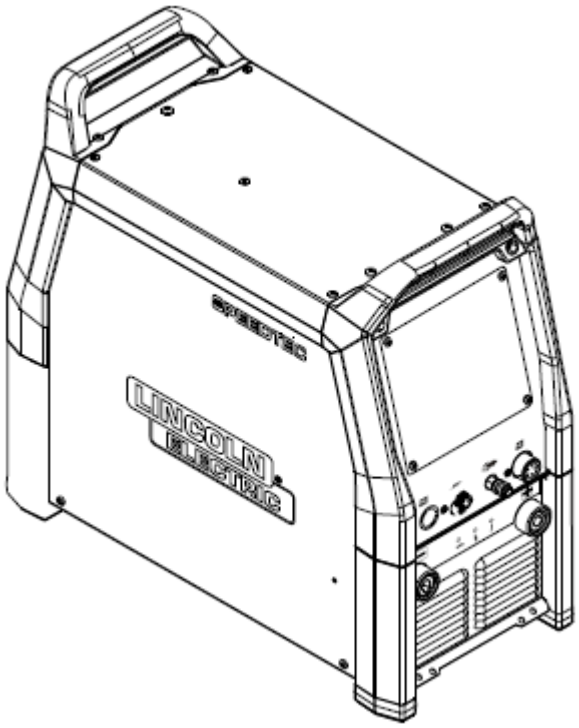
SVM 3221
Rev.00 10-2026

SPEEDTEC® 400S - 500S Gen4

For use with machines having code numbers: 50781, 50782



SERVICE MANUAL

LINCOLN ELECTRIC EUROPE
www.lincolnelectric.eu

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TECHNICAL SPECIFICATIONS

NAME	INDEX
SPEEDTEC® 400SP STANDARD	K14457-1

INPUT				
Input Voltage U_1	400V±10% 3-phase			
Rated Cycle	100%			
Input Power at Rated Cycle	20kVA			
Input Amperes I_{1max}	28A			
Power Factor PF	0,83			
EMC Class	A			
Frequency	50/60Hz			
RATED OUTPUT AT 40°C				
Process	GMAW	FCAW	SMAW	GTAW
Input Voltage	400V			
Open Circuit Voltage (peak)	65Vdc			
Rated Cycle (based on a 10 min. period)	100%	100%	100%	100%
Output Current	420A	420A	420A	420A
Output Voltage	35Vdc	35Vdc	36,8Vdc	26,8Vdc
WELDING CURRENT RANGE				
Input Voltage	400V			
GMAW	20A ÷ 420A			
FCAW	20A ÷ 420A			
SMAW	15A ÷ 420A			
GTAW	15A ÷ 420A			
WELDING VOLTAGE REGULATION RANGE				
GMAW	10V ÷ 45V			
FCAW	10V ÷ 45V			
RECOMMENDED SUPPLY NETWORK CABLE AND FUSE SIZES				
Supply network cable	4x4mm^2			
Fuse Type gR or Circuit Breaker Type Z	32A			

NAME					INDEX			
SPEEDTEC® 500SP STANDARD					K14458-1			
INPUT								
Input Voltage U_1	400V±10% 3-phase							
Rated Cycle	100%				60%			
Input Power at Rated Cycle	20kVA				25kVA			
Input Amperes I_{1max}	28A				35A			
Power Factor PF	0,83				0,88			
EMC Class	A							
Frequency	50/60Hz							
RATED OUTPUT AT 40°C								
Process	GMAW		FACW		SMAW		GTAW	
Input Voltage	400V							
Open Circuit Voltage (peak)	65Vdc							
Rated Cycle (based on a 10 min. period)	100%	60%	100%	60%	100%	60%	100%	60%
Output Current	420A	500A	420A	500A	420A	500A	420A	500A
Output Voltage	35Vdc	39Vdc	35Vdc	39Vdc	36,8Vdc	40Vdc	26,8Vdc	30Vdc
WELDING CURRENT RANGE								
Input Voltage	400V							
GMAW	20A ÷ 500A							
FCAW	20A ÷ 500A							
SMAW	15A ÷ 500A							
GTAW	15A ÷ 500A							
WELDING VOLTAGE REGULATION RANGE								
GMAW	10V ÷ 45V							
FCAW	10V ÷ 45V							
RECOMMENDED SUPPLY NETWORK CABLE AND FUSE SIZES								
Supply network cable	4x4mm^2							
Fuse Type gR or Circuit Breaker Type Z	32A							

ONLINE ACCESS TO INSTRUCTION MANUAL

The current version of the instruction manual is available online at the following link:

https://www.lincolnelectric.com/en-GB/Operators-Manuals

It is recommended to use the online version as the most up-to-date source of information

SAFETY FIRST !

WARNING

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

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ELECTRIC SHOCK can kill

Have an electrician to install and service this equipment.
Turn the input power off at the fuse box before working on equipment.
Do not touch electrically hot parts.

SAFETY FIRST!
Lincoln Electric take this very seriously.

Personal safety needs to be a matter that everyone who works around electricity takes seriously.

Some of the next sessions require the machine plugged into the power supply network to be able to measure signals and troubleshoot the unit.

Technicians must wear clothing suitable for the locations and conditions where they are working.
This could include the use of close-fitting clothing or additional **PPE** (**P**ersonal **P**rotective **E**quipment).

Local National legislation can set out the minimum age and the criteria for competence of people.
Where there are no national requirements for competence, the following criteria shall be used in assessing the competence of people:
– knowledge of electricity;
– experience of electrical work;
– understanding of the installation to be worked on and practical experience of that work;
– understanding the hazards which can arise during the work and the precautions to be observed;

STATIC TESTS:
When working with “static test” turn off the machine and unplug it.
In this state the potential for harm will be minimal.
NOTE: While conducting static tests on machines that were previously powered, make sure the capacitors are fully discharged prior to conducting any static checks. Capacitors in inverters can provide a significant safety hazard if they are not discharged.

LIVE TESTS:
When working with live circuit tests the machine will have power applied to it. In this state the potential for shock will be substantially greater.

No electrical shock is safe, always take proper safety precautions when working with live circuits!

MAINTENANCE

WARNING



ELECTRIC SHOCK can kill

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

DC BUS CAPACITORS DISCHARGE PROCEDURE

1. Remove input power to the **SPEEDTEC® 400S & 500S Gen4.**
2. Remove the cover following the instruction available in this Service manual.
3. Obtain a high resistance and high wattage resistor (25-1000 ohms and 25 watts minimum). This resistor is NOT supplied with the machine. NEVER USE A SHORTING STRAP FOR THIS PROCEDURE.
4. Locate the two terminals **DC+** and **DC –** on the Switch Board on the right side of the machine (**See Figure 1**).
5. Use electrically insulated gloves and insulated pliers. Hold the body of the resistor and connect the resistor leads across the two terminals. Hold the resistor in place for 10 seconds. DO NOT TOUCH CAPACITOR TERMINALS WITH YOUR BARE HANDS.
6. Check the voltage across the two terminals. Voltage should be zero. If any voltage remains, repeat this procedure.

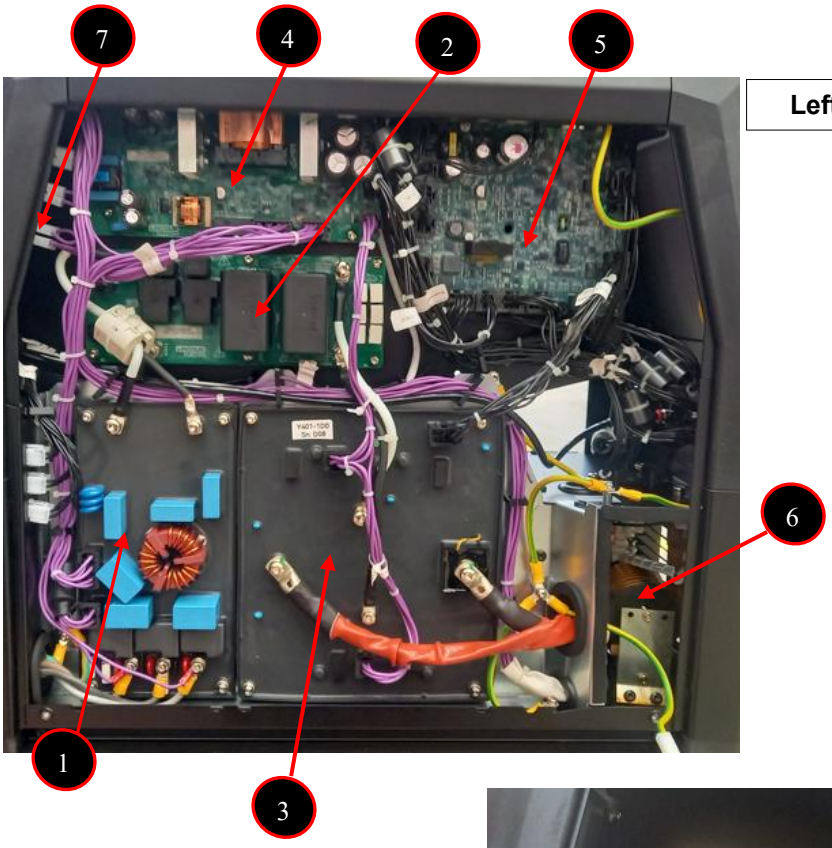


Figure 1
Showing machine left side

MAJOR COMPONENTS LOCATION

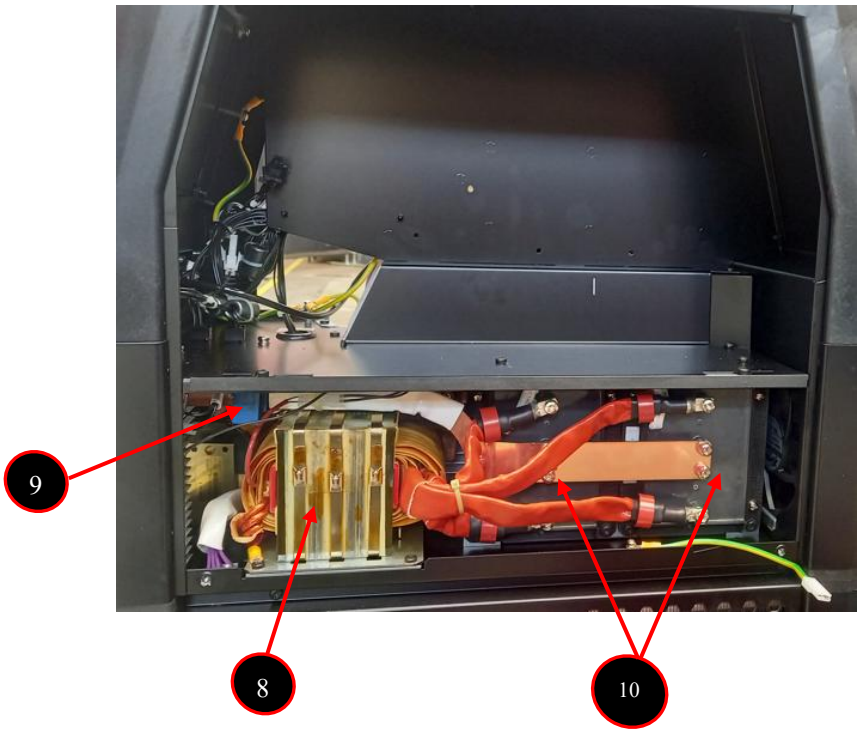
SPEEDTEC® 400S – 500 S Gen4

1. EMC Filter Board (Y102-1)
2. DC Link Capacitor Bank (Y302-1)
3. inverter Board (Y401-1)
4. Auxiliary Power Supply Board (Y202-1)
5. Control Board (G11866-1)
6. Output Choke (L1)
7. ON/OFF switch
8. Output Transformer (T1)
9. Output Current Sensor
10. Output Diodes

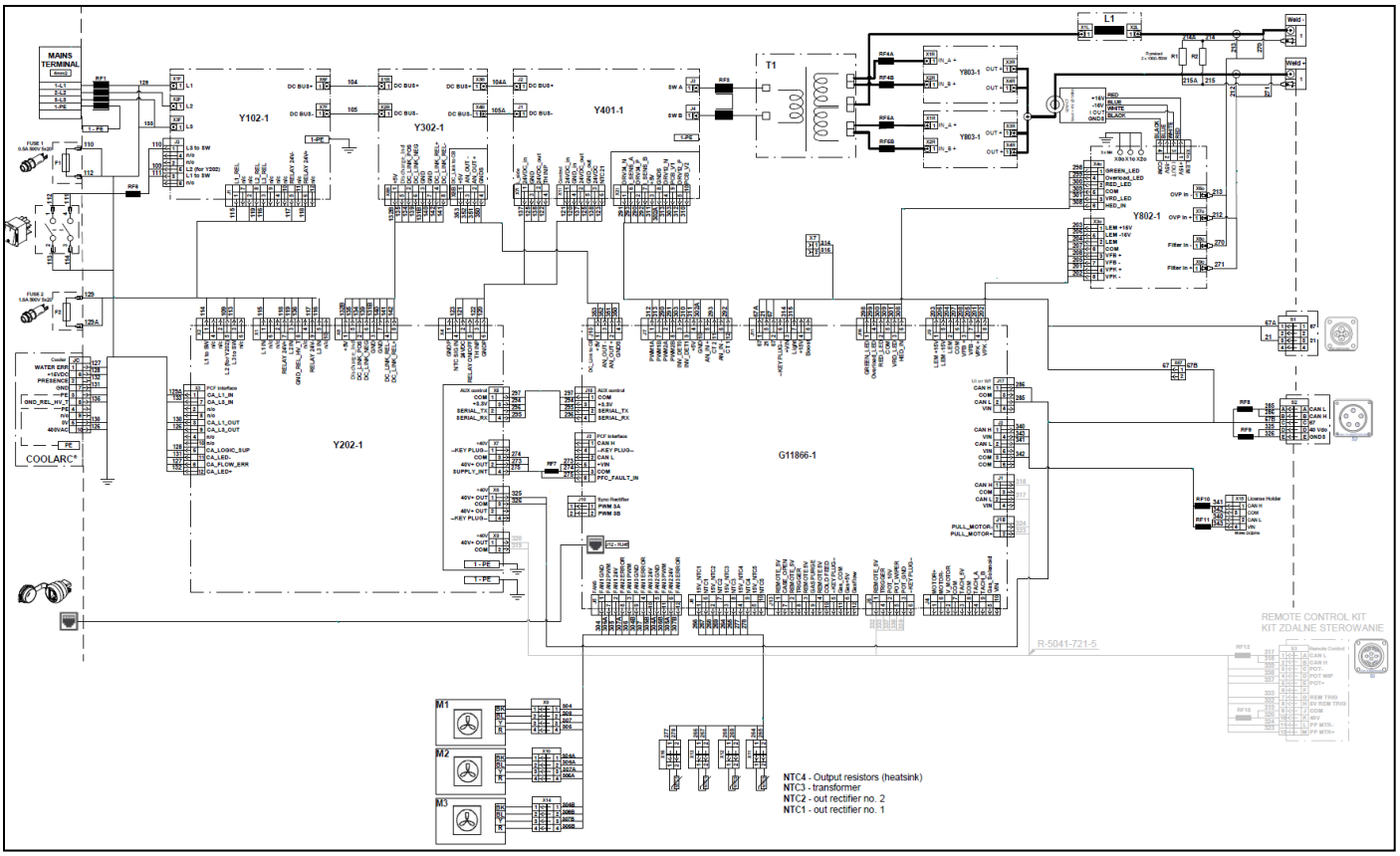


Left Side

Right Side



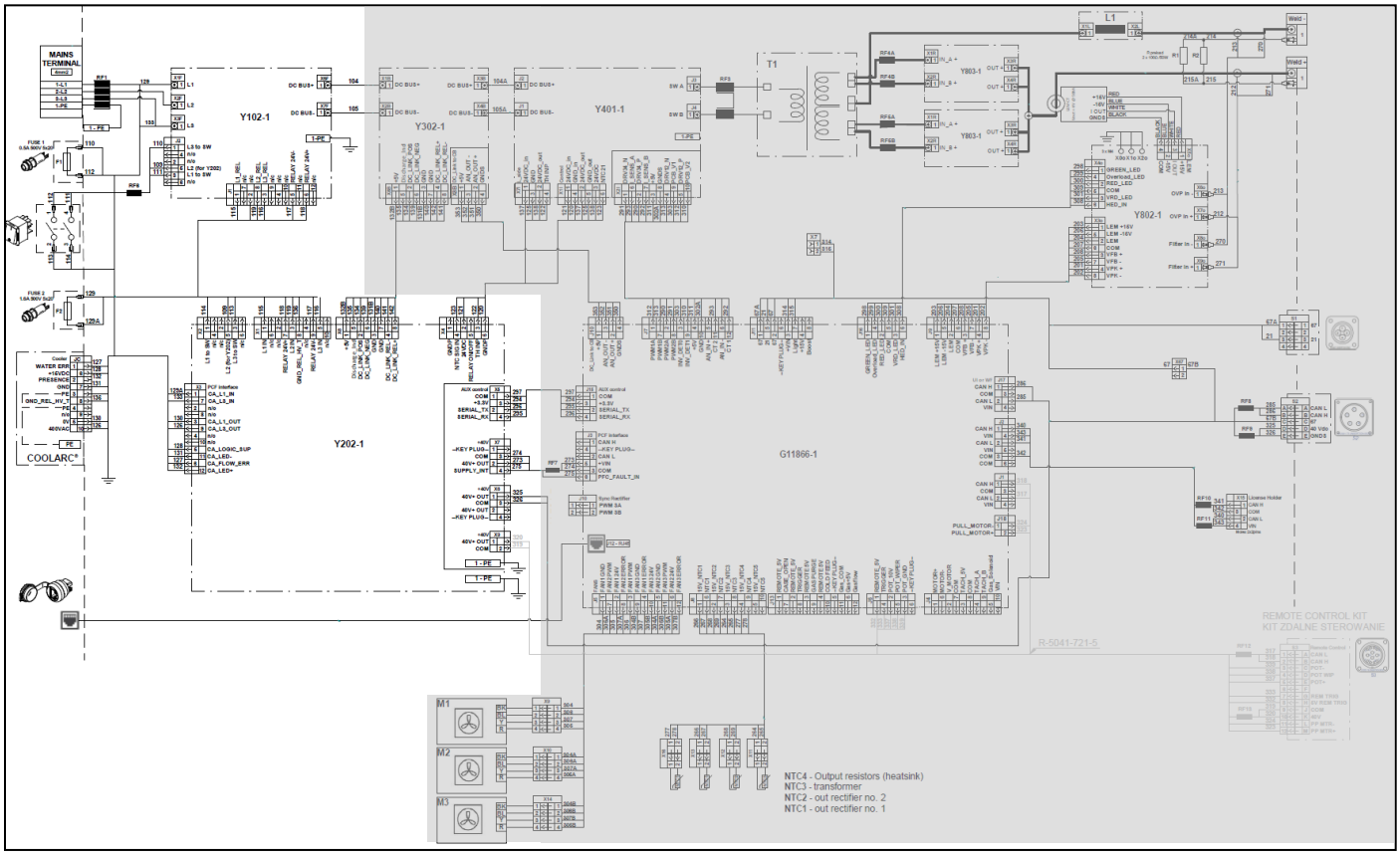
SPEEDTEC® 400S – 500S Gen4 – DIAGRAM



GENERAL DESCRIPTION

The **SPEEDTEC® 400S & 500S Gen4** are multi-process CC/CV DC inverter base welding power sources. The welding response of **SPEEDTEC® 400S & 500S Gen4** has been optimized for GMAW-FCAW-LIFT TIG-STICK and CAG.
SPEEDTEC® 400S & 500S Gen4 have pulse welding capability with maximum peak output up to 500A/60V for ST 400SP 4th Gen. and 600A/60V for ST 500SP 4th Gen. These units can operate with input voltage 400Vac 50/60Hz, three phases only.
Thanks to their IP23 rating and fully potted power board these power sources can be used in both factory or field operations. Using the Arclink protocol, they can be used with Arclink feeders.
Water Cooler is available as an option and must be installed on the bottom of the machine.

INPUT SECTION



INPUT SECTION

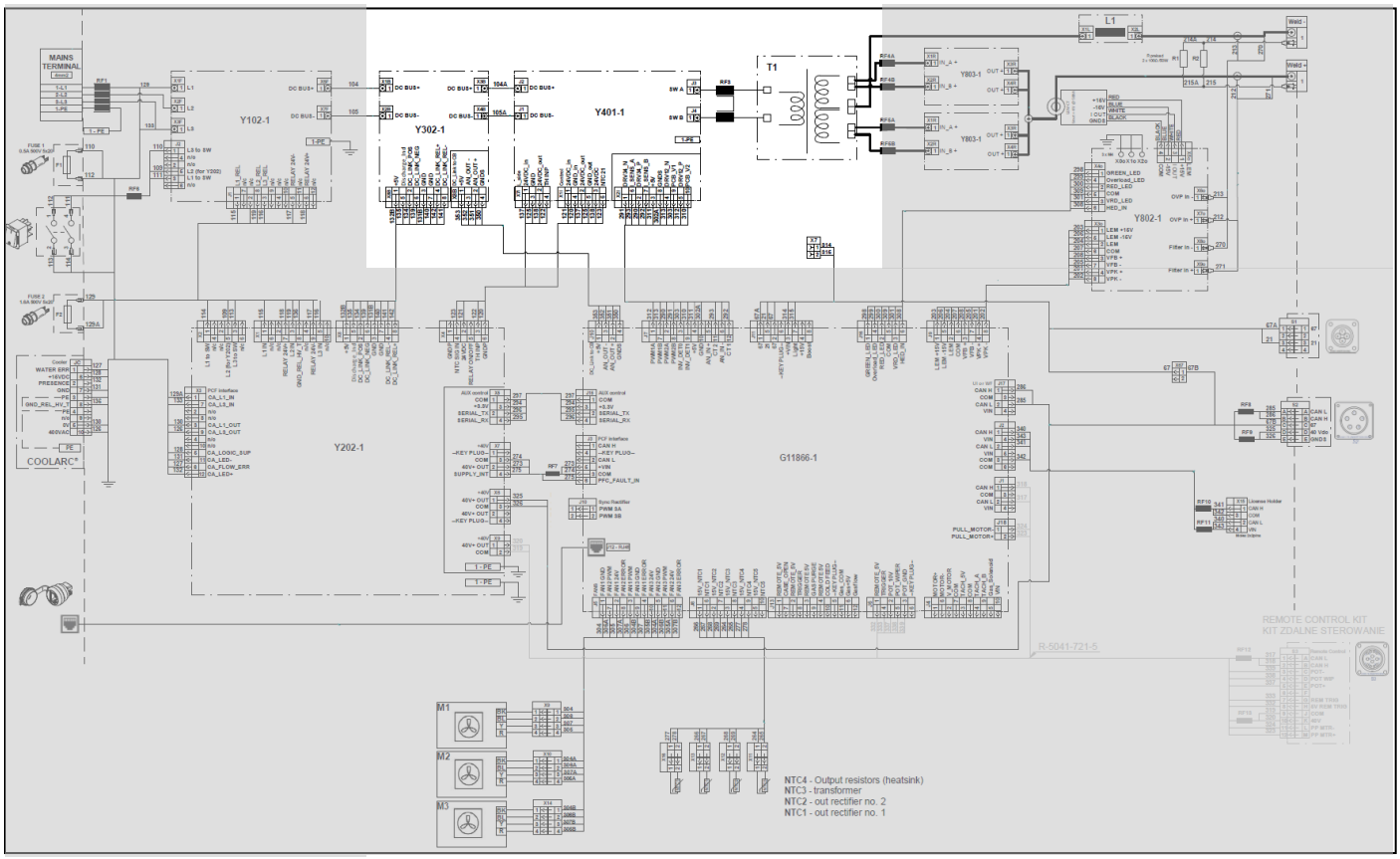
When the three phase input voltage 400Vac is applied to the **SPEEDTEC® 400S & 500S Gen4** and the ON/OFF switch is moved to ON the Auxiliary Supply PCB provides the 24Vdc power supply for the relays present on the EMI filter Board.
When the relays close, the three phases are applied directly to the EMC filter circuit.

EMC filter circuit prevents noise from the machine from being transmitted along the main power line and vice versa, necessary to be in accordance with all relevant directives and standards.

The three phases applied to the EMC Filter Board are rectified by the input rectifier bridge allocated on the EMC Board and the resultant 565VDC voltage is applied to the DC Link Capacitor Bank board.

The Auxiliary Power Board generates all the auxiliary voltages needed by the machine and Coolarc circuits (24Vdc, 5Vdc and 40Vdc).
It also provides, after checking the correctness of the input voltage supply applied to the machine, the OK, to the three relays that are located on the EMI filter, to close.
It also communicates via RS232 to the control board informing about the status of the input line.

DC LINK CAPACITOR BOARD, INVERTER BOARD and OUTPUT TRANSFORMER



DC LINK CAPACITOR BOARD, INVERTER BOARD and OUTPUT TRANSFORMER

The DC LINK CAPACITOR BOARD hosts the pre-charge relays that receive command to close only after the logic circuits have verified that input line is fine and that there are no other error status.
When the DC Bus capacitors are fully charged, they act as power supplies for the IGBT switching circuit. The IGBTs switch the DC power from the DC Bus capacitors "on and off," thus supplying pulsed DC current to the main transformer primary winding.

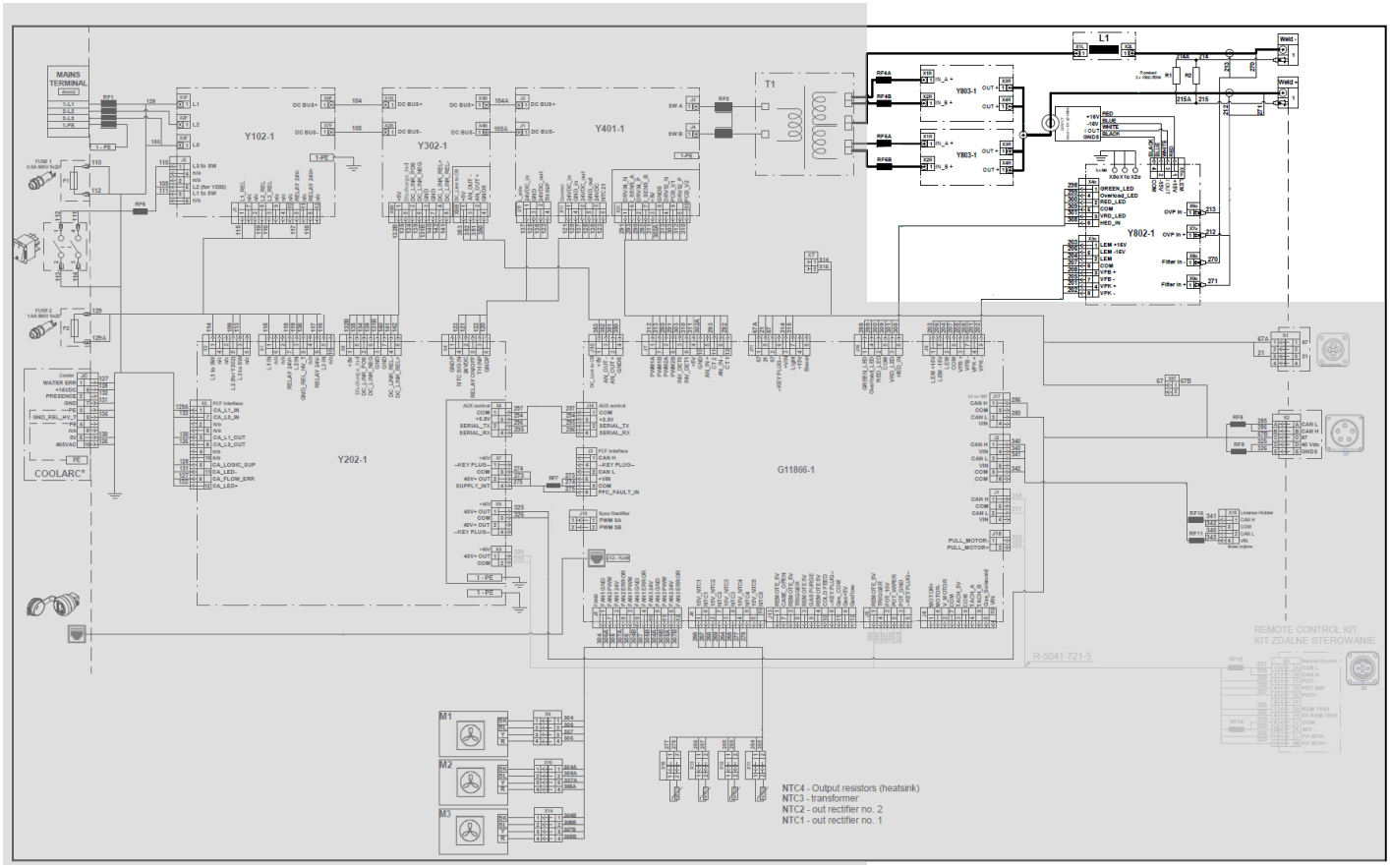
The full bridge inverter switching frequency is 50KHz.

Current transducer located on the inverter board monitor the primary current. If the primary current becomes abnormally high, the control board circuit will shut off the IGBTs, thus disabling the machine's output.

Thermal protectors are also present, on the inverter heat-sink, to protect the IGBTs from overheating conditions.

The primary winding of the main welding transformer receives the Pulse Width Modulated power from the switch board. AC output that is created on the secondary windings is applied to the output rectifier. The Transformer is thermal protected by an NTC. Correct value @25°C is 10 Kohms.

OUTPUT SECTION



OUTPUT SECTION

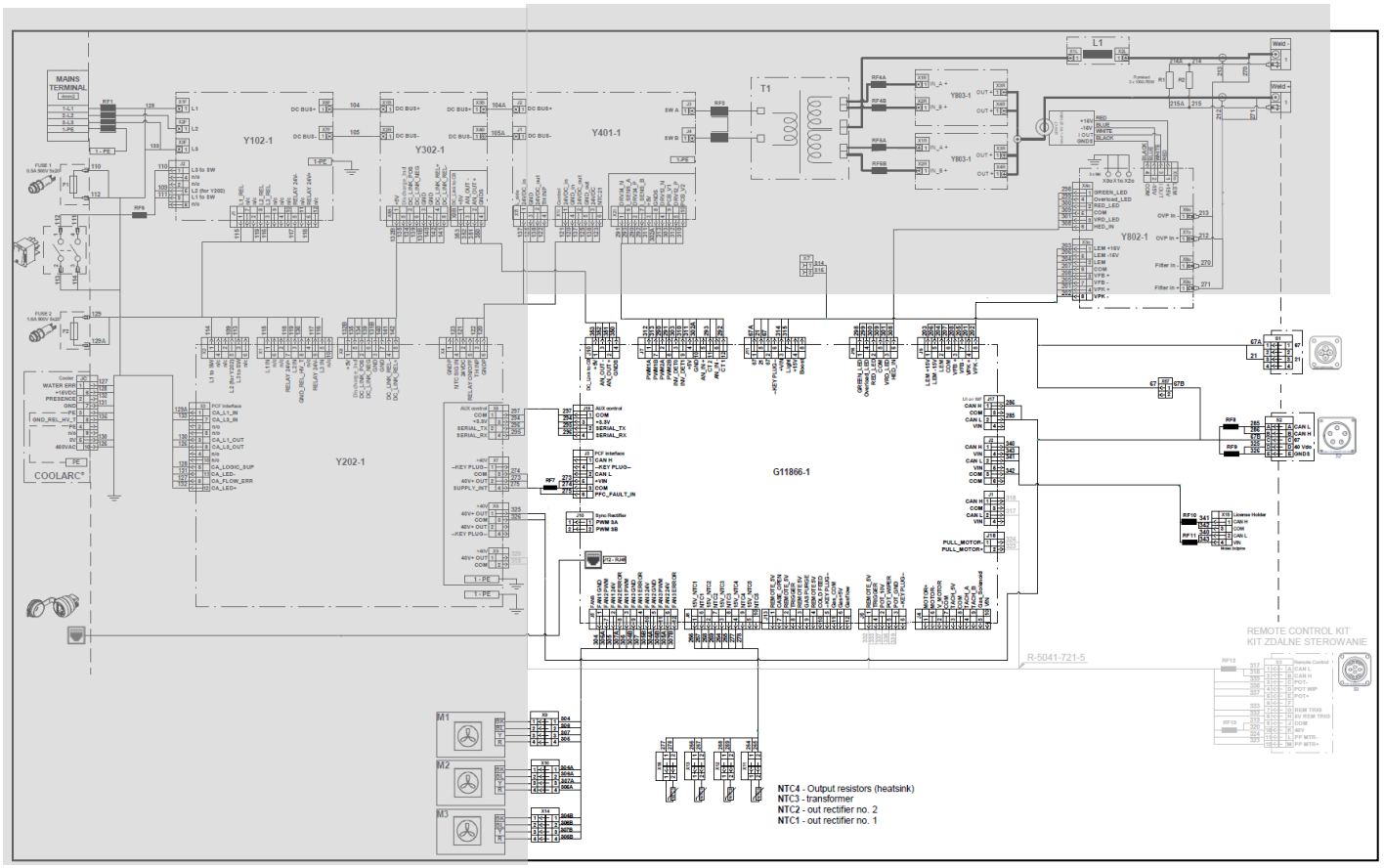
AC output that is created on the secondary windings is applied to the output rectifier.
The resultant rectified DC+ power is applied, through an output choke (L1), to the output terminal.

The output choke is an inductor that provides filtering to enhance the arc performance and accurate waveform response.

A current transducer provides accurate feedback of output current to the inverter board control circuits section to obtain the correct output characteristic.

2 thermal sensors are present, to the output diodes heat-sink, to protect them from overheating, and 1 is present on the output resistors heatsink. All have a value of 10 Kohms @25°C.

CONTROL BOARD



CONTROL BOARD

The Control Board performs the primary interfacing functions to establish and maintain output control of the **SPEEDTEC® 400S & 500S Gen4**.

Digital user command signals from the UI and feedback information are received and processed by the Control Board.
Software loaded in the Control Board processes the command and feedback information and sends the appropriate pulse width modulation (PWM) signals to the Inverter board IGBTs.

The Control Board is supplied by 40VDC generated by the Auxiliary Voltage Supply Board.

In addition, the Control Board performs the following functions:

- monitors output current
- monitors the thermostats status
- supply the fans

OVERLOAD PROTECTION

SPEEDTEC® 400S & 500S Gen4 are electrically protected from producing higher output currents. An electronic protection circuit limits the current to within the capabilities of the machine.

THERMAL PROTECTION

Thermal Protection Devices protect the machine from excessive operating temperatures.
Excessive temperature may be caused by a lack of cooling air or by operating the machine beyond the duty cycle and output rating. If excessive operating temperature should occur, the Thermal LED indicator on the front panel, will turn ON and the thermostat will prevent output current.

The thermal protections are self-resetting once the machine cools sufficiently. If the shutdown was caused by excessive output or duty cycle and the fan is operating normally, the power switch may be left on and the reset should occur within about 15 minute period. If the fan is not turning or the air intake louvers are obstructed, the input power must be removed and the fan problem or air obstruction must be corrected.

HOW TO USE TROUBLESHOOTING GUIDE

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

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

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

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

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

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

WARNING



ELECTRIC SHOCK can kill

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

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

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

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

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

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

TROUBLESHOOTING

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

PROBLEMS / SYMPTOMS	CHECKS / ERROR DESCRIPTION	RECOMMENDED COURSE OF ACTION
A VISUAL DAMAGE IS EVIDENT WHEN YOU OPEN THE COVER	----------	• REPLACE THE BROKEN PART AND PERFORM THE TESTS FOR THE OTHER MACHINE COMPONENTS
MACHINE IS DEAD, NO STATUS LED	• MAKE SURE THAT THE INPUT LINE IS PRESENT • CHECK THE MACHINE ON/OFF SWITCH • CHECK THE FUSE F1 and F2 ON THE REAR PANEL OF THE MACHINE	• CONNECT THE INPUT LINE • REPLACE THE MACHINE ON/OFF SWITCH IF NECESSARY
THE MAIN INPUT FUSES REPEATEDLY FAIL OR THE INPUT LINE CIRCUIT BREAKER TRIPPING	• MAKE CERTAIN THE FUSES OR BREAKERS ARE PROPERLY SIZED FOR THE INPUT DRAW OF THE MACHINE. SEE MACHINE RATING PLATE OR TECHNICAL SPECIFICATION AVAILABLE IN THIS SERVICE MANUAL • A SHORT CIRCUIT MAY BE PRESENT INSIDE THE MACHINE	• PERFORM THE INPUT SECTION CHECKS • PERFORM THE INVERTER BOARD TEST
THERE IS NO WELDING OUTPUT	• MAKE SURE THAT THE RECTIFIED VOLTAGE IS APPLIED TO THE INVERTER BOARD • ONE OF THE MACHINE THERMAL SENSOR MAY HAS TRIPPED, CHECK TERMAL STATUS LED. • MAY BE ONE OF THE OUTPUT RECTIFIER MODULE IS IN SHORT CIRCUIT	• CHECK THE PRESENCE OF THE INPUT 3 PHASES AT EMI FILETR BOARD • DO NOT TURN THE UNIT OFF, ALLOW THE MACHINE TO COOL DOWN, THE THERMAL PROTECTION CIRCUITS WILL RESET THEMSELVES, IF NOT CHECK THE THERMAL SENSORS AND THERMAL SENSORS CIRCUIT • PERFORM THE OUTPUT RECTIFIER MODULES TESTS
THE THERMAL LAMP IS ON, THE MACHINE OVERHEAT VERY FREQUENTLY	• THE WELDING CURRENT USED MAY EXCEED THE MACHINE DUTY CYCLE • DUST MAY HAVE CLOGGED THE COOLING HEAT-SINK • LOUVERS MAY BE BLOCKED BY INADEQUATE CLEARANCE AROUND THE MACHINE • MAY BE THE FAN IS NOT WORKING	• CHECK AND FOLLOW THE MACHINE DUTY CYCLE • CLEAN THE MACHINE USING DRY COMPRESSED AIR • REMOVE ANY PARTS AROUND THE MACHINE THAT MAY BLOCK THE AIR FLOW AND THE LOUVERS • PERFORM THE FAN TEST
THE WIRE FEEDER CONNECTED TO THE MACHINE IS COMPLETELY OFF	• MAY BE THE 40VDC POWER SUPPLY IS NOT PRESENT • THE CONTROL CABLE MAY BE DEFECT	• PERFORM THE TEST OF THE AUXILIARY BOARD TO CHECK THE PRESENCE OF 40VDC • CHECK FOR 40VDC BETWEEN PIN D AND E ON WIRE FEEDER ARCLINK CONNECTOR LOCATED ON THE MACHINE FRONT PANEL • CHECK CONTROL CABLE CONTINUITY
THE STATUS LAMP ON THE FRONT PANEL OF THE MACHINE IS BLINKING GREEN AND RED	• SYSTEM FAULT. DECODE THE ERROR NUMBER USING THE STATUS LAMP FLASHING SEQUENCE	• REFER TO THE ERROR CODE LIST AVAILABLE ON THIS MANUAL FOR INFORMATION ABOUT THE TYPE OF ERROR.
ERROR 6: POWER SOURCE IS NOT CONNECTED.	• THE USER INTERFACE CANNOT SEEM TO COMMUNICATE WITH THE POWER SOURCE.	• CHECK CABLE CONNECTIONS BETWEEN THE POWER SOURCE AND THE USER INTERFACE.
ERROR 18: CONFIGURATION ERROR	• THE MACHINE COULD NOT PROPERLY CONFIGURE THE DEVICES THAT ARE ATTACHED TO IT. THIS CONFIGURATION PROBLEM COULD BE CAUSED BY THE TYPE OF DEVICES THAT ARE CONNECTED TO THE MACHINE OR A REQUIRED DEVICE THAT IS NOT CONNECTED.	• CONSULT THE OPERATORS MANUAL FOR PROPER DEVICE CONFIGURATION. • VERIFY ALL DEVICES IN THE SYSTEM ARE PROPERLY POWERED.

ERROR 36: THE MACHINE HAS SHUT DOWN BECAUSE IT HAS OVERHEATED.	• SYSTEM DETECTED A TEMPERATURE LEVEL BEYOND THE NORMAL SYSTEM OPERATING LIMIT.	• BE SURE PROCESS DOES NOT EXCEED DUTY CYCLE LIMIT OF THE MACHINE. • CHECK THE SETUP FOR PROPER AIR FLOW AROUND AND THROUGH THE SYSTEM. • CHECK THAT THE SYSTEM HAS BEEN PROPERLY MAINTAINED, INCLUDING REMOVAL OF ACCUMULATED DUST AND DIRT FROM THE INTAKE AND OUTLET LOUVERS. • WHEN THE MACHINE HAS COOLED DOWN TO A SAFE LEVEL, THE INTERFACE SIGNALS THIS BY FLASHING TWO LEDS NEXT TO BUTTON OR START WELDING OPERATION BY THE TORCH TRIGGER.
ERROR 46, 54: OUTPUT CURRENT EXCEEDED	• THE AVERAGE VALUE OF THE OUTPUT CURRENT HAS BEEN EXCEEDED.	• VERIFY THAT THE WELDING CIRCUIT DOES NOT HAVE A SHORT IN IT. • VERIFY STICK OUT, WIRE SIZE, AND GAS ARE CORRECT FOR THE PROCESS THAT IS SELECTED. • DECREASE THE VALUE OF THE OUTPUT PARAMETERS. • CHECK THE WELD CIRCUIT FOR SHORT CIRCUITS AND OTHER LEAKAGE PATHS THAT MAY RESULT IN EXCESSIVE CURRENT.
ERROR 49: LACK OF PHASE	• SINGLE PHASE INPUT OPERATION HAS BEEN DETECTED.	• VERIFY ALL FUSES ARE GOOD. • VERIFY ALL THREE LEGS OF THE INPUT POWER ARE PRESENT AT THE INPUT CONTACTOR. WHEN THE CONTACTOR CLOSES, BE SURE ALL THREE LEGS ARE PRESENT ON THE OUTPUT SIDE AS WELL (TOWARD THE RECTIFIER). • CHECK THE CONDITION OF THE ELECTRICAL SYSTEM.
ERROR 71: OUTPUT POWER EXCEEDED	• THE MACHINE DETECTED EXCESSIVE OUTPUT POWER	• VERIFY STICK OUT, WIRE SIZE, AND GAS ARE CORRECT FOR THE PROCESS THAT IS SELECTED. • DECREASE THE VALUE OF THE OUTPUT PARAMETERS. • CHECK THE WELD CIRCUIT FOR SHORT CIRCUITS AND OTHER LEAKAGE PATHS THAT MAY RESULT IN EXCESSIVE CURRENT.
ERROR 81: MOTOR OVERLOAD, LONG TERM.	• THE WIRE DRIVE MOTOR HAS OVERHEATED. CHECK THAT THE WELDING WIRE SLIDES EASILY THROUGH THE GUN AND CABLE.	• REMOVE TIGHT BENDS FROM THE GUN AND CABLE. • CHECK THAT THE SPINDLE BRAKE IS NOT TOO TIGHT. • VERIFY THE ADEQUACY OF THE WELDING WIRE TO THE WELDING PROCESS. • VERIFY A HIGH-QUALITY WELDING WIRE IS BEING USED. • CHECK DRIVE ROLLS ALIGNMENT AND GEARS. • WAIT FOR THE ERROR TO RESET AND THE MOTOR TO COOL (APPROXIMATELY 1 MINUTE).
ERROR 92: NO COOLANT FLOW	• THERE IS NO COOLANT FLOW IN THE COOLER AFTER 3 SECONDS OF WELDING.	• MAKE SURE THERE IS ENOUGH COOLANT IN THE TANK AND THAT AUXILIARY POWER IS SUPPLIED. • MAKE SURE THE PUMP IS WORKING. WHEN THE TRIGGER IS PULLED THE PUMP SHOULD RUN.
ERROR 262: INCOMPATIBLE EQUIPMENT	• REQUIRED CONFIGURATION COULD NOT BE FOUND IN THE MACHINE. VERIFY THE CONFIGURATION AND THE STATUS OF THE DEVICES CONNECTED TO THE MACHINE.	• CHECK IF THE CONNECTED POWER SOURCE IS IN THE LIST OF COMPATIBLE POWER SOURCES. • UPDATE THE SYSTEM WITH THE LATEST FIRMWARE.

ERROR 269: ARC WAS LOST OR NEVER ESTABLISHED	• AN ARC WAS NOT ESTABLISHED WITHIN THE AMOUNT OF TIME SPECIFIED BY SETUP PARAMETER P.22 AFTER THE TRIGGER WAS PULLED OR IF THE TRIGGER REMAINED PULLED AFTER AN ARC WAS LOST. THIS ERROR DETECTION IS ONLY ACTIVE IN WIRE WELDING MODES AND IS INTENDED TO PREVENT AN ELECTRICALLY HOT WIRE FROM BEING FED IN THE ABSENCE OF AN ARC.	• ADJUST P.22 BASED ON WELD WFS, RUN-IN WFS, ETC. IF ARC ERROR DETECTION IS NEEDED • SET P.22 TO OFF IF ARC ERROR DETECTION IS NOT NEEDED

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

CASE COVER REMOVAL AND DC BUS CAPACITOR DISCHARGE PROCEDURE

WARNING

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

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

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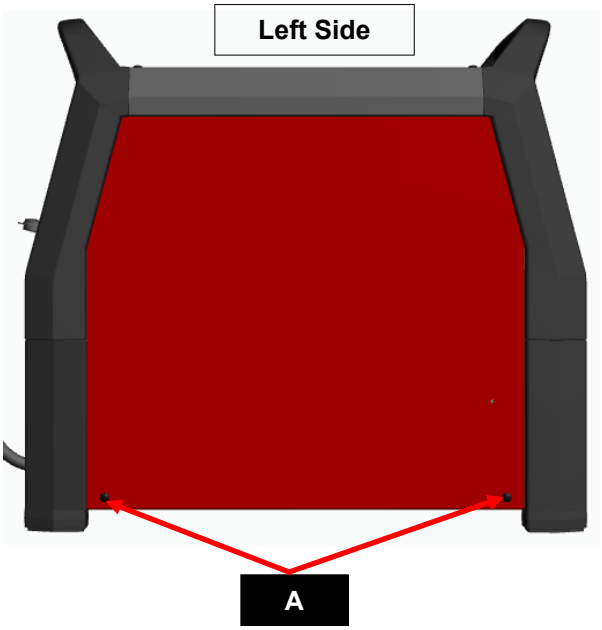
DESCRIPTION

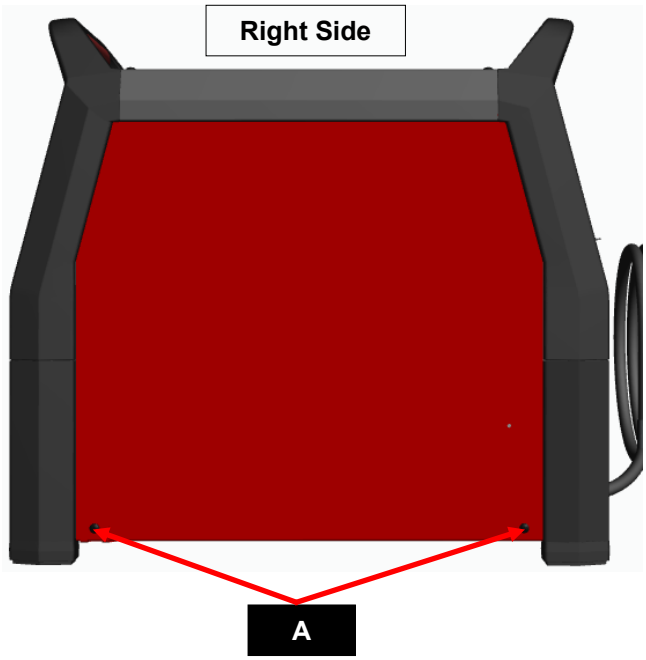
This procedure will aid the technician in the removal and replacement of the case sheet metal covers and discharging the DC link capacitor making it safe for the technician to work on the machine.

MATERIALS NEEDED

TORX wrench TX-20 driver

SPEEDTEC® 400S-500S Gen4 - CASE COVER REMOVAL





Procedure:

1. Turn ON/OFF switch to OFF position.
2. **Disconnect Input Power from the machine !**
3. Using the TORX wrench TX-25 driver, remove the 2 screws on the left side and the 2 screws on the right side of the machine (**A**)
4. Remove the two side panels by sliding them down, taking care to disconnect the two ground wires.
5. Follow the next page for **DC BUS capacitors discharge procedure !**

DC BUS CAPACITORS DISCHARGE PROCEDURE

WARNING



ELECTRIC SHOCK can kill

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

DC BUS CAPACITORS DISCHARGE PROCEDURE

1. Remove input power to the **SPEEDTEC® 400S & 500S Gen4**.
2. Remove the cover following the instruction available in this Service manual.
3. Obtain a high resistance and high wattage resistor (25-1000 ohms and 25 watts minimum). This resistor is NOT supplied with the machine. NEVER USE A SHORTING STRAP FOR THIS PROCEDURE.
4. Locate the two terminals **DC+** and **DC –** on the Switch Board on the right side of the machine (**See Figure 1**).
5. Use electrically insulated gloves and insulated pliers. Hold the body of the resistor and connect the resistor leads across the two terminals. Hold the resistor in place for 10 seconds. DO NOT TOUCH CAPACITOR TERMINALS WITH YOUR BARE HANDS.
6. Check the voltage across the two terminals. Voltage should be zero. If any voltage remains, repeat this procedure.

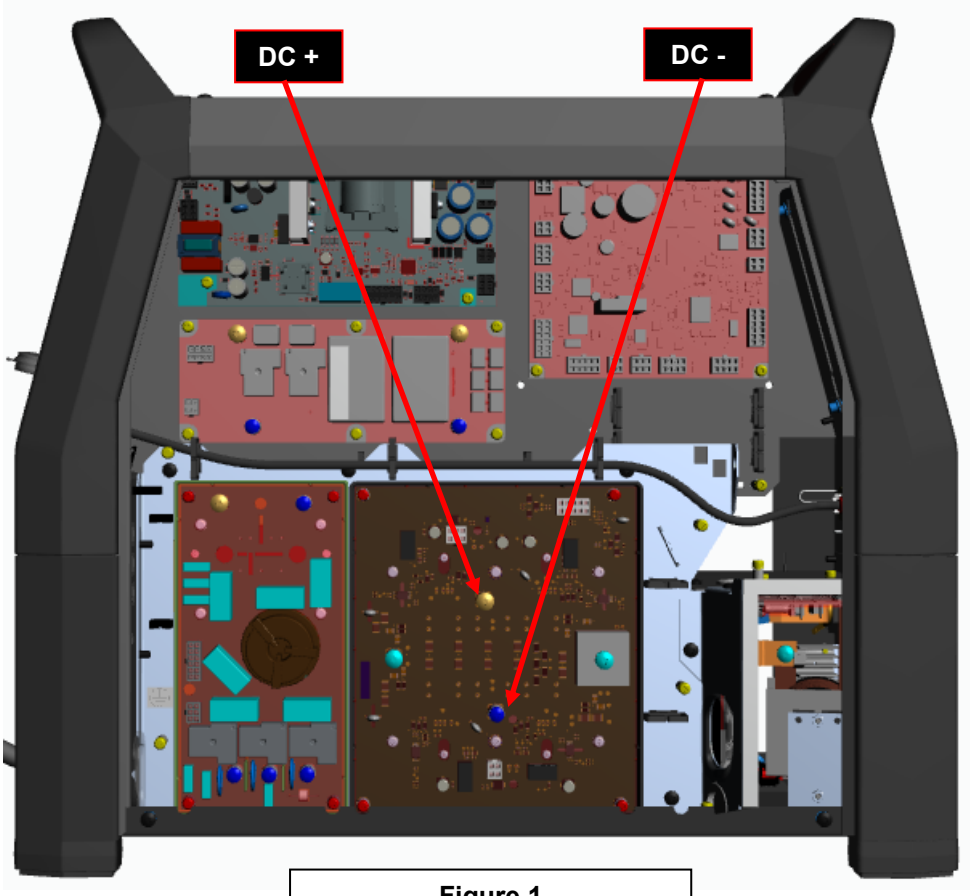


Figure 1
Showing letside of machine

EMI FILTER BOARD WITH RECTIFIER – STATIC TEST

WARNING

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

……

TEST DESCRIPTION

This test will determine if the EMI Filter Board has failed.

MATERIALS NEEDED

Multimeter
Machine Wiring diagram
TORX wrench TX-30

EMI FILTER BOARD WITH RECTIFIER – STATIC TEST (continued)

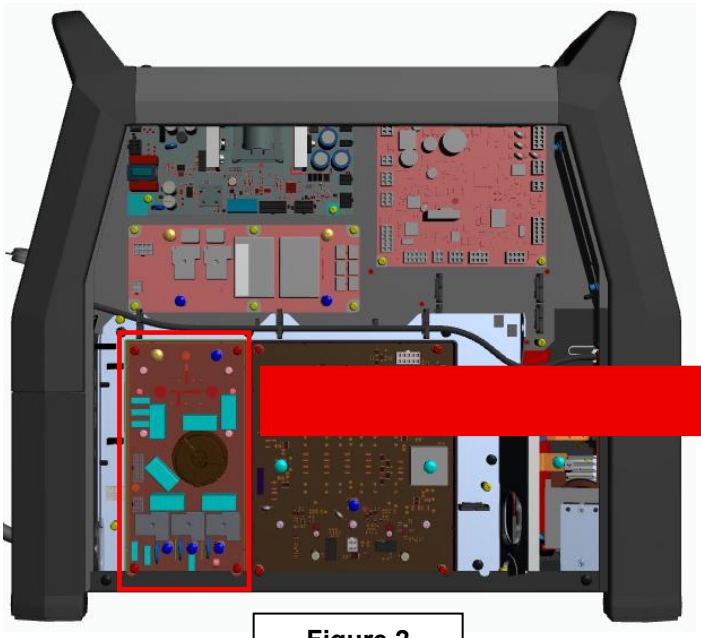


Figure 2

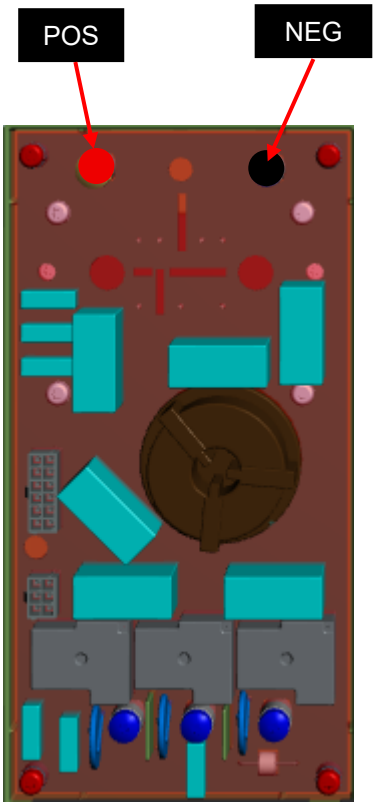


Figure 2a

TEST PROCEDURE

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

1. Remove main input power to the **SPEEDTEC® 400S & 500S Gen4**.
2. Perform the **Case Cover removal** and **Discharge procedure**
3. Visually check for burned areas or damaged components. If any components are physically damaged they must be replaced
4. Disconnecte the Positive and Negative cables from the EMI Filter Board to the DC Link Board.
5. Using the multimeter (ohm mode) perform the tests as indicated in **Test Table 1**. See **Figure 2a** for correct test points location.

Test table 1

Machine condition	*Positive Probe (RED)*	*Negative Probe (BLACK)*	*Value*
Machine disconnected from input voltage and capacitors discharged.	POS	NEG	Open
	NEG	POS	0,7-0,9

6. If a short circuit is detected, the EMI filter Board has to be replaced.
7. If test is OK connect again the Positive and Negative cables and go ahead with other tests.

INVERTER BOARD - STATIC TEST

WARNING

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

……

TEST DESCRIPTION

This test will help to determine if the power section of the Inverter board is working correctly. This test will not indicate if the entire board is fuctional.

MATERIALS NEEDED

Multimeter
Machine schematic
TORX wrench TX-30

INVERTER BOARD - STATIC TEST (continued)

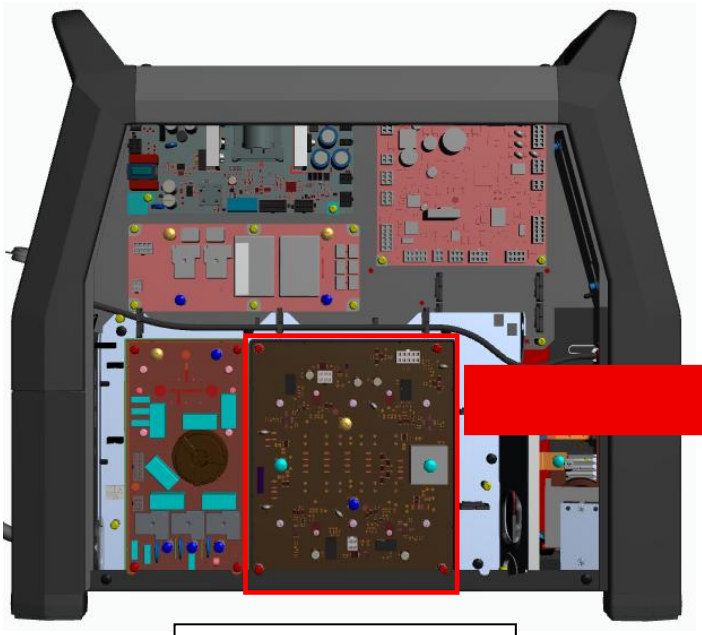


Figure 3

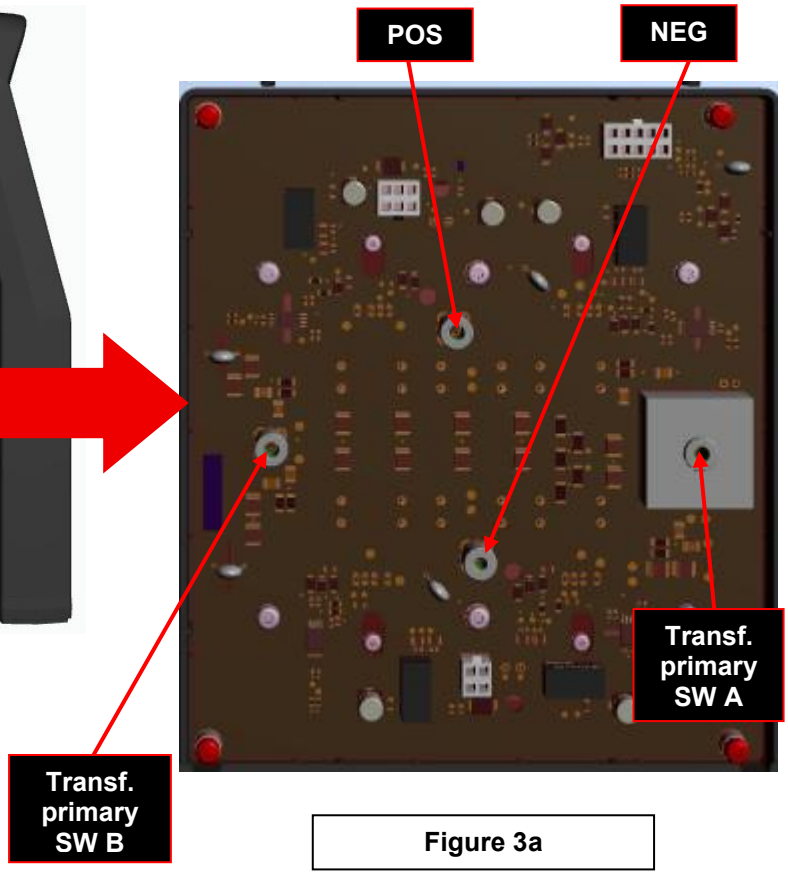


Figure 3a

TEST PROCEDURE

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

1. Remove main input power to the **SPEEDTEC® 400S & 500S Gen4**
2. Perform the **Case Cover removal** and **Discharge procedure**
3. Locate the Inverter board. See **Figure 3**.
4. Visually check for burned areas/signs on potting. If a burned areas/signs on potting is present the Inverter board should be replaced
5. Using the TX30 screwdriver, disconnect and label POS, NEG and the two transformer primary leads from the inverter board. See **Figure 3a** for leads location.
6. Using the multimeter in diode test mode perform the tests detailed in **Test Table 2**. See **Figure 3a** for Test Point locations.

Test table 2 – Inverter board static test

Positive Probe (RED)	*Negative Probe (BLACK)*	*Value*
NEG	SW A	0.7 – 1.3V
SW A	NEG	Open
POS	SW A	Open
SW A	POS	0.7 – 1.3V
NEG	SW B	0.7 – 1.3V
SW B	NEG	Open
POS	SW B	Open
SW B	POS	0.7 – 1.3V

Note: If any of the above test fails the inverter board may be faulty and must be replaced

OUTPUT RECTIFIER MODULE – STATIC TEST

WARNING

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

……

TEST DESCRIPTION

This test will help determine if the output diode modules are functioning correctly.

MATERIALS NEEDED

Multimeter
Machine schematic
TORX wrench TX-30

OUTPUT RECTIFIER MODULE – STATIC TEST (continued)

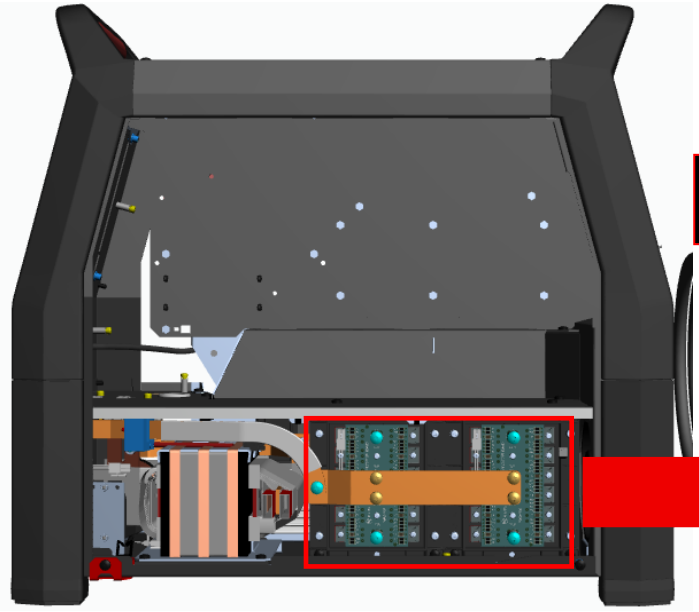


Figure 4

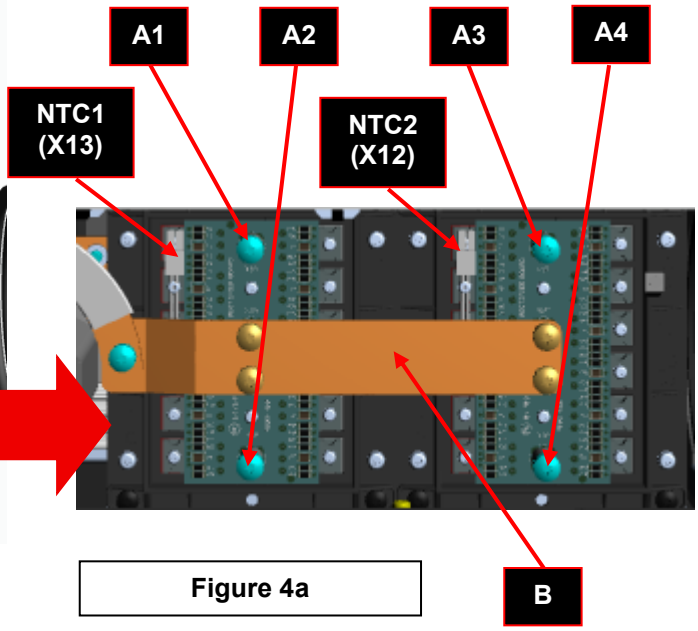


Figure 4a

TEST PROCEDURE

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

1. Remove main input power to the **SPEEDTEC® 400S & 500S Gen4**
2. Perform the **Case Cover removal** and **Discharge procedure**
3. Locate the Output rectifier modules. See **Figure 4**.
4. Visually check for burned areas/signs on potting. If burned areas/signs on potting is present the output rectifier module should be replaced
5. Label or take a picture of the position of the cables and using the TX 30 wrench remove all cables (**A**) coming from the secondary winding of the output transformer. See **Figure 4a**.
6. Using the multimeter in diode test mode check each rectifier module following the tests below:

Test table 3 – Output diode module Test

Positive Probe (RED)	*Negative Probe (BLACK)*	*Value*
A1	**B**	0,2V-0,7V
B	**A1**	Open
A2	**B**	0,2V-0,7V
B	**A2**	Open
A3	**B**	0,2V-0,7V
B	**A3**	Open
A4	**B**	0,2V-0,7V
B	**A4**	Open

7. If the tests determine that the rectifier modules are short or open, replace them with new modules following the disassembly and replacement procedure available in this service manual.
8. Disconnect NTC 1 and NTC2 connectors X12 and X13. **See figure 3a**
9. Using multimeter in ohm mode check correct value of Thermal sensors NTC1 and NTC2. Correct value is 10Kohms +/- 15% @25°C

EMI FILTER BOARD WITH RECTIFIER – ACTIVE TEST

WARNING

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

……

TEST DESCRIPTION

This test will determine if the EMI Filter Board have failed.

MATERIALS NEEDED

Multimeter
Machine Wiring diagram

EMI FILTER BOARD WITH RECTIFIER – ACTIVE TEST (continued)

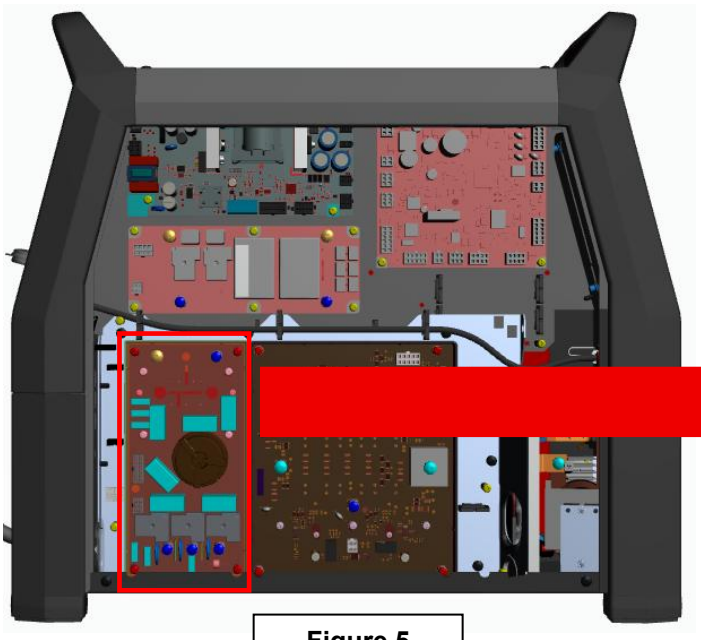


Figure 5

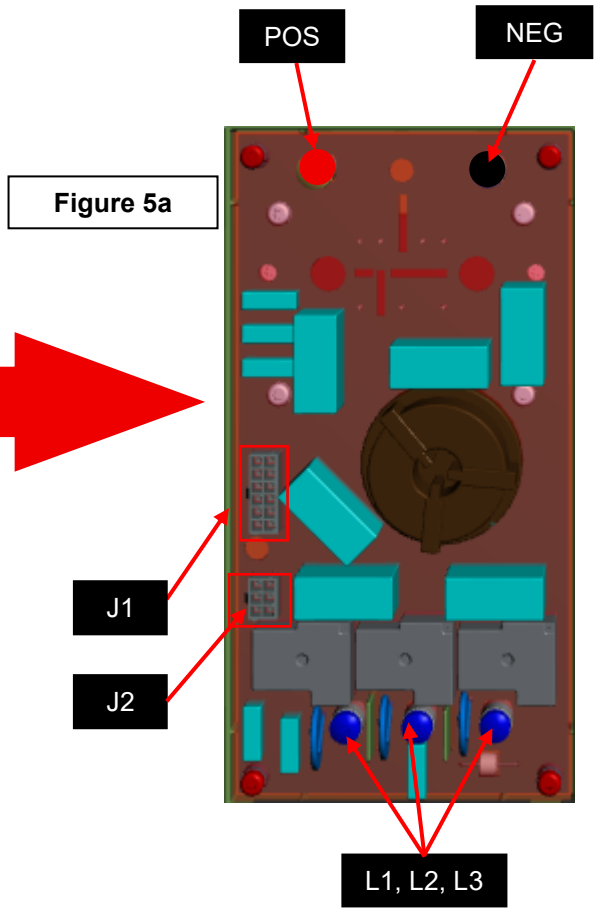
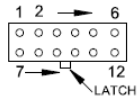


Figure 5a

CONNECTOR PIN NUMBERS:

EX. 12 PIN CONNECTOR



VIEW OF CONNECTOR ON PC BOARD

TEST PROCEDURE

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

1. Remove main input power to the **SPEEDTEC® 400S & 500S Gen4**
2. Follow the **Case Cover removal** procedure available in this Service Manual
3. Locate the EMI Filter Board. See **Figure 5**.
4. Apply 400 Vac +/- 10% to the **SPEEDTEC® 400S & 500S Gen4**
5. **WARNING!** EMI filter is always supplied also before the machine main switch is turned to ON !
6. Before switch to ON the machine main switch check between EMI filter input voltage points **L1, L2 and L3** for 400Vac +/- 10%. **See figure 5a**
7. Switch to ON the machine main switch located on the rear panel
8. Check between **POS** and **NEG** for 565 Vdc +/-10%. **See figure 5a**
9. Check also other voltages as per the following Table tests:

J2: EMI Filter Board to Auxiliary Voltage Supply Board

Pin #	Description	Value	Notes
1	Power supply to Voltage Supply Board	400Vac between each of the three pins	Always also when switch is to OFF position
3			
5			

J1: EMI Filter Board to Auxiliary Voltage Supply Board

Pin #	Description	Value	Notes
1	Power supply to Voltage Supply Board	400Vac between each of the three pins	Only after mains switch is ON
3			
8			
5	Power supply for relays mounted on EMI FILTER BOARD	+ 24Vdc +/-10%	When Mains switch is ON and machine complete the initial self check
6			

DC LINK CAPACITORS BOARD – ACTIVE TEST (continued)

WARNING

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

……

TEST DESCRIPTION

This test will determine if the DC Link Capacitor Board have failed.

MATERIALS NEEDED

Multimeter
Machine Wiring diagram

DC LINK CAPACITORS BOARD – ACTIVE TEST

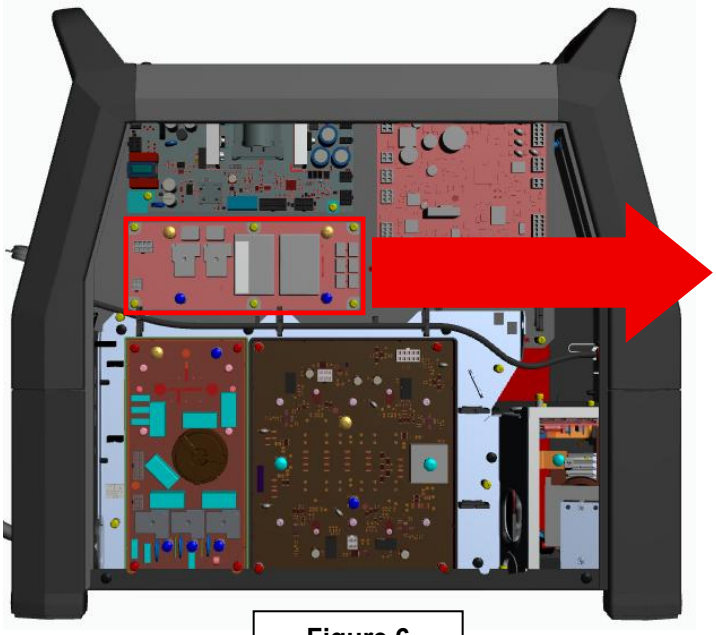


Figure 6

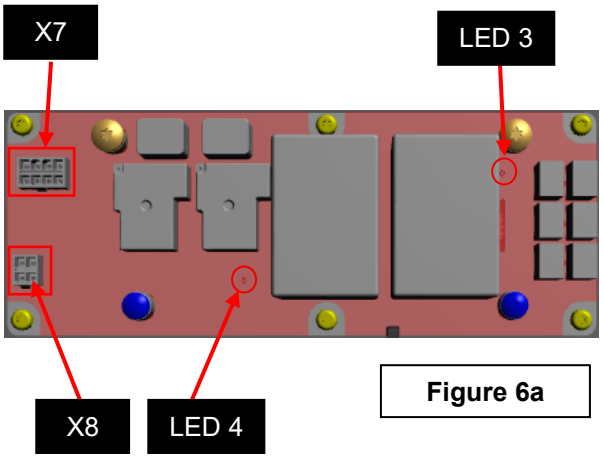
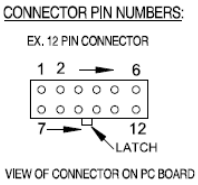


Figure 6a



TEST PROCEDURE

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

1. Remove main input power to the **SPEEDTEC® 400S & 500S Gen4**
2. Follow the **Case Cover removal** procedure available in this Service Manual
3. Locate the DC Link Capacitor Board. See **Figure 6**.
4. Apply 400 Vac +/- 10% to the **SPEEDTEC® 400S & 500S Gen4**
5. **WARNING!** EMI filter is always supplied also before the machine main switch is turned to ON !
5. Switch to ON the machine main switch located on the rear panel
6. Follow the below tables tests (see **Figure 6a** for connector location):

X7: To Auxiliary Power Board

Pin #	Description	Value	Notes
4 8	Pre-charge relays Power supply	+24Vdc +/- 10%	Will be present after few seconds after machine Power Up
1 3	Supply	+ 5Vdc +/- 10%	Voltage supply for electronic components mounted on this PCB

X8: To Control Board

Pin #	Description	Value	Notes
1 4	Supply	+5Vdc +/- 10%	Will be present after few seconds after machine Power Up

LED 4 (Blue) = When lit indicates presence of DC BUS Voltage.
LED 3 (Blue) = Only lit when machine is switched off indicating, when goes off, that voltage across DC BUS capacitors is below 20 Vdc

INVERTER BOARD - ACTIVE TEST

WARNING

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

……..

TEST DESCRIPTION

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

MATERIALS NEEDED

Volt/Ohmmeter
Machine Wiring Diagrams

INVERTER BOARD - ACTIVE TEST (continued)

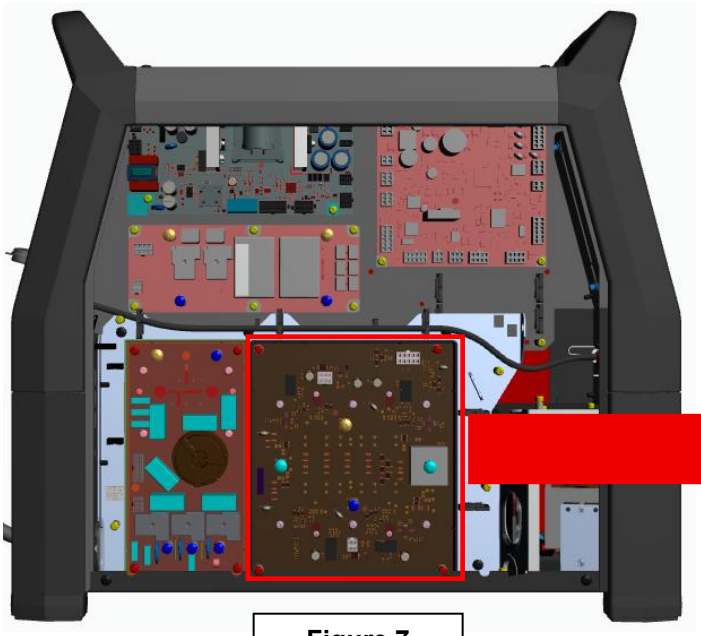


Figure 7

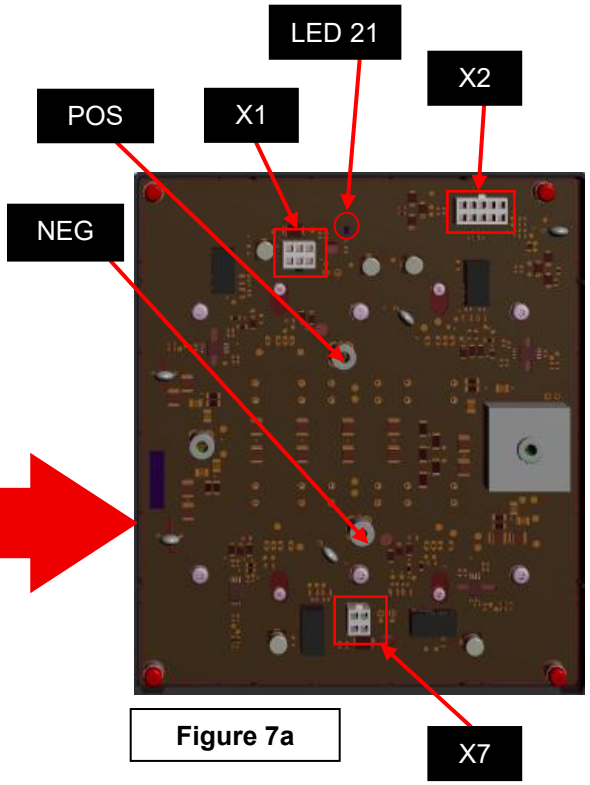
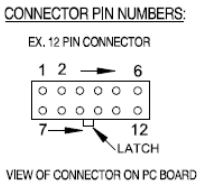


Figure 7a

TEST PROCEDURE



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

1. Remove main input power to the **SPEEDTEC® 400S & 500S Gen4**
2. Follow the **Case Cover removal** procedure available in this Service Manual
3. Locate the Inverter Board. See **Figure 7**.
4. Apply 400 Vac +/- 10% to the **SPEEDTEC® 400S & 500S Gen4**
5. **WARNING!** EMI filter is always supplied also before the machine main switch is turned to ON !
7. Switch to ON the machine main switch located on the rear panel
8. Check between POS and NEG the presence of 565Vdc.
9. Follow the below tables tests (see **Figure 7a** for connectors location):

X1: Inverter Board to Auxiliary Power Supply Board

Pin #	Description	Value	Notes
1 4	Inverter circuit power supply	+ 24 Vdc +/- 10%	Generated by the Auxiliary Power Supply Board
5 6	Thermal sensor signal (HT1)	1,5 Vdc +/- 10%	When no thermal condition is present on Inverter

X7: Inverter Board to Inverter Board

Pin #	Description	Value	Notes
1&2 3	Inverter circuit power supply	+ 24 Vdc +/- 10%	Generated by the Auxiliary Power Supply Board
4 3	Thermal sensor signal (HT2)	1,5 Vdc +/- 10%	When no thermal condition is present on inverter

X2: Inverter Board to Control Board

Pin #	Description	Value	Notes
3 8	Power supply	+ 5 Vdc +/- 10% Secondary side	Generated by the Control Board

LED 21 (Green) = When lit indicates presence of 24Vdc on Inverter Board

AUXILIARY POWER SUPPLY BOARD - ACTIVE TEST

WARNING

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

……..

TEST DESCRIPTION

This test will help to determine if the correct input voltages are applied to the auxiliary voltage supply board and also if the correct regulated voltages are being processed by the board.

MATERIALS NEEDED

Volt/Ohmmeter
Machine Wiring Diagrams

AUXILIARY POWER SUPPLY BOARD - ACTIVE TEST (continued)



Figure 8

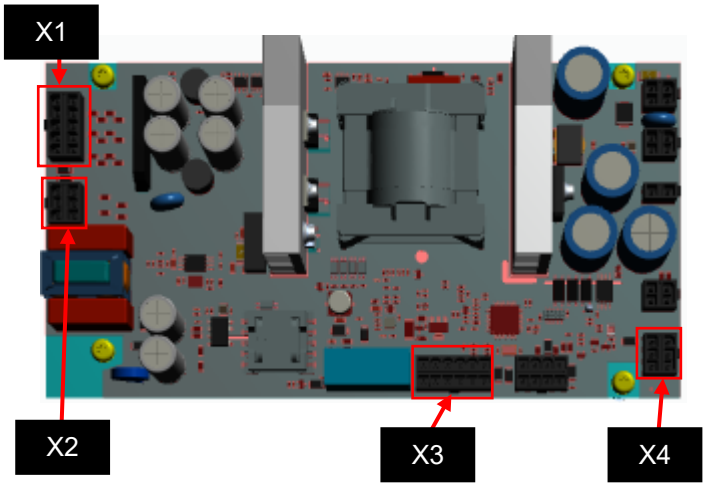
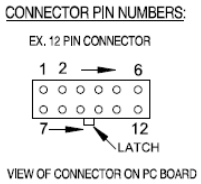


Figure 8a



TEST PROCEDURE

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

1. Remove main input power to the **SPEEDTEC® 400S & 500S Gen4**
2. Follow the **Case Cover removal** procedure available in this Service Manual
3. Locate the Inverter Board. See **Figure 8**.
4. Apply 400 Vac +/- 10% to the **SPEEDTEC® 400S & 500S Gen4**
5. **WARNING!** EMI filter is always supplied also before the machine main switch is turned to ON !
6. Switch to ON the machine main switch located on the rear panel
7. Follow the below tables tests (see **Figure 8a** for connectors location):

X1: Auxiliary Power Supply Board to/from EMI Filter Board

Pin #	Description	Value	Notes
1	Input lines from EMI filter board	565 Vdc +/- 10%	Only present when relays on EMI filter board are closed
3			
5			
7	Power supply for the relays on EMI filter Board	+ 24 Vdc +/- 10%	Will be present after few seconds after machine Power Up
9			

X2: Auxiliary Power Supply Board to/from EMI Filter Board and ON/OFF Switch

Pin #	Description	Value	Notes
1	Input lines from EMI filter board	565 Vdc +/- 10%	Only present when ON/OFF switch is to ON position
3			
5			

X3: Auxiliary Power Supply Board to/from Coolarc connector

Pin #	Description	Value	Notes
3	Power supply to Coolarc	400 Vac +/- 10%	Only when Coolarc is enable
9			

X4: Auxiliary Power Supply Board to/from Inverter Board

Pin #	Description	Value	Notes
2	Power supply to Inverter Board	24 Vdc +/- 10%	Will be present after few seconds after machine Power Up
6			
4	Inverter Thermal signal	1,5 Vdc +/- 10%	When no thermal condition is present on inverter
6			
3	Inverter Thermal signal	1,5 Vdc +/- 10%	When no thermal condition is present on inverter
6			

AUXILIARY POWER SUPPLY BOARD – ACTIVE TEST (continued)



Figure 8

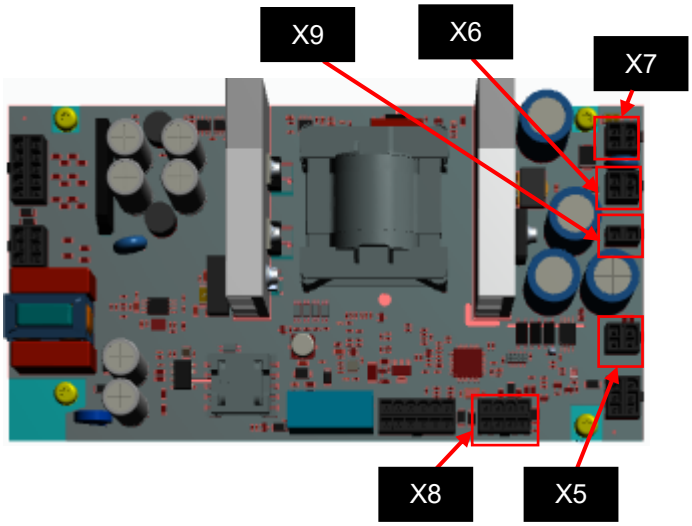
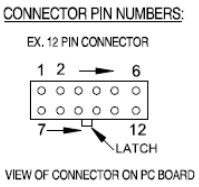


Figure 8a



TEST PROCEDURE

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

8. Remove main input power to the **SPEEDTEC® 400S & 500S Gen4**.
9. Follow the **Case Cover removal** procedure available in this Service Manual
10. Locate the Inverter Board. See **Figure 8**.
11. Apply 400 Vac +/- 10% to the **SPEEDTEC® 400S & 500S Gen4**
12. **WARNING!** EMI filter is always supplied also before the machine main switch is turned to ON !
13. Switch to ON the machine main switch located on the rear panel
14. Follow the below tables tests (see **Figure 8a** for connectors location):

X5: Auxiliary Power Supply Board to/from Control Board

Pin #	Description	Value	Notes
3 1	Power supply for Micro processor	+3,3 Vdc	Always present

X6: Auxiliary Power Supply Board to ArcLinc Connector on front panel

Pin #	Description	Value	Notes
1 3	Power supply for feeder	+40 Vdc	Always present

X7: Auxiliary Power Supply Board to Control Board

Pin #	Description	Value	Notes
2 3	Power supply for Control Board	+40 Vdc	Always present

X8: Auxiliary Power Supply Board to DC Link Capacitors Board

Pin #	Description	Value	Notes
1 3	Power supply for the DC Link Capacitors circuits	+5 Vdc +/- 10%	Always present

AUXILIARY POWER SUPPLY BOARD – ACTIVE TEST (continued)

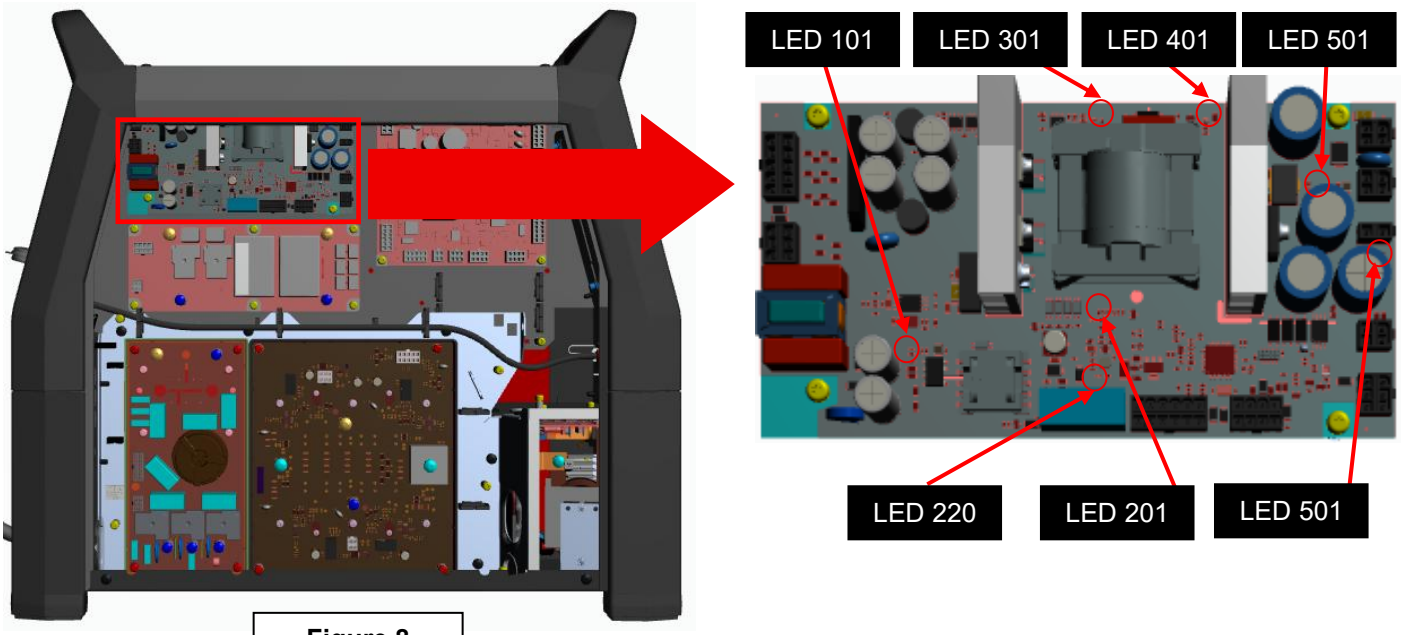


Figure 8

Auxiliary Power Board LEDs locations and Description

LED 101(Blue) = When lit indicates presence of 12 Vdc on flyback circuit

LED 201 (Blue) = When lit indicates presence of 24 Vdc

LED 220 (Blue) = When lit indicates presence of 5 Vdc

LED 301 (Blue) = When lit indicates presence of 15 Vdc

LED 401 (Blue) = When lit indicates presence of 40 Vdc

CONTROL BOARD - ACTIVE TEST

WARNING

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

……..

TEST DESCRIPTION

This test will help to determine if the correct input voltage is being applied to the control board and if it may be faulty.

MATERIALS NEEDED

Volt/Ohmmeter
Machine Wiring Diagrams

CONTROL BOARD - ACTIVE TEST (continued)

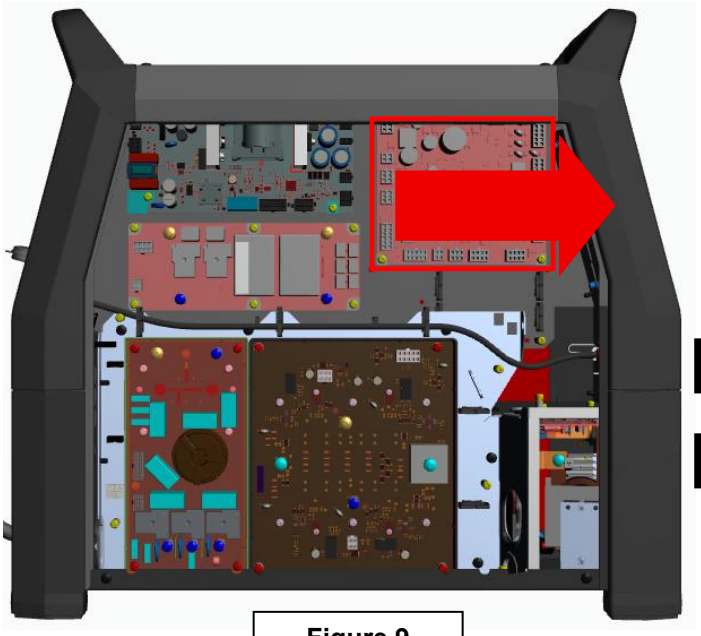


Figure 9

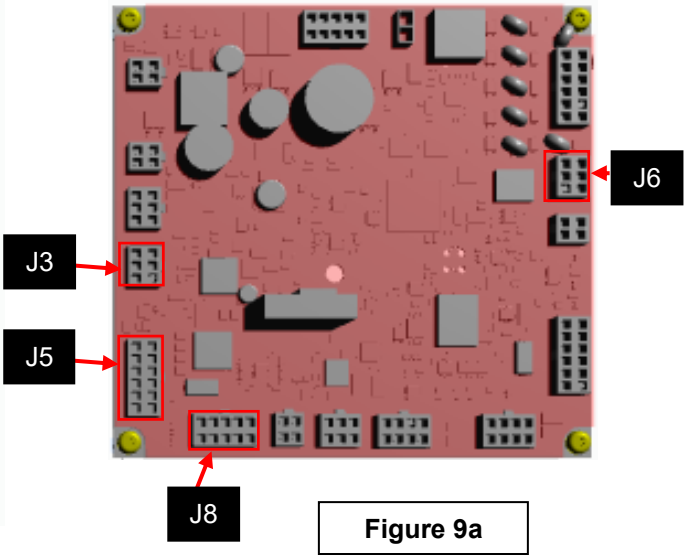
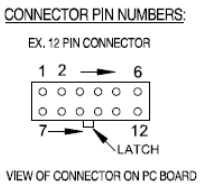


Figure 9a



TEST PROCEDURE

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

1. Remove main input power to the **SPEEDTEC® 400S & 500S Gen4**
2. Follow the **Case Cover removal** procedure available in this Service Manual
3. Locate the Control Board. See **Figure 9**.
4. Apply 400 Vac +/- 10% to the **SPEEDTEC® 400S & 500S Gen4**
5. **WARNING!** EMI filter is always supplied also before the machine main switch is turned to ON !
6. Switch to ON the machine main switch located on the rear panel
7. Follow the below tables tests (see **Figure 9a** for connectors location):

J3: Auxiliary Power Supply Board to/from Control Board

Pin #	Description	Value	Notes
5 3	Power supply for Control Board	+40 Vdc	Always present

J5: Control Board to Fans

Pin #	Description	Value	Notes
2 1	Power supply for fan 1	+24 Vdc +/- 10%	Always present
10 9	Power supply for fan 3	+24 Vdc +/- 10%	Always present
6 5	Power supply for fan 2	+24 Vdc +/- 10%	Always present

J6: Control Board to Remote Connector

Pin #	Description	Value	Notes
1 4	Trigger Circuit	+5 Vdc +/- 10%	Always present

J8: Control Board to NTCs

Pin #	Description	Value	Notes
1 6	NTC1 (output rectifier)	7,5 Vdc +/- 10%	When no thermal condition (when NTC1 is in thermal condition, the value is 15 Vdc +/- 10%)
2 7	NTC2 (output rectifier)	7,5 Vdc +/- 10%	When no thermal condition (when NTC2 is in thermal condition, the value is 15 Vdc +/- 10%)
3 8	NTC3 (Output Transformer)	7,5 Vdc +/- 10%	When no thermal condition (when NTC3 is in thermal condition, the value is 15 Vdc +/- 10%)
4 9	NTC4 (Output Resistors)	7,5 Vdc +/- 10%	When no thermal condition (when NTC4 is in thermal condition, the value is 15 Vdc +/- 10%)

CONTROL BOARD - ACTIVE TEST (continued)

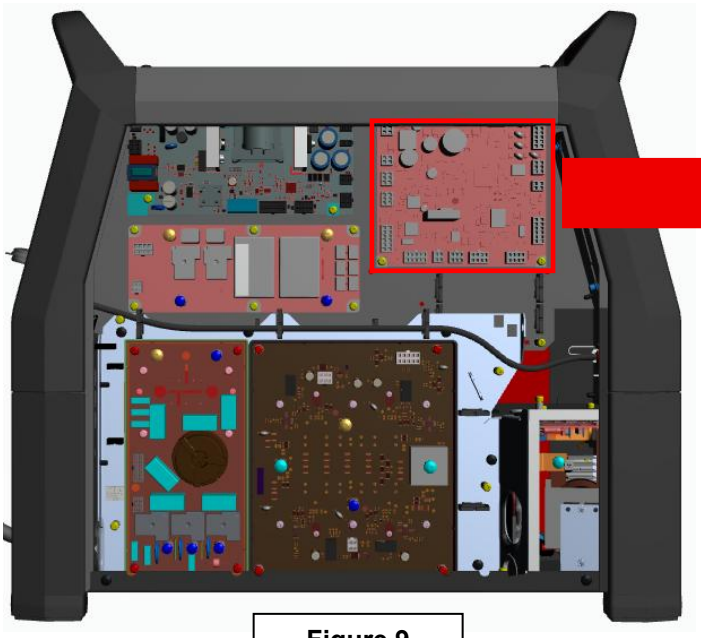


Figure 9

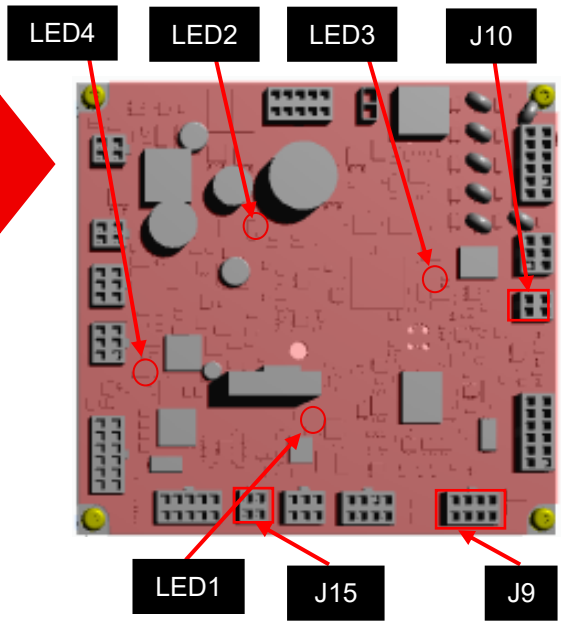
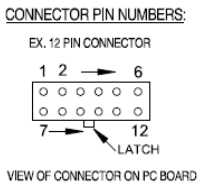


Figure 9a



J9: Control Board to Output Filter Board

Pin #	Description	Value	Notes
1 6	Power supply for Current Sensor	+15Vdc +/- 10%	Always present
5 6	Power supply for Current Sensor	-15Vdc +/- 10%	Always present
2 6	Return feedback from Current Sensor	4V @ 500A	Only during welding

J10: Control Board to DC Link Capacitor Board

Pin #	Description	Value	Notes
1 4	Supply	+5Vdc +/- 10%	Will be present after few seconds after machine Power Up

J15: Control Board to Auxiliary Power Board

Pin #	Description	Value	Notes
3 1	Power supply for Micro processor	+3,3 Vdc	Always present

Control Board LEDs locations and Description

LED 1 (green/red) = When it is lit green indicate machine status is OK. When flashing red and green indicates machine's error status

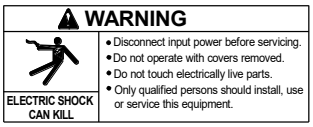
LED 2 (green) = When lit indicates presence of 15Vdc

LED 3 (flashing green) = When flashing green indicates micro processor OK

LED 4 (green) = When lit indicates presence of 24Vdc

DISASSEMBLY OPERATIONS

EMI FILTER BOARD WITH RECTIFIER REMOVAL AND REPLACEMENT PROCEDURE



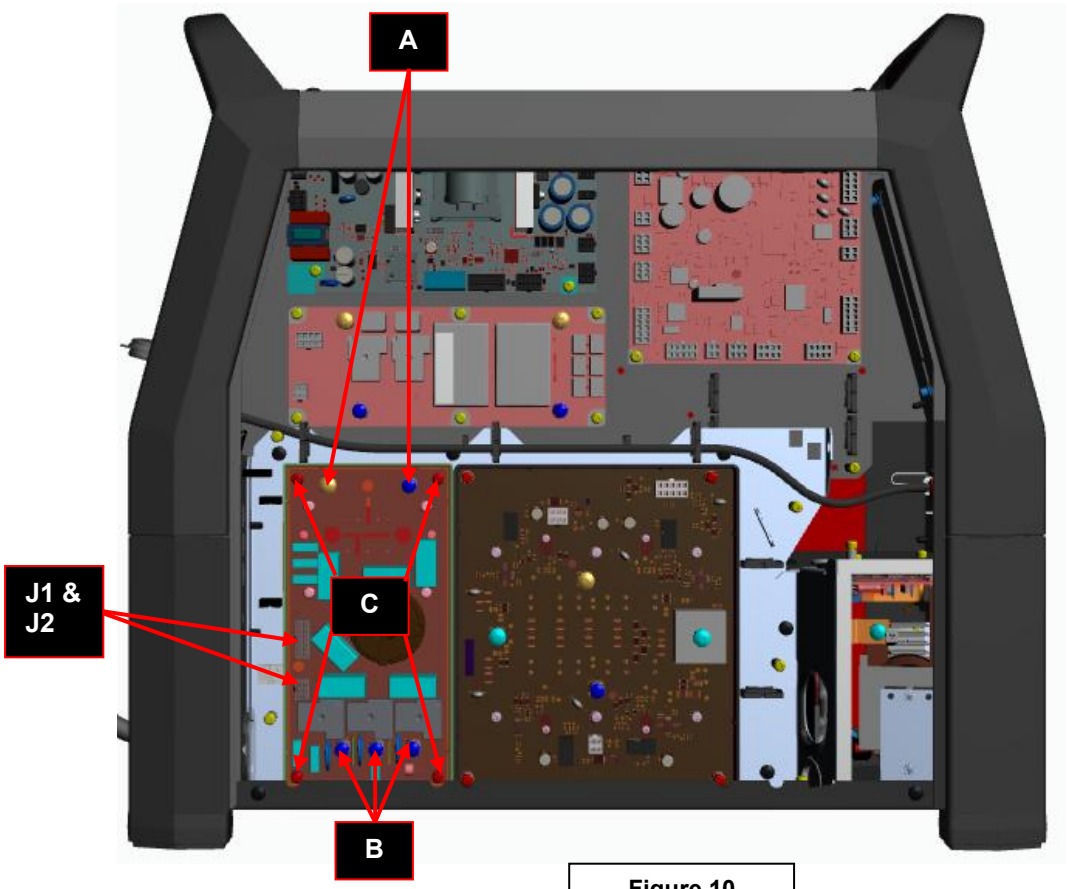


Figure 10

REMOVAL PROCEDURE

Necessary tool:

- TORX wrench TX-20
- TORX wrench TX-30

1. Remove main input power to the **SPEEDTEC® 400S & 500S Gen4**.
2. Perform the **Case Cover removal** and **Discharge procedure**
3. Locate the EMI Filter Board. See **Figure 10**
4. Using TORX wrench TX-30 remove and label the 2 cables (**A**) connected to the terminals **POS & NEG** and the 3 + 2 input cables (**B**) connected to the terminals **L1, L2, L3**. See **Figure 10**
5. Disconnect connectors J1 and J2 from the EMI Filter Board. See **Figure 10**
6. Using TORX wrench TX-20 remove the 4 screws (**C**) that are fixing the EMI Filter Board to the machine frame.
7. Remove the EMI Filter Board from the machine.
8. **For the new EMI Filter Board re-assembly operations,** make the previous steps in the reverse order.
   Warning: max torque for screws A & B must be 4 Nm

DISASSEMBLY OPERATIONS

DC LINK CAPACITOR BOARD REMOVAL AND REPLACEMENT PROCEDURE

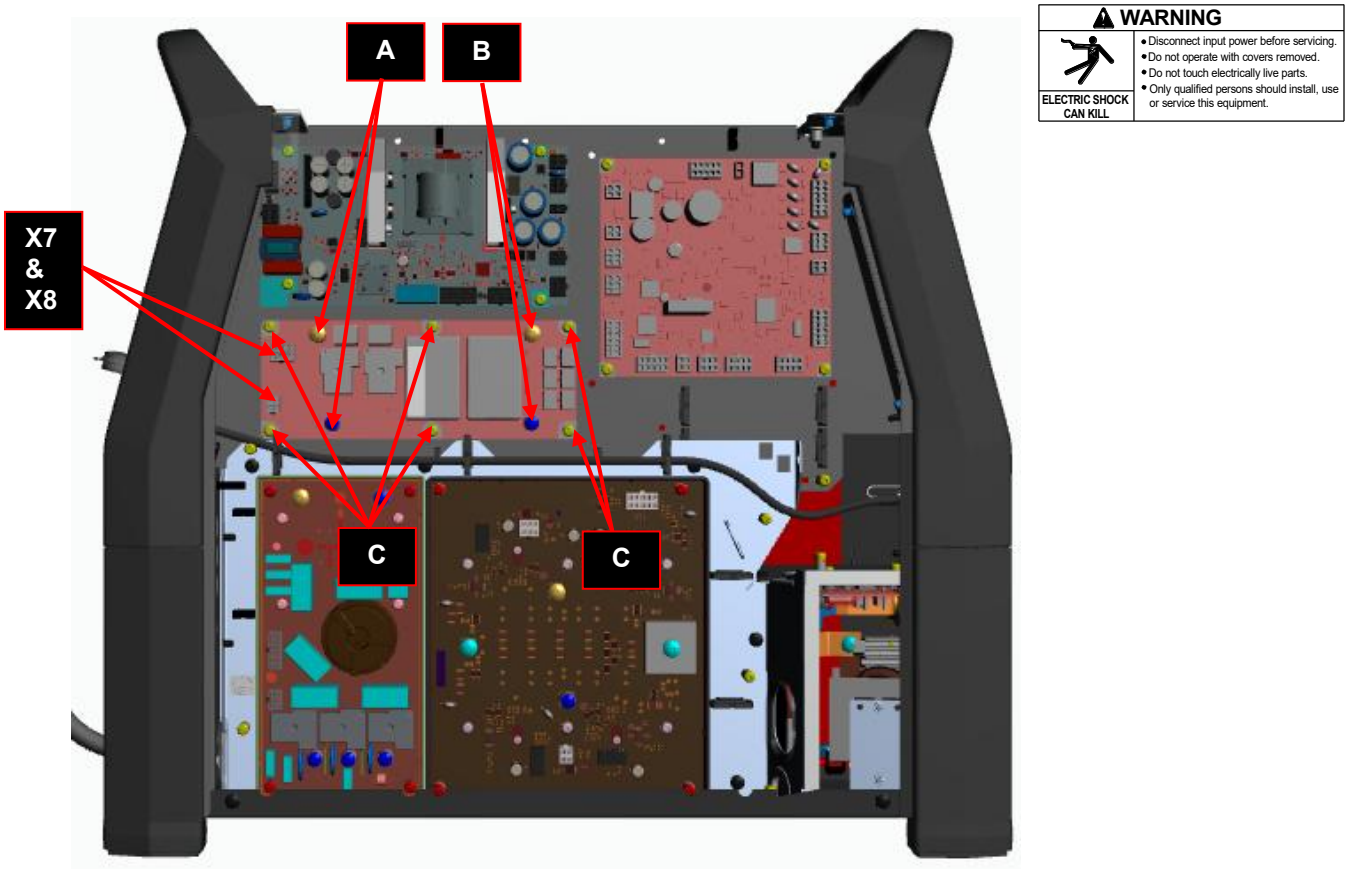


Figure 11

REMOVAL PROCEDURE

Necessary tool:

- TORX wrench TX-20
- TORX wrench TX-30

1. Remove main input power to the **SPEEDTEC® 400S & 500S Gen4**.
2. Perform the **Case Cover removal** and **Discharge procedure**
3. Locate the DC Link Capacitor Board. See **Figure 11**
4. Using TORX wrench TX-30 remove and label the 2 cables (**A**) connected to the terminals INPUT **POS & NEG**
5. Using TORX wrench TX-30 remove and label the 2 cables (**B**) connected to the terminals OUTPUT **POS & NEG**
6. Disconnect connectors X7 and X8 from the DC Link Capacitor Board. See **Figure 11**
7. Using TORX wrench TX-20 remove the 6 screws (**C**) that are fixing the DC Link Capacitor Board to the machine frame.
8. Remove the DC Link Capacitor Board from the machine.
9. **For the new DC Linkl Capacitor Board re-assembly operations,** make the previous steps in the reverse order
   Warning: max torque for screws A & B must be 4 Nm

DISASSEMBLY OPERATIONS

INVERTER BOARD REMOVAL AND REPLACEMENT PROCEDURE

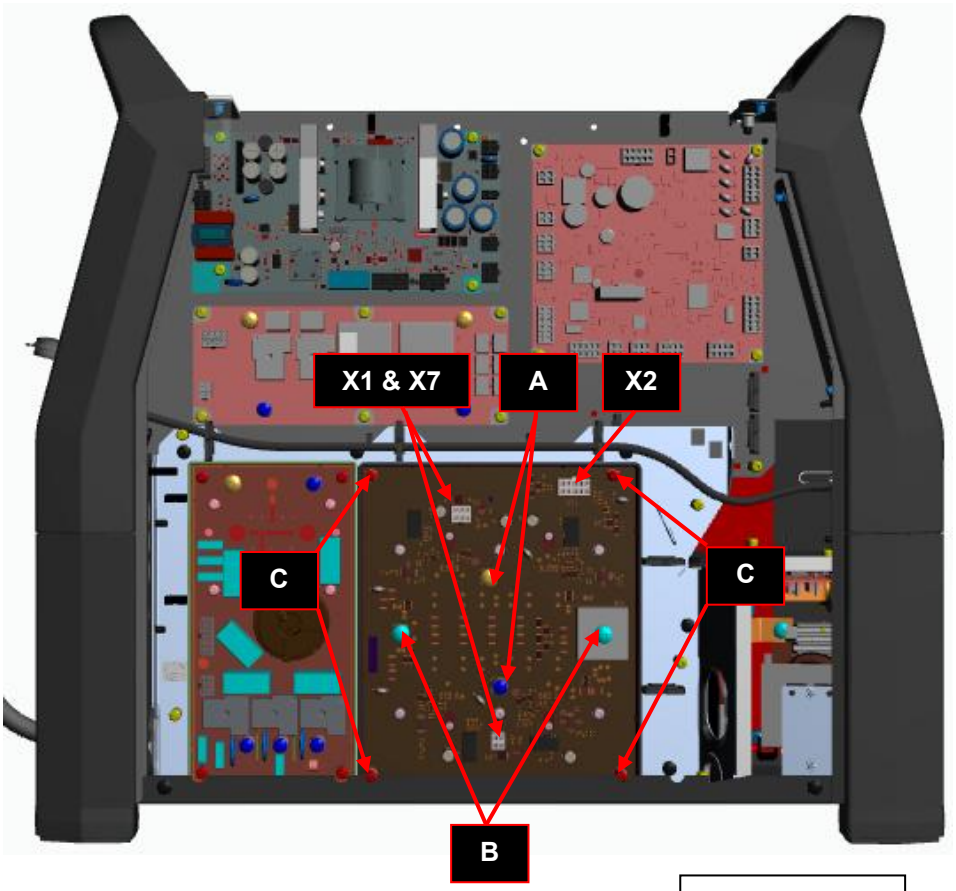
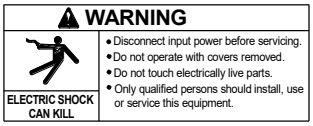


Figure 12



REMOVAL PROCEDURE

Necessary tool:

- TORX wrench TX-20
- TORX wrench TX-30

1. Remove main input power to the **SPEEDTEC® 400S & 500S Gen4**.
2. Perform the **Case Cover removal** and **Discharge procedure**
3. Locate the Inverter Board. See **Figure 12**
4. Using TORX wrench TX-30 remove and label the 2 cables (**A**) connected to the terminals INPUT **POS & NEG**
5. Using TORX wrench TX-30 remove and label the 2 cables (**B**) connected to the terminals OUTPUT **SWA & SWB**
6. Disconnect connectors X1, X2 and X7 from the Inverter Board. See **Figure 12**
7. Using TORX wrench TX-20 remove the 4 screws © that are fixing the Inverter Board to the machine frame.
8. Remove the Inverter Board from the machine.

For the new Inverter Board re-assembly operations, make the previous steps in the reverse order

Warning: max torque for screws A & B must be 4 Nm

DISASSEMBLY OPERATIONS

AUXILIARY POWER SUPPLY BOARD REMOVAL AND REPLACEMENT PROCEDURE

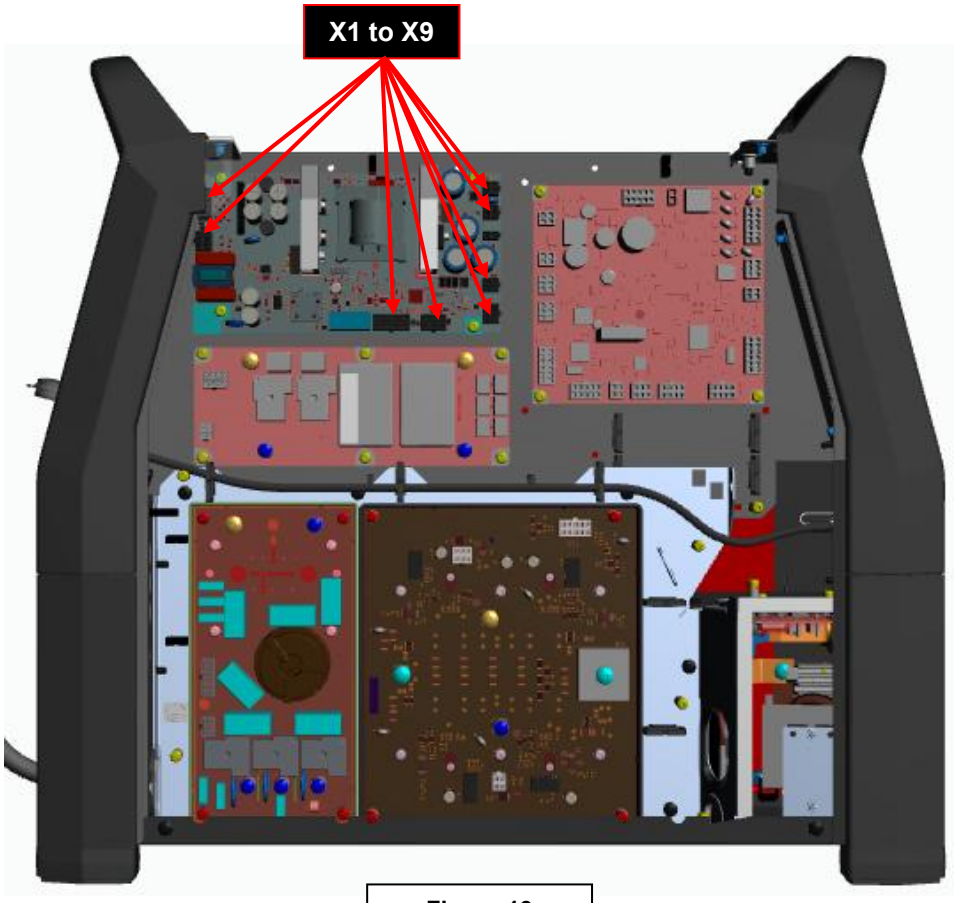


Figure 13

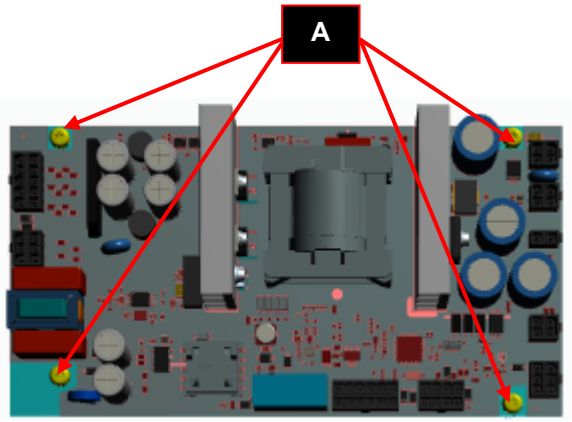


Figure 13a

REMOVAL PROCEDURE

Necessary tool:

- TORX wrench TX-20

1. Remove main input power to the **SPEEDTEC® 400S & 500S Gen4**.
2. Perform the **Case Cover removal** and **Discharge procedure**
3. Locate the Auxiliary Power Supply Board. See **Figure 13**
4. Disconnect connectors X1, X2, X3, X4, X5, X6, X7, X8 and X9 from the Aux. Power Supply Board. See **Figure 13**
5. Using TORX wrench TX-20 remove the 4 screws (**A**) that are fixing the Aux. Power Supply Board to the machine frame. **See Figure 13a**
6. Remove the Auxiliary Power Supply Board from the machine.

For the new Auxiliary Power Supply Board re-assembly operations, make the previous steps in the reverse order

DISASSEMBLY OPERATIONS

CONTROL BOARD REMOVAL AND REPLACEMENT PROCEDURE

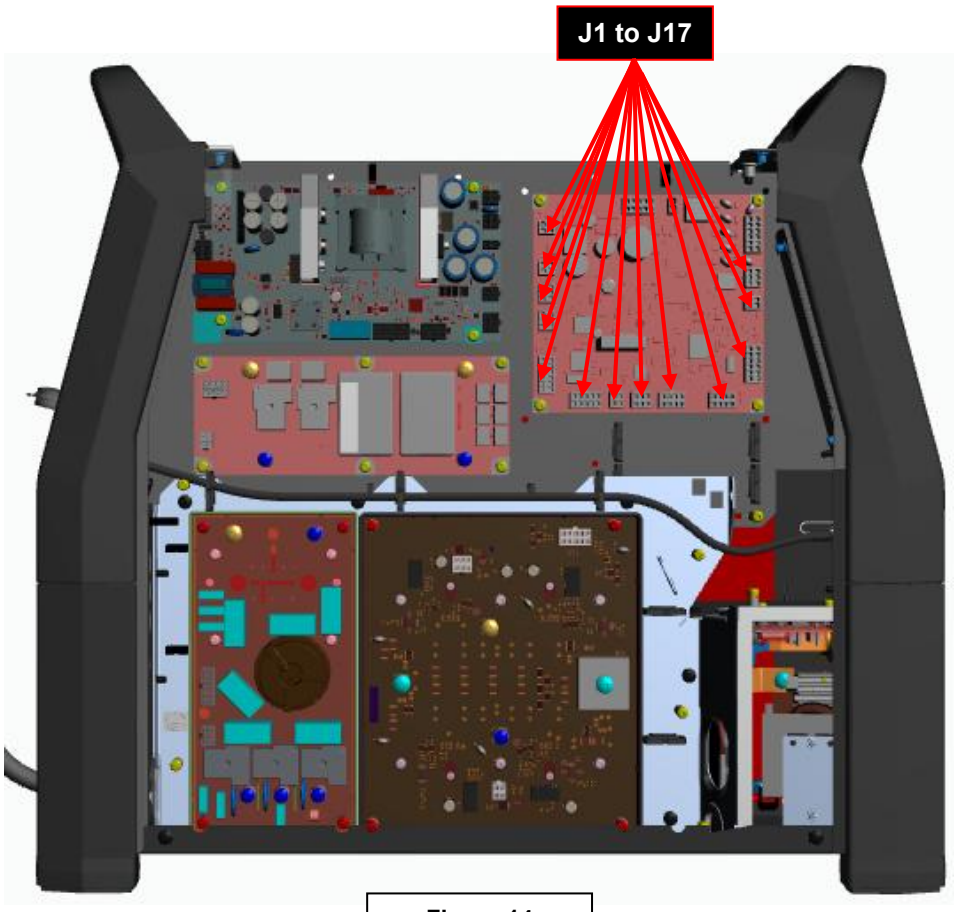
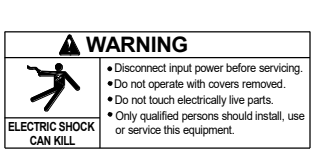


Figure 14



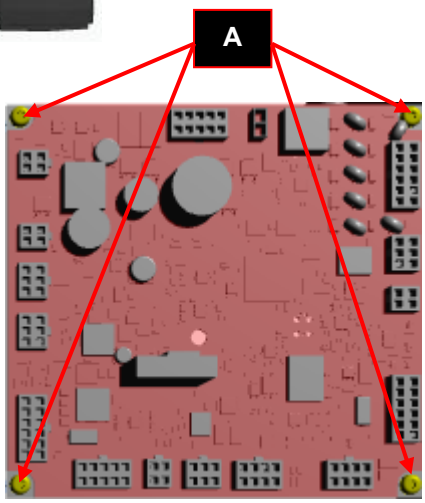


Figure 14a

REMOVAL PROCEDURE

Necessary tool:

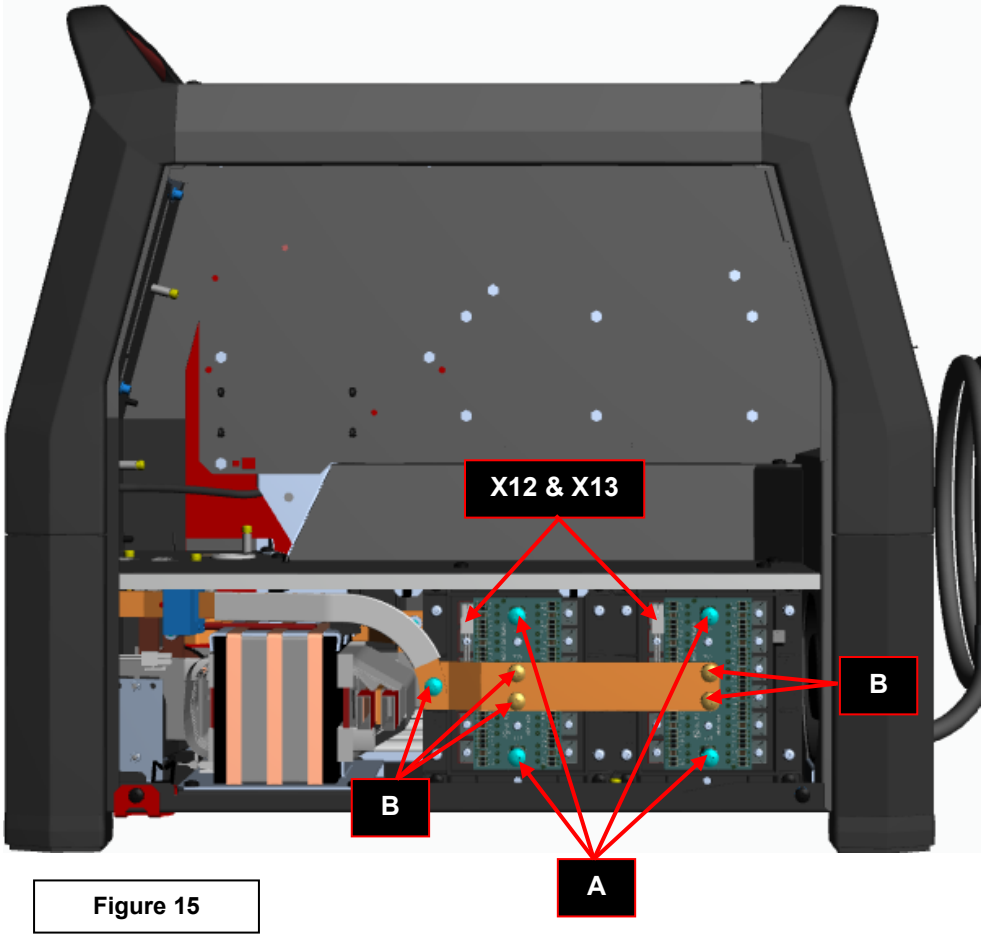
- TORX wrench TX-20

1. Remove main input power to the **SPEEDTEC® 400S & 500S Gen4**
2. Perform the **Case Cover removal** and **Discharge procedure**
3. Locate the Control Board. See **Figure 14**
4. Disconnect connectors J1, J2, J3, J5, J6, J7, J8, J9, J11, J12, J15, J16 and J17 from the Control Board. See **Figure 14**
5. Using TORX wrench TX-20 remove the 4 screws (**A**) that are fixing the Control Board to the machine frame. **See Figure 14a**
6. Remove the Control Board from the machine.

For the new Control Board re-assembly operations, make the previous steps in the reverse order

DISASSEMBLY OPERATIONS

OUTPUT RECTIFIER MODULE REMOVAL AND REPLACEMENT PROCEDURE



WARNING

ELECTRIC SHOCK CAN KILL

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

Figure 15

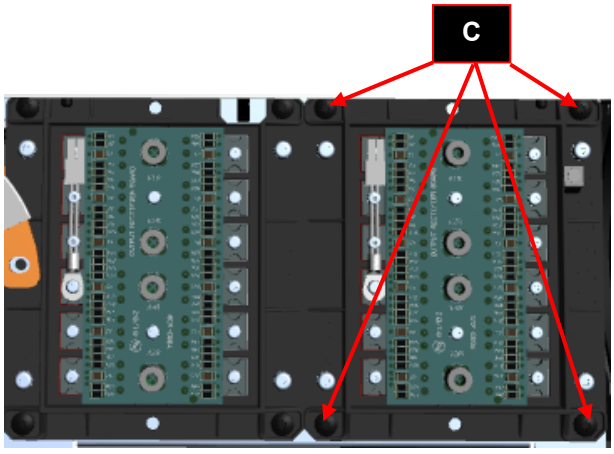


Figure 15a

REMOVAL PROCEDURE

Necessary tool:

- TORX wrench TX-20
- TORX wrench TX-30

1. Remove main input power to the **SPEEDTEC® 400S & 500S Gen4**.
2. Perform the **Case Cover removal** and **Discharge procedure**
3. Locate the Output rectifier Module. See **Figure 15**
4. Label all the power cables to remember their location.
5. Using the TX-30 Torx wrench remove the 4 cables (**A**) connected to Output Rectifier Module from the Output Transformer. See **Figure 15**
6. Using TORX wrench TX-30 remove the 5 screws (**B**) that are fixing the copper bar to the Output Rectifier modules and output copper bar. **See Figure 15**
7. Disconnect the Thermal sensor connectors **X12** and **X13** fron the machine's harness
8. Using the TORX wrench TX-20 remove the 4 screws © that are fixing the faulty Output Rectifier module to the machine
9. Remove the faulty Output Rectifier module from the machine.

For the new Output Rectifier module re-assembly operations, make the previous steps in the reverse order

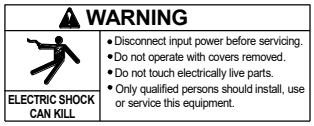
Warning: max torque for screws A & B must be 6 Nm

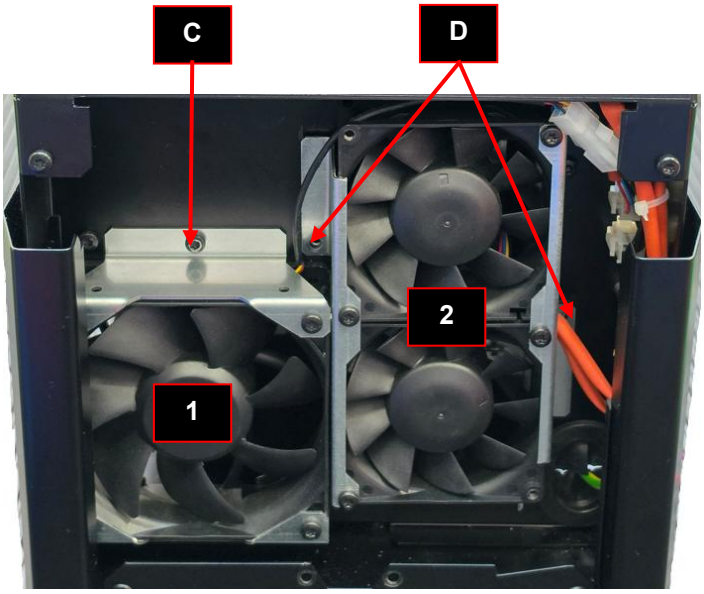
DISASSEMBLY OPERATIONS

FANS REMOVAL AND REPLACEMENT PROCEDURE



Figure 16





REMOVAL PROCEDURE

Necessary tool:

- TORX wrench TX-20

1. Remove main input power to the **SPEEDTEC® 400S & 500S Gen4**
2. Perform the **Case Cover removal** and **Discharge procedure**
3. Using the TX-20 Torx wrench remove the 2 screws (**B**) and pull from the bottom side the rear louvers panel to get access to the fans. See **Figure 16**
4. Locate the faulty fan and procced with removal procedure:
   - If fan 1 needs to be replaced using the TX-20 Torx wrench remove the screw (**C**) pull the fan a little bit and move to the top.
     Disconnect the harness from the fan
     Remove the brackets from the fan using the TX-20 Torx wrench.
   - If one of the fans 2 needs to be replaced using the TX-20 Torx wrench remove the 2 screws (D) move the fan assembly a bit to the top and remove the assembly from the machine.
     Disconnect the harness from the fans
     Replace the faulty fan and reassembly it to the brackets.

Make the previous steps in the reverse order to reassembly the fans assembly.

RETEST AFTER REPAIR

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

Machine input and output

SPEEDTEC® 400S Gen4

Input Voltage	Max Input Current	Rated Output	OCV (open circuit voltage) Peak
400Vac-3ph-50/60Hz	28A	Stick Mode 420A/36,8V@100%	65 Vp

Output Current range	
SMAW & GTAW	15A - 420A
GMAW & FCAW	20A– 420A

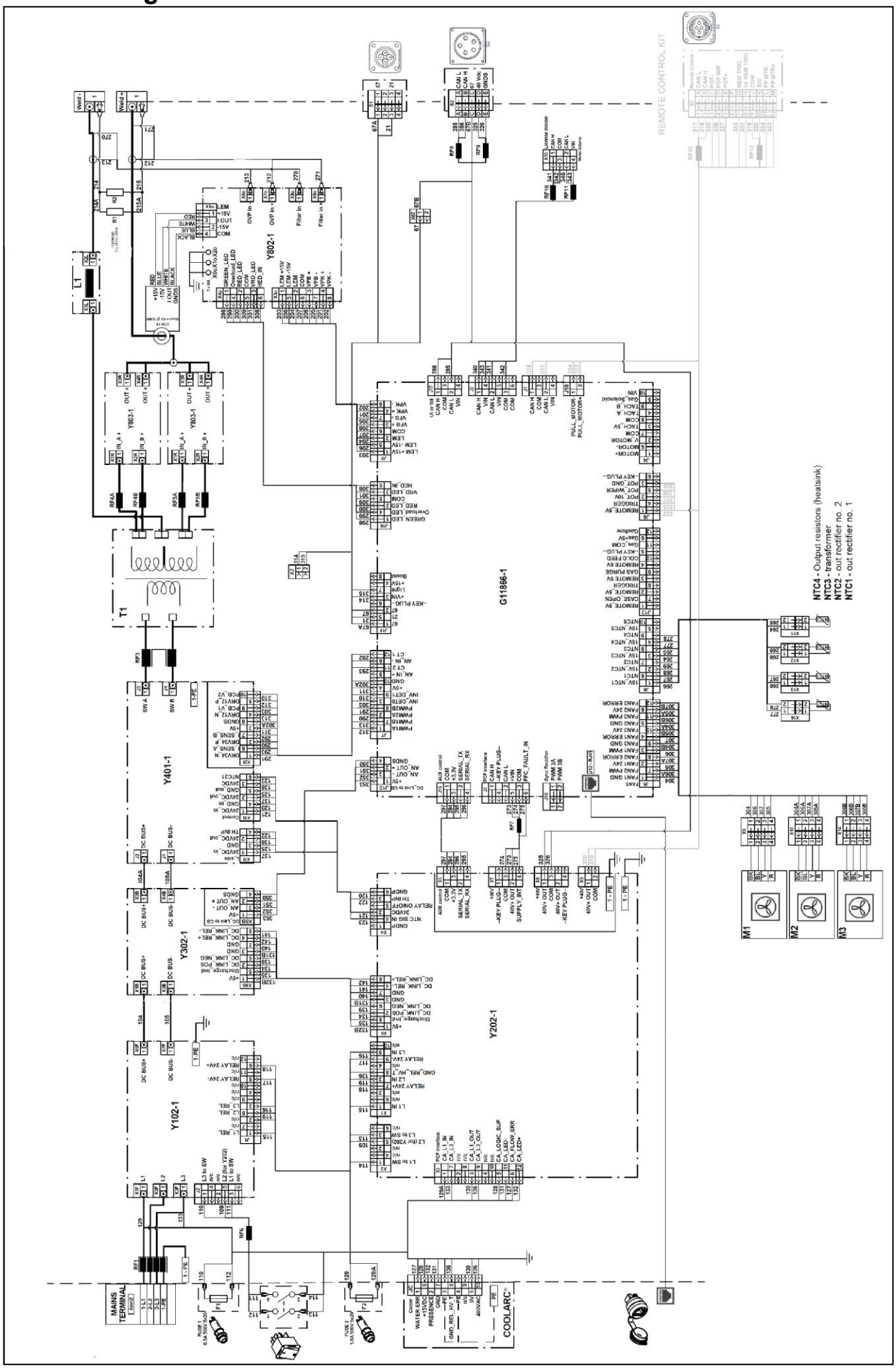
SPEEDTEC® 500S Gen4

Input Voltage	Max Input Current	Rated Output	OCV (open circuit voltage) Peak
400Vac-3ph-50/60Hz	36A	Stick Mode 500A/40V@60%	65Vp

Output Current range	
SMAW & GTAW	15A - 500A
GMAW & FCAW	20A– 500A

ELECTRICAL SCHEMATICS

Schematic Diagram: SPEEDTEC® 400S-500S Gen4



ERROR CODES

A two color light that indicates system errors. Normal operation is steady green light. Error conditions are indicated, per Table.

Table:

Light Condition	Meaning
Steady Green	System O.K. Power source comunicating normaly with wire feeder.
Blinking Green	Occurs during a reset, and indicates the power source is mapping (identyfying) each component in the systems. Normal for first 1-10 seconds after power is turned on, or if the system configuration is changed during operation.
Alternating Green and Red	Non-recoverable system fault. If the PS status light is flashing any combination of red and green, errors are present in power source. Individual code digits are flashed in red with a long pause between digits. If more then one code is present, the codes will be separated by green light. Read the error code before the machine is turned off. If occurs, to clear the error try to turn off the machine, wait for a few seconds, then turn on again. If the error remains, a maintenance is required.
Steady Red	Non recoverable hardware fault. Generally indicates nothing is connected to the power source wire feeder receptacle.
Blinking Red	Not applicable.

Event Codes

6 - Power source is not connected
11 - action database failed
12 - Attribute error
13 - non volatile attributes restore fault
14 - primary non-volatile section bad
15 - secondary non-volatile section bad
16 - non volatile attributes write bad
17 - HSL watch dog timeout
18 - ArcLink mapping failed.
19 - Excessive EEPROM saves detected for the specified attribute
21 - weld sequencer entered faulted state
22 - fault state entry caused by WCD
23 - weld sequencer error updating active state
24 - error changing mode data
25 - weld sequencer write configuration memory with state memory action failed
26 - problem with paired mapping
27 - read/write request failed during paired mapping
28 - Output locked out in the Weld Controller
29 - DSP DAC ISR dangerously close to limit - failure imminent
31 - primary over current
32 - cap bank 'A' under voltage
33 - cap bank 'B' under voltage
34 - cap bank 'A' over voltage
35 - cap bank 'B' over voltage
36 - thermal shutdown
37 - soft start failed
38 - Momentary AC dropout
39 - miscellaneous hardware fault
41 - secondary over current (long average)
42 - power down 42 (GFCI trip)
43 - cap delta voltage
44 - DSP detects host dropped HB
45 - output voltage high
46 - secondary over current (short average)
47 - miscellaneous. hw fault
48 - miscellaneous. hw fault high
49 - single phase
51 - Weld controller failed to set weld sequencer schedule memory.
52 - DSP load high
53 - voltage sense loss
54 - secondary over current (long average)
55 - Communication with DSP failed
56 - Communication with Chopper failed
57 - FGEN error
58 - Primary input power board not ready
59 - Reduced input power detected
61 - slope calculation truncated to zero
62 - sequencer Weld Cycle Data retry
63 - Problem with submerged arc Slave device
71 - Secondary over-power
72 - Unsupported hardware revision
73 - FGEN ISR Overlap
81 - wire drive Motor Overload Fault
82 - wire drive motor over current fault
83 - shutdown bit 1
84 - shutdown bit 2
85 - failed finding Arc Object for trigger command
86 - wire drive input voltage too high
87 - wire drive could not find object
88 - wire drive could not send trigger
89 - WD faild to find PM
91 - failed to update the polarity attribute
92 - Remote shutdown of Weld Controller/Water Cooler error
95 - Spool / Pull motor overload fault code
96 - Weld Controller failed to read WFS decimal places
97 - Licensed feature trial expired, or problem with licensed feature database.
98 - Tried to select an unlicensed weld procedure
99 - STT switch fault
111 - Undefined exception
111 - State memory event queue overflowed

112 - bus error
112 - Error in state timer enable access function
113 - address error
113 - DeviceNet State Enable function error
114 - illegal instruction
114 - DeviceNet Weld Mode change timed-out
115 - divide by zero math error
115 - DeviceNet Creating Change-of-State event failed
116 - Failed to get the object's ArcLink mapping address
116 - F_CHK
117 - F_TRAPV
118 - F_PRIVILEGE
118 - DeviceNet Polled connection Timeout
119 - F_TRACE
119 - DeviceNet Connection was Deallocated
121 - F_EMULA
121 - DeviceNet write database property failed
122 - F_EMULF
122 - DeviceNet read database property failed
123 - F_HW
123 - DeviceNet failed setting polled I/O digital inputs to off.
124 - F_PROTO
124 - DeviceNet Weld Mode change failed
125 - Error getting scaled trim values
125 - F_FORMAT
126 - Error getting un-scaled trim values
126 - F_UNINIT
127 - Error setting trims on a mode change
127 - F_RESVD
128 - Error in writing out an EE value
128 - Spurious Interrupt event
129 - Error in initializing DeviceNet attributes
129 - F_AUTO1
131 - F_AUTO2
131 - EE read failed or bad EE checksum
132 - F_AUTO3
132 - Write To EE failed
133 - Write ArcLink Action Failed
133 - F_AUTO4
134 - F_AUTO5
134 - DeviceNet Master got a fragmented Explicit Message Response
135 - DeviceNet Master got a Bad Explicit Message
135 - F_AUTO6
136 - DeviceNet Master could not open slave
136 - F_AUTO7
137 - DeviceNet Master lost communications to slave
137 - F_TRAP0
138 - DeviceNet Master got a bad I/O Message Response
138 - F_TRAP1
139 - F_TRAP2
139 - DeviceNet Master read a bad high limit for the set WFS
141 - F_TRAP3
141 - DeviceNet Master sending poll I/O failed
142 - F_TRAP4
142 - Error in reading modes form Weld Controller
143 - F_TRAP4
143 - Error in setting SPI panel item
144 - Error accessing Trim item
144 - F_TRAP6
145 - DeviceNet duplicate MAC address error
145 - F_TRAP7
146 - DeviceNet Bus off
146 - F_TRAP8
147 - Error in accessing an attribute over polled I/O
147 - F_TRAP9
148 - Error in switching schedules
148 - F_TRAPA
149 - time out due to zero length I/O
149 - F_TRAPB
151 - F_TRAPC
152 - F_TRAPD
153 - F_TRAPE
154 - F_TRAPF
155 - F_USER
156 - F_UNS_INSTR
157 - F_NPC_BKPNT_DEBUG_INTR
158 - F_PC_BKPNT_DEBUG_INTR
159 - Invalid IP address
159 - F_FP_BRANCH
161 - F_FP_INEXACT
161 - Ethernet Watchdog timeout
162 - F_FP_DIV_BY_ZERO
162 - Ethernet connection timer expired
163 - F_FP_UNDERFLOW
163 - Error in getting system information for email
164 - Error sending email
164 - F_FP_OPER_ERR
165 - Error accessing email memory
165 - F_FP_OVERFLOW
166 - action failed
166 - F_FP_IN_NOT_A_NUMBER
167 - Ethernet Europipe PLC
167 - F_FP_IN_DENORMALIZED
168 - Ethernet UPD port busy
169 - Ethernet connection watchdog timeout
171 - CPU Bus Problem
171 - Ethernet socket timeout
172 - Ethernet watchdog timeout
173 - Failed to create a change of state event.
174 - Failed getting ArcLink object address
175 - ArcLink message failed
176 - Error in setting up the Web Server
177 - High speed event registration failed
178 - High Speed Event Read Failed
179 - An incoming ArcLink Event queue overflowed.
181 - Failed to add object to ArcLink group.
181 - System CPU exception (F_UNALIGN)
182 - System CPU exception (F_NOCP)
182 - Could not allocate TPU timer
183 - System CPU exception (F_INVPC)
183 - Could not deallocate TPU timer
184 - System CPU exception (F_INVSTAT)
184 - Error in opening UDP listen port
185 - Non-Authorized IP address sent a UDP packet
185 - System CPU exception (F_BSTKE)
186 - System CPU exception (F_BUSTKE)
186 - Incoming UDP packet bad
187 - Could not allocate a UPD packet
187 - System CPU exception (F_IMPRE)
188 - System CPU exception (F_PRECISE)
188 - Send a UDP packet failed
189 - System CPU exception (F_IBUS)
189 - Error in updating cache memory
191 - Error in checking UDP cache item
191 - System CPU exception (F_MLSPERR)
192 - System CPU exception (F_MSTKE)
192 - Error in creating UDP cache item
193 - System CPU exception (F_MUSTKE)
193 - Error in removing an item from cache memory.
194 - System CPU exception (F_DERR)
194 - Error in sending a UDP message from an Ethernet client
195 - System CPU exception (F_IERR)
195 - Had a problem with a client socket call
196 - System CPU exception (F_HFAULT_STAT_VECT)
196 - Had a problem opening client
197 - Client detected problem with Server data
198 - Client timed out waiting for Ethernet server reply
199 - Error getting sequence cross reference attribute number
211 - DSP Illegal Instruction
212 - control board can't be found
212 - DSP/BIOS Task Creation Failed
213 - DSP/BIOS Resource Lock Creation Failed
213 - control board is offline
214 - wire drive board can't be found
214 - DSP/BIOS Mailbox Creation Failed
215 - DSP/BIOS Semaphore Creation Failed
215 - wire drive board is offline
216 - error sending message to Ethernet client
217 - arc master had a problem
218 - action to sequencer failed
219 - Ethernet board not found
221 - Error setting sequence memory
222 - Error getting sequencer cross reference
223 - Error getting arc data
224 - Error with a message to a server
225 - Bad Session Id
226 - Error with a message to a server
227 - New Arclink XT object Found
228 - Arclink XT communication problem
229 - Ethernet Transmit Error
231 - Power source is not connected
232 - arc control object write workpoint
233 - arc control object write trim
234 - arc control object write wave 1
235 - arc control object write wave 2
236 - arc control object write wave 3
237 - arc control object write wave 4
238 - arc control object write WFS
239 - arc control object write timer
241 - arc control object write state enable

242 - arc control object write timer enable
243 - arc control object read failure
244 - arc control object can not find required object
245 - arc control object non sequence write
246 - arc control object mode change
247 - arc control object latched fault
251 - Master machine detected an error with one of its slave machines.
252 - AC/DC trail arc fault
253 - Trail Arc mapping fault
259 - Loss Of Communication with the Secondary Microcontroller
261 - dual memory panel dip switches not set correctly
262 - power source is not compatible
263 - user interface found no compatible weld modes
264 - user interface tried to select non-existent weld mode
265 - selected weld mode is not supported by the user interface
266 - the user interface I/O is preventing the user interface from becoming ready
267 - user interface found too many arc control objects
268 - arc control object not enabled
269 - Arc was lost or never established
271 - user interface shutdown bit 1
272 - user interface shutdown bit 2
273 - user interface CPLD not supported
274 - the info restored from memory does not match the weld mode info (e.g. wp units)
275 - user interface write failure (could not lock user interface memory resource)
276 - user interface read failure (could not lock user interface memory resources)
277 - user interface memories were converted
278 - user interface limits were converted
279 - UI_MAPPING_DIPS_ERROR
281 - user interface failed to read attribute
282 - user interface failed to write attribute
283 - user interface failed an ArcLink action
284 - An attempt was made to update Arc Object from group/sched other than 0
285 - Bad checksum during restore of memory
286 - Block meter timer timed out because meter events did not end properly
287 - User Interface failed to find a Touch Sense mode
288 - Failed to find Spool Gun board
289 - Failed to find Tractor object
291 - input b shutdown
292 - Failed to find Flux Hopper object
293 - Output disabled from Weld Controller
294 - More weld modes found than the UI can store
295 - Push Button is Stuck
296 - Weld Set Incompatibility
297 - USB Drive Access Error
301 - write to battery backup failed (production monitoring counters)
302 - write to battery backup failed (production monitoring weld profiles configuration)
303 - write to battery backup failed (production monitoring system configuration)
304 - read from battery backup failed (production monitoring counters)
305 - read from battery backup failed (production monitoring weld profiles configuration)
306 - read from battery backup failed (production monitoring system configuration)
307 - read workpoint failed
308 - Save Production Monitoring data to battery backed RAM failed
309 - Restoring Production Monitoring data from battery back RAM failed
351 - weld profile fault I limit occurred
352 - weld profile fault V limit occurred
353 - weld profile fault WFS limit occurred
354 - weld profile fault WeldScore limit occurred
355 - weld profile fault T limit occurred
361 - weld profile alarm I limit occurred
362 - weld profile alarm V limit occurred
363 - weld profile alarm WFS limit occurred
364 - weld profile alarm WeldScore limit occurred
365 - weld profile alarm T limit occurred
371 - weld profile runt occurred
372 - consumable low
373 - Did Not Save Weld Logs
381 - weld profile latched alarm I limit occurred
382 - weld profile latched alarm V limit occurred
383 - weld profile latched alarm WFS limit occurred
384 - weld profile latched alarm WeldScore limit occurred
385 - weld profile latched alarm T limit occurred
411 - Spread Arc Limit switch error
412 - Travel Motor Overload Fault
413 - Travel motor over current fault
414 - Ground Loop Protection fault
421 - Dips override firmware
441 - Spool Gun Object Not Found
442 - Arc Object Not Found
443 - Travel Object Not Found
444 - Flux Object Not Found
511 - Request to Function Generator failed
521 - AC Switch Problem
611 - Action to restore flash attributes failed
612 - Object Not Ready
613 - Module pairing was auto-reconfigured
614 - Auto-mapping needs to be enabled
615 - Mapped Object Answered Recognition
616 - A board is in bootstrap
711 - Capacitor Fault
712 - cLink Watchdog Timeout
713 - Supply Voltage Too High
714 - Supply Voltage Too Low
715 - Switchboard Undervoltage Lockout
716 - Microcontroller Locked
717 - Machine Identity Error
718 - Interprocessor Communication Timeout
719 - Switchboard Critical Error
721 - Capacitor bank under-voltage.
722 - Capacitor bank over-voltage.

Fatal errors

1111 - boot code checksum
1112 - power on reset
1113 - forced boot
1116 - RAM failure
1117 - Data/Address failure
1118 - Mapping failure
1119 - Failed to erase flash memory
1121 - Failed to program flash memory
1122 - Flash memory programming voltage problem
1123 - Failed to unlock flash memory for programming
1213 - Timer Allocation error
1214 - Bad event queues
1215 - Bad event queues read
1216 - Watchdog time expired
1311 - Main code checksum error
1312 - Parameter file checksum error
1313 - FPGA file checksum error.
1314 - Weld Table checksum error
1315 - DSP checksum error
1316 - param file format error
1317 - hardware revision format error
1318 - Automapping failure
1319 - EEPROM Memory Allocation Error
1321 - UI parameter definition error
1322 - Bad FGEN file
1323 - FGEN load error
1324 - FGEN HPI int error
1325 - FGEN Start Error
1326 - Main execution RAM checksum error
1327 - CPLD Heart Beat Event
1328 - HPI comm error
1329 - Error in finding all the attributes in the system.
1331 - Error in reading Weld Daq data from the Fgen
1332 - First-sector flash attributes not programmed
1333 - FGEN/Weld controller data mismatch
1334 - Invalid Weld Mode pointer
1335 - Flash calibration attributes not found
1418 - cLink mapping failed
1511 - Too many objects
1521 - Task failed to register for ArcLink reset acknowledgement.
2111 - Controller Area Network(CAN) spurious interrupt
2112 - Controller Area Network(CAN) spurious interrupt
2113 - CAN spurious interrupt
2114 - CAN object allocation error
2115 - CAN weld cycle blocks out of sequence
2116 - CAN bus warning
2117 - CAN bus off
2118 - CAN receive data not new
2119 - CAN hardware did not come out of reset
3111 - HSL spurious Tx interrupt
3112 - Mail for serial download request was bad
3211 - The Cold Fire I2C bus reported busy
3212 - The Cold File I2C bus timed out
3213 - A slave on the Cold Fire I2C bus did not respond
3214 - The Cold Fire OS was not up when trying to use the I2C bus
4111 - Cannot program firmware in Main code
4211 - specified EEPROM section number is invalid
4212 - too many nonvolatile attributes found
4213 - non-Volatile EE checksum invalid after save all.
4214 - EEPROM defined sections overlap
4215 - EE defined section smaller than header size
4216 - Log section of EE is larger than allocated.
5111 - FGEN busy
5112 - Unable to initialize DeviceNet attribute
5113 - Error in loading Weld Mode 0 to the Ffen
5511 - Return buffer is not properly initialized
5512 - Return buffer is not properly initialized
6111 - F_SEQ_BADWCYC
6112 - F_SEQ_WRITE_ERR
6113 - F_SEQ_BUILD_ERR
6114 - F_SEQ_BUILD_CFG
6115 - F_SEQ_BUILD_CON
6116 - F_SEQ_MEM_OVERFLOW
6117 - F_SEQ_BUILD_PAR
6211 - Empty Weld Set
6212 - Bad weld set
6213 - F_WC_WTABLE_VER
6214 - F_WC_FPGA_FAULT
6215 - Parameter file slope is too high
6216 - Incompatible weld table.
6217 - MCU/DSP weld table data mismatch.
6218 - Error transferring weld table to DSP.
6311 - Noisy WFS input
6411 - Phase Generator mapped in system
6412 - Phase Generator failed to read ArcLink property
6413 - Phase Generator failed to write ArcLink property
6511 - More than one UI was found for the Tractor
6512 - More than one Tractor object was found
6611 - More than one lead tried to communicate with trail arcs
6612 - System Interface failed to read ArcLink attribute
6613 - System Interface failed to write ArcLink attribute
6614 - More than one trail arc with the same arc number found
6615 - Too many trail arcs
7111 - Unknown SPI panel installed
7112 - SPI panel RAM allocation err
7121 - repeated bad data read from panel 0
7122 - repeated bad data read from panel 1
7123 - repeated bad data read from panel 2
7124 - repeated bad data read from panel 3
7125 - repeated bad data read from panel 4
7126 - repeated bad data read from panel 5
7127 - repeated bad data read from panel 6
7128 - repeated bad data read from panel 7
7131 - Panel 0 is necessary and not found
7132 - Panel 1 is necessary and not found
7133 - Panel 2 is necessary and not found
7134 - Panel 3 is necessary and not found
7135 - Panel 4 is necessary and not found
7136 - Panel 5 is necessary and not found
7137 - Panel 6 is necessary and not found
7138 - Panel 7 is necessary and not found
8111 - DSP - FPGA load failure
8112 - DSP Clear Failure
8113 - DSP Set Failure
8114 - DSP program failure
8115 - DSP version changed
8116 - DSP RAM error
8117 - DSP Checksum Error
8118 - DSP Heartbeat Error
8119 - DSP Program Timeout
8121 - DSP Watchdog Timeout
8122 - DSP Depletion Error
8123 - DSP flash loader not found
8124 - DSP program loader not found
8125 - DSP main program not found
8126 - DSP timeout
8127 - DSP response incorrect
8128 - DSP flash sector empty
8211 - A user safety attribute could not be written
8212 - Operational Hardware check failed
9111 - FPGA - Bad Config
9112 - FPGA programming fault
9121 - PSoC has no main code (G4774)
9122 - PSoC watchdog timed out (G4774)
9123 - Wire drive PSoC error
9124 - Wire drive PSoC error
9125 - Wire drive PSoC error
9311 - SwitchBoard fault
9411 - Submerged arc slave error
9511 - TCP Stack
9512 - There is a hardware problem on the board

NOTE

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