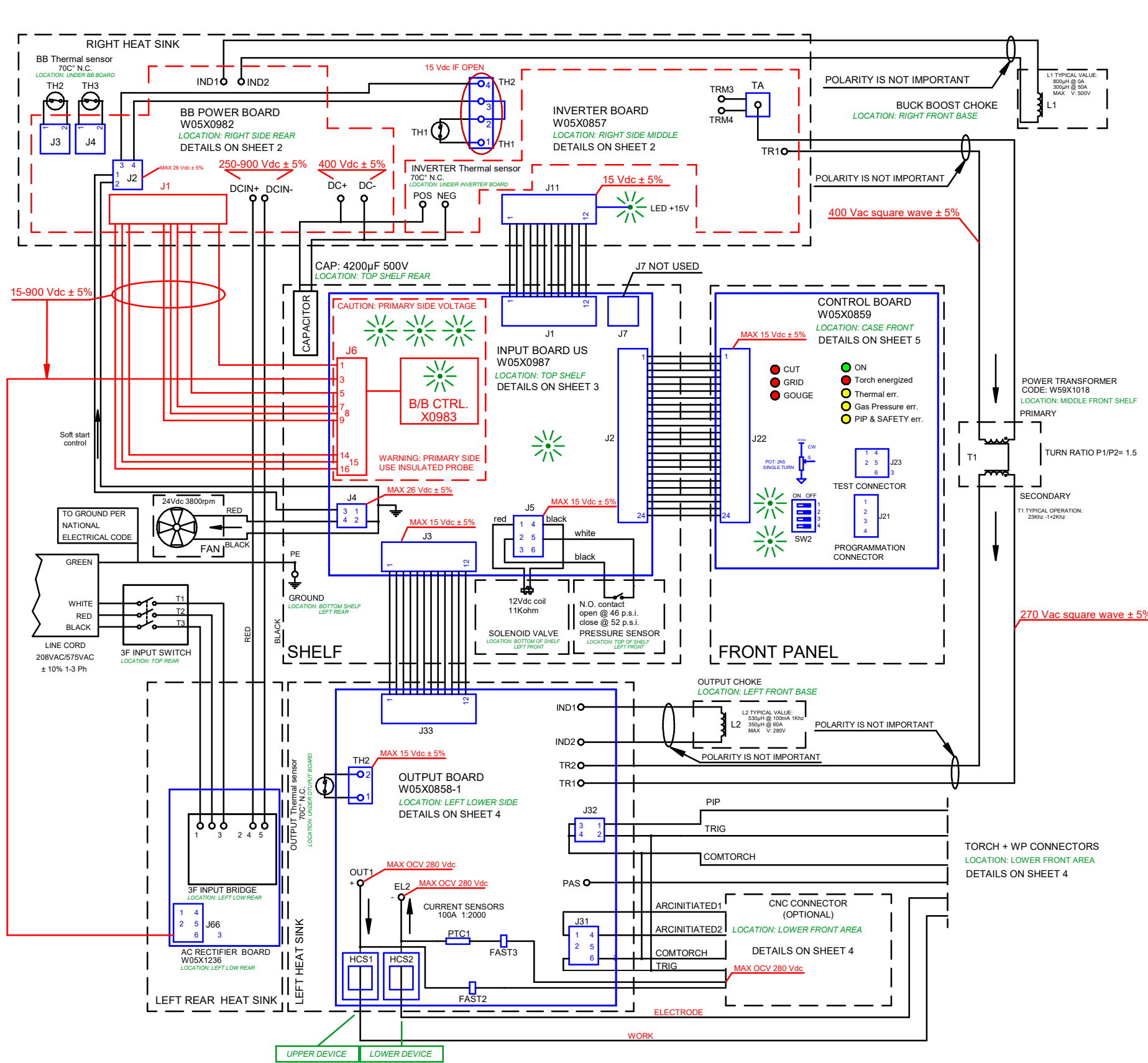
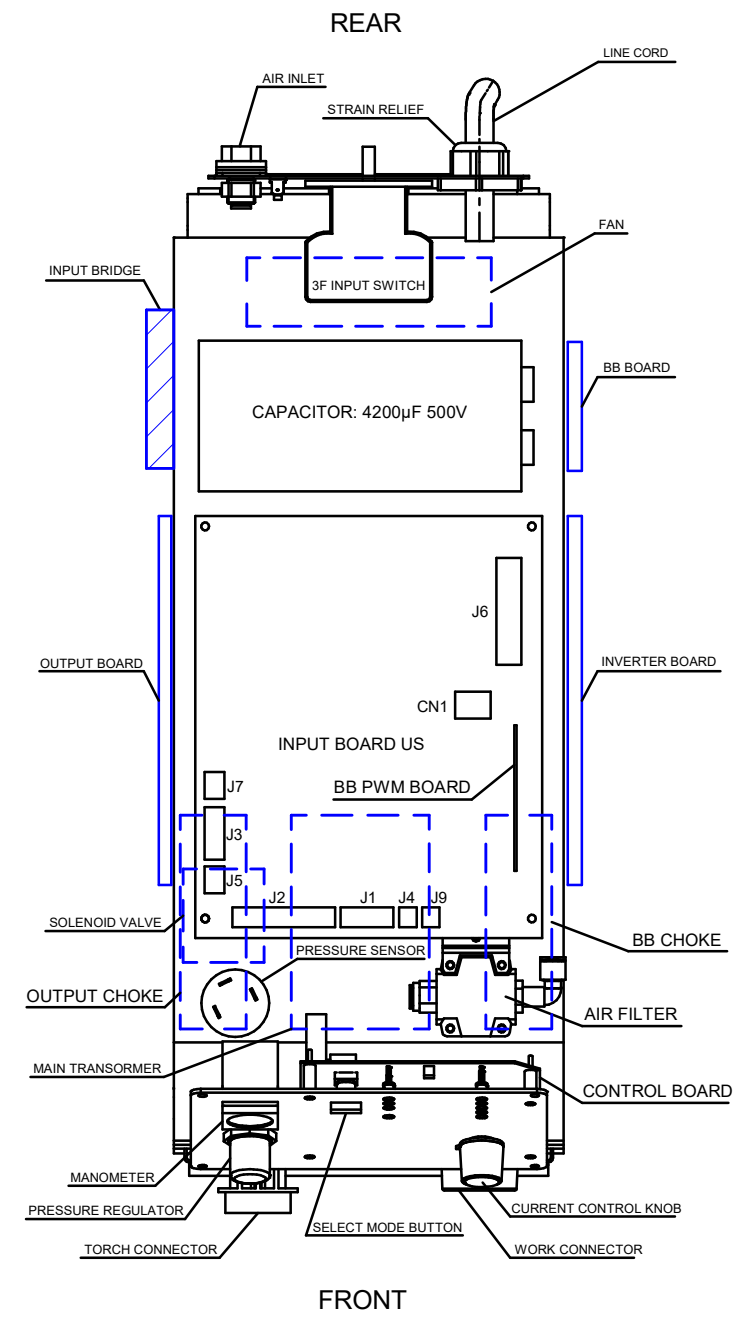


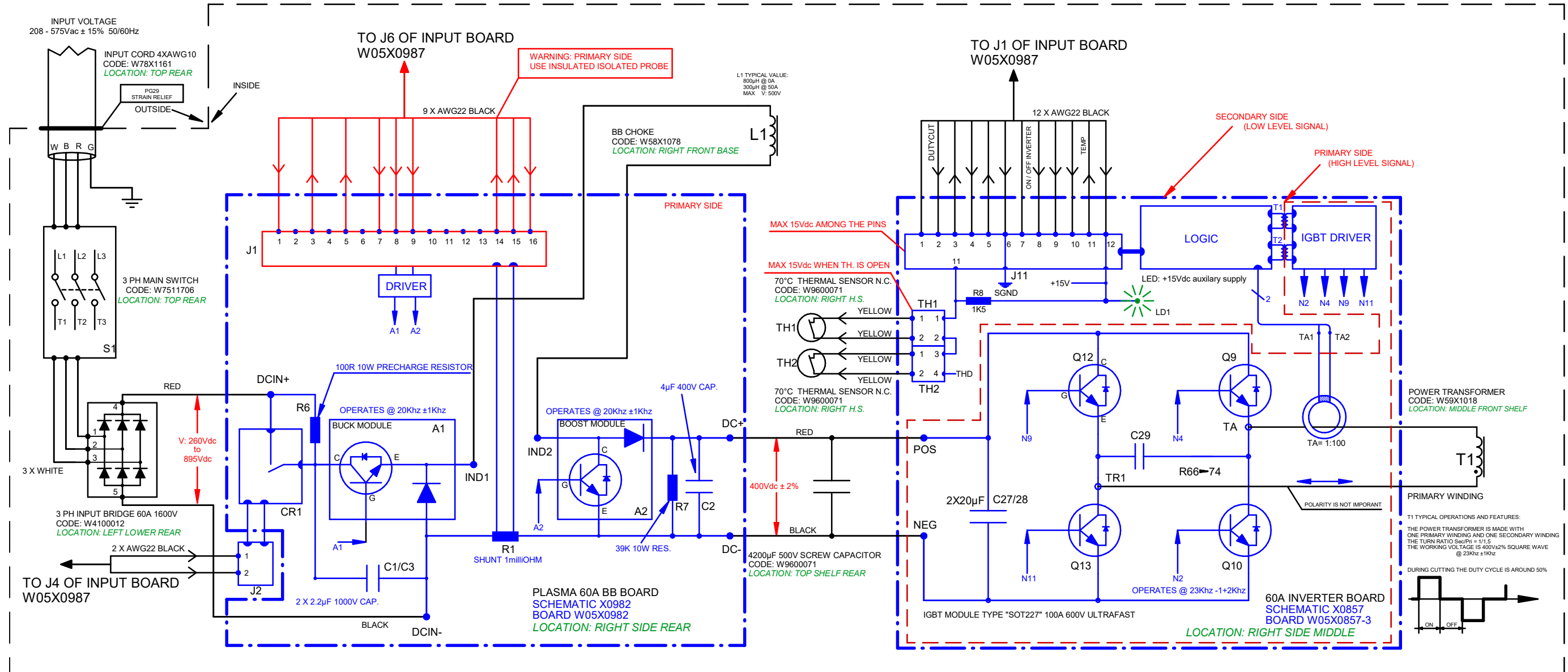
# TOMAHAWK 1000 MACHINE SCHEMATIC M22293 REV: A



TOMAHAWK 1000 COMPONENT LAYOUT



# TOMAHAWK 1000 MACHINE SCHEMATIC M22293 REV: A PAGE 2



J1 PIN OUT		
POS.	NET	DESCRIPTION
1	BUCK_DRIVE	BUCK DRIVER PILOT SIGNAL
3	RECT_AC_LINE	RECTIFIED SIGNAL
5	V_BUS	DC BUS VOLTAGE FEEDBACK
7	GND	RETURN BOOST DRIVER SIGNAL
8	BOOST_DRIVE	BOOST DRIVER PILOT SIGNAL
9	BUCK_COM	RETURN BUCK DRIVER SIGNAL
14	SHUNT_COM	IN SHUNT SIGNAL
15		OUT SHUNT SIGNAL
16	GND	RETURN BOOST DRIVER SIGNAL
OTHERS		Not USED

WARNING: PRIMARY SIDE SIGNALS USE INSULATED ISOLATED PROBE

J11 PIN OUT		
POS.	NET	DESCRIPTION
1	VREG	Not USED
2	DUTYCUT	OUTPUT CURRENT LEVEL CONTROL
3	TA	TA SIGNAL (ONLY FOR TEST)
4	-5V	-5V SEC. SIDE AUXILIARY SUPPLY
5	THD	THERMOSTAT SIGNAL
6	SGND	SECONDARY SIDE GROUND (0V ref)
7		Not USED
8	SDINVB	ON / OFF INVERTER
9	ICUT_CLP	LOW LEVEL CURRENT IN GRID MODE
10	I_LEL	CURRENT SIGNAL FROM HCS2
11	TH1	THERMOSTAT SIGNAL
12	+15V	+15V SEC. SIDE AUXILIARY SUPPLY

J2 PIN OUT		
POS.	NET	DESCRIPTION
1	PRECHARGE_RELAY	POSITIVE RELAY VOLTAGE
2	SGND	NEGATIVE RELAY VOLTAGE

TH1 PIN OUT		
POS.	NET	DESCRIPTION
1		THERMAL SIGNAL SUPPLY
2		THERMAL SIGNAL SHORTCUT

TH2 PIN OUT		
POS.	NET	DESCRIPTION
1		THERMAL SIGNAL SHORTCUT
2	THD	THERMAL SIGNAL RETURN

**BUCK BOOST BOARD** FUNCTIONALITY AND REQUIREMENTS OF THE BOARD W05X0982

The function of this board is to manage the input power (DC/DC converter) to create the 400V DC-BUS for the inverter W05X0857

One high side (buck) module with 75A 1200V ultrafast type IGBT and freewiling ultrafast DIODE inside.

One low side (boost) module with 100A 600V ultrafast type IGBT and ultrafast DIODE inside.

**60A INVERTER BOARD** FUNCTIONALITY AND REQUIREMENTS OF THE BOARD W05X0857

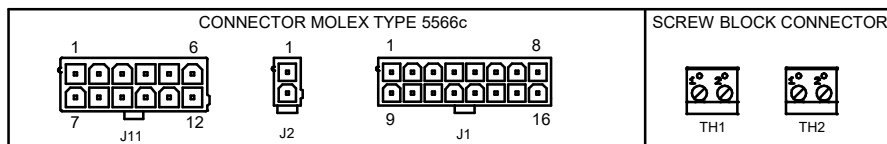
The function of this board is convert the DC continuous bus into a high frequency AC (DC/AC converter)

Power configuration: H-BRIDGE PWM configuration: current mode.

Four modules with 75A 1200V ultrafast type IGBT and freewiling ultrafast DIODE inside.

PWM and driver onboard supplies modulate voltage to the H bridge. Through the main transformer T1 the AC bus is transferred to the secondary. The TA transformer senses the primary current and gives isolated feedback to the PWM.

## BUCK / BOOST AND INVERTER DRAWING



# TOMAHAWK 1000 MACHINE SCHEMATIC M22293 REV: A PAGE 3

POS.	NET	DESCRIPTION
1	TDO	Test Data Output
2	TDI	Test Data Input
3	TCK	Test Clock
4	TMS	Test mode select
5	+3.3V	Supply for JTAG
6	COM	RETURN OF NOT INSULATED SUPPLY (0V ref)

POS.	NET	DESCRIPTION
1	BUCK_DRIVE	BUCK DRIVER PILOT SIGNAL
3	RECT_AC_LINE	RECTIFIED SIGNAL
5	V_BUS	DC BUS VOLTAGE FEEDBACK
7	COM	RETURN OF NOT INSULATED SUPPLY (0V ref)
8	BOOST_DRIVE	BOOST DRIVER PILOT SIGNAL
9	BUCK_COM	RETURN BUCK DRIVER SIGNAL
13	+150_V	LOW POWER SIGNAL
14	SHUNT_AC	IN SHUNT SIGNAL
15	SHUNT_COM	OUT SHUNT SIGNAL
16	COM	RETURN OF NOT INSULATED SUPPLY (0V ref)

POS.	NET	DESCRIPTION
1	REMSIGN	REMOTE CONTROL SIGNAL
2	VCC_5	+5V SEC. SIDE AUXILIARY SUPPLY
3	SGND	RETURN SEC. SIDE AUX. SUPPLY (0V ref)
4	ARCINITIATED	ARC INITIATED SIGNAL
5	/TR	TRIGGER SIGNAL
6	+15V	+15V SEC. SIDE AUXILIARY SUPPLY

POS.	NET	DESCRIPTION
1	I_WP	CURRENT SIGNAL FROM HCS1 (2.15V = 60A)
2	SW_CTRL	PILOT ARC STATIC SWITCH CONTROL: 0V PILOT ARC STATIC SW. CLOSED 15V PILOT ARC STATIC SW. OPENED
3	-5V	-5V SEC. SIDE AUXILIARY SUPPLY
4	I_EL	CURRENT SIGNAL FROM HCS2 (2.4V = 60A)
5	SGND	RETURN SEC. SIDE AUX. SUPPLY (0V ref)
6		Not USED
7	/TR	TRIGGER TORCH SIGNAL: 0V TRIGGER DRY CLOSED 15V TRIGGER RELEASED
8	/PIP	PART IN PLACE SIGNAL: 0V SHIELD CUP IN THE RIGHT POSITION 15V SHIELD CUP ASSEMBLED WRONG
9	ARCINITIATED	ARCINITIATED
10	THD	THERMOSTAT SIGNAL
11	+15V	+15V SEC. SIDE AUXILIARY SUPPLY
12	NOZ	Not USED

**WARNING: PRIMARY SIDE USE INSULATED PROBE ISOLATED**

TO J1 OF BB BOARD W05X0982  
HARNESS COD.: W6860019  
9 X AWG22 BLACK

POS.	NET	DESCRIPTION
1	FAN_ON	FAN AUXILIARY SUPPLY (28Vdc)
2	SGND	GND SEC. SIDE AUXILIARY SUPPLY (0V ref)

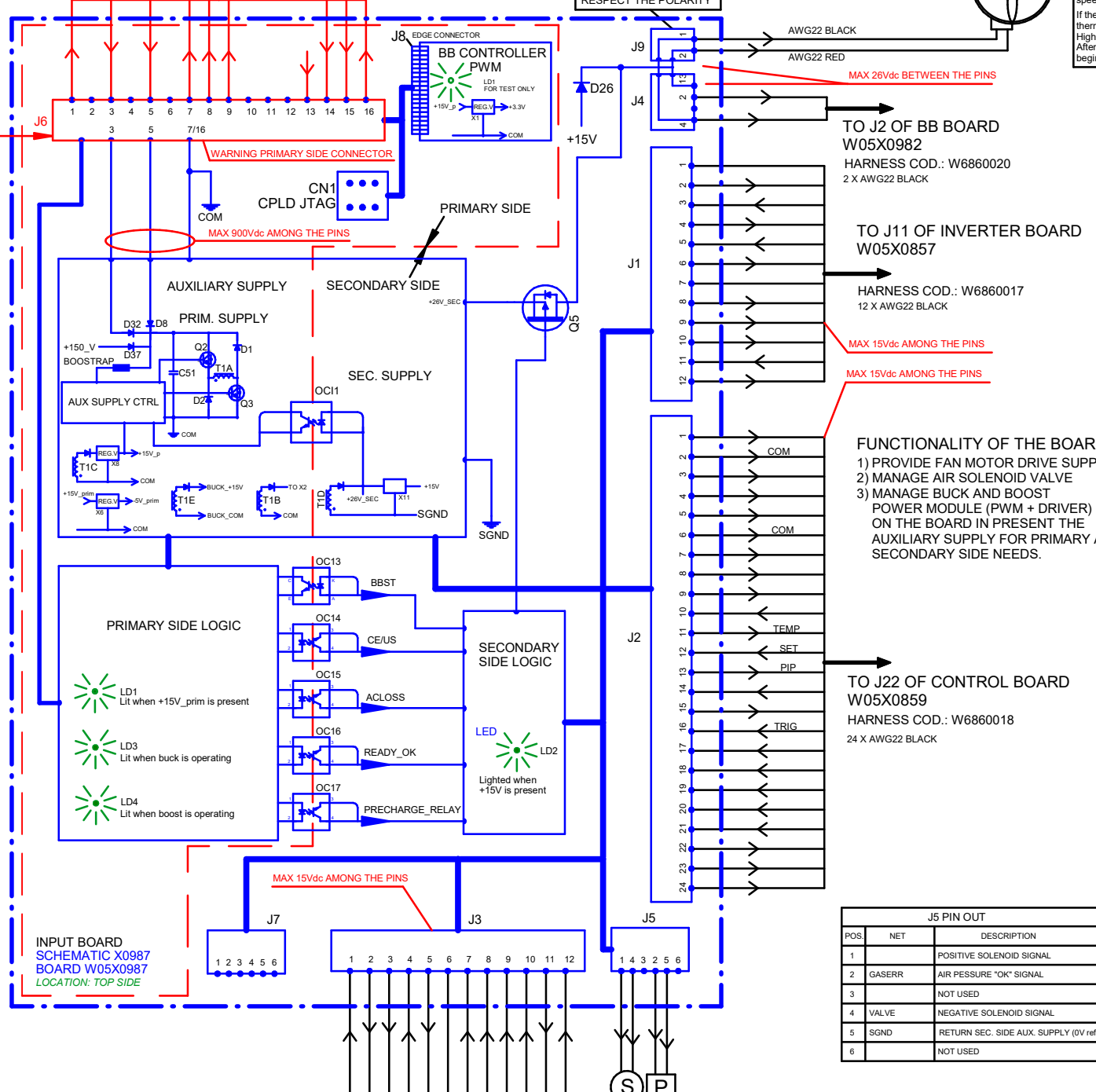
**FAN**  
LOCATION: LOWER REAR  
24Vdc 1.1A  
3800 rpm ± 10%  
260 CFM in free air  
172 x 150 x 51 mm

**FAN OPERATION**  
When the unit is energized the fan starts to run at "High speed".  
FAN AS NEEDED FUNCTIONALITY  
After five minute from when the machine has been turned on and no current flow to the output the fan goes from high speed to low speed.  
If the high temperature error comes from the thermal sensor (TH1) the µC puts the fan in High speed status until the error disappears. After that the process starts again from the beginning.

POS.	NET	DESCRIPTION
1	SGND	GND SEC. SIDE AUXILIARY SUPPLY (0V ref)
2	SGND	GND SEC. SIDE AUXILIARY SUPPLY (0V ref)
3	RELAY	POSITIVE RELAY VOLTAGE SUPPLY
4	FAN_ON	POSITIVE FAN VOLTAGE SUPPLY

POS.	NET	DESCRIPTION
1	VREG	Not USED
2	DUTYCUT	OUTPUT CURRENT LEVEL CONTROL
3	TA	TA SIGNAL (ONLY FOR TEST)
4	-5V	-5V SEC. SIDE AUXILIARY SUPPLY
5	THD	THERMOSTAT SIGNAL
6	SGND	RETURN SEC. SIDE AUX. SUPPLY (0V ref)
7		Not USED
8	SDINVB	ON / OFF INVERTER
9	ICUT_CLP	LOW LEVEL CURRENT IN GRID MODE
10	I_EL	CURRENT SIGNAL FROM HCS2
11	TH1	THERMOSTAT SIGNAL
12	+15V	+15V SEC. SIDE AUXILIARY SUPPLY

POS.	NET	DESCRIPTION
1	+15V	+15V SEC. SIDE AUXILIARY SUPPLY
2	SGND	RETURN SEC. SIDE AUX. SUPPLY (0V ref)
3	GASERR	AIR PESSURE SIGNAL: 0V PESSURE OK 15V PESSURE OUT OF RANGE
4	I_EL	CURRENT SIGNAL FROM HCS2 (2.4V=60A)
5	I_WP	CURRENT SIGNAL FROM HCS1 (2.15V = 60A)
6	SGND	GND SEC. SIDE AUXILIARY SUPPLY (0V ref)
7	NOZ	NOT USED
8	REMSIGN	REMOTE CONTROL SIGNAL: 0-4.28V = 0-60A
9	READY_OK	SIGNAL "READY OK" TO START CUTTING: 0V = NO ERROR -> OK TO START 15V = ERROR -> WAITING NO ERROR TO START
10	SW_CTRL	PILOT ARC STATIC SWITCH SIGNAL: 0V = STATIC SWITCH CLOSE 15V = STATIC SWITCH OPEN
11	TH1	THERMOSTAT SIGNAL: 0V= NO ERROR, 15V= ERROR
12	DUTYCUT	CURRENT SET SIGNAL 9.6V = 60A
13	/PIP	PART IN PLACE SECONDARY SIDE SIGNAL: 0V = shield cup in the right position 15V = shield cup wrong assembled
14	SDINVB	SHUT DOWN INVERTER SIGNAL: 0V = inverter ON 15V = inverter OFF
15	TH2	NOT USED
16	/TR	TRIGGER TORCH SECONDARY SIDE SIGNAL: 0V = trigger dry close 15V = trigger released
17	SOL	SOLENOID VALVE SIGNAL: 0V= SOL. ON; 15V= SOL. OFF
18	FAN	FAN SIGNAL: 0V= FAN OFF; 15V= FAN ON
19	ARCINITIATED	ARC INITIATED: 0V= ARC ON; 15V= ARC OFF
20	ICUT_CLP	LOW LEVEL GRID MODE: 0V= NO CLAMP; 15V= CLAMP
21	BBST	SWITCH OFF BB: 0V= BB ON; 15V= BB OFF
22	CEUS	HIGH LEVEL = CE VERSION, LOW LEVEL = US
23	ACLOSS	LOSS OF WAVE SIGNAL: 0V=OK, 15V=ERROR
24	TA	TA SIGNAL (ONLY FOR TEST)

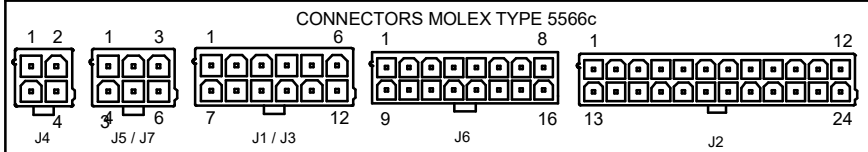


**FUNCTIONALITY OF THE BOARD:**  
1) PROVIDE FAN MOTOR DRIVE SUPPLY  
2) MANAGE AIR SOLENOID VALVE  
3) MANAGE BUCK AND BOOST POWER MODULE (PWM + DRIVER) ON THE BOARD IN PRESENT THE AUXILIARY SUPPLY FOR PRIMARY AND SECONDARY SIDE NEEDS.

POS.	NET	DESCRIPTION
1		POSITIVE SOLENOID SIGNAL
2	GASERR	AIR PESSURE "OK" SIGNAL
3		NOT USED
4	VALVE	NEGATIVE SOLENOID SIGNAL
5	SGND	RETURN SEC. SIDE AUX. SUPPLY (0V ref)
6		NOT USED

TO J33 OF OUTPUT BOARD W05X0857  
HARNESS COD.: W6860017  
12 X AWG22 BLACK

TO PRESSURE SENSOR AND SOLENOID VALVE  
HARNESS COD.: W6820009  
SEE SHEET N°3



## INPUT BOARD AND BB PWM DRAWING

# TOMAHAWK 1000 MACHINE SCHEMATIC M22293 REV: A PAGE 4

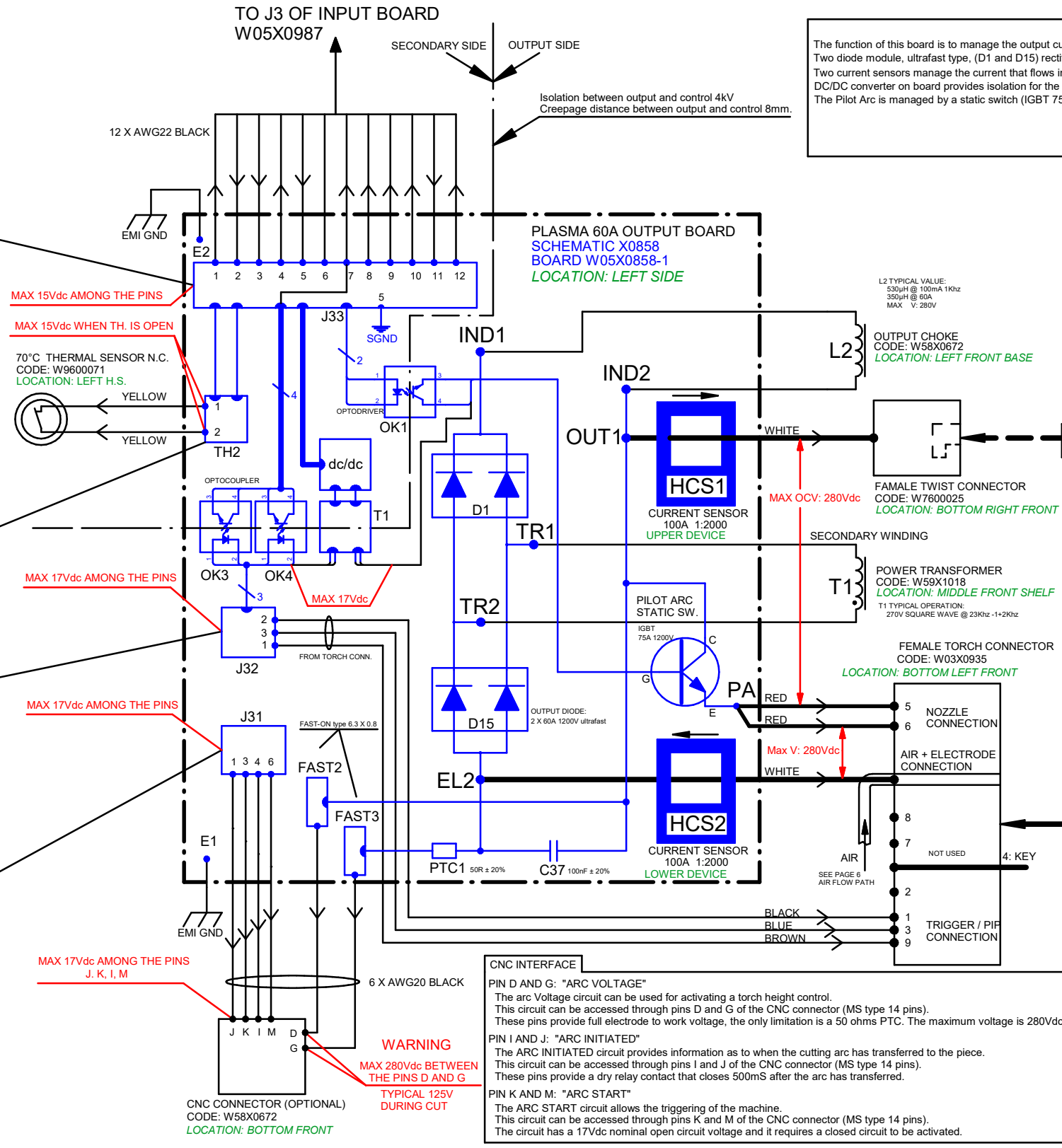
POS.	NET	DESCRIPTION
1	I_WP	CURRENT SIGNAL FROM HCS1
2	SW_CTRL	PILOT ARC STATIC SWITCH CONTROL
3	-5V	-5V SEC. SIDE AUXILIARY SUPPLY
4	I_EL	CURRENT SIGNAL FROM HCS2
5	SGND	SECONDARY SIDE GROUND
6	Not USED	Not USED
7	/TR	TRIGGER TORCH SECONDARY SIDE SIGNAL
8	/PIP	PART IN PLACE SECONDARY SIDE SIGNAL
9	ARCINITIATED	ARCINITIATED
10	THD	THERMOSTAT SIGNAL
11	+15V	+15V SEC. SIDE AUXILIARY SUPPLY
12	NOZ	Not USED

POS.	NET	DESCRIPTION
1	SGND	SECONDARY SIDE GROUND (0V ref)
2	THD	THERMOSTAT SIGNAL

POS.	NET	DESCRIPTION
1	PIP	PART IN PLACE SIGNAL
2	TRIG	TRIGGER TORCH SIGNAL
3	COMTORCH	COMMON RETURN
4	COMTORCH	COMMON RETURN

POS.	NET	DESCRIPTION
1	ARCINITIATED1	ARC INITIATED RELE CONTACT
2	Not USED	
3	TRIG	TRIGGER COMMAND
4	ARCINITIATED2	ARC INITIATED RELE CONTACT
5	Not USED	
6	COMTORCH	COMMON TR/PIP RETURN

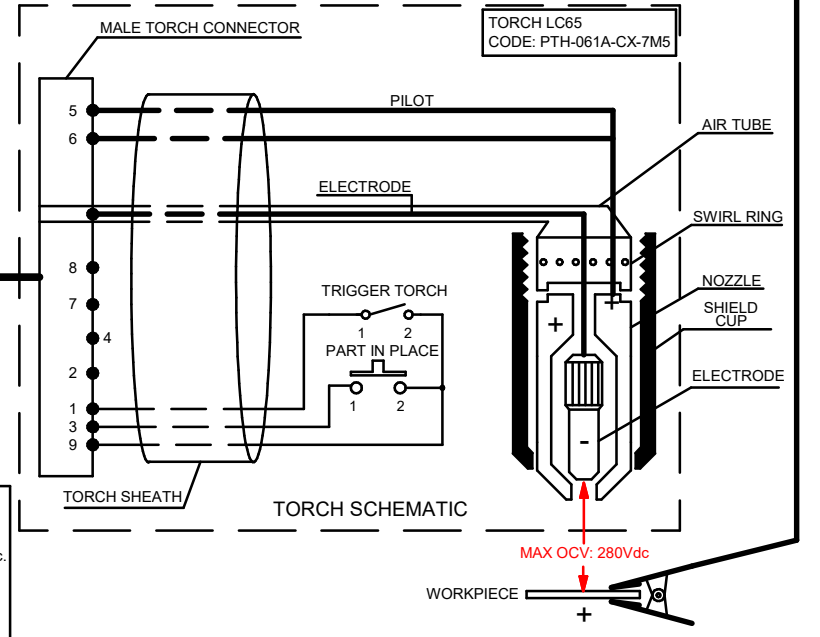
POS.	NET	DESCRIPTION
FAST2	+ Vout	POSITIVE OUTPUT VOLTAGE
FAST3	- Vout	NEGATIVE OUTPUT VOLTAGE



**FUNCTIONALITY OF THE BOARD W05X0858**  
 The function of this board is to manage the output current and signals.  
 Two diode module, ultrafast type, (D1 and D15) rectify the secondary from the power transformer and create the output DC supply.  
 Two current sensors manage the current that flows in the workpiece and in the electrode and generates the feedback to the control to manage the different cutting operations.  
 DC/DC converter on board provides isolation for the torch signals (trigger, pip), the static switch, CNC signal and the secondary side control system.  
 The Pilot Arc is managed by a static switch (IGBT 75A 1200V) Q1.

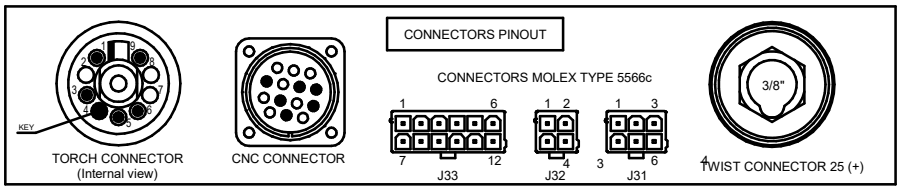
**TORCH FUNCTIONS AND REQUIREMENTS**  
 The pilot arc ignition is lift type  
 The maximum OCV is 320Vdc  
**PILOT ARC:** The pilot arc current is 18A±2A for 4 seconds. The pilot arc current increases up to 25A when the cut is starting (the threshold is around 4A of the I workpiece).  
 When the cut is established the pilot arc is turned off.  
 The cutting air flow time varies with the current setting from 15s @20A to 30s @60A  
 The length of the standard manual torch is 25' (7.5m); available optional 50' manual torch and 25' mechanized torch.  
 More info about the torch and consumables is available in the manual.

**WORKPIECE CABLE FUNCTIONS AND REQUIREMENTS**  
 The length the standard workpiece cable is 20' (6m).  
 The cross section is 16mm²



**CNC INTERFACE**  
**PIN D AND G: "ARC VOLTAGE"**  
 This arc Voltage circuit can be used for activating a torch height control.  
 This circuit can be accessed through pins D and G of the CNC connector (MS type 14 pins).  
 These pins provide full electrode to work voltage, the only limitation is a 50 ohms PTC. The maximum voltage is 280Vdc.  
**PIN I AND J: "ARC INITIATED"**  
 The ARC INITIATED circuit provides information as to when the cutting arc has transferred to the piece.  
 This circuit can be accessed through pins I and J of the CNC connector (MS type 14 pins).  
 These pins provide a dry relay contact that closes 500mS after the arc has transferred.  
**PIN K AND M: "ARC START"**  
 The ARC START circuit allows the triggering of the machine.  
 This circuit can be accessed through pins K and M of the CNC connector (MS type 14 pins).  
 The circuit has a 17Vdc nominal open circuit voltage and it requires a closed circuit to be activated.

## OUTPUT STAGE AND TORCH DRAWING



# TOMAHAWK 1000 MACHINE SCHEMATIC M22293 REV: A PAGE 5

**J22 PIN OUT for voltages see page 3.**

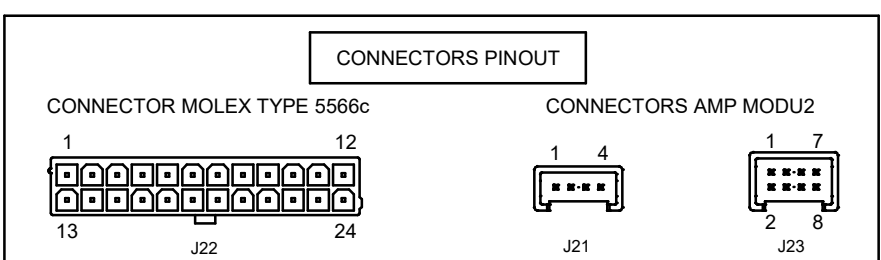
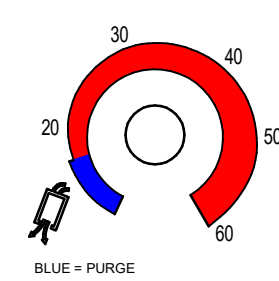
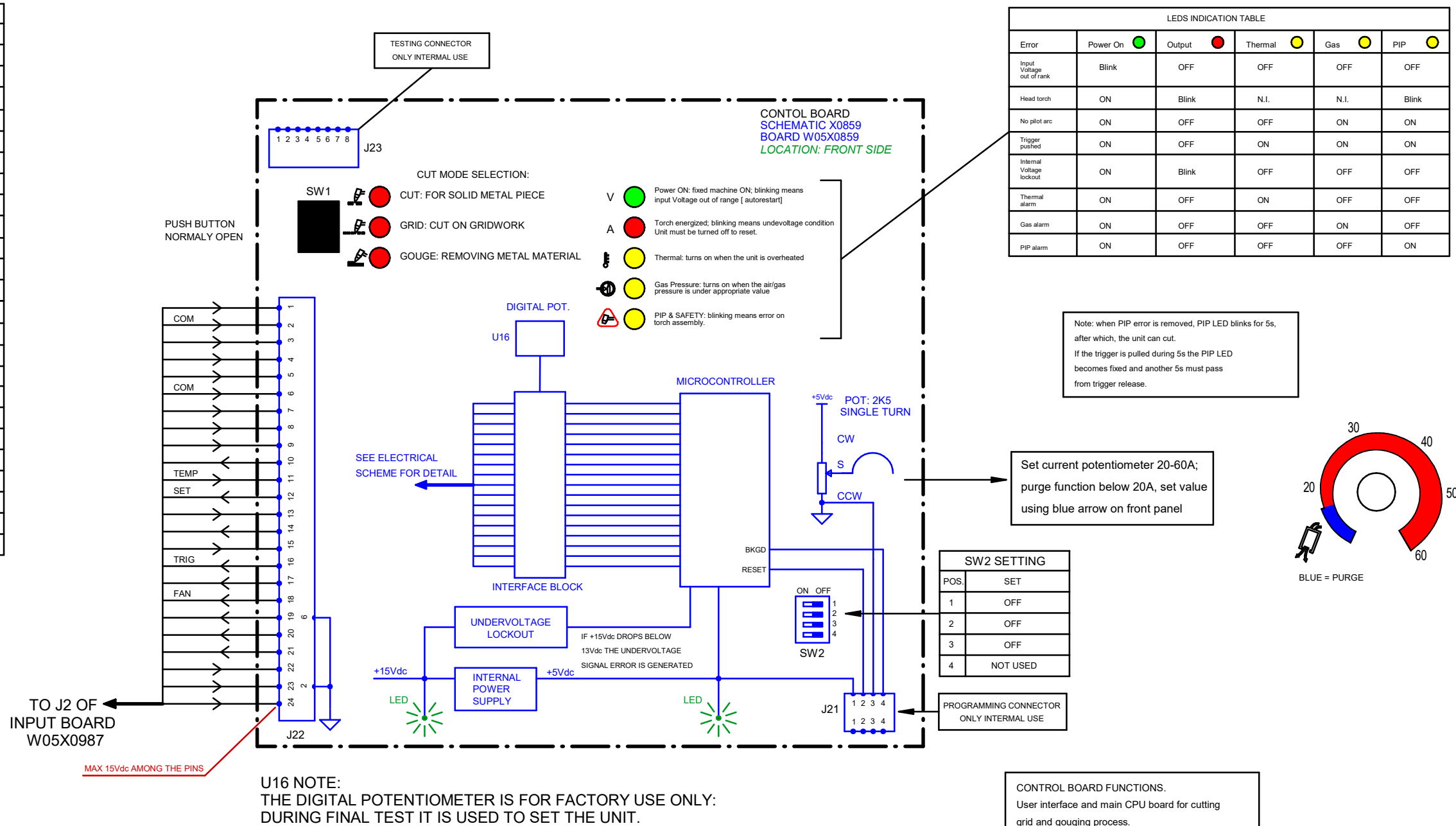
POS.	NET	DESCRIPTION
1	+15V	+15V SEC. SIDE AUXILIARY SUPPLY
2	SGND	GND SEC. SIDE AUXILIARY SUPPLY (0V ref)
3	GASERR	AIR PESSURE SIGNAL
4	I_EL	CURRENT SIGNAL FROM HCS2
5	I_WP	CURRENT SIGNAL FROM HCS1
6	SGND	GND SEC. SIDE AUXILIARY SUPPLY (0V ref)
7	NOZ	NOT USED
8	REMSIGN	REMOTE CONTROL SIGNAL
9	READY_OK	SIGNAL "READY OK" TO START CUTTING
10	SW_CTRL	PILOT ARC STATIC SWITCH SIGNAL
11	TH1	THERMOSTAT SIGNAL: 0= NO ERROR; 1= ERROR
12	DUTYCUT	CURRENT SET SIGNAL
13	/PIP	PART IN PLACE SECONDARY SIDE SIGNAL
14	SDINVB	SHUT DOWN INVERTER SIGNAL
15	TH2	NOT USED
16	/TR	TRIGGER TORCH SECONDARY SIDE SIGNAL
17	SOL	SOLENOID VALVE SIGNAL
18	FAN	FAN SIGNAL
19	ARCINITIATED	ARC INITIATED
20	ICUT_CLP	LOW LEVEL GRID MODE
21	BBST	SWITCH OFF BB
22	CEIUS	HIGH LEVEL = CE VERSION
23	ACLOSS	LOSS OF WAVE SIGNAL
24	TA	TA SIGNAL (ONLY FOR TEST)

**J23 PIN OUT see note at connector**

POS.	NET	DESCRIPTION
1	TA	CURRENT SIGNAL FROM TA
2	SGND	SECONDARY SIDE GROUND
3	FAN	GND THE PIN TO PUT THE FAN OFF
4	THER	THERMAL LED SIGNAL
5	READY_OK	SIGNAL READY OK
6	SGND	SECONDARY SIDE GROUND
7	RX	RX rs232 (FROM PIN 14 / U2)
8	TX	TX rs232 (FROM PIN 13 / U2)

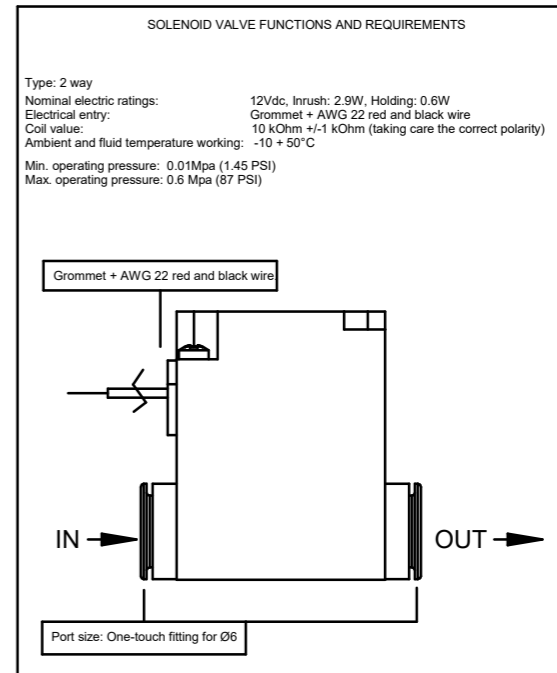
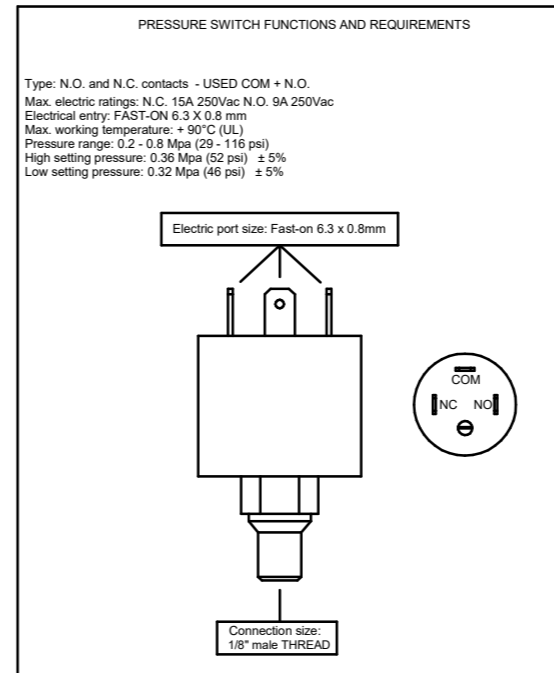
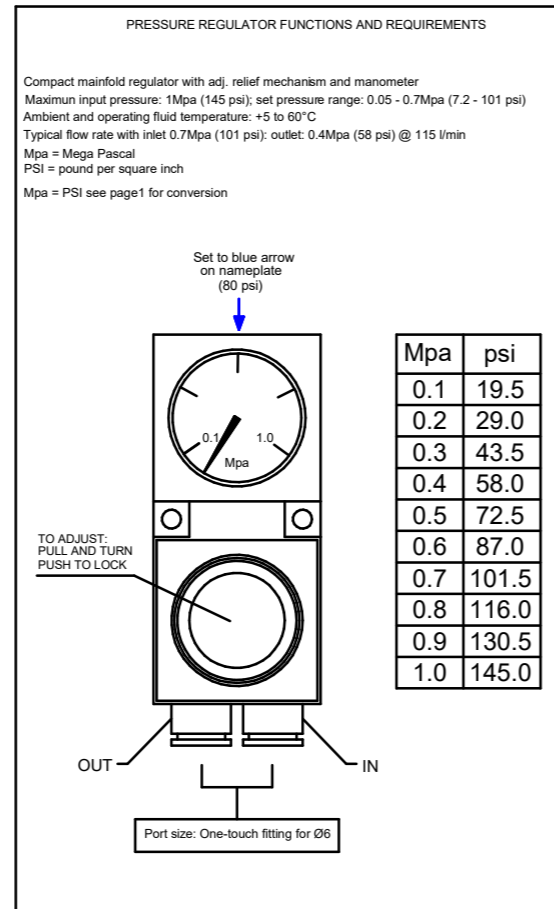
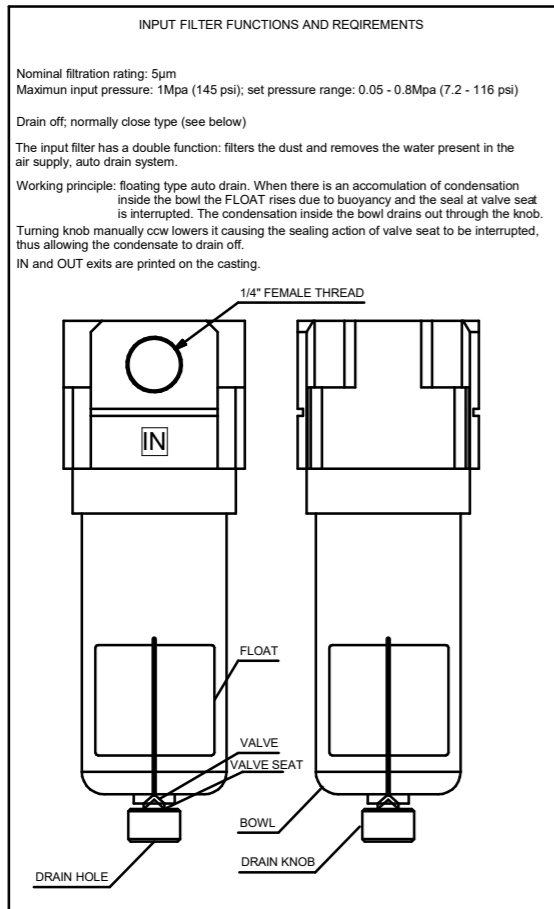
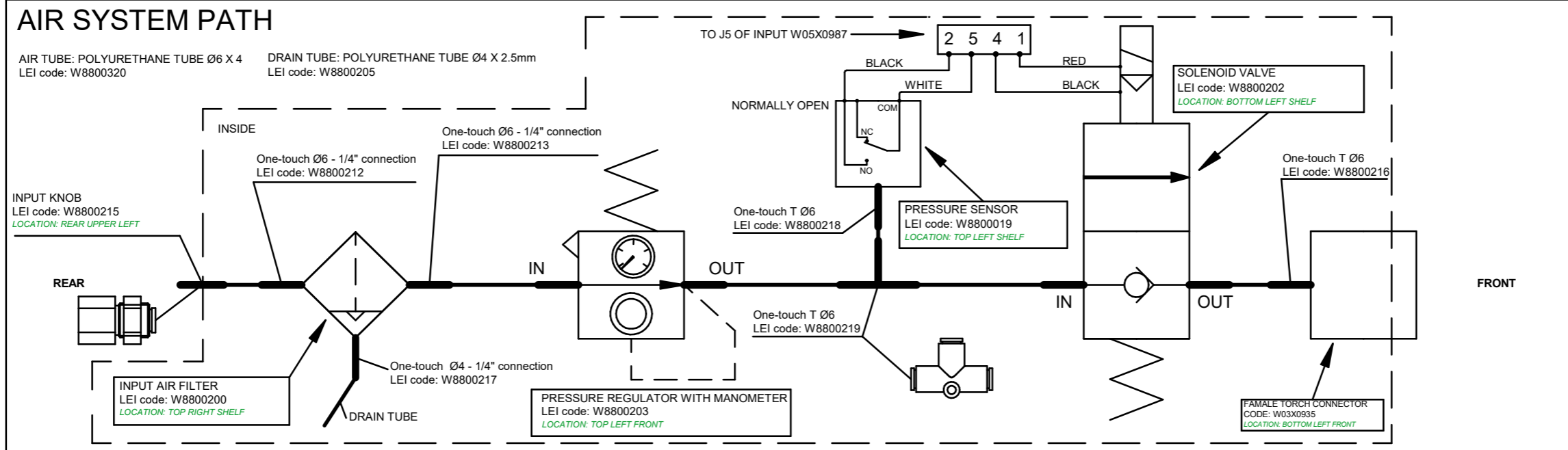
**J21 PIN OUT see note at connector**

POS.	NET	DESCRIPTION
1	+5Vdc	SEC. SIDE +5V AUXILIARY SUPPLY
2	RESET	PROGRAMMING SIGNAL TO PIN 3 / U2
3	SGND	SECONDARY SIDE GROUND
4	BKGD	PROGRAMMING SIGNAL TO PIN 56 / U2



## CONTROL BOARD DRAWING

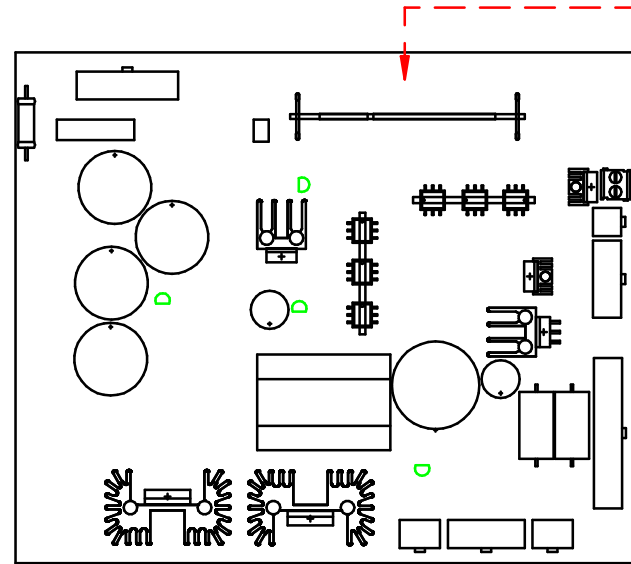
# TOMAHAWK 1000 MACHINE SCHEMATIC M22293 REV: A PAGE 6



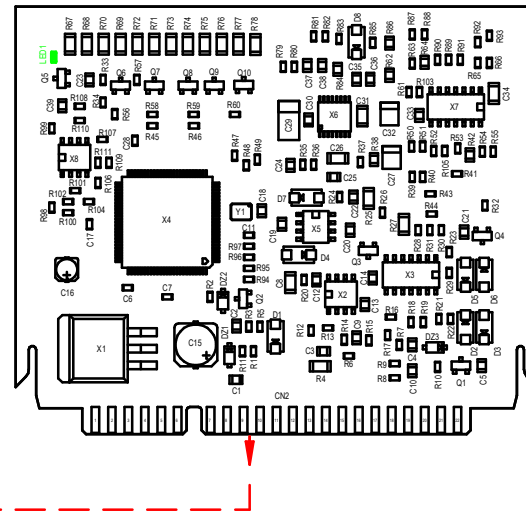
**AIR SYSTEM DRAWING**

# TOMAHAWK 1000 MACHINE SCHEMATIC M22293 REV: A PAGE 7

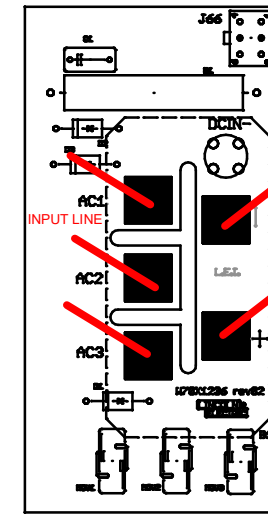
INPUT BOARD W05X0987  
PWM BB BOARD W05X0983



PWM BB BOARD W05X0983  
(daughter board of Input board)



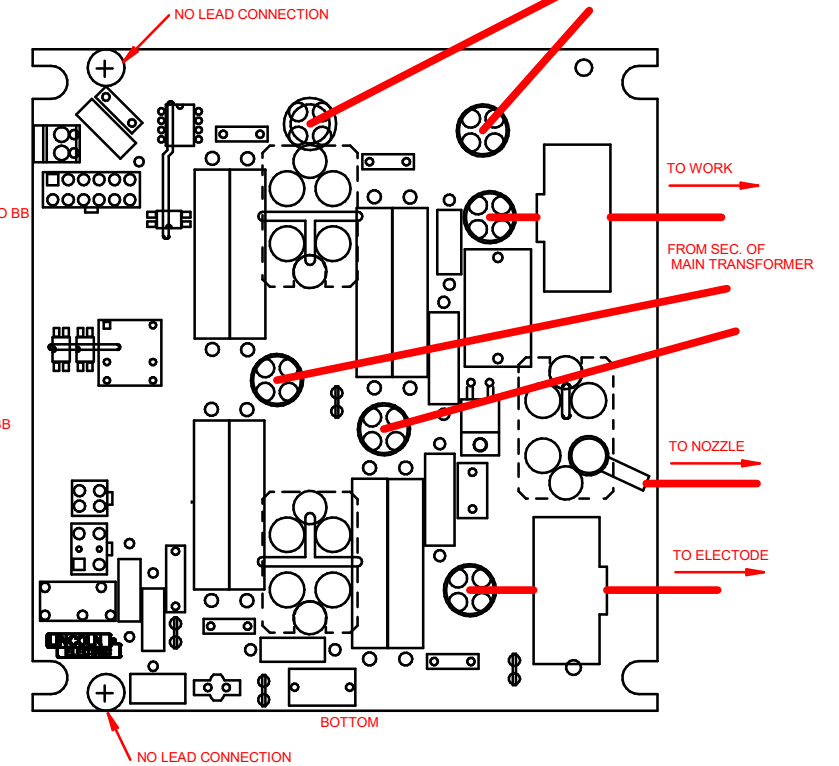
AC RECTIFIER BOARD W05X1236



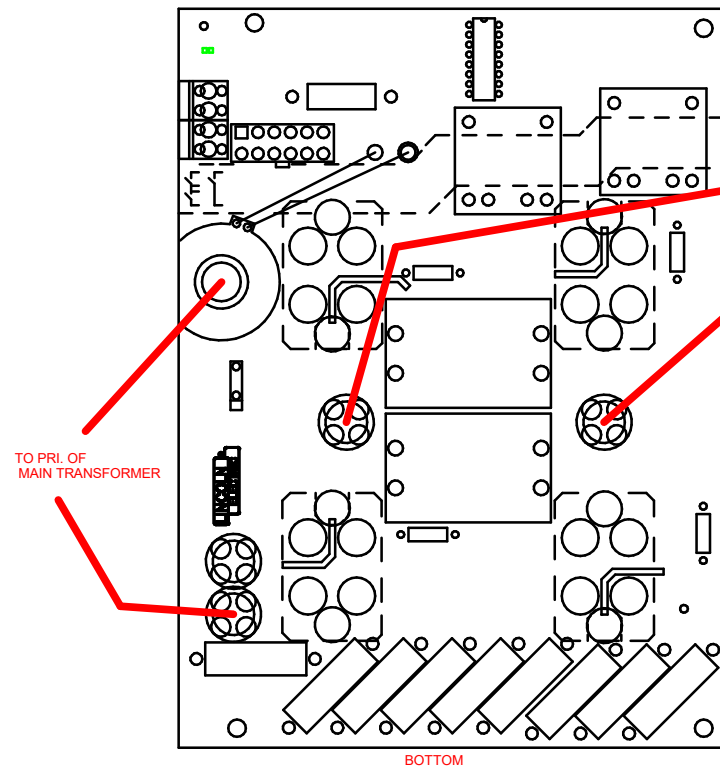
BLACK: TO BB  
DCIN-

RED: TO BB  
DCIN+

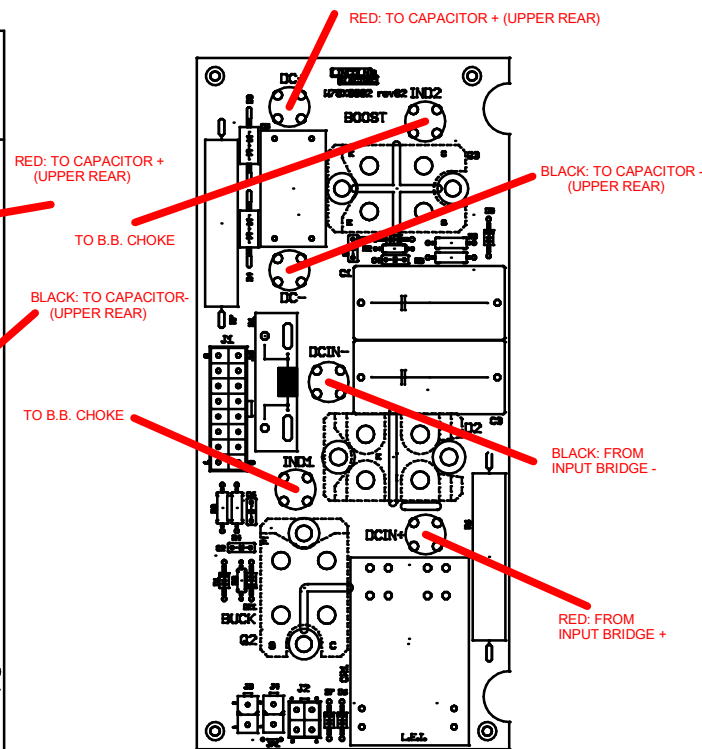
OUTPUT BOARD W05X0858



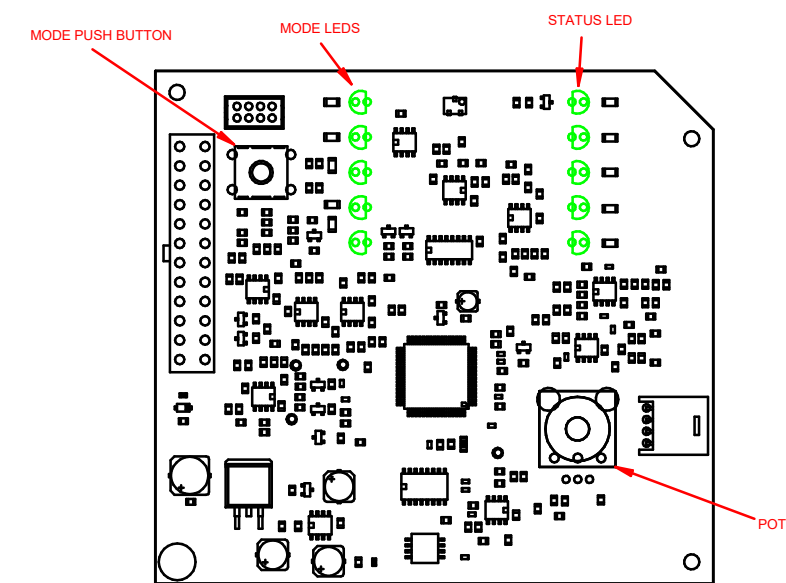
INVERTER BOARD W05X0857



BB BOARD W05X0982



CONTROL BOARD W05X0859



**BOARD LAYOUT DRAWING**