

# *Chapter*

# *4*

## *Maintenance*

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### *Summary*

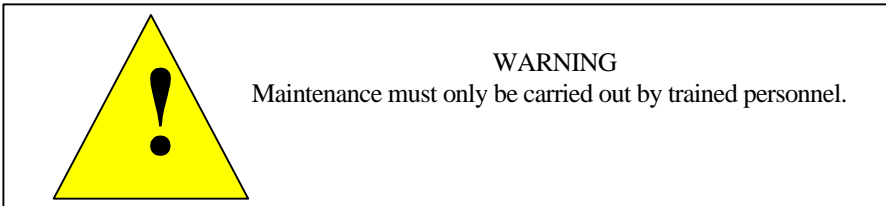
This chapter describes a maintenance schedule for the inspection system. Where possible it refers to the electrical schematic drawing numbers that describe the circuits involved. They are contained in a

separate document. This schedule must be strictly adhered to and be performed only by qualified personnel.

## **4.1 Introduction**

Maintenance is divided into weekly, monthly, quarterly and yearly schedules. It is also divided into five main sections, each covering an area on the machine. These areas are as follows;

- Electrical Maintenance.
- X-Y table Maintenance.
- Conveyor Maintenance.
- Pneumatic Maintenance.
- General Maintenance.

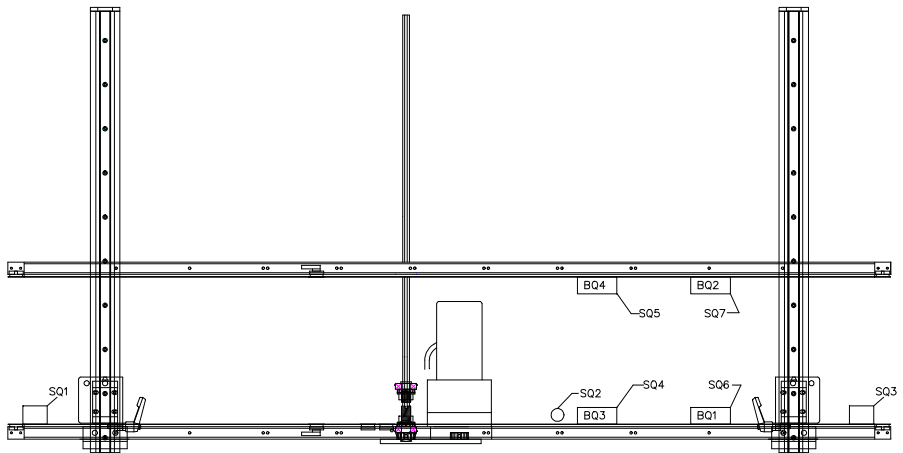


## **4.2 Electrical Maintenance**

### **Weekly**

1. Visually inspect the electrical control panel by turning off the machine at the ON/OFF switch and putting the isolator handle in the OFF position. Open the back door. Make sure the computer has been shutdown correctly before this is done.
2. Inspect all electrical equipment on the machine for damaged contacts, exposed wire cores and frayed insulation.
3. Ensure there are no items in front of the transformer panel; i.e. Check that the vent is kept clear of obstruction (refer to fig. 2.1).
4. Clean the optical sensors with a dry cloth.

- 
5. Pull out the PC drawer and check the cables going into the PC, ensure that they have not become loose by trying to push them in.
  6. Pull out the motor controller drawer and check the cables going into the motor controller, ensure that they have not become loose.
  7. Inspect the X-Y Table and check all cables and connectors.
  8. Power back up the machine.
  9. Operate the E-Stop and open front window. Ensure that both of these mechanisms effectively stop the machine.
  10. Operate the clamping and the stopping mechanisms by manually moving the piston heads. Examine the indicator LED's on the sensors to ensure that they are operating properly.
    - ⇒ Clamp mechanism forward SQ4 ON + SQ5 OFF
    - ⇒ Clamp mechanism back SQ4 OFF + SQ5 ON
    - ⇒ Stop mechanism up SQ6 ON + SQ7 OFF
    - ⇒ Stop mechanism down SQ6 OFF + SQ7 ON
  11. If the system has up-lift clamping then follow this sequence;
    - ⇒ Clamp mechanism up SQ4 ON + SQ5 OFF
    - ⇒ Clamp mechanism down SQ4 OFF + SQ5 ON
    - ⇒ Stop mechanism up SQ6 ON + SQ7 OFF
    - ⇒ Stop mechanism down SQ6 OFF + SQ7 ON
  12. Release the E-Stop and press the reset switch.



**Figure 4.1 - The System Conveyor Schematic**

13. Cycle a board through the machine and watch its operation for any faults.

### Monthly

1. Carry out weekly routine.
2. Open the pneumatic panel and check the terminals and solenoid valves connections (refer to fig. 4.4).

### Quarterly

1. Carry out monthly routine.
2. When inspecting the control panel, check the tightness of the connections at random.

The following points below 'Changing the lighting head fluorescent tube' only applies to the GS-1 system.

3. Change the lighting head fluorescent tube, (life span of bulb is 2000hrs). To replace the bulb do the following;
  - ⇒ Open main window and remove the push on bulb cable.
  - ⇒ Release the 2 x M3 grub screws clamping the metal bulb end.

- ⇒ Gently pull the bulb downwards away from the bulb holder to remove bulb from bulb clips.
- ⇒ Reverse this procedure to install new bulb.

**Caution:      The bulb may still be hot. Allow 15 minutes cool down time before removing it.**

## Yearly

1. Isolate machine from mains supply. Take off all side panels and physically check all electrical connections on the machine.
  - ⇒ Main control panel.
  - ⇒ X-Y Table.
  - ⇒ PC.
  - ⇒ Motor Controller.
  - ⇒ Pneumatic control panel.
  - ⇒ Transformer if fitted.
  - ⇒ Lighting head power-supply unit.
  - ⇒ All connectors.
2. Check the insulation resistance of the mains voltage supplies. Follow this procedure carefully.

Only a qualified technician can carry out this test

- ⇒ Power off the machine.
- ⇒ Switch off the main isolator.
- ⇒ Disconnect the mains plugs to the monitors, PC, Motor controller and lighting head PSU.
- ⇒ Disconnect the 220V side of the following PS1, PS2, PS3 and the PLC. Leave the loose wires apart and not touching.
- ⇒ Using an insulation resistance tester (**NOTE THIS IS 500V DC**) check between L1 and earth. There should be a reading of >1 M ohm.
- ⇒ Then check between N1 and earth. It should have the same reading.
- ⇒ Check again to ensure all equipment stated above is disconnected.

- ⇒ Check the reading for cable 14 to earth, then cable 13 to earth and finally cable 13 to 14. Again the reading should be  $> 1\text{M ohm}$ .
  - ⇒ This test will give an indication that the insulation resistance of the cables and mains supply to the body of the machine is intact and complies with the relevant standards.
3. Open the transformer panel and check the condition of the transformer (refer to fig. 2.1). Examine it for any of the following:
- ⇒ Discoloured, blistered or cracked transformer coating.
  - ⇒ Cable and crimp integrity.
  - ⇒ Broken or chipped terminals.
  - ⇒ Excessive blackening of transformer guard.
  - ⇒ Check all terminal connections on the machine and complete the monthly routine.
  - ⇒ Check DC power supply unit outputs.

## 4.3 X-Y Table Maintenance

### Weekly

1. Power down the machine and switch off the X-Y stage at the controller.
2. Inspect the X-Y table, by moving the stage manually from one end of the axis travel to the other. This will also redistribute the lubricant and extend the stage life.
3. Check that all cables on the stage are free and not obstructing its movement.
4. Ensure the bearings are kept free from dust, loose particles and moisture, Fig 4.2 (D).
5. Ensure the magnetic platens are free from debris, Fig 4.2 (E).
6. Run the machine and press the E-Stop to ensure that it operates as normal.
7. Visually examine the encoder, Fig 4.2 (C), on each axis to ensure that there are no scratches, grease or dirt. If some grease or dirt needs to be removed, do this with a very fine lint free cloth only. **Take care not to scratch gold foil as this will greatly affect the table's accuracy.**
8. Check the small home marker contacts and end limits are intact; Figure 4.2 (C), (B). Ensure that they are free from dirt and grease.

### Monthly

1. Carry out weekly routine.
2. When inspecting the connections on the stage and at the controller check the integrity of the connectors at random.

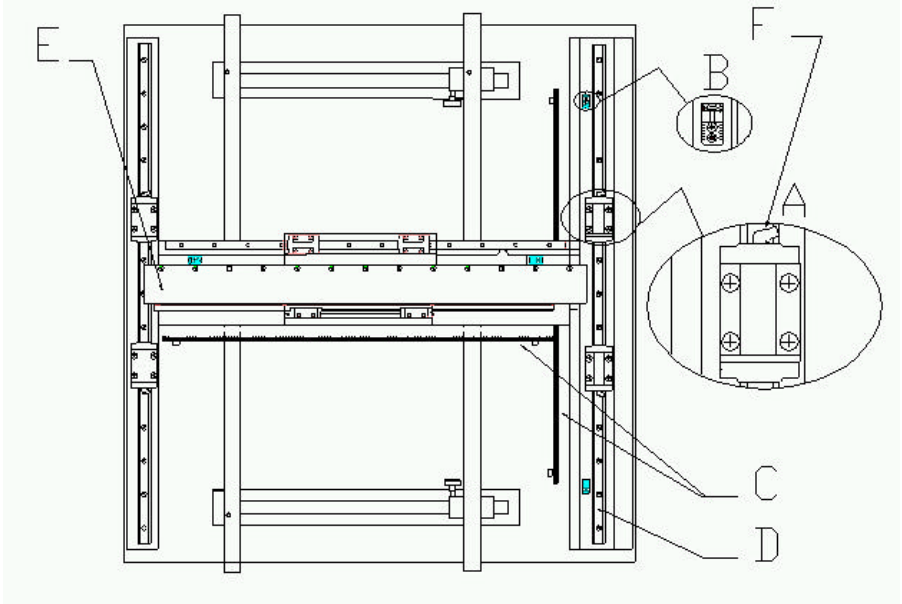


Fig 4.2 - X-Y gantry schematic



**WARNING**  
Failure to lubricate the stage at quarterly intervals  
invalidates all warranties.

### Quarterly

1. a) Carry out Monthly routine.
2. b) Carry out the following procedure for lubricating and cleaning of the stage.
3. Turn off controller and activate the E-Stop.
4. Drive the stage to one end of its travel.
5. Open door and remove side-panels.
6. Remove any accumulated dust or debris from inside of the assembly.



7. Vacuum-clean the base of the table.
8. Remove any dirty or dried lubricant from the bearing guides. Figure 4.2 (D). Use a clean cloth with along the rails to clean the bearing guides. A cotton swab soaked in solvent will suffice to remove stubborn debris.
9. After the solvent has evaporated (if used), apply a thin, continuous film of lubricant to the bearing guides. A good quality natural bristle artist's brush is an excellent applicator for this.
10. Lubricate the four LMG bearing trucks on each stage, Figure 4.2 (A). (See note on lubricant overleaf). Use a grease gun with a grease nipple (type UU or SS), Figure 4.2 (F).
11. Refit all panels and close the door.
12. Restore power to the machine.

### **Yearly**

1. Carry out quarterly routine.
2. Take off the cover of the controller and check the interior for loose connections. Ensure that the internal fan is functioning.
3. Using an 8mm Allen key ensures that the securing bolts on the table have not become loose. (Tighten to 35 Nm, 310 lbf.inch)

### **Important notes on lubrication.**

Be sure to use a clean dry, soft lint free cloth for cleaning.

Take the time to inspect the linear motor drives for wear and signs of damage.

Further disassembly of the stage is NOT recommended, since proper setting and calibration can only be carried out at the factory.

### **Recommended Lubricants.**

1. Dow Corning's Molykote 44 is recommended.
2. Only use lithium based grease.

## 4.4 Conveyor Maintenance

### General Warnings

**NEVER** clean with a compressed air stream. It may cause dirt etc. to get lodged into the motor shaft. Use a vacuum cleaner to remove loose dust or dirt.

**NEVER** disassemble the motor.

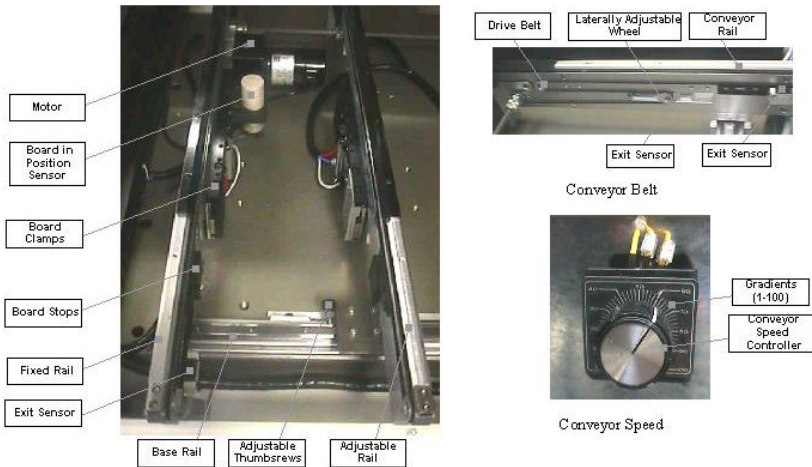


Fig 4.3 – Conveyor Components

### Weekly

1. Check the function of the sensors by placing a sample board over them. Look at the indicator light on each of the sensors.
2. Check soundness of all motor housings.
3. Lubricate belt motor drive shaft. **DO NOT** leave shaft dripping with oil; a light coating is all that is needed.
4. Lubricate conveyor support rods. **DO NOT** apply excessive oil, a light coating is all that is needed.
5. Wipe off edge belts with recommended cleaning agent 409 spray cleaner. An alternative is to use alcohol or equivalent.

## Monthly

1. Carry out the weekly maintenance routine in full.
2. Examine crown/toothed bearings for sticking or wobble. Ensure all bearings are free running and belt tension is adequate.
3. Ensure that conveyor belts are not twisted on either rail.

## Yearly

1. Carry out monthly maintenance routine in full.
2. Check the electrical connections at the conveyor motor and in junction box "C". Make sure all connections are intact and securely fitted.
3. Check all mounting screws and hardware on the machine.
4. Systematically check all nuts, bolts and screws on rails, lifting mechanism, air cylinders, bearings and mountings for all hardware.
5. Check for insulation resistance of the motor => 10 M Ohms, using a 500V DC insulation resistance tester.



### **WARNING**

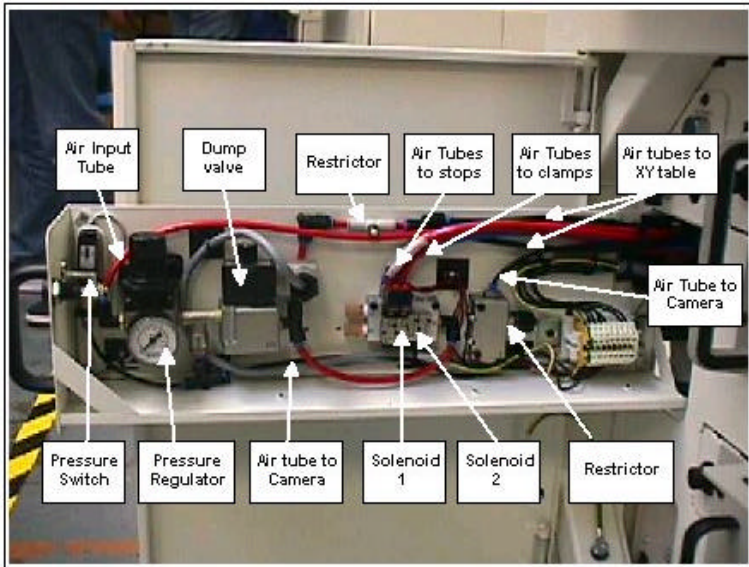
**Isolate the machine and disconnect the conveyor motor from the supply at junction box "c" before doing insulation resistance test.**

## 4.5 Pneumatic Maintenance

### Weekly

Check the air pressure of the following.

- |                           |        |
|---------------------------|--------|
| ⇒ Main pressure regulator | 5 Bar. |
| ⇒ Pressure sensor         | 3 Bar. |



**Fig 4.4 - Pneumatic Drawer**

## Monthly

1. Operate the E-Stop to ensure that the dump valve is operating correctly.
2. Manually operate the control solenoid valves and ensure that the stops and the clamping, if installed, are operating correctly. Ensure that they are not sticking.
3. Check the air purge to the lighting head.
4. Ensure the pressure switch is operating, if installed, by removing the air from the system, the PC should indicate this on the monitor.

## Yearly

1. Carry out the monthly routine as above.
2. Ensure the lighting head restrictor is set to the desired airflow.
3. Ensure the air purge to the X-Y table is operating and that the restrictor is fully open.
4. Replace the main air filter by removing the half panel above the transformer guard. Ensure that the main air supply is isolated from the machine prior to replacing filter (refer to fig. 2.1).

## 4.6 SP-2 Additions

### Pneumatics Wiring

Figure 4.6 shows the pneumatic diagram for the Entry/Exit doors on the SP-2 system.

- The doors remain open by default preventing operation of the laser. If there is a loss of air pressure, the doors will close slowly under their own weight, with no danger of pinching or cutting.
- The flow control on the door open supply is set to ensure smooth, low-impact, opening of the shields.
- The Pressure Regulator on the door close supply is set to a very low pressure (0.2-0.3 MPA maximum) to provide the minimum force required to assist the doors closing under their own weight.

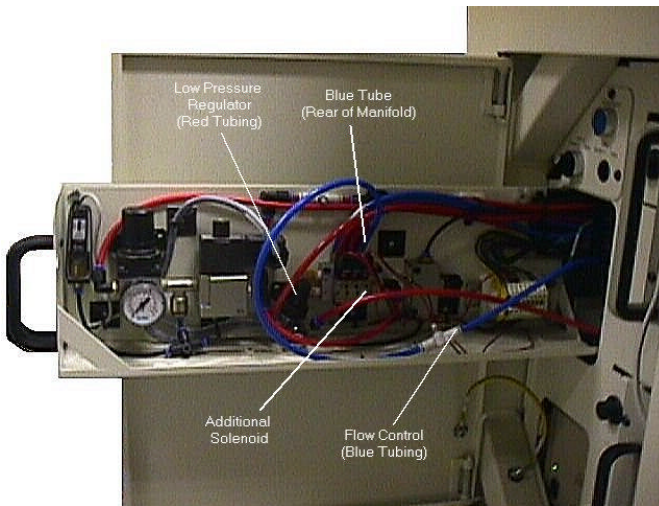
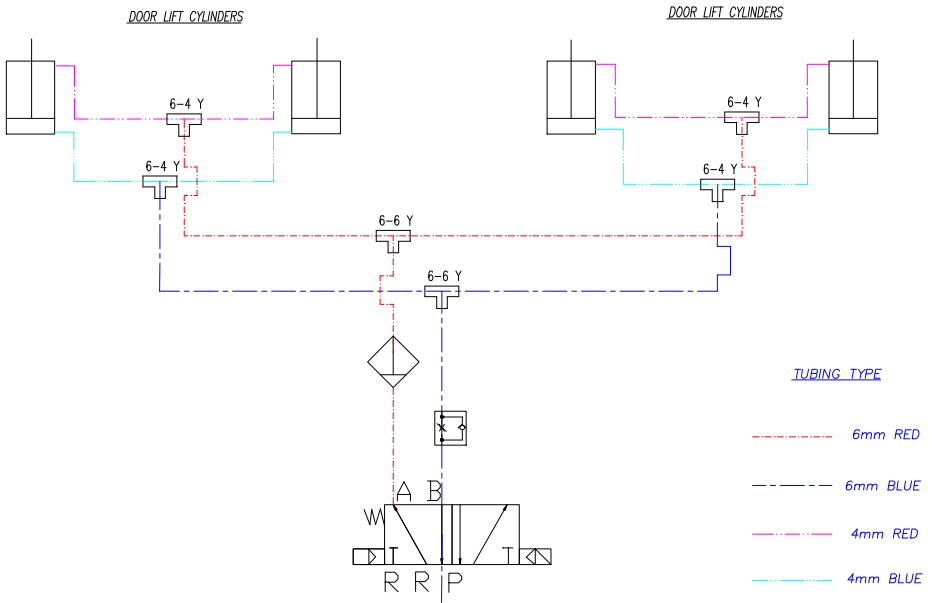


Figure 4.5 – SP-2 Pneumatic drawer



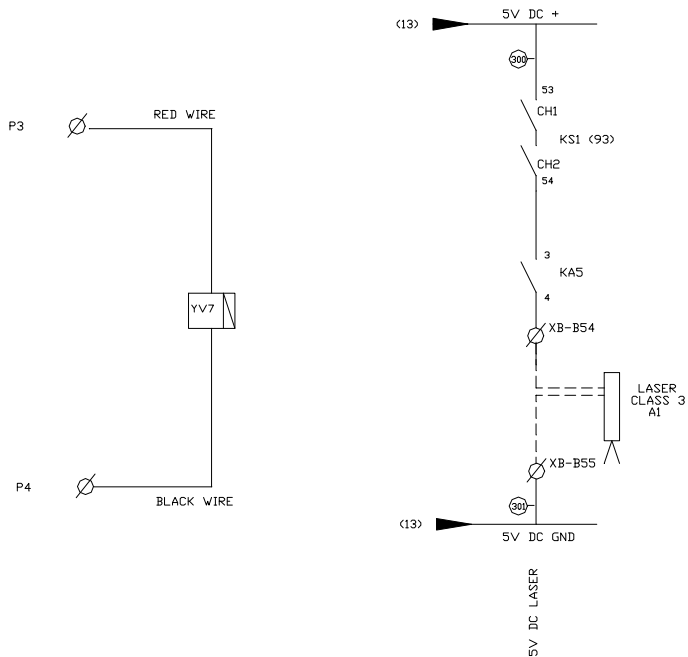
**Figure 4.6 – SP-2 Pneumatic Wiring Schematic**

- The Regulator should not be adjusted, except by qualified personnel as an increase in air pressure could result in injury due to the greater closing force of the doors.

### SP-2 Extra Wiring

Figure 4.7 shows the extra wiring installed for an SP-2 system.

- YV7 is the solenoid valve for the vacuum pump, when YV7 is energized the vacuum switches on and holds the board flat.
- The laser is energized when the doors are all closed (see fig.4.8). The laser is also on the Emergency Stop circuit which will shut down the laser in the event of an E-Stop or when the front door is opened.



**Figure 4.7 – SP-2 Extra Wiring Schematic**

- The side door inputs are fed into the PLC, which closes the side doors when a board is in position and then turns on the laser. When the inspection is finished, the doors are opened and the laser is switched off. The SP-2 system then waits for the next board.

### PLC Inputs for SP-2 Doors

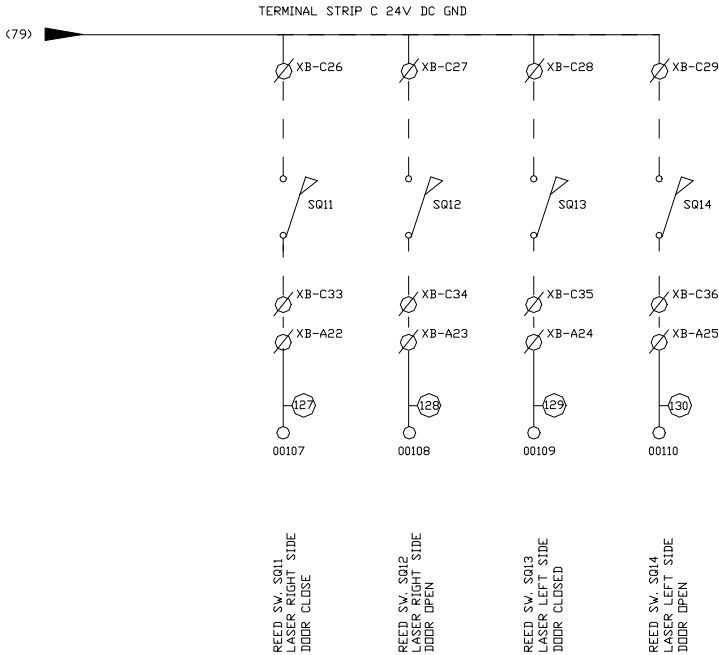


Figure 4.8 – SP-2 PLC Inputs for doors schematic



## **4.7 General Maintenance**

### **Weekly**

1. Clean down the machine panels.
2. Clean the PC filter, if fitted.
3. Check fan on the motor controller, you should hear this fan running when the drawer is pulled fully out.
4. Check PC power supply fan is running. Open the PC drawer and feel the air intake at the power supply.
5. Check PC CPU fan is running, if fitted.
6. Clean camera lens. Only use a proper lens cleaning solution and lint free cloth. Ensure that the lens is securely in place, while doing this.

### **Appendix I - Requirements Listing**

1. Set of Metric Hexagonal Allen keys; 1.5, 2, 2.5, 3, 4, 4.5, 5, 5.5, 6, 7, 8, 9, 10.
2. Set of insulated slotted screwdrivers: 2.8, 4.0, 5.5, and 6.5.
3. Pistol grease gun.
4. Natural Bristle artist's brush.
5. Lint-free cloth.
6. Anti static cleaning spray.
7. Dow Corning Molykote 44 grease.
8. Fast dry precision cleaner solvent; RS#203-0716.
9. Aerosol optical instrument cleaner; RS#217-3857.
10. Megger BM101/4 - Insulation resistance tester.
11. Flow-rate sensor.

## ***Appendix II - Maintenance Checklists***

Site: \_\_\_\_\_

Completion

Date: \_\_\_\_\_

System

Type: \_\_\_\_\_

System Serial

Number: \_\_\_\_\_

Weekly Maintenance Schedule

Performed

by: \_\_\_\_\_

	Good /Bad	Comments and/or Corrective Actions (if necessary)
<b>Electrical</b>		
Inspect El. Control Panel		
Inspect mains transformer		
Clean optical sensors		
Examine cables to PC		
Examine cables to the XY table controller		
Inspect connections to XY gantry		
Test E-Stop and door interlock		
Test clamping and stop mechanisms		
Test E-Stop reset switch		
Test System Cycle		

<b>X-Y Table</b>		
Examine X-Y table motion		
Examine cabling		
Inspect bearings		
Inspect magnet platten		
Inspect encoder		
Inspect limit switches		
<b>Conveyor</b>		
Examine moving parts		
Inspect conveyor belts		
Test all sensors		
Clean belts		
<b>Pneumatics</b>		
Check the systems pressure settings		
<b>General</b>		
Wipe down the machine panels		
Clean the PC filter		
Check operation and direction of motor controller fan		

---

Check operation and direction of PC fans		
Inspect and clean camera lens		
Observe one board cycling through the machine		
<b>Overall Comments on System:</b>		
<b>Actions Required:</b>		
1		
2		
3		
4		

Site \_\_\_\_\_

Completion Date: \_\_\_\_\_

System Type: \_\_\_\_\_

System Serial Number: \_\_\_\_\_

**Monthly Maintenance Schedule**

Performed by: \_\_\_\_\_

	Good /Bad	Comments and/or Corrective Action (if necessary)
<b>Electrical</b>		
Inspect El. Control Panel		
Inspect mains transformer		
Clean optical sensors		
Examine cables to PC		
Examine cables to the XY table controller		
Inspect connections to XY table		
Test E-Stop and door interlock		
Test clamping and stop mechanisms		
Test E-Stop reset switch		
Test System cycle		
Inspect pneumatic panel		

<b>X-Y Table</b>		
Examine X-Y table motion		
Examine cabling		
Inspect bearings		
Inspect magnet plattens		
Inspect encoder		
Inspect limit switches		
Check cable integrity		
<b>Conveyor</b>		
Examine moving parts		
Inspect conveyor belts		
Test all sensors		
Clean belts		
Examine crown bearings for wear and dirt.		
<b>Pneumatics</b>		
Check the systems pressure settings		
Test dump valve		
Test solenoid valves		

Test airflow to lighting head		
Test pressure sensor		
<b>General</b>		
Wipe down the machine panels		
Clean the PC filter		
Check direction of motor controller fan		
Check operation and direction of PC fans		
Inspect and clean camera lens		
Cycle a PCB through the machine		
<b>Overall Comments on System:</b>		
<b>Actions Required:</b>		
1		
2		
3		
4		

**Site:** \_\_\_\_\_

**Completion Date:** \_\_\_\_\_

**System Type:** \_\_\_\_\_

**System Serial Number:** \_\_\_\_\_

## Quarterly Maintenance Schedule

Performed by: \_\_\_\_\_

	Good /Bad	Corrective Action (if necessary)
<b>Electrical</b>		
Inspect El. Control Panel		
Inspect mains transformer		
Clean optical sensors		
Examine cables to PC		
Examine cables to the XY table controller		
Inspect connections to XY table		
Test E-Stop and door interlock		
Test clamping and stop mechanisms		
Test E-Stop reset switch		
Test System cycle		
Inspect pneumatic panel		



Check Connections in control panel		
<b>X-Y Table</b>		
Examine X-Y table motion		
Examine cabling		
Inspect bearings		
Inspect magnet plattens		
Inspect encoder		
Inspect limit switches		
Check cable integrity		
Lubricate the guide rails		
<b>Conveyor</b>		
Examine moving parts		
Inspect conveyor belts		
Test all sensors		
Clean belts		
Examine crown bearings for wear and dirt.		
Lubricate motor drive shaft		
Lubricate conveyor linear bearings		
<b>Pneumatics</b>		

Check the systems pressure settings		
Test dump valve		
Test solenoid valves		
Test airflow to lighting head		
Test pressure sensor		
<b>General</b>		
Wipe down the machine panels		
Clean the PC filter		
Check operation and direction of motor controller fan		
Check operation and direction of PC fans		
Inspect and clean camera lens		
Cycle a PCB through the machine		
<b>Overall Comments on System:</b>		
<b>Actions Required:</b>		
1		
2		
3		
4		

**Location:** \_\_\_\_\_

**Completion Date:** \_\_\_\_\_

**System Type:** \_\_\_\_\_

**System Serial Number:** \_\_\_\_\_

**Yearly Maintenance Schedule**

Performed by: \_\_\_\_\_

	<b>Good /Bad</b>	<b>Comments and/or Corrective Action (if necessary)</b>
<b>Electrical</b>		
Inspect EI. Control Panel		
Inspect mains transformer		
Clean optical sensors		
Examine cables to PC		
Examine cables to the XY table controller		
Inspect connections to XY table		
Test E-Stop and door interlock		
Test clamping and stop mechanisms		
Test E-Stop reset switch		
Check connections to terminals and solenoid valves		
Inspect connections to pneumatic panel		

Check connections to control panel		
Check electrical connections		
Test system insulation resistance		
Inspect transformer		
Test terminals		
<b>X-Y Table</b>		
Examine X-Y table motion		
Examine cabling		
Inspect bearings		
Inspect magnet plattens		
Inspect encoder		
Inspect limit switches		
Check cable integrity		
Lubricate the guide rails		
Inspect motor controller		
Test tightness of base plate bolts		
<b>Conveyor</b>		
Examine moving parts		

Inspect conveyor belts		
Test all sensors		
Clean belts		
Examine crown bearings for wear and dirt.		
Lubricate the motor drive shaft		
Lubricate conveyor linear bearings		
Inspect electrical connections		
Check mounting screws		
Check motor cable insulation resistance		
<b>Pneumatics</b>		
Check the systems pressure settings		
Test dump valve		
Test solenoid valves		
Test airflow to lighting head		
Test pressure sensor		
Check air purge motors		
replace main air filter		

<b>General</b>		
Wipe down the machine panels		
Clean the PC filter		
Check direction of motor controller fan		
Check operation and direction of PC fans		
Inspect and clean camera lens		
Observe one board cycling through the machine		
<b>Overall Comments on System:</b>		
<b>Actions Required:</b>		
1		
2		
3		

# *Chapter*

# *5*

## *Troubleshooting Guide*

### *Chapter Contents*

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### *Summary*

The Troubleshooting Guide is intended to assist the user to solve problems that they may encounter with their system. It describes the sequence to follow when the system does not function within normal operating parameters. We have concentrated on the failure modes that happen most frequently and with the greatest effect to productivity. IE those that would cause the line to stop. Use this manual in conjunction with the electrical drawings issued with the document pack.

## 5.1 System Power

For the locations of terminals, relays, PLC displays, PSUs and MCBs refer to Electrical Schematic Drgs. 2005-0117/-0118, depending on whether you have a single or dual lane system.

### Power failure or no power response

- Is the main supply connected?
- Is the main isolator in the 'ON' position?
- Are the main circuit breakers in the 'ON' position?
- Is the 'Power On' light illuminated.
- Is the key switch in the 'ON' position?
- Check **MCB Q15** is on.
- Is the mains contact energised?
- Check the supply voltage at the main terminals.

### Mains transformer is not working

- Check **MCB Q2** is on.
- Check main **MCB Q1** is on.
- Ensure there is the customer-selected voltage at terminals **L1** and **N1**.
- Ensure there is 230V at terminals **L2** and **N2**.
- Check transformer resistance (>1 ohm), at terminals **L1** and **N1**.
- **WARNING ENSURE MACHINE IS FIRST ISOLATED FROM MAINS SUPPLY.**
- Check transformer resistance (>1 ohm), at terminals **L2** and **N2**.
- **WARNING ENSURE MACHINE IS FIRST ISOLATED FROM MAINS SUPPLY.**
- Check cables and terminals at transformer are intact.



## 5.2 Conveyor

For the locations of terminals, relays, PLC displays, PSUs and MCBs refer to Electrical Schematic Drgs. 2005-0117/-0118, depending on whether you have a single or dual lane system.

### Conveyor will not run

- Refer to Electrical Schematic Drgs.
- Check that the conveyor is not obstructed.
- Check **MCB Q14** is on.
- Check emergency stop is in the off position. Examine the three indicator lights on the relay.
- Check **VR1** (rail 1) or **VR2** (rail 2) is **not** turned to zero

Conveyor 1:

- Check that the Module 3 PLC output **10000** is on.
- Check relay '**KA1**' is energised by examining its indicator light.

Conveyor 2:

- Check that the Module 3 PLC output **10005** is on.
- Check relay '**KA5**' is energised by examining its indicator light.

### Conveyor will not run (no output from PLC)

- Refer to Electrical Schematic Drgs.
- Check that the Module 1 PLC input **00002** was pulsed.
- Check that the Module 1 PLC inputs **00007 & 00009** are off and **00008 & 00010** are on.
- To see if sensors are operating look at the indicator light on each sensor, check it is set in the correct position.

Stop **UP** input **00009**

Stop **DOWN** input **00010**

Clamping **ON** input **00007**

Clamping **OFF** input **00008**

- Check that the Module 2 PLC input **00102** was pulsed
- Also check that the Module 2 PLC inputs **00107 & 00109** are off and **00108 & 00110** are on.

- To see if sensors are operating look at the indicator light on each sensor, check it is set in the correct position.

Stop **UP** input **00109**

Stop **DOWN** input **00110**

Clamping **ON** input **00107**

Clamping **OFF** input **00108**.

### **5.3 PCB Inspection Sequence**

For the locations of terminals, relays, PLC displays, PSUs and MCBs refer to Electrical Schematic Drgs. 2005-0117/-0118, depending on whether you have a single or dual lane system.

#### **System will not inspect**

Refer to Electrical Schematic Drgs.

- Check that the Module 3 PLC output 10009 is on.
- Check Opto 0 is on.
- Check stops are in up position and that the Module 1 PLC input 00009 is on.
- Check clamp is in on position and that the Module 1 PLC input 00007 is on.
- To see if sensors are operating examine the indicator light on each sensor. Check it is set in the right position.

Stop **UP** input **00009**

Stop **DOWN** input **00010**

Clamping **ON** input **00007**

Clamping **OFF** input **00008**

- Check that conveyor motor is not running. No Module 3 PLC output 10000 on the PLC.
- Check that the Module 3 PLC outputs 10009 & 10010 are on.
- Check Optos 1 & 2 are on.
- Check stops are in up position. The Module 2 PLC input 00109 is on.
- Check clamp is in on position. The Module 2 PLC input 00107 is on.

- To see if sensors are operating examine the indicator light on each sensor, check it is set in the right position.

Stop **UP** input **00109**

Stop **DOWN** input **00110**

Clamping **ON** input **00107**

Clamping **OFF** input **00108**

- Check that conveyor motor is not running. No Module 3 output **10005** on the PLC.

### **System will not release board Downstream**

Refer to Electrical Schematic Drgs.

- Check Opto 20 output is pulsed after the inspection.
- Check that the Module 1 PLC input 00011 is pulsed after the inspection.
- Check that the Module 1 PLC inputs 00007 & 00009 are off and 00008 & 00010 are on. Also check that Module 2 inputs 00107 & 00109 are off and 00108 & 00110 are on while working on conveyor 2.
- To see if sensors are operating examine the indicator light on each sensor, check it is set in the right position, As per 4.1 above.

### **System will not give failed signal to downstream machine**

Refer to Electrical Schematic Drgs.

- Check Opto 23 output is pulsed after a PCB has failed inspection.
- Check that the Module 1 PLC input **00015** is pulsed after the inspection.
- Check that the Module 1 PLC inputs **00007 & 00009** are off and **00008 & 00010** are on. Similarly, check that inputs **00107 & 00109** are off and **00108 & 00110** are on when working on conveyor 2.
- To see if sensors are operating examine the indicator light on each sensor, check it is set in the right position, As per 4.1 above.

### **PCB stops at exit**

Refer to Electrical Schematic Drgs.

- Check that the Module 1 PLC input 00003 is on.
- Check SMEMA 1 pins 1 & 2 are shorted from the SMEMA downstream cable on the next machine.

Conveyor 2:

- Check that the Module 2 PLC input 00103 is on.
- Check SMEMA 2 pins 1 & 2 are shorted from the SMEMA downstream cable on the next machine.

### **PCB will not enter next machine**

Refer to Electrical Schematic Drgs.

- Check that the Module 4 PLC output 10104 (board available to next machine from rail 1) is on. Also check that output 10102 (board available to next machine from rail 2) is on.
- Check pins 3 & 4 are shorted on SMEMA downstream socket.

### **PCB will not stop for inspection**

Refer to Electrical Schematic Drgs.

- Check the pass through switch is in the inspect position.
- Check the computer software is not in pass through.
- Check Opto 21 is on when the machine is in inspect mode.

Conveyor 1:

- Check that the Module 1 PLC input 00012 is on.
- Check that the Module 1 PLC input 00005 is working by placing an object over the sensor and checking the input. Ensure that the sensor is not positioned too far from the bottom off the board.

Conveyor 2:

- Check that the Module 2 PLC input 00100 is on.
- Check that the Module 3 PLC sensor input 00105 is working by placing an object over the sensor and checking the input. Ensure that the sensor is not positioned too far from the bottom off the board.

### **System will not release board to rework station**

Refer to Electrical Schematic Drgs.

- Check Opto 22 is pulsed when the board is released to the rework.
- Check that the Module 1 PLC input 00013 is pulsed.
- Check relay KA1 is energised. Examine its indicator light.
- Check emergency stop is off by examining the three indicator lights on the safety relay.

- Check that the Module 1 PLC inputs 00007 & 00009 are off and 00008 and 00010 are on.
- To see if sensors are operating examine the indicator light on each sensor. Check that it is set to the correct position.

Stop **UP** input **00009**

Stop **DOWN** input **00010**

Clamping **ON** input **00007**

Clamping **OFF** input **00008**

### **PCB will not enter upstream, single rail machine.**

Refer to Electrical Schematic Drgs.

- Check the Module 4 PLC output 10103. It indicates that a board has failed inspection.
- Check pins 3 & 8 are shorted on SMEMA downstream socket.

### **PCB will not slow down on exit**

Refer to Electrical Schematic Drgs.

- For conveyor 1, check that relay 'KA2' is energised by examining its indicator light. Relay 'KA6' corresponds to conveyor 2.
- Check that the Module 3 PLC output 10001 is on. Similarly check output 10006 for conveyor 2.
- Check that the Module 1 input 00000, slow on exit, is enabled on PLC.
- Check the resistance is respectively 3k3 and 15k ohms across terminals D1 & D2 and D2 & D3. Repeat for rail 2 with the same resistors: 3k3 between D4 & D5 and 15k between D5 & D6.

**ENSURE THAT ALL POWER HAS BEEN REMOVED FROM THE SYSTEM BEFORE PERFORMING THIS TEST.**

### **Next PCB will not enter rework station**

Refer to Electrical Schematic Drgs.

Note: Only used with MVT RS-1 upstream from system.

- Check that the Module 4 PLC output 10101 is pulsed when PCB is finished inspection.
- Check pins 1 & 6 are shorted on SMEMA upstream socket when inspection is complete.

## **PCB will not enter system from rework station**

- (Only available on single rail conveyor)

Refer to Electrical Schematic Drgs.

Note: Only used with MVT RS1 upstream from system.

- Check that the Module 4 PLC output 10102 is on.
- Check pins 1 & 7 are shorted on the SMEMA upstream socket.

## **5.4 Other Electrical**

For the locations of terminals, relays, PLC displays, PSUs and MCBs refer to Electrical Schematic Drgs. 2005-0117/-0118, depending on whether you have a single or dual lane system.

### **Lighting tree will not operate**

Refer to Electrical Schematic Drgs.

- Is it plugged in?
- Check bulbs and sounder.
- Check Optos 15 to 18 for relevant light or sounder.
- Check Opto configuration on PC software (refer to user manual).
- Check connector is intact and undamaged.

### **NO 24V supply**

Refer to Electrical Schematic Drgs.

- Check 24V supply PS1 looks at the indicator light.
- Check MCB Q3 is on.
- Check MCB Q16 is on, 24V control MCB.

### **NO PLC inputs or outputs**

Refer to Electrical Schematic Drgs.

- Check power to PLC (MCB Q6). Look at its power indication light.
- Check 24V supply on PLC is functioning. Look at its input indication lights.
- Check that PLC modules are clipped together properly.
- Make sure that the PLC run light is on.

## Opto board not functioning

Refer to Electrical Schematic Drgs.

- Check 5V PSU examining its indication light.
- Check MCB **Q5** is on.
- Check Opto cable to PC has not come loose, or is damaged in any way.
- Check Opto card in PC is seated and functioning.

## Safety relay will not reset

Refer to Electrical Schematic Drgs.

- Check 24V supply across the relay terminals A1-A2.
- Check emergency stop and door interlock is functioning correctly.

This can be done by checking the continuity across terminals 35 and 36 for circuit no.1, and across 37 and 38 for circuit no. 2.

There are three indicator lights on the safety relay. The top light represents power on and the bottom ones represent circuit no. 1 and circuit no. 2 respectively.

When the three lights are on this means that, the relay is functioning correctly.

- Check that all contacts and terminations are intact.
- Check the software key press Opto 19 activates reset circuit; see is it being pulsed.
- Check reset circuit, activated by the hardware push/button that shorts out terminals B39 and B40 on the control panel.
- If the emergency stop is on and there is no indication on the monitor screen check Opto 4.

## X-Y table motor controller not Operating

- Is MCB **Q7** on?
- Is the local on/off switch in the on position?
- Is there an emergency stop condition? Examine the three indicator lights on the safety relay.
- Are the safety circuit contacts functioning correctly? To do this, disconnect cable SLC24 going into the motor controller. There are three pairs of pins. With the emergency stop off, check that the continuity between these pins are:

Pins 2 and 10

Pins 11 and 12

Pins 13 and 14

- Check all cables are tight and in position.
- For further information consult Aerotech manual.

## **Monitors are not Operating**

- Are they switched on and plugged in.
- Check MCB Q9 is on for the video monitor and MCB Q10 is on for the text monitor.
- Check cables for tight connections.
- If UPS installed, make sure that it's switched on.
- Refer to PC manual for further information.

## **PC is not Operating**

- Is it plugged in and switched on.
- Check MCB Q8 is on.
- If UPS installed, make sure that it's switched on
- For further information consult manual.

## **Lighting head PSU is not Operating (GS-1 and GS-1+ only)**

- Is it turned on?
- Check MCB Q11.
- Has the connector to the lighting head become loose?
- Has the connector at the unit become loose?
- Has the bulb blown?
- Is the internal fuse on the unit blown?

## **Camera will not Operate**

- Check 12V PSU.
- Check MCB Q4 is on.
- Check 12V DC at terminal E1 & E2.
- Check cable to lighting head.
- Check all connections.
- Check software configuration
- For further information consult manual.



## **5.5 Pneumatics**

For the locations of terminals, relays, PLC displays, PSUs and MCBs refer to Electrical Schematic Drgs. 2005-0117/-0118, depending on whether you have a single or dual lane system.

### **No Air supply**

- Check source of air.
- Check air pressure is set at 5 bar at regulator.
- Check E-stop is not pressed or safety relay is engaged.

### **Dump valve will not function**

- Check air pressure is set to 5 bar at regulator.
- Check emergency stop is off.
- Check for indicator light on valve.
- Check 24V supply at terminals 1 and 2 in the pneumatic panel.

### **Stops will not engage**

Refer to Electrical Schematic Drgs.

- Check that the Module 3 PLC outputs 10003 (rail 1) or 10007 (rail 2) is on.
- Check solenoid valve YV2 or YV4 is on.
- Check air supply is on.
- Check dump valve YV1 is energised examining the indicator light.
- Check 24V supply at terminals 3 and 4 in the pneumatic panel.
- Check for kinks in the tubes.

### **Clamp will not engage**

Refer to Electrical Schematic Drgs.

- Check that the Module 3 PLC output 10004 or 10008 is on.
- Check solenoid valve YV3 is on.
- Check air supply is on.
- Check dump valve YV1 is energised examining the indicator light.
- Check 24V supply at terminals 5 and 6 in the pneumatic panel and at terminals 6 and 10 for conveyor 2.
- Check for kinks in the tubes.
- Check PLC input 00001 is on, clamping enabled.

**No purge on lighting Head**

- Check air supply at the regulator.
- Check for kinked tubes.
- Check for air leaks.

**No purge to X-Y table**

- Check Dump valve.
- Check air supply at the regulator.
- Check for kinked tubes.
- Check for air leaks.

**Laser will not operate SP-2 or No Inspection Signal**

Check side doors are closed. PLC Inputs:

- 107 OFF
- 108 ON
- 109 OFF
- 110 ON

Check stops and clamps are on. PLC Inputs:

- 007 ON
- 008 OFF
- 009 ON
- 010 OFF

Check Emergency Stop Circuit.

# *Chapter*

# *6*

## *System Specifications*

### *Chapter Contents*

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### *Summary*

This chapter is intended to outline the systems specifications. It includes the physical specs like footprint and electrical and pneumatic inputs as well as the software operating system. These are accurate at the time of printing and are liable to change. We recommend that you consult with the Functional Specifications for each system for the most up to date set of specifications.

## 6.1 SJ-10 Functional Specifications

<b>Software System</b>	
<b>Operating system</b>	<ul style="list-style-type: none"> <li>Windows NT™ V4.00</li> </ul>
<b>User Interface</b>	<ul style="list-style-type: none"> <li>Graphical User Interface with password protected user levels.</li> </ul>
<b>Data Transfer Interfaces</b>	<ul style="list-style-type: none"> <li>Any ASCII file format via floppy disk or Ethernet (TCP/IP or MS Network).</li> </ul>
<b>Hardware System</b>	
<b>Computer System</b>	<ul style="list-style-type: none"> <li>High Speed Pentium II™ based PC in an industrial rack.</li> </ul>
<b>Host Communications</b>	<ul style="list-style-type: none"> <li>Thin wire or twisted pair Ethernet supporting TCP/IP or MS Network.</li> </ul>
<b>CAD File Formats</b>	<ul style="list-style-type: none"> <li>Depending on the inspection application, the SJ Series requires CAD from a number of sources. Generally these will be Gerber file (for paste inspection) format or any ASCII based CAD file format (such as Fuji etc). Filters available for GC-Place, Unicam, FABmaster, and CIMbridge '97.</li> </ul>
<b>Imaging Hardware</b>	<ul style="list-style-type: none"> <li>PCI Bus framegrabber</li> </ul>
<b>Camera System</b>	<ul style="list-style-type: none"> <li>Camera: CCD 1280 x 1024 pixels, Electronic Shutter.</li> <li>Optics: Telecentric gauging lens. Field of View: 26mm x 20mm @ a Pixel Size of 20µm.</li> <li>Illumination: Multi-layer LED.</li> </ul>
<b>X-Y Robot System</b>	<ul style="list-style-type: none"> <li>Gantry robot system with linear motors and linear encoders.</li> <li>Travel: 590mm x 490mm or 490mm x 490mm</li> <li>Velocity (x, y): 1500mm (60")/Sec.</li> <li>Encoder Resolution: 1.25µm</li> </ul>

<b>Board Clearance</b>	<ul style="list-style-type: none"> <li>• Depends on application. Either 28mm (as standard) or 12mm (with low-level lighting fitted).</li> </ul>
<b>Conveyor System</b>	<ul style="list-style-type: none"> <li>• SMEMA standard conveyor supplied with speed adjustment.</li> </ul>
<b>Position</b>	<ul style="list-style-type: none"> <li>• Depends on application</li> <li>• Post-Oven/Post-Wave (with h/w modifications)</li> <li>• Pre-Oven</li> <li>• Pre-placement in the SMT manufacturing process.</li> </ul>
<b>Enclosure</b>	<ul style="list-style-type: none"> <li>• The enclosure is designed to conform to CE Mark standards for electrical and mechanical industrial safety. Auto width adjustment available as option.</li> </ul>
<b>Supply Facilities</b>	
<b>Electricity</b>	<ul style="list-style-type: none"> <li>• 210-240V 25A ...100-120V 40A.</li> </ul>
<b>Air Requirements</b>	<ul style="list-style-type: none"> <li>• Clean filtered air at 5 Bar, 12 mm or 6mm input line.</li> </ul>
<b>Operating Temperature</b>	<ul style="list-style-type: none"> <li>• 10 to 35° C.</li> </ul>
<b>Physical Dimensions</b>	
<b>Footprint</b>	<ul style="list-style-type: none"> <li>• 1000mm x 1200mm or 1200 mm x 1200 mm</li> </ul>
<b>Height</b>	<ul style="list-style-type: none"> <li>• 1450mm excluding light tree and monitors.</li> </ul>
<b>Weight</b>	<ul style="list-style-type: none"> <li>• 1500 kg (approximate).</li> </ul>

## 6.2 SP-1 Functional Specifications

<b>Software System</b>	
<b>Operating system</b>	Windows NT™ V4.00
<b>User Interface</b>	Graphical User Interface with password protected user levels.
<b>Vision Algorithms</b>	2D: Sub-pixel region boundary analysis for area and offset information. 3D: Laser triangulation technique employing a proprietary sensing system.
<b>Data Transfer Interfaces</b>	Any ASCII file format via floppy disk or Ethernet (TCP/IP or MS Network).
<b>Statistical Analysis</b>	Mean, std. deviation, Cp, K, CpK, Pareto, control, charts based on the X, Y, theta, area, height or volume.
<b>Hardware System</b>	
<b>Computer System</b>	High Speed Pentium III™ based PC with flat screen monitor.
<b>Host Communications</b>	Thin wire or twisted pair Ethernet supporting TCP/IP or MS Network.
<b>CAD File Formats</b>	Gerber file format conversion with GC Place software.
<b>Imaging Hardware</b>	PCI Bus framestore.
<b>2D Camera System</b>	Camera: Large area CCD camera, Electronic Shutter. Optics: Telecentric gauging lens. Field of View: 25 mm x 25mm Pixel Size: 25µm. Lighting: LED lighting head x 2
<b>3D Camera System</b>	High speed sensor system

<b>X-Y Robot System</b>	Gantry robot system with linear motors and linear encoders. 2D Travel: 490mm x 480mm or 590mm x 480mm 3D Travel: 440mm x 410mm or 540 x 410mm. Velocity (x, y): 1.5~3.0m/Sec. Encoder Resolution: 1.25 $\mu$ m
<b>Board Clearance</b>	Top side: 15mm Bottom side: 30mm (10mm close to clamp blades) 4.7mm component clearance along edge of PCB.
<b>Conveyor System</b>	SMEMA standard conveyor supplied as standard with manual width and speed adjustment.
<b>Clamping System</b>	Bottom-up clamping (knife edge) with centre post support and vacuum leveling to an overall board flatness of $\pm >100\mu\text{m}$ .
<b>Enclosure</b>	The enclosure is designed to conform to CE Mark standards for electrical and mechanical industrial safety. UL approval by Q1 2000.
<b>Optional extras</b>	Bar code reader. Auto-width adjust. GC Place software. Dual lane and dual stage.
<b>Functionality</b>	
<b>Measurements</b>	Board-wide: X, Y and $\theta$ (100% 2D coverage) Per pad: X, Y, Area (100% 2D coverage), Height, Volume (sampled 3D coverage). Bridge detection.
<b>Target Gauging R&amp;R Capability</b>	2D: $<15\mu\text{m}$ for X,Y Offset, $<10\%$ on pad area with a process width of $\pm 20\%$ of the nominal area. 3D: $<10\%$ on fine-pitch solder paste height of $200\mu\text{m}$ with a process width of $\pm 50\mu\text{m}$ . $<10\%$ on pad volume with a process width of $\pm 30\%$ of the nominal area.

<b>Speed of operation</b>	2D: 18 cm <sup>2</sup> (2.8 in <sup>2</sup> ) per second. 3D: The speed of measurement is dependent on the pad size and is typically 8 x 3mm <sup>2</sup> per second for fine pitch and 16 x 3 mm <sup>2</sup> per larger pads/deposits. Ability to inspect multiple uBGA/CSP rows in one scan.
<b>Position</b>	Pre-placement in the SMT manufacturing process.
<b>Facilities</b>	
<b>Electricity</b>	220V 20A or 110V 40A.
<b>Air Requirements</b>	Clean filtered air at 5 Bar, 12 mm input line.
<b>Operating Temperature</b>	10 to 35 degrees C.
<b>Physical Characteristics</b>	
<b>Footprint</b>	1000mm x 1200mm or 1200 mm x 1200 mm
<b>Height</b>	1450mm excluding light tree.
<b>Weight</b>	1500 kg (approximate).



### 6.3 GS-1 Functional Specifications

<b>Software System</b>	
<b>Operating system</b>	<ul style="list-style-type: none"> <li>Windows NT™ V4.00</li> </ul>
<b>User Interface</b>	<ul style="list-style-type: none"> <li>Graphical User Interface with password protected user levels.</li> </ul>
<b>Data Transfer Interfaces</b>	<ul style="list-style-type: none"> <li>Any ASCII file format via floppy disk or Ethernet (TCP/IP or MS Network).</li> </ul>
<b>Hardware System</b>	
<b>Computer System</b>	<ul style="list-style-type: none"> <li>High Speed Pentium II™ based PC in an industrial rack.</li> </ul>
<b>Host Communications</b>	<ul style="list-style-type: none"> <li>Thin wire or twisted pair Ethernet supporting TCP/IP or MS Network.</li> </ul>
<b>CAD File Formats</b>	<ul style="list-style-type: none"> <li>Depending on the inspection application, the SJ Series requires CAD from a number of sources. Generally these will be Gerber file format or any ASCII based CAD file format (such as Fuji etc). Filters available for GC-Place, Unicam, FABmaster, and CIMbridge '97.</li> </ul>
<b>Imaging Hardware</b>	<ul style="list-style-type: none"> <li>PCI Bus framegrabber</li> </ul>
<b>Camera System</b>	<ul style="list-style-type: none"> <li>Camera: CCD 1280 x 1024 pixels, Electronic Shutter.</li> <li>Optics: Telecentric gauging lens. Field of View: 26mm x 20mm @ a Pixel Size of 20µm.</li> <li>Illumination: Multi-layer LED.</li> </ul>
<b>X-Y Robot System</b>	<ul style="list-style-type: none"> <li>Gantry robot system with linear motors and linear encoders.</li> <li>Travel: 590mm x 490mm or 490mm x 490mm</li> <li>Velocity (x, y): 1500mm (60")/Sec. Encoder Resolution: 1.25µm</li> </ul>

<b>Board Clearance</b>	<ul style="list-style-type: none"> <li>• Depends on application. Either 28mm (as standard) or 12mm (with low-level lighting fitted).</li> </ul>
<b>Conveyor System</b>	<ul style="list-style-type: none"> <li>• SMEMA standard conveyor supplied with speed adjustment.</li> </ul>
<b>Position</b>	<ul style="list-style-type: none"> <li>• Post-Placement/Pre-Reflow in the SMT Manufacturing Process.</li> </ul>
<b>Enclosure</b>	<ul style="list-style-type: none"> <li>• The enclosure is designed to conform to CE Mark standards for electrical and mechanical industrial safety. Auto width adjustment available as option.</li> </ul>
<b>Supply Facilities</b>	
<b>Electricity</b>	<ul style="list-style-type: none"> <li>• 200-240V 25A ...100-120V 40A.</li> </ul>
<b>Air Requirements</b>	<ul style="list-style-type: none"> <li>• Clean filtered air at 5 Bar, 12 mm or 6mm input line.</li> </ul>
<b>Operating Temperature</b>	<ul style="list-style-type: none"> <li>• 10 to 35° C.</li> </ul>
<b>Physical Dimensions</b>	
<b>Footprint</b>	<ul style="list-style-type: none"> <li>• 1000mm x 1200mm or 1200 mm x 1200 mm</li> </ul>
<b>Height</b>	<ul style="list-style-type: none"> <li>• 1450mm excluding light tree and monitors.</li> </ul>
<b>Weight</b>	<ul style="list-style-type: none"> <li>• 1500 kg (approximate).</li> </ul>

## 6.4 SP-2 Functional Specifications

<b>Software System</b>	
<b>Operating system</b>	Windows NT™ V4.00
<b>User Interface</b>	Graphical User Interface with password protected user levels.
<b>Vision Algorithms</b>	2D: Sub-pixel region boundary analysis for area and offset information. 3D: Laser triangulation technique employing a proprietary sensing system.
<b>Data Transfer Interfaces</b>	Any ASCII file format via floppy disk or Ethernet (TCP/IP or MS Network).
<b>Statistical Analysis</b>	Mean, std. deviation, Cp, K, CpK, Pareto, control, charts based on the X, Y, theta, area, height or volume.
<b>Hardware System</b>	
<b>Computer System</b>	High Speed Pentium III™ based PC with flat screen monitor.
<b>Host Communications</b>	Thin wire or twisted pair Ethernet supporting TCP/IP or MS Network.
<b>CAD File Formats</b>	Gerber file format conversion with GC Place software.
<b>Imaging Hardware</b>	PCI Bus framestore.
<b>2D Camera System</b>	Camera: Large area CCD camera, Electronic Shutter. Optics: Telecentric gauging lens. Field of View: 32 mm x 25mm Pixel Size: 25µm. Lighting Ultra-bright LEDs x 2.
<b>3D Camera System</b>	High speed sensor system

<b>X-Y Robot System</b>	Gantry robot system with linear motors and linear encoders. 2D Travel: 490mm x 480mm or 590mm x 480mm 3D Travel: 440mm x 410mm or 540 x 410mm. Velocity (x, y): 1.5~3.0m/Sec. Encoder Resolution: 1.25 $\mu$ m
<b>Board Clearance</b>	Top & Bottom side: 15mm Base Clearance: 2.5mm – 4.7mm
<b>Conveyor System</b>	SMEMA standard conveyor supplied as standard with manual width and speed adjustment.
<b>Clamping System</b>	Bottom-up clamping (knife edge) with centre post support and vacuum leveling to an overall board flatness of $\pm 100\mu$ m.
<b>Enclosure</b>	The enclosure is designed to conform to CE Mark standards for electrical and mechanical industrial safety.
<b>Optional extras</b>	Bar code reader. Auto-width adjust. GC Place software. Dual lane and dual stage.
<b>Functionality</b>	
<b>Measurements</b>	Board-wide: X, Y and $\theta$ (100% 2D coverage) Per pad: X, Y, Area (100% 2D coverage), Height, Volume (sampled 3D coverage). Bridge detection.
<b>Target Gauging R&amp;R Capability</b>	2D: <15 $\mu$ m for X,Y Offset, <10% on pad area with a process width of $\pm 20\%$ of the nominal area. 3D: Height: $\pm 5$ mm <10% on pad volume with a process width of $\pm 30\%$ of the nominal volume.

<b>Speed of operation</b>	2D: 18 cm <sup>2</sup> (2.8 in <sup>2</sup> ) per second. 3D: The speed of measurement is dependent on the pad size and is typically 32mm x 4.5mm sec scan for larger pads/deposits. Ability to inspect multiple uBGA/CSP rows in one scan.
<b>Position</b>	Pre-placement in the SMT manufacturing process.
<b>Facilities</b>	
<b>Electricity</b>	220V 20A or 110V 40A.
<b>Air Requirements</b>	Clean filtered air at 6 Bar, 6mm input line.
<b>Operating Temperature</b>	10 to 35 degrees C.
<b>Physical Characteristics</b>	
<b>Footprint</b>	1000mm x 1200mm or 1200 mm x 1200 mm
<b>Height</b>	1450mm excluding light tree and monitors.
<b>Weight</b>	1500 kg (approximate).