

## **EC Declaration of Conformity**

### **The responsible person**

Mr D. Bilton  
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### **declares that the machinery described:**

1. Make FB Laser Cutter
2. Model FB 400, FB 700, FB 1500, FB 1600,  
FB 1800, FB 2000 including all series and laser  
powers
- Laser Powers 10w, 30w, 50w, 100w, 200w, 400w
3. Serial Number All Machines

### **conforms to the following Directives:**

Supply of Machinery (Safety) Regulations 1992  
Supply of Machinery (Safety) (Amendment) Regulations 1994  
EC Machinery Directive 98/37/EEC as amended  
EC Electromagnetic Compatibility Directive 89/336/EEC as amended  
EC Low Voltage Electrical Equipment Directive 73/23/EEC as amended

### **and uses the following standards:**

EN60825, BS EN292-1, prEN953, EN60204-1, prEN1050,  
BS EN414, BS EN294, prEN50099-1, prEN594-1,  
BS EN418, BS EN50081-1, BD EN50082-1

### **and complies with the relevant essential health & safety requirements**



signed by Mr D. Bilton

Financial Director

Signed at Nottingham on 22 March 2005



# **FB Series Laser Cutter User Manual**

## **Table of Contents**

<b>SAFETY.....</b>	<b>9</b>
<b>Safety Information .....</b>	<b>9</b>
Ventilation .....	10
Noise.....	10
Fire Precautions .....	10
Training .....	10
Cutting Materials.....	10
Extraction System .....	10
Laser Warning Labels .....	11
<b>Safety Devices .....</b>	<b>15</b>
Polycarbonate Safety Cover .....	15
Electromechanical Interlock .....	15
Mechanical Shutter.....	16
<b>GENERAL CUTTING INFORMATION.....</b>	<b>19</b>
<b>General Information - Introduction.....</b>	<b>19</b>
<b>The Laser.....</b>	<b>20</b>
<b>The FB Series Laser Cutter.....</b>	<b>21</b>
Description .....	21
<b>Cutting Materials.....</b>	<b>23</b>
<b>Comparison of the FB Series Laser Cutter with Conventional Cutting Systems .....</b>	<b>25</b>
Reflective Material .....	25
Plastics .....	26

<b>Fabrics .....</b>	<b>26</b>
<b>INDIVIDUAL MACHINE SETUP .....</b>	<b>27</b>
<b>FB400 - Machine Set Up Guide .....</b>	<b>27</b>
<b>General.....</b>	<b>27</b>
<b>Specific Requirements .....</b>	<b>27</b>
<b>Commissioning .....</b>	<b>27</b>
<b>FB700 - Machine Set Up Guide .....</b>	<b>29</b>
<b>General.....</b>	<b>29</b>
<b>Options.....</b>	<b>29</b>
<b>Specific Requirements .....</b>	<b>30</b>
<b>Commissioning .....</b>	<b>30</b>
<b>FB1500 - Machine Set up Guide.....</b>	<b>31</b>
<b>General.....</b>	<b>31</b>
<b>Options.....</b>	<b>31</b>
<b>Specific Requirements .....</b>	<b>32</b>
<b>Commissioning .....</b>	<b>32</b>
<b>FB1800 - Machine Set up Guide.....</b>	<b>33</b>
<b>General.....</b>	<b>33</b>
<b>Options.....</b>	<b>33</b>
<b>Specific Requirements .....</b>	<b>34</b>
<b>Commissioning .....</b>	<b>34</b>
<b>EXTRACTION SYSTEM .....</b>	<b>35</b>
<b>Description.....</b>	<b>35</b>
<b>Extraction Unit Checklist .....</b>	<b>35</b>
<b>Maintenance of All Fan Units .....</b>	<b>36</b>
<b>CHILLERS/AIR COOLED .....</b>	<b>40</b>
<b>Air Cooled Laser Systems.....</b>	<b>40</b>
<b>General.....</b>	<b>40</b>
<b>Maintenance .....</b>	<b>40</b>

LASERS .....	43
Laser Types.....	43
OPTIONS .....	49
Roll Feed .....	49
General .....	49
Troubleshooting .....	52
Slat Conveyor .....	54
General .....	54
Maintenance of Slat Conveyor.....	54
Honeycomb Conveyor.....	55
General .....	55
Maintenance .....	56
Honeycomb Bed Maintenance .....	56
Cleaning the Bed Surface.....	57
Using Cutting Gases .....	58
OPTICAL SYSTEM .....	59
Installation of USB Camera or MuTech Video and Grabber Drivers .....	59
Installation of ApS-Ethos Cutter Driver.....	60
Feed Tray.....	62
Specific Requirements .....	62
OPTICAL COMPONENTS .....	63
IRRIGATION .....	65
Nozzle Purging - All Models.....	65
General .....	65
Options.....	65
CONTROL PANEL .....	67
The Control Pad.....	67

<b>The Liquid Crystal Display .....</b>	<b>67</b>
<b>The Jogging Pad .....</b>	<b>68</b>
<b>The Reset/Load Key .....</b>	<b>68</b>
<b>The On-line Key .....</b>	<b>69</b>
<b>Factory Spot-Mode .....</b>	<b>70</b>
<b>The Menu Key .....</b>	<b>70</b>
<b>Flatbed Series Configuration Submenus .....</b>	<b>71</b>
<b>Contents of the Menus .....</b>	<b>72</b>
<b>The Enter Key .....</b>	<b>72</b>
<b>The 1 and 2 Keys .....</b>	<b>72</b>
<b>The 3 Key .....</b>	<b>72</b>
<b>The 4 Key .....</b>	<b>72</b>
<b>Normal Operation.....</b>	<b>72</b>
<b>On Line and Off Line .....</b>	<b>73</b>
<b>Local (Off Line) Operation .....</b>	<b>74</b>
<b>The User Config Menu.....</b>	<b>75</b>
<b>Max Power.....</b>	<b>76</b>
<b>Power Band .....</b>	<b>76</b>
<b>Down Velocity .....</b>	<b>76</b>
<b>Up Velocity .....</b>	<b>76</b>
<b>Down Acceleration .....</b>	<b>77</b>
<b>Up Acceleration .....</b>	<b>77</b>
<b>System Setup.....</b>	<b>77</b>
<b>    System Setup .....</b>	<b>77</b>
<b>Concatenation .....</b>	<b>77</b>
<b>Smoothing .....</b>	<b>78</b>
<b>Emulate .....</b>	<b>78</b>
<b>Menu Units .....</b>	<b>78</b>
<b>Addressing .....</b>	<b>79</b>
<b>Baud Rate .....</b>	<b>79</b>
<b>Parity .....</b>	<b>79</b>
<b>    Internal Test Menu .....</b>	<b>80</b>
<b>Internal Test Submenus .....</b>	<b>81</b>
<b>Din Cut.....</b>	<b>81</b>

<b>System Tests .....</b>	81
<b>System Tests .....</b>	81
Language .....	81
Rom Revision.....	82
Calibrate X/Y .....	82
RS232 Test .....	82
Install Menu .....	83
LCD Contrast .....	83
<b>Loading &amp; Cutting.....</b>	83
Laminating Flexible Materials .....	84
Loading Procedure .....	84
Roll Loading Procedure .....	84
Control Pad Load Procedure.....	85
Checklist Before Cutting .....	86
Focusing the Laser Beam .....	87
Nozzle Gas Cutting - Aiming the Mirror on the Cutting Head	88
<b>GENERAL MAINTENANCE .....</b>	90
<b>Maintenance Introduction .....</b>	90
<b>Maintenance Schedule .....</b>	90
<b>Water Chiller Maintenance .....</b>	93
Coolant Level .....	93
Grill and Cooler Matrix .....	93
Draining Procedure .....	95
Filling Procedure.....	95
Thermostat Control Unit .....	96
<b>Water Cooler Maintenance.....</b>	97
Coolant Level .....	97
Grill and Cooler Matrix .....	98
Filling Procedure.....	98
<b>Optical Components.....</b>	99
Cleaning the Cutting Head Lens .....	100
Examining/Cleaning the Cutting Head Mirror .....	103

<b>The Cutter</b> .....	106
Head Transport Rails .....	106
Cutting Head Drive Belt .....	107
<b>TROUBLESHOOTING</b> .....	108
<b>Troubleshooting - All Models</b> .....	108
General.....	108
<b>Hints &amp; Tips</b> .....	115
Engraving .....	115
Cutting .....	115
Speed and Power Controls.....	116
Understanding Focus.....	118
<b>APPENDICES</b> .....	120
<b>Specifications</b> .....	120
Laser Cutter.....	120
Cutting Area .....	120
Fabric .....	120
Interface.....	121
Firmware.....	121
Performance .....	121
Environmental (Cutter without Fabric) .....	122
Electrical.....	122
Fuse Location and Value .....	123
<b>Spare Parts</b> .....	124
<b>Control System</b> .....	125
<b>Optics</b> .....	126
<b>Mechanical</b> .....	127

# **Safety**

## **Safety Information**

### **WARNINGS:**

- THE LASER EMITS INVISIBLE RADIATION; AVOID EYE OR SKIN EXPOSURE TO DIRECT OR SCATTERED RADIATION.
- ANY PERSON OR ORGANIZATION PERFORMING ANY MODIFICATION TO THE FB SERIES LASER CUTTER IS RESPONSIBLE FOR ENSURING THE RECLASSIFICATION AND RELABELLING OF THE LASER PRODUCT.
- THE FB SERIES LASER CUTTER MUST NOT BE OPERATED WITH ANY OF THE SAFETY INTERLOCKS, SHUTTERS, GUARDS OR PROTECTIVE HOUSINGS REMOVED.
- BEFORE COMMENCING ANY CUTTING PROCEDURE ENSURE THAT THE FUME EXTRACTION SYSTEM IS IN GOOD WORKING ORDER AND OPERATES CORRECTLY.
- WHEN CLOSING THE SAFETY COVER ENSURE THAT NO FINGERS OR OTHER ITEMS CAN BE TRAPPED BETWEEN THE SAFETY COVER AND THE SIDE POD.
- WHEN THE SAFETY COVER IS LIFTED CARE MUST BE TAKEN TO AVOID POSSIBLE HEAD CONTACT WITH THE RAISED COVER.
- SOME MATERIALS MAY PRODUCE HAZARDOUS FUMES IF CUT USING THE LASER - CHECK WITH THE MATERIAL SUPPLIER OR MANUFACTURER BEFORE CUTTING. ENSURE THAT ANY FUMES ARE EXHAUSTED IN ACCORDANCE WITH HEALTH AND SAFETY REQUIREMENTS.
- THE ELECTRICAL ENCLOSURES (I.E. DOORS &

COVER PODS, ETC.) MUST ONLY BE OPENED BY TRAINED SERVICE PERSONNEL.

- WHEN THE LASER CUTTER IS OPERATING, DO NOT LEAVE IT UNATTENDED AT ANY TIME.

## **Ventilation**

The cutter has its own extraction system however, good ventilation of the cutting area is strongly recommended in the event of extraction failure. The cutter must not be left cutting unattended at any time.

## **Noise**

The noise level does not exceed 75 dBA.

## **Fire Precautions**

The cutting area must be provided with a carbon dioxide fire extinguisher and any relevant personnel familiarized with its operation.

## **Training**

It is advisable that all cutter operators receive some degree of training before using the cutter and that they all read the user manual.

## **Cutting Materials**

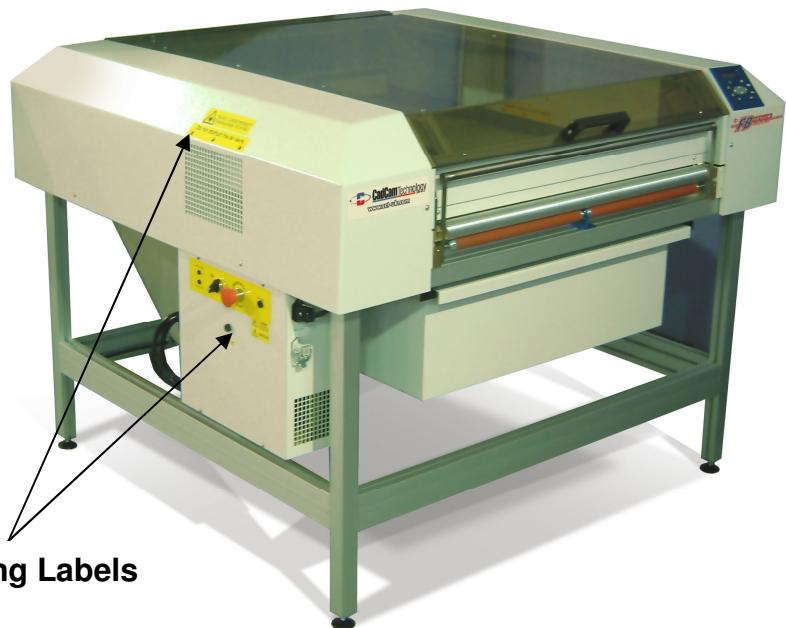
The operator must ensure that the materials to be cut are suitable and do not produce toxic gases when laser cut. The ventilation and extraction system must also be in good condition before any cutting takes place.

## **Extraction System**

The operator must ensure that the extraction system is

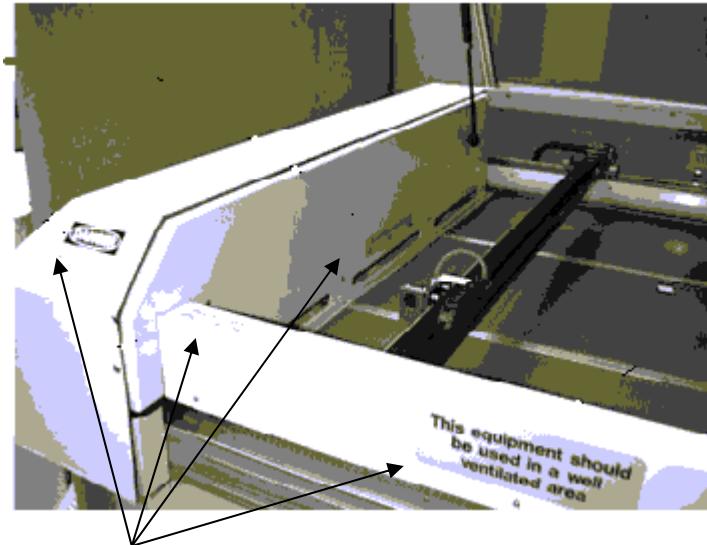
working correctly, with no obstructions in the pipelines. If the laser cutter is operated with a blockage in the extraction system, this could reduce the effectiveness of the extraction system and lead to local contamination of the air and a possible Health and Safety hazard.

## Laser Warning Labels



**Warning Labels**

**Position of Laser Cutter Warning Labels (Front)**



**Position of Laser Cutter Warning Labels (Inside Cover)**

### Laser Warning Labels



**LASER RADIATION  
DO NOT STARE INTO BEAM  
CLASS 2 LASER PRODUCT**



**CAUTION-LASER RADIATION WHEN OPEN  
AVOID EXPOSURE TO BEAM**

LASER RADIATION  
AVOID EYE OR SKIN EXPOSURE TO  
DIRECT OR SCATTERED RADIATION  
CLASS 4 LASER PRODUCT

This equipment should be  
used in a well ventilated  
area

LASER  
APERTURE



# Mind Your Head When Cover Lifted

Do not obstruct the Air Vents



## Safety Devices

There are three safety devices to protect the operator from the laser beam as follows:

### Polycarbonate Safety Cover

The polycarbonate cover is 6mm thick. In the unlikely event of a severe misalignment of the laser beam, the cover will tolerate a maximum of 25 Watts of beam intensity for a period of approximately 12 minutes.

When the cover is lifted the cutter stops immediately and then goes off-line via an electromechanical interlock.

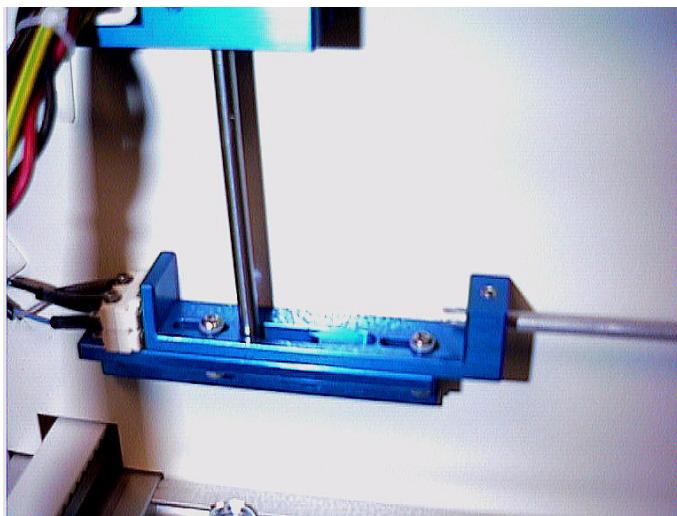
### Electromechanical Interlock

The electromechanical interlock is operated by the safety cover. Once the safety cover starts to open, the laser beam is stopped and the cutting head halts almost immediately afterwards. The cutter then goes off-line. The laser cutting

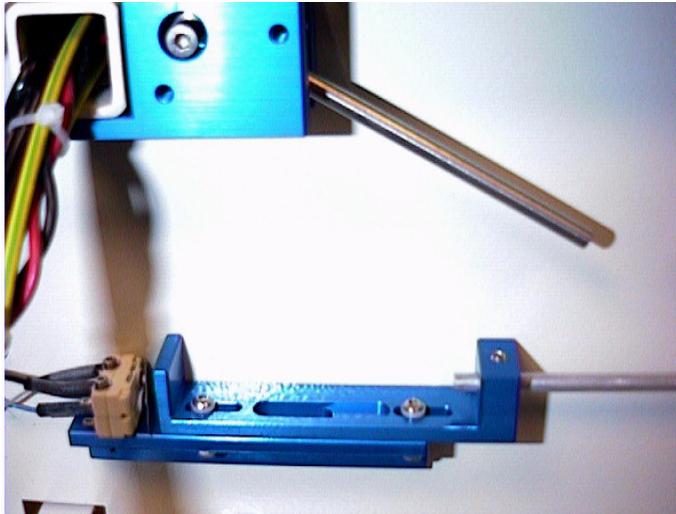
head cannot be moved whilst the safety cover is open. The cutter will not return to an online condition until the cover is lowered and then the machine will continue with the cutting operation.

## Mechanical Shutter

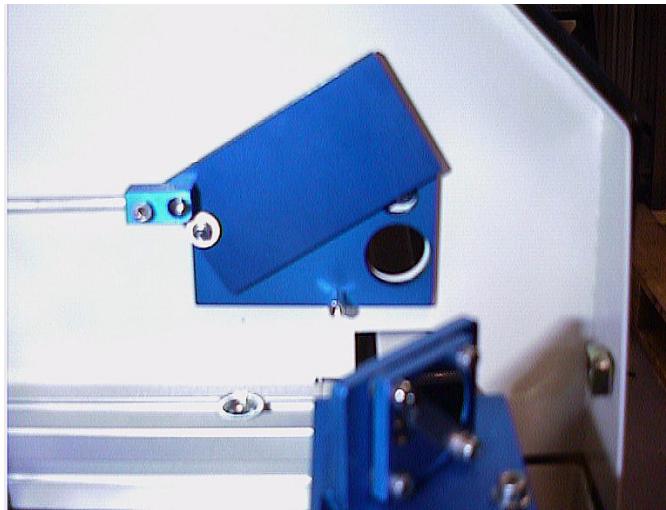
A mechanical shutter is also linked to the safety cover. This provides a physical barrier to the beam whenever the cover is lifted. The shutter provides continuous protection in the event of electrical malfunction and requires no maintenance.



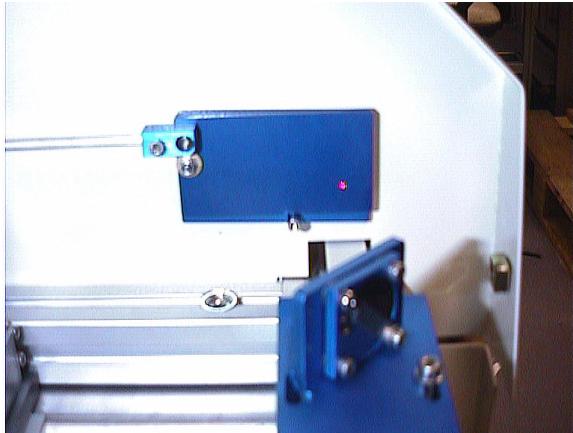
**Safety Cover Closed - Micro-switch Closed**



**Safety Cover Open - Micro-switch Open**



**Mechanical Baffle Open**



**Mechanical Baffle Closed**

When the safety cover is closed, the micro-switches are closed, the mechanical baffle is open and the cutter is in a cutting operation mode. When the safety cover is open, the micro-switches are open, the mechanical baffle is closed and the cutter is unable to perform a cutting operation.

# General Cutting Information

## General Information - Introduction

This section contains general information about the User Manual, a brief introduction to lasers, the cutting capability of lasers and, more particularly, the FB Series Laser Cutter. This manual covers both the FB 700 and 1500 Series Laser Cutters. The specific machines are:

**FB710** - 10 Watt Laser 840mm (33") bed width

**FB730** - 30 Watt Laser 840mm (33") bed width

**FB750** - 50 Watt Laser 840mm (33") bed width

**FB7100** - 100 Watt Laser 840mm (33") bed width

**FB1510** - 10 Watt Laser 1560mm (61") bed width

**FB1530** - 30 Watt Laser 1560mm (61") bed width

**FB1550** - 50 Watt Laser 1560mm (61") bed width

**FB15100** - 100 Watt Laser 1560mm (61") bed width

### Note -

Active Cutting Areas for FB Series Laser Cutters -

**FB700 Series** - 725mm x 990mm (28.5" x 39")

**FB1500 Series** - 1470mm x 990mm (57.9" x 9")

The manual contains all the information necessary for correct set up and operation of the laser cutter. It is strongly recommended that you read this manual as this will greatly assist in obtaining the best performance from the equipment.

## The Laser

A laser is a device that produces electromagnetic radiation of a specific wavelength. There are many types of lasers such as:

Carbon Dioxide (CO<sub>2</sub>), Helium Neon, Noble Gas Ion, Helium Cadmium, Nitrogen, Semiconductor Diode, Ruby, Yag.

All of the above lasers produce electromagnetic radiation at specific wavelengths and require various forms of excitation. Some may produce continuous wave energy, whilst others only short bursts. The different types tend to be suited to different applications.

The FB Series Laser Cutters use low power sealed carbon dioxide (CO<sub>2</sub>) lasers.

This type of laser has the following advantages:

- Low maintenance
- Cost effective
- Efficient
- Compact
- Sealed
- Readily available
- Easy installation

The principle of the CO<sub>2</sub> laser is relatively simple. The gas inside the laser is energized using electricity. When the gas reaches a critical energy level it emits infrared (invisible) radiation, i.e. the laser beam; this phenomenon is similar to a fluorescent light tube.

Infrared radiation is essentially heat and the laser beam is a very intense beam of heat. As with all appliances that generate intense heat, lasers must be treated with respect, particularly where your eyes are concerned.

There are a number of factors that affect how the laser performs, in particular, temperature. This affects the mechanical stability and efficiency of the laser; excessive heat causes mechanical distortion, which affects the laser beam quality and impairs the

gas' performance. However, the laser control system cuts out should the temperature exceed the specified range. The FB Series Laser Cutters are supplied with a water-cooling system, which circulates cooled water through the body of the laser. The cooling unit maintains the laser at its optimum operating temperature.

## The FB Series Laser Cutter

A laser is often the only means of effectively cutting certain types of materials. A knife cutter may cope with some materials but the blades can have a very short life.

The FB Series Laser Cutter has been designed to produce computer generated graphic shapes of great complexity and accuracy on synthetic and natural fabrics. It is classified as a Class I laser product, with its power source being supplied by a Class IV CO<sub>2</sub> embedded laser.

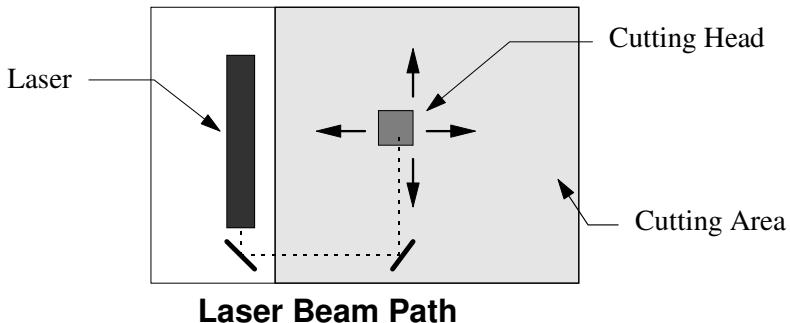
The laser cutter has the following features:

- Variable material widths up to 840mm (33") for the 700 Series and 1560mm (61") for the 1500 Series.  
(Maximum cutting width 725mm (28.5") for the 700 Series and 1470mm (58") for the 1500 Series)
- DM/PL\* software protocols
- Communication with host computer via standard serial RS-232-C or parallel interface
- 6-key control panel
- Resolution - 0.025 mm (0.005")
- Variable cutting speeds from 10 mm/s to 600 mm/s (0.4"/s to 24"/s )
- High-precision, stepless laser cutting

## Description

The laser is mounted horizontally in the left hand pod of the laser cutter. The beam path is dependent upon whether a

beam expander is used. The beam expander effectively cleans up the laser beam and produces a uniform beam of around 12mm (0.5"). The beam expander produces a higher quality cut and is supplied as an option for all of the FB Series Laser Cutters. The laser beam exits the laser towards a mirror mounted inside the left hand pod. If a beam expander is used, this is placed between the laser and this first mirror. This mirror deflects the beam through 90° exiting the left hand pod through a small aperture. The beam travels along the line of the main rails until it reaches another mirror which reflects the beam 90° horizontally again, causing the beam to travel along the line of the cross beam. Mounted on the cross beam is the laser head which contains another mirror and focusing assembly. The mirror deflects the beam vertically downwards and the lens focuses the beam into a spot approximately 0.1mm diameter on the laser bed.



Focusing the laser beam to 0.1mm diameter has the effect of concentrating all of the laser energy onto a very small area, which can produce temperatures in excess of 1000 °C. The high temperature causes the material directly under the laser beam to either vaporize or melt. This is the cutting process. Any vaporized or melted debris is drawn off by a fume extraction system.

## Cutting Materials

### WARNINGS:

- BEFORE COMMENCING ANY CUTTING PROCEDURE ENSURE THAT THE FUME EXTRACTION SYSTEM IS IN GOOD WORKING ORDER AND OPERATES CORRECTLY.
- SOME MATERIALS MAY PRODUCE HAZARDOUS FUMES IF CUT USING THE LASER - CHECK WITH THE MATERIAL SUPPLIER OR MANUFACTURER BEFORE CUTTING. ENSURE THAT ANY FUMES ARE EXHAUSTED IN ACCORDANCE WITH HEALTH AND SAFETY REQUIREMENTS.

The materials that can be cut are dependent on many factors and no 'golden' rules apply - the type of material, density and thickness are the determining factors. However, some material cutting data has been gained empirically and the table below gives an indication of the capabilities of the 10 Watt (FB710 & FB1510) and 25 Watt (FB725 & FB1525) type laser cutters. The 50 Watt and 100 Watt machines give the advantage of cutting thicker materials or at an increased throughput.

<b>Material</b>	<b>FB710 &amp; FB1510</b>		<b>FB725 &amp; FB1525</b>	
	<b>Engrave</b>	<b>Cut</b>	<b>Engrave</b>	<b>Cut</b>
Paper		◆		◆
Card				◆
Vinyl		◆		◆
Ruby & amber film		◆		◆
Retro-Reflective material		◆		◆
Sand blast masking material		◆		◆
Magnetic vinyls		◆		◆
Plywood 1mm	◆	◆	◆	◆
Plywood 3mm	◆		◆	◆
Balsa wood 1-3mm	◆	◆	◆	◆
Balsa wood 4-8mm	◆		◆	◆
Acrylic 3mm	◆	◆	◆	◆
Acrylic 6mm	◆		◆	◆
Glass	◆		◆	
Natural fibres		◆		◆
Man-made fibres		◆		◆
Stencil materials (Polyester Film)		◆		◆
Leather	◆		◆	◆
Rubber	◆		◆	◆
Parachute material		◆		◆
Air Bag Material		◆		◆
Mirror silvering	◆		◆	

## **Comparison of the FB Series Laser Cutter with Conventional Cutting Systems**

The most effective method of cutting system comparison is to compare the systems' effectiveness when cutting various types of material, e.g. reflective material, plastics, fabrics.

### **Reflective Material**

**Control** - When cutting heavy reflectives with a knife, the pressure normally has to be set to maximum. This can cause problems when there are large changes in velocity, i.e. moving from lines to tight curves. The FB Series Laser Cutter control system modifies the power output to suit the cutting speed (modulation), thus the power output is decreased when the cutter moves more slowly around complex areas of a design. This extra control enables the cut to penetrate just to the backing material however thick the material or complex the design.

**Sealing** - The laser uses heat to cut the material which actually helps to seal the cut edges, thus giving better protection against outside weather conditions. Cutting with a conventional knife or flat bed leaves gaps between the layers of the material which obviously causes problems if the material is used in poor weather conditions.

**Consistency** - Reflective material tends to blunt knife-cutting tools quickly because of the high cutting force required. This is expensive and can be a major source of downtime. The laser uses non-contact cutting. There is no tool deterioration or slippage due to high-pressure contact.

## Plastics

**Complexity** - The FB laser cutter has a focused beam diameter of less than 0.1mm. This enables the user to produce very complex and intricate work. A conventional router would have to use a very small tool, cutting at a very low speed at small depths to stop the tool from breaking.

**Versatility** - The FB Series Laser Cutters functions both as a router and an engraver, e.g. a complex design could be engraved at high speed on clear acrylic, then cut out at slower speed on the final pass. Traditional routers or engravers do not exhibit this versatility.

## Fabrics

**Penetration** - Control & Complex Shapes. The conventional fabric cutting methods, such as die-cutting and water jet, are unable to cut without breaking through the backing material. Complex designs that contain holes are also not feasible.

**Price** - Die-cutters and water jet cutters are expensive, however, the FB Series Laser Cutters use state-of-the-art technology, yet are still affordable.

**Versatility** - To accommodate the current market requirement for flexibility in production, the FB Series Laser Cutters bridge the divide between roll and flat bed technologies.

# **Individual Machine Setup**

## **FB400 - Machine Set Up Guide**

### **General**

The FB400 is the smallest machine in the CCT range and the laser power is currently limited to 10 Watts only by virtue of design and physical size. The floor space required for this model is only 90cms x 90cms including its built in fluid cooling system and fume extractor.

The machine also requires a PC to output data to the cutter, so thought needs to be given to a mobile desk or static platform as well.

This machine has a full keypad and display for operator inputs and general machine settings. Being small, the machine is fairly easy to keep clean and oiled, regular cleaning and oiling on a weekly basis is important to keep the machine cutting at maximum efficiency.

### **Specific Requirements**

- Floor space - 90cms x 90cms (not including PC).
- Concrete floor - (preferred but not essential).
- Effective overhead lighting.
- 220 Vac single phase supply x 3.
- 100mm diameter fume vent to outside of building (this should be kept as short as possible in all cases with due consideration of fume discharge path and adjoining properties).

### **Commissioning**

Having first decided on the most suitable fume-venting site, the machine can be placed in position. This model requires

very little in the way of setup, being almost ready to use as delivered. The machine is levelled with the jacking feet, filled with water and the mains supplies provided to PC, cutter and fume extractor. With the software loaded on the PC, test cutting can begin. The normal communication speed for the cutter is 38400 baud. This machine has a vented, perforated bed surface.

# **FB700 - Machine Set Up Guide**

## **General**

The FB 700 series is the most popular size cutter in the model range. The cutting field area is approximately 990mm x 730mm. This machine can be fitted with and/or upgraded with the following laser systems:

1. 10 Watt ULS Laser - refrigerated fluid cooled.
2. 30 Watt ULS Laser - air cooled.
3. 50 Watt ULS Laser - air cooled.
4. 100 Watt ULS Laser - air cooled.
5. 200 Watt Laser.
6. 400 Watt Laser.

## **Options**

- Beds - Plain planks, laser cut grid, honeycomb, planks/ramp/aperture. Double, side to side tray system with any of the above bed type options.
- Roll feeder axis (Quality silicon faced drive rollers).
- Conveyor bed (vented slat type or full slats).
- Conveyor bed (seamless honeycomb surface).
- Rear fabric roll stand for above.
- Solenoid operated gas nozzle purging.
- Fume extraction - cross bed flow or vented bed, or both.
- Optically assisted cutting with camera on cutting head.
- Standard or large fume extractor motor/fan.

The machine also requires a PC to output data to the cutter, so thought needs to be given to a mobile desk or static platform.

This machine has a full keypad and display for operator inputs and general machine settings. Being small, the machine is

fairly easy to keep clean and oiled. Regular cleaning and oiling on a weekly basis is important to keep the machine cutting at maximum efficiency.

## **Specific Requirements**

- Floor space - 140cms x 140cms (not including PC or Cooler).
- Concrete floor (preferred but not essential).
- Effective overhead lighting.
- 220 Vac single phase supply x 3.
- 150mm diameter fume vent to outside of building (this should be kept as short as possible in all cases with due consideration of fume discharge path and adjoining properties).

## **Commissioning**

Having first decided on the most suitable fume venting site, the machine can be placed in position. The machine is firstly levelled in both X and Y planes. The cooler where fitted is filled and set up and its function/temperature range checked. The whole cooling system including laser tubes/joints must be checked for leaks. The laser beam path/alignment is set if required. The software is loaded to the PC and the entire machine checked for correct function.

Communication port speed is normally 38400 for the cutter.

# **FB1500 - Machine Set up Guide**

## **General**

The FB1500 series has a cutting field area of approximately 990mm x 1460mm. This machine can be fitted with and/or upgraded with the following laser systems:

1. 10 Watt ULS Laser - refrigerated fluid cooled.
2. 30 Watt ULS Laser - air cooled.
3. 50 Watt ULS Laser - air cooled.
4. 100 Watt ULS Laser - air cooled.
5. 200 Watt Laser.
6. 400 Watt Laser.

## **Options**

- Beds - Plain planks, laser cut grid, honeycomb, planks/ramp/aperture. Double, side to side tray system with any of the above bed type options.
- Roll feeder axis (Quality silicon faced drive rollers).
- Conveyor bed (vented slat type or full slats).
- Conveyor bed (seamless honeycomb surface).
- Rear fabric roll stand for above.
- Solenoid operated gas nozzle purging.
- Fume extraction - cross bed flow or vented bed, or both.
- Optically assisted cutting with camera on cutting head.
- Standard or large fume extractor motor/fan.

The machine also requires a PC to output data to the cutter, so thought needs to be given to a mobile desk or static platform.

This machine has a full keypad and display for operator inputs and general machine settings

Being larger in terms of bed size the machine requires more regular cleaning.

Oiling on a weekly basis is important to keep the machine slides moving freely.

## **Specific Requirements**

- Floor space - 210cms x 140cms...(not including PC or Cooler).
- Concrete floor (preferred but not essential).
- Effective overhead lighting.
- 220 Vac single phase supply x 3.
- 200mm diameter fume vent to outside of building (this should be kept as short as possible in all cases with due consideration of fume discharge path and adjoining properties).
- 3-phase outlet if using large fume extractor blower.

## **Commissioning**

Having first decided on the most suitable fume venting site, the machine can be placed in position. The machine is firstly levelled in both X and Y planes. The cooler where fitted is filled and set up and its function/temperature range checked. The whole cooling system including laser tubes/joints must be checked for leaks. The laser beam path, beam expander and alignment is set as required.

The software is loaded to the PC and the entire machine checked for correct function.

Communication port speed is normally 38400 for the cutter.

# **FB1800 - Machine Set up Guide**

## **General**

The FB1800 series has a cutting field area of approximately 990mm x 1800mm. This machine can be fitted with and/or upgraded with the following laser systems:

1. 10 Watt ULS Laser - refrigerated fluid cooled.
2. 30 Watt ULS Laser - air cooled.
3. 50 Watt ULS Laser - air cooled.
4. 100 Watt ULS Laser - air cooled.
5. 200 Watt ULS Laser.
6. 400 Watt Laser.

## **Options**

- Beds - Plain planks, laser cut grid, honeycomb, planks/ramp/aperture. Double, side to side tray system with any of the above bed type options.
- Roll feeder axis (Quality silicon faced drive rollers).
- Conveyor bed (vented slat type or full slats).
- Conveyor bed (seamless honeycomb surface).
- Rear fabric roll stand for above.
- Solenoid operated gas nozzle purging.
- Fume extraction - cross bed flow or vented bed, or both.
- Optically assisted cutting with camera on cutting head.
- Standard or large fume extractor motor/fan.

The machine also requires a PC to output data to the cutter, so thought needs to be given to a mobile desk or static platform.

This machine has a full keypad and display for operator inputs and general machine settings

Being larger in terms of bed size the machine requires more regular cleaning.

Oiling on a weekly basis is important to keep the machine slides moving freely.

## Specific Requirements

- Floor space - 240cms x 140cms (not including PC or Cooler).
- Concrete floor (preferred but not essential).
- Effective overhead lighting.
- 220 Vac single phase supply x 3.
- 200mm diameter fume vent to outside of building (this should be kept as short as possible in all cases with due consideration of fume discharge path and adjoining properties).
- 3-phase outlet if using large fume extractor blower.

## Commissioning

Having first decided on the most suitable fume venting site, the machine can be placed in position. The machine is firstly levelled in both X and Y planes. The cooler where fitted is filled and set up and its function/temperature range checked. The whole cooling system including laser tubes/joints must be checked for leaks. The laser beam path, beam expander and alignment are set as required.

The software is loaded to the PC and the entire machine checked for correct function.

Communication port speed is normally 38400 for the cutter.

# **Extraction System**

## **Description**

The vacuum extraction system removes the cutting fumes from the vicinity of the cutting point. The fumes are drawn across the bed of the laser cutter and enter the three 50mm bore diameter flexible hoses beneath the machine on the left hand side, before being exhausted through a 150mm bore diameter flexible hose.

## **Extraction Unit Checklist**

Before using the cutter the following components of the extraction system should be checked for cleanliness and all faults corrected:

- Hose inlet spigot tube (situated on underside of the cutting bed).
- 50mm diameter bore hose between cutter and extraction unit.
- 150mm diameter bore hose to outside of building.
- Ensure that all the hose and pipe connections are intact.
- Ensure that all the flexible pipes are free of any kinks or severe bends.

## **WARNINGS:**

BEFORE COMMENCING ANY CUTTING PROCEDURE  
ENSURE THAT THE FUME EXTRACTION SYSTEM IS IN  
GOOD WORKING ORDER AND OPERATES CORRECTLY.  
SOME MATERIALS MAY PRODUCE HAZARDOUS FUMES  
IF CUT USING THE LASER - CHECK WITH THE MATERIAL

SUPPLIER OR MANUFACTURER BEFORE CUTTING.  
ENSURE THAT ANY FUMES ARE EXHAUSTED IN  
ACCORDANCE WITH HEALTH AND SAFETY  
REQUIREMENTS.



**4 KW 3 Phase @ 480Vac Speed Controller**

Essential controller to control the speed of the main server fan unit, this device gives full control of the motors speed from zero to maximum.

## Maintenance of All Fan Units

Periodic maintenance will need to be carried out on the fan blades. The frequency of cleaning to some extent is dependant on the types of material being cut and the types of residue they produce. Before doing any maintenance ensure for your own safety that the fan unit is isolated from the mains supply.

As can be seen in the picture below, the fan enclosure/ over is retained with screws. Removal of the cover will allow access

for cleaning of the fan blades. Cleaning is easier using a short stiff bristled brush (such as an old toothbrush for example) combined with a vacuum cleaner. It is advisable to wear a mask to prevent inhalation of dust/residue etc.

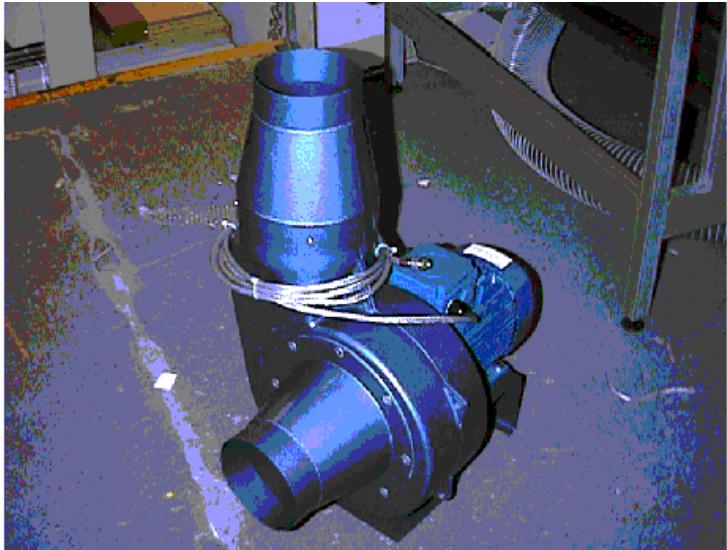
The fan blades are cup shaped in section, and over time will fill with dust/residue. This will impair performance and reduce airflow.

Efficient fume removal is essential to minimise cleaning of the moving parts within the cutting area and also for health and safety reasons.

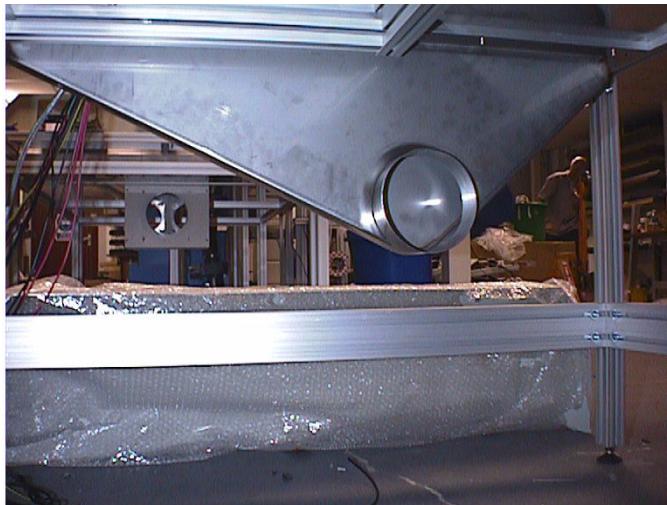


**MK2 Single Port Fume Extractor Fan**

This type of unit can provide a vacuum under the surface of a vented bed or it can be used in a side exhaust configuration. Honeycomb plank or conveyor system is typical. This unit takes cutting fumes directly from the cut down and beneath the bed surface, efficiently removing the fumes and providing surface pressure vacuum clamping for the work-piece. The unit is inverter controlled from zero speed to maximum.



**Mk2 2KW Single Port Fan Unit**



**Exhaust Manifold (side takeoff) single large bore type.**

This type of manifold allows more effective airflow to purge the fumes from the cutting area within the machine. It has a single large diameter port feeding directly into the fan. Care should be taken to prevent large pieces of fabric waste etc. entering

the ductwork and getting into the fan/rotor.



Under bed view of vacuum table showing the 2 into 1 manifold, one bed port only in view (15 Series machine). This arrangement gives a more equal vacuum to each side of the large table. One side may be blanked if desired to increase vacuum on one side of the table only.

# **Chillers/Air Cooled**

## **Air Cooled Laser Systems**

### **General**

Air-cooled laser systems are cooled by an electric fan or series of fans. The fans are usually an integral part of the laser tube housing and are designed and fitted by the laser manufacturer. When using an air-cooled laser system it is advisable to ensure that the machine and laser system are working in a favourable environment. Some guidelines are listed below:

- Ambient air temperature between 16 °C and 20 °C.
- Clean floor/work area around the machine.
- Filtered air for working area (to remove dust/lint etc.).

The above conditions are basically what an air-conditioned environment would offer. While the machine will operate in a non air-conditioned environment, an air-conditioned environment is preferred.

### **Maintenance**

Ensure the machine is isolated from the mains before removing any covers etc.

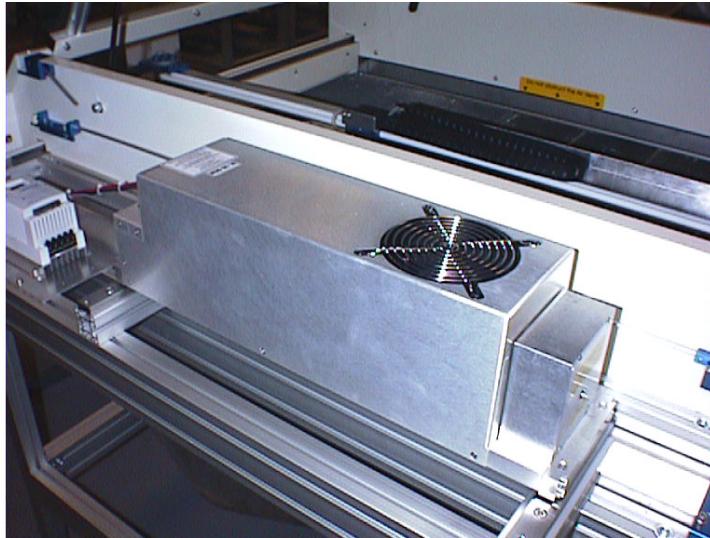
It is advisable to periodically inspect the laser and its enclosure for collection of dust and lint etc. This is also a good opportunity to clean and lubricate the shutter mechanism and check that the micro switch interlock is operating OK.

Cleaning the exterior of the laser tube should be carried out using a powerful industrial vacuum cleaner with a small nozzle fitted. This should enable you to remove any dust or lint, which inevitably will gather over the course of time. It is not advisable to remove the laser's outer covers to clean the air ducts since this will necessitate removal of the tube from its mount. This will affect beam alignment to a small extent.

If you have to remove any of the laser tube covers to remove lint etc, be aware of any seals, which may affect the warranty of the tube itself. If the seals are broken then the warranty is void.

If the laser tube is fitted with a beam expander and you wish to clean the primary optic, proceed with caution. Ensure that you can mechanically refit the expander after cleaning exactly where it was originally situated.

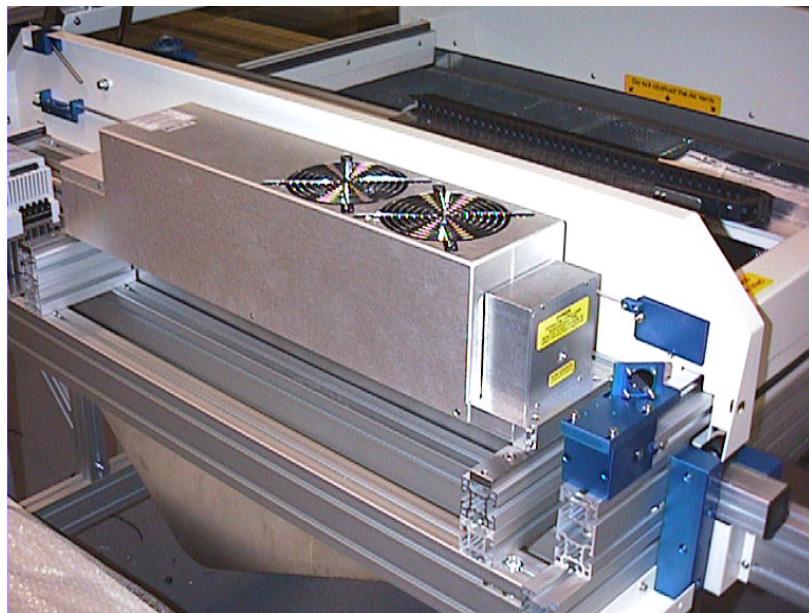
This is simple when the expander is fitted to a screwed holder. Release the thin locking ring first and then unscrew the beam expander. Alternately, the expander may be held via a cup clamp arrangement. Simply remove the 2 M5 bolts on the upper clamp and remove the expander. The primary mirror can also be carefully removed for cleaning if necessary or it can be cleaned in situ using a cotton bud. Ensure the mirror-retaining clip has a slight bend in it to give spring pressure to the mirror. Never, under any circumstances use compressed air in an attempt to clean the laser cutter.



**Universal 30 Watt Air Cooled Laser System**

The previous picture clearly shows the position of the cooling

fan. The 50Watt system is very similar except the laser is longer and has a pair of fans. The fans are dynamically balanced and in order to remain free from vibration it is recommended that the wire finger guards are removed in order to clean the guard and the fan blades simultaneously. To do this, carefully remove the four screws at each corner, and lift off the finger guard. You can now clean each blade of the fan quite easily. Now check that the exit duct is clear of debris. The airflow exit is at the opposite end to the laser's output window. It must be clear to allow the free passage of air for efficient cooling.

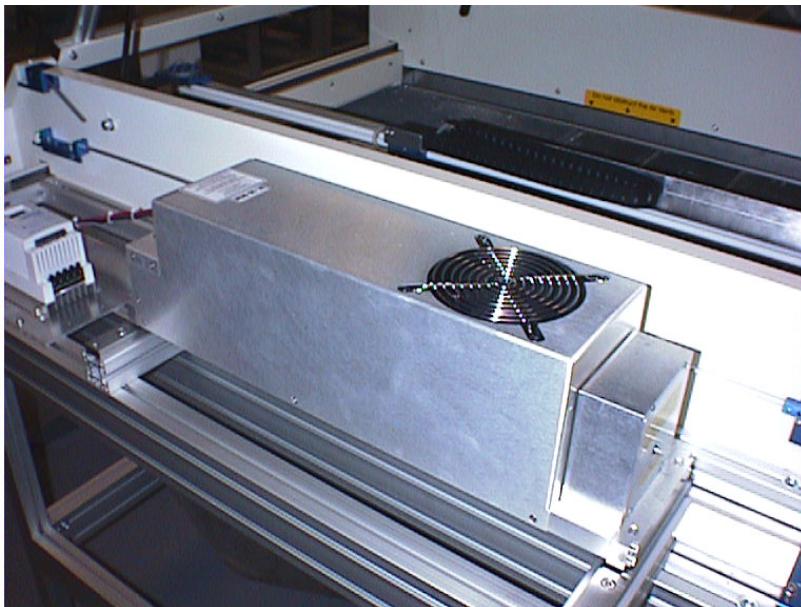


**Universal 50 Watt Air Cooled Laser**

# **Lasers**

## **Laser Types**

Laser Systems for FB Series Machines - General Information

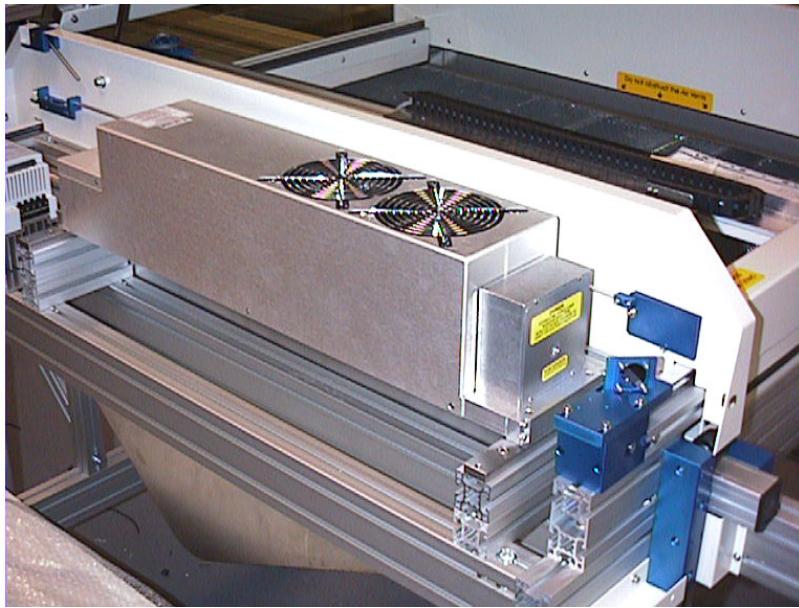


**30 Watt Universal Air Cooled Tube**

Operating voltage = 48Vdc

Frequency = 5 khz register 10 = 800

Tickle pulse, none required from control system = Onboard,  
register 64 = 0



**50 Watt Universal Air Cooled Tube**

Operating voltage = 48Vdc

Frequency = 5 Khz register 10 = 800

Tickle pulse, none required = Onboard. Register 64 = 0

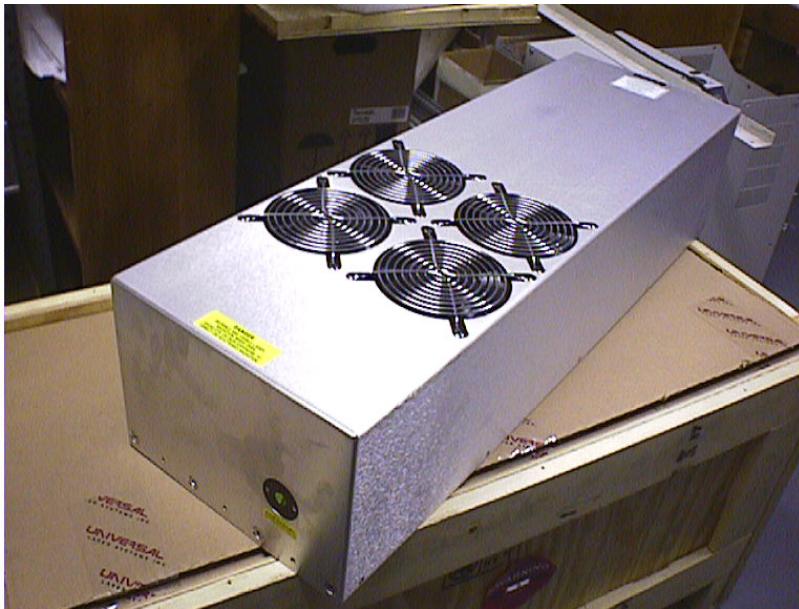


**10 Watt Synrad Water Cooled Tube (no water tubes fitted)**

Operating voltage = 30 Vdc

Frequency = 5 KHz register 10 = 800

Tickle pulse, 1 micro sec @ 5 KHz = Register 64 = 4



**100 Watt Universal Air Cooled Tube**

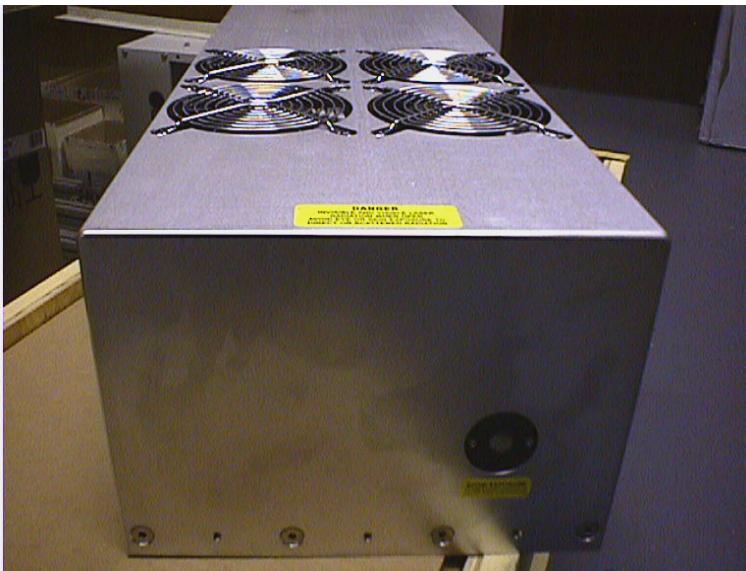
Operating voltage = 48Vdc

Frequency = 5 khz register 10 = 800

Tickle pulse, not required = Onboard,register 64 = 0



**100 Watt Universal Air Cooled Tube (view from rear)**  
Air exit grill may be removed for cleaning if required.



**100 Watt Universal Air Cooled (note removable output window)**

## **100 Watt Coherent Fluid Cooled System**

Operating voltage = 48 Vdc

Frequency range = 1 Khz to 20Khz register 10 = 4000 to 200

Tickle pulse, not required = Register 64 = 0

**Note -** This laser system is always fitted with a beam expander due to the high divergence angle of the beam.

# **Options**

## **Roll Feed**

### **General**

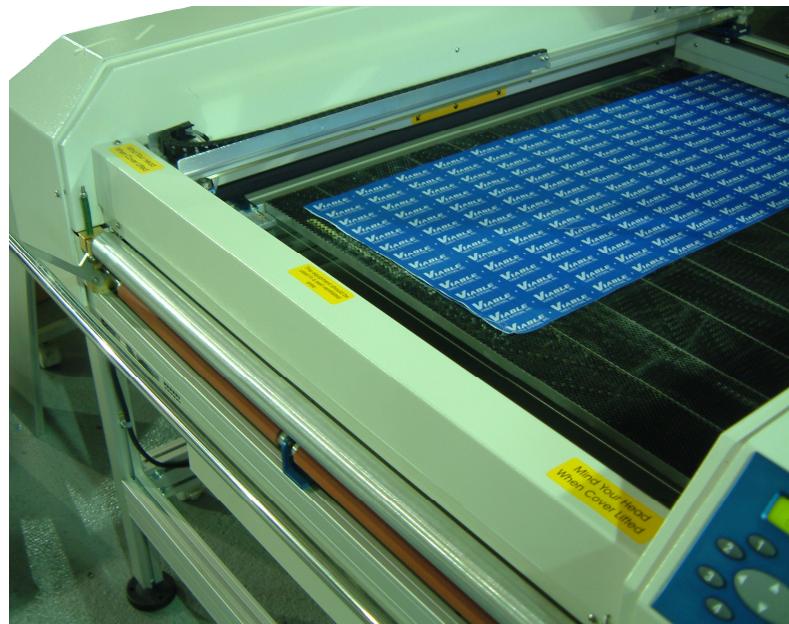
The roll feed attachment may be fitted to either the 700 series or 1500 series machines. As the name implies, this axis is used to feed materials automatically through the bed of the machine. This leaves the operator free to carry out other duties while the machine has media to cut. Since the media is usually flexible, it is normally in roll form enabling a large amount of material to be fed to the machine automatically as the machine requires it.

The device is very simple in nature, comprising of a pair or four Silicon faced rollers, which drive the media through the machine. Above the drive rollers is the spring loaded pressure roller. The media is trapped between the pressure and drive rollers in order to feed it. The drive rollers are driven by a precision encoded servo motor and epicyclic gearbox giving a lash free smooth mechanism. This system may also be retrofitted fairly easily should the customer require it at a later date.

It is usual for the media to be laminated with a paper carrier with or without adhesive transfer in order to facilitate continuous unmanned cutting, the media being cut only and not the paper it is mounted upon. This of course makes for a very effective cutting process with little or no operator intervention.

The FB Laser can be fitted with an optional roll-feed mechanism allowing fabric and non-rigid material to be automatically advanced through the machine. *Figures 1 & 2* show the roll-feed mechanism, which consists of drive rollers on the bottom and a free running smooth pressure roller on top.

**Figure 1 – FB700 Roll Feed System**



**Figure 2 – FB700 Roll Feed System**



Cut Part Collector Bin

The figures above show how to load fabric into the roll-feed mechanism. The operating bar is pulled down, locking in place and lifting the smooth pressure roller approximately 6mm above the drive rollers. Fabric can now be inserted between the two rollers, either from the front, if the fabric is to be pushed or from the rear if the fabric is to be pulled. For most applications it is recommended that the fabric is pulled, and so the material is loaded from the back of the machine. The roller is lowered by pushing the Operating Bar forward until it locks in place. This will then grip the material between the two rollers allowing it to be transported. The pressure between the two rollers can be adjusted, if necessary, using the adjustable pressure spring, and these are supplied with a nominal spring load.

An additional roller and support assembly can be supplied for mounting at the rear of the machine to support a roll of fabric.

## Troubleshooting

With the machine turned off, the silicon-faced rollers are fixed by grub screws. In the event of uneven feeding you may want to check that all grub screws are secure on the shafts. Raise the pressure roller and try to turn the driveshaft by hand, grasping one of the silicon rollers furthest from the motor and gearbox and turning it. Loss of transmitted rotary motion will be obvious if you look carefully. Simply tighten the screws ensuring that the flat on the shaft is at 90° to the grub screw. This is important. If all is OK, but the machine still feeds askew check that the material is free to move through the bed without obstruction. Now check that the pressure roller is closing evenly onto the drive rollers with no gaps and sufficient downward pressure. The pressure may be increased by turning the M5 nuts in a clockwise direction until an even pressure across the roller is obtained giving a good grip on the media being fed.

Fitted between the drive shaft and gearbox is a flexible, self aligning coupler, blue in colour. This is also retained using grub screws. In the event of lash in the system you may want to check these screws for tightness/drive.

In the event your roll feeder does not work when expected, firstly ensure you have selected the correct cutter driver for your particular model of machine. For instance, FB725 sheet/roll and that the roll feed is switched on in the cutter set-up. The small black dot indicates that the device is switched on.

Do not remove the motor and gearbox until you have concluded that there is something wrong with either the motor or its encoder or its associated cables.

If the control system beeps after attempting to move the feeder axis, it is fair to assume something is wrong with the encoder or indeed its motor but this is not always the case.

Check out the encoder lead and the two pole power wire supplying the feeder motor. This can be done with an ordinary electrical meter using its continuity function. Proceed with care

and check through the plugs.

Referring to the circuit diagram, swap the Y-axis outputs with the feeder axis cables and switch on the machine. If all is OK, then the rollers will rotate until they are gripped by your hand and prevented from turning. At this point the X-axis will drive to its normal position and the machine will go online as normal. If this is the case, nothing is wrong with the feeder motor or its encoder. If the machine fails to go online and it is obvious something is wrong with the feeder motor and/or its encoder, proceed as follows to remove the motor and gearbox: -

1. Slacken the grub screw in the blue coupler. Unplug the 5-pin Encoder lead. Unsolder the clear and blue wires from the motor noting their polarity/position. Using an open ended M5 spanner slacken and remove the entire gearbox/motor assembly.
2. Now remove the 4 M3 countersunk screws from the periphery of the epicyclic gearbox. With the encoder uppermost, slowly slide out the motor from the gearbox taking care not to disturb the gears within. You should now have the faulty motor/encoder in your hand.
3. Remove the drive pinion from the motor shaft, or if it is just loose apply blue Loctite to the grub screw and refit it. Note the pinions position on the motor shaft - it should be flush with the end. This is important. Now remove the alum spacer that sits between the motor and gearbox (imperial Allen key), and place the faulty motor/encoder to one side.

To refit a new motor/encoder, follow the above procedure in reverse.

## **Slat Conveyor**

### **General**

The conveyor table may be fitted to either the FB700 or FB1500 series machines. This option is usually built into the machine at the factory. The table surface is metal chain driven for durability and laser proofing

This moving table can be provided with a choice of surfaces depending upon customer requirements.

- Full width slats (no under venting)
- Narrow slats (vented)

The chain drive is sprocket driven from the front of the machine via an epicyclic gearbox and precision servo motor/encoder. This motor and gearbox is usually located outside the table on a 700 series machine under the keypad. On the larger 1500 series machine the gearbox/motor is located under the slats/surface in the centre/front of the table. Access is gained by removing a few of the slats. It is then fairly easy to adjust/remove the motor and gearbox from the machine if necessary.

### **Maintenance of Slat Conveyor**

The surface of the slats require regular cleaning.

Some materials leave a worse cutting residue than others and different cleaning solutions may be required. The slats are made from aluminium strip and a smooth or polished surface is desirable. This will make cleaning considerably easier.

The slats may be removed for cleaning if required. Simply remove the countersunk retaining screws. This will enable the strips to be soaked in a cleaning solution of your choice. Under no circumstances should large amounts of cleaning fluid be used on the slats if they are fitted to the machine. Be aware of the position of the feed motor and gearbox for the conveyor.

This unit will not tolerate being splashed with fluid of any kind. If solvents are used, please observe the manufacturer's safety recommendations and guidelines. Solvents are generally very flammable. When the slats have been removed, the opportunity to inspect and lubricate the chains and sprockets will present itself. The chains and sprockets may be cleaned and lubricated with a medium to heavy oil. The belt drive from the gearbox may also be cleaned and inspected at this point. Re-fit the slats when satisfied all is in order.

## **Honeycomb Conveyor**

### **General**

The honeycomb conveyor table is a factory fitted unit. This type of moving bed surface is particularly useful as it gives a very low contact area and also a vacuum-clamping surface. Both of these features are considered highly desirable to aid cutting without marking, enabling gas flow through the cut. This feature also has the effect of driving the cutting fumes through the bed surface and directly into the fume extractor. Continuous throughput of the work is also possible.

It is most important that heavy objects are not used over or near the bed surface. Due to the nature of the honeycomb construction it may become damaged if a heavy object is dropped onto its surface. Please ensure your operator takes adequate precautions to prevent this.

The bed surface is very lightweight, and as such the load on its drive mechanism is also very light. The drive mechanism is very durable and should have a very long life during normal use.

## **Maintenance**

Over a period of time the bed surface and the pockets will become contaminated with the material that has been cut. In order to maintain clamping and clean cutting, periodic cleaning will be necessary. Due to the large surface area of the bed this should not be too frequent. Gentle use of compressed air may be used to clear light ash particles or better still a powerful local nozzle type vacuum cleaner, but if adhesives have been cut then a different approach is required. If you have been cutting materials coated with heat sensitive adhesives then a hot air heat gun has been proven to remove the residue very well. If solvents are used, the normal precautions will need to be taken.

## **Honeycomb Bed Maintenance**

CadCam Technology provides machines with static and moving Conveyor table surfaces. The advantage of a honeycomb surface is that the contact area of the work-piece is very low and that the bed surface may also be used with an underflow vacuum to extract fumes and provide a degree of clamping of the work. The under-bed vacuum also encourages the passage of inert gases, if used to flow through the cut as it takes place. The use of Nitrogen gas, for example can reduce edge marking considerably with a honeycomb bed on materials which, for example are white in colour and vulnerable to marking.

## Cleaning the Bed Surface

If the material being cut has been laminated with a heat sensitive adhesive then some of this adhesive will, over the course of time become stuck to the pockets and will need removal periodically. Removal of this adhesive is quite easy by using a heat gun. Most heat guns are capable of 600 °C but you will not need to use this much heat. Either turn down the temperature or hold the gun at a distance from the honeycomb surface. The adhesive will melt and turn into a liquid and run out of the pockets. If you continue to apply heat it will start to vaporise and produce a lot of smoke. Only use enough heat to melt the adhesive. Do not expose the delicate surface to excessive heat.

See the adhesive specifications for its melting point. Use a local fume extraction duct to take away the fumes when using a heat gun and take any other precautions you may feel are necessary.

The honeycomb conveyor system must not be subjected to liquid cleaners of any kind. This may cause problems with the electronics/motors within the table.

If the materials you have been cutting leave a dry ash residue, this may be cleared with the aid of compressed air. In the case of honeycomb bed planks, it is advised to remove these for cleaning away from the cutter itself.

You will need to clean the conveyor type bed whilst in situ. Take precautions; wear safety glasses and gloves when using pressurised air. Try to avoid blowing debris into the moving parts of the cutter.

The honeycomb planks are made entirely from Stainless Steel and as such are mildly resistant to corrosion. You may immerse them in a cleaning solution if you wish, but some form of forced drying is advised post cleaning to avoid corrosion.

## Using Cutting Gases

Cutting gases are sometimes used in conjunction with the honeycomb bed surface. The gas has three basic functions:

- The gas flows through the cut and acts as a flame retardant.
- The gas flow pushes the cutting fumes below the bed surface directly into the vacuum chamber, efficiently removing the fumes directly from the machine.
- The gas flows through the cut as it takes place, preventing oxidisation and edge marking significantly.

The popular gas used is Nitrogen. This is an inert gas and is generally readily available in pressurised bottles. Carbon dioxide may also be used for a similar result.

Some customers use compressed air instead if they have it. This will drive the fumes below the bed surface, which is desirable, although it does not prevent oxidising as effectively as the inert gases. It is a cheaper option than gas.

CadCam Technology can provide a solenoid operated gas valve to retrofit to your machine if it does not have one. This valve opens and closes automatically as the machine is in use, saving precious gas or compressed air when the machine is at idle.

The gas bottle will require a pressure/flow regulator of some kind, which may be obtained by your local gas bottle supplier. The gas inlet fitting on the cutter is a standard 6mm push fit/release.

Please note, all gases or compressed air must be filtered and dried. Oil or moisture in the gas will have an adverse affect on the lens coatings. Lenses and mirrors are not covered under the machine's warranty.

# Optical System

## Installation of USB Camera or MuTech Video and Grabber Drivers

In order to install the relevant drivers for the optical system you wish to use, place the ApS-Ethos CD into the CD Drive and select either:

OptoCut Mutech Support

Or

OptoCut USB Support



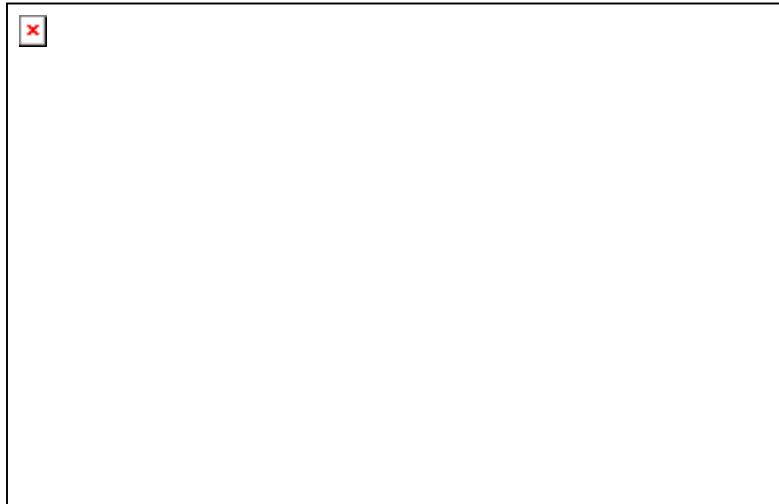
## Installation of ApS-Ethos Cutter Driver

Once the relevant drivers have been installed, Aps-Ethos can be started. When Aps-Ethos is started for the first time, you will be prompted to install a cutter driver. This can also be done by selecting the **Design** menu - **Cutters -Install Cutter**. This will display the install cutter wizard.

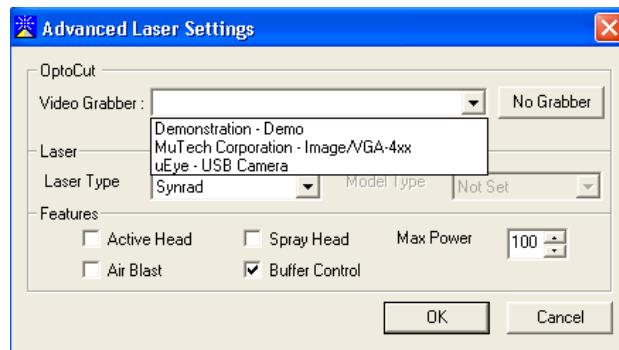


Select CadCam Technology as the manufacturer and then select the cutter model from the right and window e.g. Flat Bed Laser – 710 (Roll/Sheet). This can be selected as the default cutter if there is more than 1 cutter installed.

Press Next and the following form will be displayed:



This form gives details about the cutter, maximum sizes, port settings etc. Select **Next**. On the following Cutter Details form select **Advanced** to set the Video Grabber information. The Advanced Laser Settings form will appear select the required option from the list.



The Laser type should also be shown correctly. If there is an error displayed, then the drivers have not been installed properly.

## **Feed Tray**

This option is usually fitted when the customer has parts which are small in size and which then have to be removed by hand from the bed post cut cycle. Since the machine has 2 beds, parts can be removed whilst the other bed is being cut, eliminating off-line time. The tables are safety interlocked, disabling the laser system during table movements.

The bed frame is double size and slides in and out supported by wheels on the main machine chassis/frame. The beds are locked at extreme position by use of a pin and locking mechanism for each side. The beds can be fitted with plain planks, laser cut grids or honeycomb planks depending on customer requirements.

Fume extraction may be cross flow or under-flow depending upon the nature of the work.

The machine requires twice the normal floor space of a single bed machine.

The table is supported on long life nylon wheels that also have ball bearing inserts for easy table movement and durability.

Due to the simple nature of the table mechanism, this option rarely gives trouble during service and provides an alternative to the conveyor system.

## **Specific Requirements**

This device may be fitted to either the FB700 or FB1500 series of machines. Normally this option is fitted when the machine is built only, and is not retrofitted.

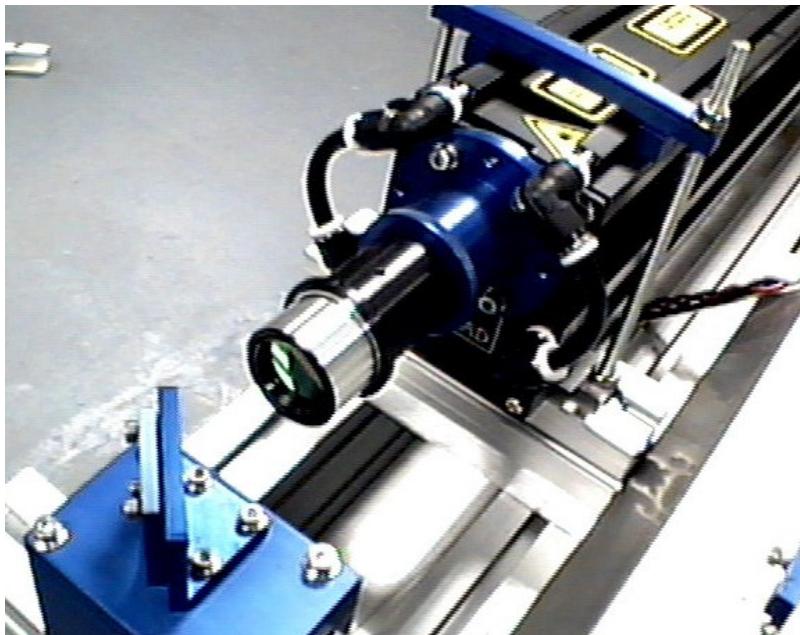
# Optical Components

## 25 Watt Synrad Laser fitted with Beam Expander

The beam expander may be removed for cleaning of the primary input lens. Simply release the thin blue locking ring and unscrew the Expander from its holder.

Note the position of the small grub screw in the body of the expander. This is the focus adjustment for the Expander, which is factory set. Do not attempt to adjust.

You can clean the larger, secondary output lens quite easily whilst the expander is in situ using a cotton bud and solution. Avoid removal of the Expander.



**2.5 x Beam Expander**

Correct orientation and cleanliness of all the optical components is essential to ensure efficient cutting.



**FB Series Mirror**

**Note** - The mirror-retaining clip should always have a slight bend in it giving sprung seating pressure to the mirror. The single clip retaining screw should never be tightened until the spring clip goes flat. This will mis-align the beam position. The gold beryllium coated face of the mirror is the reflective side. This should always face the beam.

# Irrigation

## Nozzle Purging - All Models

### General

The purpose of feeding ambient air or a gas such as nitrogen serves three main purposes. They are as follows:

1. To continuously purge the cavity between the lens underside and the beam outlet nozzle. This keeps the underside of the lens clean.
2. To provide a flow of inert gas through the cut as it takes place (honeycomb beds). This negates the oxidising effect of ambient air and in some materials prevents edge 'browning'.
3. When using a gas such as Nitrogen this can prevent flaring and burning and provides a measure of safety when cutting materials which are by nature flammable.

### Options

Unless specifically requested, machines are not fitted with a solenoid operated gas valve and are simply provided with a small diaphragm pump which provides ambient air to the cutting nozzle/lens cavity. This pump is usually fitted to the fume extractor fan or machine chassis, and becomes active during the cut cycle with the fan.

In order to use nitrogen or other exotic gases, it is strongly recommended that a valve is fitted, since the gas will run out very quickly otherwise.

In the case of a valve fitment, compressed air may also be substituted instead of gas or a mix of both from a source that the customer may have at his disposal. The only proviso is that the compressed air is dry and filtered and has no oil content.

This is essential if damage to the lens is to be avoided. Lenses will not tolerate oil or water of any kind and are not covered under warranty.

# Control Panel

## The Control Pad

The following figure shows the control panel of the FB Series Laser Cutters. The main functions of the liquid crystal display (LCD) and the control panel keys are explained in the following paragraphs.



## The Liquid Crystal Display

The 32-character liquid crystal display (LCD) contains two lines of 16 characters each. The LCD provides cutter status information during operations and displays menu options for the configuration of the cutter.

The contrast of the LCD can be adjusted from the control panel in order to ensure optimum readability under varying

lighting conditions.

The various menu and submenu items are always presented in a loop, which means that when the last menu or submenu item is displayed, pressing the appropriate key will automatically take you back to the first item of the same menu or submenu.

Next to the status messages and/or menu options displayed

on the LCD, arrow symbols representing the , , ,

 jogging keys and  key will tell you what keys to press to go to the next menu item (top line of the display) or to the next value for a given submenu item (bottom line of the display).

## The Jogging Pad

The use of the jogging keys varies according to the operation in progress.

For example, when working in the USER CONFIG menu, the

 or  jogging key is used to select the new user number and the  or  jogging key is used to go to the previous or next menu item.

The , , ,  Jogging keys are used to move the cutting head when in **off-line** mode and in **Set Media Area** mode.

## The Reset/Load Key

The  key (RESET/LOAD) is used to move the origin, to initiate a load sequence, to reset the cutter, to abort the cut in progress or to recut the last file. When the  key (RESET/LOAD) is pressed, the cutter goes off line, suspends all operations in progress and displays the RESET/LOAD menu. Press the  key until SET ORIGIN, LOAD, RESET, ABORT or RECUT is displayed. To confirm RESET, ABORT

or RECUT press the key (ENTER). To execute the SET ORIGIN instruction move the cutting head origin using the , , jogging keys and press the key (ENTER) to confirm the new origin position. Upon termination of any of these instructions, the cutter goes on line again.

The SET ORIGIN instruction is used to move the origin.

The LOAD instruction is used to initiate a load sequence.

The RESET instruction performs a complete reset of the cutter.

The ABORT instruction simply cancels the cut in progress.

Aborting a cut will not reset the cutter parameters: the parameters that had been selected for the cut remain in effect.

The RECUT instruction recuts the last file sent to the cutter (provided that it fitted into the buffer).

When using the multiple recut function the different copies will be cut in the media in such a way that there is only a minimal loss of media. To use the default area, do not press the Reset Load key.

## The On-line Key

The on-line key toggles between on-line and off-line operation.

Selecting off-line (the LCD display will show the selected mode) will suspend all operations in progress. Pressing the on-line key while the cutter is off-line will bring the cutter go on-line again, resuming the suspended operation.

While the cutter is off-line and the safety cover is closed, the following operations can be performed :

- Press the or jogging key to move the cutting head to the left or right.
- Press the or jogging key to move the

cutting head forward (towards you) or backward (away from you).

If the cutting head has been moved using the Jogging keys, pressing the  on-line key will move the head back to its original position and start cutting again.

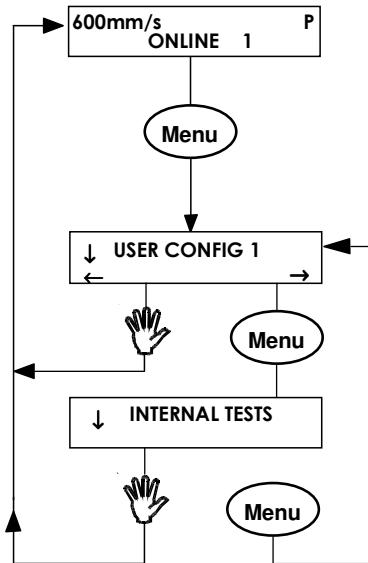
## Factory Spot-Mode

This is a special mode of operation for aligning the Laser and should not normally be used except by specialist engineers.

This mode is entered by pressing the UP and DOWN, ,  jogging keys rapidly in sequence. This will sound a number of BEEPS and put the Laser Cutter into Engineer Mode. If this mode is entered accidentally, press the  on-line key, which will put the cutter back into the normal mode or switch the cutter off and restart. Using this mode may result in damage to materials if not used by experienced personnel.

## The Menu Key

The Menu key is used to select one of the menus. Pressing the Menu key will make the cutter go off line and suspend all operations in progress. Pressing the Menu key repeatedly will display the different menus one by one. As the menu options are on a loop, pressing the Menu key when the last option is displayed will automatically return you to the first option.



## Flatbed Series Configuration Submenus

To select a menu by scrolling through the different options, press the jogging key.

To exit from the menus and resume the previous on line operation, press the key (ON LINE).

Under normal conditions, the cutter is on line; it may then be selected by the host computer for a cutting or plotting operation or deselected by the host computer. Pressing the , , or Menu key will make the cutter go off line, in order to initiate another operation.

MENU	DESCRIPTION
USER CONFIG 1	Selects the active cutter configuration from the set of configuration parameters stored in the unit's memory
INTERNAL TEST	Activates one of the resident

	cutting plots provided for informational purposes.
--	--

## Contents of the Menus

### The Enter Key

The  key (ENTER) is used to select the item currently displayed on the LCD.

### The 1 and 2 Keys

The use of the 1 and 2 keys varies according to the operation in progress; their use is displayed on the LCD as appropriate.

### The 3 Key

The 3 key is used while the cutter is off line to fire the laser. Pressing the 3 key once will prompt you to press 1 (yes) to turn on the laser or 2 (no) to exit. Pressing the 3 key again or going on-line will return the laser cutter to normal operation. If the head is not moved for approximately eight seconds, it is switched off automatically.

### The 4 Key

The 4 key is for expansion purposes and is not currently used.

## Normal Operation

### **WARNINGS:**

WHEN CLOSING THE SAFETY COVER ENSURE THAT NO FINGERS OR OTHER ITEMS CAN BE TRAPPED BETWEEN THE SAFETY COVER AND THE SIDE POD.

WHEN THE SAFETY COVER IS LIFTED CARE MUST BE TAKEN TO AVOID POSSIBLE HEAD CONTACT WITH THE

## RAISED COVER.

The term ‘normal operation’ covers on line operation, off line operation and local operation, i.e. the three types of operation for actual cutting or plotting. They are explained in further detail in the following paragraphs.

### On Line and Off Line

On line and off line are two important concepts when using the laser cutters. The cutter is on line only when the following message is displayed on the LCD display:

600mm/s	P
ON LINE 1	

This display message should be read as follows:

600mm/s = velocity

ON LINE = cutter is ready to receive data

1 = user number

In all other cases, the cutter is off line.

When on line, the cutter can be addressed by the host computer, which means that the cutter will execute cutting or plotting instructions issued by the host computer's application software. The host computer will first issue a SELECT sequence to the on line cutter, and the message ‘\*ON LINE’ will be displayed on the LCD. The asterisk indicates that the host is in communication with the cutter: i.e. the cutter is now ‘selected’ by the computer.

When the cutter is on line and ready to receive instructions from the host computer, it will remain de-selected until actual instructions from the computer are received. When the cutter is on line, but has not been selected by the host computer, the message ‘ON LINE’ is displayed on the LCD, without the asterisk.

For normal cutting operations, the cutter MUST be on line, so that it can receive instructions from the host computer and the cutting/plotting software.

To put the cutter on-line, ensure that the safety cover is closed and press the on-line key.

**Note** - If the safety cover is opened, the current operation will be suspended, similar to pressing the  on-line key.

However, the laser is switched off as soon as the cover starts to open, but the cutter head may continue to move for approximately 1 second. This will mean that the current item being cut will be faulty, not being cut on part of a vector.

Therefore, the recommended way to stop the machine is to use the  on-line key which will stop the cutting head and laser simultaneously at the end of the next vector, ready to go on-line again and continue cutting, ensuring that there are no faulty components.

When the cutter is on line, but has not been selected by the host computer, the following conditions must be met:

- The cutter must be powered ON.
- Media must be loaded. For detailed media loading instructions, see user's manual.
- The cutter must be connected to the host computer via a serial RS-232-C link.
- The cutter must be configured for the scheduled operation.

To put the cutter off line, press the  ,  or Menu key. Pressing any of these keys will suspend the current cutting/plotting operation until the cutter is put on line again.

## Local (Off Line) Operation

Local operation is only possible while the cutter is off line and the safety cover is closed. Local operation means that the

cutter is operated directly by the operator via instructions entered on the control panel.

To work in local operation mode, proceed as follows:

1. If the cutter is still on line, press the  key once to select off line. The media will move forward over a certain distance.
2. To move the cutting head to the left or right, press the  or  jogging key.
3. To make the cutting head move forwards (towards you) or backwards (away from you), press the  or  jogging key.
4. To fire the laser, press the 3 key followed by the 1 (yes) or 2 (no) key. To turn the laser off, press the 3 key.
5. To end local mode and put the cutter on line again, press the  key.

## The User Config Menu

The USER CONFIG(uration) menu gives access to different submenus which allow you to configure the cutter's operating parameters. It should be taken into account that access to some of the submenus will be determined by the plotting language you are using.

To select and alter a configuration parameter, proceed as follows:

1. Power on the cutter.
2. Press the Menu key until USER CONFIG 1 is displayed.
3. Press the  or  jogging key until the desired submenu is displayed on the first line of the LCD.
4. Press the  or  jogging key until the desired value is displayed on the second line.
5. Press the  key to confirm the selection, an \* will be displayed next to the selected setting. (An \* is always displayed next to the active value.)

Menu entries 6.1 through 6.3 are over-ridden by software commands from the cutting software and are only used in manual laser firing mode.

## **Max Power**

The Max power submenu is used to set or modify the maximum power of the cutting system.

The maximum power can be set between 0 and 99%.

## **Power Band**

The power band submenu is used to set or modify the power band of the cutting system.

The power band can be set between 0 and 99%.

## **Down Velocity**

The DOWN VELOCITY submenu is used to set or modify the velocity of the cutting system when the laser is cutting (from internal plots only).

The default velocity is 600mm/s.

The velocity can be set between 10mm/s and 600mm/s.

## **Up Velocity**

The UP VELOCITY submenu is used to set or modify the velocity of the cutting system when the laser is not cutting or moving between cut shapes.

The default velocity is 600mm/s.

The velocity can be set between 10mm/s and 600mm/s.

## **Down Acceleration**

The DOWN acceleration submenu is used to set or modify the acceleration of the cutting system when the laser is cutting.

The default down acceleration is 0.5g.

The down acceleration can be set between 0.1g and a maximum set by the factory.

## **Up Acceleration**

The UP acceleration submenu is used to set or modify the acceleration of the cutting system when the laser is not cutting.

The default up acceleration is 0.5g.

The up acceleration can be set between 0.1g and a maximum set by the factory.

## **System Setup**

The SYSTEM SETUP submenu covers the menu items you normally only need when establishing the initial setup e.g. when you install the cutter in combination with the software you use.

Press the  key to access the different submenu items.

## **System Setup**

### **Concatenation**

The CONCATENATION feature increases the speed and quality with which cut data of a very high resolution is cut. However, when changing over to normal characters again, deactivate concatenation by setting this parameter to 0.

On the LCD, the active concatenation value is marked with an \*.

## **Smoothing**

The SMOOTHING feature helps to cut smoother curves when curve data with many short vectors is received from the computer.

The default setting is OFF.

On the LCD, the active setting is marked with an \*.

## **Emulate**

The EMULATE submenu is used to select the active cutting/plotting language for the cutter.

The Flatbed cutters support DM/PL , HP/GL and HP/GL/2.

On the LCD, the active plotting language setting is marked with an \*.

**Note** - The active cutting/plotting language MUST match the cutting software. Always select a language which is supported by the host computer's cutting software.

Whenever possible, select the DM/PL menu option to set the active cutting/plotting language to Houston Instrument Digital Microprocessor/Plotting Language (DM/PL). This selection will allow the cutter to operate with DM/PL-based cutting/plotting software. This language, having special command extensions for cutting, normally gives superior cutting performance.

## **Menu Units**

The MENU UNITS submenu allows you to select English or metric menu units for DM/PL. In HP/GL & HP/GL/2 the menu units are always in metric.

For all FB series laser cutters, metric units are the default setting.

On the LCD, the active menu units setting is marked with an \*.

## **Addressing**

The ADDRESSING submenu is used to select the cutter's default DM/PL user-addressable resolution. In HP/GL & HP/GL/2 the addressing is fixed at 0.025 mm.

The default addressing resolution is 0.025 mm.

The user-addressable resolution can be set to 0.025 mm or 0.1 mm.

On the LCD, the active resolution value is marked with an \*.

## **Baud Rate**

The BAUD RATE submenu is used to set or modify the operating baud rate for RS-232-C serial communications between your cutter and the host computer.

The default baud rate is 9600 bps.

The baud rate can be set to any of the following values: 2400 bps, 4800 bps, 9600 bps, 19200 and 38400 bps.

On the LCD, the active baud rate value is marked with an \*.

**Note** - The baud rate setting of your cutter MUST match the host computer's baud rate setting.

## **Parity**

The PARITY submenu is used to set or modify the byte format and parity type for RS-232-C serial communications between your cutter and the host computer.

The default parity setting is bit 8 = 0 (8 data bits, no parity, the 8th bit being a low bit). The parity can be set to any of the following values:

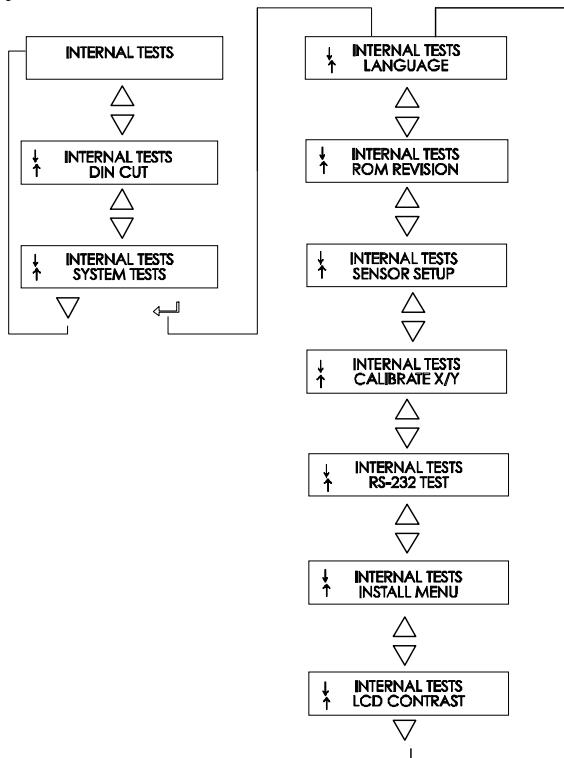
Normal setting at the Keypad for Parity is – None

It can also be set to Mark/Even or Odd.

# Internal Test Menu

To access any internal test, proceed as follows:

1. Power the cutter on.
  2. Load cutting media.
  3. Press the Menu key until INTERNAL TEST is displayed and press the  jogging key.
  4. Press the  or  jogging key until the desired internal test is displayed.
  5. To perform the test, press the  key.
- To exit from this menu and go to another menu, press the Menu key until the desired menu is displayed.
- To exit from the menus and put the cutter on line again, press the  key.



## **Internal Test Submenus**

### **Din Cut**

The DIN CUT also performs an electrical and mechanical test of the cutter, in order to check the cut quality.

This cut is always run as a DIN A4 portrait/A-size image, regardless of the actual size of the media loaded. If the media loaded is smaller than DIN A4/A-size, part of the outer box will be clipped (not cut). This cut is always executed in the sequence prescribed by the ISO DIN standard.

### **System Tests**

The SYSTEM TESTS submenu covers the menu items you only occasionally need to adjust the cutting process.

Press the  ENTER key to access the different submenu items.

### **System Tests**

**Caution** - The following test routines are restricted to CadCam Field Service Personnel.

The SYSTEM TESTS menu is a special set of procedures, which are not required for normal cutter operation. Field service personnel, however, will use the SYSTEM TESTS menu occasionally. When in SYSTEM TESTS, the cutter is fully operational and performs as described in this manual.

### **Language**

The MENU LANGUAGE submenu is used to set or modify the dialogue language on the LCD. Press the  or  jogging key until the desired language is displayed on the LCD and press  to confirm.

The information on the LCD can be displayed in English,

French, German, Dutch, Spanish or Italian.

## Rom Revision

Selecting the ROM REVISION option, by pressing the  key will furnish the details on the cutter's ROM revision. This information is often helpful to technicians when diagnosing problems over the telephone.

## Calibrate X/Y

Calibration allows the length of the lines cut to be adjusted to within the specifications.

For instance, if a cut line should measure 100 mm exactly, the cutter can be adjusted for any discrepancy.

## RS232 Test

The RS232 TEST routine verifies the cutter's RS-232-C serial communications (transmit data, receive data, and hardware handshaking) circuits. This test does not require pen, knife or media to be loaded.

To run the RS-232-C test, proceed as follows:

1. Unplug the RS-232-C data cable from the rear panel of the cutter.
2. Use a loop back test connector or cable to connect pin 2 of the cutter's data connector to pin 3 and pin 7 to pin 8.
3. With RS232 TEST displayed, press the ENTER key. The cutter will start transmitting and receiving data at all available baud rates and parity settings. The length of the transmissions will vary because of the different baud rates used. The unit then checks the hardware handshake lines.
4. Upon completion of the test, remove the loop back test connector.
5. Plug the RS-232-C data cable into the connector.

## Install Menu

The INSTALL MENU routine restores the factory-defined menu settings in all four USER CONFIG menus. This test routine can be performed without a tool and without media.

## LCD Contrast

The LCD CONTRAST submenu is used to adjust the contrast (or intensity) of the liquid crystal display on the control panel.

Press the or jogging key to increase or reduce the contrast and press to confirm.

## Loading & Cutting

### **WARNINGS:**

BEFORE COMMENCING THE ACTUAL CUTTING PROCEDURE ENSURE THAT THE FUME EXTRACTION SYSTEM IS IN GOOD WORKING ORDER AND OPERATES CORRECTLY.

SOME MATERIALS MAY PRODUCE HAZARDOUS FUMES IF CUT USING THE LASER - CHECK WITH THE MATERIAL SUPPLIER OR MANUFACTURER BEFORE CUTTING.  
ENSURE THAT ANY FUMES ARE EXHAUSTED IN ACCORDANCE WITH HEALTH AND SAFETY REQUIREMENTS.

WHEN CLOSING THE SAFETY COVER ENSURE THAT NO FINGERS OR OTHER ITEMS CAN BE TRAPPED BETWEEN THE SAFETY COVER AND THE SIDE POD.

WHEN THE SAFETY COVER IS LIFTED CARE MUST BE TAKEN TO AVOID POSSIBLE HEAD CONTACT WITH THE RAISED COVER.

WHEN THE LASER CUTTER IS OPERATING, DO NOT LEAVE IT UNATTENDED AT ANY TIME.

## **Laminating Flexible Materials**

Some flexible materials, e.g. fabric, can be laminated with a backing media, usually paper. Laminating has two major benefits:

- The material is stabilized and stiffened, which aids the material feed through the cutter, if the optional material feed is used.
- An adhesive backing can be put onto the material, which is used extensively for appliqué within the embroidery industry.

Other commercial materials such as vinyl and retro-reflective road-sign materials, which are already backed, can be cut with excellent weeding characteristics and none of the problems associated with mechanical cutting devices.

In order to obtain good cutting results using laminated materials, it is essential that the materials are laminated correctly thus providing a smooth, flat surface for cutting. Good laminating improves the cutting process and it is well worth developing good laminating techniques. Laminating machines are available through our offices and technical advice is available if necessary.

## **Loading Procedure**

Lift the acrylic safety cover.

Place the article to be cut on the bed-plate.

Lower the safety cover.

The material is now ready to have the media area specified, see the Control Pad Load Procedure.

## **Roll Loading Procedure**

Lift the acrylic safety cover.

If the optional fabric feed mechanism is being used, lift the roller and feed the fabric between the two rollers at the front of

the machine.

Ensure that the fabric is aligned correctly, i.e. flat and straight.  
Lower the pressure roller onto the fabric.

Close the safety cover.

The material is now ready to have the media area specified, detailed below.

## Control Pad Load Procedure

At the control pad, press the  Reset/load key until LOAD MEDIA is displayed and press the  key.

Use the , , ,  Jogging keys to move the laser cutter head to the new Origin, (the X,Y position of the cutting head will be displayed in the LCD display) i.e. lower left hand corner of the media area you wish to use and press the  key.

Use the , , ,  Jogging keys to move the laser cutter head to the extents of the media area, (the size of the media you are entering will be displayed in the LCD display) i.e. upper right hand corner of the media area you wish to use and press the  key.

This specifies the media area, and the cutter will immediately move back to the new Origin ready for cutting and go on-line. The laser cutter is now ready for on-line cutting operations.

## WARNINGS:

BEFORE COMMENCING THE ACTUAL CUTTING PROCEDURE ENSURE THAT THE FUME EXTRACTION SYSTEM IS IN GOOD WORKING ORDER AND OPERATES CORRECTLY.

SOME MATERIALS MAY PRODUCE HAZARDOUS FUMES IF CUT USING THE LASER - CHECK WITH THE MATERIAL SUPPLIER OR MANUFACTURER BEFORE CUTTING.

ENSURE THAT ANY FUMES ARE EXHAUSTED IN ACCORDANCE WITH HEALTH AND SAFETY REQUIREMENTS.

WHEN THE LASER CUTTER IS OPERATING, DO NOT LEAVE IT UNATTENDED AT ANY TIME.

**Note -**

The correct method of aborting a cutting process is to bring the cutter off-line using the  on-line key, then press  Reset/load key.

### **Checklist Before Cutting**

Familiarization with this checklist and the operation of the laser cutter and software should allow trouble-free use of the laser cutter. The objective of cutting laminated materials is, generally, to cut the work-piece but not to penetrate through the paper backing media. With a little practice this can be achieved by selecting the correct cutting speed and laser power level for the material and design shape.

It is possible to cut certain fabrics, which have been treated with a layer of heat sensitive adhesive, without laminating with paper backing media. This is largely due to the refined laser and speed control offered by the controlling software and extra rigidity due to the layer of adhesive.

**Material** - positioned squarely and tracking correctly during the input cycle.

**Media Area** - large enough for design.

**Design** - correct orientation for media area.

**Laser Setting** - correct cutting speed and laser power for the shape and material being cut.

**Drawing Item** - start/finish points in a favourable position and the cutting order correct.

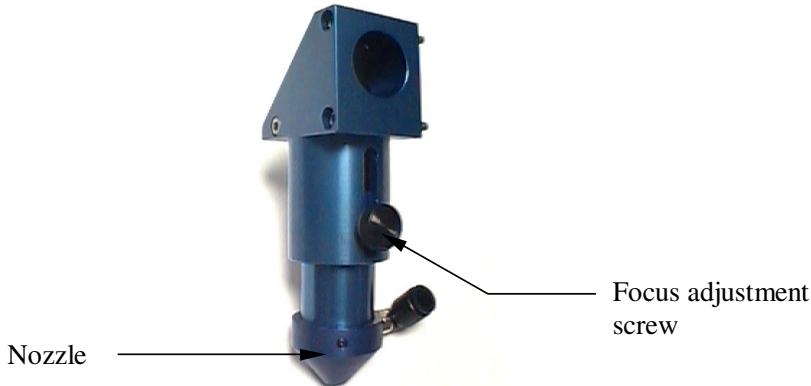
**Laser Cutter** - on-line and ready to accept data.

### **Note -**

The correct method of aborting a cutting process is to bring the cutter off-line using the  on-line key, then press  Reset/load key.

### **Focusing the Laser Beam**

The laser beam can be focused using the focusing mechanism on the cutting head. Slackening of the adjustment screw allows the lens carrier to be moved up or down in the cutting head, to suit its focal length. The nominal focus is when the distance between the end of the nozzle and the bed-plate is 8mm in the case of the conical nozzle and 20 - 21mm in the case of the flat-faced nozzle. When cutting thick materials the point of focus should be set within the top few millimetres of the material to be cut. This will allow the initial piercing of the material to be cut as the effective field of focus i.e. maximum power density is 2 -3mm. Above and below this point the power density is reduced.



**Laser Cutting Head Focusing Mechanism**

If two cuts are compared that were carried out at the same speed and laser power, etc. but different lens focus positions, then the deeper cut penetration indicates more accurate focusing.

**Note** - Slackening of the focus adjustment screw allows the lens carrier to be moved up or down to adjust the focus.

## Nozzle Gas Cutting - Aiming the Mirror on the Cutting Head

Machines fitted with a Honeycomb bed (metal or plastic) require careful aiming of the mirror on the cutting head. This is because the hole in the cutting nozzle is very small and the focused beam must exit this hole **without touching** the edges of the hole. This makes the focused beam perpendicular to the cutting bed and increases cutting efficiency. It also reduces the heat affected zone of the material you are cutting giving a nice clean result.

Nozzle gas cutting using compressed air regulated to an air pressure of 2 bar max is recommended, normally other gasses are not required, but Carbon dioxide may be used as a fire suppressant when cutting Acrylic or other flammable organic materials for example.

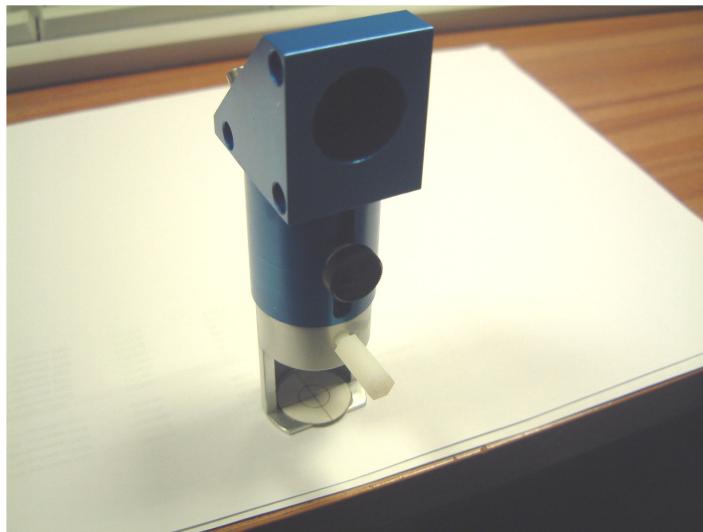
Included in the machine toolkit is a special tool to enable you to aim this mirror precisely (see *Figure 2*). This tool also requires a card target to see the path of the focused laser beam and makes a small hole when the laser is pulsed by hand from the machines keypad.

Lasers fitted with red pointers make this aiming operation simpler, however the laser should always be used to get a true picture of the cutting beam path. If your machine has a honeycomb bed, then using this nozzle arrangement and compressed air is essential for good cutting results. It also keeps the machine very clean by driving cutting fumes directly under-bed making fume collection easy.

See picture of high pressure cutting nozzle for use with Honeycomb beds only.

**Note** - To adjust the 3 mirror aiming screws you will need a ball ended 1,5mm Allen wrench.

*Figure 1*



**Cutting Head with Head Mirror Aligning Tool in Position**

*Figure 2*



**Close Up of Head Mirror Aligning Tool**

# General Maintenance

## Maintenance Introduction

The FB Series Laser Cutter has a number of sliding surfaces made of smooth metals and plastics. They are virtually friction-free and require little lubrication. They will, however, collect dust and lint, which may affect the performance of the cutter.

Keep the cutter as clean as possible. When necessary, clean the unit with a soft damp cloth. Do not use abrasives or solvent-based cleaners on the polycarbonate safety cover.

The maintenance and cleaning tasks are listed in the maintenance schedule, with the periods allowable between checks. However, the laser cutter should be checked thoroughly every time it is used, so that minor faults can be corrected without serious damage occurring.

## Maintenance Schedule

Task	Days	Weeks	Months	Other
Ensure that the fume extraction system is working correctly	1			Each time the cutter is used
Clean the cotton filter				As required, etc.
Change the cotton filter				As required, etc.
Clean extraction Fan impeller				As required, etc.
Check the cooler unit coolant level		1		
Clean the cooler unit		1		

external grills				
Clean the cutting head lens		1		
Clean the cutting head mirror			2	
Clean and grease all transport rails		1		
Check and, if necessary, clean the cutting head drive belt		1		
Clean the cutting bed plate				Check during use

The laser cutter is fitted with a centrifugal fan extraction system using bypass cooling (ambient air cools the motor rather than the exhaust fumes), which extracts and filters the cutting fumes from around the cut area. The fumes are drawn across the laser bed and down into the extraction pipe-work. Three 50mm (bore diameter) flexible hoses carry the exhaust fumes away from the cutter to the extraction unit. The motor draws the filtered air through the filter bag and expels it through a 102mm (bore diameter) flexible hose exhaust hose.

Assuming that there are no restrictions inside any of the pipe work, the main build up of residue will occur just inside the filter bag.

- Remove the three hoses from the extraction unit or from the underneath of the laser cutter.
- Let the Extraction System run for a short time and check whether a good flow of air is entering the unit, by checking the air flow into the unit through one of the three inlet hoses or spigots.

**Note** - If the air flow is high then the problem lies with a blockage further up-stream in the extraction system. If the airflow is poor then this indicates that the main body filter bag is blocked.

## **WARNING:**

IF LIQUID BASED CLEANERS ARE USED, ENSURE THAT THE UNIT IS COMPLETELY DRY BEFORE SWITCHING ON.

- Examine the impeller blades of the motor and clean if necessary.
- Reassemble the motor on top of the main filter body of the extraction unit, ensuring that the locating lugs in each corner are seated correctly.
- Fasten the 4 clips that hold the motor unit in place

**Note** - If the inlet and outlet fittings have been removed from the extraction unit, they can be replaced by pressing the hoses onto the necessary spigots.

- Connect the outlet hose to the outlet fitting at the top of the extraction unit.
- Connect the extraction unit to laser cutter power outlet.
- Insert the laser key and turn the key to **ON**.
- Press the **online** button on the control pad.
- Ensure that a good flow of air is entering through the inlet fitting at the base of the extraction unit.

**Note** - If the air flow is still poor then the filter bag must be replaced.

- Connect the inlet hoses to the extraction unit and also connect the hoses to the laser cutter as shown.

# Water Chiller Maintenance

A water chiller is normally supplied with a laser cutter that will be used under heavy duty or high ambient temperatures.

## Coolant Level

The coolant water level should be regularly checked at least once per week and topped up, as necessary, to the maximum level line.

## Grill and Cooler Matrix

**Caution** - Materials should not be draped over the cooler or items placed on it. Always ensure that air can enter the front grill and exit the unit unimpeded.

The exterior grill and cooler matrix of the machine should also be checked at least once per week and cleaned as necessary. Clean the cooler unit using a vacuum cleaner with a small nozzle. This will remove dust from around the grill and also clear the cooler matrix allowing an unrestricted flow of cooling air through the matrix.



Flowcool Cooler Unit (Front)



Flowcool Cooler Unit (Rear)

## Draining Procedure

- Turn the laser key to **OFF** and remove the key.
- Ensure that a water container with a capacity of at least 5 litres is available.
- Using a small screwdriver, release the two push-on pipe fittings from the rear of the laser cutter left-hand pod, but do not remove the pipes from the tubes immediately.
- Remove the pipes from the tubes and place the pipe ends in the water container.
- Operate the water chiller pump until the pump noise changes, indicating that the water has been expelled and air is just entering the pump.
- Switch off the chiller unit to prevent the pump running too long with no fluid in the system.

## Filling Procedure

- Connect the two pipes to the connections beneath the laser cutter left-hand pod.
- Fill the chiller reservoir: using approximately 3 litres of water, pour the water down the filler tube at the rear of the cooler unit until the water is level with the red indicator line.
- Connect the both the chiller and the laser cutter power cables.
- Ensure that the laser cutter master switch is in the **OFF** position.

### Notes -

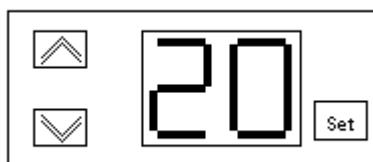
- The pump may need to operate for up to 10 minutes before all the air is expelled.
- The audio alarm will sound until both the level and flow indicator lights are illuminated.
- The level indicator light will come on initially, indicating

that there is sufficient water in the reservoir. The flow indicator light will illuminate when the water starts circulating around the cooling system. The water will circulate when the air has been expelled from the system.

- The water level may drop as the air is expelled from the system.
- Switch the mains supply to the water chiller on and operate the chiller unit in order to expel all the air in the system.
- When both the level indicator and flow lights are illuminated, all the air has been expelled.
- Using the water filler tube, top up the water until level with the red indicator line.
- Ensure that the chiller unit maintains the water temperature within the 4 °C range set at the thermostat.
- Switch the chiller unit off if the laser cutter is not going to be operated.

## Thermostat Control Unit

The thermostat control unit is shown below together with details about changing the various settings.



## Temperature Display and Thermostat Controller

The thermostat controller uses a Set Point which is the target temperature, i.e. the water temperature that is maintained in the reservoir. When the laser cutter is in operation and the

cooler reservoir temperature reaches the Set Point + 2 °C, the water chiller starts and cools the reservoir down to the Set Point - 2 °C, at which time it cuts out and waits for the temperature to increase once again. This temperature is pre-set and should not normally be changed. However, the Set Point temperature can be altered by pressing the Set button and adjusting the temperature using the arrow keys. The recommended target temperature is 20 °C.

The normal coolant temperature range is as follows.

Minimum - 18 °C

Maximum - 25 °C

**Caution** - Under no circumstances should the water temperature be allowed to reach or fall below dew point, i.e. the temperature at which dew (condensation) forms. Operating the cooler unit at temperatures lower than those specified may result in serious damage to the laser due to condensation. This type of damage is not covered by the manufacturer's warranty.

The laser system itself has its own thermal cut-out should the operating temperature exceed 50 °C. No damage will be incurred to the laser itself as a result of thermal cutout.

## Water Cooler Maintenance

On some machines that have only light duty and reasonably low ambient temperatures, a water cooler can be supplied. This unit comprises a pump, radiator and fans.

### Coolant Level

The coolant water level in the water reservoir should be regularly checked at least once per week and topped up, as

necessary, to the maximum level line.

## Grill and Cooler Matrix

**Caution -** Materials should not be allowed to obstruct the inlet or outlet of the cooler unit. Always ensure that air can enter the front grill and exit the unit unimpeded.

The cooler unit works by pumping water through the laser. The warm water from the laser enters the radiator where it is cooled, by convection, using two forced air fans. The cool water leaves the radiator and enters the external reservoir ready to be pumped back to the laser.

## Filling Procedure

- Switch the mains supply to the cooler off.
- Remove the reservoir from the base of the unit.
- Fill the reservoir to the required level and replace.
- Switch the mains supply to the cooler on.
- Examine the level in the reservoir.

**Note -** If the level falls below the minimum, or the reservoir is emptied, switch the cooler off, refill the reservoir and refit. Switch the cooler back on and repeat this process. If this procedure is carried out more than twice, check for leakage in the cooling system.

**Note –** Laser machines are provided with a range of coolers, each of which have their own manufacturers manual. Please see this for detailed reference.

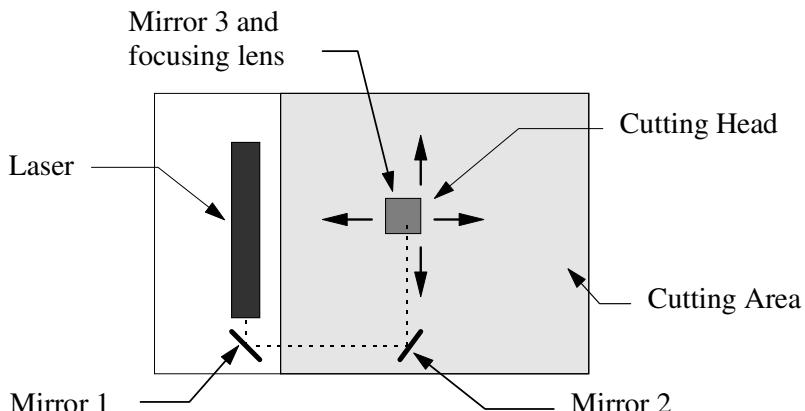
# Optical Components

## WARNING:

WHEN CLOSING THE SAFETY COVER ENSURE THAT NO FINGERS OR OTHER ITEMS CAN BE TRAPPED BETWEEN THE SAFETY COVER AND THE SIDE POD.

WHEN THE SAFETY COVER IS LIFTED CARE MUST BE TAKEN TO AVOID POSSIBLE HEAD CONTACT WITH THE RAISED COVER.

In order to achieve maximum output from the laser cutter it is important to ensure that the systems optical components are in good working order. The optical components are shown in the figure below. The cutting head lens and mirror require periodic cleaning by the user.



**Schematic of Laser Beam Path**

**Caution** - The optics must be handled with care and only cleaned with optical cleaning solution and an optical grade polishing cloth or cotton buds. They must not be subjected to abrasives, etc. The working surfaces must not be handled directly; ideally gloves or finger-cots should be used to avoid finger prints.

**Note** - Optical cleaning equipment is supplied with the tool-kit

and further supplies may be obtained from the distributor.

In order to clean either the lens or the mirror, remove the head from the machine and take it to a clean flat surface.

## Cleaning the Cutting Head Lens

**Note** - New and re-coated lenses are available from CadCam Technology Ltd.

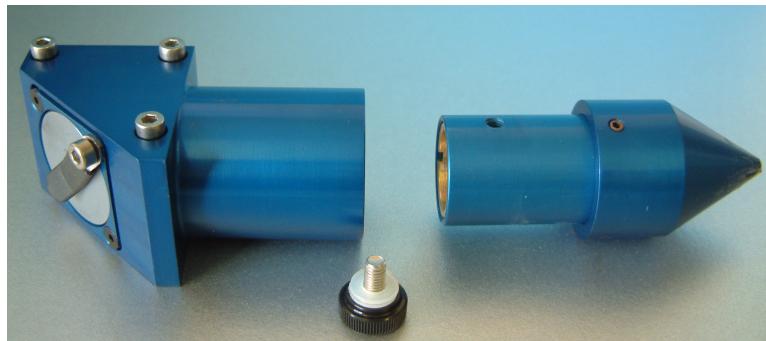
- Remove the cutting head by releasing the three M3 cap head screws and detaching the irrigation tube.
- Unscrew the barrel as shown in *Figure 1*.

**Figure 1**

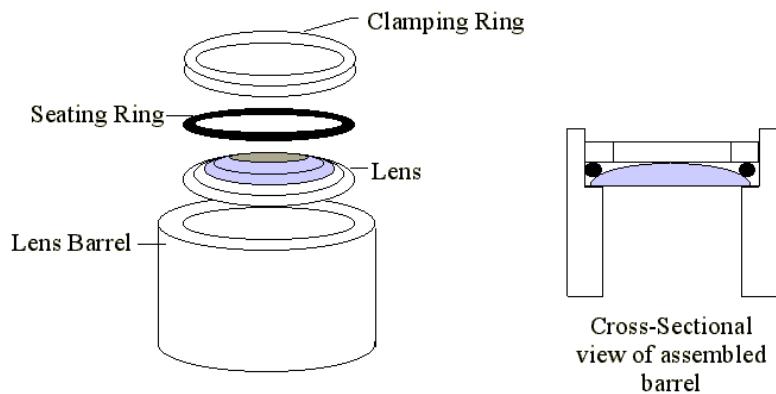


- Slide the barrel until it is released from the head as shown in *Figure 2*.

**Figure 2**



- Unscrew the clamping ring that secures the lens in the barrel.



### The Lens Assembly and Orientation

- Carefully remove the seating ring.

#### **WARNING:**

WHEN USING SOLVENTS:

- ENSURE THAT THERE IS GOOD VENTILATION OF THE AREA.

- ENSURE THAT THE SOLVENT IS NOT CLOSE TO HEAT OR FLAMES.
- WEAR APPROPRIATE CLOTHES AND GOGGLES TO GIVE PROTECTION.
- DO NOT BREATHE THE FUMES.
- AVOID CONTACT WITH SKIN OR EYES.

IF YOU GET SOLVENT ON YOUR SKIN OR IN YOUR EYES, FLUSH YOUR SKIN OR EYES WITH CLEAN, COLD WATER AND SEEK MEDICAL AID.

SOLVENTS ARE POISONOUS: IF SWALLOWED, GET MEDICAL AID.

### **Caution -**

The lens coating is fragile; do not drop the lens onto any hard surface or touch the lens with any sharp objects since this can damage the lens and reduce cutting efficiency.

Always use cloths or cotton buds that are moistened with 100% acetone; never use materials which are dry.

- Hold the moistened polishing cloth over the top of the barrel and turn the barrel upside down so that the lens comes out onto the cloth in your hand.

### **Caution -**

Hard rubbing of the optical components may cause surface marks.

Do not touch the polished surfaces when handling the lens.

- Douse the lens with cleaning solution (100% acetone - a solvent).

**Note** - The lens can be soaked in the solution for a few seconds to remove any stubborn residue.

- Gently lay the acetone-moistened cloth on one edge of the lens and gently draw the cloth right across the lens in one continuous movement.

### **Cautions -**

Hard rubbing of the optical components may cause surface

marks.

Do not touch the polished surfaces when handling the lens.

- Any residue particles may be gently removed using an acetone-moistened cotton bud.
- When the lens is clean, hold the edges of the lens, with the convex surface uppermost, and carefully replace it in the machined recess in the barrel.
- Ensure that the lens is seated correctly and that the convex surface is uppermost, i.e. the flatter surface of the lens touches the seat in the barrel.
- Replace the seating ring and screw the clamping ring into the barrel and place the barrel in the cutting head.
- Replace the circlip at the base of the focusing ring.
- Examine/clean the mirror. If necessary, lubricate the focusing mechanism: apply lithium grease to the inside of the focusing ring when disassembled.

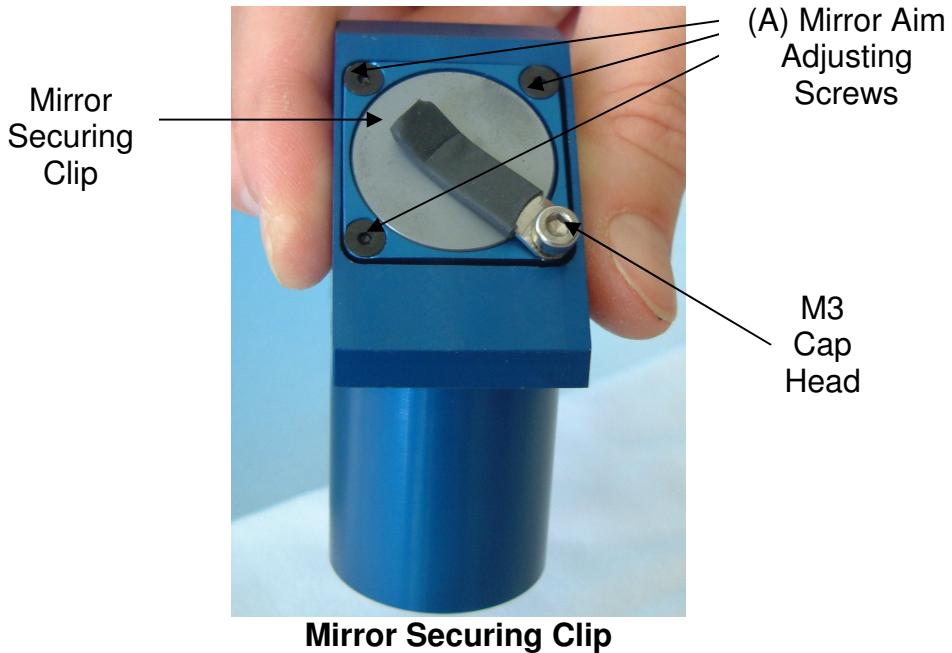
**Caution** - Do not over tighten the M3 cap head fixing screws when securing the cutting head on the machine.

- Attach the cutting head to the machine and secure with the M3 cap head fixing bolts.

## **Examining/Cleaning the Cutting Head Mirror**

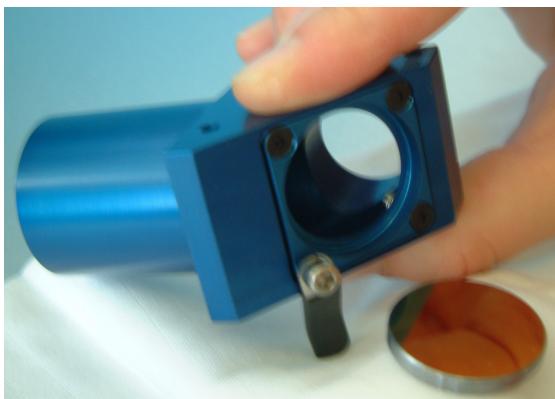
- Release the M3 cap head fixing bolts and remove the cutting head from the machine.
- Place the cutting head on a clean, flat surface.
- Remove the M3 cap head screw holding the mirror securing clip.

**Note** – Do not adjust the screws (A) unless adjusting the mirror aim.



**Note** - Ensure that a soft optical cleaning cloth is available for cleaning the mirror.

- Gently rotate the head so that the mirror will fall onto the cleaning cloth.



## **WARNING:**

### WHEN USING SOLVENTS:

- ENSURE THAT THERE IS GOOD VENTILATION OF THE AREA.
- ENSURE THAT THE SOLVENT IS NOT CLOSE TO HEAT OR FLAMES.
- WEAR APPROPRIATE CLOTHES AND GOGGLES TO GIVE PROTECTION.
- DO NOT BREATHE THE FUMES.
- AVOID CONTACT WITH SKIN OR EYES.

IF YOU GET SOLVENT ON YOUR SKIN OR IN YOUR EYES, FLUSH YOUR SKIN OR EYES WITH CLEAN, COLD WATER AND SEEK MEDICAL AID.

SOLVENTS ARE POISONOUS: IF SWALLOWED, GET MEDICAL AID.

- Apply cleaning solution (100% acetone - a solvent) to the mirror face and let it soak for a few seconds.
- Gently lay an acetone-moistened cloth on one edge of the mirror and gently draw the cloth right across the mirror in one continuous movement.
- Any residue particles may be gently removed using an acetone-moistened cotton bud.
- Replace the mirror in the housing and secure it with the mirror securing clip and the M3 cap head screw.
- Ensure that the retaining clip has a little bend in it after fitting to ensure that the mirror is seated. DO NOT fully tighten the single M3 screw.

**Caution** - Do not over tighten the M3 cap head fixing screws when securing the cutting head on the machine.

- Attach the cutting head to the machine and secure with the M3 cap head fixing bolts.

## The Cutter

### **WARNING:**

WHEN CLOSING THE SAFETY COVER ENSURE THAT NO FINGERS OR OTHER ITEMS CAN BE TRAPPED BETWEEN THE SAFETY COVER AND THE SIDE POD.

WHEN THE SAFETY COVER IS LIFTED CARE MUST BE TAKEN TO AVOID POSSIBLE HEAD CONTACT WITH THE RAISED COVER.

## Head Transport Rails

The head transport rails carry the laser head from side to side and across the bed. In order to ensure free movement and long life it is recommended that they are cleaned and lubricated every two months:

- Turn the laser key to **OFF** and remove the key.
- Disconnect the laser cutter from the mains power supply.
- Move the cutting head to the right-hand side of the cutter by hand.
- Wipe each side of the 'V' section of all three slide rails with a clean dry cloth until all traces of oil have been removed.
- Using steel wool, gently polish the rails until they are bright and clean.
- Remove any particles of steel wool from the rail using another clean cloth.
- Lubricate each side of each rail with a thin film of oil.

**Note** - The purpose of the oil is to lubricate the carriage wheels and to protect the transport rail from corrosion.

- Lubricate the four carriage wheels on each of the three carriages using light oil applied sparingly. The carriage wheels are located beneath the carriage and make contact with the 'V' section slide.

- Gently move the cutting head and cutting arm from side to side to check for free movement.

## Cutting Head Drive Belt

The cutting head drive belt is a toothed belt. It will need checking and cleaning periodically to ensure there is no contamination in the teeth of the belt.

- Turn the laser key to **OFF** and remove the key.
- Disconnect the laser cutter from the mains power supply.
- Move the cutting head to the rear of the cutter by hand.

**Caution** – Do not use a cleaning agent on the drive belt.

- Using a clean, dry, lint-free cloth, remove any debris from the exposed area of the belt.
- Move the cutting head to the front of the cutter by hand.
- Using a clean, dry, lint-free cloth, remove any debris from the exposed area of the belt.
- Lubricate *all* drive belt teeth once a month using WD40 oil.

# Troubleshooting

## Troubleshooting - All Models

### General

The following guide is general in nature and tries to cover simple problems, which may arise during the life of the machine with some 'fixes' the user may be able to provide. When attempting to find apparent faults with the cutter always take the following precautions when dealing with mains power and exposed laser beams.

- Isolate the mains power whenever possible during checking.
- Do not under any circumstances use a meter probe on the control boards when in a powered condition. This also applies to cables attached to the control boards/motors. Generally, this is not necessary and puts the PCBs at risk of damage.
- Wear safety spectacles if the laser tube is exposed or guards removed and the cutter is in a powered condition.
- Do not dismantle the cutter before first considering the problem

### ***"The cutter does not power up when switched on"***

Check the following:

- The mains supply at the socket/wall outlet.
- The fuses in the plug/line.
- The fuse on the side of the mains box (cutter).
- The green PSU LEDs on? (Indicating DC power).
- That the PSU/PSUs are functional and that they are not shorted out. (You may have to apply power to test the PSU).

- For 30V DC power reaching the main control boards power inlet plug?

### ***"The machine is moving but not lasing"***

Check the following:

- That the cooler is receiving mains power.
- The cooler's fuses using a meter (see cooler manual).
- The cooler is full of water.
- That the pump is running.
- That the water temperature is 20 °C (nominal).
- That the water is circulating around the laser.
- The cooler is pumping sufficient water to trip the flow switch in the case of a Coherent laser system.
- That the compressor is running when required and that it lowers the water temperature when it does.
- That the cooler is not at a temperature less than 20 °C.
- That the cooler pipes are not crushed preventing water flow.
- Has the laser tube overheated?

Most laser tubes have an internal thermal protection trip circuit to protect them from overheating. If this trip is activated because the tube has overheated, it usually requires the cutter/laser to be powered off and then on again to reset the trip circuit.

If an air-cooled laser system overheats check out the ambient air temperature and also the cooling fans or ducts to see that they are not blocked with dust or lint and that the airflow is sufficient. In the case of fluid cooled systems check out the cooler. A cooler manual is provided with the cutter.

- Is the shutter mechanism working?
- Remove the cover from the laser side of the cutter (LH) being careful not to disturb the primary mirror and check that the shutter is fully open when the cover is closed.  
This is also a good opportunity to check that the micro switch interlock is closed with the lid shut and oil the

mechanism if necessary.

- Is the laser power supply working?

On most models there are green LEDs on the outside of the mains control box. These lamps indicate control system power and laser DC power. You can also check the status LEDs on the laser tube itself that indicate the tube is receiving power. Some laser tubes carry an on-board fuse, which may also be checked.

- Have the Mirrors been fitted correctly?

Check that all mirrors are fitted with their reflective surface facing the beam. A mirror fitted backwards will not reflect laser energy. The gold side of the mirror is the reflective side.

### ***"The machine does not cut very well"***

Check the following:

- That the lens is clean and oriented correctly (see manual).
- That the lens is focused properly according to material thickness.
- That all the mirrors are clean.
- That the shutter is fully open (see above).
- The laser beam alignment (as last resort - see manual).
- See Specific section in this manual '**Cutting Guide**'.
- Check the Head Mirror Aim, see the section '**Nozzle Gas Cutting - Aiming the Mirror on the Cutting Head**'.

### ***"The head does not go to origin when I switch the cutter on"***

Check the following:

- That the axis X and Y moves freely by hand with power off.
- Clean and lubricate all drive belts (WD 40 oil).

- That the small endless Y belt is not tensioned too tight.
- Any obstructions on the bed or motion rails.

***The cut object does not "close".***

Stop or play in either the X or Y axis will usually result in cut items which do not close fully and are therefore difficult to remove from the sheet. Check out the following features of both axes.

- That all pulleys are firmly fixed to their shafts / motors, with the grub screws. Apply a little locking fluid to the threads before re-tightening. Ensure the grub screw engages the flat on the shaft/s.
- That the belts have no teeth missing or damaged.
- That all belts are adequately tensioned. (Do not over tension the belts).
- That the X-axis gearbox and half shaft couplers are secure.
- That the arm is re-set square using the flexible drive couplers if you have adjusted the mechanism in any way.
- Adjustment of the above may require beam re-alignment.
- That the drawn item is fully closed.

***"The curved cut lines are not smooth"***

- Check the X Motors and their spring belt tensioner mechanisms. Both X motors should be free to move up and down with the spring tensioners moving freely, but the motors should not be so loose that they are free to wiggle around. To check this, lightly grip the Encoder end of the motor and attempt to rotate the end of the motor in a circle. Adjust the 3 nylock nuts to remove excess play or release if the mechanism is too tight. The areas around the 3 nylock adjusting nuts should be oiled to ensure free movement and hence constant

tension of the 2 endless drive belts. It is a good idea to lubricate all drive belts tooth side with a light oil such as WD 40 (provided with the laser in the tool kit).

- Adjust arc error in material effects (small value for large arcs - 25 nominal).

### ***"Failure to communicate with the cutter"***

Check the following:

- That the data cable is secured to PC and Cutter properly.
- That the COM speed of the PC matches that of the cutter.
- That the PC COM port is functioning using a known working device (printer).
- Try an alternative COM port in the PC.
- That the cutter is in an online condition.
- Try setting the PC COM speed to 9600-baud rate (ctl.sys default).
- That no other software is in use, blocking the COM port of the PC.
- Try re-booting the cutter or/and PC to clear the port.

### ***"The machine will not go online"***

Check the following:

- That the lid/interlock is fully closed.
- That the drawer is fully closed (where fitted).
- That the table is fully home and locked (in the case of a dual tray machine).
- All micro switch interlocks need to go closed circuit in order for the machine to go into an online condition. The interlock circuits can easily be checked using a continuity meter. All continuity checks must be done with power OFF.

## ***“Roll Feed Axis Not Working?”***

Check the following

- Do you have the correct cutter driver loaded in your cutter set-up?  
For example: FB725 (Roll/Sheet)
- Is the Sheet and Roll button on in the cutter set-up? (black dot is on).
- With the cutter powered off, can you turn the silicon drive rollers easily?
- Is the material free to move through the rollers?
- Is the pinch/pressure roller rotating easily?
- Is there sufficient spring pressure on the pressure roller?
- If the cutter beeps when attempting to drive the rollers and there is a problem, the following will appear in the LCD display: **“Y2 axis error”**
- The beep may indicate there is a problem with the drive motor/encoder but check the above points first before condemning the motor/encoder.

## ***“Conveyor bed not working (Slat and honeycomb types)”***

Check the following:

- Do you have the correct cutter driver loaded in your cutter set-up?  
For example: FB750 Conveyor
- Is the Sheet and Roll button on in the cutter set-up? (black dot is on).
- With the cutter powered off, can the bed surface be moved by hand?

**Note -** There is significant gearing on the drive train, and this will need to be accounted for in your assessment of free movement)

- Is there any cutting debris trapped in the chains or drive sprockets (check carefully)

- Are there any retaining screws missing from the slats?
- Are any slat retaining screws interfering with the mechanism?
- Are any guards/cutting debris causing an obstruction to table movement?
- Is the pressure roller at the table rear free to rotate?
- Can the material roll be pulled onto the bed easily enough from the stand?
- Have the drive chains/sprockets been oiled recently?
- Is anything trapped in the main drive belt teeth from the gearbox? (On some models the gearbox/motor is under the slats in the centre of the bed and on 7 series models mounted to the machine chassis at the front RH side).
- If the cutter beeps when attempting to drive the bed and there is a problem, the following will appear in the LCD display: "**Y2 axis error**"
- The beep may indicate a problem with the drive motor/encoder but check the above points first before condemning the motor/encoder drive unit.

### ***“Computers - General Information”***

- It is strongly recommended that the computer attached to the laser cutter is protected by a UPS or line conditioner to prevent mains surge and electrical noise generated by heavy machinery reaching the computer. Since the Computer is attached to the laser cutter by a data cable this also affords some protection to the cutters control system.
- All Computers should have a good sound earth connection.
- Video cards and serial port cards should be inserted correctly and secured using the screws provided.
- When using the cutting software ensure that no other programs are running and that the task bar is not loaded. This applies in particular to Optically assisted

cutting machines.

## Hints & Tips

### Engraving

Most engraving is best done at low laser power combined with a relatively low speed.

If the vector lengths are long, then the speed and power may be increased, in particular when using the Scan Lines feature in the software. Generally speaking, if the engraving path is curved then a low power/speed will usually give a better result. Most lasers will not laser below a power setting of 5%. This is the minimum power setting.

### Cutting

Clean, fast efficient cutting is affected by the following factors:

1. The mirrors and lenses must be clean.
2. The lens must be focused (even a small adjustment will make a big difference).
3. The material must be as flat as possible and lay flat on the bed surface.
4. Ensure you have selected the correct material in your active Manager (Software).
5. Ensure you have the correct cutter model/laser selected in your cutter set-up.
6. Ensure you have specific effects assigned to the designs colours, e.g., Engrave, remove any colours that are superfluous to the design using the Palette editor.
7. Cutting of rigid sheet can be enhanced by raising the sheet off the bed surface. About 3mm is typical. This will allow any nozzle gas used to flow through if you don't have a Honeycomb bed surface. Set the nominal

focus to the middle of the rigid sheet. If you are in doubt, try cutting some small objects to test the focus for optimum distance and cut quality.

## Speed and Power Controls

There are 3 main parameters controlled by the Software and motion system to control the cutting process. They are as follows:

1. Velocity (cutting speed).
2. Maximum laser power (when the machine attains the velocity command).
3. Minimum laser power (when the machine does not reach max velocity).

The velocity should be considered as a fairly coarse control ranging from 1cms/sec to a maximum of 60cms/sec. This control increments at 1cm/sec.

Laser power minimum or maximum can be intimately set in 1% increments from a minimum of 5% to a maximum of 100%.

When trying to cut any material, the amount of laser power used is dependant on the cutting speed you select. Therefore you can cut a material slowly or quickly. While both may work, the quality of the cut may differ significantly depending on the speed of cut.

**Note** - Cutting straight lines is significantly different to cutting curved objects, in particular small objects which have a lot of small radii. The two shape types need treating quite differently.

As a basic rule, objects comprising of lines only may be cut with maximum power and speed.

Objects which are complex in terms of shape, generally with small radii are best cut at speeds of up to 12cms/sec max, using a minimum power of 5% and a maximum power to suit.

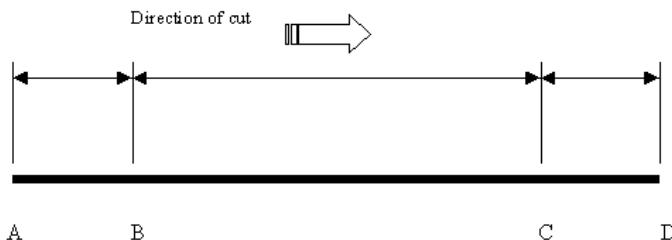
If, for example, the maximum power is set to 50% and the minimum power is set to 5% then the only time the laser will

output 50% power is when the cutter attains the set speed command.

If, for example the maximum power and minimum power are both set to 50% then the laser will output 50% power, regardless of whether or not the command speed is actually reached.

Understanding the effect of adjusting these 3 parameters is essential for good clean cutting.

### **Example - Cutting a Line at 15cms / per sec @ Max Power 75% & Min Power 5%**

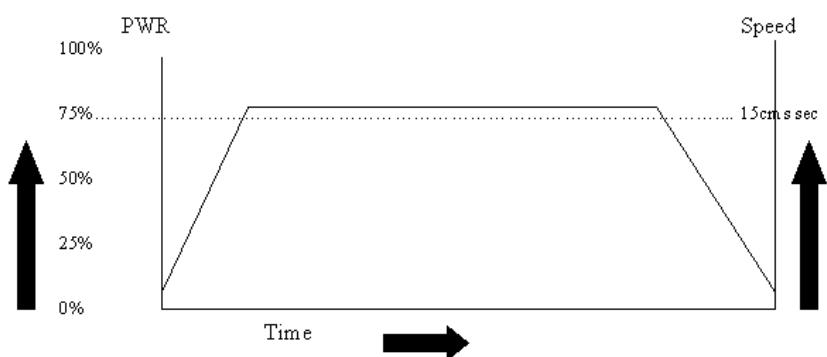


A to B = Acceleration Phase.....(5% up to 75% Power)

B to C = 15cms / per second.....(75% Power)

C to D = Deceleration Phase.....(75% Power down to 5%)

A to D = Total length of cut line



If the line were cut, for example at 75% max and 75% min laser power, then during the acceleration and de-acceleration

phases the laser power would still be at 75%, which would be excessive and cause some over cutting of the material during this period.

The auto laser power ramping is a feature of CadCam Technology and its cutting philosophy. As the machine's actual speed fluctuates during cutting, so does the laser power to give an even depth of cut. This will allow, for example 'Kiss Cutting' where the material is mounted on for example a paper laminate and the material only is cut leaving it still mounted on the paper post cut.

## **Understanding Focus**

In order to cut cleanly and efficiently, it is important to have the beam focused. The nominal focal distance is 68mm. Please note that this distance is a nominal figure and that due to manufacturing tolerances of this optical component, this may vary from one lens to another by plus or minus 1mm. No two lenses are exactly the same.

A simple and easy way to find the optimum focus for any lens is to get the machine to etch or engrave lightly on the surface of paper. A typical setting to achieve this with, for example a 30 Watt laser system is velocity 8cm/sec, max and min laser power 7%.

Output to the machine a small circle about 30mm in diameter and then adjust the focal distance until the engraved line is as fine or as narrow as possible. This is obvious with careful observation of the result. The paper may even start to cut as the focus is optimised.

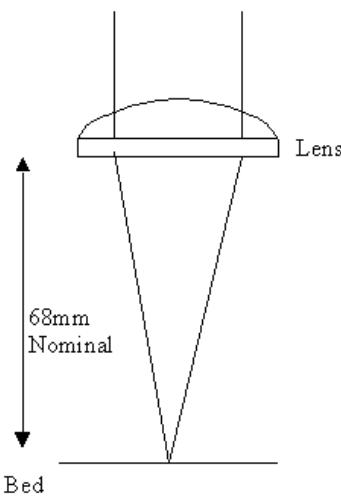
When you have the focus set correctly, you can then measure the focus barrel position relative to the cutting head body and make a note of it for future reference.

This way you can clean the lens and return to optimum focus immediately after reassembling the cutting head. Below are some examples of focal set-ups for thin materials and thicker

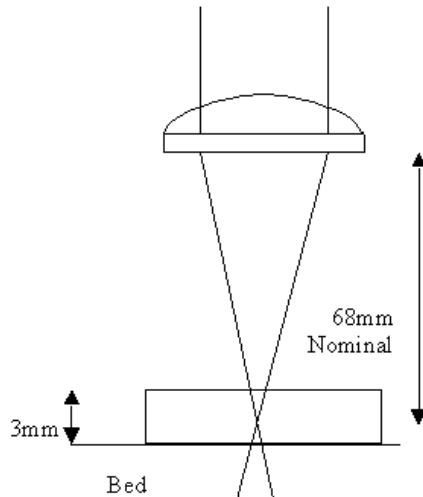
materials.

The example below shows a thin material set-up and a set-up to cut a material 3mm in thickness. In order to cut the 3mm thick material the focus will need to be raised 1.5mm to put the optimum focus in the centre of the material. So for a material 6mm thick the focus must be raised 3mm. This is why the focus is optimised on the surface of paper, because it is thin and you can see when the focus is improved by trial and error.

**Thin materials**



**Thick materials**



# Appendices

## Specifications

### Laser Cutter

FB Laser Series	700 Series	1500 Series
Height	1120mm (44.1")	1120mm (44.1")
Width	1340mm (52.8")	2060mm (81.1")
Depth	1260mm (49.6")	1260mm (49.6")
Weight	130kg (286 lbs)	200kg (440 lbs)

### Cutting Area

FB Laser Series	700 Series	1500 Series
Maximum cutting width	725mm (28.5")	1475mm (58.1")
Maximum cutting length	995mm (39.2")	995mm (39.2")

### Fabric

FB Laser Series	700 Series	1500 Series
Maximum Roll width	840mm (33.1")	1560mm (61.4""")
Maximum Bed width	870mm (34.3")	1590mm (62.6")
Maximum Bed length	1050mm (41.3")	1050mm (41.3")

## Interface

Communication	HI standard asynchronous RS-232-C
I/O Port Connector	DB-9P
Mating connector	DB-9S
Byte format	8 data bits, 2 stop bits
Baud rate	9600, 4800, 2400 and 1200 bps

## Firmware

Language	DM/PL w/cutter commands B, N, K
Supported character sets	Standard ASCII, Mathematics, German, French, Swedish, Norwegian/Danish, Spanish, Italian
Supported fonts	Serif, Sans Serif, Serif Bold, Sans Serif Bold

## Performance

**Notes** - The accuracy values do not take into account inaccuracies due to fabric expansion, stretching, etc.

Axial speed	10 to 600mm/s	0.4 to 23.6 IPS
Default speed	600mm/s	23.6 IPS
Acceleration	up to 1g	up to 1g
Resolution	0.025mm	0.001"
Mechanical resolution	0.0127mm	0.0005"

Accuracy	0.2% of move or 0.25mm, whichever is greater*	0.2% of move or 0.010", whichever is greater*
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## Environmental (Cutter without Fabric)

Operating Temperature	5 to 35°C	40 to 95°F
Storage temperature	-40 to 60°C	-40 to 140°F
Relative humidity	35 - 80 %,non-condensing	35 - 80 %,non-condensing

## Electrical

Input Power 47-63 Hz, single phase

**Caution** - If the nominal line voltage varies above or below the permitted tolerances damage may be caused to the laser power supply units which would not be covered under the guarantee.

Nominal line	Min./Max. line	Ampere	Fuse
110 V AC	85 - 132 V AC	10 AMP	10 AMP
230 V AC	170 - 264 V AC	5 AMP	5 AMP

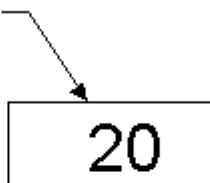
## Fuse Location and Value

The fuse for the Laser Cutter is located at the right-hand side of the cutter under the mains inlet socket as shown below:



The Water Chiller has its own fuses which are mounted on the front panel of the unit as shown below:

Coolant Temperature Readout and Thermostat Controller



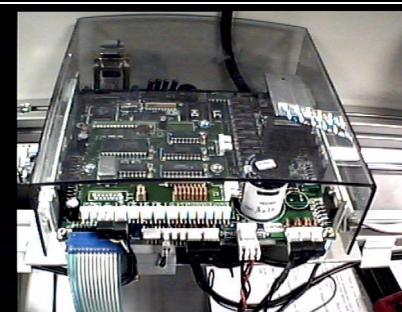
Location of Flowcool LC400 Fuses

## Spare Parts

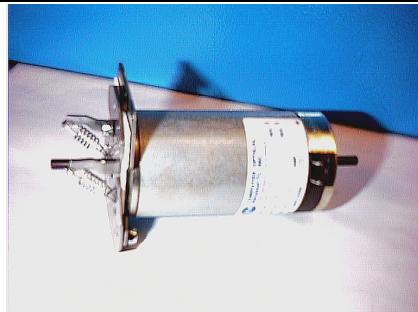
Listed below are some of the most popular spares and consumable items. CadCam Technology can provide any item of the cutting system you may need. Prices on request.

- 50mm diameter bore flexible extraction hose (10m lengths)
- 102mm diameter bore flexible extraction hose (10m lengths)
- Extraction system filters
- Clear plastic water cooler pipes (Pair including fittings)
- 25.4mm diameter x 3mm thick mirror
- Lenses 19mm diameter.
- Optical seating rings for mirrors and lenses
- Optical cleaning fluid.
- Optical cleaning cloths
- Allen keys
- RS232C Data transfer leads
- Mains power leads
- Fuses
- Master keys for cutter
- Aluminium faced cutting bed
- Steel cored toothed belt.
- 17 Polycarbonate safety cover.

# Control System



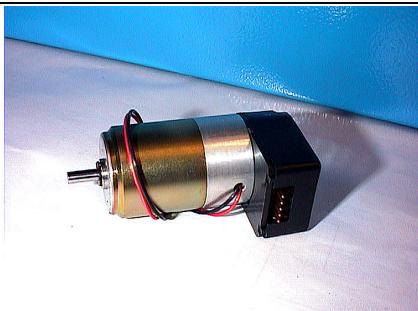
**Control System**



**X Motor - no encoder**

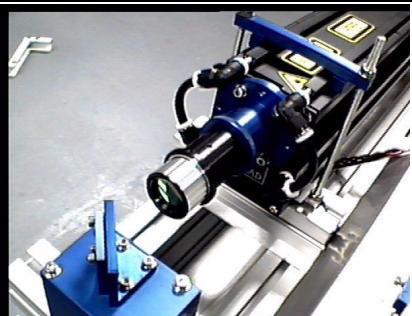


**X Motor with encoder**



**Y Motor with encoder**

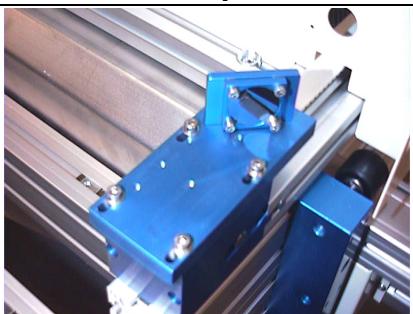
## Optics



**Beam Expander**



**FB Lens**

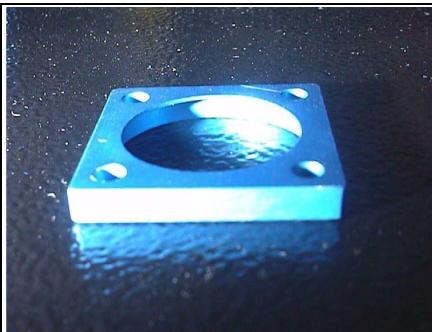


**Mirror Assembly**



**Cutting Head with Head  
Mirror Aligning Tool in  
Position**

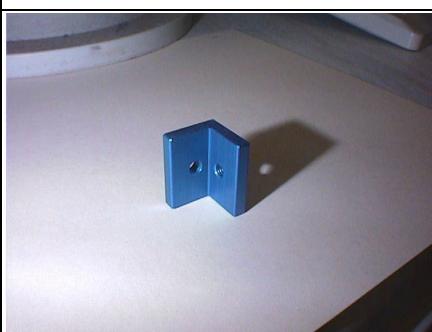
## Mechanical



**25mm Mirror Frame**



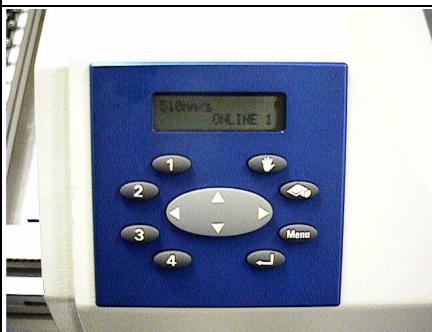
**Focus Tube**



**Front Beam Cover Bracket**



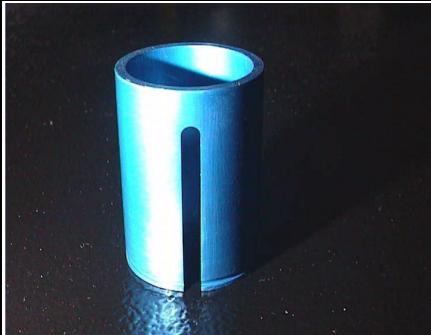
**Head Nozzle**



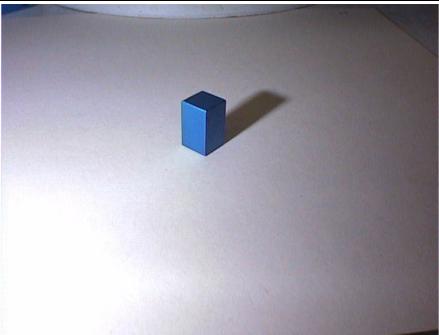
**Keypad**



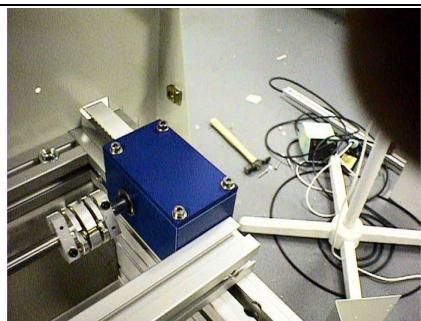
**Old Focus Ring**



**Old Focus Tube**



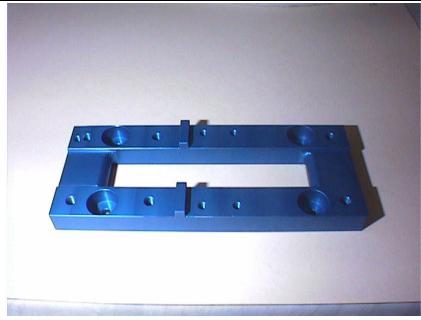
**Synrad Laser Clamping Block**



**x Flexible Drive Coupler**



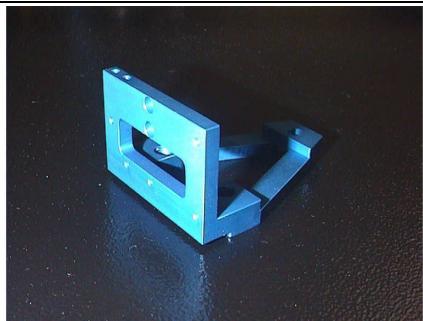
**x Axis Smooth Pulley**



**x Carriage**



**y Axis Smooth Pulley**



**y Rail Carriage**