



# Hardware Manual

HARDWARE MANUAL

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*Hardware Manual*

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## *Chapter Contents*

<b>1.0 Safety</b>	<b>1</b>
<b>1.1 Electrical Safety</b>	<b>2</b>
Electrical Enclosure	2
Emergency Stop Loop	2
Power Up Sequence to restore from 'E-Stop' Situation	3
Power Up Sequence from 'Mains Off' Situation	3
No Uncontrolled motion on restart	4
Earth Bonding	4
<b>1.2 Protective Guards</b>	<b>4</b>
<b>1.3 Explanation of System Warning/Caution Labels</b>	<b>5</b>
<b>1.4 Safety Warnings</b>	<b>6</b>
Safety Devices	6
Conveyor safety	6
X-Y Gantry	7
Stability	7
Falling Objects	7
PC Safety	7
Laser Safety	8
<b>2.0 Installation</b>	<b>9</b>
<b>2.1 System Overview</b>	<b>10</b>
Machine Layout	10
System event cycle	12
<b>2.2 Machine Installation</b>	<b>14</b>
Required Environmental Conditions	14
Unpacking the system	14
Handling the system	15
Off-line Installation	15
Indicator Beacon	15
Monitors	16
Keyboard and Trackball	17
Computer Hard-drive	17
In-Line Installation	18

---

Machine Installation	18
Height Adjustment	18
Conveyor Adjustment	18
S.M.E.M.A. Communications	18
S.M.E.M.A. Connections	19
Network Connections	20
Serial Connections	20
Power up the System	20
Electrical Power	20
Pneumatic Power	23
Power Up Sequence	23
Starting the Application Software	24
Set up the Imaging System	24
<b>3.0 Calibration</b>	<b>25</b>
<b>3.1 Introduction</b>	<b>26</b>
<b>3.2 Focusing the Camera</b>	<b>27</b>
<b>3.3 Changing the Camera Aperture Setting</b>	<b>28</b>
<b>3.4 Scaling the System</b>	<b>28</b>
Manually Scaling the System	28
Automatically Scaling the System	28
<b>3.5 Position In View Calibration</b>	<b>29</b>
Position In View Tests	30
View	30
Create Test	30
Run Test	30
<b>3.6 Optimizing the X-Y Table speed.</b>	<b>31</b>
<b>3.7 Lighting Head Calibration</b>	<b>32</b>
How to check the lighting intensity readings.	32
How to Reset the Lighting Intensity	33
Lighting setups for different applications	34
<b>3.8 SP-1 Calibration</b>	<b>35</b>
Calibrating the 3D imaging system	35
Focusing the 3D Camera	35
Center the laser in the field of view	37

---

Focusing the Laser	38
Aligning the Camera Image	39
3D Camera Software Calibration	40
X/Y Offset Calibration	40
Pixel Size Calibration	42
Paste Height Calibration	42
Check the results	43
Loading New Software to 3D Imaging Head	43
<b>3.9 SP-2 Calibration</b>	<b>46</b>
Calibrating the 3D imaging system	46
Focusing the 3D Camera	46
Center the laser in the field of view	48
Focusing the Laser	49
Aligning the Camera Image	50
3D Camera Software Calibration	51
X/Y Offset Calibration	51
Pixel Size Calibration	52
Paste Height Calibration	53
Check the results	54
Loading New Software to 3D Imaging Head	54
<b>4.0 Maintenance</b>	<b>57</b>
<b>4.1 Introduction</b>	<b>58</b>
<b>4.2 Electrical Maintenance</b>	<b>58</b>
Weekly	58
Monthly	60
Quarterly	60
Yearly	61
<b>4.3 X-Y Table Maintenance</b>	<b>63</b>
Weekly	63
Monthly	63
Quarterly	64
Yearly	65
Important notes on lubrication.	65
<b>4.4 Conveyor Maintenance</b>	<b>66</b>
General Warnings	66
Weekly	66

---

Monthly _____	67
Yearly _____	67
<b>4.5 Pneumatic Maintenance _____</b>	<b>67</b>
Weekly _____	67
Monthly _____	68
Yearly _____	68
<b>4.6 SP-2 Additions _____</b>	<b>69</b>
Pneumatics Wiring _____	69
SP-2 Extra Wiring _____	71
PLC Inputs for SP-2 Doors _____	72
<b>4.7 General Maintenance _____</b>	<b>73</b>
Weekly _____	73
<b>Appendix I - Requirements Listing _____</b>	<b>73</b>
<b>Appendix II - Maintenance Checklists _____</b>	<b>74</b>
<b>5.0 Troubleshooting Guide _____</b>	<b>87</b>
<b>5.1 System Power _____</b>	<b>88</b>
Power failure or no power response _____	88
Mains transformer is not working _____	88
<b>5.2 Conveyor _____</b>	<b>89</b>
Conveyor will not run _____	89
Conveyor will not run (no output from PLC) _____	89
<b>5.3 PCB Inspection Sequence _____</b>	<b>90</b>
System will not inspect _____	90
System will not release board Downstream _____	91
System will not give failed signal to downstream machine _____	91
PCB stops at exit _____	91
PCB will not enter next machine _____	92
PCB will not stop for inspection _____	92
System will not release board to rework station _____	92
PCB will not enter upstream, single rail machine. _____	93
PCB will not slow down on exit _____	93
Next PCB will not enter rework station _____	93
PCB will not enter system from rework station _____	94
<b>5.4 Other Electrical _____</b>	<b>94</b>

---

Lighting tree will not operate _____	94
NO 24V supply _____	94
NO PLC inputs or outputs _____	94
Opto board not functioning _____	95
Safety relay will not reset _____	95
X-Y table motor controller not Operating _____	95
Monitors are not Operating _____	96
PC is not Operating _____	96
Lighting head PSU is not Operating _____	96
Camera will not Operate _____	96
<b>5.5 Pneumatics _____</b>	<b>97</b>
No Air supply _____	97
Dump valve will not function _____	97
Stops will not engage _____	97
Clamp will not engage _____	97
No purge on lighting Head _____	98
No purge to X-Y table _____	98
Laser will not operate SP-2 or No InspectionSignal _____	98
<b>6.0 System Specifications _____</b>	<b>99</b>
<b>6.1 SJ-10 Functional Specifications _____</b>	<b>100</b>
Software System _____	100
Hardware System _____	100
Supply Facilities _____	101
Physical Dimensions _____	101
<b>6.2 SP-1 Functional Specifications _____</b>	<b>102</b>
Software System _____	102
Hardware System _____	102
Functionality _____	103
Facilities _____	104
Physical Characteristics _____	104
<b>6.3 GS-1 Functional Specifications _____</b>	<b>105</b>
Software System _____	105
Hardware System _____	105
Supply Facilities _____	106
Physical Dimensions _____	106
<b>6.4 SP-2 Functional Specifications _____</b>	<b>107</b>

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Software System _____	107
Hardware System _____	107
Functionality _____	108
Facilities _____	109
Physical Characteristics _____	109

### *Revision History*

<b>Revision</b>	<b>Nature of Change</b>	<b>Description</b>	<b>Author</b>	<b>Date</b>
1.0	First release.	Combined SJ-10, GS-1, SP-1 and SP-2 Hardware Manuals for New SJ-10 GUI	L.Stapleton	Sept' '99
2.0	Additional Section	Include a new section on SP-2	L.Stapleton	Feb' '00

#### **Please Note**

**This Manual provides a Hardware Overview of the SJ-10, GS-1, SP-2 and SP-1 Systems. There are specific sections within chapters of this manual that will only apply to one of these Systems.**

**These sections are clearly indicated throughout each Chapter.**



# *Chapter*

# *1*

## *Safety*

### *Chapter Contents*

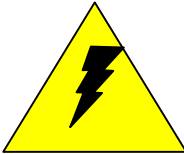
<b>1.1</b>	<b>Electrical Safety</b>	<b>2</b>
<b>1.2</b>	<b>Protective Guards</b>	<b>4</b>
<b>1.3</b>	<b>Explanation of System Warning/Caution Labels</b>	<b>5</b>
<b>1.4</b>	<b>Safety Warnings</b>	<b>6</b>

### *Summary*

This chapter describes the various safety features that are incorporated into the machine to provide a safe environment for the operator. The machine is designed so that during the course of normal operation the user is never required to work in or have exposure to areas where they could cause harm to themselves or others.

## 1.1 *Electrical Safety*

### Electrical Enclosure



**WARNING: LETHAL VOLTAGE**  
DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT. ENSURE THAT ALL ELECTRICAL ENCLOSURE COVERS ARE FITTED AND INTACT BEFORE OPERATING THE EQUIPMENT.

All live power and control circuits are installed into an enclosure to reduce the risk of direct contact with live parts. This is positioned to the rear of the machine. The main electrical enclosure provides further protection by interlocking the access door to the enclosure with the safety circuit. The enclosure door will not open until the interlocking device is activated.

Activation of the lockable interlocking device removes power from all of the internal circuitry except the primary side of the mains contactor. This is clearly labeled and protected by a non-conducting cover.

The Low voltage control gear in the pneumatics panel is also protected in an enclosure behind a labeled 'Fixed Guard'. 'Fixed Guards' protect all other low voltage circuits.

**NEVER REMOVE THE FIXED GUARDS!!**

### Emergency Stop Loop

The Emergency Stop (or E-Stop) connects selected modules in the machine and shuts down powered mechanisms that may cause harm to the user during emergency situations.

The E-Stop of this machine is clearly visible and identifiable. It is at the front right hand side of the machine and is activated by pushing down on it once.

Raising the front hood door has the same effect as pressing the E-Stop.

This machine has many modes of operation. Each mode is overridden by the E-Stop and all modes have the same safety requirements.

Pressing the E-Stop button or opening the front hood automatically removes power from the conveyors, XY Table and causes the pneumatic circuits to lose power.

Opening the rear electrical enclosure isolates the System from the mains power.

The E-Stop on this machine is designed to meet the harmonised European standard for safety of machinery - electrical equipment EN 60204-1. This machine can only be started or restarted by the user with the start-up devices provided. It is important to use the correct Power Up Sequence.

### **Power Up Sequence to restore from 'E-Stop' Situation**

1. Pull out the E-Stop button until it stays up.
2. Press the E-Stop reset switch as shown in the diagram Fig 2.2 'System Front View'.

### **Power Up Sequence from 'Mains Off' Situation**

1. Turn the 'Mains Isolator' to the 'ON' position when the rear access doors are locked.
2. Ensure that the X-Y table is free to move over its entire envelope before continuing. Remove any tools or equipment that may hinder the table as it moves inside the enclosure.
3. Ensure that the top frame window is fully closed and the E-stop depressed before continuing.
4. Turn the key switch at the front of the machine to the 'ON' position if not already in this position. The green light will come on at the front panel.
5. Turn on the power supply unit for the lighting head and ensure the setting is on 'High'.
6. Ensure the 'Pass Through' switch is in the correct position.
7. Turn on the motor controller unit at the 'ON' switch.
8. Turn on the LCD monitor or dual monitor systems.
9. Release the 'Emergency Stop' push button by pulling it up.
10. Depress the emergency stop 'Reset' button (See Figure 2.1).
11. Power on the Industrial PC at its 'ON' switch and await the 'Log-on' prompt. This can take two minutes.

## No Uncontrolled motion on restart

When energy supply is removed from the system, it defaults to its safe mode. On restoration of supply the safety relay will not re-close contacts until the power up sequence has been undertaken. This ensures that uncontrolled motion of X-Y table or conveyor is impossible without the operator resetting the power.

## Earth Bonding

All external metal surfaces are mechanically and electrically bonded to the machine earth point. The bonding wire used is identified by its green and yellow insulation and is commonly used to earth bond throughout. Never remove or cut these wires and if you should find a cut or damaged connection, do not operate the machine and inform a technician as soon as possible.



### **WARNING**

THIS MACHINE MUST ALWAYS BE EARTHED WHILE IN USE.

## 1.2 Protective Guards

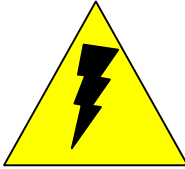
MVT equipment is fitted with a set of protective guards that fully enclose any moving and electrical mechanisms that may harm the user during normal use. On MVT equipment, fixed and moveable guards conform to the appropriate international safety standards.



### **WARNING**

DO NOT OPERATE THE MACHINE WHILE ANY OF THE SAFETY GUARDS ARE OPEN, LOOSE, DAMAGED OR MISSING. THIS INCLUDES ACCESS PANELS TO THE PC AND PNEUMATIC VALVES. THE PROTECTION PROVIDED MAY BE IMPAIRED IF IT IS NOT USED IN THE CORRECT MANNER.

### **1.3 Explanation of System Warning/Caution Labels**



Warning: Electrical danger.



General warning label.



The operator manual must be read before the machine is used so the operator can identify the hazards associated with the operation of the machine

## 1.4 Safety Warnings

### Safety Devices

1. Dangerous voltages exist in areas of this machine.
2. Its safety features are designed for the protection of all people working on it, both in Operations and Maintenance.

**MVT strongly recommends that all safety devices and interlocks are never overridden and that all enclosure covers are fitted and intact before operating the machine.**

### Conveyor safety

Do not put hands on conveyor when it is running. It could cause friction burns and your hand could get caught between the conveyors of adjoining machines.



Labels have been placed at the Exit and Entry areas warning of the danger of placing hands in the openings.



This depicts a hazard of moving parts at the conveyor entry and exit openings (for the board) at the side of the machine, which could cause finger and hand damage.

## X-Y Gantry

The X-Y table is a solid metal assembly and can move at up to 1.5 m/s. This could cause severe impact or crush injury. The Protective Guards are designed to prevent access to areas where this potential injury may occur.

**Do not operate the machine while any of the safety guards are open, loose, damaged or missing.**

## Stability

This machine weighs approx. 1,500 kg, and has a low center of gravity.

**Do not attempt to lift or tip the machine at either end or side, as you will damage both the machine and your back.**

**Don't even do it with the help of others!**

## Falling Objects

Do not store boards, equipment, stencils etc. on top of the machine.

## PC Safety

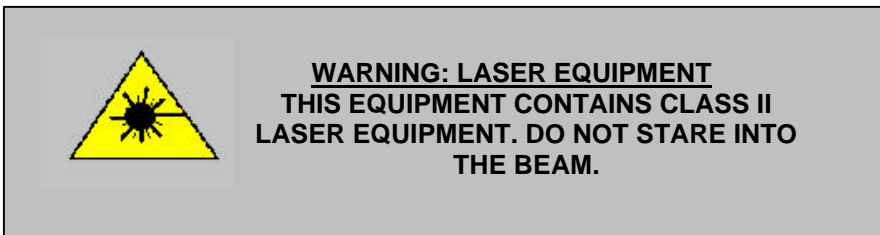
The PC's motherboard contains a lithium battery: Maxell 3V.

**There is a danger of explosion if the battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to manufacturer instructions**

## Laser Safety

The **SP-1** 3D ranging camera uses a class II semiconductor laser. It can be dangerous to stare directly into the laser beam. Doing so could cause total or partial blindness.

The laser is wired into the E-Stop loop. Pressing the E-Stop button or raising the front hood door will automatically shut off power to the laser assembly and turn the beam off.



**WARNING: LASER EQUIPMENT**  
**THIS EQUIPMENT CONTAINS CLASS II**  
**LASER EQUIPMENT. DO NOT STARE INTO**  
**THE BEAM.**

This block contains a yellow triangular warning symbol with a black laser beam and a starburst effect, and the text: **WARNING: LASER EQUIPMENT THIS EQUIPMENT CONTAINS CLASS II LASER EQUIPMENT. DO NOT STARE INTO THE BEAM.**

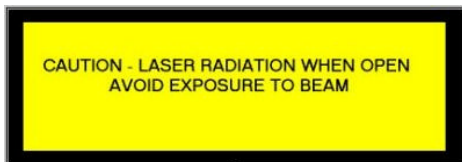
The **SP-2** system contains a Class IIIa Laser and as such is required to carry labels shielding appropriate to the safe operation of the system.

**Note:** The SP-2 side doors must be closed for the laser to operate.



LASER RADIATION  
DO NOT STARE INTO BEAM OR VIEW  
DIRECTLY WITH OPTICAL INSTRUMENTS  
CLASS 3A LASER PRODUCT

This block contains a yellow rectangular label with a black border and the text: **LASER RADIATION DO NOT STARE INTO BEAM OR VIEW DIRECTLY WITH OPTICAL INSTRUMENTS CLASS 3A LASER PRODUCT**



CAUTION - LASER RADIATION WHEN OPEN  
AVOID EXPOSURE TO BEAM

This block contains a yellow rectangular label with a black border and the text: **CAUTION - LASER RADIATION WHEN OPEN AVOID EXPOSURE TO BEAM**





***Chapter***  
***2***

***Installation***

***Chapter Contents***

**2.1 System Overview ..... 10**  
**2.2 Machine Installation..... 14**

***Summary***

This Chapter provides instructions for setting up and installing the inspection and measurement systems.

## 2.1 System Overview

### Machine Layout

The systems are constructed from a rigid welded base frame which gives stability and support to the X-Y gantry robot and houses the electrical control of the machine.

The base frame houses the Industrial PC, the pneumatics panel and motor controller on three sliding drawer units which allow easy access to the rear of these units. These units are then protected behind the front access doors, which are lockable. The emergency stop reset switch and the pass-through/inspect switch are also mounted behind these doors, see fig 2.2.

The facilities panel mounted in the rear electrical enclosure provides interconnections for the 2 SMEMA cables, the Ethernet cable, and the serial port. The electrical mains inlet cable and system pneumatic power is supplied through a cutout in the machine base-plate, which is also accessible from the rear electrical enclosure.

The pneumatics panel has a sliding drawer providing access to the systems pressure regulators and valves, and can be opened using a slotted screwdriver.

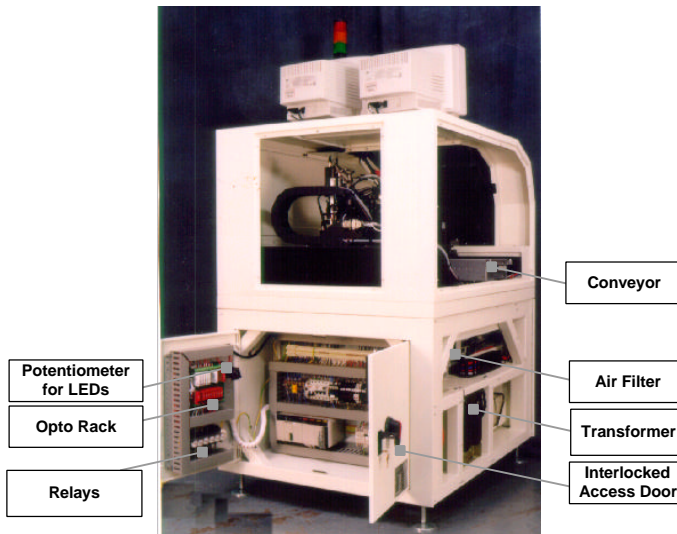


Figure 2.1 Rear End View

The rear of the base frame houses all of the systems electrical controls. These controls are secured behind a lockable door. These rear access doors also include the mains isolator switch which can be locked in the off position to prevent accidental start up. The rear access doors cannot be opened with the isolator switch in the ON position. The transformer guard panel protects against unauthorised access to the system's mains transformer.

Only trained personnel should remove the transformer guard panel.

The facilities panel houses the systems communications interfaces. The system's power is fed in through the base of the machine.

Untrained personnel should never remove this panel.

The final two panels on the system base are the lower-right access panel and the lower-left access panel.

These panels need only be removed when access is required to internal system wiring.

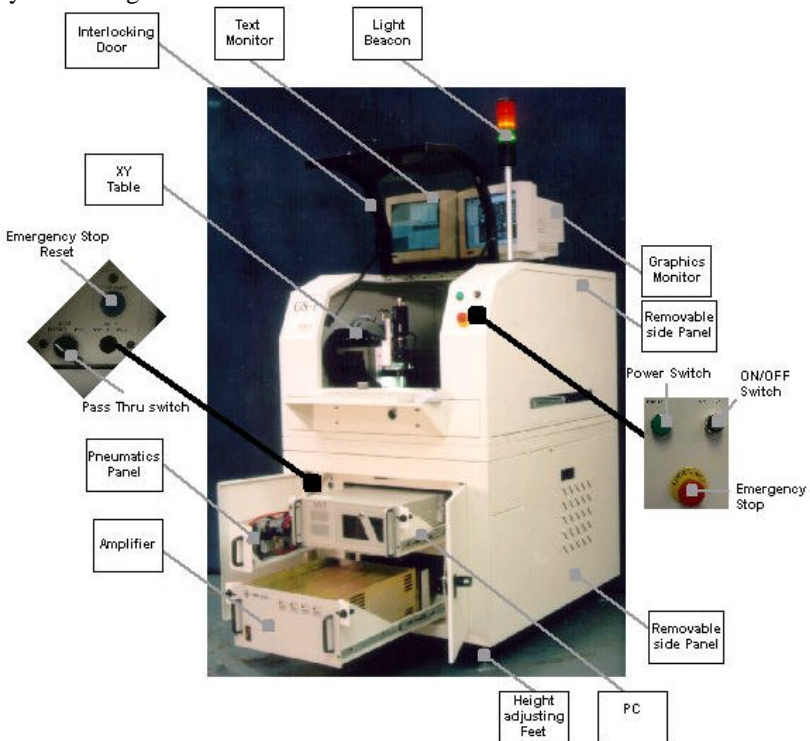


Fig 2.2 System Front View

The systems base frame is covered by a folded and welded top frame which is designed to protect personnel against the motion of the X-Y gantry robot, and to provide for mounting of control interfaces.

The systems top frame gives access to the machine internals primarily through the top frame polycarbonate window. Further access is possible through the left and right upper panels, the rear upper panel and finally the roof panel. The entire top frame can also be separated from the base frame if further access is required. The systems top frame also provides for the mounting of the control interface, see Fig 2.2

Finally, the system indicator beacon is mounted on the system roof.

## System event cycle

In a normal inspection cycle, a PCB enters the system, is clamped, and then inspected. It is released immediately if there were no board errors. If there are errors, the operator may view them before the board is released. A normal inspection involves the following system event cycle:

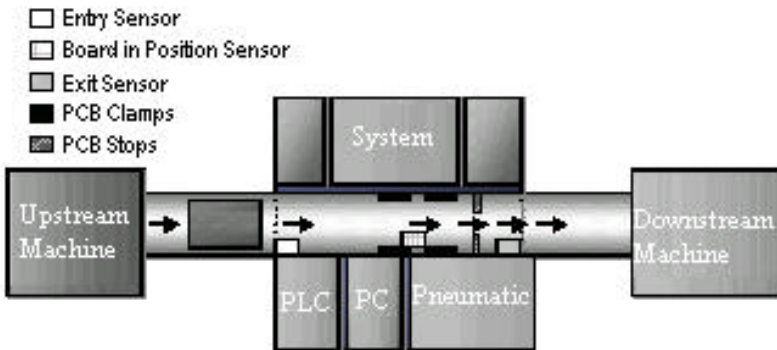


Figure 2.3 System layout

1. The system PLC receives a SMEMA signal from an Upstream machine (e.g. a placement machine) that there is a board available.
2. The PLC registers a board available signal from the upstream machine, then the inspection system is free. It will send a ready signal to the upstream machine to allow board transfer.
3. The upstream conveyor comes on.
4. The Conveyor comes on.
5. The PCB travels into the system and triggers the Entry Sensor, which sends a signal to the Programmable Logic Controller (PLC).
6. The PCB triggers the Board In Place sensor, which sends a signal to the PLC.
7. The stop cylinders, which are pneumatically controlled from the PLC signal, come up.
8. The conveyor starts to slow down and comes to a complete stop.
9. The reed switches on the stop cylinders are activated.
10. Clamps come up and board is clamped.
11. The reed switches on the clamp cylinder are activated.
12. A signal is sent to the Opto board to inform the PC that the PCB is ready for inspection.
13. The X-Y gantry, which is located over Fiducial 1, inspects Fiducial 1 first, then the other Fiducials and the rest of the components on the board.
14. After the board has passed inspection, a signal is sent from the PC to the PLC via the Opto rack that the inspection is finished.
15. The PLC in turn retracts the stops and the clamps.
16. The conveyor comes on and the PCB triggers the Exit Sensor at the end of the system conveyor.
17. This stops the conveyor and the board remains at end of the conveyor, if the downstream machine is not busy.
18. The PCB waits here until the PLC receives a SMEMA signal from a downstream machine (e.g. RS-1, conveyor, and oven) that it is available for a PCB.
19. When the PLC receives this signal, it sends a return SMEMA signal to the downstream machine and the downstream conveyor is activated. The system's downstream conveyor is activated and moves the PCB to the downstream machine.
20. The PLC sends a SMEMA signal to the upstream machine to inform it that it is available to receive a PCB.

The system can also operate in a Pass Thru mode in which the board inspection is effectively disabled. This means that boards pass through the system but are not clamped or inspected.

Alternatively, it can be placed into Softstop mode. This effectively disables steps 10 to 12 from occurring. The operator must inspect and release the board using keyboard commands.

## **2.2 Machine Installation**

This section outlines the general procedure for unpacking and installing the system.

### **Required Environmental Conditions**

This system has been designed to operate safely under the conditions listed below. It is imperative that these conditions exist before you install and use the system:

- Indoor use only.
- Max. altitude of 2000m.
- Temperature at 5 to 40° C.
- Max. relative humidity 80% for temps. up to 31° C decreasing linearly to 50% relative humidity at 40° C.
- Mains supply voltage fluctuations not to exceed +/- 10% of the nominal voltage (see Systems Specifications for nominal voltage in Chapter 5).
- Transient over-voltages in compliance to UL Installation Category II. This equates to 1500V overvoltage for a system operating in our specified range (ref. Annex J of UL Safety Standard UL3101-1).

### **Unpacking the system**

The system is shipped in a sturdy wooden protective crate.

To remove the system from its crate:

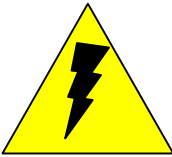
1. Remove the crate top panel by unscrewing the carriage bolts at the top of the crate using the appropriate socket head driver.
2. Remove the front panel to expose the machine and the transportation straps. The straps can then be unhooked to free the machine for lifting from its crate by use of a forklift. Please read the section 'Handling the system', before removing the machine from its crate.

3. Remove the packaged parts from inside the system by removing the lower right panel with a 4mm hexagonal Allen key. The packaged parts can then be removed and the panel replaced and secured.

### Handling the system

The system is designed for transportation and handling by hydraulic pallet truck or forklift.

It is important to note that the lifting device used must be rated to lift and carry a 2 tonne load. The forks of the lifting device should be a minimum of 1.0 meters long with a minimum fork spacing of 0.5 meters wide at the inside of the forks. The system is designed to be lifted from any of its four sides, however, when inserting the forks of the lifting device under the machine, care must be taken to ensure that the lower panels are not damaged as a result of poor handling. When lowering the system from an elevated position the lifting device operator must ensure that all sides of the machine are clear from obstructions.



**WARNING**  
**The machine must never be raised while electrical or pneumatic power is connected.**

### Off-line Installation

The system can be partially set up prior to moving it in-line and connecting it to machines up and downstream. Modules installed off-line are listed below.

#### Indicator Beacon

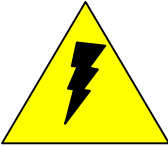
The system's indicator beacon should be mounted in the position shown in Fig 1. Examination of the top frame of the system at the location shown will reveal an array of 4 by M5 tapped holes that will align with the mounting plate on the indicator beacon.

In order to mount the indicator beacon, the top frame inside right trunking cover must be removed by unfastening 10 captive fasteners with a 5mm hexagonal Allen key. This will reveal a 14-way circular d-pole female connector. This connector should be securely mated with the 14-way circular d-pole male connector on the trailing lead of the indicator beacon.

The indicator beacon can now be securely fastened to the top frame with the four fasteners provided and using a 4mm Allen key.

Finally the trunking cover can be reinstalled, taking care to completely cover the circular connectors.

## Monitors



### **WARNING**

**The power cables 'PWC 9' and 'PWC 10' provide 220Vac to the monitors. DO NOT connect US standard 110Vac monitors to the System**

The system is supplied with one 15-inch SVGA monitors. Each of these monitors will be provided with both a power cable and a VGA signal cable. These four cables are routed through the top frame inside right trunking and then pass through a circular cutout on the roof of the machine.

Place the two monitors on the roof of the system taking care to ensure that they are back from the edge of the top frame window to prevent a clash. The cables can then be connected to the monitors.

The left or video monitor should be connected to the power cable labeled 'PWC 9' (part no. 2003-0049), and the VGA signal cable labeled 'SLC 26' (p.n. 2003-0013).

The right or text monitor should be connected to the power cable labeled 'PWC 10' (p.n. 2003-0033), and the VGA signal cable labeled 'SLC 33' (p.n. 2003-0035).



### **WARNING**

**Under no circumstances should the monitor cables be connected while power is applied to the system.**



## Keyboard and Trackball

The system is shipped with a keyboard, trackball and keyboard support shelf. Having unpacked the system it is necessary to mount the keyboard and trackball support shelf using the four screws provided with the use of a 4mm Allen key. In order to connect the keyboard and trackball cables it is necessary to remove the top frame inner shelf, this is located immediately inside the window of the hood. Remove the 3 Allen bolts holding this panel in place and then remove the panel.

Removing the shelf will expose the top frame interface plate. The keyboard and trackball cables can be securely connected to it. The cables must be routed through the cutout in the underside of the keyboard and trackball support shelf. The top frame inner shelf can then be replaced by gently pressing downwards.

## Computer Hard-drive

The system is shipped with a system hard-drive. The Windows NT 4 compatible hard-drive containing the application software will be labeled.

To install the Windows NT 4 operating system hard-drive:

1. Open the lower front doors of the machine using the key provided. This will expose the E-stop reset switches, industrial PC, the motor controller unit, the lighting head PSU and the Pass-through switch.
2. Open the Industrial PC bay access door with the key provided. This will expose the PC on/off switch, the removable hard-drive bay, the CD-ROM and the floppy disk drive.
3. The Windows NT 4 hard-drive can now be gently inserted into the removable hard-drive bay and pressed home with a slight pressure until the cradle lock engages. This will be indicated by an audible click when the drive has seated in the bay. The cradle-locking key must then be turned to the lock position and removed.

The cradle locating, PC bay and lower front door keys should be held by a suitable person.



**Attention!**  
**A designated person should hold the front and back panel and hard-drive keys.**

## **In-Line Installation**

Placing the system in-line into the production line and connecting communications with the line.

## **Machine Installation**

Having ensured that the correct space is available on the production line the system can be lifted and handled into position as described in a previous section. It is important that the machine is aligned so that the system conveyor fixed rail is in-line with the fixed rails of the conveyors on either side of the machine.

## **Height Adjustment**

Once the machine has been placed roughly in the correct location the system height must be adjusted to ensure that boards can travel from the upstream conveyor, through the system, and on to the downstream machine. Adjusting the 4 machine feet varies the height of the system.

To adjust the feet the foot-locking nut must be loosened using a 46mm spanner. With the locking nut loosened the feet can be raised or lowered using a 20mm spanner on the spanner flats provided. Once the correct height has been achieved, the feet locking nuts must be retightened with the 46mm spanner.

It is important to ensure that the machine weight is evenly distributed between the four feet, otherwise excessive vibration during operation may occur.

## **Conveyor Adjustment**

Once the machine has been correctly positioned, and the system height adjusted to allow boards traverse through the machine with ease, the system variable conveyor rail must be horizontally adjusted to optimise board transfer.

This is achieved by placing a board in the system with the adjustable rail securing knobs loosened. The adjustable rail is then moved to allow the board to just traverse the system without catching or jamming. The securing knobs should be tightened at this point.

## **S.M.E.M.A. Communications**

A SMEMA standard is used for the machine to machine electrical interface, which controls the proper sequencing of boards. It uses two signal lines: “Machine Not Busy” and “Board Available”, to indicate when the system can receive a board and when the system has completed a board.

Signals are communicated between machines via the 14-pin SMEMA connector. The “Machine Not Busy” and “Board Available” signals use pins 1 & 2 and 3 &

4 respectively. The minimum requirements are to switch 30 V, 10 mA. At 10 mA the output “LOW” must not exceed 0.8V.

In the sequence outlined below, boards are transferred from Machine A to B and from B to C.

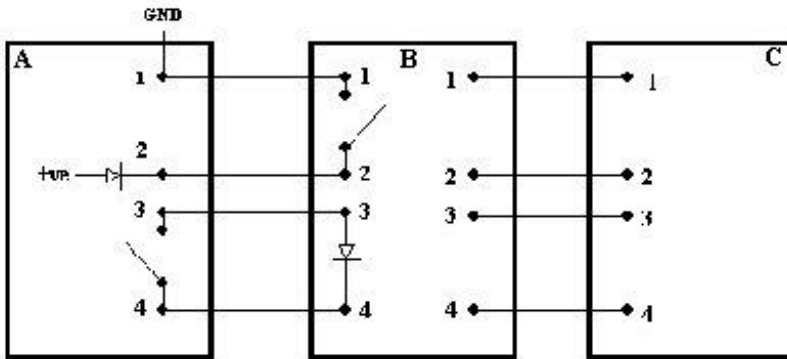


Fig. 2.4 - Pins 1 to 4 of SMEMA connector.

In the state shown above Machine B is “Not Busy” as its pins 1 & 2 are open. Machine A has “No Board Available” as its pins 3 & 4 are open.

If Machine A did have a board available for transfer, the board would trip its exit sensor and the machine would close contact between pins 3 & 4. This would give the signal to Machine B that there is a “Board Available”.

If Machine B were processing a board, it would close contact between pins 1 & 2 to give the “Machine Busy” signal to Machine A.

Board transfer **only** occurs when Machine A has a “Board Available” (contact closed) and Machine B is “Not Busy” (contact closed).

### S.M.E.M.A. Connections

The SMEMA interface ports are located inside the rear electrical enclosure of the system. The upstream and downstream connections must be made for the system to function correctly while operating single or dual line.

The system comes equipped with two SMEMA cables for each conveyor line to connect the system to equipment up and downstream. The upstream cable ‘SLC 27’ (p.n. 2003-0024) must be connected to the ‘SMEMA UP’ connector on the facilities panel, while the downstream cable ‘SLC 28’ (p.n. 2003-0025) is to be connected to the ‘SMEMA DOWN’ connector. These cables need to be routed through the base of the system using the cutout provided. These can also be connected in reverse.

If an MVT RS-1 is upstream from the system, connect SLC 28 downstream.

### **Network Connections**

An interface connection is located in the rear electrical enclosure to provide for network connectivity of the system.

If the Networking option has been supplied, please contact your system administrator for details of connecting the system to the network.

### **Serial Connections**

A serial port connection is provided on the facilities panel to allow for the connection of miscellaneous equipment if required (e.g. barcode readers).

## **Power up the System**

### **Electrical Power**

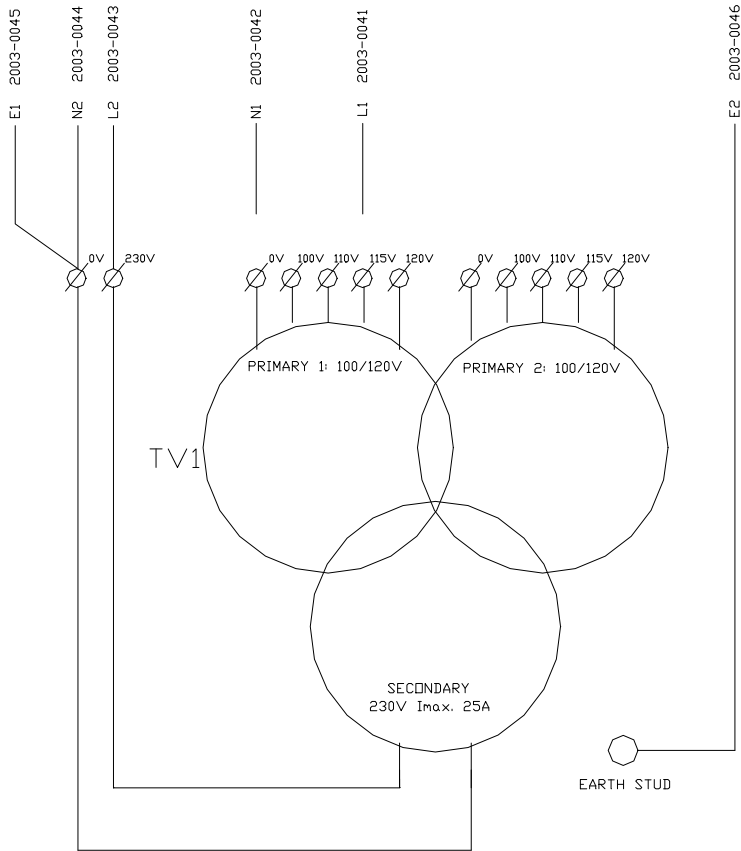
All sub-circuits in the system operate at 230V. The system can be set to accept a number of mains voltages (normally 210-240V 25A ...100-120V 40A). It achieves this by using a universal transformer (see wiring diagram below).

The primary voltage is manipulated to achieve the secondary output voltage of 230V. See Fig. 2.6 or the Primary Terminal Wiring set-ups for most common electrical supplies from 100 – 120VAC to 200-240VAC. The user must secure N1 and L1 to the terminals indicated below.

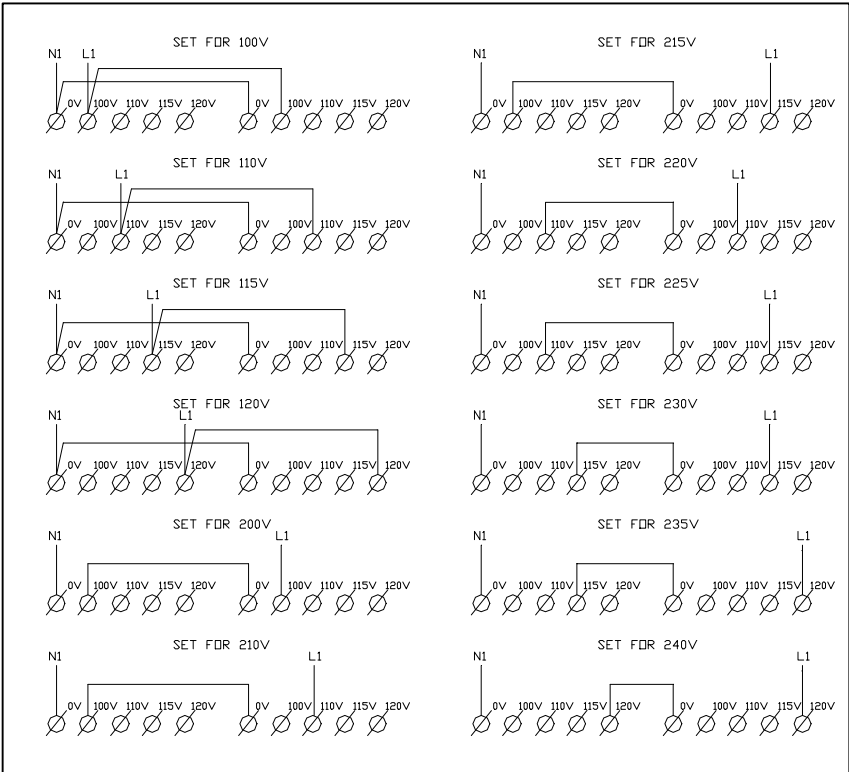
Note: The link wire must be a minimum cross-sectional area of 6mm<sup>2</sup> (or 8AWG).



**WARNING**  
**All system sub-circuits are 230VAC. Only connect equipment rated to this voltage to the system**



**Fig. 2.5 - Universal Transformer Wiring Diagram (General)**



**Fig. 2.6 - Primary Terminal Wiring set-ups for most common electrical supply.**

**The system should be protected by a circuit breaker of not more than the maximum current carrying capacity of the mains cable. EG this should be of a min. 25A for voltages 200-240 or 40A for 100-120V.**

## Pneumatic Power

Pneumatic power is supplied to the system through the pneumatic inlet port in the rear electrical enclosure. This port is a 6mm quick fitting connector and will mate with a US standard ¼ inch fitting. The system must be supplied with 5 bar clean filtered air, 3-4 (cubic feet/minute).



**WARNING**  
**THIS SYSTEM MUST BE EARTHED BEFORE AND DURING USE.**



**WARNING**  
**The System should never be operated without pneumatic power applied to the system.**

## Power Up Sequence

1. Ensure that only trained personnel have connected the electrical power to the system.
2. Verify that the voltage terminals at L2, N2 is at 230VAC.
3. Ensure that the X-Y table is free to move over its entire envelope before continuing. You can manually move it around its enclosure.
4. Ensure that the top frame window is fully closed and the E-stop depressed before continuing.
5. Turn the 'Mains Isolator' to the on position when the rear access doors are locked.
6. Turn the key switch at the front of the machine to the 'ON' position.
7. Turn on the power supply unit for the lighting head and ensure the setting is on 'High'.
8. Ensure the 'Pass Thru' switch is set to "Inspect".
9. Turn on the motor controller unit at the ON switch.
10. Turn on the monitor.
11. Release the red 'Emergency Stop' push button.
12. Depress the 'Emergency Stop Reset' button.

13. Power on the Industrial PC at the ON switch and await the 'Log-on' prompt.

## **Starting the Application Software**

After the system is powered up and in pass thru mode, the user must log into the main application account. It will configure the system for operation. This is achieved by logging in at the user prompt as 'cpi' with the password 'cpi602'.

The user name and password are case sensitive.

Following log in, the system automatically goes through an initialisation procedure. This includes starting X-Windows and initialising the hardware components such as the X-Y table, the Opto-22 communications with the PLC, and the framstore.

During the initialisation process, the X-Y table is homed and moved to the Fiducial 1 location for the default PCB. The default PCB is the last PCB that was inspected by the system before it was last shut down.

If the system is being cold started, the user should watch the initialisation procedure on screen to ensure that all the sub-systems start successfully.

## **Set up the Imaging System**

These steps must be performed before the system can be used in production. They are explained in more detail in the following chapter.

1. Focus the camera(s).
2. Set the camera aperture(s)
3. Automatically scale the system
4. Calibrate the lighting head

And for the SP-1

1. Focus the laser
2. Centre the laser in the field of view
3. Align the laser
4. Set the scan speed
5. Calibrate height
6. Calibrate the X/Y Offset (SP-1, SP-2 only)
7. Calibrate the pixel size (3D Camera)