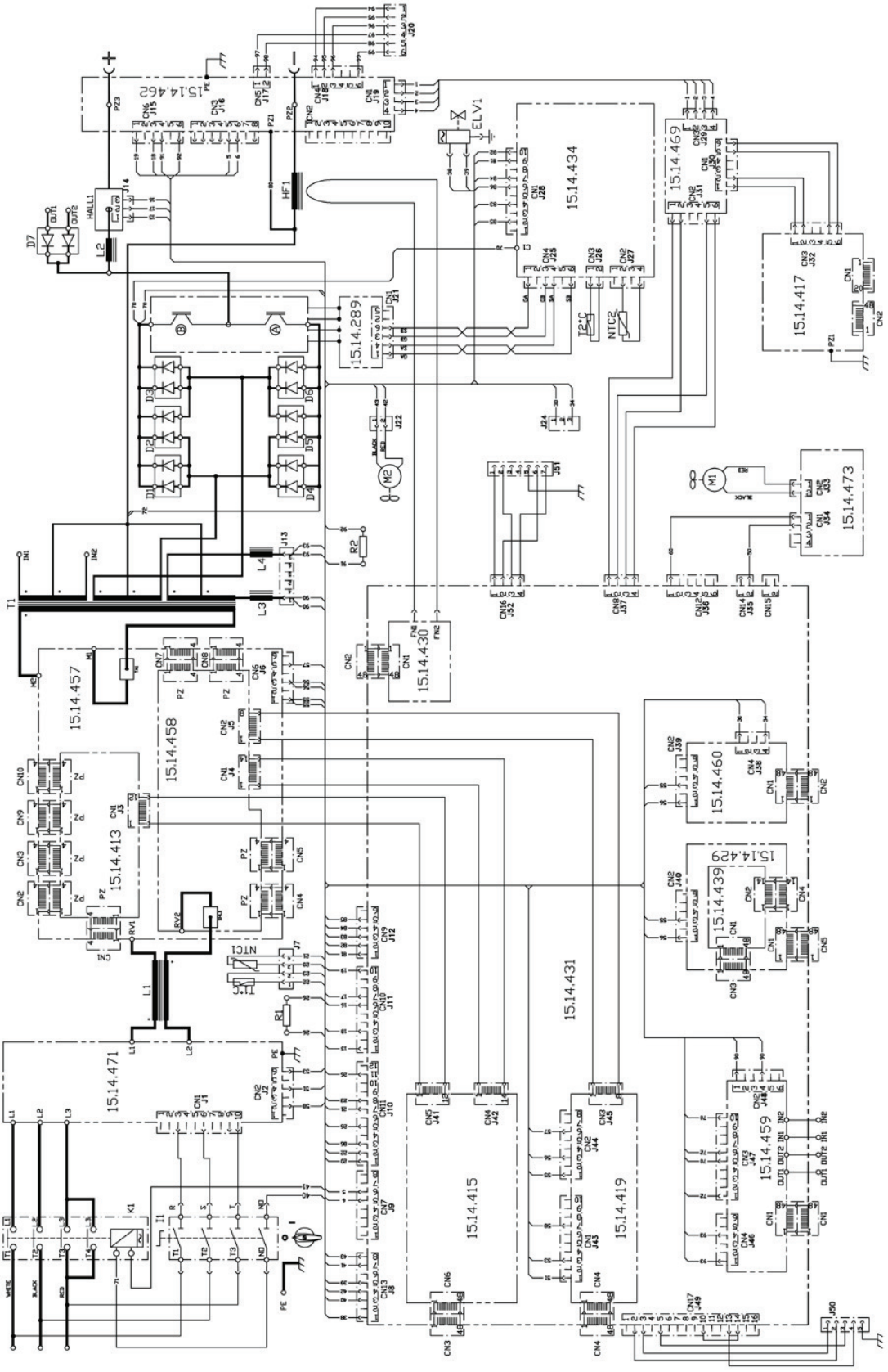


LINCOLN ELECTRIC	THE LINCOLN ELECTRIC COMPANY CLEVELAND OHIO 44117-1199 U.S.A. Made in Italy
COOL ARC 35 K 2630-1 Code 11427	N° EN/IEC 60974-2 EN/IEC 60974-10
Energy input	
U1=350V DC	I1max = 0,35A
IP 23 S	
Liquid cooling system	
P1l/min = 1,4 kW	Pmax = 0,35 MPa (3,5 bar)

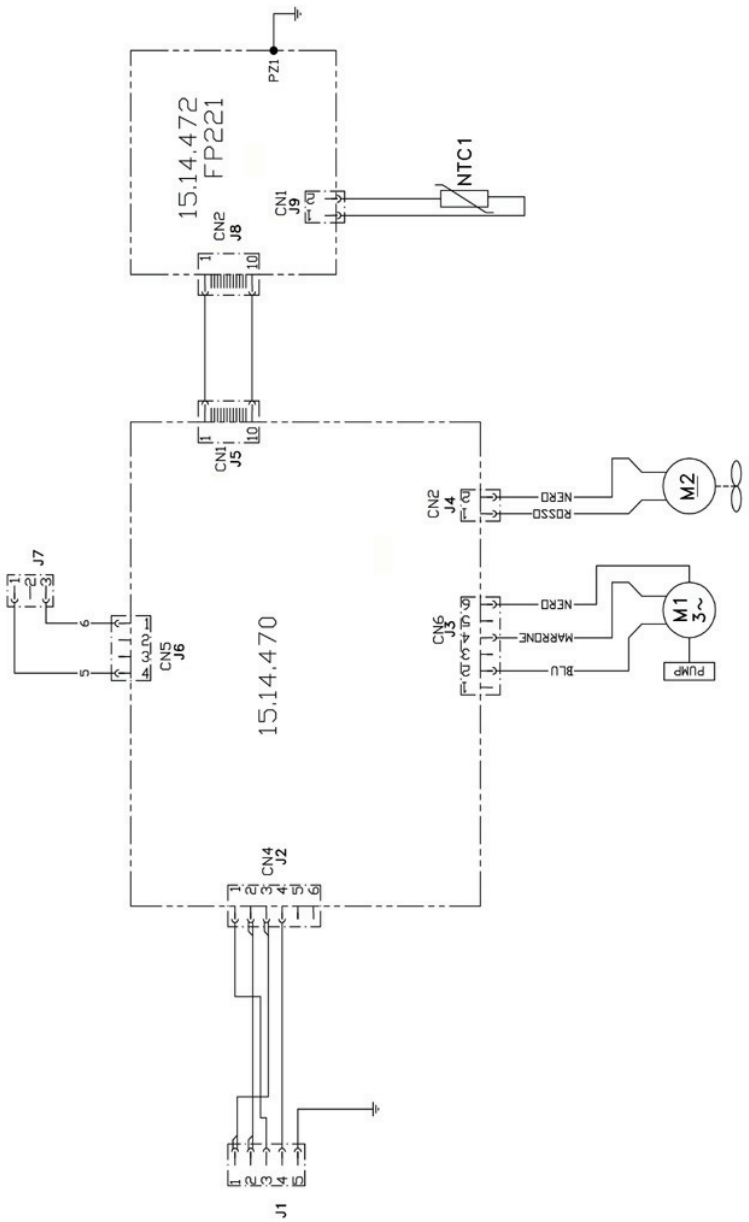
C US CE N80

3) WIRING DIAGRAM

3.1) K2228-1 INVERTEC V310-T AC/DC USA

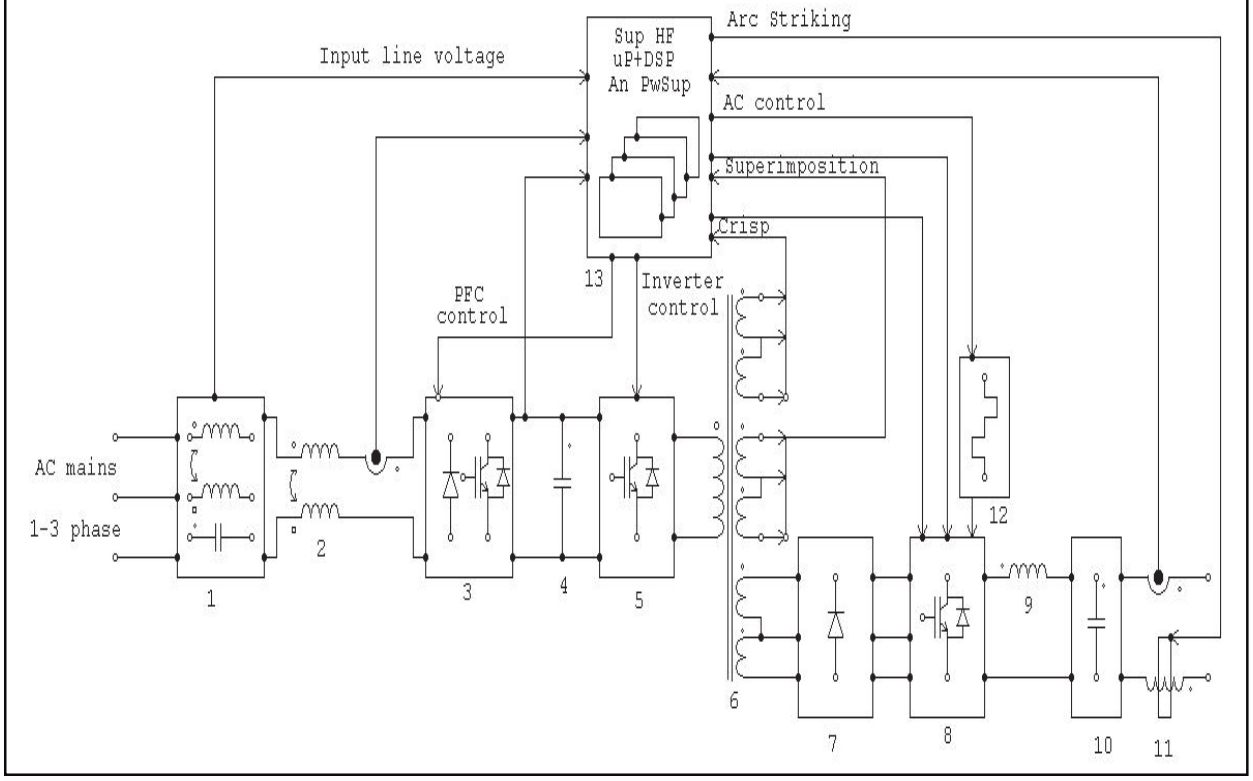


3.2) K2630 - COOL ARC 35



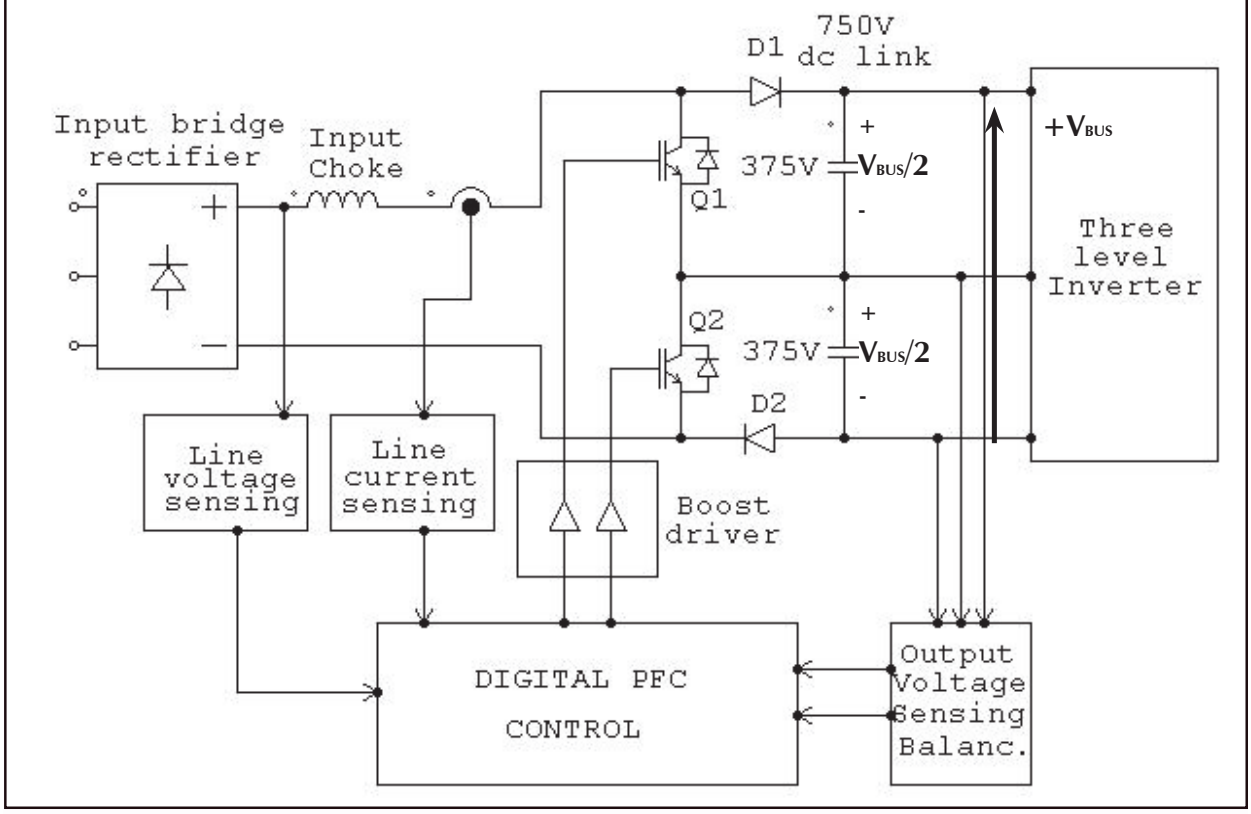
4) DESCRIPTION OF MACHINE OPERATION

POWER SOURCE BLOCK DIAGRAM



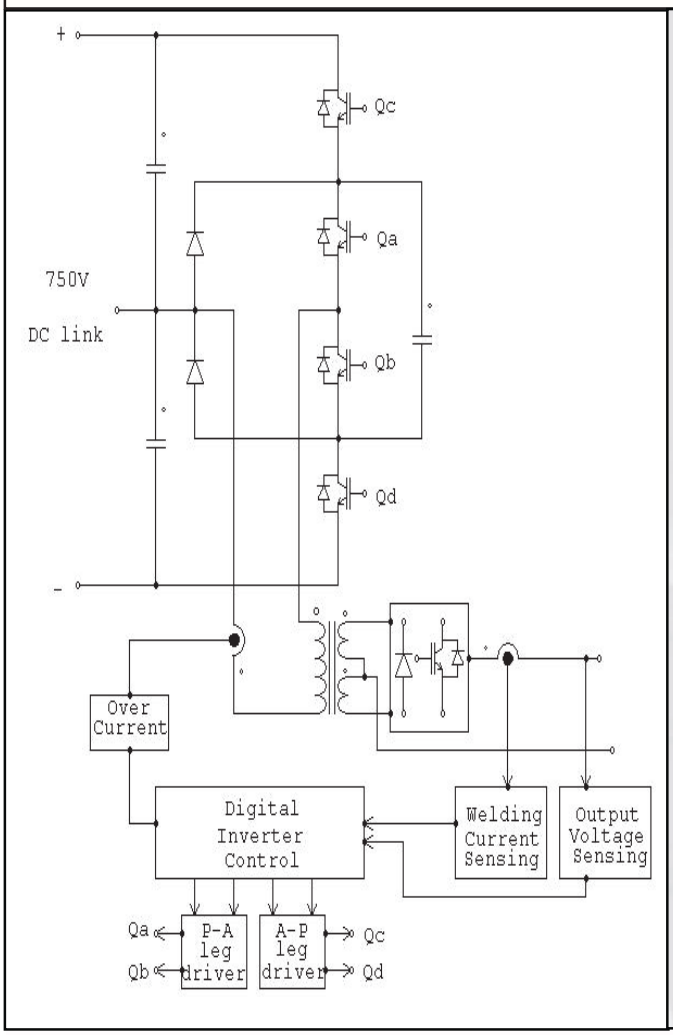
1 – EMI INPUT FILTER
2 – INPUT CHOKE + RECTIFIER
3 – P.F.C. (POWER FACTOR CORRECTOR)
4 – DC LINK CAPACITORS
5 – ZVS PHASE SHIFTED THREE LEVEL INVERTER
6 – HIGH FREQUENCY POWER TRANSFORMER
7 – OUTPUT RECTIFIER
8 – OUTPUT AC INVERTER
9 – OUTPUT CHOKE
10– OUTPUT FILTER
11– H.F. TRANSFORMER
12– AC CONTROL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

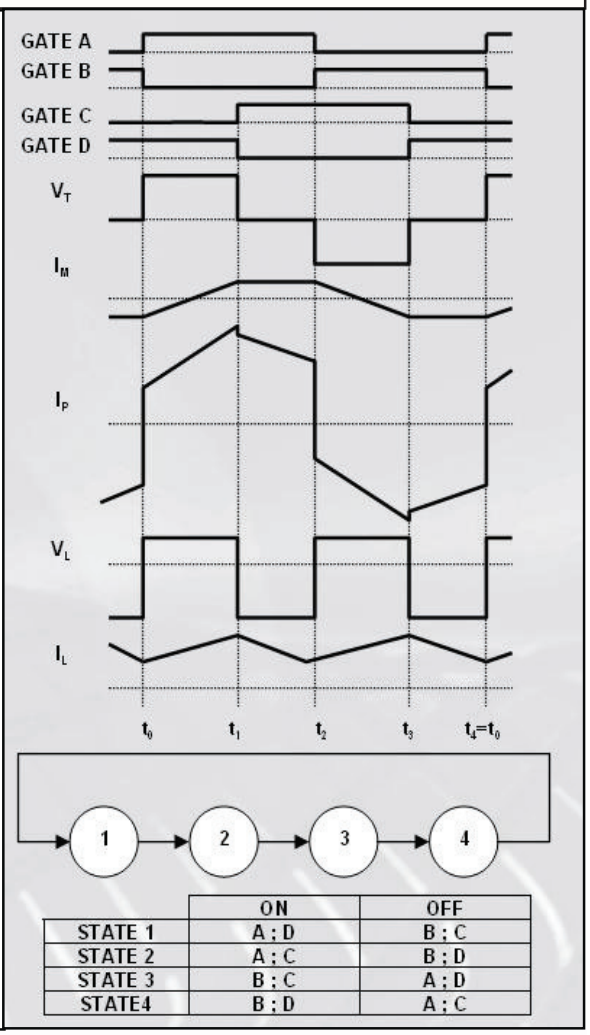
UNITY POWER FACTOR RECTIFIER



- 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

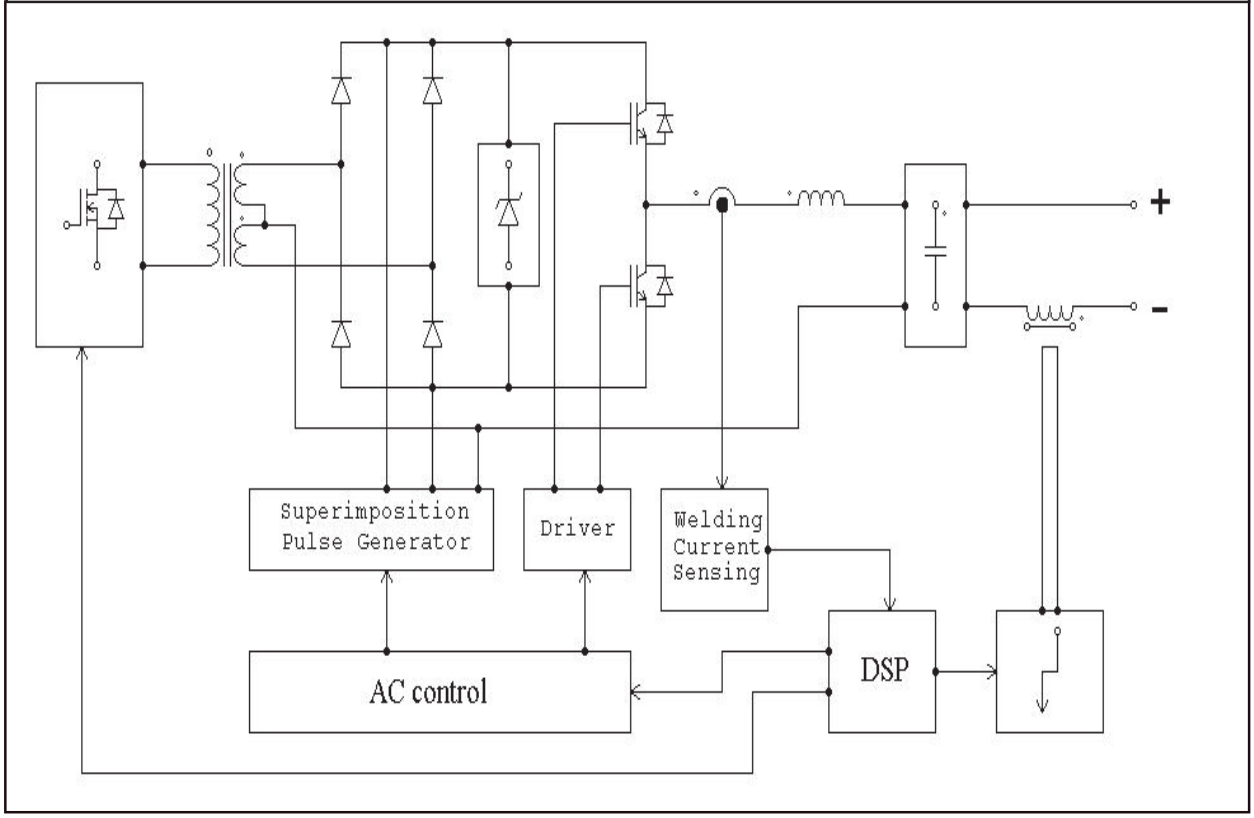
• 80kHz switching frequency
- Fast response welding current loop
- High stability welding arc

• Digital control by DSP

• ZVS for IGBTs
- Improved efficiency and reduced EMI

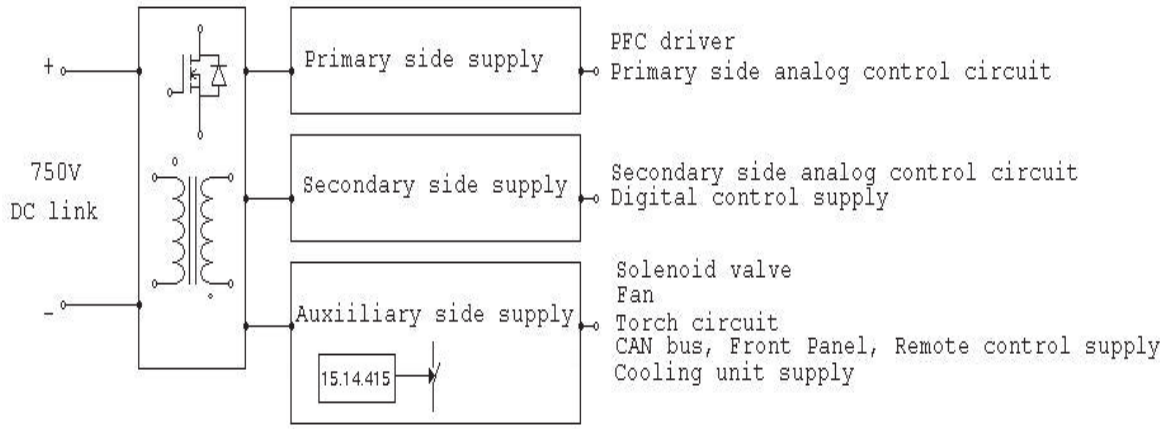
• Primary overcurrent fast protection circuit

OUTPUT RECTIFIER & AC INVERTER



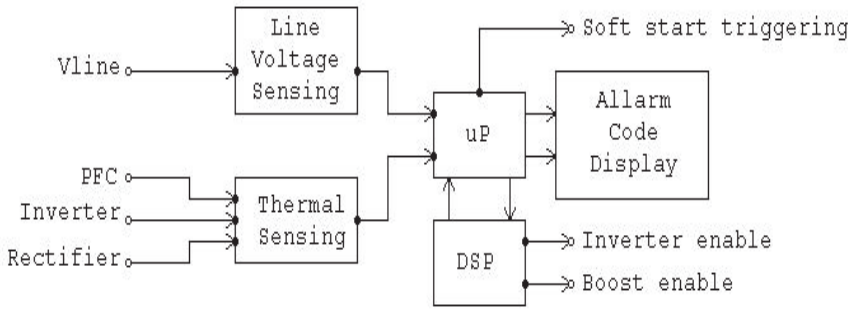
- Full bridge FRED rectifier magnetic snubbered.
- DSP AC current shaping.
- DSP controlled inversion.
  Minimized voltage clamp.
- Superimposition pulse generator.
  Easy arc inversion and stable arc in AC welding.
- DSP triggered arc stiking circuit
- Superimposition pulse and arc striking pulse
  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:

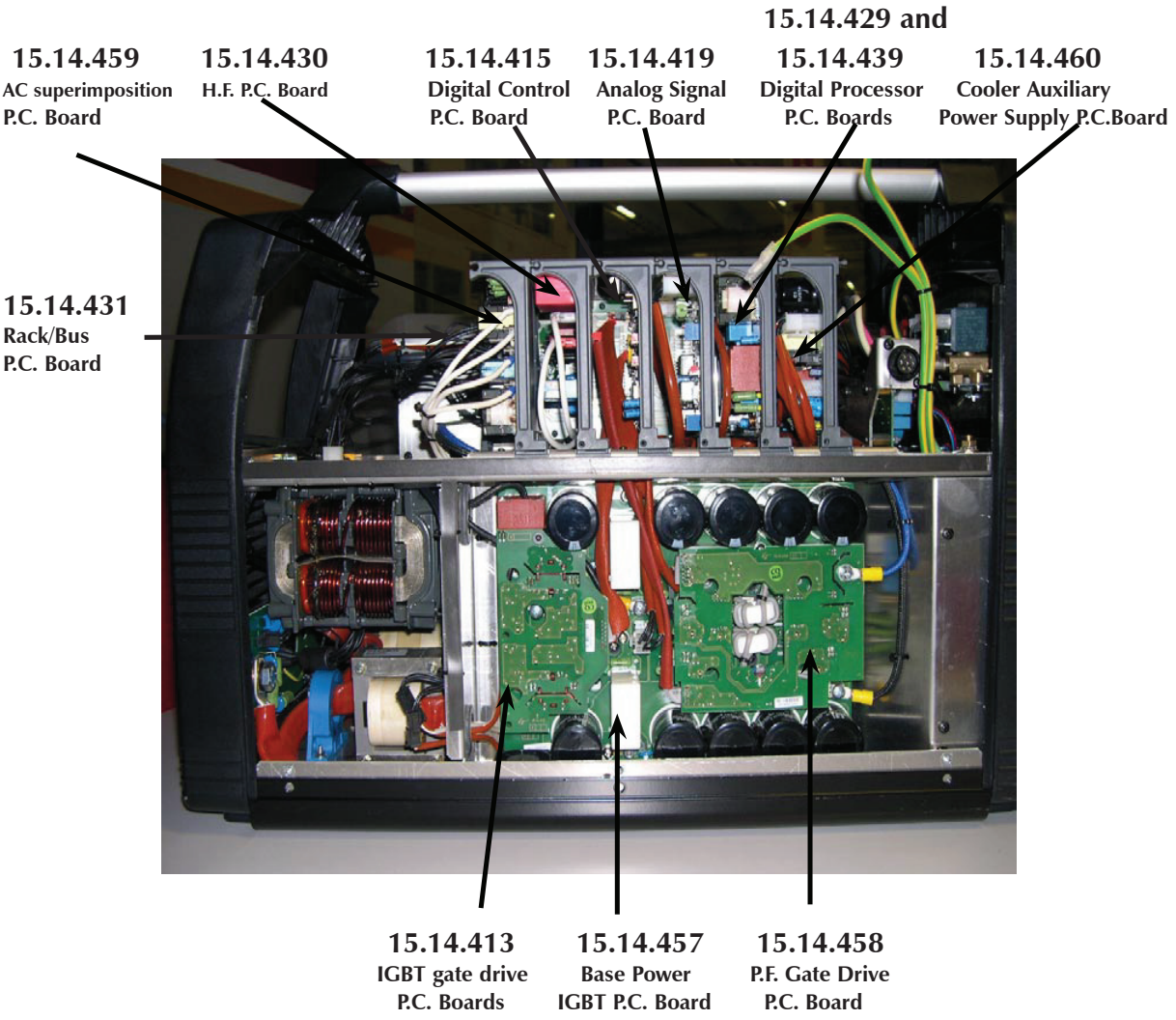
AC or DC voltage measurement (multimeter in voltmeter mode)

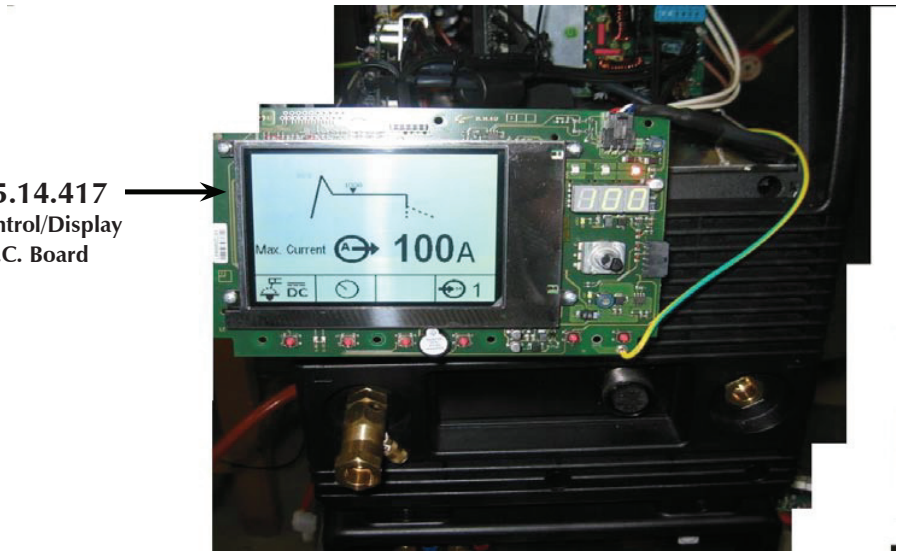
Resistance measurement (multimeter in ohmmeter mode)

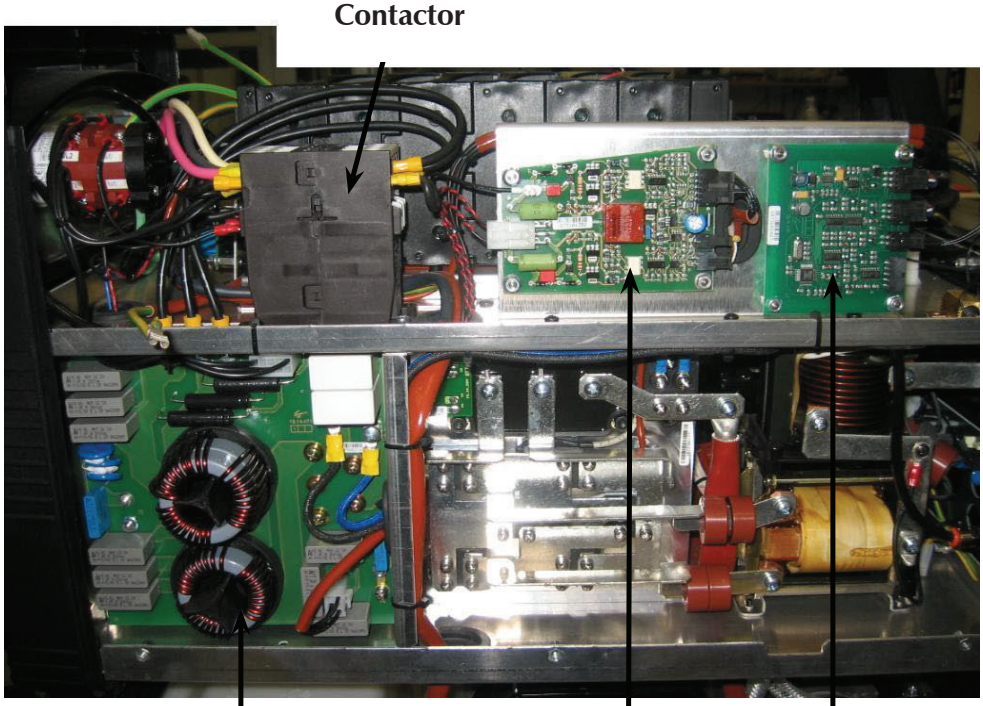
Current measurement (ammeter clamp or shunt + multimeter in millivoltmeter mode)

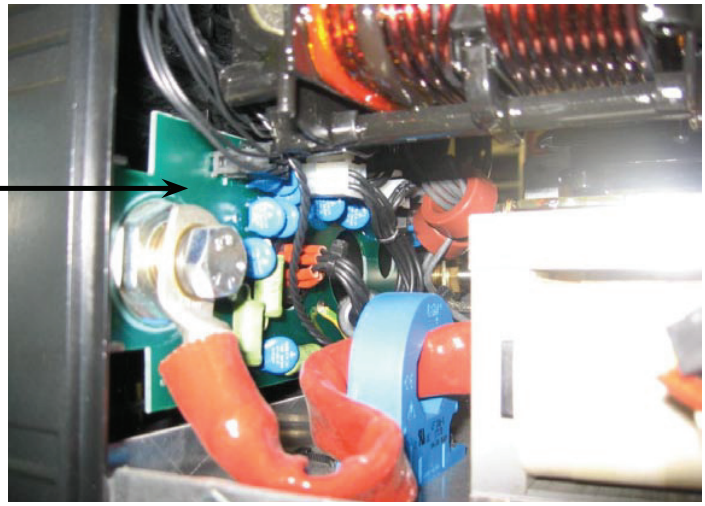
The measuring conditions (power source on/off etc.) are always clearly indicated beside the values to be measured.
The connector terminals are indicated by the name of the connector followed by a slash and the number of the terminal; for example CN1/2 indicates terminal 2 of connector CN1.

POSITION OF THE BOARD INSIDE THE INVERTEC V310T

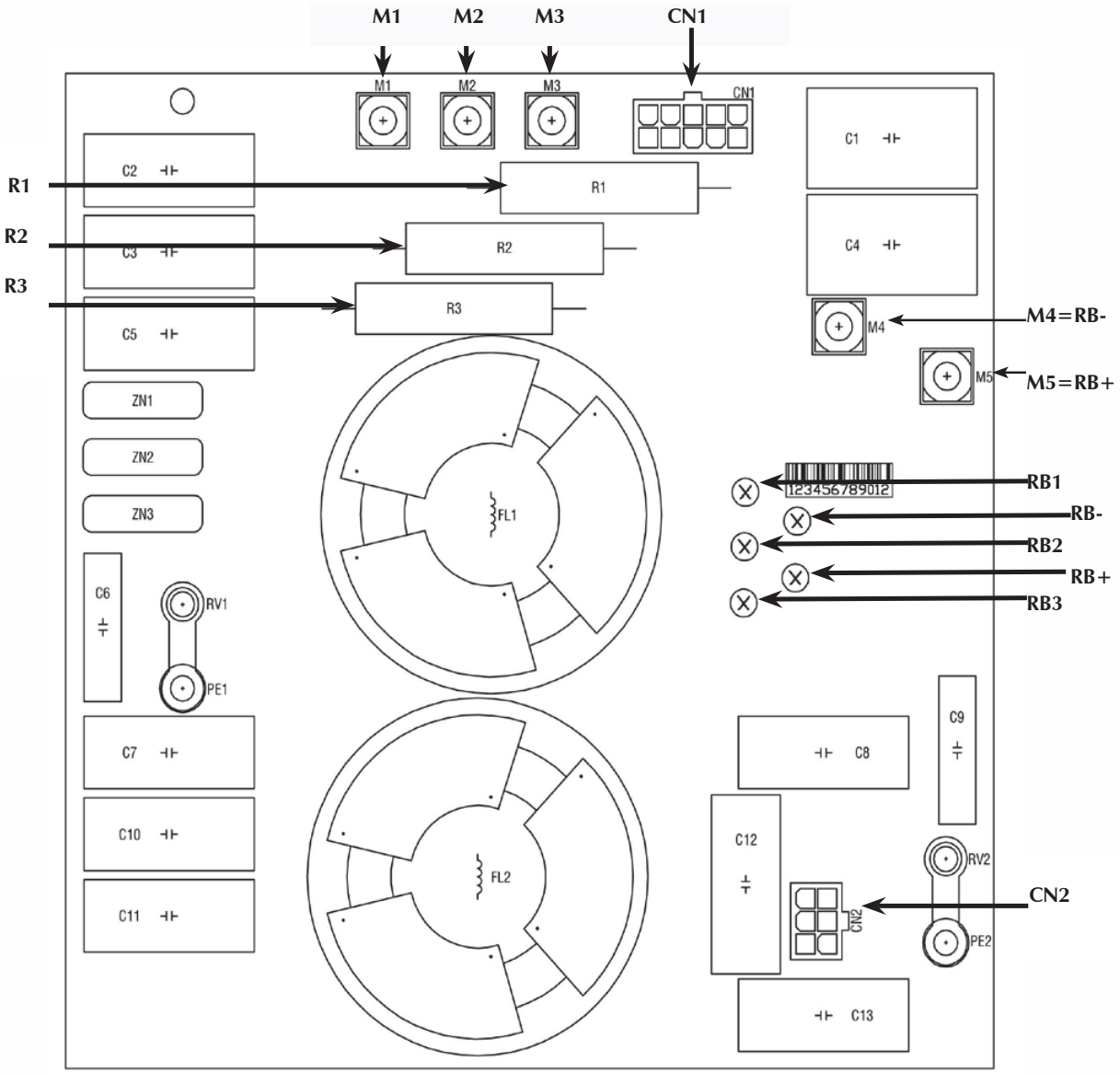


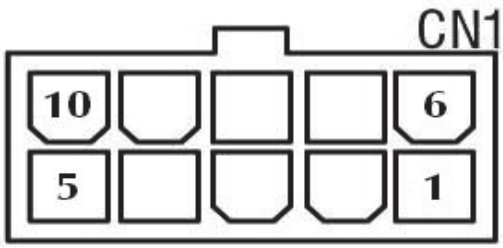


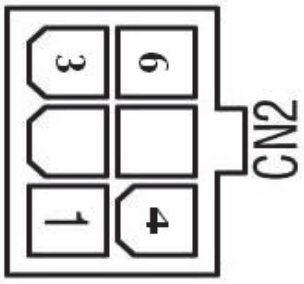

Contactor
15.14.471
Input P.C. Board
15.14.434
Output Module
Driver P.C. Board
15.14.469
A/D Remote Control
conversion Board


15.14.462
Output Filter
P.C. Board

5.1) 15.14.471 INPUT FILTER P.C. BOARD



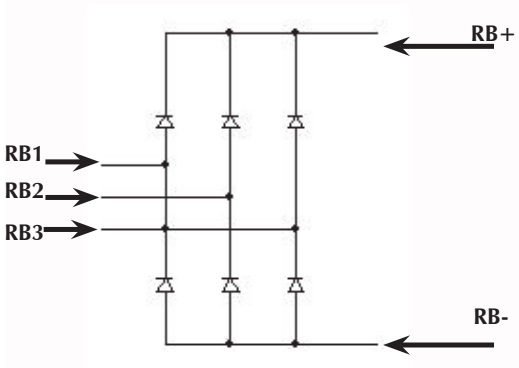


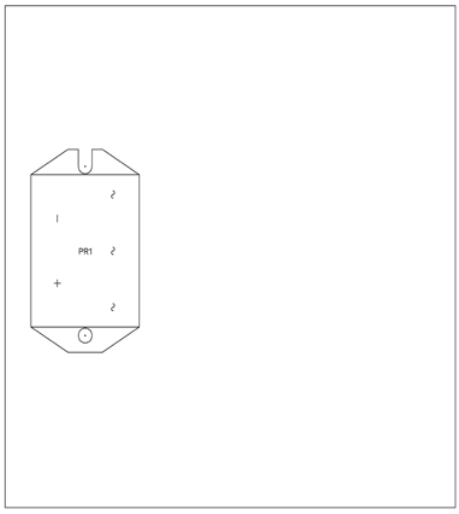


Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Supplies voltage	ON	---	CN1/3 ⟷ CN1/6	400Vac	V	From input switch
			CN1/3 ⟷ CN1/10	400Vac	V	
			CN1/6 ⟷ CN1/10	400Vac	V	
			M1 ⟷ M2	400Vac*	V	*With contactor ON
			M1 ⟷ M3	400Vac*	V	
			M2 ⟷ M3	400Vac*	V	
			CN2/2 ⟷ CN2/4	400Vac	V	To 15.14.419 Analog Signal P.C. Board
			CN2/2 ⟷ CN2/6	400Vac	V	
			CN2/4 ⟷ CN1/6	400Vac	V	
Rectifier Voltage	ON	---	RB+ ⟵ RB-	+565Vdc	V	
Input Bridge Rectifier	OFF	RB	RB1 ⟵ RB+	+0.5Vdc	⏚	
			RB2 ⟵ RB+	+0.5Vdc	⏚	
			RB3 ⟵ RB+	+0.5Vdc	⏚	
			RB- ⟵ RB1	+0.5Vdc	⏚	
			RB- ⟵ RB3	+0.5Vdc	⏚	
			RB- ⟵ RB3	+0.5Vdc	⏚	
Pre-load resistance	OFF	R1	R1/1 ⟷ R1/2	8.2ohm	Ω	
		R2	R2/1 ⟷ R2/2	8.2ohm	Ω	
		R3	R3/1 ⟷ R3/2	8.2ohm	Ω	

Note:

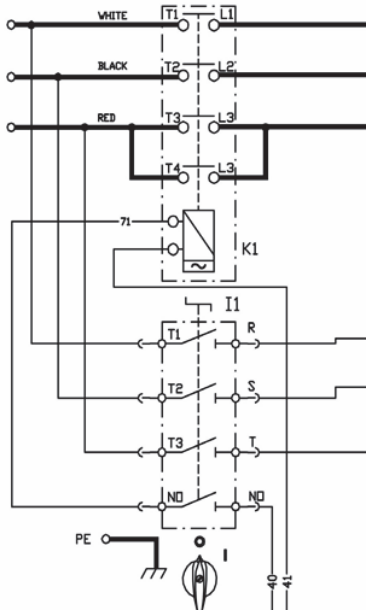
*** Rectifier Bridge**

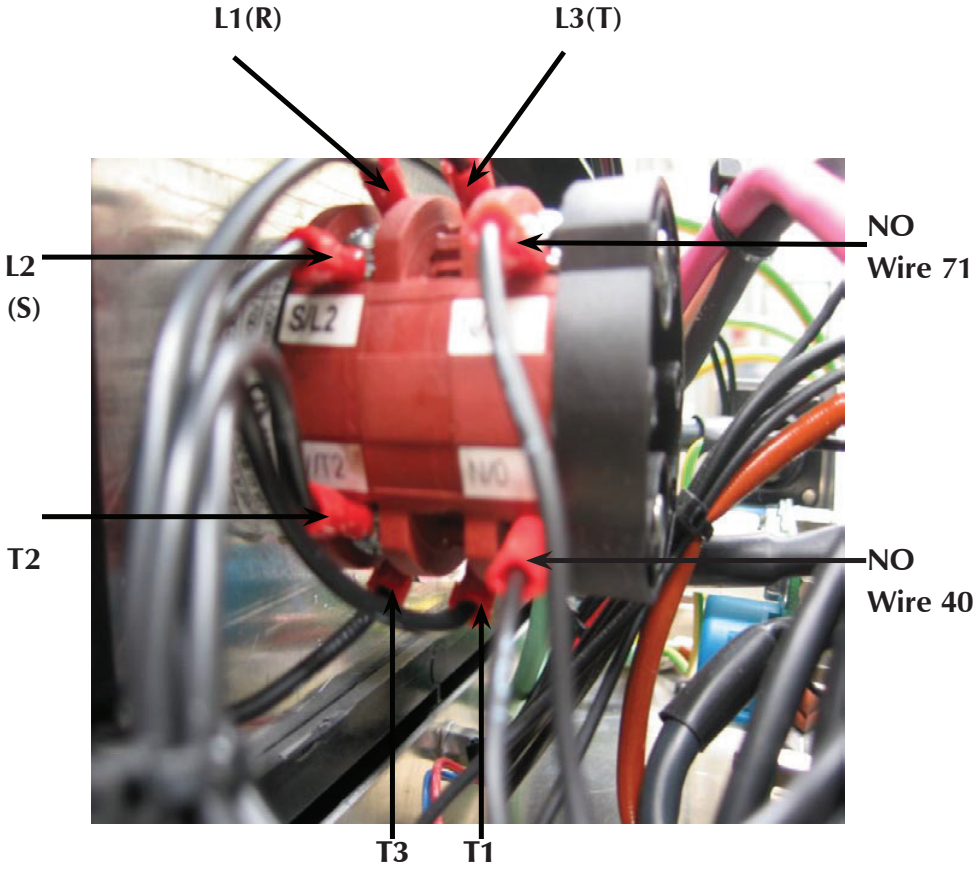




Soldering side

Input switch





WARNING

If plug is connected between T1, T2 and T3 there is the input voltage independently from input switch state (0 or 1).

Disconnect the input plug.

Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Supplies voltage	OFF (IS=0) **Plug disconnects**	---	T1⟷R	Open circuit	Ω	
			T2⟷S	Open circuit	Ω	
			T3⟷T	Open circuit	Ω	
			Wire71⟷Wire40	Open circuit	Ω	
	ON (IS=1) **Plug disconnects**	---	T1⟷R	0ohm	Ω	
			T2⟷S	0ohm	Ω	
			T3⟷T	0ohm	Ω	
			Wire71⟷Wire40	0ohm	Ω	

Connect the plug

WARNING

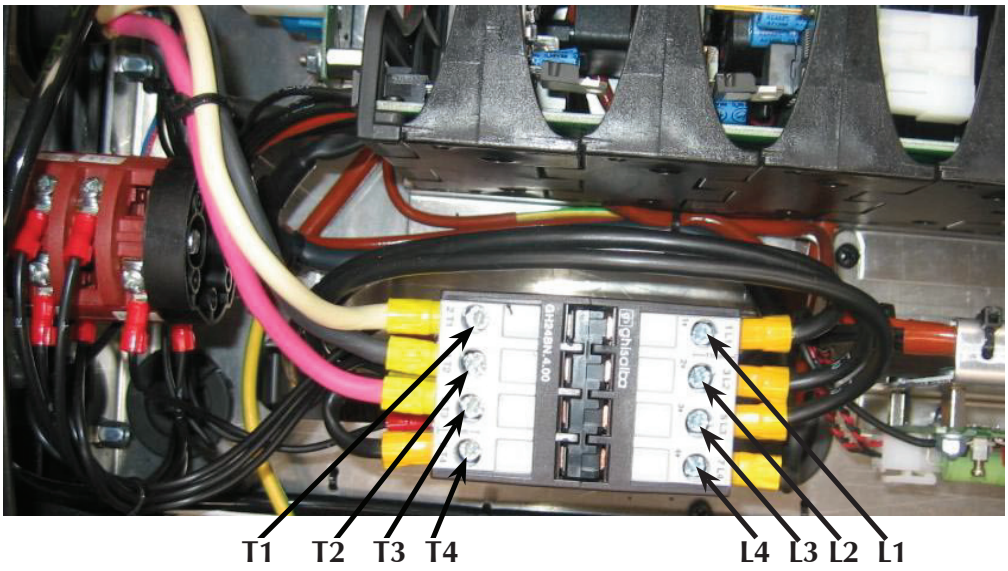
With plug connects between T1, T2 and T3 there is the input voltage independently from input switch state (0 or 1).

Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Supplies voltage	OFF (IS=0)	---	T1⟷T2	400Vac	V	
			T1⟷T3	400Vac	V	
			T2⟷T3	400Vac	V	
			R⟷S	0Vac	V	
			R⟷T	0Vac	V	
			S⟷T	0Vac	V	
	ON (IS=1)	---	T1⟷T2	400Vac	V	
			T1⟷T3	400Vac	V	
			T2⟷T3	400Vac	V	
			R⟷S	400Vac	V	To 15.14.471 P.C. Board
			R⟷T	400Vac	V	
			S⟷T	400Vac	V	

Contactor

1. Mechanical control

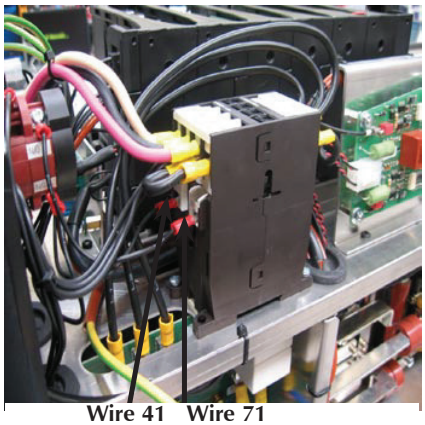
This control must be done with the input plug disconnect.



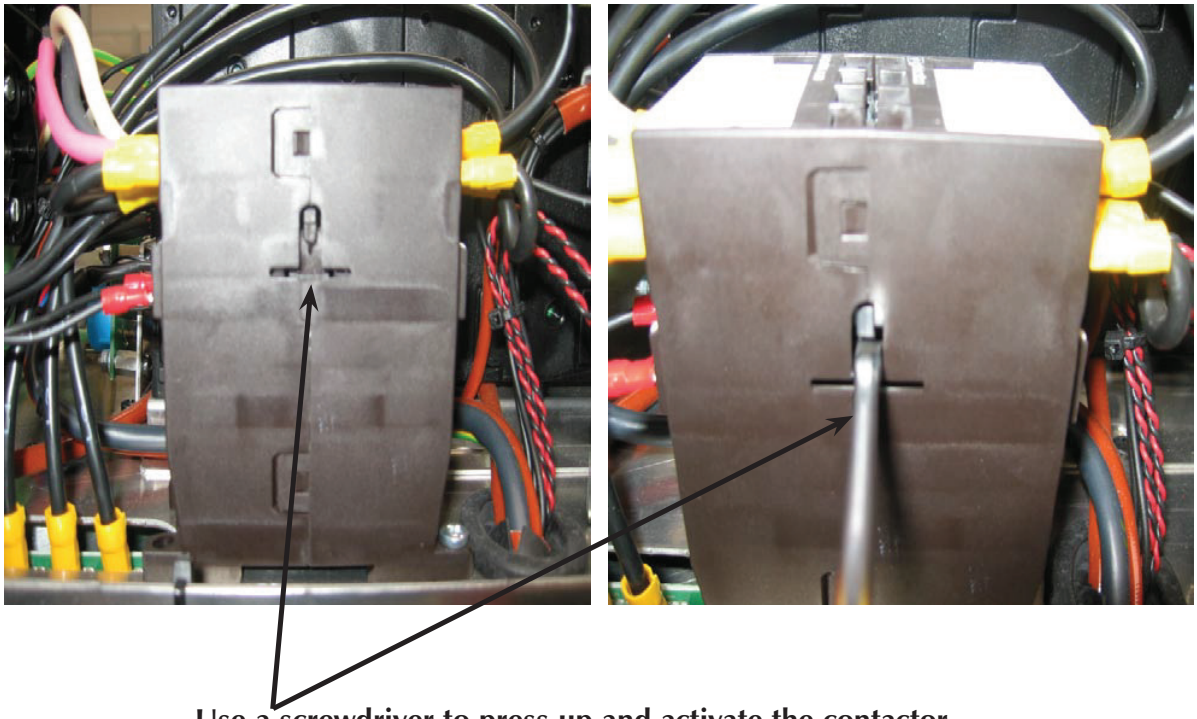
Disconnect the plug

Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Contactor mechanical control	OFF **Plug disconnects**	---	T1 ⟷ L1	Open circuit	Ω	
			T2 ⟷ L2	Open circuit	Ω	
			T3 ⟷ L3	Open circuit	Ω	
			T4 ⟷ L4	Open circuit	Ω	
Coil	OFF **Plug disconnects**	---	Wire 41 ⟷ Wire71	170ohm	Ω	

Coil of contactor



Press up to activate the contactor



Use a screwdriver to press up and activate the contactor

Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Contactor mechanical control	OFF **Plug disconnects**	---	T1 ⟷ L1 T2 ⟷ L2 T3 ⟷ L3 T4 ⟷ L4	0ohm 0ohm 0ohm 0ohm	Ω Ω Ω Ω	

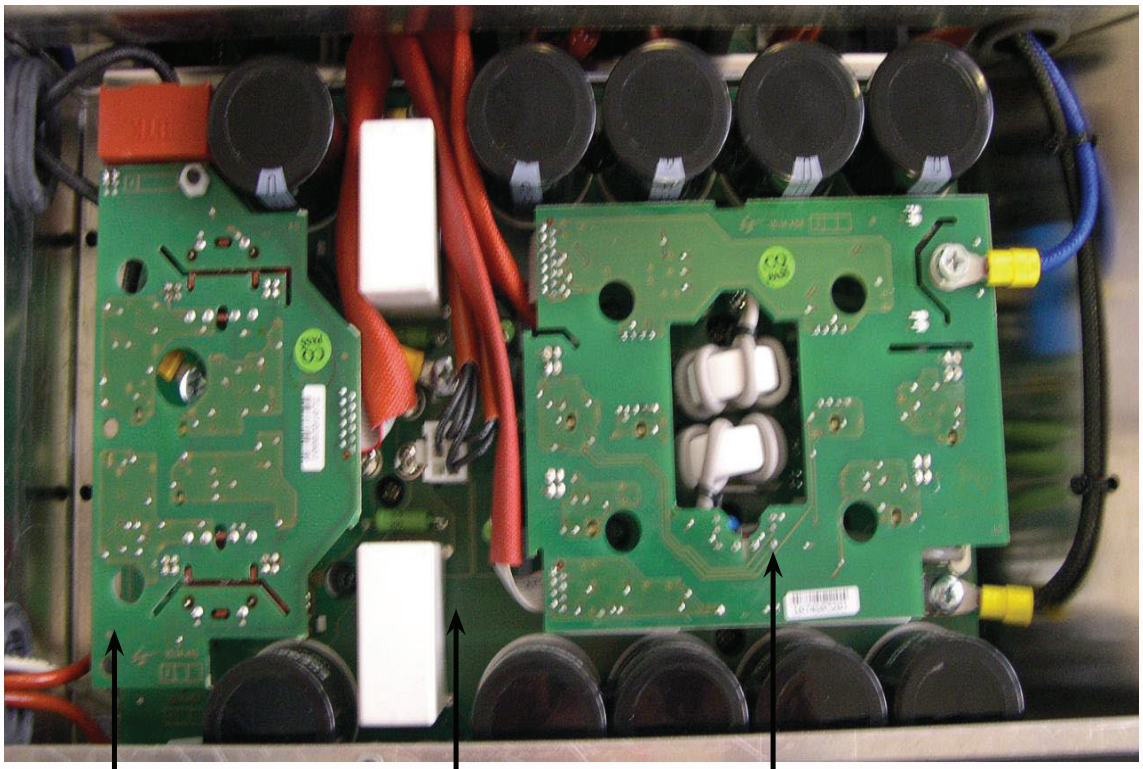
2. Contactor command

Connect the plug.
Switch-on the machine.

Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Contactor command	ON	---	Wire 41 ⟵ Wire71	+24Vdc	V	

5.2) POWER MODULE

- 15.14.457 POWER P.C. BOARD
- 15.14.413 INVERTER DRIVER P.C. BOARD
- 15.14.458 BOOST DRIVER P.C. BOARD

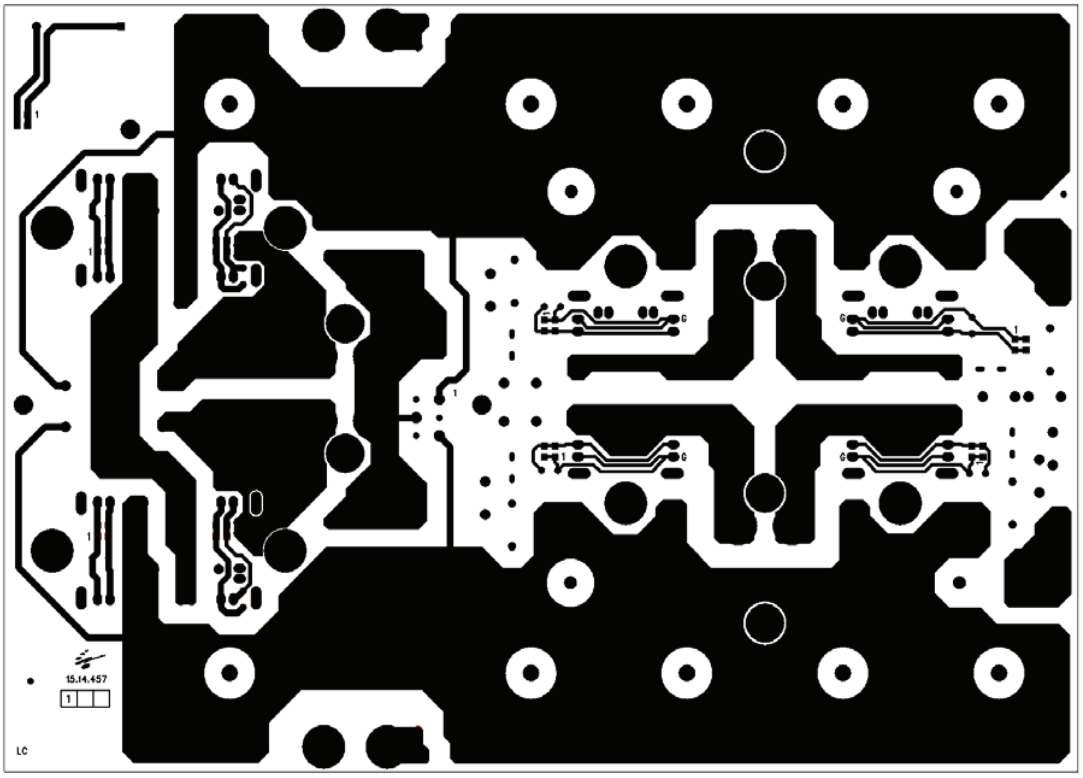


15.14.457
POWER P.C. BOARD

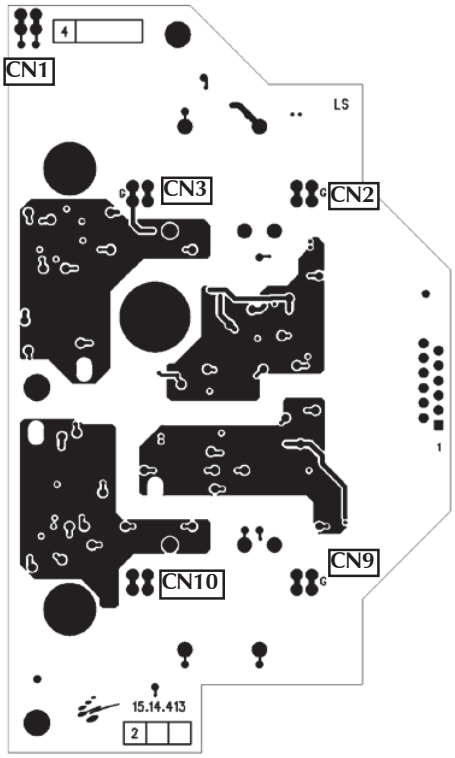
15.14.413
INVERTER DRIVER P.C. BOARD

15.14.458
BOOST DRIVER P.C. BOARD

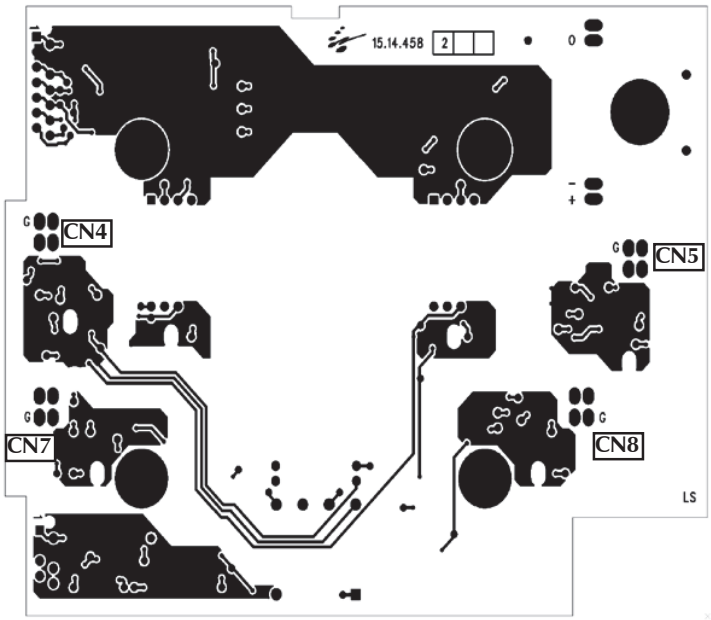
15.14.457



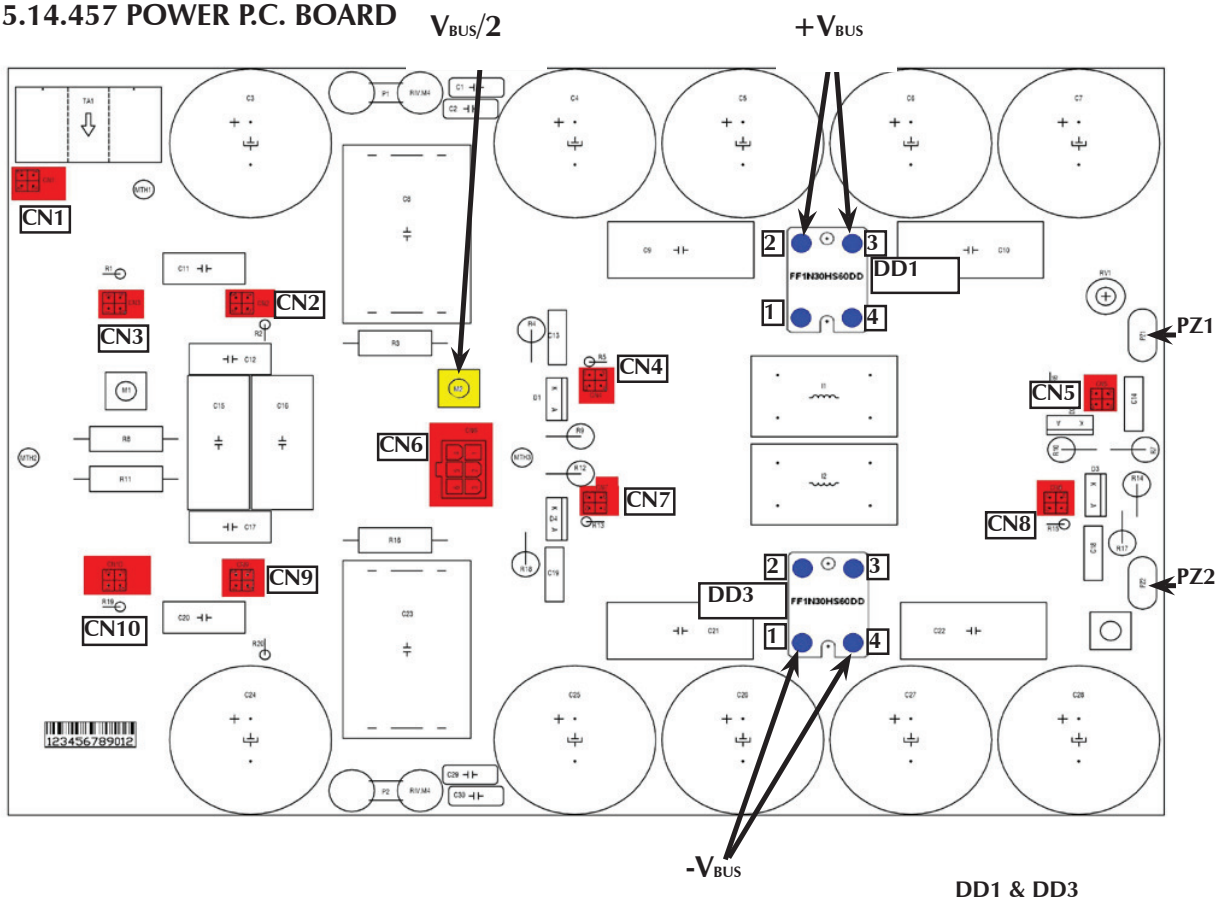
15.14.413

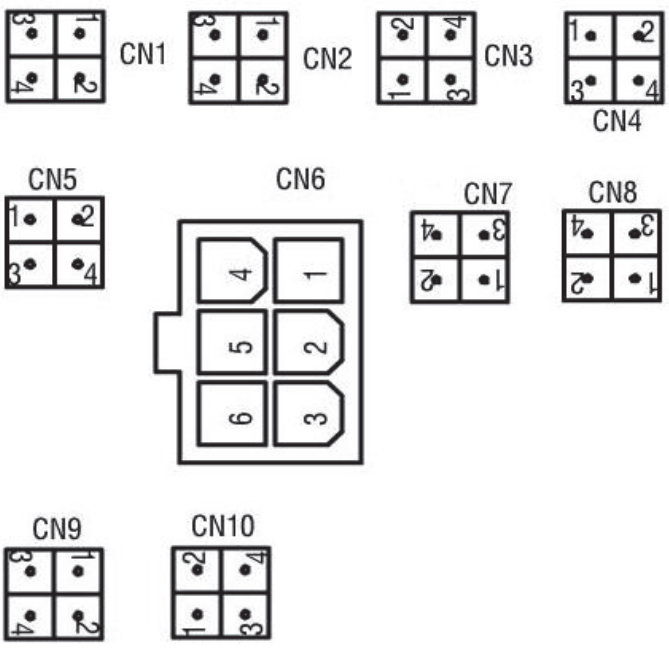


15.14.458

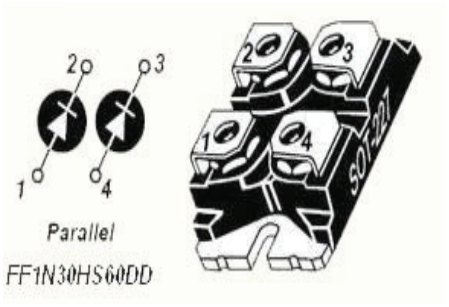


15.14.457 POWER P.C. BOARD

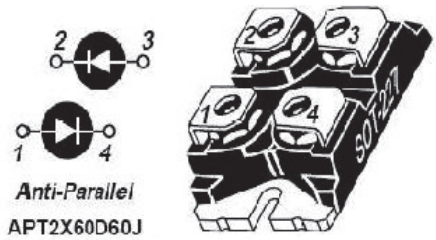




DD1 & DD3



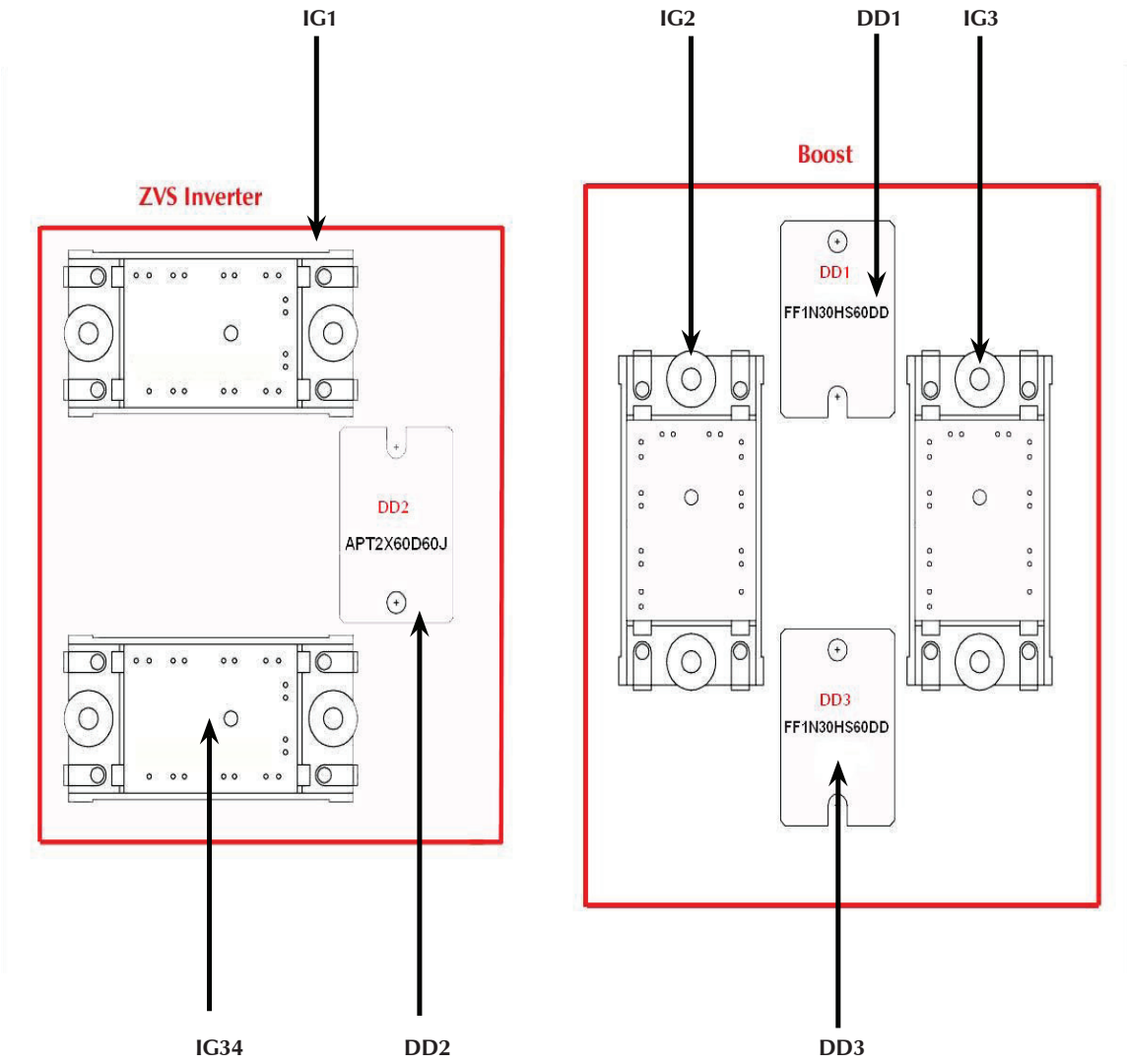
DD2



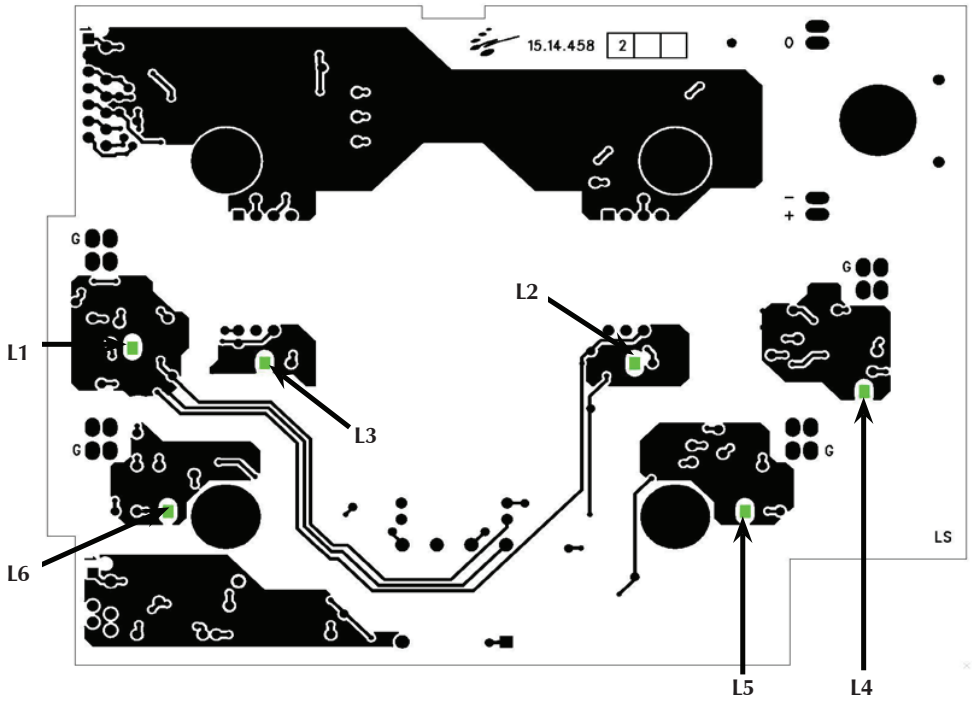
Diodi APT

Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Boost	OFF	IG2	CN4/4 ⟷ CN4/1	3.3kohm*	Ω	3.3kohm is obtained with the parallel of 10kohm resistor on 15.14.457 PC board with 4.7kohm on PC board 15.14.458
			CN7/4 ⟷ CN7/1	3.3kohm*	Ω	
			CN4/4 ⟵ PZ1	+0.4Vdc	⏚	
			CN7/4 ⟵ CN6/5	+0.4Vdc	⏚	
		IG3	CN5/4 ⟷ CN5/1	3.3kohm*	Ω	*Boost command from 15.14.415 Digital Processor P.C. Board FLAT cable B
			CN8/4 ⟷ CN8/1	3.3kohm*	Ω	
			CN6/5 ⟵ PZ1	+0.4Vdc	⏚	
			CN8/4 ⟵ CN6/5	+0.4Vdc	⏚	
		DD1	PZ1 ⟵ CN6/1	+0.35Vdc	⏚	
		DD3	CN6/3 ⟵ PZ2	+0.35Vdc	⏚	
Inverter	OFF	IG1	CN2/4 ⟷ CN2/1	1.8kohm**	Ω	1.8kohm is obtained with the parallel of 10kohm resistor on 15.14.457 PC board with 2.2kohm on PC board 15.14.413
			CN3/4 ⟷ CN3/1	1.8kohm**	Ω	
			CN2/4 ⟵ CN6/1	+0.4Vdc	⏚	
			CN3/4 ⟵ CN2/4	+0.4Vdc	⏚	
		IG4	CN9/4 ⟷ CN9/1	1.8kohm**	Ω	**Inverter command from 15.14.415 Digital Processor P.C. Board FLAT cable A
			CN10/4 ⟷ CN10/1	1.8kohm**	Ω	
			CN9/4 ⟵ CN3/4	+0.4Vdc	⏚	
			CN6/3 ⟵ CN9/4	+0.4Vdc	⏚	
		DD2	CN6/5 ⟵ CN2/4	+0.35Vdc	⏚	
			CN9/4 ⟵ CN6/5	+0.35Vdc	⏚	
DC LINK Voltage	ON	---	$+V_{BUS}$ ⟵ $-V_{BUS}$	+750Vdc	V	From CN6 connector to: 15.14.419 Analog Signal P.C. Board
			CN6/1 ⟵ CN6/3			
			$+V_{BUS}$ ⟵ $V_{BUS}/2$	+375Vdc	V	15.14.429 Switching Power Supply P.C. Board
			CN6/1 ⟵ CN6/5			
			$V_{BUS}/2$ ⟵ $-V_{BUS}$	+375Vdc	V	15.14.460 Cooler Auxiliary Power Supply P.C. Board
			CN6/5 ⟵ CN6/3			

Power Modules

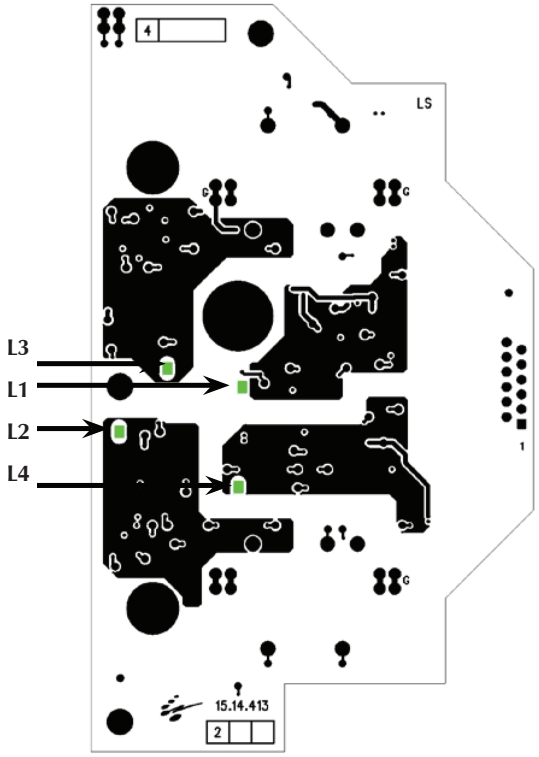


15.14.458 Boost Driver P.C. Board



Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Driver Boost Power Supply	ON	L2=ON	---	---	---	Voltage supplies for boost command
		L3=ON	---	---	---	
Driver Boost	ON	L1=ON	---	---	---	Boost command through Flat B 15.14.415. V_{BUS}=750V
		L4=ON	---	---	---	
		L5=ON	---	---	---	
		L6=ON	---	---	---	

15.14.413 Inverter Driver P.C. Board

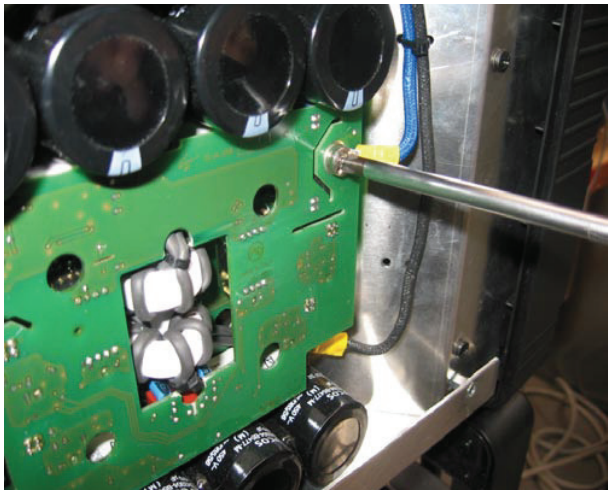


Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Inverter Driver	ON	L1=ON*	---	---	---	*Stick mode
		L2=ON*	---	---	---	Inverter command through 15.14.415 FLAT cable A
		L3=ON*	---	---	---	
		L4=ON*	---	---	---	

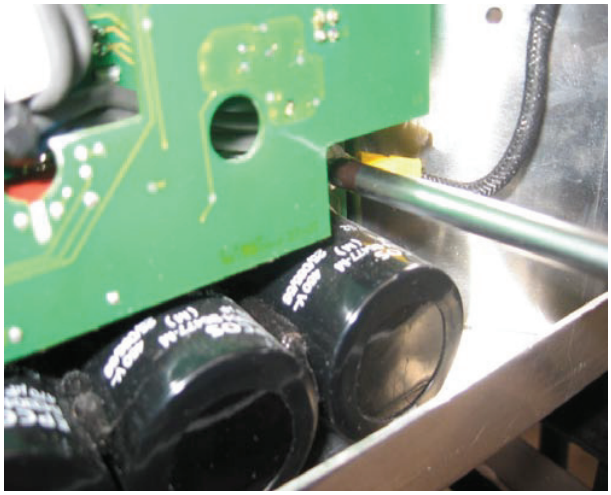
To Remove the Power Module in this way:

1. Remove the flat cable and connectors.

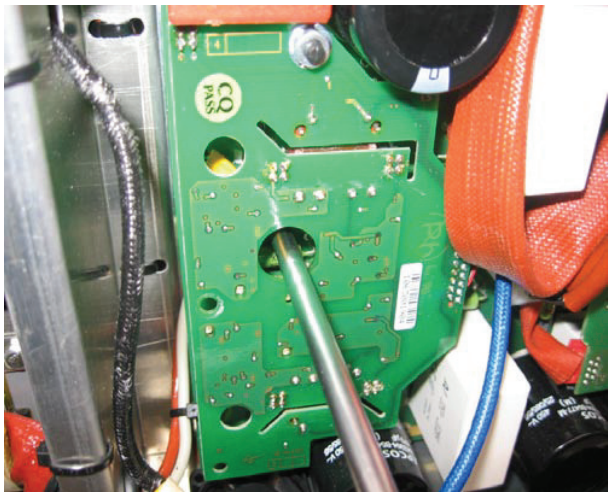
2. Remove the screw S1 / Side Boost-Inductor



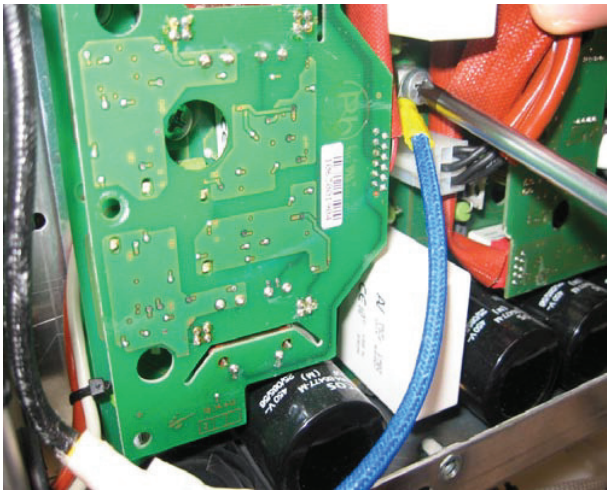
3. Remove the screw S2 / Side Boost-Inductor



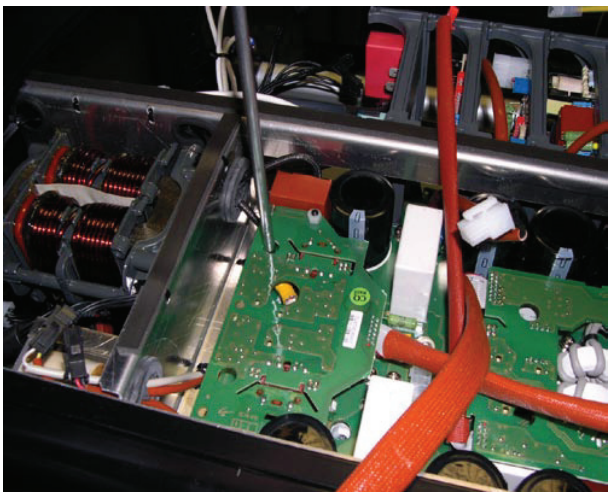
4. Remove the screw S3 / Side Inverter-Transformer



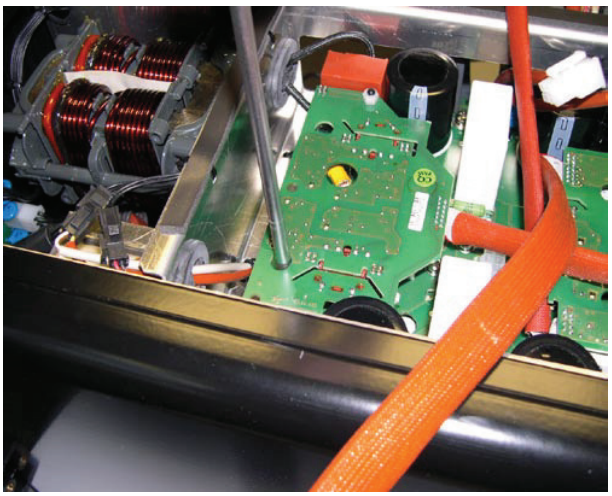
5. Remove the screw S4 / Side Inverter-Transformer



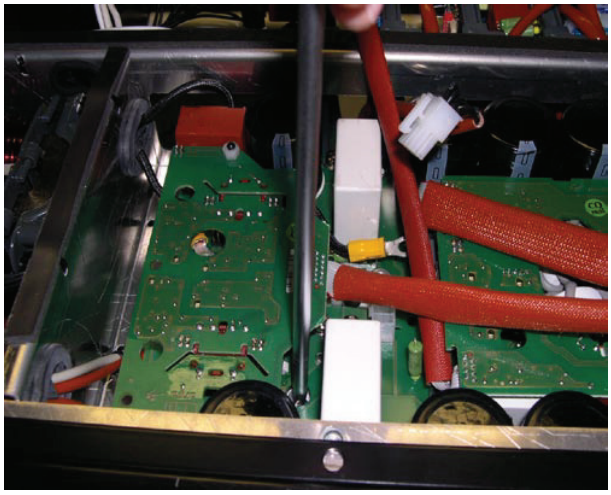
6. Remove the screw S5 / Side Inverter-Power module



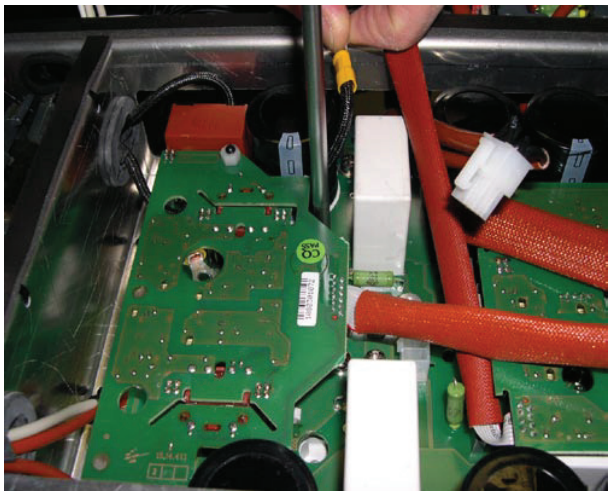
7. Remove the screw S6 / Side Inverter-Power module



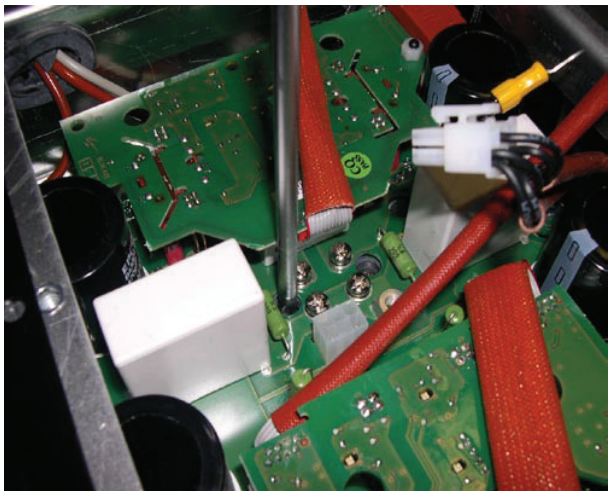
8. Remove the screw S7 / Side Inverter-Power module



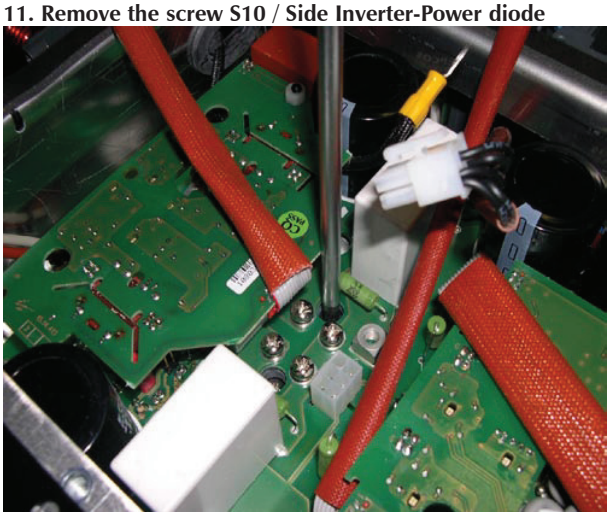
9. Remove the screw S8 / Side Inverter-Power module



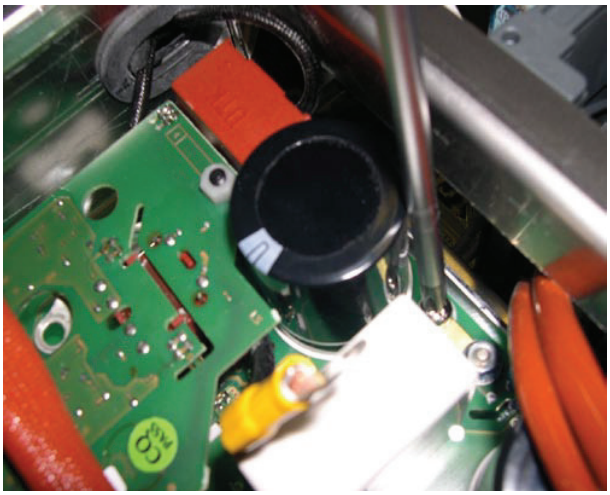
10. Remove the screw S9 / Side Inverter-Power diode



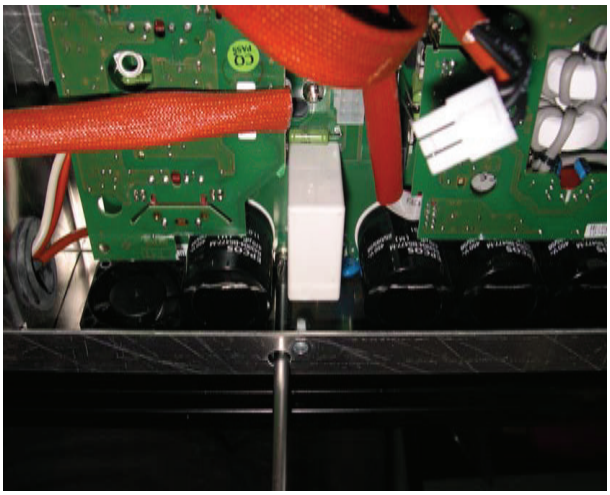
11. Remove the screw S10 / Side Inverter-Power diode



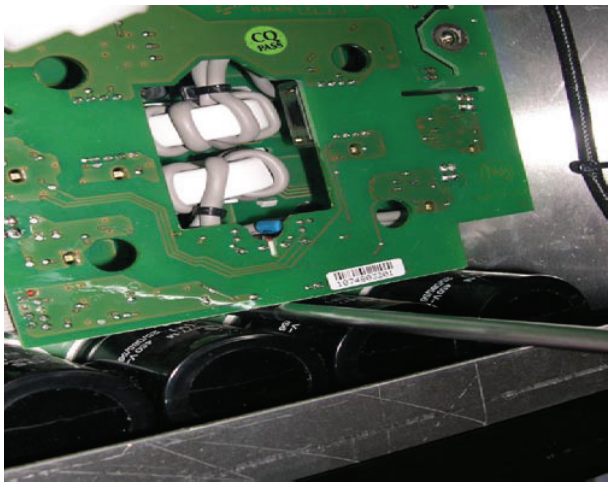
12. Remove the screw S11 / Remove the screw that connects metal turret



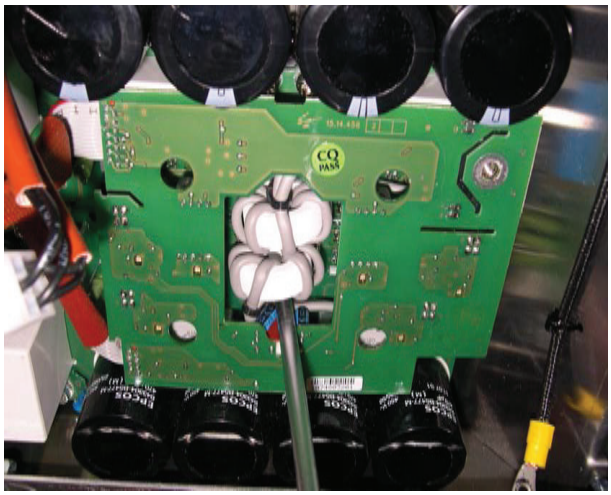
13. Remove the screw S12/ Remove the screw that connects metal turret



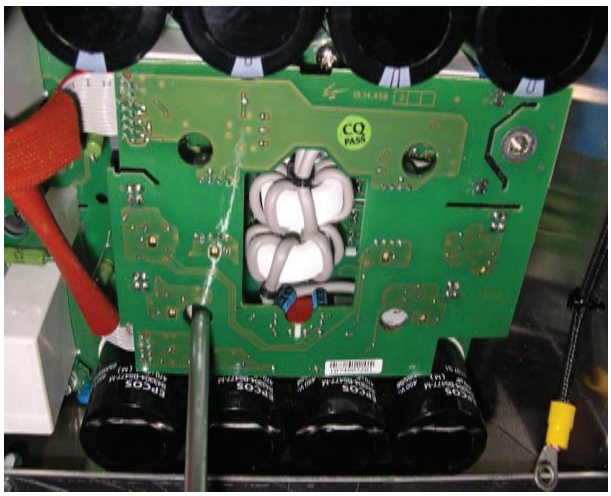
14. Remove the screw S13 / Side Boost-Power diode



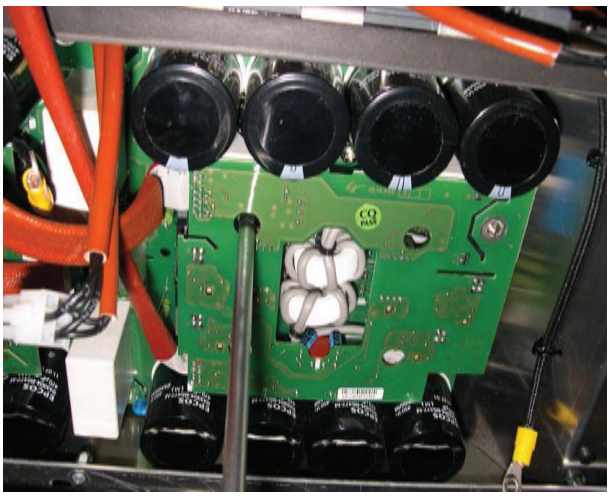
15. Remove the screw S14 / Side Boost-Power diode



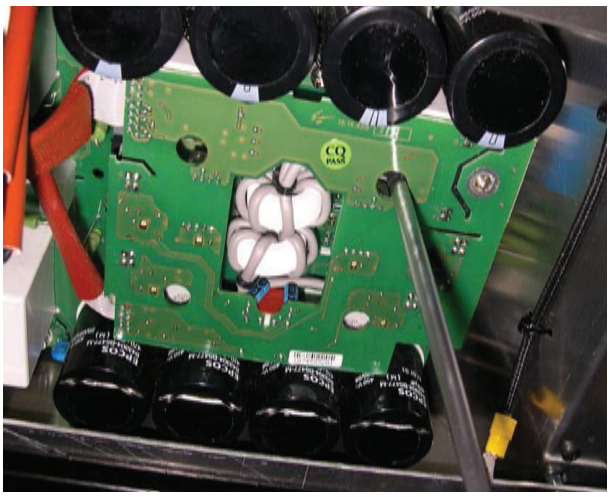
16. Remove the screw S15/ Side Boost-Power module



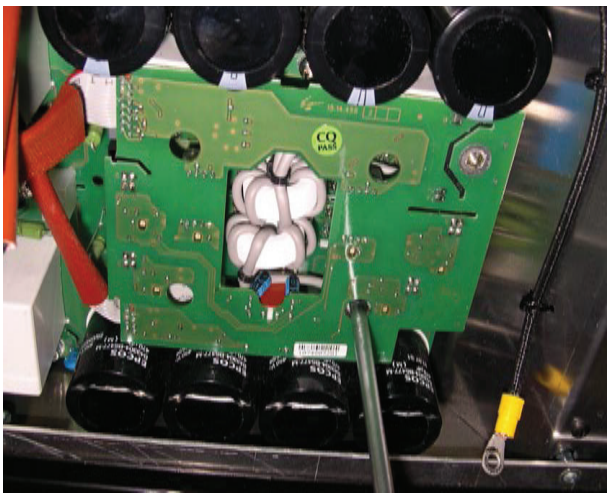
17. Remove the screw S16 / Side Boost-Power module



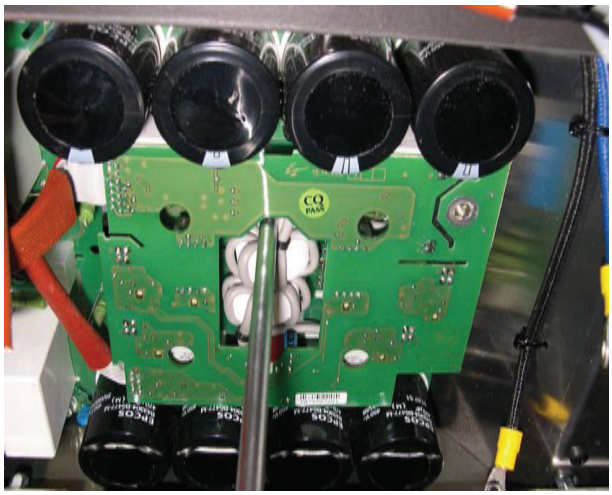
18. Remove the screw S17/ Side Boost-Power module



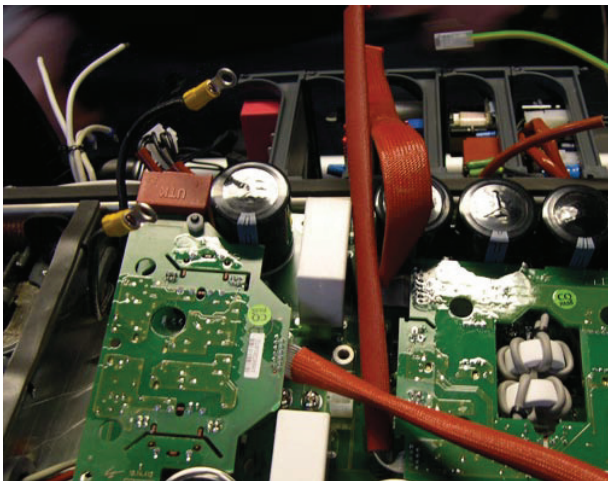
19. Remove the screw S18 / Side Boost-Power module



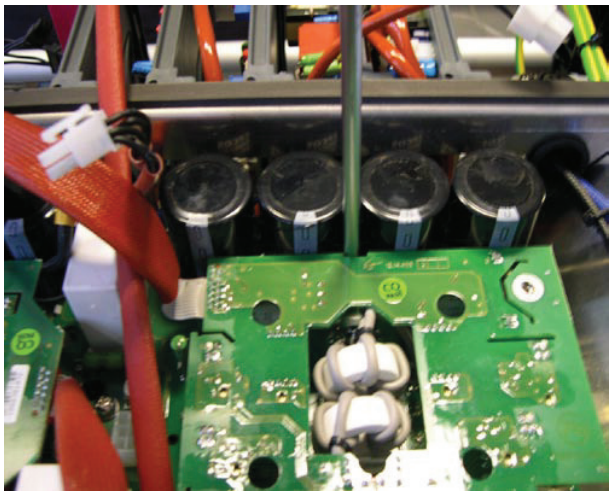
20. Remove the screw S19 / Side Boost-Power diode

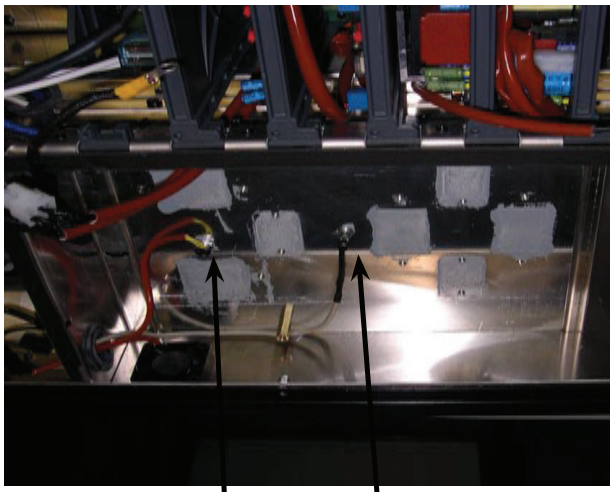


REMOVE THE POWER MODULE



21. Remove the screw S20 / Side Boost-Power diode





T1
Thermostate

NTC1
Thermo sensor device

Screw type 1

Quantity = 2

S11, S12

Screw type 2

Quantity = 2

S4, S5

Screw type 3

Quantity = 2

S9, S10, S13, S14, S19, S20

Screw type 4

Quantity = 8

S3, S6, S7, S8, S15, S16, S17, S18

Screw type 5

Quantity = 1

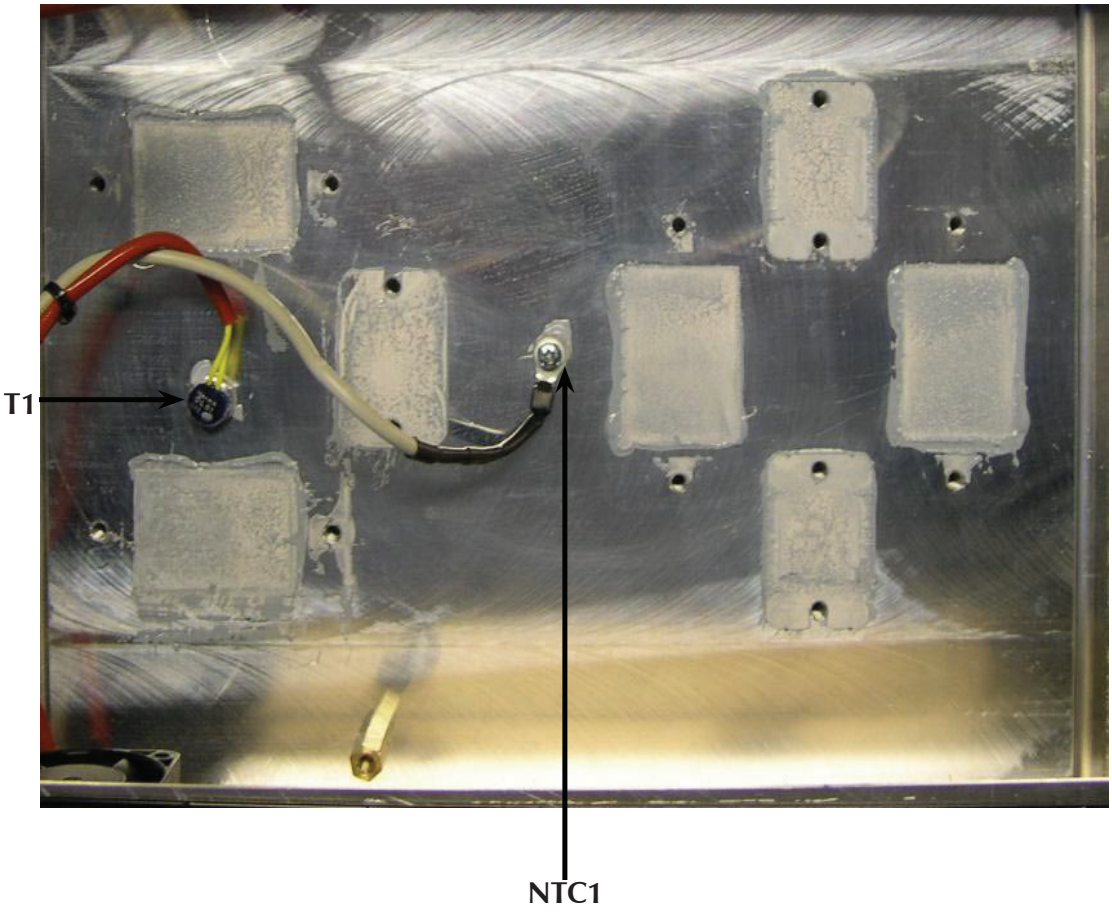
S2

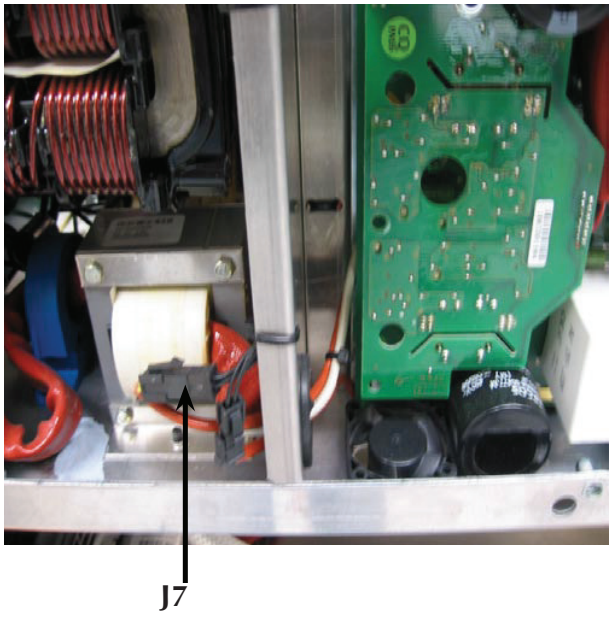
Screw type 6

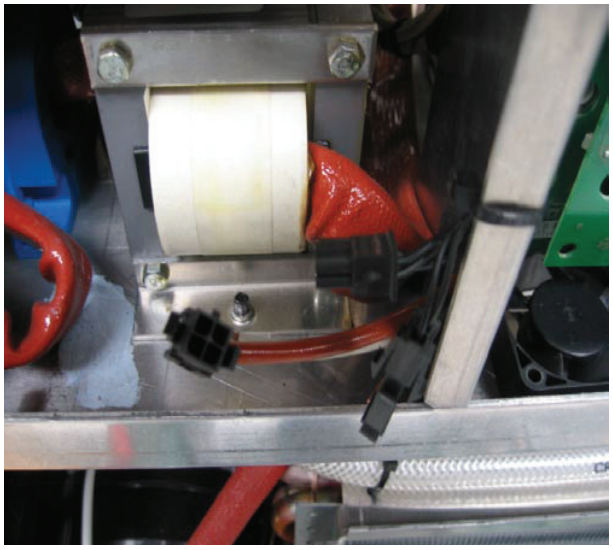
Quantity = 1

S1

Thermostat & NTC Probe Inverter and PFC







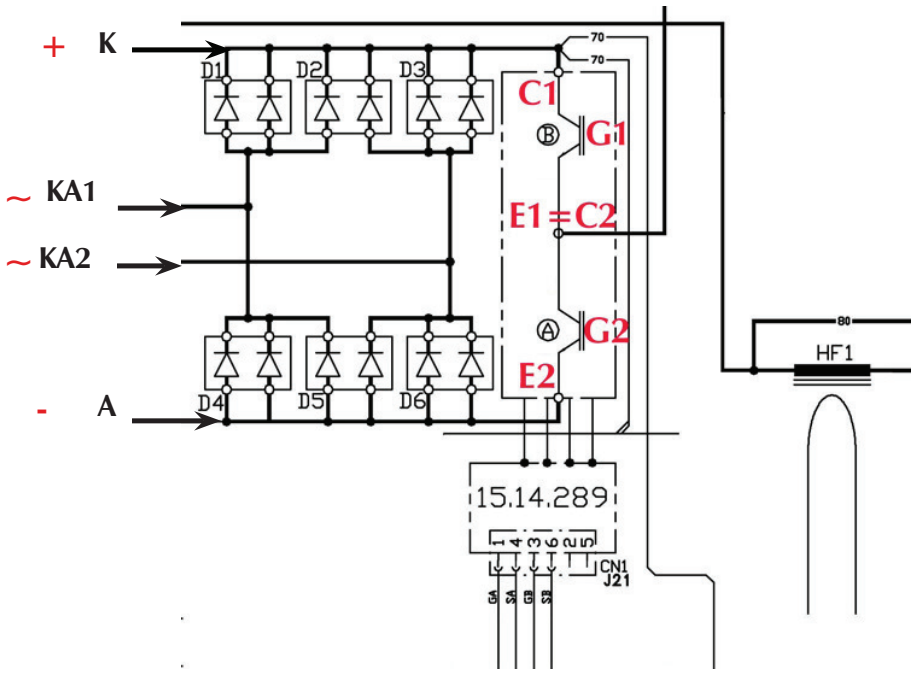
Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Thermostat & NTC Probe Inverter and PFC	OFF	T1	J7/1 ⟷ J7/2	0ohm	Ω	*
		NTC1	J7/3⟷J7/4	12kohm	Ω	@T=25°C**

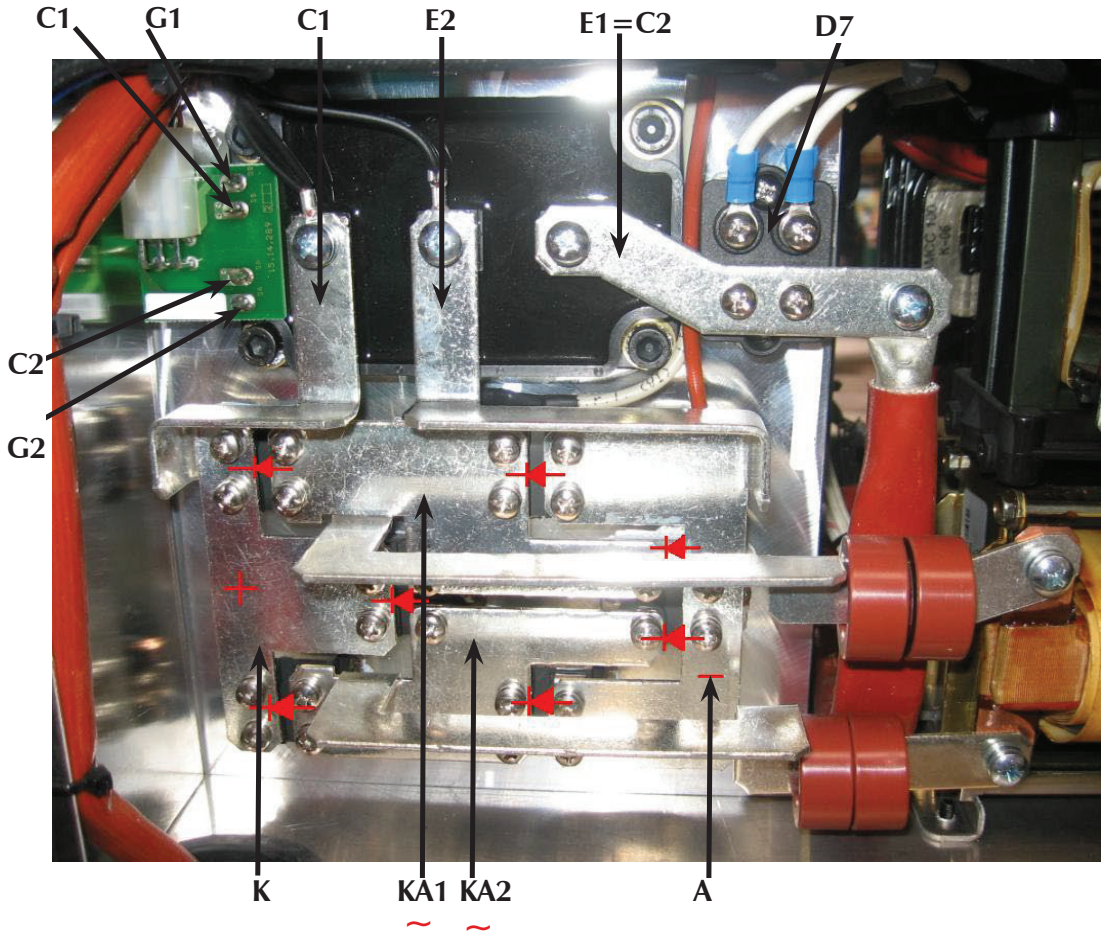
Notes:

* 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

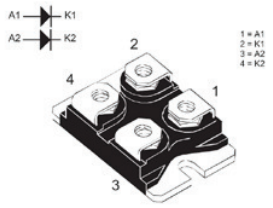




Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Rectifier diodes	OFF	D1,D2,D3	KA1 ⟵ K	+0.1Vdc	⏚	
		D4,D5,D6	KA2 ⟵ K	+0.1Vdc	⏚	
			A ⟵ KA1	+0.1Vdc	⏚	
			A ⟵ KA2	+0.1Vdc	⏚	
Superimposition switch	OFF	IGA	G2 ⟵ C2	10kohm	Ω	
			E2 ⟵ C2	+0.3Vdc	⏚	
		IGB	G1 ⟵ C1	10kohm	Ω	
			E1 ⟵ C1	+0.3Vdc	⏚	
Output Boost Circuit Diode	OFF	D7	OUT1 ⟵ K	+0.1Vdc	⏚	
			OUT2 ⟵ K	+0.1Vdc	⏚	

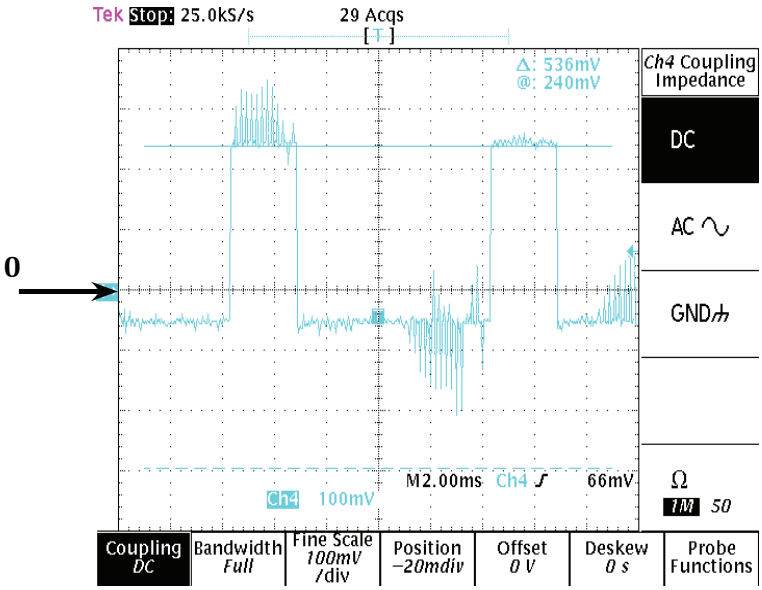
Notes:

*** Diodes D1,D2,D3,D4,D5,D6 and D7 are ST-BYT200PIV-400R (2x100 A ,400 V)**



ISOTOP™

Command G2⟵ E2 measures with differential probe (Attenuation 1:50)

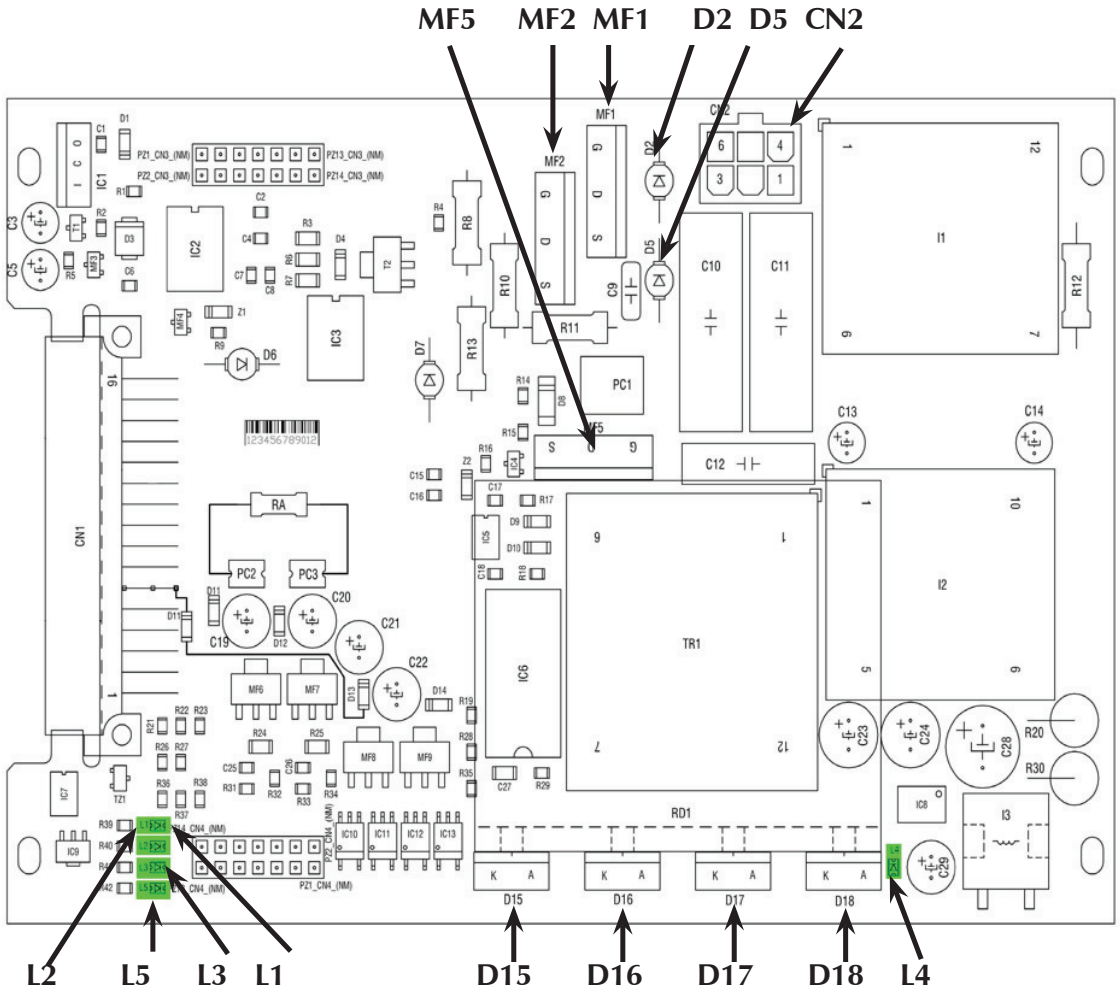


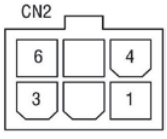
5.4) SWITCHING POWER SUPPLY P.C. BOARD 15.14.429

DESCRIPTION

This board manages:

- Solenoid valve command
- Fan command
- Contactor command

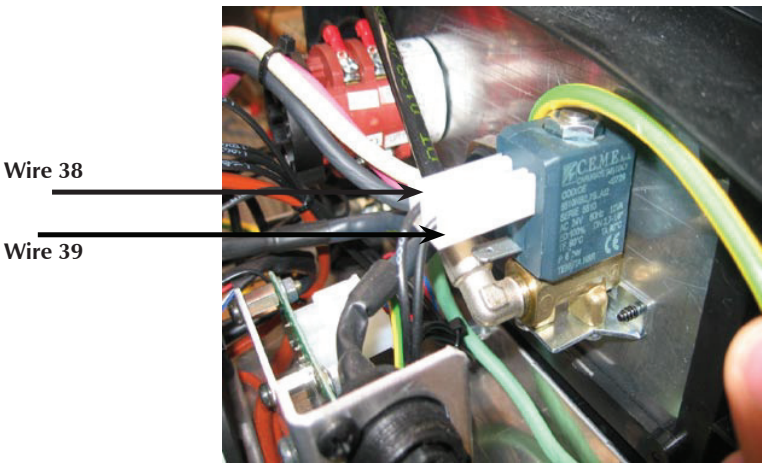




Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Power Mosfet	OFF	MF1	G ← S	10kohm	Ω	
		D2	A ← K	+0.45Vdc	⏚	
		MF2	G ← S	10kohm	Ω	
		D5	A ← K	+0.45Vdc	⏚	
		MF5	S ← D	+0.45Vdc	⏚	
Diodes	OFF	D15	A ← K	+0.25Vdc	⏚	
		D16	A ← K	+0.25Vdc	⏚	
		D17	A ← K	+0.25Vdc	⏚	
		D18	A ← K	+0.25Vdc	⏚	
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				
Contactor ***	ON	L5=ON				
ELV 2	ON	L1=OFF				V310T has only one ELV

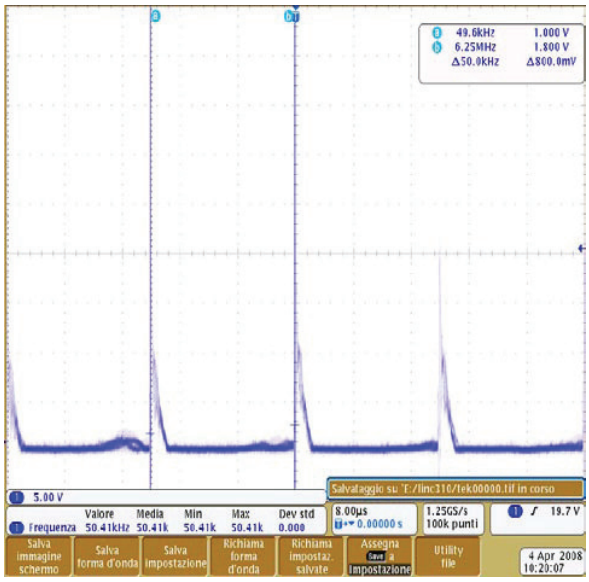
Notes:
* Command from 15.14.415 P.C. Board -> 15.14.429 -> Connector CN12/1 (60) and CN12/2 (50) 15.14.431 -> 15.14.473
** Command from 15.14.415 P.C. Board -> 15.14.429 -> Connector CN13/1 (38) and CN13/5 (39) 15.14.431
*** Command from 15.14.415 P.C. Board -> 15.14.429 -> Connector CN13/3 (40) and CN13/7 (41) 15.14.431

SOLENOID VALVE

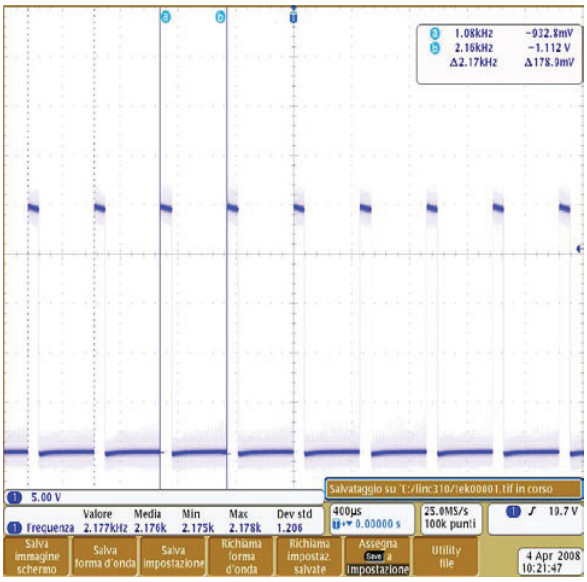


Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Solenoid valve command	ON	ELV1	38 ⟵ 39	150mVac* 60kHz*	V Hz	* ELV1 OFF Torch button released
Solenoid valve command	ON	ELV1	38 ⟵ 39	8.5Vac** 2.1kHz**	V Hz	**ELV1 ON Torch button pressed
Coil	OFF	ELV1	38 ⟷ 39	25ohm	Ω	

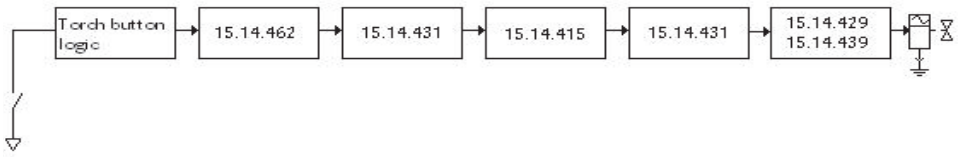
ELV1 OFF - Voltage signal between wire 38 and wire 39



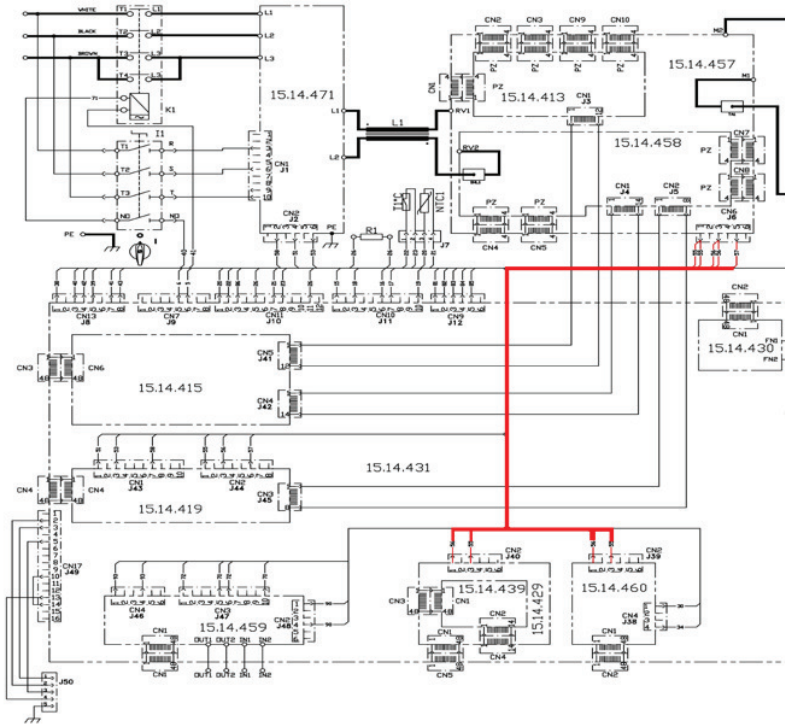
ELV1 ON - Voltage signal between wire 38 and wire 39



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



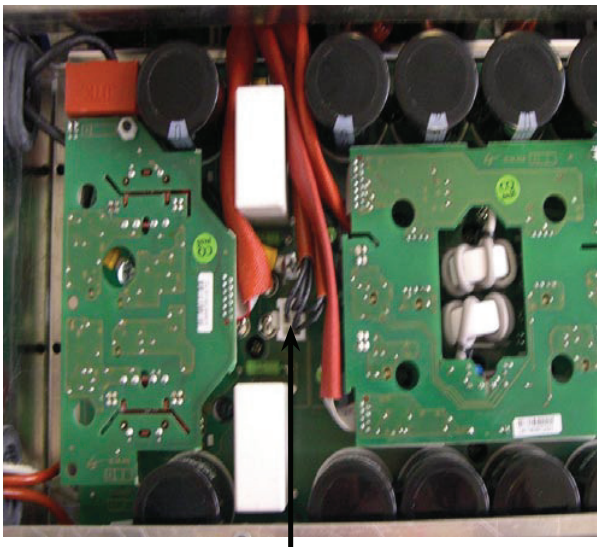
CHECK POWER SUPPLY



Check DC LINK voltage on 15.14.457 PC board and check the link between 15.14.457-15.14.460-15.14.429 PC boards

WARNING

HIGH VOLTAGE

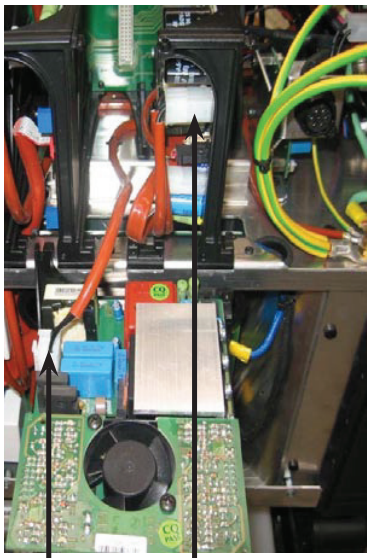


Connector CN6 on 15.14.457 PC board

CN6/1 = Wire 55 = +VBUS

CN6/3 = Wire 56 = -VBUS

CN6/5 = Wire 57 = VBUS/2



CN2 on 15.14.429 PC board

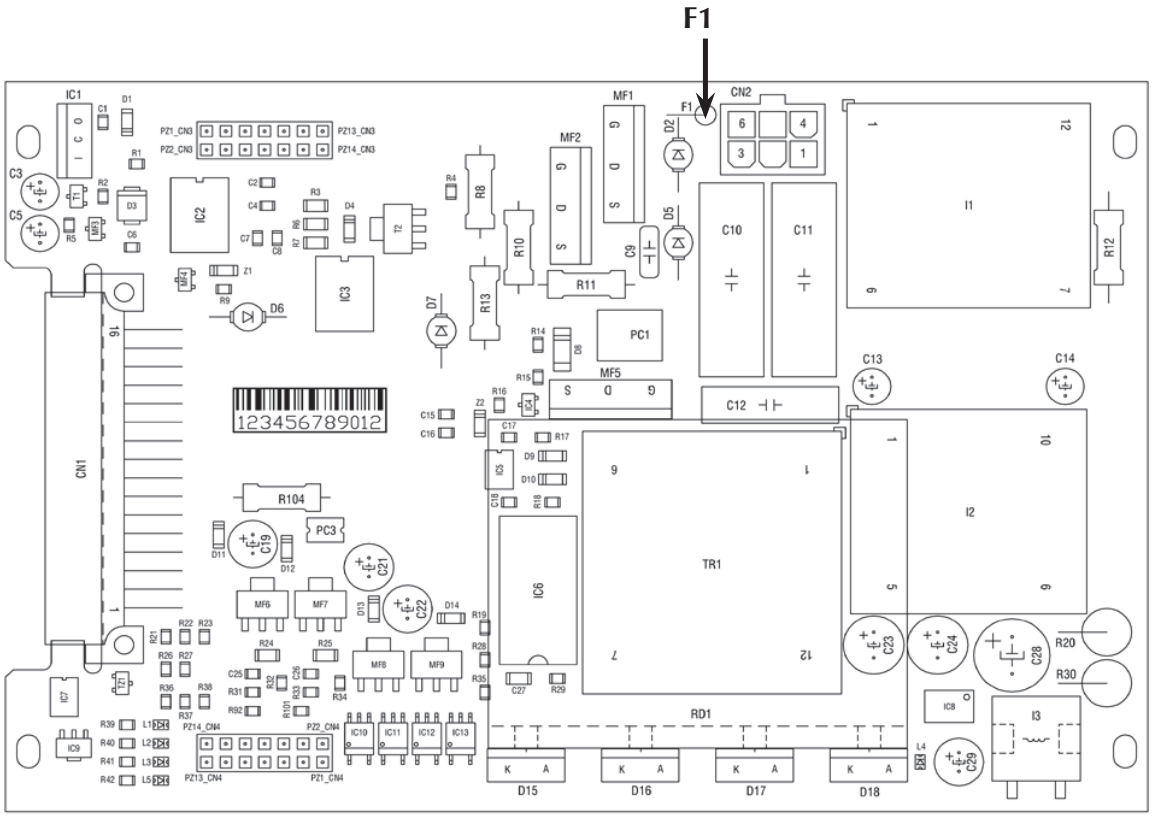
CN2 on 15.14.460 PC board

Connector CN2

CN2/1 = Wire 56 = -VBUS

CN2/3 = Wire 55 = +VBUS

Check Fuse F1 on P.C. board 15.14.429v3



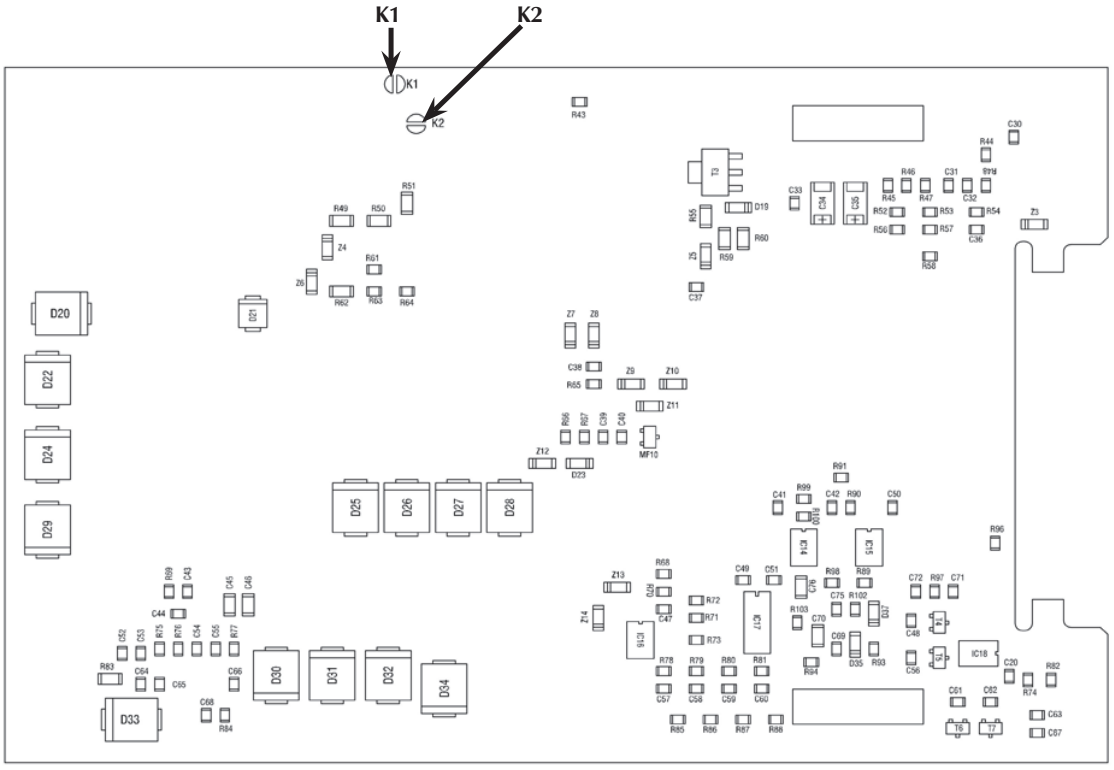
Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Fuse	OFF	F1	F1/1 ⟵ F1/2	+0Vdc	⏚	

Note:

* Fuse F1: The PINs of fuse are interchangeable.

F1/1 —▭— F1/2 or F1/2 —▭— F1/1

15.14.429 BOTTOM VIEW

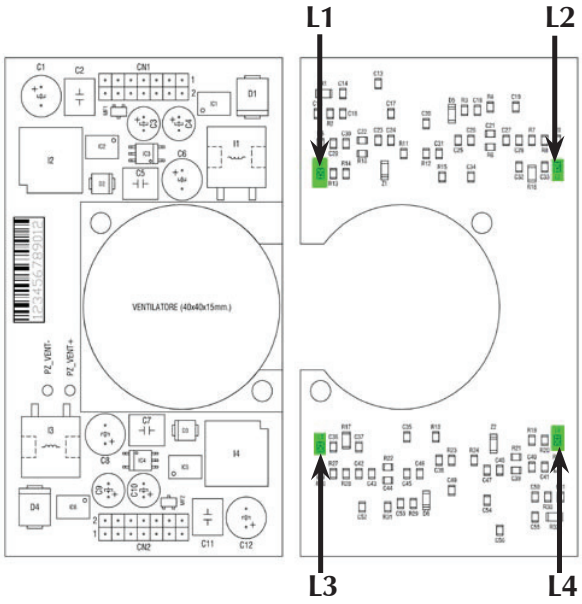


JUMPERS STATE

K1 = OPENED

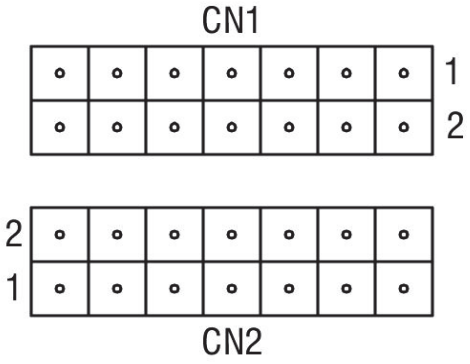
K2 = CLOSED

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:



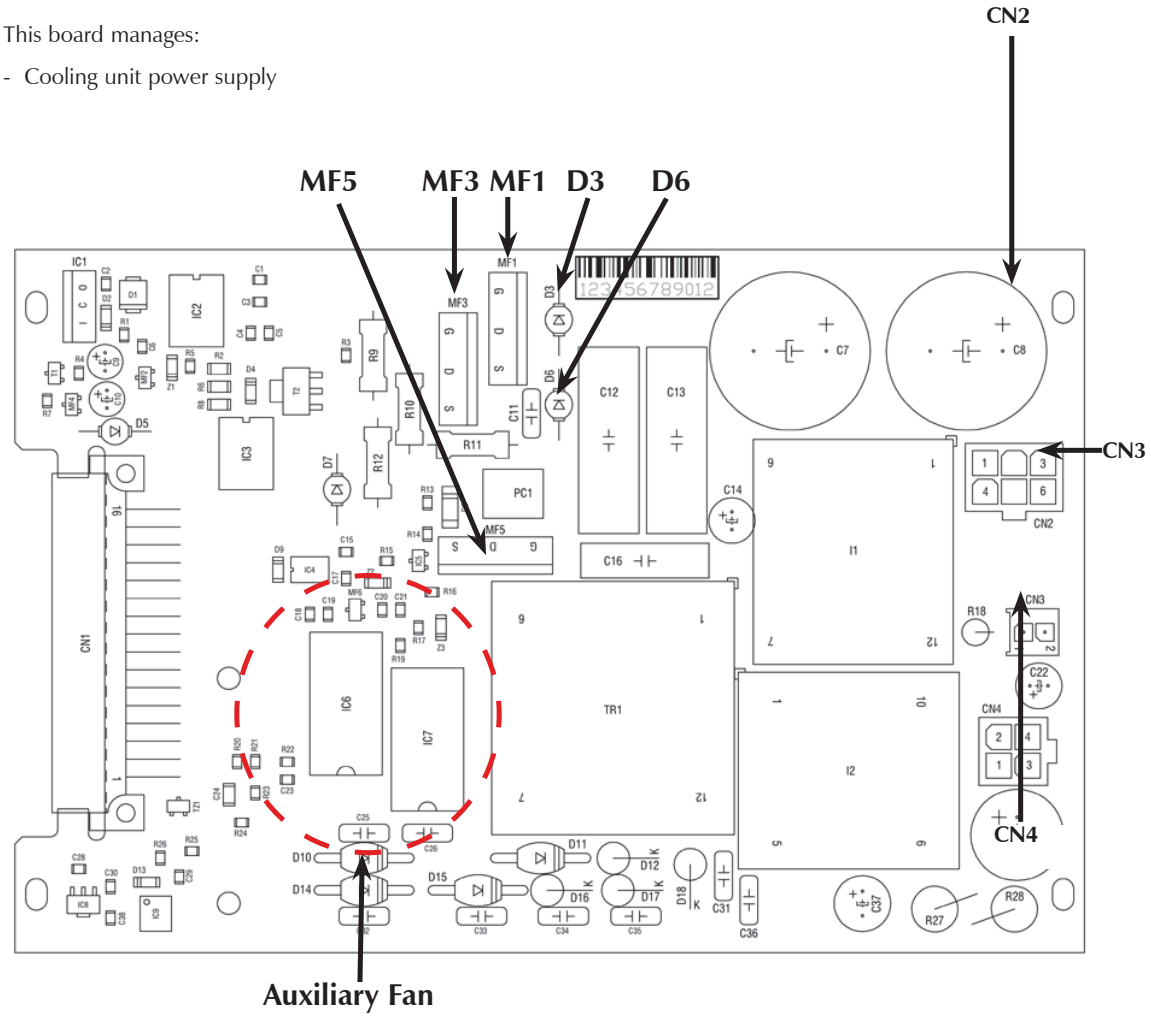
CN1/1 -> +15Vdc_sec	**CN1/8 -> GND_sec**	**CN2/1 -> +15Vdc_pri**	**CN2/8 -> GND_pri**
CN1/2 -> +15Vdc_sec	**CN1/9 -> Not connected**	**CN2/2 -> +15Vdc_pri**	**CN2/9 -> Not connected**
CN1/3 -> - 15Vdc_sec	**CN1/10 -> Not connected**	**CN2/3 -> - 15Vdc_pri**	**CN2/10 -> Not connected**
CN1/4 -> - 15Vdc_sec	**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) COOLER AUXILIARY POWER SUPPLY P.C. BOARD 15.14.460 (Welder Bus/Rack Board Area)

DESCRIPTION

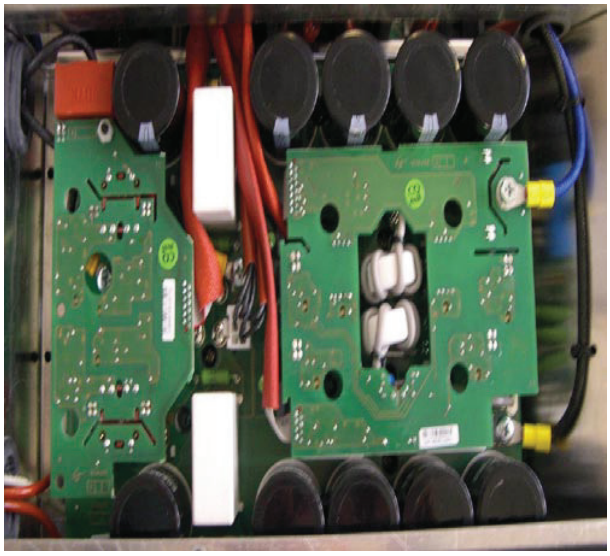
This board manages:

- Cooling unit power supply



Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Power Mosfet	OFF	MF1	G ⟵ S	10kohm	Ω	
		D3	A ⟵ K	+0.45Vdc	⏚	
		MF3	G ⟵ S	10kohm	Ω	
		D6	A ⟵ K	+0.45Vdc	⏚	
		MF5	S ⟵ D	+0.45Vdc	⏚	
DC LINK	ON	CN2	CN2/1 ⟵ CN2/3	+750Vdc	V	
Voltage supply	ON	CN4	CN4/1 ⟵ CN4/4	+350Vdc	V	
		J24	J24/1 ⟵ J24/3	+350Vdc	V	

Check DC LINK voltage on 15.14.457 PC board and check the link between 15.14.457-15.14.460-15.14.429 PC boards



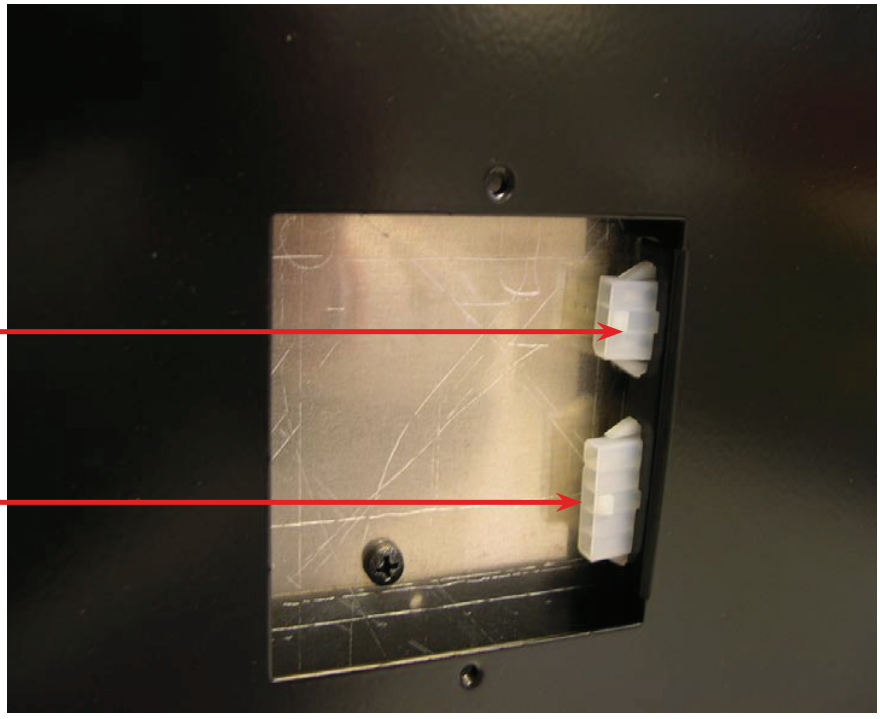
WARNING

HIGH VOLTAGE

CN2/1 = Wire 56 = -VBUS
CN2/3 = Wire 55 = +VBUS

CN3/1 = GND_+12Vdc (15.14.460 Auxiliary Fan on the PCB)
CN3/2 = +12Vdc (15.14.460 Auxiliary Fan on the PCB)

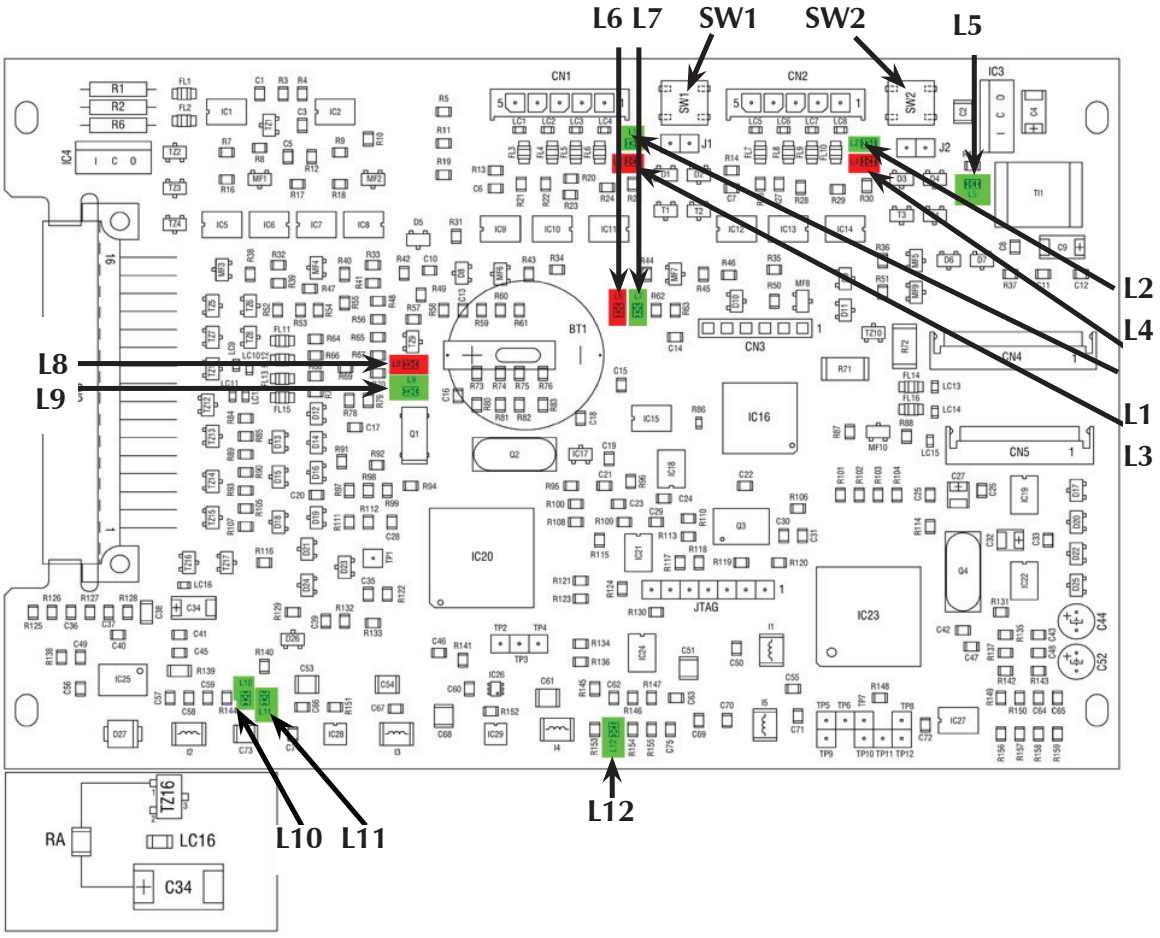
CN4/1 = +350Vdc (Cooling unit power supply)
CN4/2 = GND_CAN (Cooling unit power supply)



5.7) DIGITAL P.C. BOARD 15.14.4153

DESCRIPTION

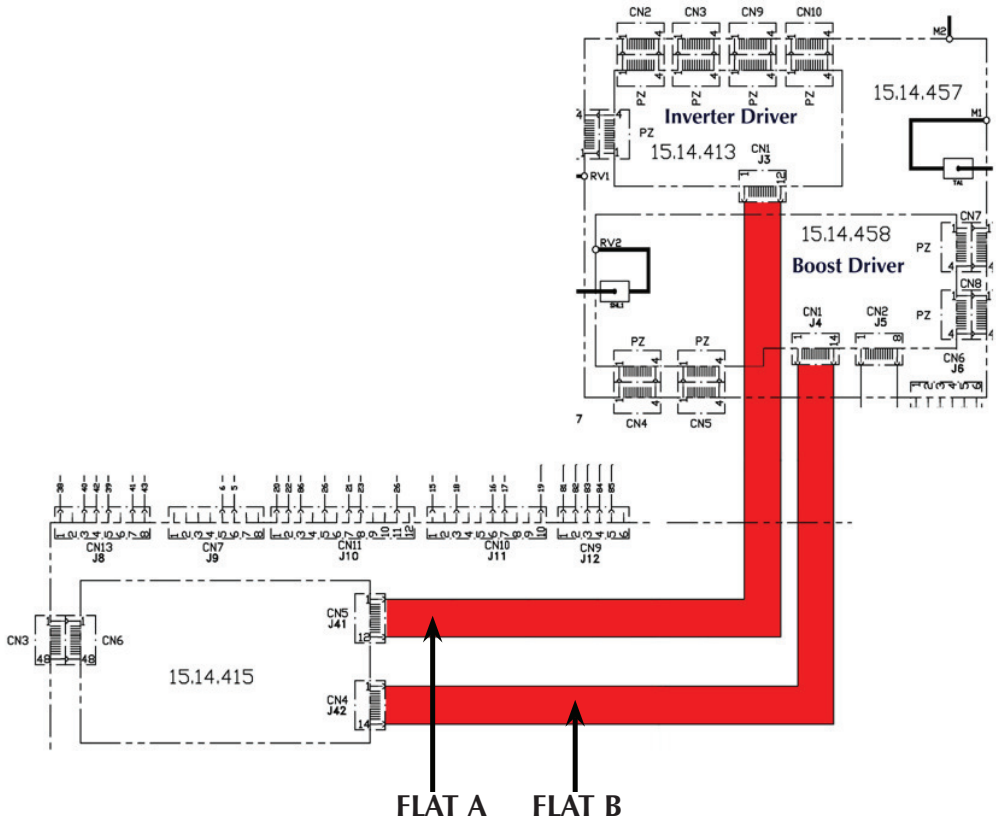
This board manages:
- Contactor command
- Fan command
- Solenoid valve command
- Boost command
- Inverter command
- System communication
- Alarm command
- Crisp command
- Superimposition command
- VLINE, VBUS, IOUT, VOUT, Thermal Protections, IBOOST, IPRY, Power Enable of the welding process



Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Machine identification (V310T) DSP	ON	L6 = ON* L7 = ON	---	---	---	*Red diode. This diodes is blinking.
Machine identification (V310T) uC		L8 = ON** L9 = ON				**Red diode. This diodes is blinking.
+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 updating
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}

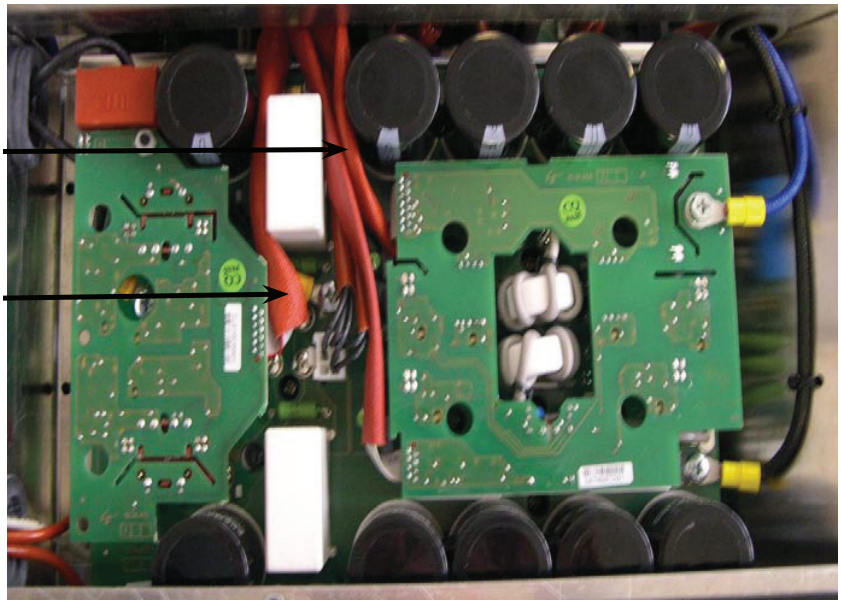
CN4/9 and CN4/10 -> COM_BOOST 1

CN4/11 and CN4/12 -> COM_BOOST 2

CN4/13 and CN4/14 -> Not use

FLAT B

FLAT A

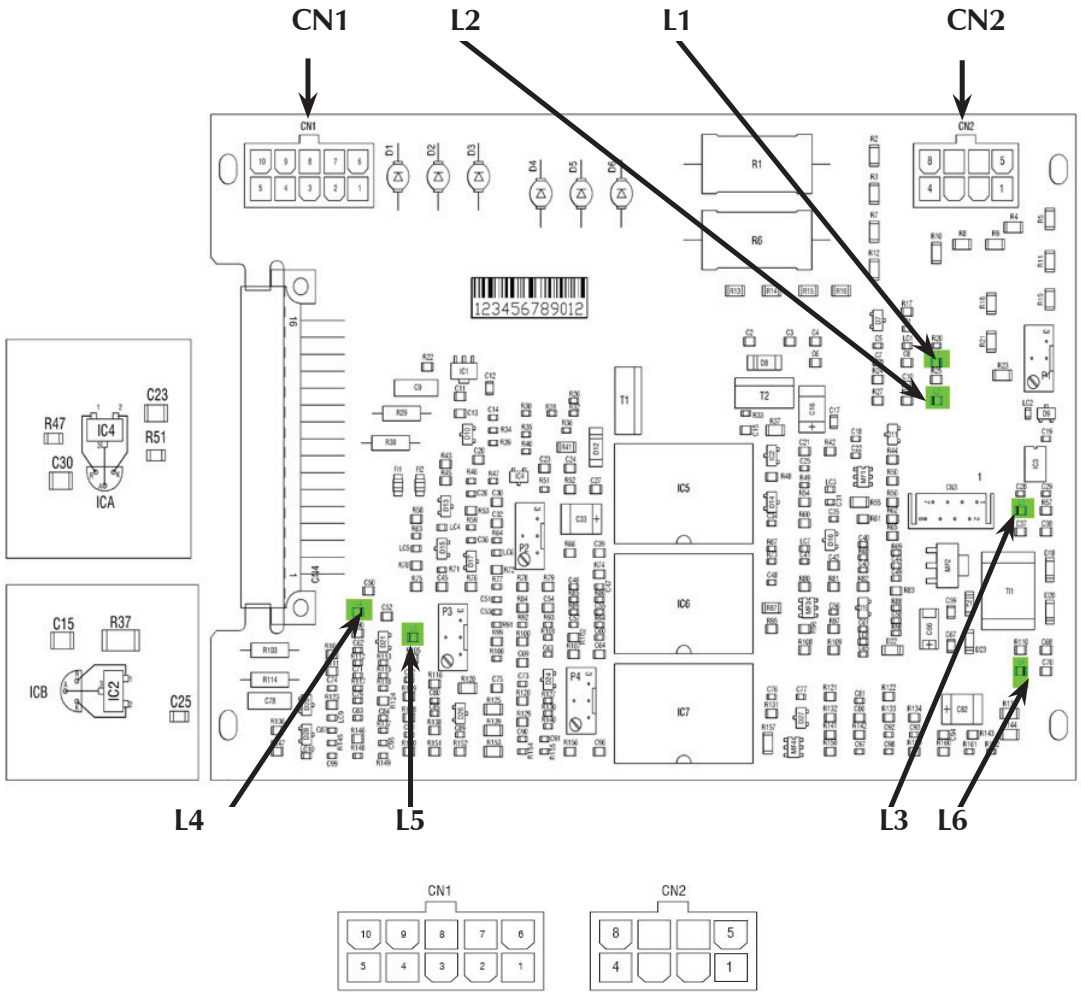


5.8) ANALOG SIGNAL P.C. BOARD 15.14.419

DESCRIPTION

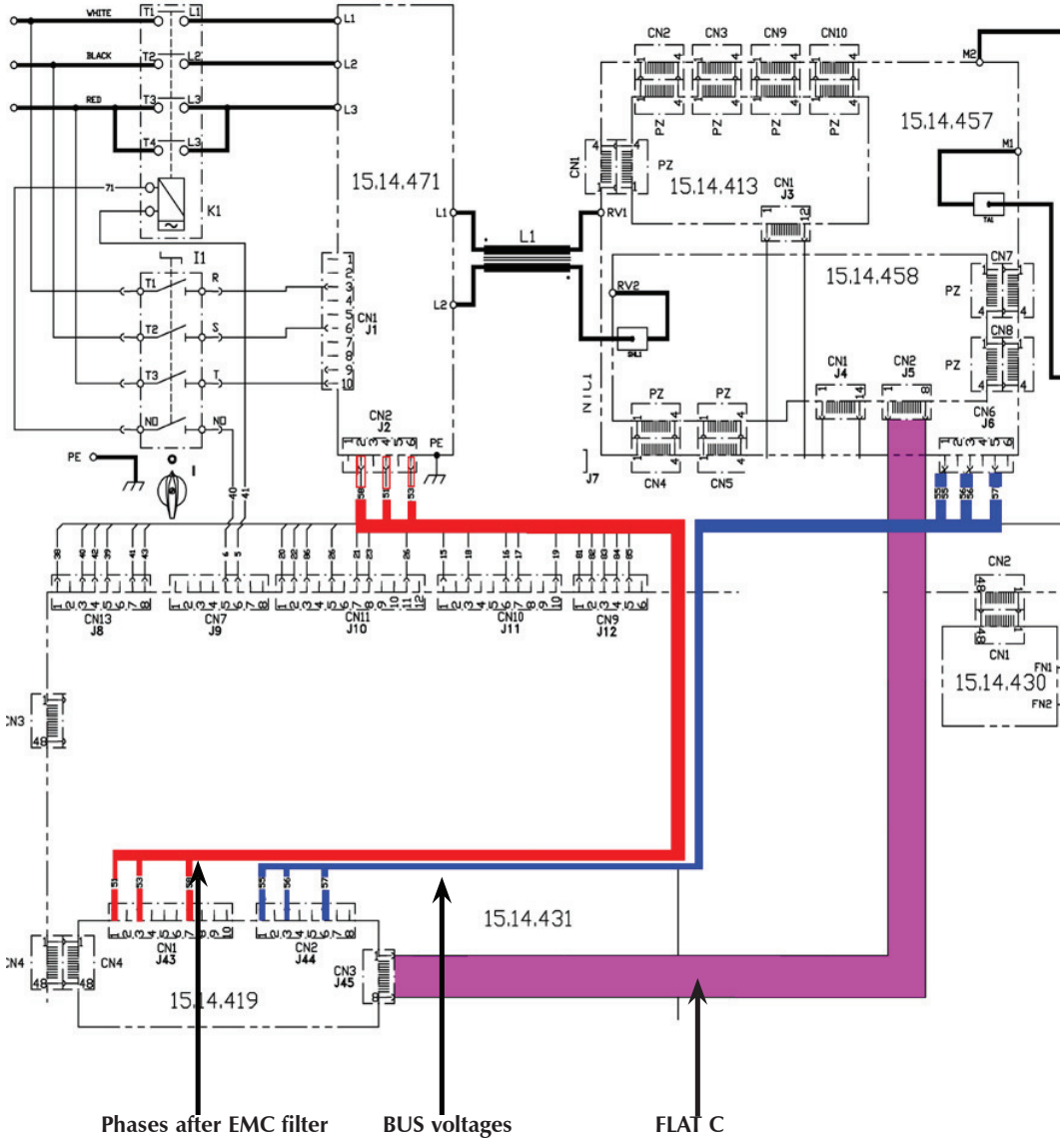
This board manages:

- IOUT, VOUT, VAC_LINE, VBUS and Thermal Protection.



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 ⟷ CN1/17	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 15.14.419-15.14.457 and 15.14.419-15.14.471 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

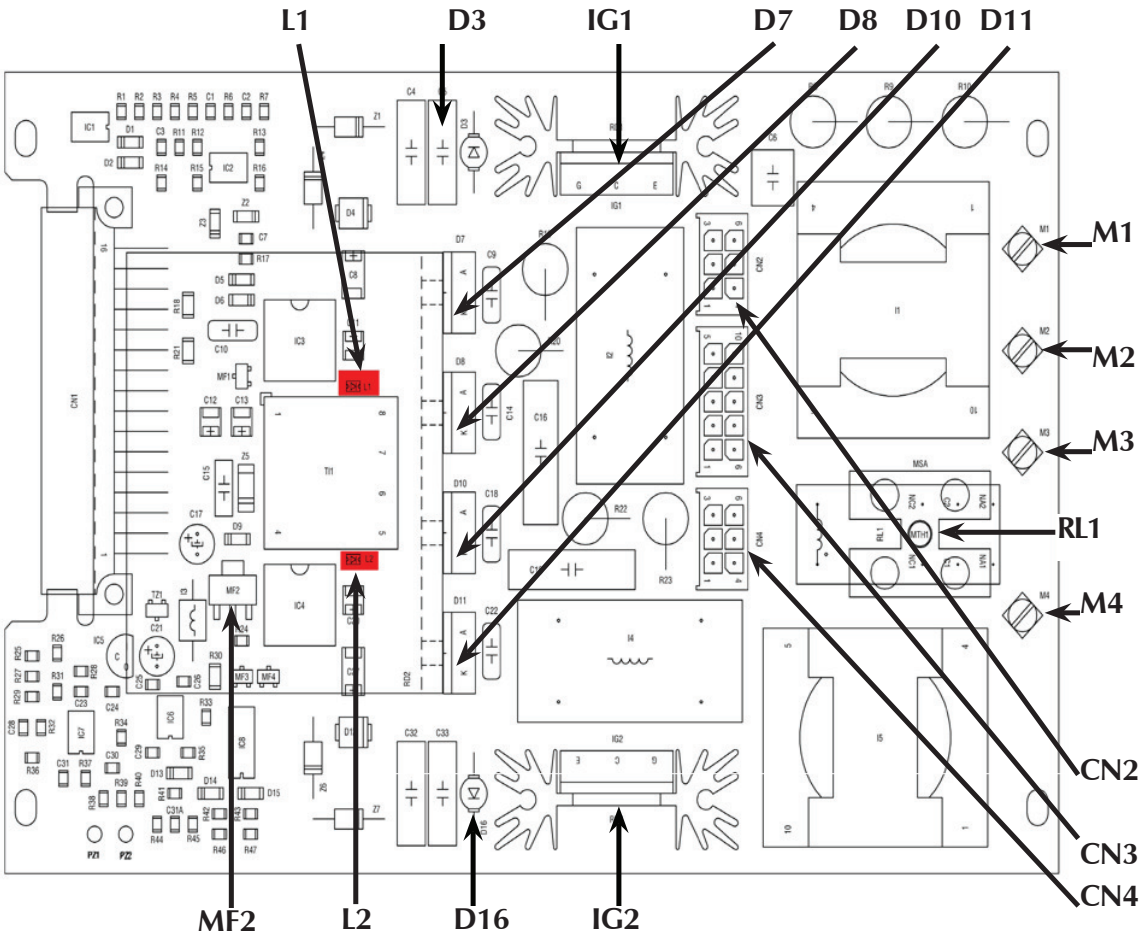
CN2/1 - Wire 55 - +VBUS
CN2/3 - Wire 56 - - VBUS
CN2/6 - Wire 57 - VBUS/2

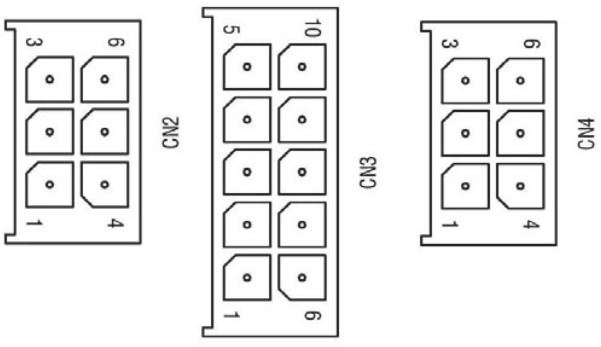
FLAT C
CN3/1 and CN3/2 -> +15Vdc_PRY
CN3/3 and CN3/4 -> GND_PRY
CN3/5 and CN3/6 -> -15Vdc_PRY
CN3/7 and CN3/8 -> Not use

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

DESCRIPTION:

This board manages:
- Superimposition in AC mode
- Crisp mode





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.
Crisp	ON	RL1				RL1 is able when is selected stick crisp mode.

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)

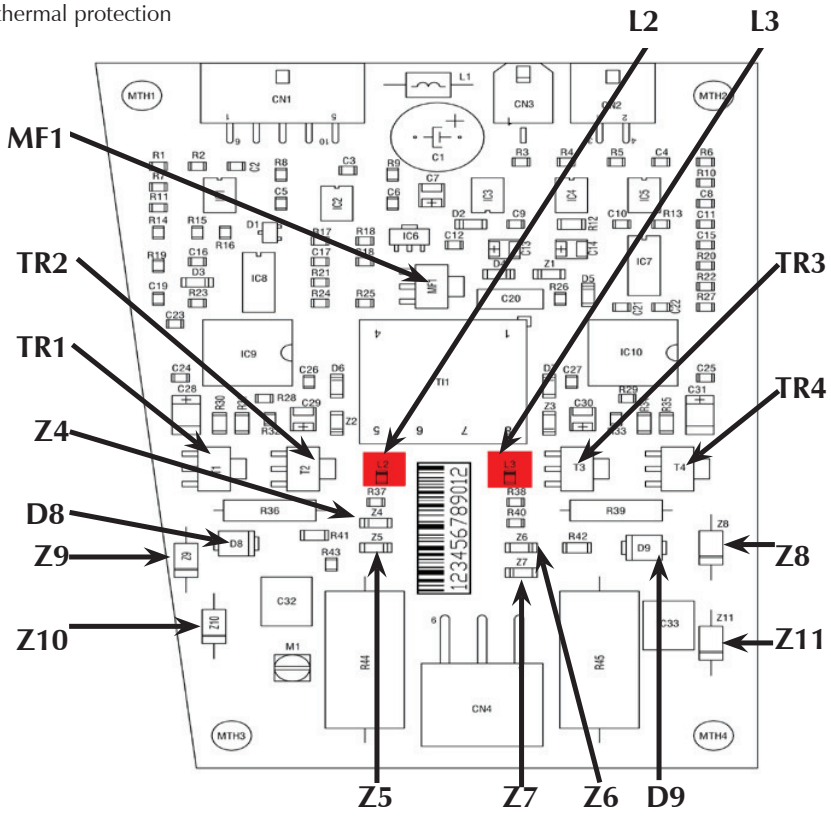
M1 = + Output clamp for Crisp mode
M2 = - Output clamp for Crisp mode
M3 = + Input clamp for Crisp mode
M4 = - Input clamp for Crisp mode

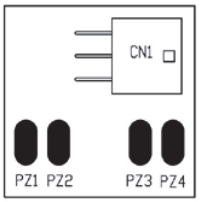
5.10) OUTPUT MODULE DRIVER P.C. BOARD 15.14.434 AND CONNECTOR BOARD 15.14.289

DESCRIPTION

This board manages:

- AC command
- Secondary side thermal protection





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	⏚ ⏚	FZT649 
		TR1 and TR4	E ⟵ B C ⟵ B	+0.6Vdc +0.6Vdc	⏚ ⏚	FZT749 
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

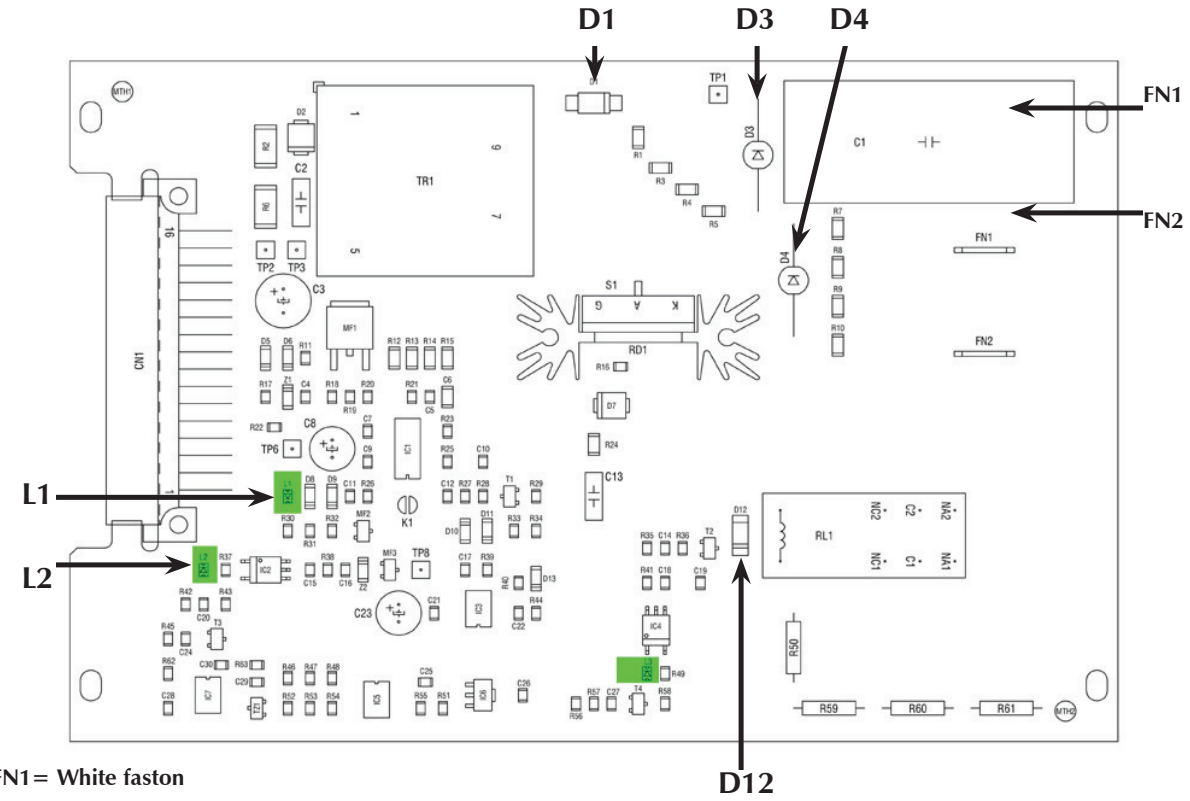
CN3/1 and CN3/2 -> Thermostat input

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

5.11) HF P.C. BOARD 15.14.430

DESCRIPTION

This board generates the HF command from DSP command.



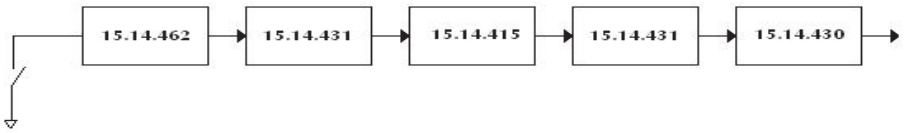
FN1= White faston

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:

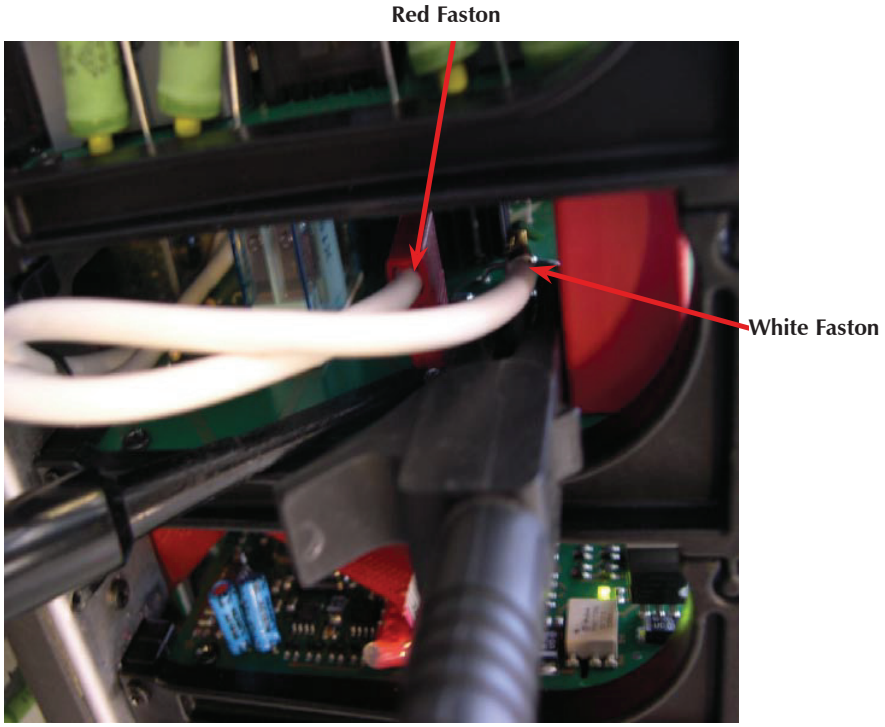
*** Command generates from 15.14.415 -> 15.14.430. The enable occurs after torch button pressed.**



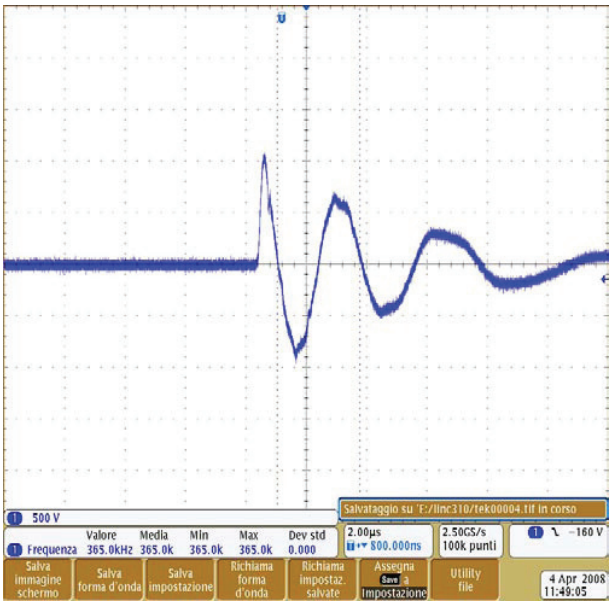
HF waveform

WARNING

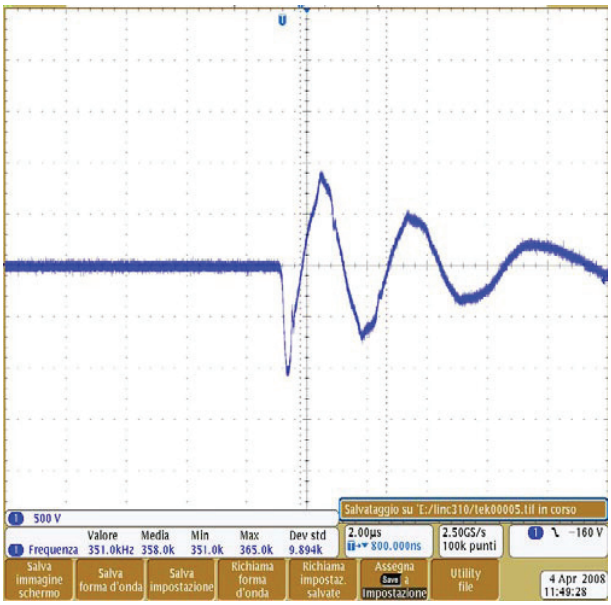
Use a probe with a minimum attenuation of x100



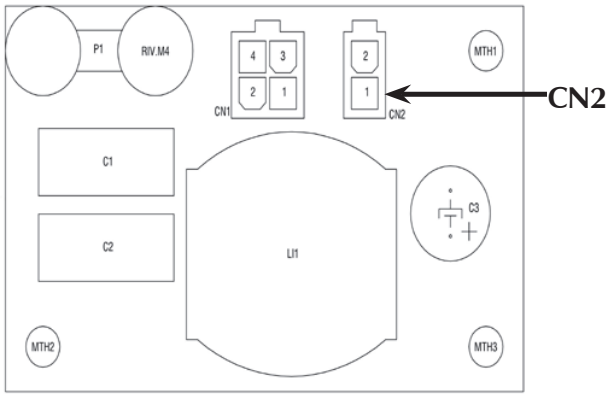
HF pulse in TIG AC



HF pulse in TIG DC



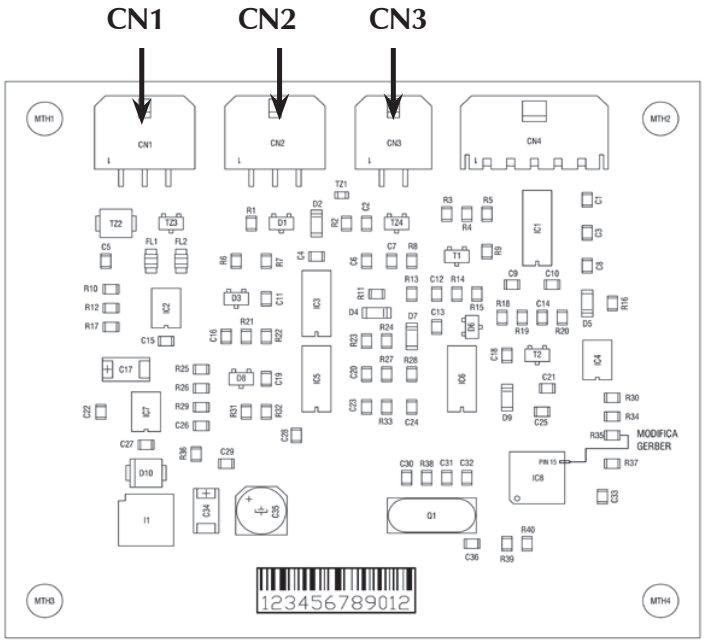
5.12) FAN EMC FILTER P.C. BOARD 15.14.473



Check the connection between CN1 and CN12 on 15.14.431.
Check the connection of CN2.

Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
Fan voltage supply	ON	CN2	CN2/1 ⟵ CN2/2	+48Vdc*	Ⓥ	*@max speed

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



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

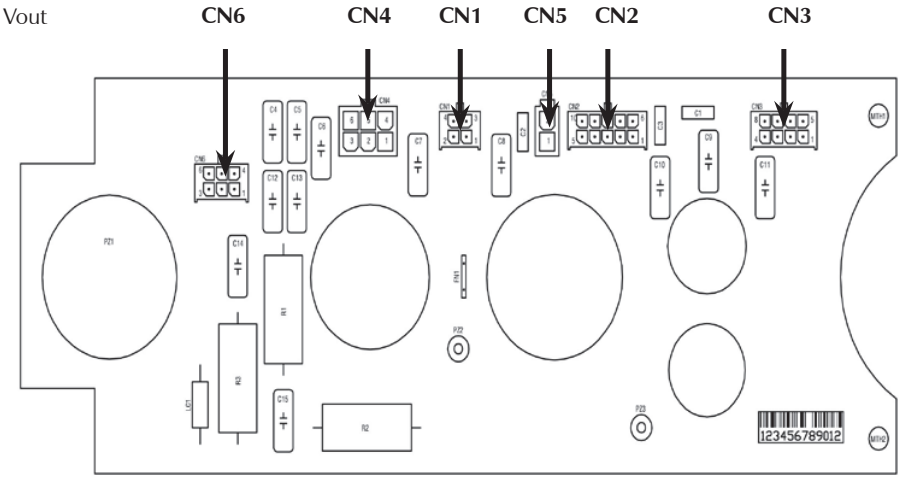
CN1 -> CAN BUS Communication

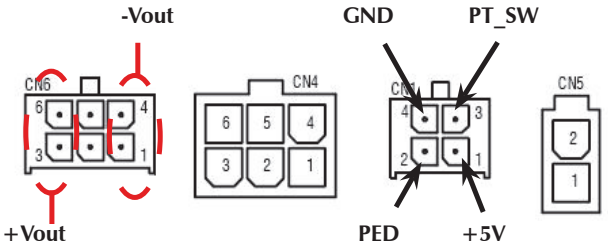
CN3 -> Remote control input from 15.14.462

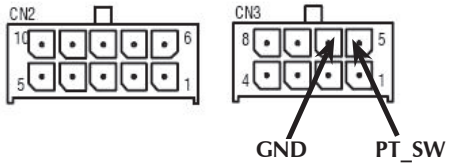
5.14) OUTPUT FILTER P.C. BOARD 15.14.462

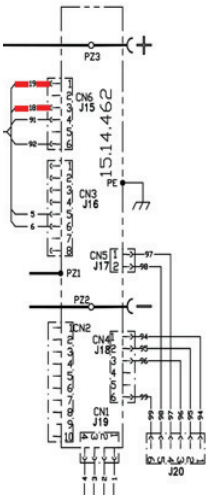
DESCRIPTION

This board manages:
- Remote control (RC)
- Torch button
- Indication of Vout









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-	+78Vdc	V	*On stick mode

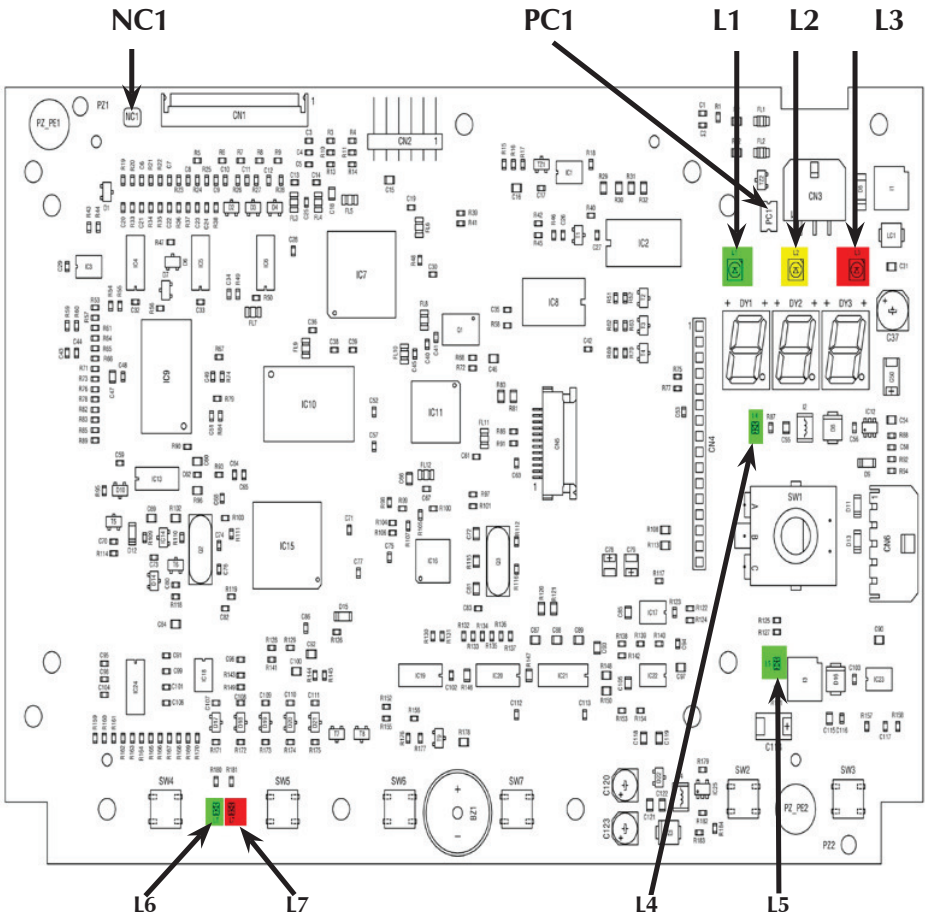
CN6/3 and CN6/6 -> +VOUT
-> 15.14.431 -> 15.14.419 -> 15.14.415 and R2
CN6/1 and CN6/4 -> -VOUT

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

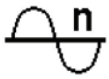
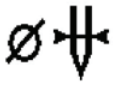
5.15) CONTROL PANEL P.C. BOARD 15.14.417



Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
PTC	OFF	PC1	PC1 ⟷ PC2	0.6ohm*	Ω	*@T=25°C
NTC	OFF	NC1	NC1 ⟷ NC2	10kohm**	Ω	**@T=25°C
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				
Firmware updated	ON	L6=OFF L7=OFF				L6 and L7 are ON when the firmware is updated.

SET-UP MENU

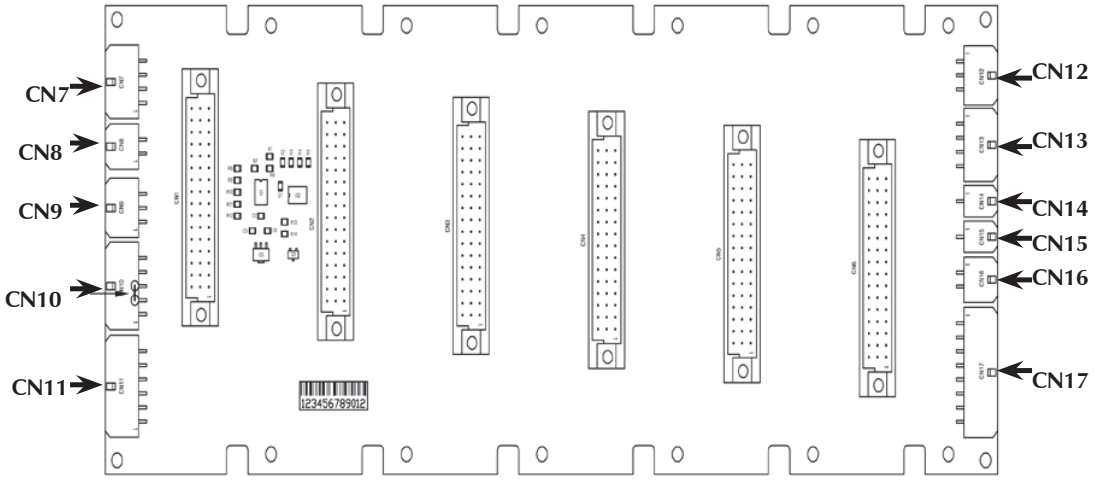
Parameter Symbol	Selection/ * Default Value	Parameter Number	Description
See Figure B.7		0	Set Up menu Exit
0	NA	1	Reset All Parameters
A	% * Amps	3	Start Current Set Unit
A2	% Amps*	8	Bi-Level Current 2 Set Unit
A	% * Amps	10	Pulse Background Current Units
A	% Amps*	17	Finish Current Set Unit
A HF DC	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
	-20 to 20 10*	553	Display Contrast
	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
	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)

Alarm codes

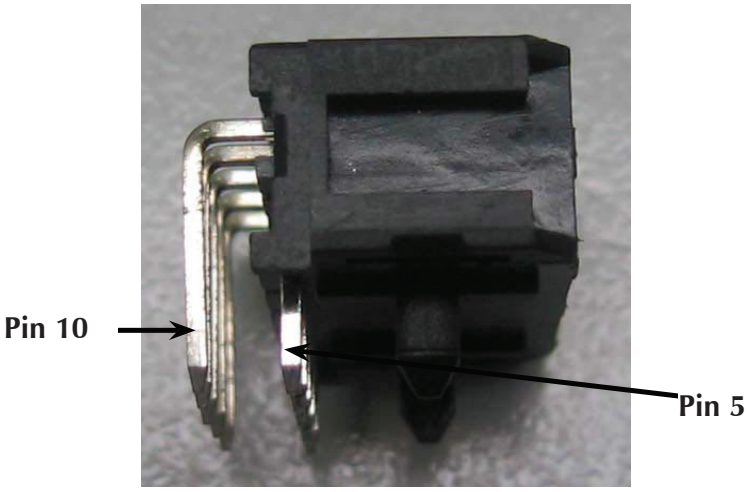
E01, E02, E03		Temperature alarm	E01 - Primary side (Boost and Inverter) temperature alarm E02 and E03 - Secondary side alarm
E10		Boost/Invert overcurrent	15.14.457 Inverter overcurrent 15.14.458 Boost overcurrent
E11,E19		System configuration alarm	E11 - Variables don't valid E19 - Type machine DSP doesn't equal to Type machine uC
E14,E15,E16		Program not valid alarm	Parameters don't recognize on welding point
E17		Communication alarm (uC-DSP) - Type 1	uC-DSP communication error
E20		Memory fault alarm	EEPROM doesn't present or broken
E21		Data loss alarm	Contradictory data in EEPROM
E22		Communication alarm (uC-DSP) - Type 2	DSP doesn't answer
E27		Memory_1 fault alarm	Missing RTC (clock) or RTC broken
E29		Output power alarm	I,V measure error
E38		Under voltage alarm	Dip Voltage
E39,E40		System power supply alarm	E39 - Voltages supply error E40 - Missing phase
E43		Coolant shortage - clogged pipe alarm	
E44		Coolant temperature alarm	
E99		General alarm	Machine doesn't recognize

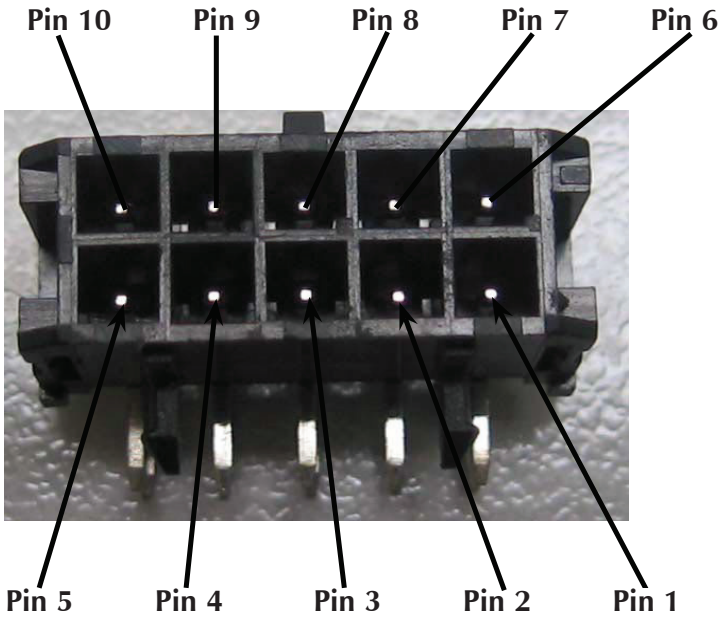
5.16) BUS P.C. BOARD 15.14.431



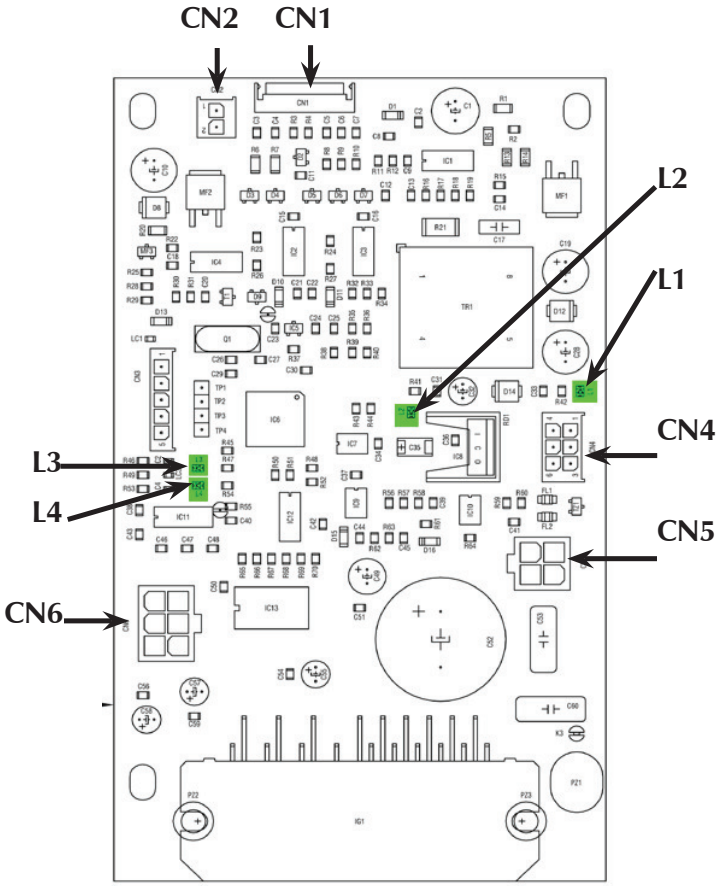
Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
+15Vdc CAN bus voltage supply	ON	CN8	CN8/1 ⟵ CN8/2	+15Vdc	Ⓥ	
Supply voltage	ON	CN9	CN9/3 ⟵ CN9/4 CN9/6 ⟵ CN9/4	+15Vdc +5Vdc	Ⓥ Ⓥ	
Hall sensor	ON	CN10	CN10/7 ⟵ CN10/2	0.68@50A 1.37@100A 2.02@150A 2.71@200A 3.38@250A	Ⓥ Ⓥ Ⓥ Ⓥ Ⓥ	Stick 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

5.17) COOL ARC 35 - PUMP CONTROL P.C. BOARD 15.14.4702



Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
BUS voltage	ON	CN5	CN5/4 ⟵ CN5/1	+350Vdc	Ⓥ	
+24Vdc voltage supply	ON	CN4	CN4/3 ⟵ CN4/2	+24Vdc	Ⓥ	
+24Vdc FAN voltage supply	ON	CN2	CN2/1 ⟵ CN2/2	0Vdc	Ⓥ	FAN OFF
				+24Vdc	Ⓥ	FAN ON
+12Vdc voltage supply	ON	L1=ON				
+5Vdc voltage supply	ON	L2=ON				
Firmware updated	ON	L3=OFF L4=OFF				L3 and L4 are ON when firmware is updated
Pump supply	ON	CN6	U ⟷ V U ⟷ W V ⟷ W	250Vac 250Vac 250Vac	Ⓥ Ⓥ Ⓥ	

CN1/1

CN1/2 -> Display vommand

CN1/3

CN1/4 -> Key button from 15.14.472

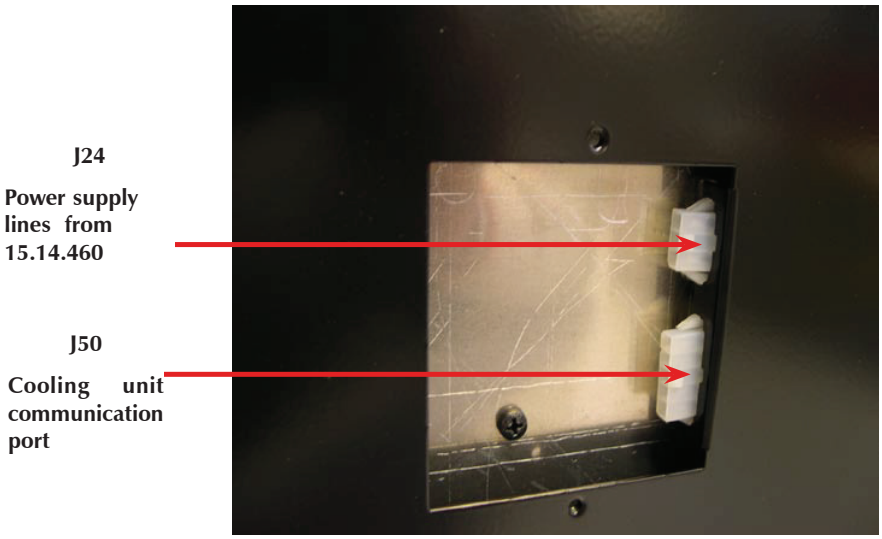
CN1/6 -> Pres

CN1/7 -> Temp

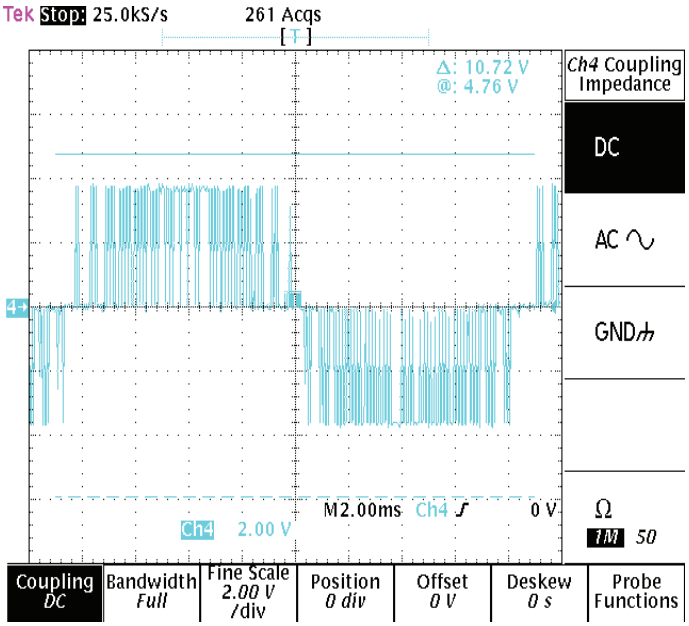
CN1/8 -> Not Use

CN1/9 -> +5V

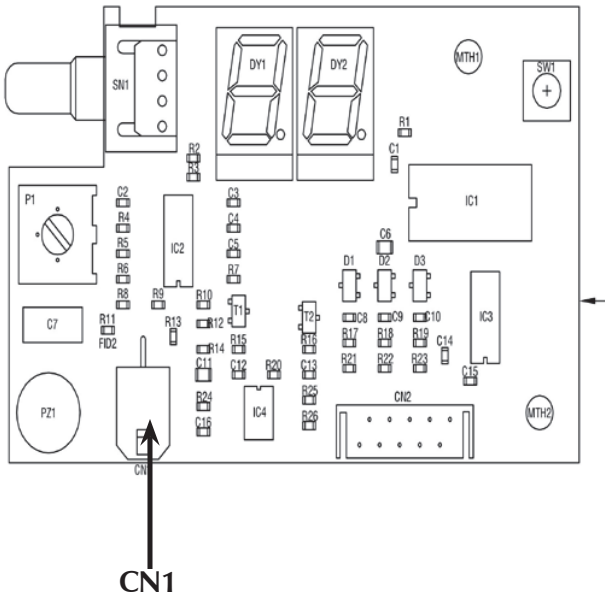
Cn1/10 GND



Waveform between U ⟷ V @ max speed (Press Pump Test - Differential Probe attenuation 1:50)



5.18) COOL ARC 35 - CONTROL PANEL 15.14.472 FP221



Functional Part	Generator/ Mode	Component	Point	Value	Type of Measure	Notes
NTC	ON	CN1	NTC1/1 ⟷ NTC1/2	12kohm*	Ω	*@T=25°C and without CN1 connected

CN2/1

CN2/2 -> Display Command

CN2/3

CN2/4 -> Key button from 15.14.472

CN2/5 -> +15Vdc

CN2/6 -> Pres

CN2/7 -> Temp

CN2/8 -> Not Use

CN2/9 -> +5V

CN2/10 -> GND