GREAT COMPUTER CORP.

LaserPro Series – Venus Maintenance Manual

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© 1st digit -> major revision/change TOC layout; 2nd digit -> minor revision/add-in sections; 3rd digit(alphabet) -> update/correction

Venus Maintenance Manual

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1

Introduction

Chapter 1: Introduction

1.1 Overview

The LaserPro® Venus, the smallest laser engraver and the highest performance in the world, precisely handles all your engraving requirements in a single compact unit that can highly increase your workshop productivity.

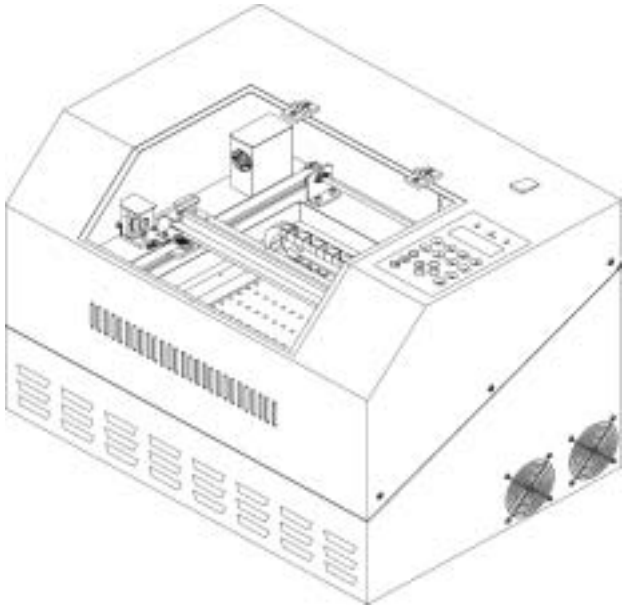


Figure 1 Front view of LaserPro Venus

The LaserPro Venus includes 3 main units as the following. The detail concept of each system will be explained in latter chapter.

- Motion System (see Figure 2)
- Laser System (see Figure 3)
- Control Panel (see Figure 4)
- Computing System

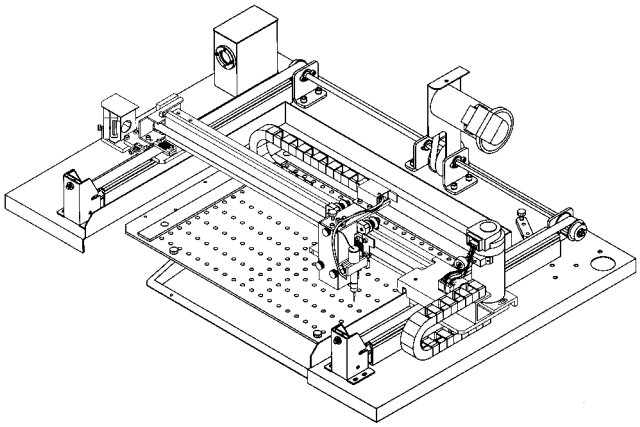


Figure 2 Top view of motion system

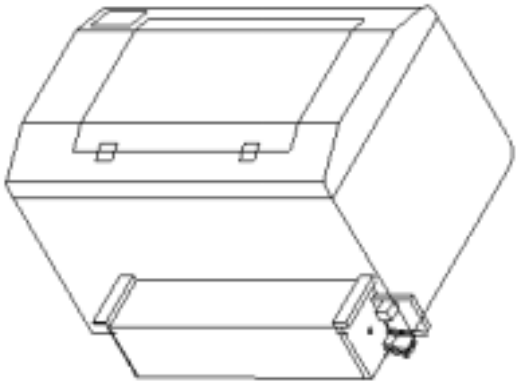


Figure 3 Top view of the Laser System

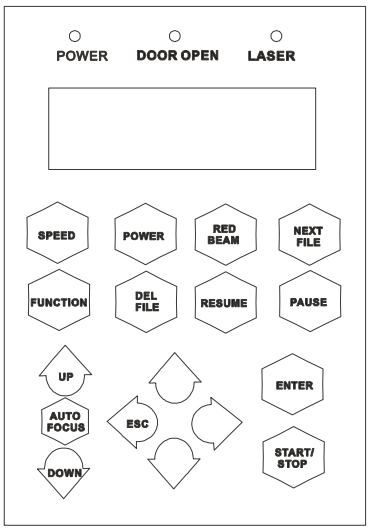


Figure 4 Control Panel for LaserPro Venus

1.2 About this Maintenance Manual

The LaserPro® Venus has a number of *subsystems*. Each subsystem is dealt with in a separate chapter in this book.

Chapter	Subsystem
2	Power System
3	Motion System
4	Laser System
5	Optical System
6	Control Panel System
7	Computing System

Other chapters deal with *procedures* for installing and maintaining:

Chapter	Subsystem
8	System Diagnostic
9	Preventive Maintenance
10	Installation
Appendix A	Troubleshooting
Appendix B	Spare Part
Appendix C	Application Configuration

1.3 Conventions Used in this Service Manual

This	Means
Typewriter font	Text that appears on the Control Panel
Bold typewriter font	Function key that you enter on the key pad
Italics	Introduces a new terminology or definition. For a new terminology, we will introduce it in the Glossary section.
Initial Capital Letters	Introduces a component or feature for the first time.
 **Note**	Information you might find useful or interesting.
 **Caution**	Information you need to protect or avoid damaging H/W or S/W.
 **Warning**	Information that is essential to your safety, or not allow to do.
 **Repair**	Information you need to replace at this step.

1.4 Safety

1.4.1 Overview

This safety guide is intended for the field service engineer. An important aspect of a service engineer's job is the maintenance of good safety practice. The guide contains the results of service engineers' accumulated experiences, and supplements existing safety rules.

Section 1.4.4 of this guide includes rules for record keeping. It is important to maintain these records accurately, as they allow the service engineer's immediate supervisor to continually evaluate and update the safety conditions. Should enhancements to the installed model require modifications to safety procedures, an update to this guide will be produced. Each model may have its own unique safety instructions and the service engineer should be thoroughly familiar with these details. With regards to the safety instructions of specific models, refer to the respective models' safety documentation. **If you are in doubt regarding any safety procedures, contact GCC Customer Service.**

1.4.2 Definitions

Machine	The entire system. The term Machinery is associated with the mechanical moving parts.
User	A person who utilizes the machine and its associated electrical equipment.
Instructed Person or Supervisor	An individual, who is sufficiently trained or is supervised by a SKILLED PERSON, to adhere to safety measures associated with the machine.
Skilled Person or Service Engineer	An individual who has sufficient technical knowledge or experience to adhere to the safety measures associated with the machine.
Danger Zone	The zone within and around the machine, where an individual is exposed to risks of safety and health.
Exposed Person	Any person in a Danger Zone.
Insulation	The method of protection against electrical hazards. The various types of protection levels are, in ascending order: ➢ Operational ➢ Basic ➢ Supplementary ➢ Double or Reinforced

	Each type used in a system achieves a specific level of protection. For example: Wire sleeving (Supplementary Insulation) is preferable to accessible insulated wires (Basic Insulation), in case the wire insulation fails.
Safeguard	The guard or protective device used to shield individuals from a present or impending danger.
Protective Interlock	The arrangement that interconnects the guard(s) or device(s) with the control system and/or the Power distribution of the machine.
Protective Grounding Terminal	The grounding terminal in equipment associated with the electrical supply wiring. This is used to protect the system from ground faults. This is denoted PE and marked on the system: 

1.4.3General and Personal Safety Precautions

1.4.3.1 Personal Safety

For personal safety, observe the following general precautions:

- A second person should be available to disable the system in an emergency.
- Wear appropriate protective gear that fits comfortably.
- Do not wear loose-fitting clothes. If you are wearing a long-sleeved shirt, fold the cuffs up your arm.
- Never wear gloves close to moving parts.
- Necklaces, ties and scarves should be tucked inside shirts.
- Long hair should be covered.

1.4.3.2 Electrical Tool Safety

When using Electrical Tools make sure to:

- Use tools that are in good operating order. Any tool that appears electrically or mechanically faulty must be labeled and sent immediately for repair.
- Make sure that you are electrically insulated when using electrical tools. Wear rubber-soled shoes and stand on a dry surface.
- If , during the use of electrical equipment, you feel an electrical discharge (e.g. a tickling sensation on your skin) immediately stop using that tool. Label it, and send it for repair.

1.4.3.3 General Site Safety Requirements

- Fire extinguishers must be in working order and within easy reach.
- The main power supply switch must be easily accessible.
- The system site must be suitably illuminated from all sides.

1.4.3.4 Safety Requirements during Installation

- The safety of the system during its transport is the responsibility of Transport Company.
- When delivered on-site, the safety responsibility for the system reverts to the factory under the supervision of the appointed service engineer.
- Raising and lowering the system should be either with a forklift or four balanced lifting screws.
- When moving the system, the terminals should be removed from the arm.
- Before connecting the system make sure that the power supply on the wall has the following:
  - Quick disconnect
  - Appropriate circuit breakers

1.4.3.5 Safety Requirements during Preventive Maintenance

- Always set the system to OFF, when performing basic system maintenance (e.g. changing components, tightening screws of the P/B or Power Supply).
- Always set the system to OFF, during preventive maintenance table, X-axis ASSEMBLY, Y-axis ASSEMBLY and Z-axis ASSEMBLY before cleaning, or aligning the lens carriage/mirrors.

***Note** Electronic boards are sensitive to static charge, which can damage their components. Therefore wear an anti-static wrist strap whenever handling them.*

- If the System is tested using the hidden diagnostics program - Do not make bodily contact with any part of the system.
- If you interrupt your servicing before the system is fully functional:
  - Leave a clearly visible sign.
  - The sign should be written in the local language.
  - The sign should warn against the use of the system.

- Disconnect the power to the fan before removing the air filter.
- Make sure that a screen or filter protects each fan.
- Make sure all interlock switches are operational.

1.4.3.6 General Electrical Safety Recommendations

You can minimize the dangers of electrocution by taking the following precautions:

- Make sure that the connections between systems, ground and the factory floor are secure.
- Use double-insulated electrical tools when working on the control cabinet/scanner/electronics cabinet/ transformer.
- When working within the Control Cabinet, make sure that the system power is OFF.
- Make sure that the system's interlock switches are fully operational before servicing the system.
- Do not connect electrical tools of higher working voltage than 50V to the mains power supply.
- Make sure that all equipment is grounded correctly. Should a tool become faulty

during servicing, the grounding will cut the power supply before it causes injury.

- Do not use a two-pin adapter in a three-pin socket.
- Treat every cable and wire as if connected to the main supply, until it is diagnosed otherwise. Wherever it is necessary to use an extension cable, first connect the cable to the equipment and then to the wall socket.
- When you have finished working with an electrical tool, immediately disconnect the plug from the wall socket.
- Never connect any cable to the main power supply without using a proper plug.
- Should a mains fuse burn out for any reason (e.g. short or overload), contact the building engineer or an authorized electrician to replace the fuse. Do not replace the fuse yourself unless you are specifically authorized to do so.
- Do not use high resistance wires or fuses of different sizes without specific authorization.
- When operating hand drills, adhere to the following specific guidelines:
  - The universal symbol for double insulation, a rectangle within a larger rectangle, should be displayed on all pieces of correctly insulated equipment.
  - Drills not marked with a double-insulation label should not be used.
- Drills exceeding 28V-working voltage should not be used.
- Make sure that no key is inserted into the drill bit before using the drill.
- Any bit keys placed on a chain, string, or similar, should be removed from the drill before use.
- Drills that are double insulated should not be connected to ground.

1.4.3.7 Electrocution First Aid

In case of electrocution, do the following:

- Call for help
- Insulate your hands before touching the electrocuted person.
- Immediately disconnect the electric circuit from the mains by doing one of the following:
  - Disconnect the main switch.
  - Remove the plug from the wall socket.
  - Remove the fuse.
- If these methods of disconnection are impossible, use insulating material (e.g. cloth, dry stick etc.) to free the injured person from contact with the source of current. Once the injured person is freed, check for breathing. If there is no breathing, immediately administer constant artificial respiration until a doctor or ambulance arrives.

1.4.4 Keeping Records

Records should be kept on the implementation of the safety steps described in this guide. These records should be updated regularly. Record in detail any dangerous or potentially hazardous conditions. Records should be submitted to your immediate supervisor. Failure to keep regular records could endanger both yourself and other people, and may result in disciplinary action.

These records should include:

- The name of the person conducting the safety inspection.

- The frequency of inspection.
- The unsafe conditions and/or work practices found.
- The action taken to correct these conditions/practices.

These records should be maintained for three years in factories where the personnel exceed ten. Where a hazard is recorded, the records should be maintained as long as the hazard conditions prevail, even in factories where the number of employees is below ten persons.
If you also supervise and train a group of service engineers, you will be required to keep the following records:

- Job assignments.
- When employees were first hired or assigned duties.

1.4.5Special LaserPro Venus Introduction

1.4.5.1 Overview

The LaserPro Venus has its own unique safety instructions and the service engineer should be thoroughly familiar with these details. Types of hazards:

- Electrically "live" parts at dangerous voltages
- Mechanical moving parts
- Ejecting parts
- Ultraviolet emissions
- Radiation emissions
- Potential shattering of high pressure light sources
- High Temperatures
- Pneumatic Pressures

These specific models have built-in safety protection devices and appropriate warning markings. However, these safety devices should not be relied upon as the only protection against hazards. You should be thoroughly familiar with the following safety instructions, which supplement the built-in safety devices in the machines.

The service engineer may be called upon to instruct the end-user in the machine's operations. It will be also necessary to familiarize the operator with the safety rules defined in GCC's *User Safety Instruction*s.

1.4.5.2 Transporting the System Safely

When transporting the laser engraver, the following precautions should be taken:

- Lock the table axis (**X/Y/Z-axis**) and lens carriage before a transportation.
- Only transport the scanner enclosed in its original crate and handles.
- Choose a wide-open area to set the system down.
- Make sure that the surface upon which the system is to rest is a strong and stable surface.

1.4.5.3 Electrical Safety Precautions

Installation:

The plug on the power supply cord should comply with the following specifications:

- IEC or UL listed and CSA certified type, according to the country of destination.
- Rating at least as high as the rating of the system.

The wall socket-outlet must include a ground-fault interrupter. Ground terminals should comply with the following specifications:

- The green-yellow insulated conductor of the main cable connects the grounding terminal in the main unit to the ground terminal in the plug.
- The power supply ground conductor terminates in a closed loop connector which is secured to a dedicated grounding stud or screw with a lock-washer and nut.
- After connecting the power supply ground conductor, other grounding conductors may be secured to the same stud by a separate lock-washer and nut.
- Connect all other grounding (green-yellow or bare) terminal conductors (including the external transformer box and Electronic Cabinet conductors) in the system to the PE terminal.

Servicing

Before and during servicing

- Turn OFF the rotary ON/OFF switch on the control cabinet to disconnect the main power supply from the system and the.
- Parts, which maintain high voltages even though the electrical supply is cut off, should be marked with the Electric Shock Hazard symbol.
- With the exception of the part to be serviced, all ground connections should remain in place.
- Only disconnect a ground connection when the electrical supply source is disconnected.
- When replacing any safety-related part, only use GCC authorized parts (or parts provided by a GCC distributor).
- Ensure that free conductors do not short with any other parts.

On completion of servicing

- Restore all grounded connections and insulate sleeve wiring (supplementary insulation).
- Restore all ferrites on cables, should any be removed during servicing.
- Restore all SAFEGUARD panels (with markings outside), and enclosure parts (e.g. panels, covers etc.). Secure with *all* the screws provided.
- Lock all doors and covers.
- Restore the protective interlock if it has been bypassed.
- Reboot the machine and run a diagnostic (functional) test.

1.4.5.4 Mechanical Safety Precautions

Before servicing

Make sure that:

- No other person will initiate any startup of the system.
- The ON/OFF power switch on the system is in the OFF position with the power cord unplugged.

After servicing

- Replace all safety-related parts, panels, doors, and bellows.
- Secure all parts using screws etc. as originally provided for the machine. Make sure that parts are secure before operating the system.
- Lock all doors and covers.
- Make sure that no tools or loose objects remain on the working table or underneath table.
- Remove the temporary-use interlock sensor on the front top door, if it was bypassed.
- Reboot the machine and run a diagnostic test.

1.4.5.5 Maintenance of the Optics System

Before servicing

- Wear protective glasses when working on the system's lighting.
- Do not look directly at the laser source / red beam.
- Take care not to place your hands where they could be trapped.
- Make sure that the motion system is OFF when placing hands or head near moving parts.
- Should it be necessary to work inside the assembly with the moving lens carriage:

  - Make sure that the interlock switches are working.
  - Work only in the presence of a second person. Make sure that the other person can operate the ON/OFF power switch.
- When cleaning or replacing the laser tube:
  - Turn off the laser tube and disconnect the power from the wall socket.
  - Wait a few minutes for the laser tube to cool down, and then continue working.

Do...

- Do wear laser-protective (wavelength = 10.6 μ m) goggles to prevent radiation damage to the eyes when aligning the mirrors for laser tube or laser diode.

Do Not...

- Do not open any cover of the laser tube before you send it back for repair.

1.4.5.6 Air Assist System

The LaserPro Venus system requires a source of compressed air:

- The air assist system can provide a much better engraving & cutting effect, as it

will blow away vaporized particles and prevent fire due to overheating.

1.4.6 Warning Labels

Locations of warning labels for light hazard, lamp explosion hazard and high voltage are shown in the following figures.

Figure 5 **On the back right side of the top area**

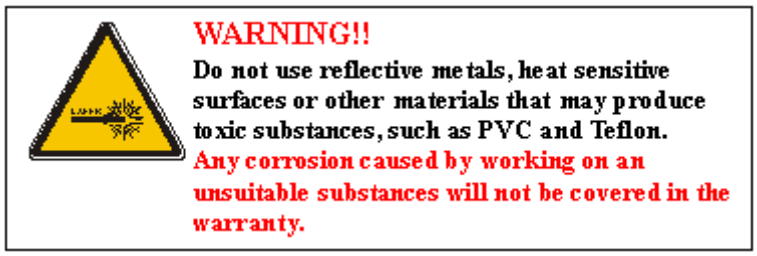


Figure 6 **On the upper center of the top area**

Figure 7 **On the front center of the top door**

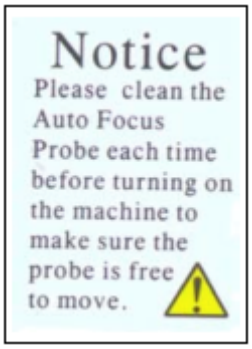


Figure 8 **On the surface of Focus Carriage**

Chapter

2

Power System

2 Power System

2.1 Overview

The first essential component for any electrical good is its power supply system. The AC input power for Venus system can be ranging from 100Vac ~ 240Vac; Venus can automatically switch between the two power levels. **In some country, to extend the maximum protection against the commercial power failure, as well as the voltage fluctuations, a power conditioner that provides line regulation and noise filtering is recommended.**

There are two circuit breakers to protect the system from over-current/short-circuit; one is 15 Amp for the total input power and the other is 3 Amp for electronic components such as main board and power board. Please refer to the figure below for the wiring.

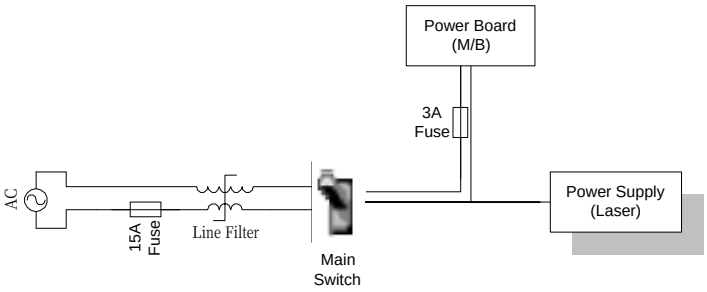


Figure 9 Wiring diagram for system power supplies

Note: *The circuit breaker is actually a thermocouple. When electrical current passes through, it will generate heat and cause the breaker to bend in a certain direction. Depending on the fuse rating, when it is over the rating the fuse will bend so much such that it breaks away from conduction. It may be necessary to wait for a few minutes to cool down the circuit breaker before switching back on again.*

2.2 Power Tray

Even though the Venus takes AC power ranging from 110Vac to 240Vac, but internally Venus operates in DC. There are two AC to DC power supplies in Venus system. The LaserPro power board provides a 5Vdc TTL to all the **electronic** ICs and communication and a 40Vdc for driving the motors. While the laser's power supply converts the 110~240Vac into 32Vdc to feed laser source and its cooling fans.

Power Supply	P/N	Part Description	Provide Power To
+5 Vdc / +40 Vdc	BK00045B	LaserPro Power Board	**+5 Vdc:** • M/B • Laser Diode • Encoder of X/Y Motor

			• Top/Front Door Sensor • Up/Lower Sensor **+40 Vdc:** • X/Y/Z Motor • Cooling Fan for M/B
+32 Vdc	PW00002B	Laser Power Supply (12W)	• 12 Watt Laser Tube • Cooling Fans for Laser Tube

2.3 Power Board (P/B) for Main Board (M/B)

2.3.1 Overview

The P/B provides both +5 Vdc and +40 Vdc to M/B. Here the +5 volts provide the operation voltage, VCC, to most of the chips on M/B except for the +40 Vdc to drive the DC servo motor and to the fan connector, JP17 (*the output is limited to 24 Vdc only*). Actually, the input power to P/B will be converted into +40 Volts at the first transformation, and then +40 Volts is regulated into +5 volts through L4960 IC. In a case when the Power LED on control panel is flashing during power on, it means that maybe the +40 or +5 volt is failed or short. The output protection for the power board is 6A. The electric current drawn in a short circuit will be over 6A and cause the power to shut down itself and restart again. Thus a flashing of power LED. *(Sometimes a flashing of LED might be too quick for a human eye, it appears the LED is on and it shows nothing on the CONTOL PANEL.)* When you find this phenomenon, just go on the *Input Power System* Troubleshooting before continuing operating the system.

NOTE: Pins assignment of JP 6 on M/B is +5Vdc/GND/+40Vdc.

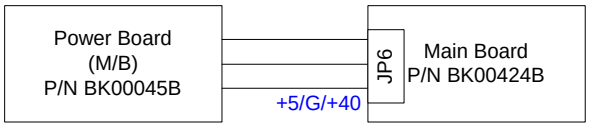


Figure 10 Wiring diagram for laser's power supply

2.3.2 Power Board Layout

Please refer to P/N BK00045B, Power Board *PCB* Layout for detail.

2.4 Power Supply for Laser System

The power supply for laser system provides +32 Vdc to the wiring PCB, which is a power distribution adaptor to supply 32 Vdc to cooling fans (*actually, the output is limited to 24 Vdc only*) and laser tube. In case that the POWER LED cannot light or all fans stop rotating, go on the *Input Power System* Troubleshooting before continuing operating the system.

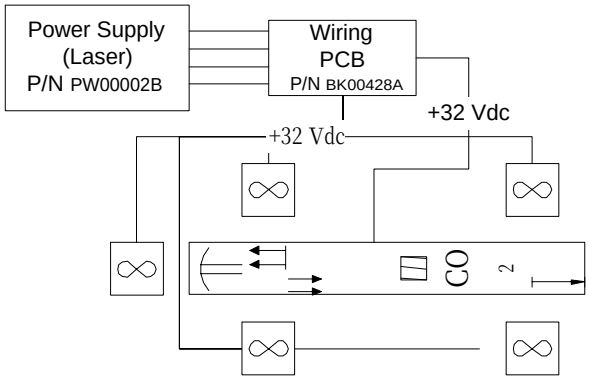


Figure 11 Wiring diagram for laser power supply

2.5 Fuse Protection

3A fuse breaks

In theory, both 3A and 15A fuses cannot break at the same time as it can be seen in the diagram of Figure 9. When the 3A fuse breaks, it means that one of the electronic components has failed, possibly a short circuit. As described before that the power board has a 6A output power protection and if it works, the 3A fuse should never breaks. In an instance of 3A fuse break, it is most likely a power board fault.

15A fuse breaks

In theory, when the 3A fuse blows, it will not cause the 15A to blow because the 3A fuse limits the power fault within the electronic components chain. A 15A fuse blows usually means one of the electrical components has failed, especially the laser power supply. Therefore, please check the laser power supply first, then the laser tube.

Chapter

3

Motion System

3 Motion System

3.1 Overview

The Motion System is driven by *DC Servo Motor*, which includes *X-axis, Y-axis motor* and *rotary attachment motor*. X-axis motor, sits at right-hand side of X-rail, moves *Lens Carriage* in a left/right direction via X-axis belt, while *Y-axis* motor drives X-rail in a forwards/backwards direction with two Y-belts located on both ends of the X-rail simultaneously.

In a laser engraver system, both the laser source and the engraving media are fixed. As a result the optical system, composes a series of reflective mirrors and focusing lens, redirects the CO_2 laser beam onto the engraving surface for marking with the help of Motion System. There are three motors in Venus system: X, Y and Z motors. The X and Y motors are motion control to direct the laser beam to construct a 2D pattern. Whereas Z motor is a stepping motor to lift/lower the working table for AutoFocus. Please refer to Chapter 5: Optical System for more information on mirrors and lens.

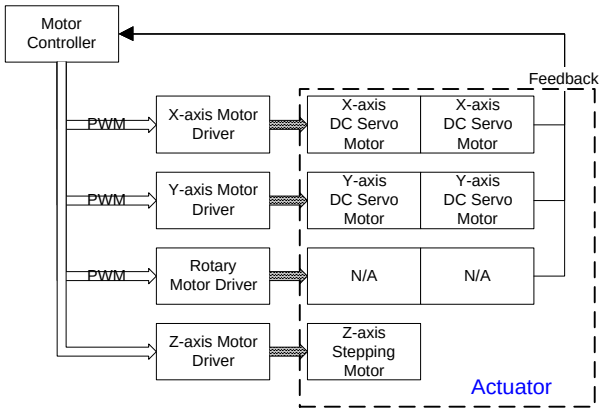


Figure 12 Function diagram of motion control system

3.2 The Actuators

3.2.1 Overview

The actuators include the DC servo/stepping motors that drive belts and gears for motion control. The following section will explore each of the motor assemblies in detail. The adjustment procedures for each motion axis are very import to those field service engineers who once replace any part in the motion system.

Motion Specification:

Travel x ..... 300 mm
Travel y ..... 210 mm

Constant velocity range..... 0.02 inches/sec ~ 20 inches/sec
Acceleration/Deceleration distance ..... 5 mm max
Acceleration/Deceleration in X-direction(Raster) 3G
Acceleration/Deceleration in Vector mode 0.1G
X-Motor.....DC servo with 500 counts/rotation
Y-Motor.....DC servo with 1000 counts/rotation
Z-Motor.....DC stepping motor, 1.8°/step

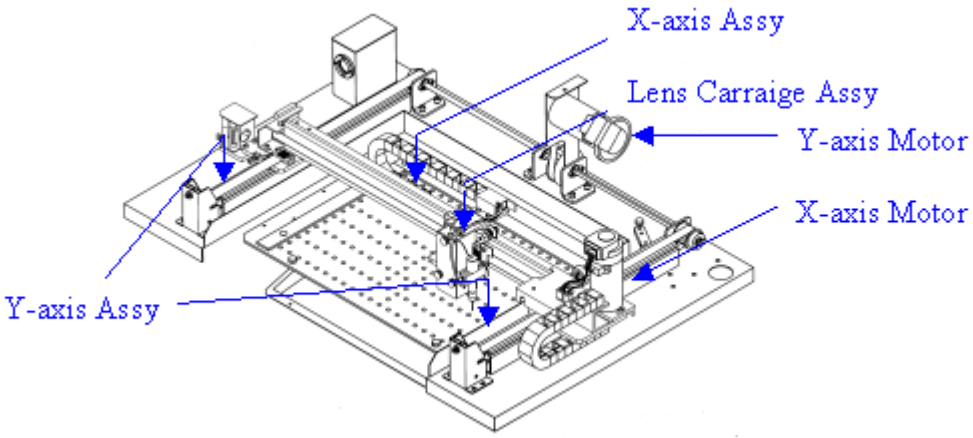
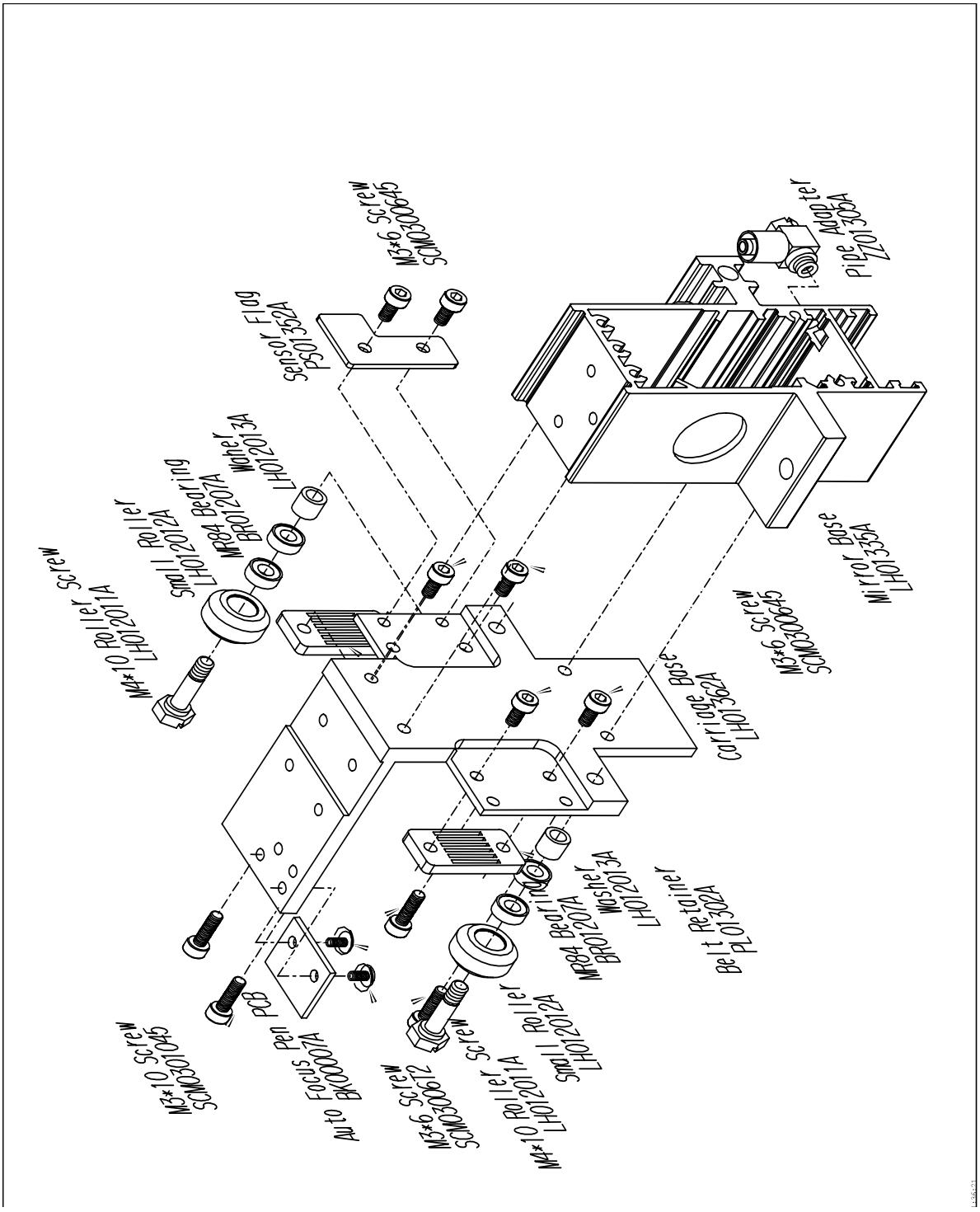


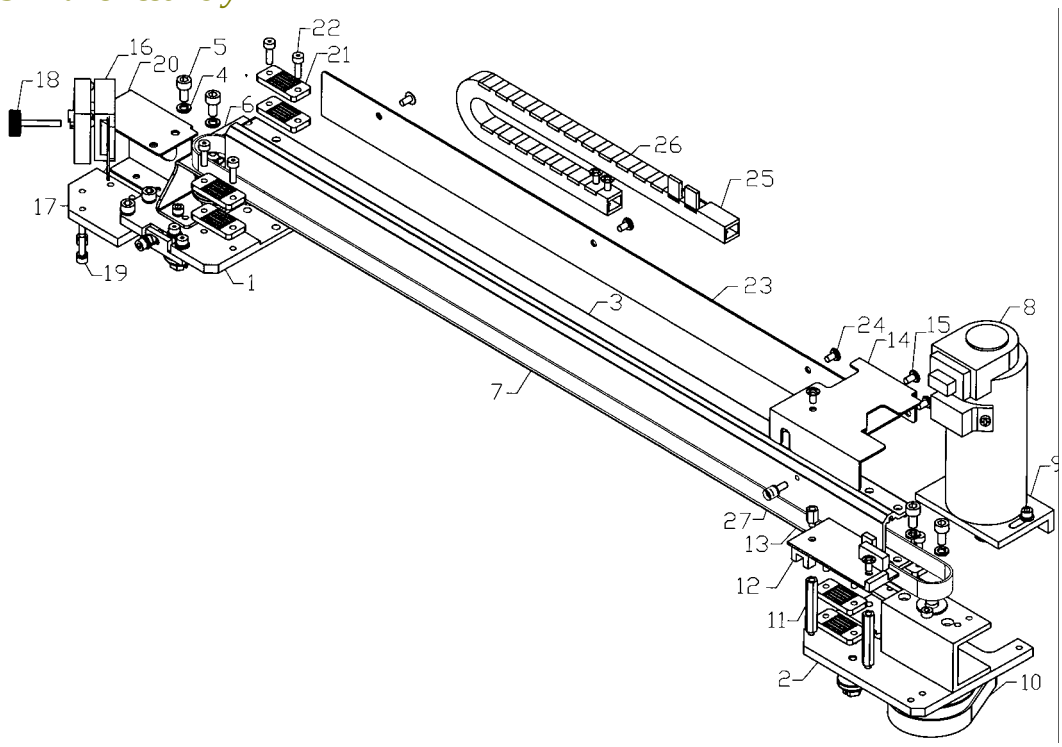
Figure 13 Top view of motion system

3.2.2 Lens Carriage

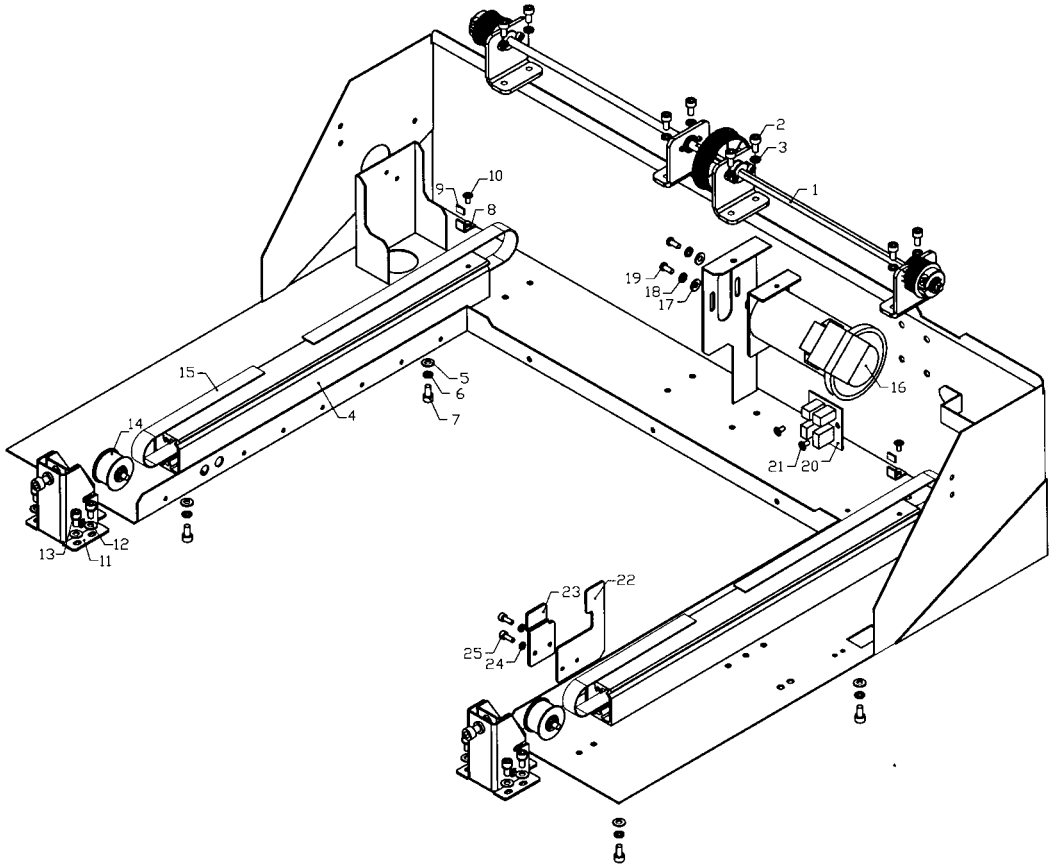
The Lens Carriage consists a mirror for reflecting the laser beam and a focus lens for focus the beam onto the media. In general, a 2.0" lens is the standard lens in the shipment; *beside GCC also offers 1.5", 2.5", 4.0" lenses depending on the application a user want to achieve*, please refer installation procedure in LaserPro Venus User's Guide for more detail.


M3*6 Screw
SCM0300645
Sensor Flag
PS01352A
Pipe Adapter
ZZ01305A
Washer
LH01201 3A
MR84 Bearing
BR01207A
Small Roller
LH01201 2A
M4*10 Roller
LH01201 1A
Screw
Mirror Base
LH01335A
M3*6 Screw
SCM0300645
Carriage Base
LH01362A
Belt Retainer
PL01302A
Washer
LH01201 3A
MR84 Bearing
BR01207A
Small Roller
LH01201 2A
M4*10 Roller
LH01201 1A
M3*6 Screw
SCM0300612
Auto Focus
BK00007A
Pen
PCB
M3*10 Screw
SCM0301045

3.2.3 X-axis Assembly



3.2.4 Y-axis Assembly



3.2.5 Rotary Attachment Motor

This function is NOT available for LaserPro Venus system.

3.2.6 Z-axis Assembly and Auto Focus

3.2.6.1 Z-axis Assembly

A stepping motor, not DC servomotor, drives the working table up/down with the Z-axis assembly. In a stepping motor, no feedback signal is provided to M/B while driving the working table. The reason that a stepping motor is used in Z-axis is because the working table is constantly locked in position during an operation and stepping motor is a better choice for locking the table height in a certain position. **When the system performs an initialization, it will lower the working table by 50mm or until it hits the bottom limit switch such that it will prevent the tool carriage hitting any unwanted object during an initialization where the lens carriage moves to the right then to the bottom.**

3.2.6.2 Working Table

How to detect and adjust working table parallel to the Motion System Frame?

In cases of the material's cutting edge is not vertical or the engraving image is not even across the working table, the laser beam may not be in the center of the lens (please refer to Chapter 5 for *Optical Adjustment*) or the working table is not parallel to the Motion System Frame (Z-axis).

If laser beam is sure to pass through the center of lens, please follow the instruction below to leveling the working table. GCC recommend having two persons to work together, as the back panel is required to be removed for an easy job.

1. Put the *focus tool* (choose the right one for current setting) into carriage.
2. Move the working table by pressing up & down arrow key until the working table almost touches the focus tool.
3. Move the lens carriage to each corner of the table and check whether there is a gap between the tip of the focus tool and the working table. If there is a gap or a difference of more than ±0.5 mm at the four corners of the working table, then it might be necessary to complete following next few steps to alignment to table to be parallel to the X-axis.
4. Un-tighten the screws on the Z motor's bracket (PS01308A) such that the belt interconnects all the gears in Z-axis assembly can be loosen. Once the belt is loosening, one of the three screws bars can be lifted/lower without affecting the other two screw bars.
5. Adjust the three screw bars one by one until the working table is leveled with the x-rail *and then go back to step 3 to repeat level checking*.
6. Once the gap between the tip of a focus tool and the working table is less than ±0.5 mm, then the belt and motor can be secured and tighten back to its original position. **Please pay attention while fixing the belt back**

onto the pulley; it is handy to have another person to assist by holding the screw bar from the rear to prevent them from an unintentional rotating. Any rotation of the screw bar will set the table off level to the Motion System Frame.

3.2.6.3 Auto Focus

The Auto-Focus Tool Assembly is located on the right of the lens carriage. This Auto-Focus tool is used to measure the height of an engraving object. When a user presses Auto Focus key, the working table will move up until the pin of Auto-Focus touches the working surface for detection, then it moves down by a distance according to the focus lens selected in the system's menu of FUNCTION->Tune(Auto Focusing).

Note: *When performing the Auto Focus function, please make sure the current used focus lens is identical to the setting in the system. Besides, to keep Auto Focus in working order, please remember to clean the Auto Focus pin after an engraving job.*

3.3 Power Supply

The power for motion system uses both +40 Vdc for driving servo/stepping motors and +5Vdc for Encoder. Inside the M/B, there is a build-in mechanism to protect the system from an over-current. When there is a main board problem with the L6203 IC shorted out, an aging motor is most likely to be cause of this. When there is a motor failure, firstly check if the motion system could be moved freely after power off by manually moving the motion system by hands. Then try to double-check on motors to make sure that the specific motor is still working fine. Please refer to Chapter 2, Power System, for more information.

Chapter

4

Laser System

Chapter 4: Laser System

4 Laser System

4.1 Overview

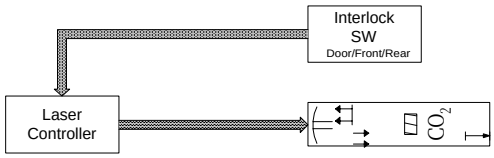
Laser operation occurs when a medium (in LaserPro Venus's case is CO_2) is excited within a chamber. The laser tube is a sealed metal tube. This light is amplified from bouncing forth and backwards inside the high voltage medium. A small hole on the one end's mirror allows the amplified and coherent light to escape or shoots out. The CO_2 laser output has a wavelength of 10.6μm which is invisible to human eyes. The red beam is used as an aid to show the approximate location CO_2 laser beam path for human.

"Laser" has found itself as a crucial component in many emerging applications. Few common used applications today are engraving, cutting, marking and even 3D prototyping.

4.2 Controller and the Laser

4.2.1 Overview

One of the major functions of the main board is to control the laser firing at a right moment on the right spot. The Synrad's CO_2 laser has a maximum firing pulse rate of 20KHz. In order to keep the response in such short duration of time and achieve a perfect synchronization of time and space, a tickle pulse is constantly sent out from main board's laser control signal, JP1, to Synrad laser. The tickle pulse is used to mildly excite the laser tube such that the laser tube is constantly in stand-by mode and ready to fire immediately upon a call. However this manual will focus on the I/O between laser controller and laser tube. The detail operating theory of the laser tube can be obtained from the laser tube's manufacturer, Synrad.



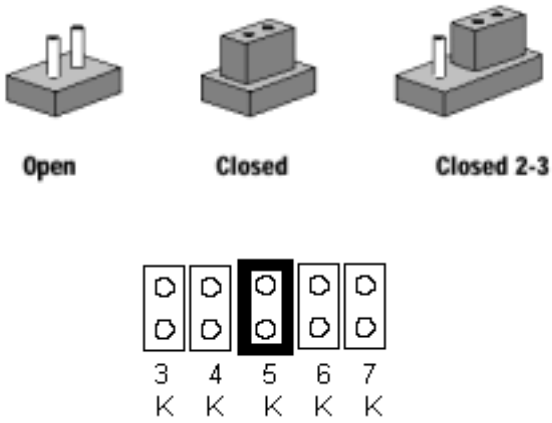
4.2.2 Laser Controller

The laser controller is built-in on the M/B. For a raster mode, it synchronizes the encoder signal for firing in raster mode. For a vector mode, it is control by the firmware inside. In addition to the complex algorithms inside the firmware, there are some others factors that may affect the performance of laser tube. In the following section, we will describe the *Tickle Pulse* and *PWM Frequency*, which take an important role to the laser control.

4.2.3 Tickle Pulse

The 12 watts laser tube requires a 1 μs tickle pulse delivered at a 5 KHz clock frequency from controller. If there is no tickle pulse to laser tube, the response time from the user's command (encoder signal) until laser emission is unpredictable. The laser contains a precision pulse stretching circuit that is preset to accept a 1 μs ± 20% no-lase, tickle pulse. Lase threshold is preset for 3 ± 0.5 μs based on a PWM and tickle frequency command input of 5 KHz.

Below shows the clock frequency source jumper setting on M/B. **The default clock setting for tickle pulse is 5 KHz**.



4.3 Figure 14 Clock frequency source for Tickle Pulse (J18 on M/B)

4.4

In order to get a 1 μs ± 20% tickle pulse, the VR1 on M/B is designed to adjust the pulse width of tickle pulse. The larger the resistor value is(eg. 7K), the wider the duty cycle is within the tickle pulse. In another word, a lower resistor value means a smaller tickle pulse to excite the laser in stand-by mode.

Caution The tickle pulse is well tuning in factory; please don't even try to touch VR1 in the field. The only occasion needed to change the JP18 setting is when the laser will get agitated during a transportation/vibration, then it will produce the laser bleeding problem with exactly the same tickle pulse.

4.4.1 PWM (Clock) Frequency

PWM duty cycle controls the laser's power level so you van direct the laser to perform a variety of cutting and marking task. The standard frequency is 15 KHz, which has a period of 66μs. The duty cycle of a PWM waveform is the percentage of the period that the output signal is high. Please refer to glossary to more detail information.

4.4.2 Laser Tube

The laser incorporates the latest technology in sealed carbon dioxide devices, combining the best features of both wave-guide and free space CO_2 laser technology. The all-metal laser tube construction features the ruggedness, stable optical support, and small size of wave-guide lasers. Its larger bore (4.8 mm) eliminated the high optical power density of wave-guide lasers with their predisposition to optical degradation and incorporates the

mode purity and easy optical alignment of free space TEM00 lasers. Low cost is achieved by using simple extruded and welded aluminum structures packages together with compact, state-of-the-art RF power supplies. The laser is self-contained requiring only the application of power, cooling air or water, and a control signal. It is therefore ideally suited for overhead installation where the laser is gantry-mounted. No RF cable runs are required.

Wavelength .....10.6 µm
Power Output ..... 12 Watts
Power Stability ..... ± 10%
Mode Quality ..... TEM00 equivalent: 95% purity
Electrical Power Input ..... 32 Vdc, 7 Amp max.
Thermal Shutdown ..... 60° C ± 2° C, warning at 54° C ± 2° C

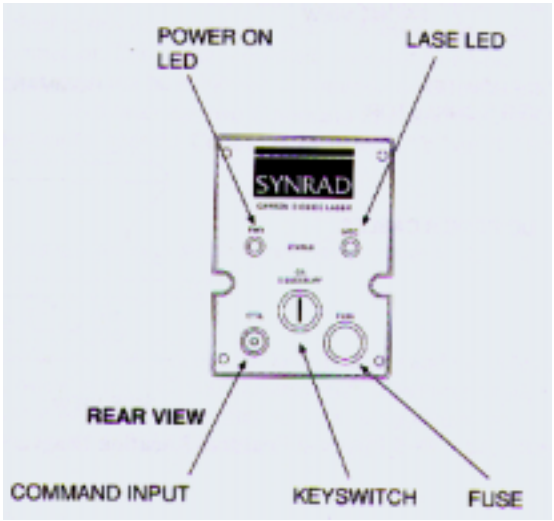


Figure 15 Laser tube panel (Rear View)

When the 32 Vdc input is ON, the green POWER ON LED will light on, when there is trigger send to laser tube, the red LASE LED can indicate the lasing status. Besides, there is an interlock cable connected between key switch (inside the laser tube) and door switch for safety purpose.

In order to operate the laser tube continuously, inside the LaserPro Venus, there are build-in cooling fans as below

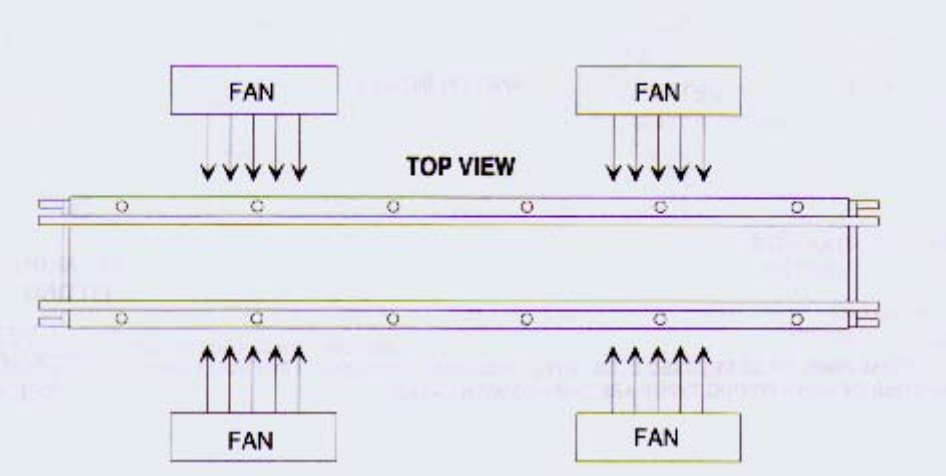


Figure 16 Cooling fans for laser tube

4.5 *Power Supply, P/S*

The Laser Power Supply (12W), P/N PW00002B, with 32 Vdc output is initially configured for 12-watt laser tube. In order to the use the same P/S to +24Vdc cooling fans for laser tube, it needs to connect through the wiring PCB, P/N BK00428A. From the wiring PCB, it provides exact +24Vdc to all of cooling fans.

Chapter

5

Optical System

5 Optical System

5.1 Overview

There are 3 reflective mirrors included in the motion system. *Mirror 2* situates at the top left corner of the motion frame to receive the up-bounded laser and reflects it to *Mirror3* that sits on the left side of X-rail. After passing Mirror 3, laser is reflected to *Mirror4* that is fixed right on top of focal lens on the Lens Carriage. Then, laser beam is guided downward through and focused through the focus lens.

5.2 Laser Diode (Red Beam Source)

The laser diode provides a red beam source for operator to make sure where to start the laser engraving. Actually, the red beam is parallel to laser beam, not inject at the same position on working table. However, the distance between 2-projected points should be less than 1 mm. If NO, go to Section 5.3.2 for the adjustment procedure.

5.3 Optical Adjustment

5.3.1 Overview

In order to keeping the well cutting or engraving quality, if you find the following situation please check laser beam path:

1. Is the cutting edge not vertical?
2. Is the power (Cutting Effect) not even at each corner from **P1**[1] to **P4**?

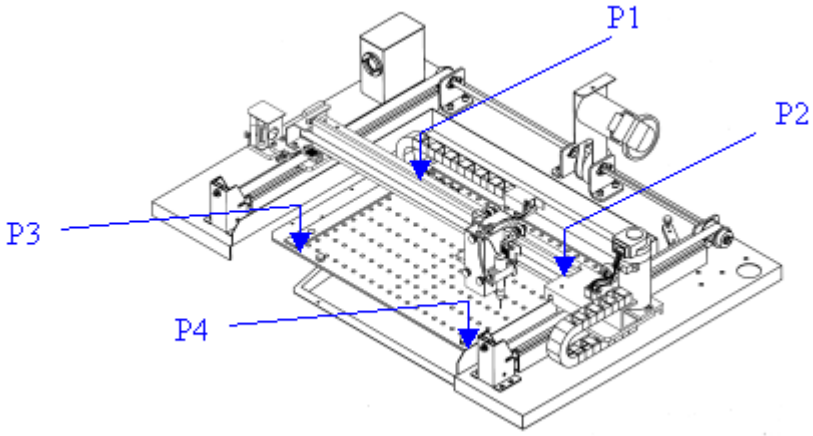


Figure 17 Location of P1/P2/P3/P4

3. Does the laser tube need disassembling for serving?

[1] **P1** stands for moving the Lens Carriage to the most upper-left position on the active area of working table from the viewpoint of operator standing in front of the system.

4. Does the *Laser Diode* need to be replaced?
5. The *red beam* still exists but it does not appear on the working table, which means that red beam is not parallel with laser beam.

If one of the above conditions is found, please follow the instruction to re-align the laser and red pointer beam Path.

Caution *During performing optical adjustment, please make sure that you have put on laser goggle to protect your eyes.*

5.3.2 Laser Diode and its Reflective Mirror Adjustment

In order to match the 1 mm different requirement between red beam and laser beam. It is very important to perform below adjustments. However, since the laser diode is adjusted before the system is shipped, only in below cases the user needs to perform below adjustment,

- Replacing Laser Diode
- Replacing Laser Tube

How to Re-alignment Laser Beam and Red Beam Parallel?

1. Remove the side covers and prism mount for Mirror 1.
2. Put a target paper away from the machine about 3 M away from the laser's shoot out.
3. Switch on the machine and select check laser source in the hidden diagnostic functions, besides setting the power to 3%[2] on 12-watt machine.
4. Press Enter till the target burning the tiny point.
5. Adjust the prism mount for Red Beam mirror to joint the red beam and tiny point together.

While the process is done please re-assemble the Prism Mount for mirror 1 back to previous position.

[2] Output = Percentage * Max Power of Laser Tube. The output for this test cannot exceed 3 watts for safety purpose.

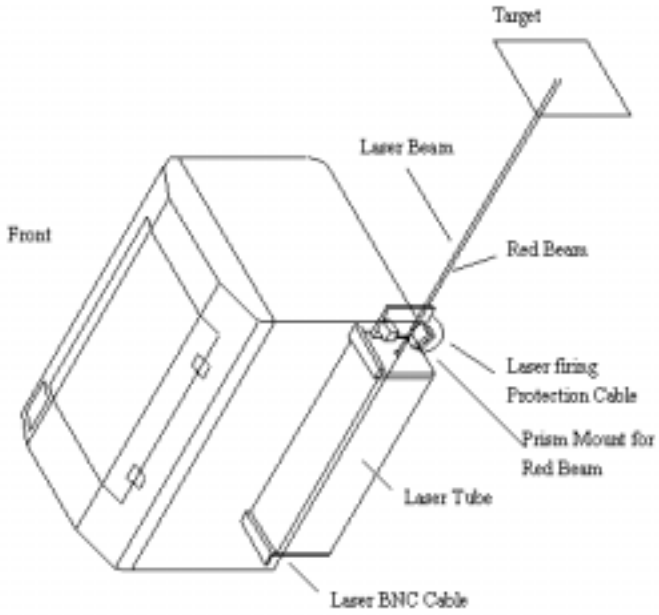


Figure 18 Rea beam adjustment procedure

After Mirror 1, the red/laser beams go the same path. In order to make sure that both beams go through the same path, it is very importance to adjust Mirror 1/2/3/4 after replace laser tube

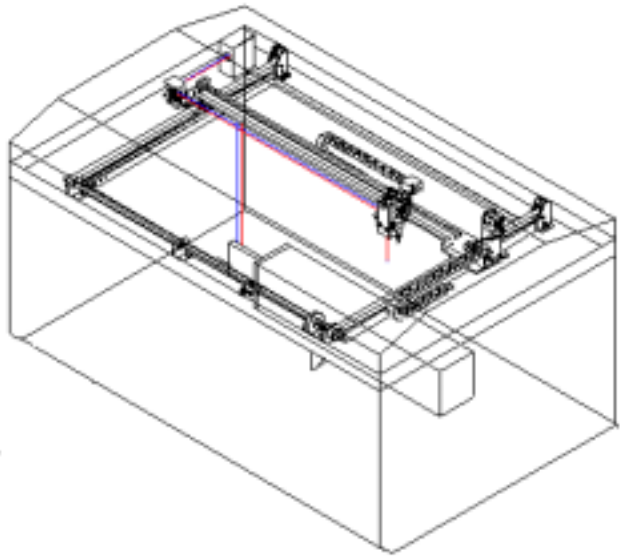
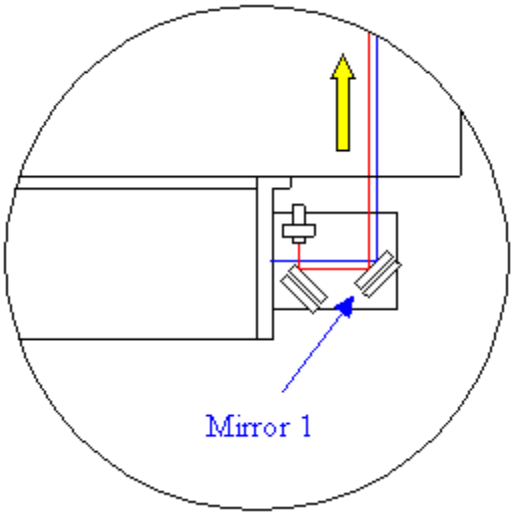


Figure 19 Rea/Laser beam path

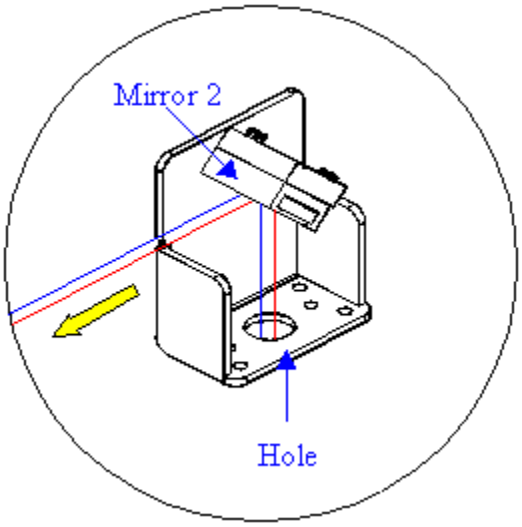


(A)

5.3.3 Mirror 1 Adjustment

1. Stick a piece of paper (label sticker is a good tool) underneath the Mirror 2's prism mount bracket hole.
2. Press ENTER till the paper is burnt with a mark.
3. If the burn mark is not in the center of the hole, adjust the Prism Mount of Mirror 1, use red beam as the reference, to bring the laser beam to the center.

Repeat step1~3 until laser beam is tuned to the center of the hole.



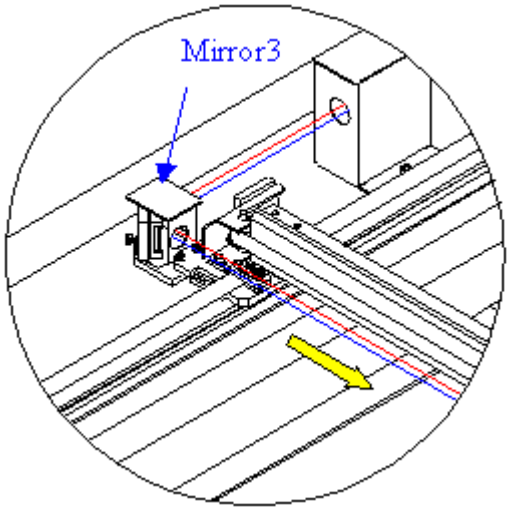
(B)

5.3.4 Mirror 2 Adjustment

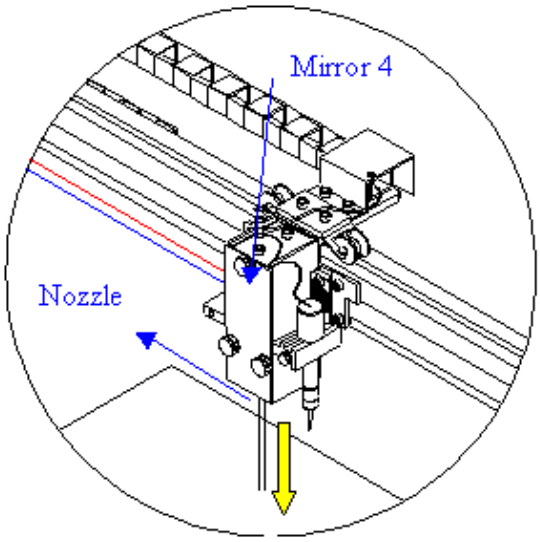
1. Move the lens carriage to the front side.
2. Stick a piece of paper before the Mirror 3's prism mount bracket hole.
3. Press ENTER till the paper is burned with a mark.
4. If the burn mark is not in the center of the hole, adjust the Prism Mount of Mirror 2, use red beam as the reference, to bring the laser beam to the center.

Repeat step1~3 until laser beam is tuned to the center of the hole.

Nozzle



(C)



(D)

Figure 20 Mirror 1/2/3/4 position and the reflective laser beam/red beam direction

5.3.5 Mirror 3 Adjustment

1. Move the lens carriage to the front-right side.
2. Stick a piece of paper before the Mirror 4's prism mount bracket hole.
3. Press ENTER till the paper is burned with a mark.
4. If the burn mark is not in the center of the hole, adjust the Prism Mount of Mirror 3, use red beam as the reference, to bring the laser beam to the center.

If step 4 cannot satisfy the requirement, go back to Section 5.3.3, repeat procedures in 5.3.3 ~ 5.3.5 until laser beam is tuned to the center of the hole.

5.3.6 Mirror 4 adjustment

There is no extra adjustment procedure to adjust the mirror 4 since it is fixed in the lens carriage. However, user can check the mirror 4 by the following procedure,

1. Move the lens carriage to the front-right side.
2. Stick a piece of paper at the blow nozzle hole under Mirror 4's prism mount bracket hole.
3. Press ENTER till the paper is burned with a mark.
4. If the burn mark is not in the center of the hole, check if there is deformation of the lens carriage by unknown reason or not.

5.4 1.5"/2.0"/2.5"/4.0" Focus Lens

5.4.1 Overview

The diameter of focal spot is a point, but a circle. Below diagram shows the function of the spot size.

$$d = \frac{1.27 * f * \lambda}{D}$$

Focal Length	Diameter of Focal Spot
1.5"	< 0.06 mm
2.0"	< 0.08 mm
2.5"	< 0.10 mm
4.0"	< 0.16 mm

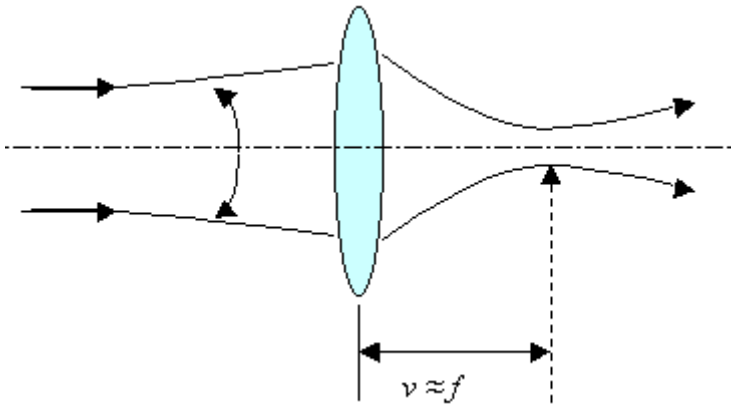


Figure 21 Focal theory and it pattern diagram

5.4.2 Focus Tools

In order to adjust the focal length quickly, a focus tool is provide in the accessory box to help user to accomplish the focus adjustment. To adjust the focal length, please refer to the LaserPro User's Manual for more detail.

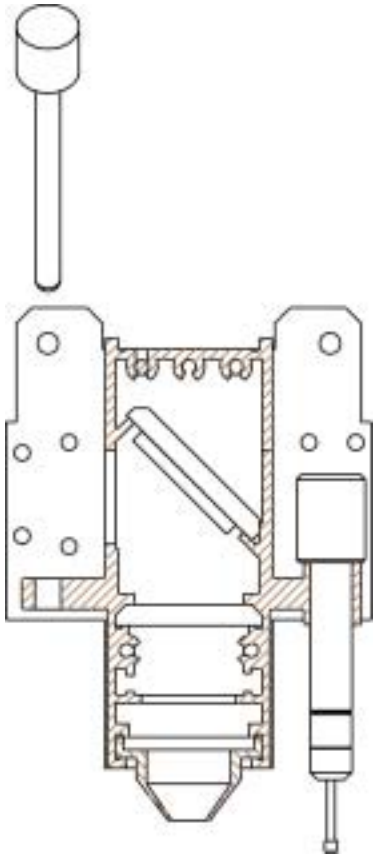


Figure 22 Position to put in the focus tool

Different focus lens has different setting, please check the current using focus lens before you perform this operation.

1. Put in the 1.5” focus tool
2. Press Down until the focus tool touches the working table. (Make sure that the focus tool is still hung on the lens carriage, not raised by the working table).
3. Press OK to finish the adjustment.

Put in the 2.0” focus tool, follow above step 2 and 3 to finish the adjustment

Put in the 2.5” focus tool, follow above step 2 and 3 to finish the adjustment

Put in the 4.0” focus tool, follow above step 2 and 3 to finish the adjustment

Chapter

6

Control Panel System

6 Control Panel System

6.1 Overview

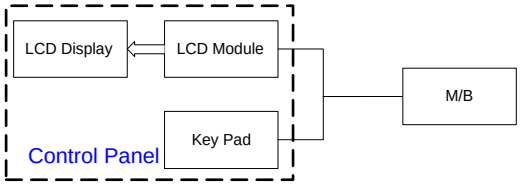


Figure 23 Control panel function diagram

6.2 Operation Modes on Control Panel Display

There are 4 different operation modes in LaserPro Venus system. General, a user can use OFF-Line/ON-Line mode to accomplish the engraving application. ***Hidden Diagnostic and Firmware Upgrade mode is for service purpose; only experienced technician can operate it.***

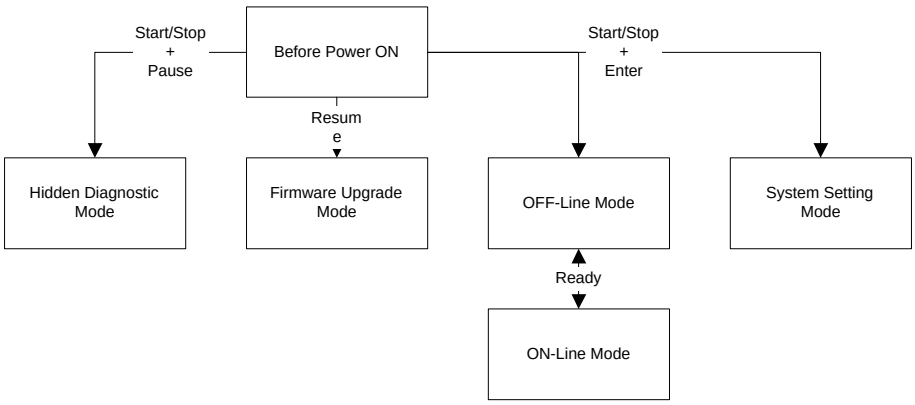


Figure 24 Operation modes switching by control panel

- **Hidden Diagnostic mode**: Power on the machine while depressing Start/Stop & Pause keys simultaneously till text appears on the display.
- **Firmware Upgrade mode**: Power on the machine while depressing Resume key simultaneously till text appears on the display.
- **OFF-Line mode**: Normal power-on without press any key until the system is ready to accept any command.
- **ON-Line mode**: Press Start/Stop key to switching between OFF-Line mode and ON-Line mode.
- **System Setting mode**: Power on the machine while depressing Start/Stop & Enter keys simultaneously till text appears on the display.

6.2.1 Hidden Diagnostic mode

The hidden diagnostic mode provides a stand-alone machine test for most of the LaserPro Venus function. Please refer to Chapter 8 for more detail.

6.2.2 Firmware Upgrade mode

In this mode, Venus's firmware can be downloaded from a PC. User can contact GCC Customer Service Dept. or connect to below web site to get the up-to-date firmware file,

WWW.GCC.COM.TW

- **From Printer Port**: Under DOS platform or ***DOS Prompt Window*** in Windows 95/98/NT platform, type in below command to copy the firmware from PC to LaserPro Venus. Here "*[Firmware]* " means the firmware filename, which you get from GCC, and "/B" means copy file in ***binary*** mode.

  C:\> COPY *[Firmware]* LPT1/B

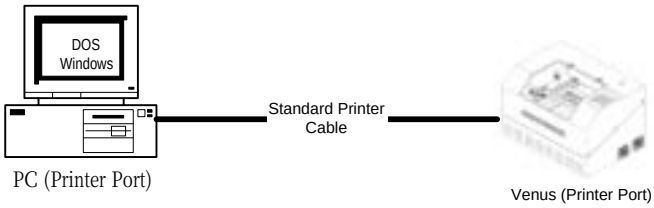


Figure 25 Upgrade firmware from printer port

**Note: Please make sure the parallel port setting is SPP mode.*

- **From Serial Port: (not recommended, because slow in speed)**

  Function N/A for LaserPro Venus system.

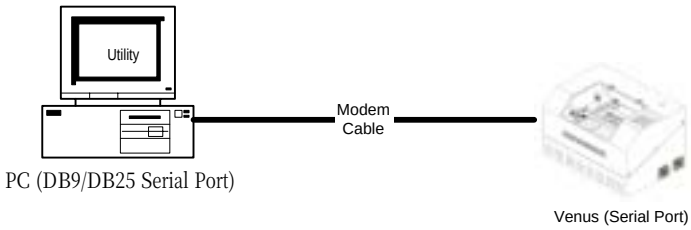


Figure 26 Upgrade firmware from serial port (RS-232C)

6.3 Post Firmware Upgrading

After the LaserPro Venus receives complete firmware from PC, it will re-flash the Flash ROM automatically, and then reboot the system. It might be necessary to wait for up to one minute for the system to initialize for the first time after the re-flashing. Please do NOT turn off the machine.

6.3.1 OFF-Line mode

In the OFF-Line mode, a user can operate the all of the utility function within the LaserPro Venus.

6.3.2 ON-Line mode

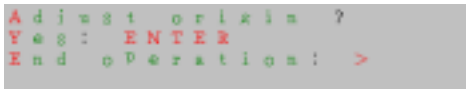
Only in the on-line mode, user could operate the laser engraving.

6.3.3 System Setting mode

There are 2 functions available in the mode,

- Test Plot
- Adjust Origin

This mode is used for GCC OQC (Out-going QC) only. There are different output graphs for different inspection. In order to make sure that each machine is under well integration, OQC will keep the final inspection test on acrylic plate as a record in GCC.



After the system perform the initialization, suppose that the lens carriage moves to the (0, 0) position of working table. When user find the red beam from laser diode indicate at incorrect position, then it is recommended to perform "Adjust origin" procedure to reset the origin position.

NOTE: In case that this procedure cannot recovery the problem, and all the time the lens carriage moves to wrong/different position, go on Motion System troubleshooting for detail checking procedure.

6.4 Error Messages

During operation you may face some error message shown on the control panel display. The following shows the action corresponding to each error message. If you have some other errors, which are not listed in the following table

Error Message	Action
File too large Please send the file again then Press START key to start	The printed file is larger than the printing buffer size. Please upgrade the DRAM module or reduce the print-out size.

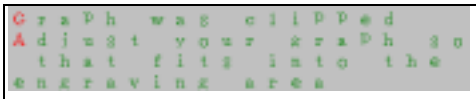
	A mark is drawn/engraved outside of the workable area. Please refer to User's Guide to make sure the Printer Driver's paper size matches the page size of the file.
	
	Printing commands to the laser engraver is unidentified. Please make sure the driver is installed properly and have the correct output commands.
	
	
	
	1. If re-send file cannot make it work, try to upgrade the memory (DRAM) size or print it in single file mode.
	
	
	
	DRAM is failed
	SRAM is failed
	
	

Table 1 Error message list

Chapter

7

Computing System

7 Computing System

7.1 Overview

The M/B provides a powerful multi-function working for the LaserPro Venus system. It includes interlock control, communication, motion control, and laser control. The figure below shows the detail function diagram of the M/B. The previous chapters have discussed the motion control and laser control. This chapter will concentrate more on the interlock control and communication.

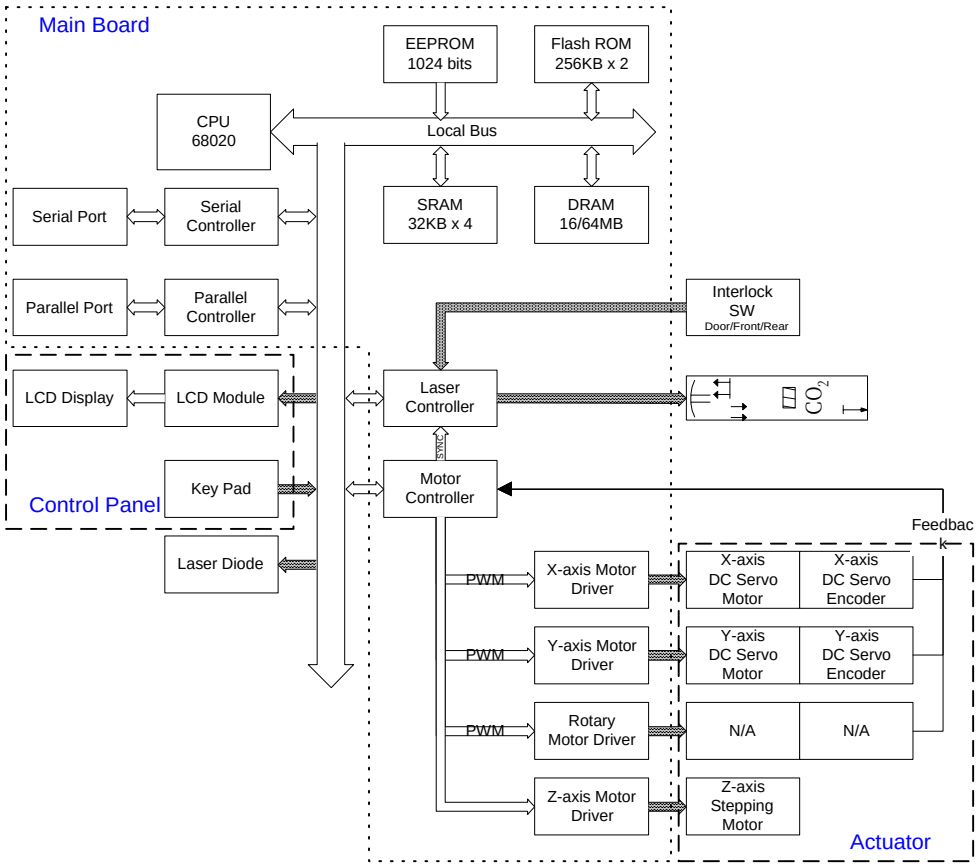


Figure 27 Function diagram of M/B and the peripheral devices

7.1.1 Main Board Layout

Please refer to P/N BK00424B, Main Board PCB Layout for detail.

7.2 Limited Sensor

The limited sensor provides safety protection to users and LaserPro Venus itself. Please check the limit sensors, door sensors or Z-axis limit sensor all the time when a system has found to have problems.

7.2.1 Front Door Sensor Switch

The door sensors are intended to provide a safety way to operator. When the any door sensor is open, the laser will not firing, but ***the motion system will still operates as normally.*** The picture below shows the location of one door sensor. The other one is located at the left side corresponding to the right one. When the door is open, the door sensor switch will be disconnected. Therefore the main board will disable the laser firing.

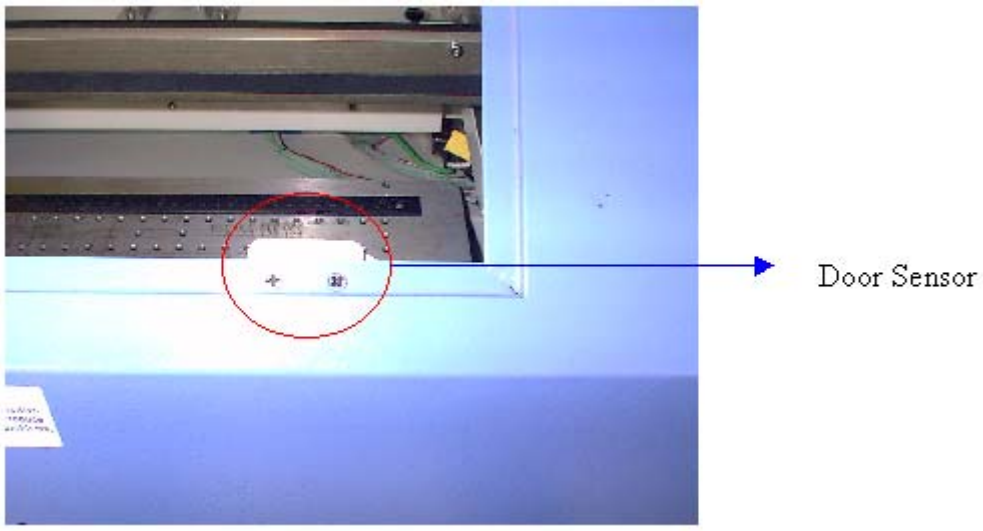


Figure 28 Front door sensor switch location

7.2.2 Upper/Lower Sensor for Working Table

The upper/lower sensors provide M/N an indication that the working table has reach the limitation position and had to stop moving up or down. Both sensors have the same P/N. **In case that one sensor if failed, please keep the good one to lower sensor position since the working table may reach the lower limit during initialization.**

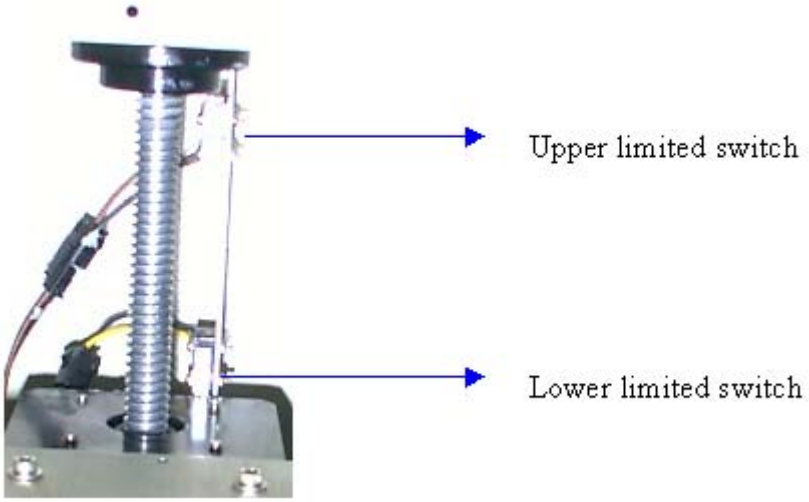


Figure 29 Upper/lower limited switch location

7.2.3 Dual Head Sensor

Function N/A for LaserPro Venus system.

7.3 Flash ROM

The flash ROM stores the firmware and the loader utility permanently. When s user try to re-flash the Flash ROM, only the firmware is replaced by the new update.

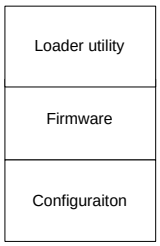


Figure 30 The structure inside the Flash ROM

7.4 SIMM DRAM

The SIMM DRAM is the destination to store data sent from PC. For Laser Venus, you can

SIMM / Size	SIMM1	SIMM2	Description
4 Mbytes	4 Mbytes		No support
8 Mbytes	4 Mbytes	4 Mbytes	No support
8 Mbytes	8 Mbytes		No support
16 Mbytes	8 Mbytes	8 Mbytes	No support
*16 Mbytes[3]	16 Mbytes		OK
32 Mbytes	16 Mbytes	16 Mbytes	No support
32 Mbytes	32 Mbytes		No support
64 Mbytes	32 Mbytes	32 Mbytes	OK

7.5 Printer Port

The Printer provides a parallel connection between PC/MAC and LaserPro Venus. The default driver setting for this system is through the Printer Port. If you try to change to serial port, please refer to next section for the setting.

Besides, the printer port supports only SPP mode, not ECP/EPP compatible, if user tried to send data through printer port, it is better to change the BIOS setting as below,

CHIPSET FEATURES SETUP

Parallel Port Mode: Normal

[3] Default configuration for LaserPro Venus system

Computer Pin	Venus Pin	Signal Name	Meaning
1 ==> 1		-STROBE	Indicated data transfer
2 ==> 2		D0	Data line – bit 0
3 ==> 2		D1	Data line – bit 1
4 ==> 2		D2	Data line – bit 2
5 ==> 2		D3	Data line – bit 3
6 ==> 2		D4	Data line – bit 4
7 ==> 2		D5	Data line – bit 5
8 ==> 2		D6	Data line – bit 6
9 ==> 2		D7	Data line – bit 7
10 <== 10		-ACK	Last character Received
11 <== 11		-BUSY`	Printer busy
12 <== 12		PE	Printer has no paper
13 <==13		SLCT	Printer is online
14 ==> 14		-AUTO FEED	Automatic CR after LF
15 <==32		-ERROR	Data transfer error
16 ==> 31		-INIT	Reset printer
17 ==> 36		SLCT IN	Turn printer online
19 ~ 25 ==> 19 ~ 30		GND	Ground

Table 2 Parallel port pin assignment between PC/MAC and LaserPro Venus

7.6 *Serial Port (RS-232C)*

7.7

The Serial Port provides a serial connection between PC/MAC and LaserPro Venus. The default factory setting for this system is as below. If you try to output from serial port, please check

Baud Rate: 57600 *BPS* (Bits Per Second)
Data Bits: 8
Start Bit: 1
Parity: None

Below shows the pin assignment of serial port on LaserPro Venus. Mostly, if end-user cannot provide safety grounding, which can connect to the grounding terminal in equipment associated with the electrical supply wiring, GCC recommends to use the same power distributor for both LaserPro Venus and PC/MAC. *This could protect both sides when there is a glitch happens at one side.*

The Baud Rate setting: 9600/19200/38400/57600

Note

1. *The effective transmit distance may change due to the baud rate setting.*
2. *The driver, which is configured, to output from COM port, should has the same baud rate setting as in LaserPro Venus.*

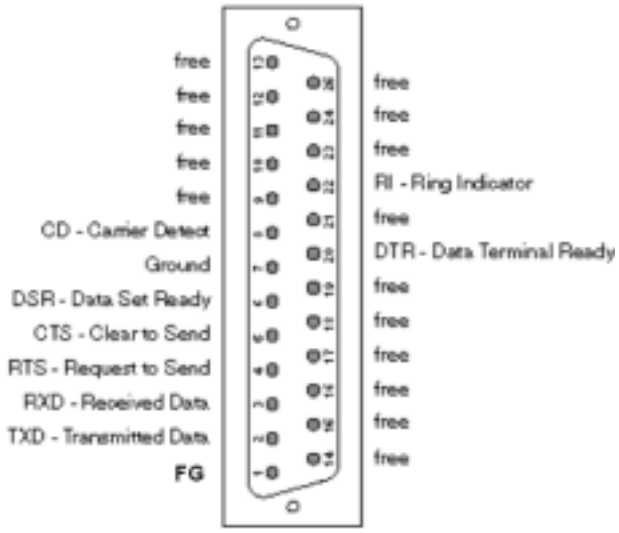


Figure 31 Pin assignment of RS-232 port on LaserPro Venus

In the following shows the pin assignment of RS-232 port of PC/MAC:

Connector	RS-45	DB-8 (MAC)	DB-9	DB-25
1	RTS	HSKo	CD	FG
2	TX	HSKi/CLK	RX	TX
3	RX	TxD-	TX	RX
4	DTR	GND	DTR	RTS
5	CTS	RxD-	SG	CTS
6	DSR	TxD+	DSR	DSR
7	GND		RTS	SG
8	CD	RxD+	CTS	DCD
9			RI	
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				DTR
21				
22				RI
23				

24				
25				

Table 3 Pins assignment for different type of RS-232 connector

7.8 Connection with PC

For PC system, there are three different kinds of connection to connect to LaserPro Venus

- To **Printer port:** You can connect any standard printer cable from PC to printer port of LaserPro Venus.

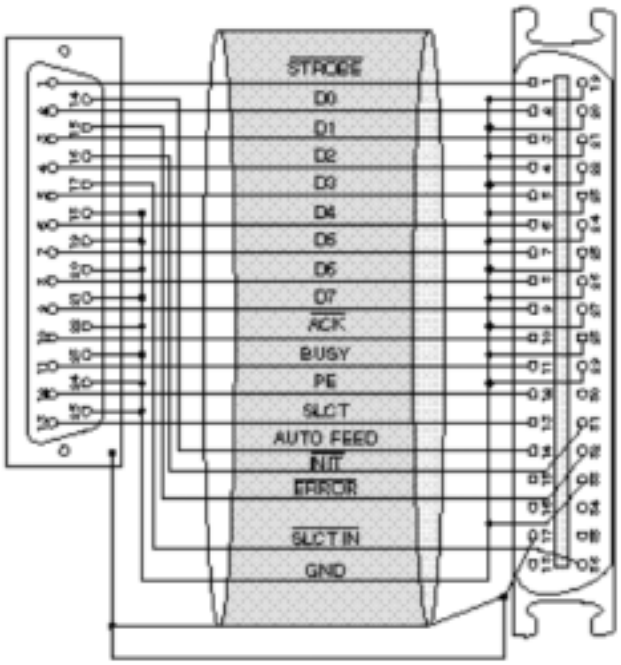


Figure 32 Pins assignment for the standard printer cable

- To **Serial port:** You can connect the serial cable (P/N **CB00010A**) from PC to serial port of LaserPro Venus.

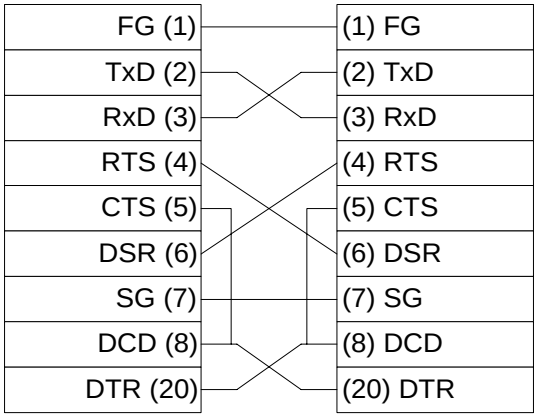


Figure 33 Pins assignment for the standard serial cable

- To **USB port:** Right now there is no LaserPro Venus driver, which supports to output from USB port. However, you can apply any commercial USB to RS-232 port or USB to Printer port adapter, then connect the corresponding cable (modem or printer cable) to LaserPro Venus. *Be sure that it needs no extra driver when uses USB adaptor to convert signal into serial/parallel port.*

7.9 Connection with MAC

For MAC system, there are two different kinds of connection to connect to LaserPro Venus

- To **Mini DIN-8 port:** You can connect to its Mini DIN-8 port through MAC serial cable (P/N **CB00400A**) to serial port of LaserPro Venus.

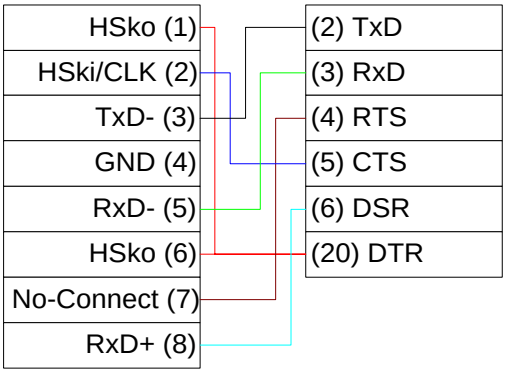


Figure 34 Pin assignment for MAC Serial cable, P/N CB00400A

- To **USB port:** Right now there is no LaserPro Venus driver, which supports to output from USB port. You can apply any commercial USB to RS-232 port or USB to printer port adapter, then connect the corresponding cable (modem or printer cable) to M/B of LaserPro Venus. *Be sure that it needs no extra driver when uses USB adaptor to convert signal into serial/parallel port.*

Chapter

8

System Diagnostics

Chapter 8: System Diagnostics

8 System Diagnostics

8.1 Overview

In order to increase the troubleshooting performance, GCC provide build-in hidden diagnostic functions to check most devices in LaserPro Venus. It is a very useful tool, which assists you to verify and locate the fault quickly when a malfunction occurs.

8.2 The Build-in Hidden Diagnostic Functions

To access to this procedure, you simply power on the machine while depressing Start/Stop & Pause keys simultaneously till text appears on the display. Refer to the following diagram, you can easily find the whole build-in hidden diagnostic functions in the LaserPro Venus system.

Caution *Improper operation may cause the system failure in the hidden diagnostic mode. Make sure that you have worked through all of the functions before you operate alone.*

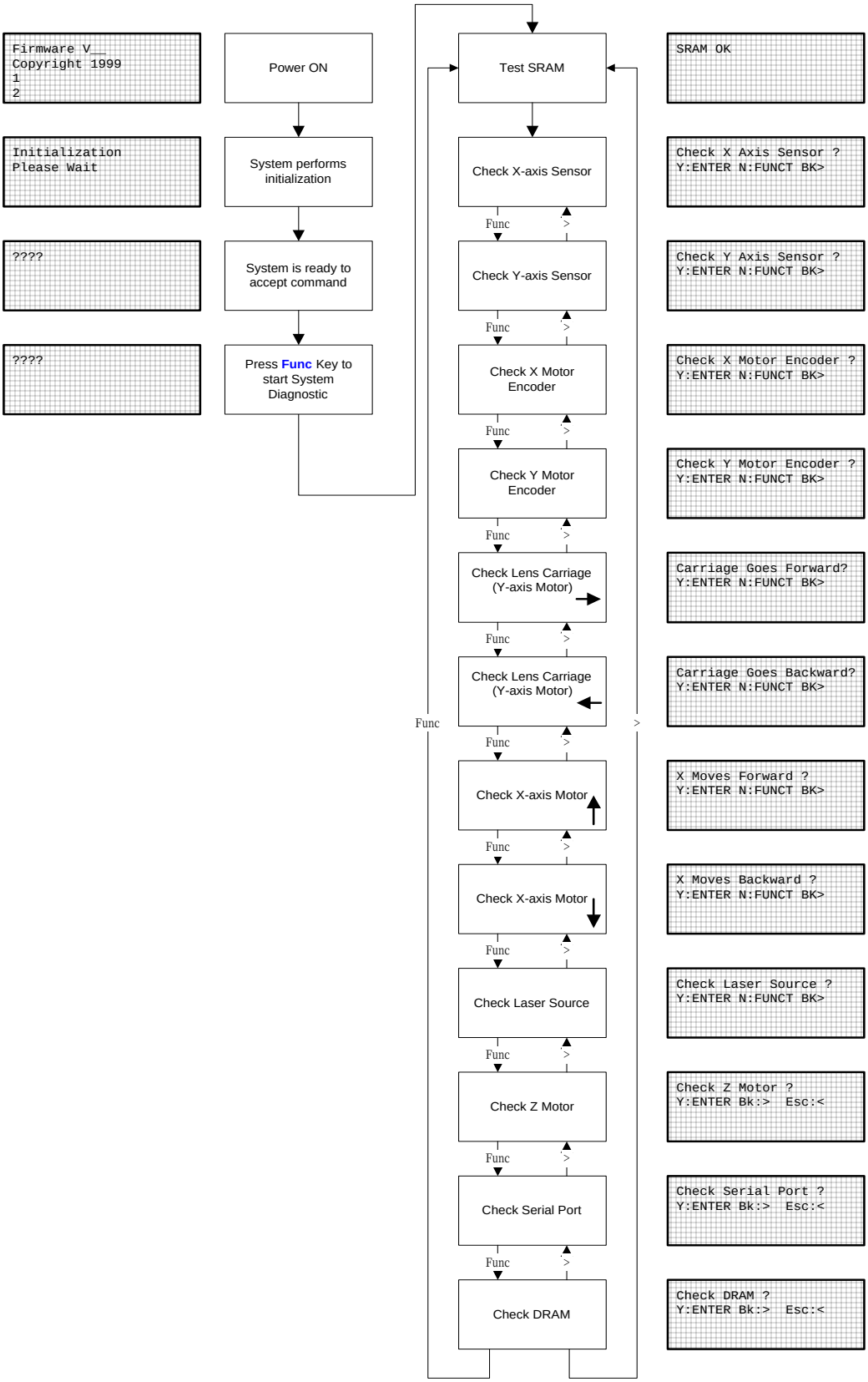


Figure 35 The build-in hidden diagnostic functions

Once enter the diagnostic procedure, the following items can be checked:

Caution *Please recovery every device to its original position, and then reboot the system after you finish the diagnostic procedures.*

- **SRAM**
- **X-axis sensor**
  In this mode, the X-axis motor will be disabled. So you can move the Lens Carriage manually. When you enter this function, it will take about 3 seconds before it try to detect the status of X-axis sensor. If you got any problem, or the message is not corresponding to the current lens carriage position, then go to Initialization Troubleshooting for detail checking since it also checks the status of X-axis sensor at the first time it reach the edge of X-axis during initialization.

If the lens carriage is in of the sensor area, it will shows message as left figure.

If the lens carriage is out of the sensor area (as below figure), it will shows message as left figure.

- **Y-axis sensor**
  In this mode, the Y-axis motor will be disabled. So you can move the Lens Carriage manually. When you enter this function, it will take about 3 seconds before it try to detect the status of Y-axis sensor. If you got any problem, or the message is not corresponding to the current lens carriage position, then go to Initialization Troubleshooting for detail checking since it also checks the status of Y-axis sensor at the first time it reach the edge of Y-axis during initialization

If the lens carriage is in of the sensor area, it will shows message as left figure.

If the lens carriage is out of the sensor area (as below figure), it will shows message as left figure.

- **X-axis motor's motion ability**
- **Y-axis motor's motion ability**
- **Z-axis motor's motion ability**

- **Laser source (useful for laser beam alignment)**
  You can set up laser power from 0 % ~ 100 % by using the Up/Down keys. Once the laser output power is set, press Enter to fire. To turn off laser output, press Enter again to stop firing.

  Except you want to check the MAX power at different location on table, GCC recommend you to set up the minimize percentage to check the possibility of laser output.

Caution *Make sure that you keep the laser power less than **3%** all the time during this test, and turn the laser OFF whenever you leave from the machine or finish the test.*

- Serial port
- DRAM

8.3 System Diagnostic in Practice

8.3.1 Overview

In order to check the current status of your LaserPro Venus while you are operating the system, GCC provides 3 different tests, which can accomplish with your application, as below,

- Initial Test: If there is an abnormality in system function, and you cannot access the Hidden Diagnostic Functions, such as a short circuit in M/B that would not let the system boot up, just go to the Initial Test section for detail checking procedure.

- Running Test: If you find abnormal sequence or system failure while operating the system, just go to the Running Test section for detail checking procedure.

- Application Test: If the system works OK, but the output cannot meet your requirement; just go to the Application Test section for detail checking procedure. If the phenomenon is mentioned in this maintenance manual, please report to GCC Customer Service Department, we will provide our best service to accomplish your application.

You don't have to perform above test day and night, but just keep in mind all of the sequences to make sure that you system is in the good condition. Also performs Preventive Maintenance in specific period to keep the system in good condition and extend its life cycle. By the way, **it is strongly recommended that only qualified technician be allowed to carry out the test**.

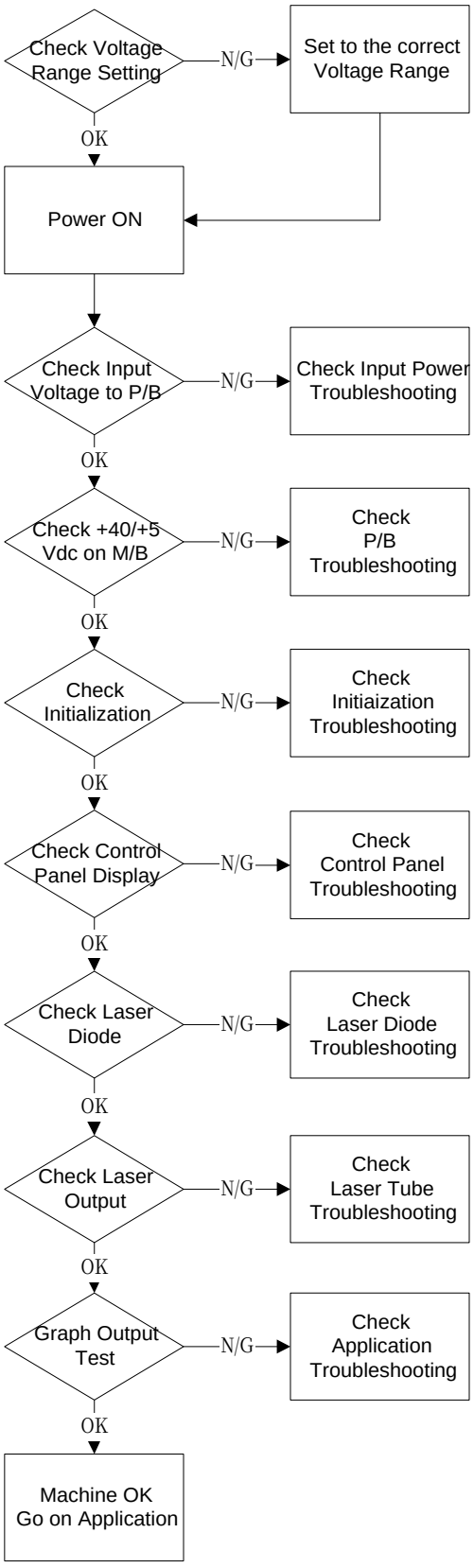


Figure 36 initial test flow diagrams

8.3.2 Initial Test

1. Before power on the system, please check the voltage range setting to fit to the local commercial power system, and then go on next step.

2. Once the power switch is turned on, the input power to J?? of P/B should be as same as the commercial power system. If not, go to Input Power System Troubleshooting for detail checking procedure, or go on next step.

3. Checking the +5 Vdc and +40 Vdc on M/B. If the voltage level is out of range or 0 volt, go to Input Power System Troubleshooting for detail checking procedure, or go on next step.

4. Check the initialization process as below. If any item is failed or cannot complete, go to Initialization Troubleshooting for detail checking procedure, or go on next step.

- Working table going down the lowest limit.
- Performs X-axis initialization.
- Performs Y-axis initialization.
- Move the lens carriage to origin position, (0, 0).

5. Check if it shows below message on the Control Panel Display after initialization. If none, all black or incorrect message is shown on the display, go to Control Panel Troubleshooting for detail checking procedure, or go on next step

6. At this time, you can look at the lens carriage underneath to make sure that the Laser Diode is existed or not. If not, go to Laser Diode Troubleshooting for detail checking procedure, or go on next step

7. You can check the laser tube and graph output at the same time. If not laser output, go to Laser Tube Troubleshoot, else go to Application Troubleshooting when output is not expected.

8.3.3 Running Test

User can check the system condition by Test Plot function. This function needs a full size Acrylic plate on he working table for test. In the test, it checks the vector, raster and more. Each graph indicates different parameter of the system. Below is the description for it.

8.3.4 Application Test

Content is N/A in this edition.

Chapter

9

Preventive Maintenance

9 Preventive Maintenance (PM)

9.1 Overview

Below shows a brief list of PM items. However, it is based on a normal operation environment. If your machine is working in a better environment, less dust and proper temperature, you can reduce the frequency. If your machine is working in a harsh environment, then you have to increase the frequency of PM should to protect your machine.

Maintenance Item		D	W	M	Q	S	A
Power System	P/B			✓	✓	✓	✓
	Power Supply			✓	✓	✓	✓
Motion System	Lens Carriage		✓	✓	✓	✓	✓
	X-axis	✓	✓	✓	✓	✓	✓
	Y-axis			✓	✓	✓	✓
	Z-axis			✓	✓	✓	✓
	Rotary-axis			✓	✓	✓	✓
Laser Assembly						✓	✓
Optical System		✓	✓	✓	✓	✓	✓
Fans				✓	✓	✓	✓
Option	Air Compressor			✓	✓	✓	✓
	Odor Reduction	✓		✓	✓	✓	✓
	Water Coolant			✓	✓	✓	✓

D: Daily, W: Weekly, M: Monthly, Q: Quarterly, S: Semi-year, A: Annual

9.2 Required Material and Tools

9.2.1 Required Material

Below shows you a list of PM material, which is applied inside GCC, manufacture factory, you can use equal or alternative material in the field. But please conform with your supplier before you use it. Improper material may cause damage to system, especially perform PM on all of the mirrors.

P/N	Description	Note

Table 4 Required Materials for PM

9.2.2 Tools

No.	Description
1	ALLEN WRENCH SET - INCH
2	ALLEN WRENCH SET - METER
3	LONG ALLEN WRENCH SET – INCH
4	LONG ALLEN WRENCH SET – METER

5	LONG ALLEN WRENCH SET - INCH (T type)
6	LONG ALLEN WRENCH SET – METER (T type)
7	DVM
8	SHORT ALLEN WRENCH SET - INCH
9	SHORT ALLEN WRENCH SET – METER
10	DIGITAL SCOPE
11	CABLE TIE

Table 5 Required Tools for PM

9.3 PM Procedures

- Power system

It is very important to check the surface cleanness of power board/supply, especially the power cable connection point. In order to extend the life cycle of the power system, it is recommended to clear the connector to get a better connection condition. After the cleanness instruction is finished, try to check below items to make sure you have completed the PM of power system.

1. Check the connection condition of power cable to power board/supply.
2. Remove any tools from the power system before you turn on the system.

- Motion System PM

The basic but very important maintenance of Motion System is a regular cleaning of rails and bearing's surface. The surfaces of rails, especially the X-rail, are easily accumulating dust and debris after running some engraving jobs, with wood in particular. If they are not removed, the bearing on the Lens Carriage will roll with bumpy effect. This bumpy effect is critical to laser, as any slight jarring impact will diver the beam path and affect the overall output quality.

The cleaning job can be carried out with a piece of dry and clean rug. Wipe the surface of X-ail with rug if necessary; dampen the rug with gentle cleaning solution. To clean the bearing, press the rug against the U rollers or small rollers and shift the Lens Carriage by the other hand. In general a weekly cleansing is recommended. If you engrave or cut wood, glass or other debris prone materials, in a heavy-duty manner, a daily cleaning is necessary for retaining the output quality.

Do not lubricate the rails and bearings, as grease will attract more dust and dirt to their surfaces.

- Laser Assembly

  The best PM to laser Assembly is to clean dust from the fans only. Do not touch the laser tube since any vibration can change the optical condition to the laser tube.

- Optical System

1. Unscrew and remove front cover of the focus carriage. Release the top screw and pull out mirror carefully.

2. Put lens tissue on the mirror and drop a little lens cleaner on the middle area of the tissue, after the fluid has been absorbed evenly, pull the tissue one direction gently to clean the mirror.

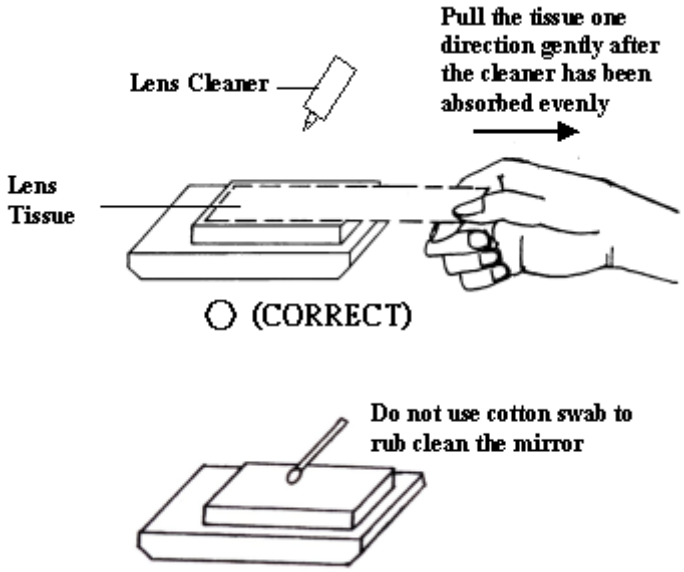


Figure 37 To clean the mirror

3. Let it air dry and re-install it.
4. Unscrew and remove the dust prevention box (refer to Fig. 2 & Fig. 3) then clean the #2 Mirror, #4 Mirror and #1 Mirror same as above process (refer to Fig. 20) separately.

- Fans
  Clean dust from the fans, and make sure it does work during power on. Any failure of the fans may cause bad performance or failure of M/B or laser tube.

- Option items
  Please follow the instruction of the option item to do the PM.

9.4 Checking Tables

Before Power ON

ITEMS	DETAILS			CHECKS
	Sub-Item	Specification	Result	
➢ **Environment**	• Temperature • Temperature stability • Humidity • Clean Class	22-27°C. ± 1°C 50± 5% < Class-100		☐ ☐ ☐ ☐
➢ **Surface**	• X-axis Assembly • Y-axis Assembly • Z-axis Assembly • Laser diode mirror • Mirror 1/2/3/4 • Focus lens			
➢ **Belt**	• X-axis belt • Y-axis belt • Z-axis belt			

Table 6 Checking Tables after PM (Before power on)

ITEMS	DETAILS	CHECKS

	Sub-Item	Specification	Result	
➢ **Input Power**		100~240 Vac		☐
➢ **Initialization**	• Working table down • X-axis initialization. • Y-axis initialization. • Move to (0, 0).			☐ ☐ ☐ ☐
➢ **Fans**	• Fan for M/B • Fans for laser tube			☐ ☐
➢ **Auto Focus**	• Move to specific distance (base on the selected focus lens)	Check by focus tool		☐
➢ **Output Graph**	Check the quality of output graph			☐
➢ **Running Test**	Check if system can continuous running for more than 1 hour without abnormal error happen			☐

Table 7 Checking Tables after PM (After power on)

Chapter

10

Installation

Chapter 10 : Installation

10 Installation

10.1 Overview

Before you perform LaserPro Venus Installation in the field, please make sure that all listed items in the site preparation are finished. Only install machine in the specific operation environment which match the specification requirement of LaserPro Venus, the system does work as long as except. Poor site preparation may cause the system failed very frequently since GCC verify each system before it was shipped. Every step in the following is trying to make the system into an optimal condition.

Do...

- Do use proper tools instead of alternative tools.

Do Not...

- Don't ask a no-experience end-user to operate the system before taking training courses to from trained technicians.

10.2 Packing List

For different country and different requirement, GCC will provide different shipping accessory in addition to the LaserPro Venus machine. Below shows the standard packing list,

10.3

10.4 Tools Required

In addition to some special tools as below for unpacking the shipment, refer to Chapter 9 for the detail tool list for installation.

10.5 Unpacking Procedure

Please follow the Chapter 2, Unpacking, of User's Manual for detail information.

10.6 System Installation/Setup

The LaserPro Venus provides a easy to use design. After user check that the system has no outer damage, just plug in the power core to start the operation of the system. For the first-time-operate user, please have one experienced technician to work together through all of the operation.

10.7 Accomplish the Installation Report

In addition to the below checking items in the shipping package, also check the table in Section 9.4.

ITEM	QUANTITY
Cleaning Set Cotton swab Lens cleaner Lens tissue (lint free)	 1 1 1
1.5” Manual Focus Gauge (blue color)	1
AC Power Cord	1
Print Port Cable	1
LaserPro VENUS Driver	1
Mirror (for Mirror#2, #3)	1
Engraving Samples	1

Appendix

A

Troubleshooting

Appendix A: Troubleshooting

A.1 *Overview*

In order to save troubleshooting time, here we provide some tips for field service engineer. In case you find a technical skill, which can improve the troubleshooting, or a new bug, which make cause system failed frequently, please report to GCC Service Department. Any comments and suggestions are appreciated to help us to enhance the content of this maintenance manual.

A.2 *Failure in Input Power System*

When power on the system, the Power LED (Green) will light on. In condition that you find any phenomena as the following, please follow the procedures in this section to fix the problem.

- Flashing Power LED
- Dark Power LED
- No LED

➢ Flashing Power LED

The X-axis motor may be malfunction, and short-circuiting. Measure the impedance between pin 1 & 3 of X-motor's driver chip (L6203), which provides *PWM* to motor. **The ideal resistance should be close, and the resistor value is around 20Ω.** If it is short and the resistance is 0Ω, there could be a short circuit in X-axis motor. **Change X-motor**.

If problem persists, **change M/B**, the driver chip on the M/B may be damaged.

Failure in Initialization

Failure in Motion System

If you find wavy output along X-axis, probably it is due to the small roller or DU roller attrition.

To remove the small roller: Unscrew the roller screw (P/N LH012011A) than replace with a new one on the same position. Because the small roller is not symmetrical, so that please make sure the right side is attached to lens carriage during the replacement.

To replace the DU roller: Please notice that as the DU roller is removed, the lens carriage only hangs by X-axis belt. So please holds the lens carriage by hand to avoid extending the X-axis belt too much until you complete the replacement.

> ***Caution*** While you replace the Small or DU roller, please check the bearings roll evenly, if not you need to examine the X-belt is fixed at the same level, beside make sure the DU roller fixed parallel and equality with Small roller.

- Auto Focus Pin is not functioning

  The focus pin could be stocked by greasy residue that coats on it. Clean the probe with alcohol or acetone.
  Check the cable of focus pin, there might be a bad contact or breakage.

- Table Can Not Move Up And Down

  Check if Z-motor is functioning.
  Chang M/B, Z-motor's driver chip could be burned.

- Unleveled Working Table

  When table is not leveled to the motion system frame, laser's focal point will not fall uniformly at the same level across the to-be-engraved object; thus, you will always find one particular area has weaker laser. **Tune working table in parallel to motion system frame**

- "X-motor Error" Message

  Power off the machine, move lens carriage left and right by hand sees if it moves freely. The error may be due to carriage's rollers or rail surface are worn or blocked by dirt on the rail, or X-motor's transmission belt is over tightened and impairs the motor's mobility.
  If system keeps showing "X-motor Error" message after clearing the above-mentioned possibilities, check if its flat cable is bad connected or defective.
  If nothing wrong with the flat cable, **change X-axis Motor's PCB** (the small circuit board that connect to the flat cable).
  Change X-axis Motor, if the PCB is fine, an open circuit in X-motor could create such problem.
  Change M/B, if X-axis Motor is proved to be fine. Motor's driver chip could be faulty. Instead of short circuit, it may have open circuit in the driver chip. Thus, the impedance between Pin 1 & 3 of X-motor's L6203 could be limitlessly big.

- "Y-motor Error" Message

  Power off the machine, move X-rail back and forth by hand see if it moves freely. The error may be due to rail's bearing or rails surfaces are worn or blocked by dirt on either sides of Y-rail, or Y-motor's transmission belt is over tightened and impairs the motor's mobility.
  If "Y-motor Error" message keeps playing up, after clearing the above-mentioned possibilities, check if Y-motor's cables are bad connected or defective.
  Change Y-axis Motor, if its cables are fine.
  Change M/B, if Y-motor is proved to be fine.

- Incorrect Working Area, or Homing at Wrong Position.

  The problem is often seen after changing M/B. If fact, its not a problem at all, the new M/B is fresh without any data stored in the EEPROM where initial data is kept, such as boundary of working area. To correct it, you need to set an origin point to the system. The procedure is as follow:
  Hold both **Enter** and **Start** keys at the same time while powering on the machine.

Jog the red point (carriage) by arrow keys to the inner junction of rulers at top left corner.
Press Enter key after the position of red pointer is right on the spot, restart the machine.

Failure in M/B

Failure in Control Panel

Failure in Laser Diode (Red Beam)
Try to change laser diode if no red beam output. It is necessary to realign the red beam with laser after changing the Red Pointer.

Failure in Laser Tube
Laser tube is a precise and delicate device; if it needs to be removed for service purpose, please handle it with extra care.

In general, laser tube does not require displacement for general maintenance, but if you find laser power either lost significantly or not outputting at all, and also are sure all optics device (mirrors and lens), including the output lens on laser tube, are clean and in good condition, the laser tube will need to be removed for repair.

One important maintenance tip is that the output lens on laser tube (situates in the front of tube, can be reached through the bracket hole) may be covered by dust after a long period of usage. Dust or debris will impair laser's output level significantly. Therefore, it is strongly recommended to clean the laser lens on regular basis. To clean the lens, drop optics solution on cotton bud and rub the lens gently.

On the other end of the tube, there are two LEDs, one green and one red. The green LED indicates the 32Vdc input power, and the red LED shows the firing status, which is controlled by top and front door interlock sensors. If laser is not firing, and green LED is not on, there is probably a problem in the DC power source. When in standby status with all doors closed, the red LED will half illuminate. If any of the doors is opened or switch cable is broken, the red LED will extinguish. And when doors are closed and a firing signal presents, the red LED will fully light up.

Before you disassemble the laser tube for service, unplug all of its cables, including the *BNC* cable, at the rear, which transfers *firing signal* from M/B, the firing protection (interlock) cable connected to a relay PCB near system M/B inside the right side panel, and the black and red power cables from power supply. If the firing protection cable is disconnected, laser will fire even doors are opened. This is useful when aligning the laser beam, but should only be practiced by trained technicians.

When packing (make sure it is properly packed with original supplier's packing box), contact GCC customer service department for RMA No. to return defective laser tube for repair. *Do not include the front and rear mounting brackets since they are not needed for service purpose*.

- No Laser Output

Check if all door sensors are working, their cables are not broken or loose.
Open the back chassis of laser compartment.
Go to "Test laser source" item under Hidden Diagnostic function and press Enter key to fire laser.
Make sure the green LED on the left end of laser tube chassis (Synrad laser, view from the back of the unit) is on which indicates 32Vdc power input. If no 32Vdc is measured directly out of the laser power supply, **change laser power supply (P/N xxxxxx)**
Observing if the red LED is flashy as you firing the laser by pressing Enter key.
If red LED is not flashing even the green LED is on (32V DC is present), check if the laser signal cable is loose either on laser tube or the M/B.
If the cable is not the problem and there is signal output from the M/B, **change the laser tube**.

- Laser Stops After a Period of Cutting Job

Laser tube maybe overheated due to poor ventilation. **Add a cooling fan at the back of the laser or cooling the ambient temperature**.

- Weak Laser Output

Make sure the lens focus is correctly set. Incorrect focus, such as wrong option of focal depth, could result in weak output. Always use the correct focus pin to check or to do "Auto focus Tuning".
Check if all optics is properly cleaned and aligned. Dirty or damaged lens and reflective mirrors (including laser tube's output lens) and poor alignment will weaken the laser. Especially, **the thin-film on the surface of Mirror 1 could be burn down after a couple times of high-power operation.**

Application Troubleshooting

Weak Laser at Right Side of Working Table
Laser beam path may be off alignment, as longer distance the laser beam travels, the more serious the laser power lost. If this is the case, laser power drop at the lower right hand corner will be more obvious. Realign the laser.
If power drops evenly on right half of the table in stead of the lower right corner, the working table could be uneven against motion system's frame. Level the table (see the next problem item).

Communication error
Original position
To draw small character / Small circle
Stamp mode
"Graphic Was Clipped…" Message
The size or location of graphic image may be bigger or beyond legal working area. Do not place graphic object, especially vectors, right from (0, 0) position, or 0 at either x or y axis of working area on application software, Corel Draw for instance, even vector

line's width has been set to the thinnest. Because at thinnest line width, it still goes beyond the boarder and causes the error.
If the message appears randomly but frequently even image object is smaller or within the legal boarder, check or change DRAM module, a bad contact or faulty DRAM could cause such error.

- "Command Error, Use GCC driver or HP Pen Plotter Command" Message

1. Make sure the driver used is for LaserPro Venus from GCC, or driver for HP pen plotter if not using GCC's driver for control.
2. If GCC driver is applied and error message still appear, DRAM module may be defective. Change DRAM module.

- **Cannot upgrade the firmware**
- **Wiggling Vertical Engraved Line**

1. Dust or engraving residues could coat the surface of X-axis rail or rollers on lens carriage.
2. Clean both X-axis rail and all rollers regularly.
3. The small rollers, on the lens carriage, sit underneath X-axis rail, could be worn. Change the small rollers.

- **Wavy Vector Cutting Line**

1. Check if software resolution set to higher one can improve the problem.
2. Output the image file in HPGL format directly under DOS mode without going through LaserPro Mercury driver.
3. Tune Y-axis motor and Lens Carriage's belt tension (all 5kg), as well as X-axis Motor's if problem is not improved.

- Image breaks and shifted

1. Make sure PC's printer port mode is set to Standard/SPP/Normal mode. EPP or ECP mode may cause data lost and shift partial image to other location.
2. Check if DRAM is causing problem by changing it with a known good one. Often a defective DRAM will cause the problem appear in the same location repeatedly.
3. If graphics shift is not due to the unsuitable printer port mode, and appears randomly, the problem is possibly caused by signal interference. If this is the case, change the signal cable, or try with another PC. And it is advised to link the PC and LaserPro Mercury to the same ground. Separate ground is subject to signal noise. If LaserPro is sharing the power source with high power equipment, such as an electric drill or saw, it is strongly suggested to separate the power source.

- Image distorted or drifted toward one direction

When graphics distorted and drifted gradually toward right or left, it indicates something is wrong in X-motor. However check if the lens carriage is loosing it tension. If belt tension is fine, change X-motor.

➢ Smoke Can Not Be Vented Properly

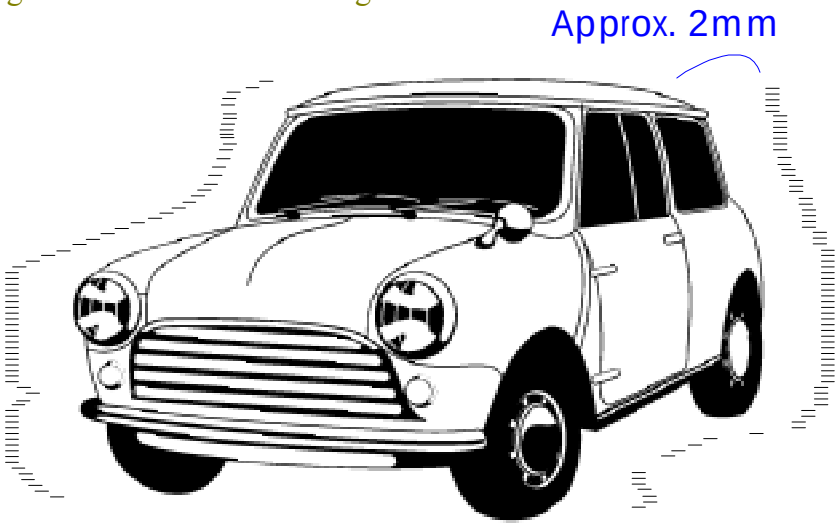
Some material produced smoke or odor easily. Wood, for instance, can produce lots of smoke and wood dust, which can easily clog Odor Reduction Unit's filter sponge situating at the exhaust end. When that happens, smoke will not be vented out and optics is likely to be covered by burned dust, on which laser can cause damage. Therefore, it is important to keep the exhaust system ventilating effectively.

➢ **Output Is Not Precise**

Do the Scaling under Paper Option of LaserPro Mercury Driver (refer to User Guide).

➢ **Laser Bleeding**

Every new laser engraver shipped out of GCC facility has undergone through QC test plot to ensure everything is in working order. But sometimes when an end-user received the laser engraver, little thing just went wrong. One of the annoying problems is the GHOST image on left/right of the engrave image, which is caused by a ***laser bleeding***. The vibration caused by a transportation of Synrad laser tube has caused it to become more agitated than before, thus the laser tube will output a bit more than its stable state. Thus the laser tube bleeds at a low power even it is not commanded to fire. This low bleeding power is clear visible when the tool carriage stops or when the tool carriage decelerates/accelerates which is the region 2cm on the left/right of the engraved image. Please refer to the diagram below:



Unwanted Ghost Image

The jumper, **JP18** located at center of a main-board, can be adjusted to stop the laser incontinence. JP18 is default at 5K value.

When a user has laser-bleeding problem, the jumper can be set to 3K/4K value to lower its agitated response. The resistors in JP18 are used to control the tickle pulse outputted to laser tube. A smaller resistor value means a shorter tickle pulse which in term calm down the laser's response, especially in agitation and it stops the bleeding problem.

*Note: After a few weeks of stabilization (no vibration to the tube), the laser tube will return to its stable state. Then the laser will fire at a slower response and cause a bad engraving quality. Then it is necessary to set the J18 to its default 5K position.

Appendix

B

Spare Parts

Appendix B: Spare Parts

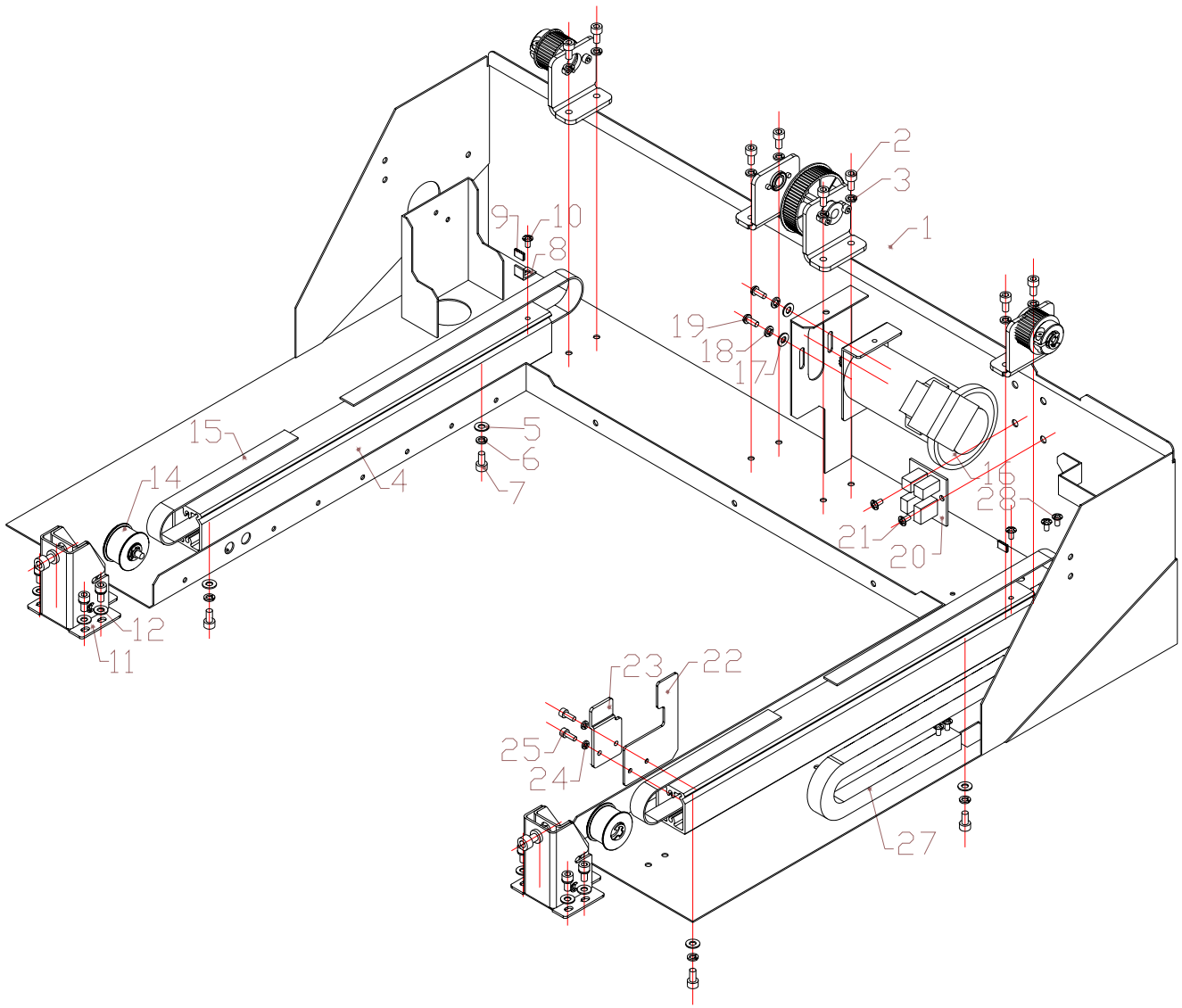
B.1 Overview

In order to save time to serve customer at the first time when system is down, it is very important to keep minimal spare parts for each different model of system.

Level 2 Parts: The common request parts

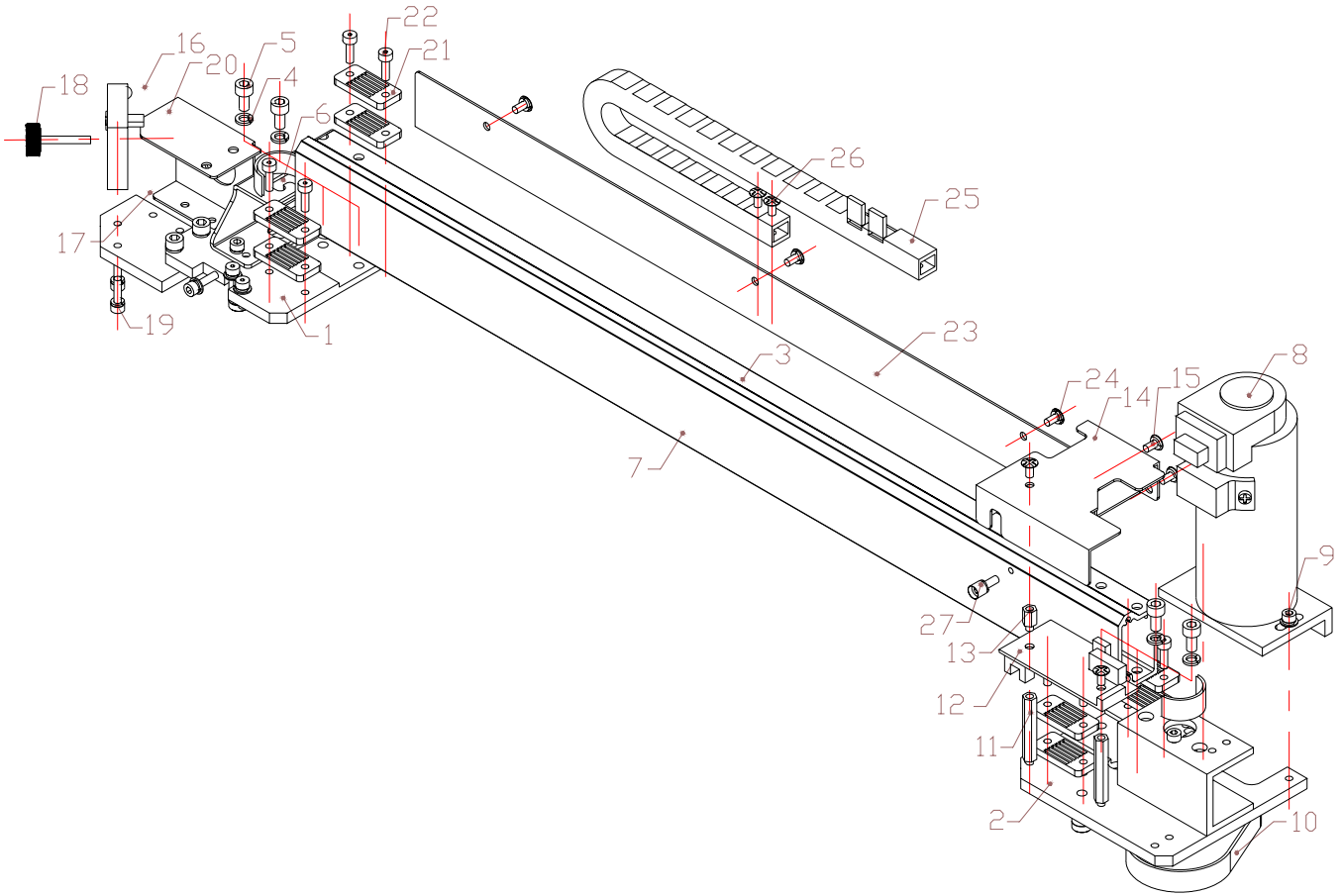
BK01504A – Venus Y-Axis Assembly

	Part #	Part Name	QTY
1	BK01505A	Y-Axis Transmission shaft Assombly	1
2	SCM0400845	HexScrew	8
3	WH00018A	Spring washer	8
4	LH01564A	Y-rail	2
5	WH00015A	Flat washer	4
6	WH00018A	Spring washer	4
7	SCM0400845	HexScrew	4
8	PS00006A	Hard stop	2
9	EZ00004A	Ø5Heat Shrink	0.0001
10	SCM03006T5	Screw	2
11	BK01353A	Y-Axis idel Pulley fixture	2
12	BK013A7A	Y-Axis Idel Pulley Bracket Screw Set	2
14	BK01354A	Y-Axis idel Pulley Assembly	2
15	BL01502A	X-axis belt	2
16	BK01506A	Y-motor Assembly	1
17	WH00015A	Flat Washer	2
18	WH00018A	Spring Washer	2
19	SCI10108P2	Pan head machine screw including spring washer	2
20	BK00056A	Y-motor wiring PCB	1
21	BK01535A	PCB securing screws	1
22	MZ01505A	Y-axis checking plate	1
23	PS01556A	Y-axis start stop	1
24	SCM0300845	HexScrew	2
25	WH00017A	Spring Washer	2
27	ZZ01502A	Y Tube Chain	1
28	SCM03006T5	Screw	4



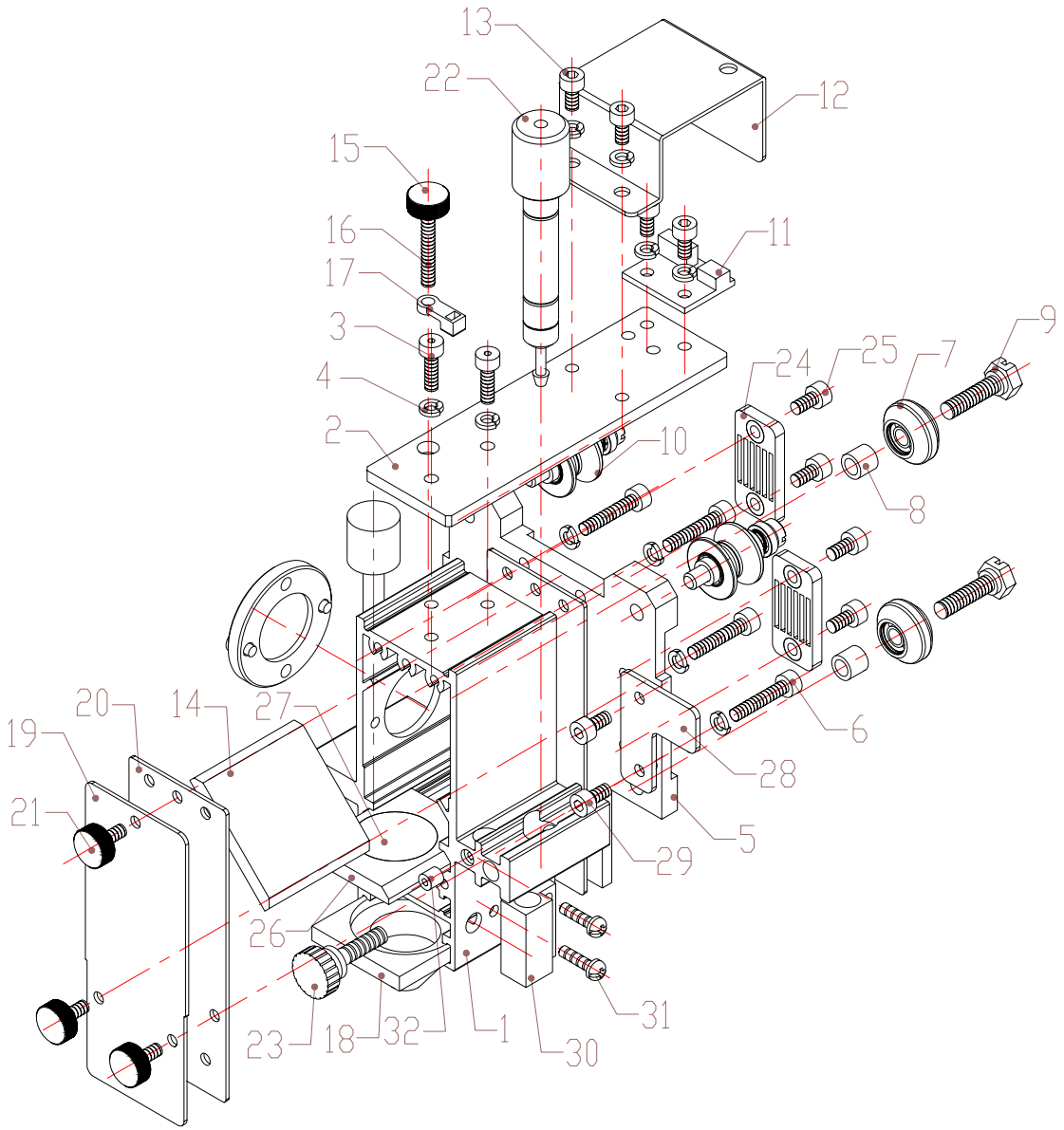
BK01507A – Venus X-Axis Assembly

	Part #	Part Name	QTY
1	BK01508A	X-Axis Left Fixture	1
2	BK01509A	X-Axis Right Fixture	1
3	LH01556A	X-axis rail	1
4	SCM0400845	HexScrew	4
5	WH00018A	Spring Washer	4
6	BK01358A	X-axis idel pulley	1
7	BL01501A	X-axis belt	1
8	BK01359A	X motor Assembly	1
9	BK013A3A	X-Motor Bracket Screw Assembly	1
10	BL01301A	X Motor Belt(2GT-160-6)	1
11	ZZ01311A	Hex pole	2
12	BK00069A	X Motor PCB	1
13	EZ00071A	Washer	1
14	PS01319C	PCB cover	1
15	BK013A2A	X-Motor PCB Cover Screw Set	1
16	BK01311D	Prism mounts assembly	1
17	BK01327D	Mirror assembly	1
18	ZZ01238A	Cover for screw	1
19	SCM0301245	HexScrew	2
20	PS01569A	Mirror 3 dust cover	1
21	PL00030A	BELT RETAINER-B	8
22	SCM0301045	HexScrew	8
23	PS01557A	Flat cable/tube guide	1
24	BK01539A	Guide's screw	1
25	ZZ01501A	X Tube Chain	1
26	SCM03006T5	Screw	2
27	BK01532A	X-axis hard stop screw	1



BK01510B – Lens Carriage Assembly

	Part #	Part Name	QTY
1	LH01573A	Tool Carriage Chassis	1
2	LH01371A	Carriage Top Plate	1
3	SCM0301045	HexScrew	2
4	WH00017A	Spring Washer	2
5	LH01362D	Carriage Base Plate	1
6	BK01396A	Carriage PCB screw set	1
7	BK01321A	A-Roller ass'y	2
8	LH012013A	4×5.5Spacer	2
9	LH012011A	A-Roller screw	2
10	BK01330D	DU Roller ass'y	2
11	BK00074B	Auto Focus Wiring PCB	1
12	PS01302B	Carriage PCB Cover	1
13	BK01395A	Carriage PCB cover screw set	1
14	BK01324C	12~30W Carriage Mirror Ass'y	1
15	ZZ01238A	cover for screw	1
16	SCM0302045	HexScrew	1
17	EZ00021A	Cable Tie YJ-80	1
18	LH01572A	Air Nozzle	1
19	PS01314A	Front cover	1
20	ZZ01329B	Sponge	1
21	BK01397A	Carriage cover set screw set	1
22	BK01325C	Auto focus pin ass'y	1
23	ZZ01318A	plastic screw S-423C-B	1
24	PL01302A	Belt Retainer	2
25	SCM03006T5	Screws	2
26	LH01569A	Lens Mount	1
27	BK01556A	Dust Prevention Window	1
28	MZ01506A	X-axis checking plate	1
29	BK01533A	Screws	1
30	LH01574A	Carriage Nozzle Connector	1
31	BK01547A	Screws	1
32	ZZ01295A	Notice Sticker	1



BK01511A – Ventilation Tube Assembly

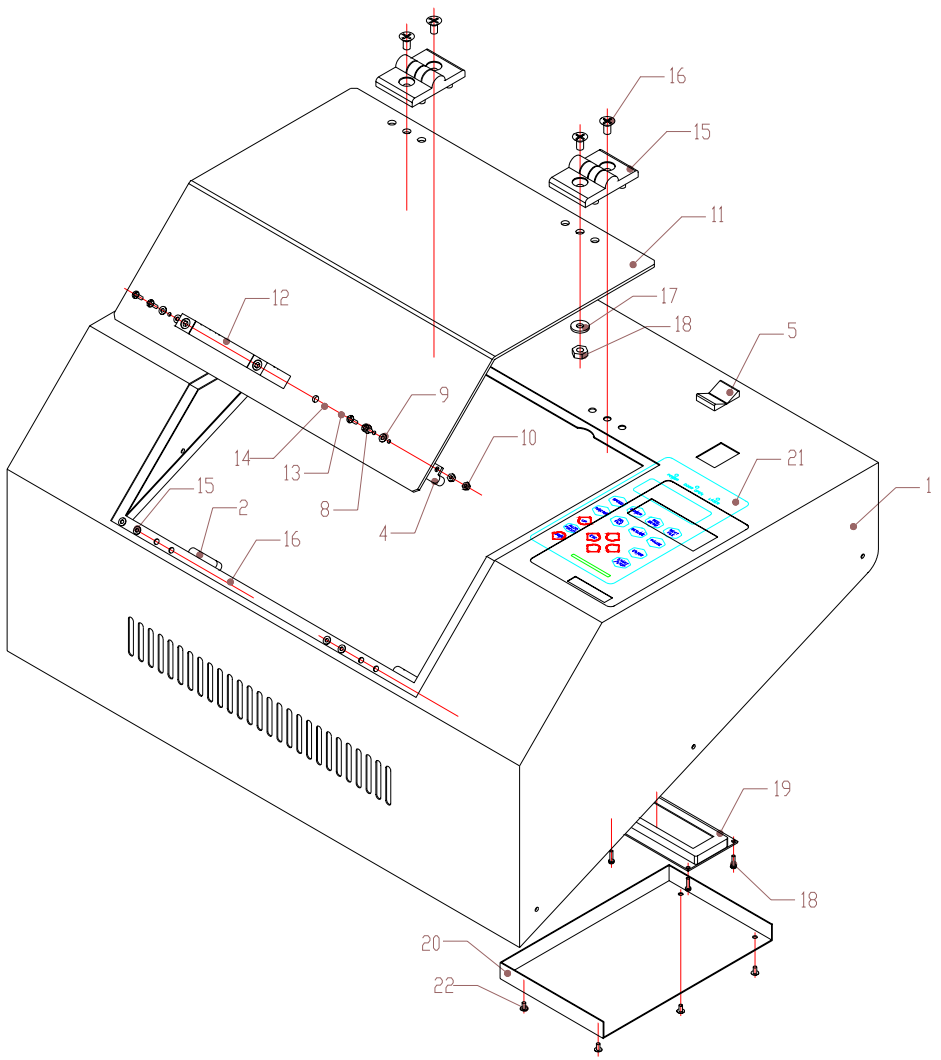
	Part #	Part Name	QTY
1	PS01564A	Ventilation Tube	1
2	MZ01511A	Tube Sealing	1
3	LH01560A	Handle	1
4	MZ01512A	Gate Sealing	2
5	LH01561A	Gate's Turning Shaft	1
6	WH00005A	Plastic washer	1
7	SCM0301045	HexScrew	3
8	WH00017A	Spring washer	3
9	SCM0400411	HexScrew	1
10	LH01562A	Ventilation Gate Handle	1
11	SCM0401645	Hexagon screw	1
12	ZZ01239A	Screw Knob	1

BK01524A – Working Table Assembly

	Part #	Part Name	QTY
1	LH01553A	Engraving Table	1
2	LH01565A	Securing Stand	2
3	BK01542A	Dust Collector screws	1
4	PS01551A	Dust Collector	1
5	MZ01507A	縱向集風盒密合墊	2
6	MZ01508A	橫向集風盒密合墊	2
7	PS01553A	集風盒風管座	1
8	MZ01509A	集風盒風管密合墊	1
9	BK01513A	Air Tube Base Screw set	1
10	SCM0400845	HexScrew	2
11	WH00015A	Flat washer	2
12	LH01332A	4×2 Spacer	2
13	MZ01503A	左右擋屑板	2
14	PS01567A	擋屑板固定片	2
15	BK01541A	擋屑板固定片螺絲組	1
16	LH01551B	X Ruler	1
17	LH01552B	Y Ruler	1
18	SCM03006T5	Truss Head Screw	4

BK01522A – Venus Top Cover Assembly

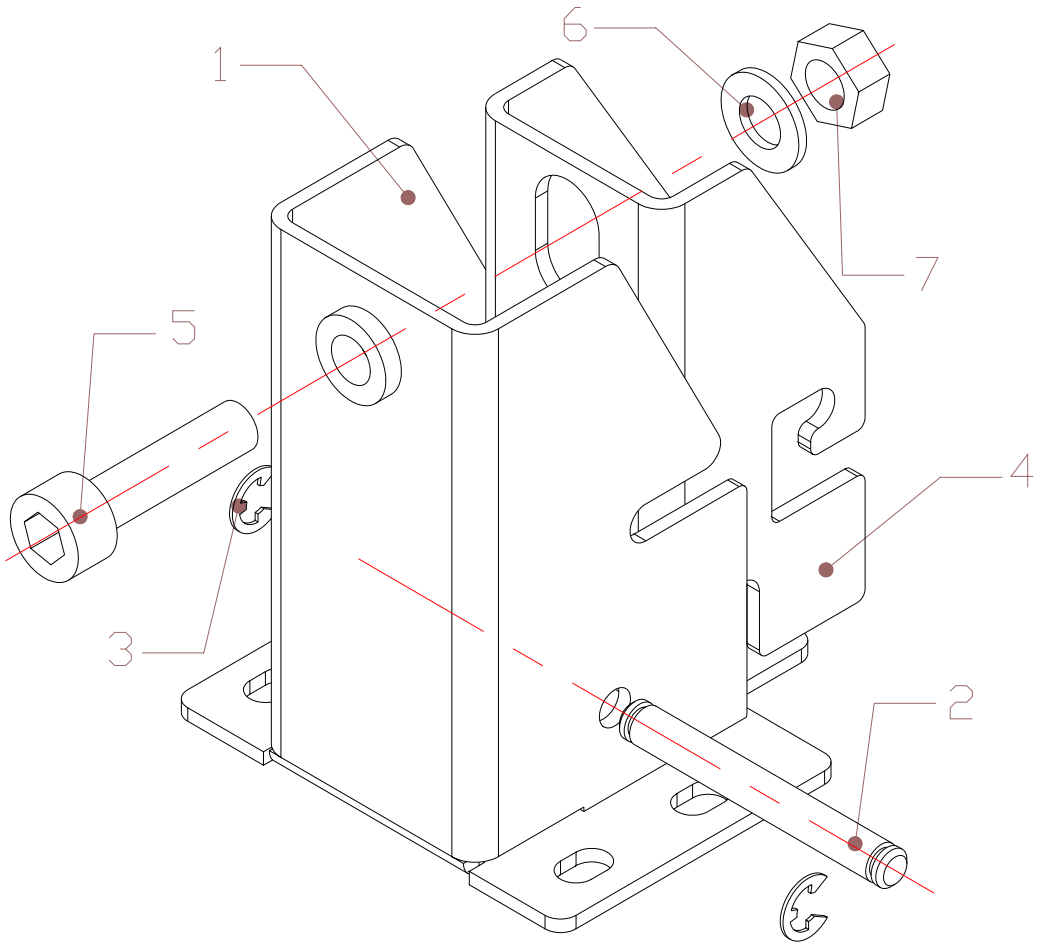
	料 號	名 稱	QTY
1	PS01562A	Top Cover	1
2	SW00018A	Magnetic Door Switch	2
3	CN00310A	Laser Control Converter Board &Limit SW to M/B Cable	1
4	BK01369A	Magnet switch ass'y	1
5	SW00017A	ON/OFF Switch	1
6	CN00304A	Front-Left Door SW Cable	1
7	CN00307A	Front-Right Door SW Cable	1
8	SCM03010T5	Truss Head Screw	4
9	WH00014A	Flat Washer	4
10	NT00110A	Nut(M3xt2.4xS5.5)	4
11	PL01501A	PC window	1
12	ZZ01507A	Handle	1
13	SCM0501245	HexScrew	2
14	WH00102A	Plastic Wahser	2
15	ZZ01212A	Window Hinge	2
16	SCM06012F5	Flat head screws	4
17	WH01206A	Flat washer	2
18	NT00107A	Nut(M6xt10xS5)	2
19	BK01523A	Control panel ass'y	1
20	PS01353B	PCB Dust Cover	1
21	PS01552A	LCD Dust Cover	1
22	SCM03006T5	Truss Head Screw	4
23	EZ00085A	Binding Tie	6
24	CN00231A	Laser Control Cable (red)	2



LEVEL 3 Parts

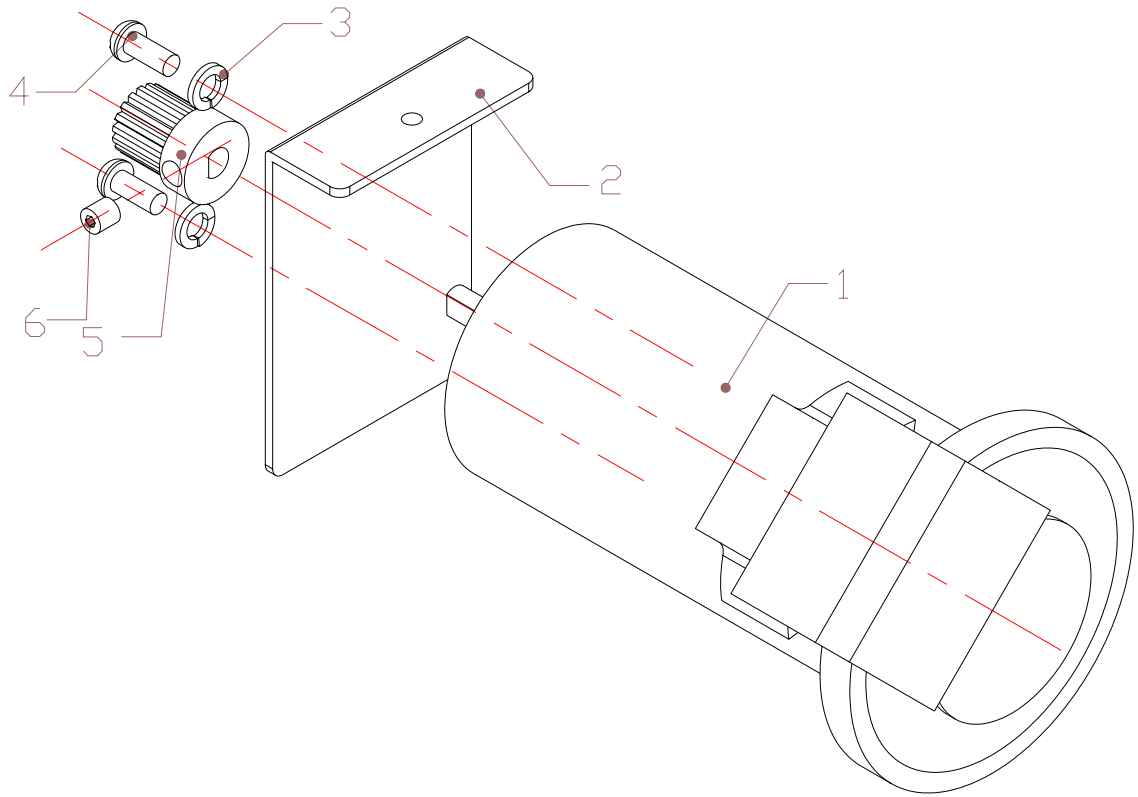
BK01540A – Venus Y-Axis Belt Fastener Assembly

	Part #	Part Name	QTY
1	PS01305B	Y 軸惰輪座	1
2	LH00501B	壓紙輪臂心軸	1
3	RR00004A	E-Shape ring	2
4	PS01306B	Y 軸惰輪槓桿	1
5	SCM0502045	HexScrew	1
6	WH00016A	Flat washer	1
7	NT00109A	Nut(M5xt4.0xS8)	1



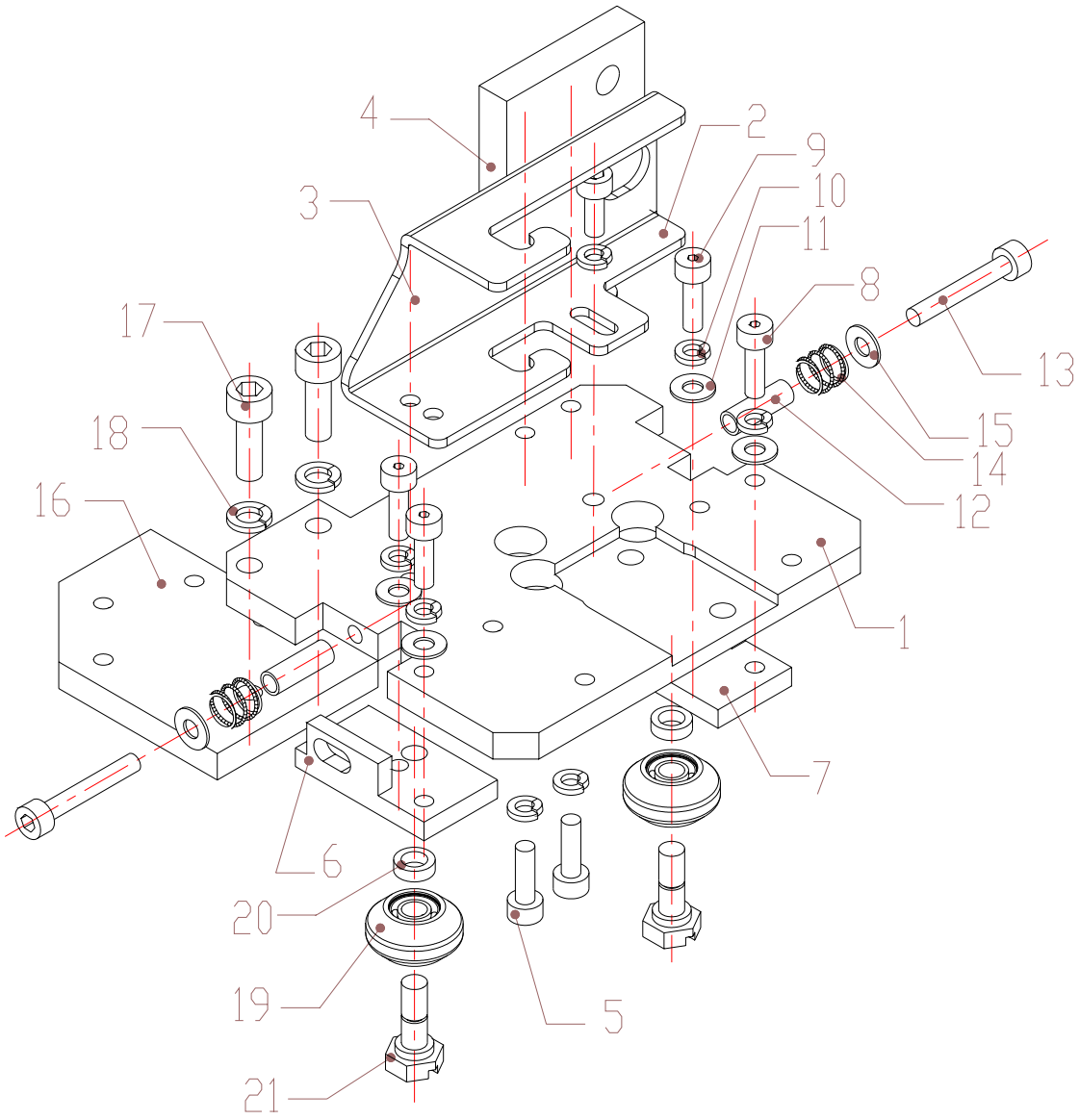
BK01506a – Venus Y-Motor Assembly

	Part #	Part Name	QTY
1	MT00009B	Motor	1
2	PS01558A	Y-motor securing piece	1
3	WH00018A	Spring Washer	2
4	SCI10108P2	Pan head machine screw	2
5	DS00003C	Motor pulley	1
6	SCM0400411	Hexagon screw	1
7	ZZ00542A	LocTite	0.005
8	CN00306A	Y Motor Driver cable	1
9	CN00305A	Y Motor Encoder cable	1



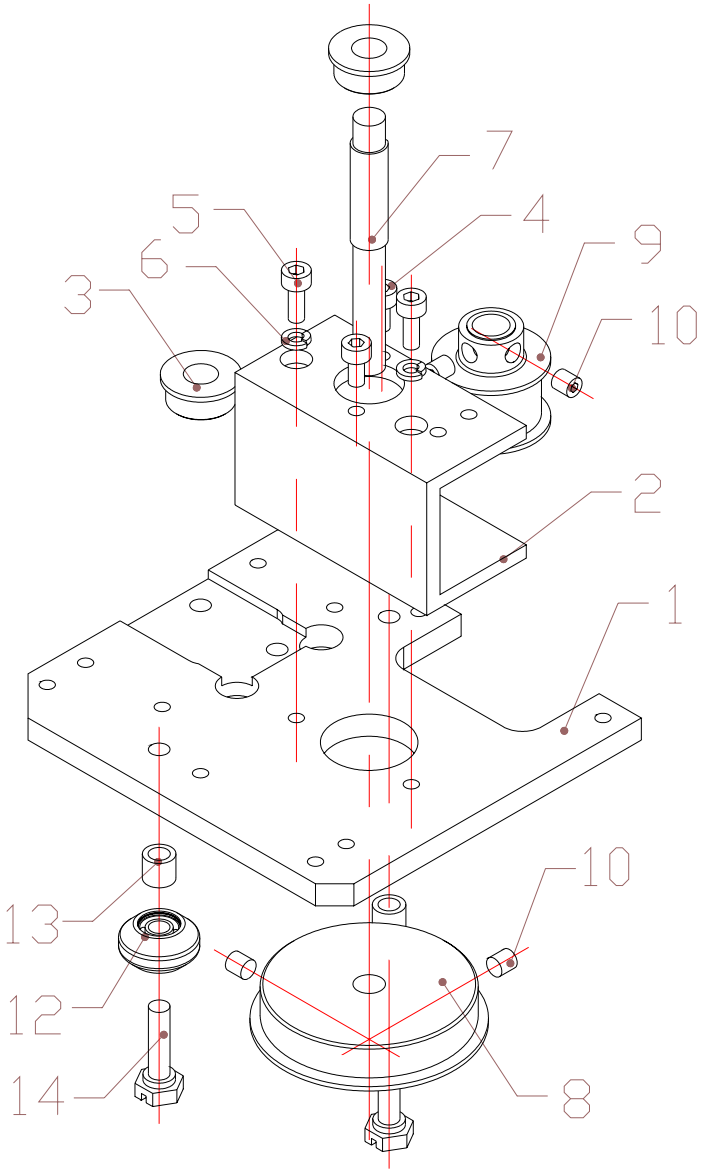
BK01508A – Venus X-Axis LEFT belt fastener

	Part #	Part Name	QTY
1	LH01566A	X 軸左固定座	1
2	PS01301B	X idle wheel lever	1
3	BK013A1A	X-Axis idel pulley lever screw set	1
4	LH01354A	idle wheel adjusting Braclcet	1
5	BK01529A	X 惰輪調整板螺絲組	1
6	LH01568A	X 軸前活動輪座	1
7	LH01567A	X 軸後活動輪座	1
8	BK01531A	X 軸活動輪座螺絲組	1
9	SCM0301045	HexScrew	2
10	WH00017A	Spring Washer	2
11	WH00014A	Flat washer	2
12	LH01364A	活動輪座 Spacer	2
13	SCM0302045	HexScrew	2
14	SP01303A	Spring	2
15	WH00015A	Flat washer	2
16	LH01563A	X 軸折射鏡座托板	1
17	SCM0401245	HexScrew	2
18	WH00018A	Spring Washer	2
19	BK01321A	A-Roller ass'y	2
20	LH01332A	4×2Spacer	2
21	LH01336B	4×5A 型輪螺栓	2



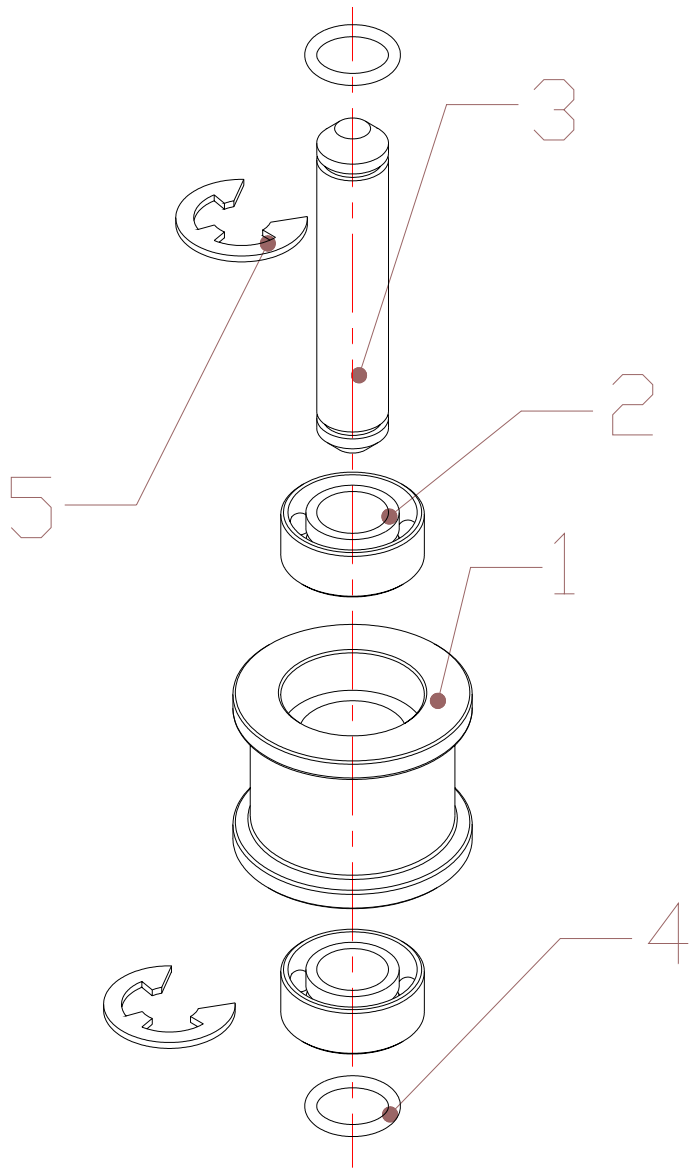
BK01357A – X-Axis RIGHT belt securing set

	Part #	Part Name	QTY
1	LH01302A	X axis Right Base	1
2	LH01340A	X shaft Bracket	1
3	BR01205A	Bearing	2
4	SCM0300645	HexScrew	2
5	SCM0300845	HexScrew	2
6	WH00017A	Spring Washer	2
7	LH01308B	X 軸中間軸	1
8	LH01310A	Pulley	1
9	LH01309A	Pulley	1
10	SCM0400411	HexScrew	4
11	ZZ00542A	LocTite	0.01
12	BK01321A	A-Roller ass'y	2
13	LH012013A	4×5.5Spacer	2
14	LH012011A	Small roller screw	2



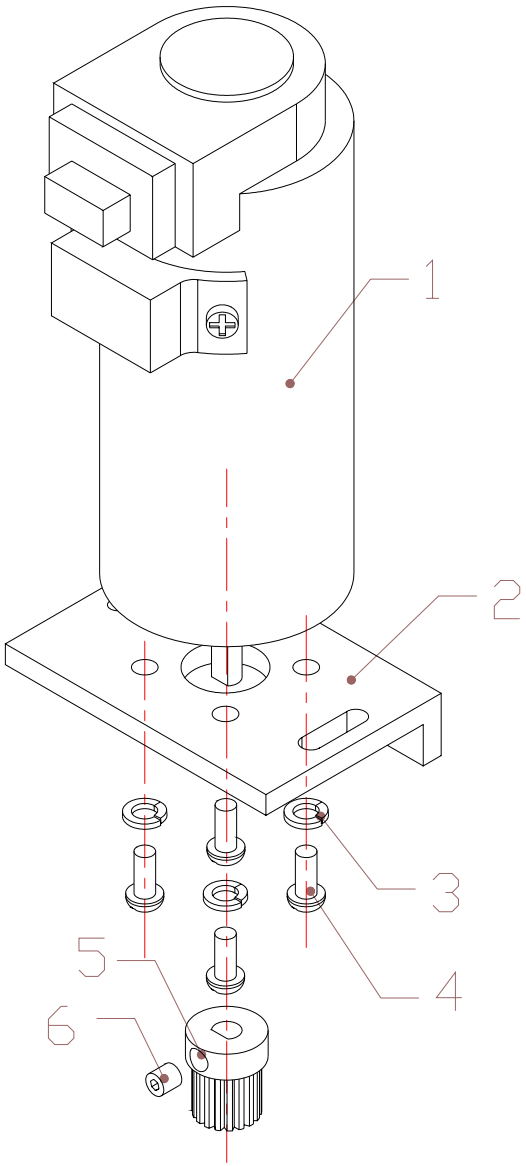
BK01358B – X-Axis Pulley Assembly

	Part #	Part Name	QTY
1	LH01307A	idle Pulley	1
2	BR01302A	Bearing	2
3	LH01379A	X 惰輪心軸	1
4	SP01302A	鋼絲環	2
5	RR00003A	E-SHAPE RING	2



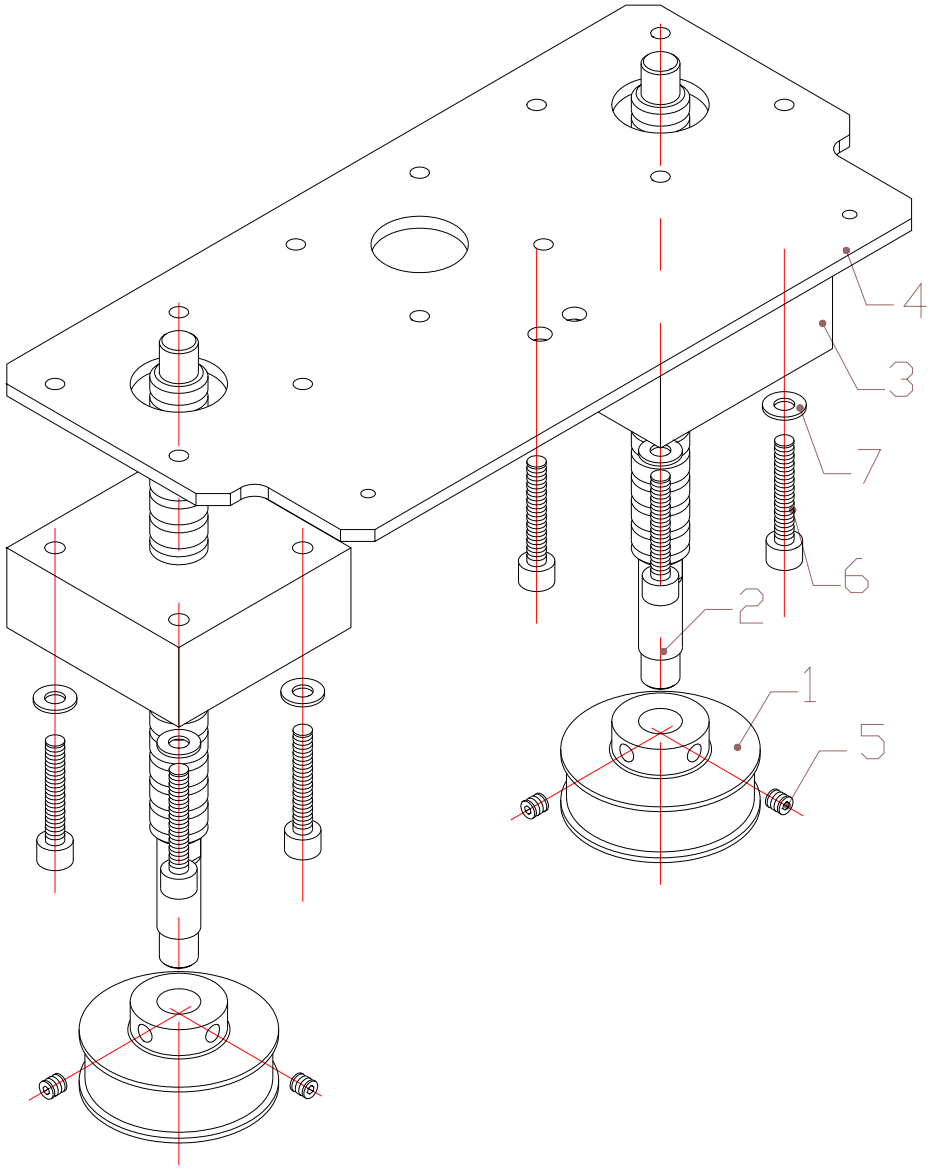
BK01359A – X-Motor Assembly

	Part #	Part Name	QTY
1	MT00008B	Motor	1
2	LH01338A	X Motor Bracket	1
3	WH00018A	Spring Washer	4
4	SCI10108P2	Pan head screw	4
5	DS00003C	Motor pulley	1
6	SCM0400411	HexScrew	1
7	ZZ00542A	LocTite	0.005



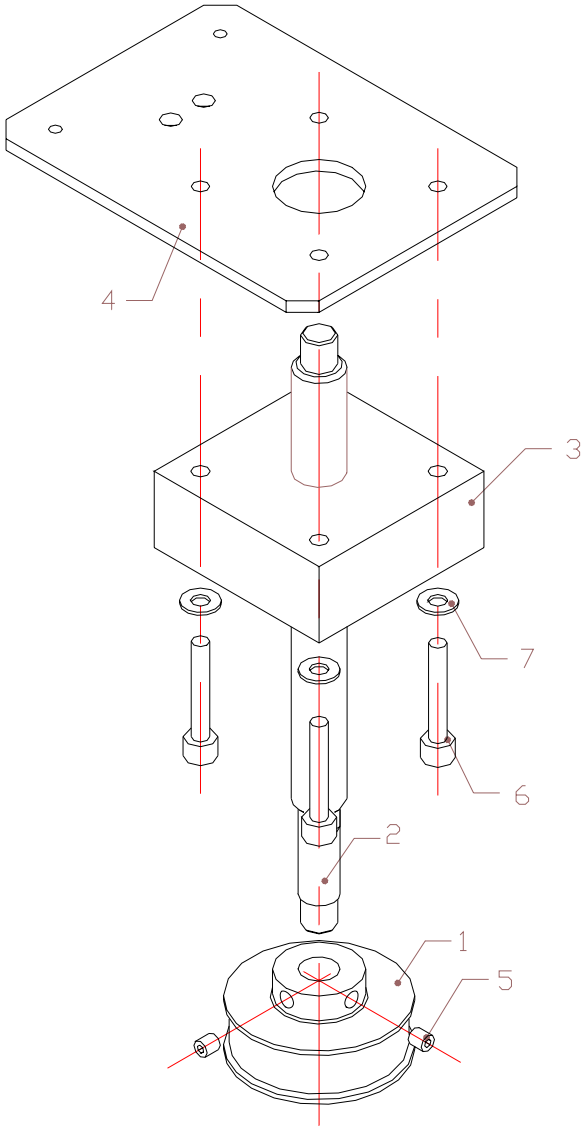
BK01515A – Venus Z-axis LEFT Helical Gear Assembly

	Part #	Part Name	QTY
1	LH01312A	Z 軸皮帶輪	2
2	LH01558A	Z 軸梯形牙棒	2
3	LH01316A	Z 軸梯形母牙	2
4	LH01554A	平台左支樘板	1
5	SCM0400411	HexScrew	4
6	SCM0402545	HexScrew	8
7	WH00015A	Flat washer	8
8	ZZ00542A	LocTite	0.01



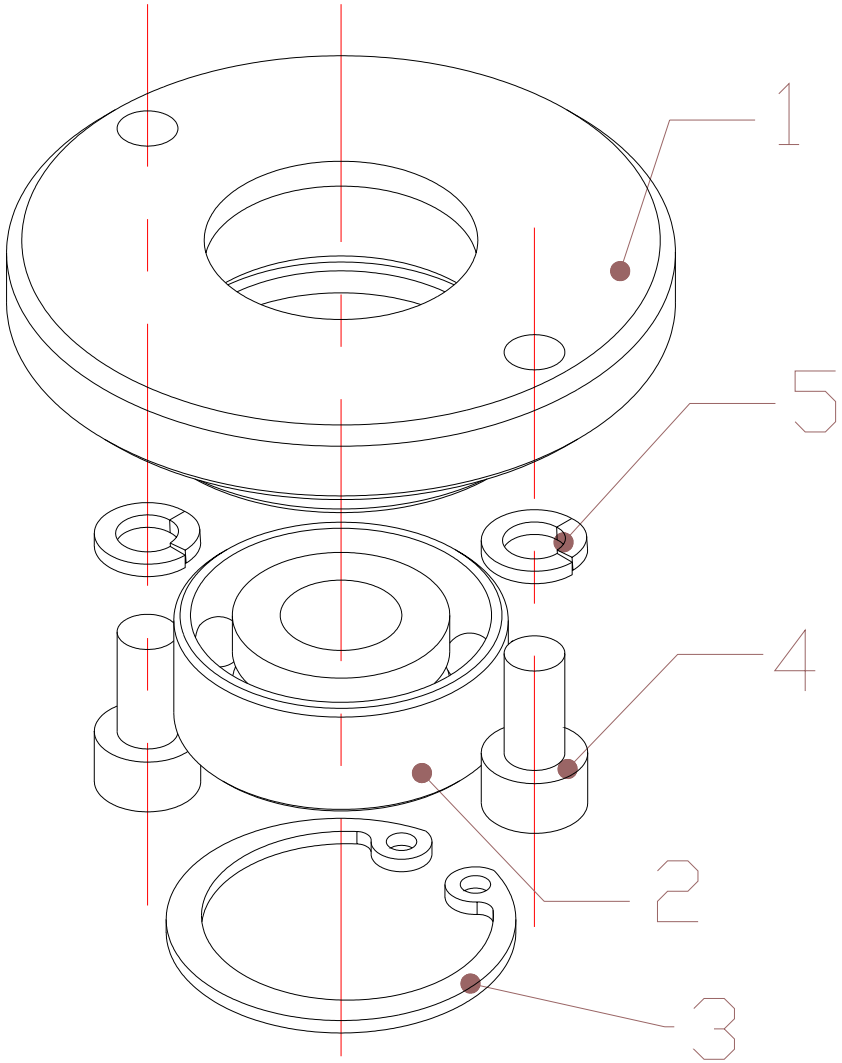
BK01516A - Venus Z-axis RIGHT Helical Gear Assembly

	Part #	Part Name	QTY
1	LH01312A	Z 軸皮帶輪	1
2	LH01558A	Z 軸梯形牙棒	1
3	LH01316A	Z 軸梯形母牙	1
4	LH01555A	平台右支樘板	1
5	SCM0400411	HexScrew	2
6	SCM0402545	HexScrew	4
7	WH00015A	Flat washer	4
8	ZZ00542A	LocTite	0.005



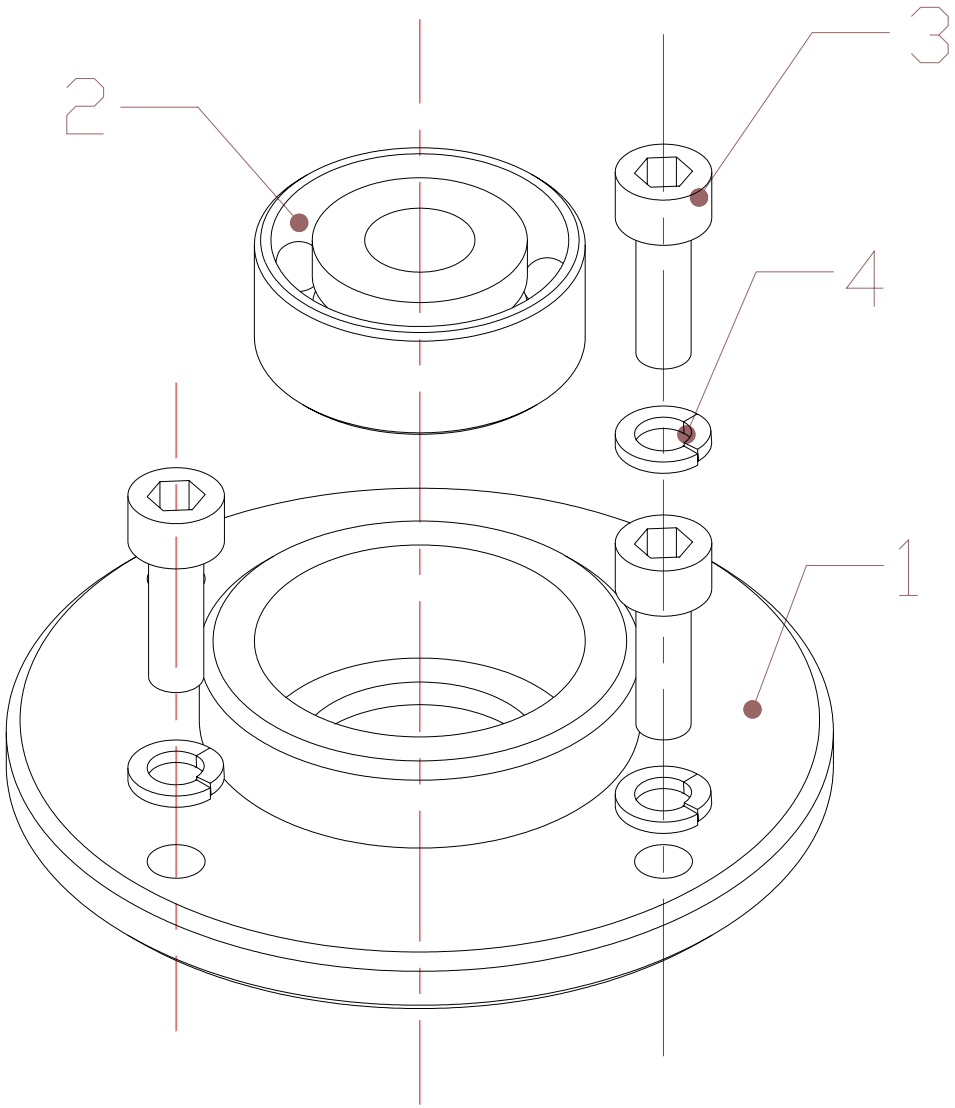
BK01517A - Z-Axis Upper Bearing Assembly

	Part #	Part Name	QTY
1	LH01571A	Z 軸上軸承座	3
2	BR01201A	Bearing	3
3	RR01201A	C shape ring	3
4	WH00018A	Spring Washer	6
5	SCM0400845	HexScrew	6



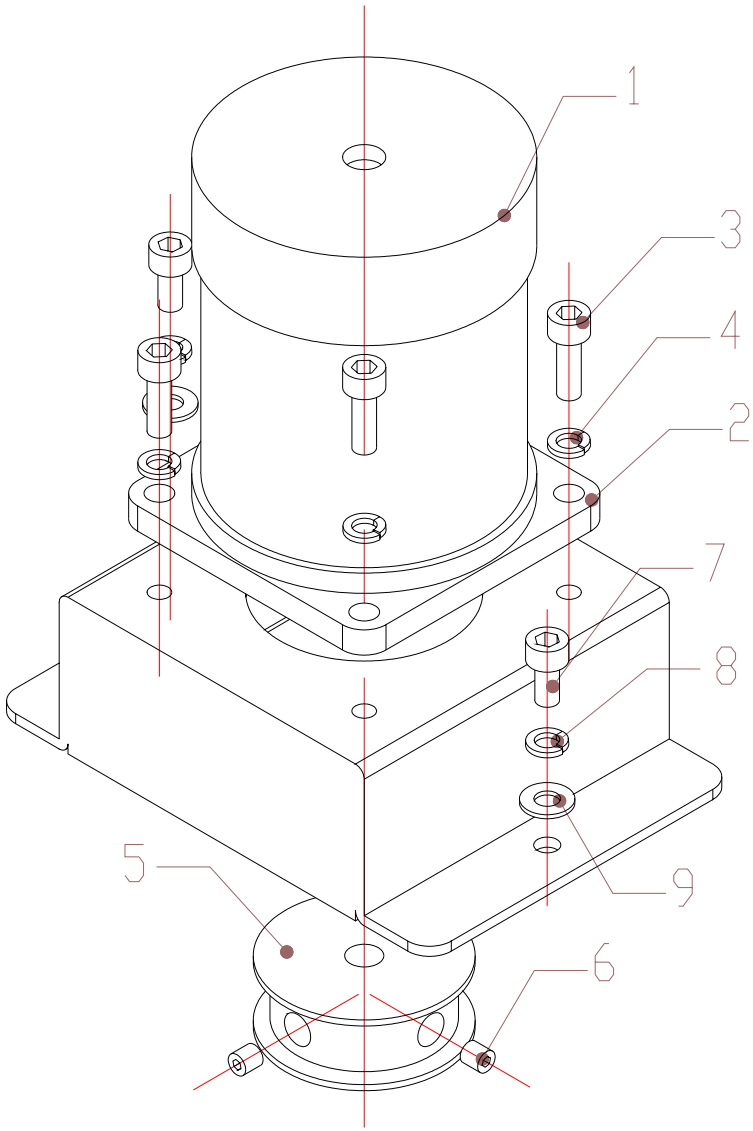
BK01518A - Z-Axis Lower Bearing Assembly

	Part #	Part Name	QTY
1	LH01570B	Z 軸下軸承座	3
2	BR01301A	Bearing	3
3	SCM0401245	HexScrew	9
4	WH00018A	Spring Washer	9



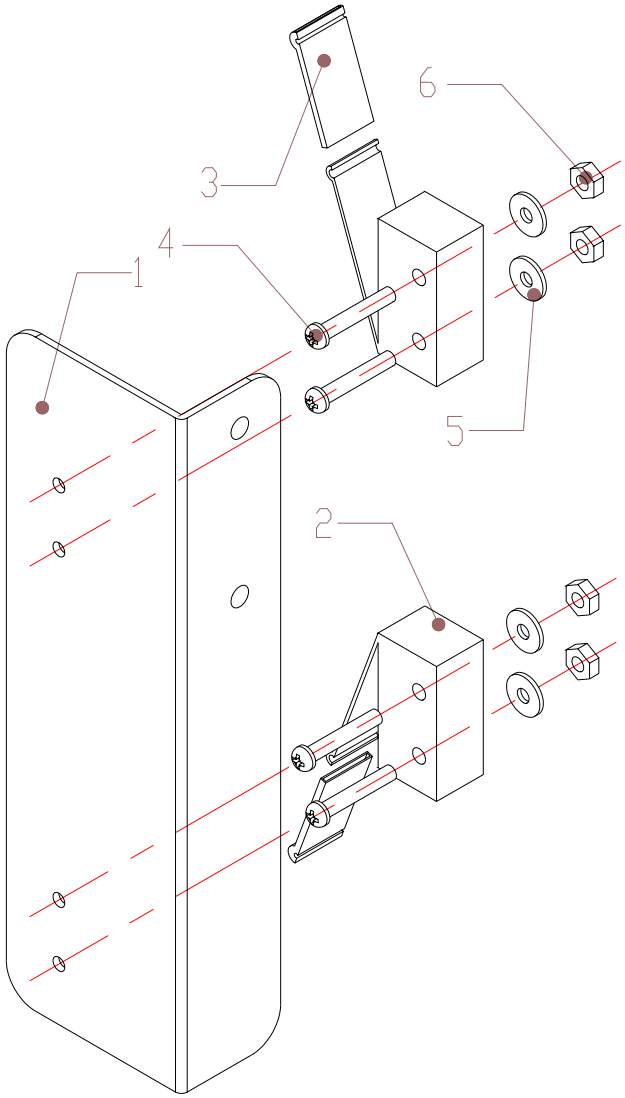
BK01519A - Z-Motor Assembly

	Part #	Part Name	QTY
1	MT00019A	Stepping Motor	1
2	PS01570A	Z motor mount	1
3	SCM0401245	HexScrew	4
4	WH00018A	Spring Washer	4
5	LH01311A	Z 軸馬達皮帶輪	1
6	SCM0400411	HexScrew	2
7	ZZ00542A	LocTite	0.005



BK01520A – Venus Limit Switch Assembly

	Part #	Part Name	QTY
1	PS01554A	Limit Switch Mount	1
2	SW00008A	VM3-04N 微動開關	2
3	EZ00024A	熱縮套管	0.0003
4	SCM0201245	HexScrew	4
5	WH00020A	Flat washer	4
6	NT00001A	Nut(2xt1.6xS4)	4
7	CN00225A		1



B.3 Consumable Spare Parts' List for PM

Appendix

C

Application Configuration

Appendix C: Application Configuration

C.1 *Overview*

Virtually any materials such as acrylic, wood, fabrics, glass, leather, marble, stone, rubber stamps, paper products, coated metals, plastics (especially micro plastic developed by IPI, Spectrum and Rowmark etc.) other hard-surface materials blended with polyester and fibers (Corian™, Fountainhead™, and Avonite™ etc.) or laserable simulated products of stone, wood and metal etc. To shorten your time in any kind of application, here we provide a list about tested material in GCC. If you have to work on a new material, which is not included in the listed table of next section, please feedback to GCC Customer Service Department. We are very happy to cooperate with customer for every kind of application.

C.2 *Material VS Its Configuration*

Mode / Material	Vector			Raster			Cutting		
	S	P	DPI	S	P	DPI	S	P	DPI
Acrylic									
Bamboo									
Coated Metal									
Crystal									
Fabrics									
Glass									
Leather									
Plastic									
Polyester Films									
Rubber									
Stone									
Vinyl									
Wood									

Table 8 Material VS Its Configuration

Glossary

Glossary

Overview

In this section, we only provide explanation to below 2 types of terminology. When you find some terminology is missing here, please contact with GCC Customer Service Dept. We will provide our best service to you.

- Terminologies in Italics type
- Terminologies in Italics type

A/B phase signal

A/B phase signal, which has 90 ° difference between each other.

AC Servo Motor

The AC servo motor, which is driven by AC voltage, provides high starting torque and is able to move very large shaft loads when it is first energized.

Aging

The change of a device over time. For example, a crystal may age 2 ppm over the first 30 days.

Auto Focus

An table leveling function which can sense the height of working piece by Auto Focus Gauge, and then move down the working table down to the height setting in the system.

Baud Rate

The rate of encoding signals -- that is, the modulation rate or signaling rate. For example, if 50 signals per second are encoded, the baud rate is 50 baud.

A signal may have more than one value encoded on it. For example, if the signal has four possible levels, then it is possible to encode 4 bits per signal. Hence, the bit rate becomes four times the baud rate.

In normal use, baud is incorrectly used synonymously with bit rate, but this is only a special case where one value is encoded per signal.

BNC - Bayonet-Neill-Concelman

A type of coaxial connector used in situations requiring shielded cable for signal connections and/or controlled impedance applications.

CAD - Computer Aided Design

Applying computer to products, component designs, analysis, and other applications, to increase the design efficiency.

CAM - Computer Aided Manufacturing

Applying computer to product manufacturing, process designs, machine control programs, and other applications, to increase the quality.

CE marking - Conformity European marking

The CE mark means that an importer or a manufacturer declares that its products comply with the portions of the European Union's (EU's) Marking Directive that apply to products in a particular class. CE marking is a certification required for

products sold in Europe. The European Power Supply Manufacturers Association (EPSMA) has issued a set of guidelines to help manufacturers comply with European rules.

The European Community accepts the CE mark as an indication that products conform to all applicable European directives and that you have carried out authorized assessment procedures on the product. The guidelines cover the scope of CE marking, and specifically explain the mark‘s use with component and standalone power suppliers.

Two directives apply to power supplies - Low Voltage Directive (LVD) 73/23/EEC and EMC Directive 89/336/EEC. The LVD applies to all power supplies with an ac input of 50 to 1000V, or a dc input of 75 to 1500V. After December 13, 1996, CE marking for the LVD becomes mandatory.

The EMC Directive does not apply to component supplies (those not accessible to the end user) but does apply to freestanding units. Since January 1, 1996 CE marking has been required for standalone supplies, to demonstrate compliance with both the emission and immunity requirements of the EMC directive. However, compliance with the harmonic-reduction and power-factor-correction sections of the directive becomes mandatory only after June 1, 1998.

Checksum

The sum of a group of data values. Usually transmitted with the data to assist in error detection.

CO_2 Laser

Laser operation occurs when a medium (in GCC case CO_2) is excited within a chamber. Ours is a sealed metal tube. This light is focused to a small, intense beam that may be used for cutting or "writing" on variety of materials. Lasers function as components within a system and are commonly used in such applications as Engraving, Cutting, Marking and even 3D Prototyping.

Compression

A method of packing data in order to save disk storage space or download time. JPEGs are generally compressed graphics files. Compression is a technique to make a file or a data stream smaller for faster transmission or to take up less storage space.

CPR – Count Per Resolution

This indicates the slot number of encoder in a resolution.

Cross-talk

The coupling of signals comes from one conductor to another nearby conductor, by magnetic or capacitive coupling.

CTS – Clear To Send

Before the driver output a graph to printer, the system clear the old file firstly. So only the latest file can be printing out. In GCC production, this mode is supported for those systems, which don’t support multi-file mode.

DC Servo Motor

The DC servo motor, which is driven by DC voltage, provides high starting torque and is able to move very large shaft loads when it is first energized.

LaserPro Series are equipped with DC Servo due to the following reasons:

- DC Servo Motor gives a higher tolerance motion thus it can achieve higher accuracy.
- DC Servo Motor has higher working speeds.

DMA - Direct Memory Access

DMA transfers data from or to memory at a high rate without involving the CPU. DMA is the hardware/software technique that allows the highest speed transfer of data, to or form random memory (RAM). Given the potentially more expensive hardware. DMA can provide the means to read or write data at precise times without restricting the microprocessor‘ tasks. For example, one system under DMA control can read or write any combination of analog, digital or counter/timer data to or from RAM at rates up to 360KB/second. This is accomplished without taking time from the other tasks of the microprocessor. The amount of time required to respond to a DMA request is very small compared to the time required to service an interrupt. This makes the goal of foreground/background operation, at high speed, possible.

DPI – Dot Per Inch

Specification of printing density for Cutter/Laser Engraver.

DRAM - Dynamic RAM

DRAM is operating at around 150 ns or less.

DSTN LCD - Double Super Twisted LCD

STN LCD is unable to provide curved display surfaces constitute a drawback in some application areas. The polymer film STN LCD works in a reflection format and presents monochrome displays.

ECP - Extended Capabilities Port (ECP)

This mode provides for bi-directional transfers and significantly improves the transfer capabilities of the host to the printer. ECP mode is capable of 2 Mbytes/sec data transfer. This port is both software and hardware compatible with existing parallel ports, allowing it to be used as a standard LPT port when ECP is not required. It provides an automatic high burst bandwidth channel that supports DMA or ECP in both the forward and reverse directions. A 16-byte FIFO is employed in both forward and reverse directions to smooth data flow and increase the maximum bandwidth. This port supports an automatic handshake for the standard parallel port to improve compatibility and increase the speed of mode transfer. It also supports run-length encoded (RLE) decompression in hardware. Compression is accomplished by counting identical bytes and transmitting an RLE byte that indicates how many times a byte is repeated.

EDO DRAM - Extended-Data-Out DRAM

Bandwidth = 240Mbytes/sec. EDO DRAMs have the same internal organization as standard page-mode DRAMs, with one significant exception: a 'D'-type latch is added to the sense amps' output. EDO can replace standard DRAMs. Standard DRAM used in Pentium systems.

EDRAM - Enhanced DRAM

EDRAMs, which Ramtron International Developed, are similar to standard DRAMs in that both memory types contain a DRAM array. To boost performance over standard DRAMs, Ramtron applied transistor-level optimizations, turned the output function of the sense amps into a true SRAM read cache, and modified the external interface. Its 15-nsec cache-access time keeps up with a 66Mhz bus.

EEPROM - Electrically EPROM

Read = 100 ns, Write = 2~10 ms, Endurance > 1M (cycles). The EEPROM is a non-volatile memory chip suitable for long-term storage. EEPROM can be erased with an electrical voltage power.

Electrostatic Discharge

(IEC 801-2 Level 4) Electrostatic discharges (ESDs) are most severe where synthetic materials and a dry atmosphere are combined. Direct discharges, as well as discharges between metal objects near the workstation, can cause interference or damage.

To test a workstation, an ESD generator applies 15KV to the system. The waveform characteristics include 150nS rise time and 150nS pulse width. While only areas of the system, which are accessible to the operator, are subject to direct discharge, as well as any peripherals attached to the system.

Encoder

Accuracy is the deviation of a measurement from a known standard. Accuracy is normally specified in percent.

EPP - Enhanced Parallel Port

EPP was developed to provide for high-speed, bi-directional data transfers that are compatible with the register map of the existing standard parallel port. The EPP specification assigns traditional microprocessor bus signaling functions to the standard parallel port lines (i.e. address strobe, data strobe) to access adapter hardware directly.

EPROM - Erasable Programmable ROM

Read = 100 ns, Write = 100 us, Endurance > 100 (cycles). The EPROM is a non-volatile memory chip suitable for long-term storage. EPROM can only be erased with an ultraviolet light.

ESD - Electrostatic Discharge

- Lighting, operation of equipment, or movement of personnel can cause ESD.
- Electrostatic Discharge is a serious and realistic threat, usually caused by a rapid

discharge from a human, although internal discharges due to mechanical movement are also possible sources. ESD can cause both direct (conducted) problems and indirect (radiated) problem.

FIFO - First In First Out

The size of the FIFO is 16 bytes deep in chipset 16C550 UART, run at near the peak 500 Kbytes/sec.

Firmware

Memory chips which hold the operating system and programs. Firmware retains such information in memory after the computer is turned off.

Flash ROM

Flash ROM is a read-only memory chip for permanent non-volatile memory, usually for firmware, which can be electrically re-programmed. Flash ROM allows you to update the memory by downloading new information through a communication port.

GIF

Stands for **G**raphics **I**nterchange **F**ormat. GIF images are the most widely used graphic format on the web. GIF images display up to 256 colors.

Graph Mode

Manual Color Fill

Manual Color Fill

3D Effect

Stamp

Grayscale

An application of black ink (for print) or the color black (for the screen) that simulates a range of tones. Grayscale images have no hue (color). In print design, a grayscale graphic image appears to be black, white, and shades of gray, but it only uses single color ink.

HPGL – HP Printer Language

For GCC printer driver, the Vector output is compatible to JP PCL5 Printer Language.

I/O - Input/Output

An I/O facilitates the transfer of data between the processor and a peripheral device.

IPS – Inch Per Second

It means the throughput of Cutter/Laser Engraver.

JPEG

Stands for **J**oint **P**hotographic **E**xperts **G**roup. File format for full-color and black-and-white graphic images. JPEG images allow for more colors than GIF images

and are usually smaller in size.

LCD - Liquid Crystal Display

The low-powered LCD technology in commonly used in digital watches, laptop computer displays, and character-based industrial workstation displays. Reflective LCD screens reflect ambient light. Backlit LCD screens use their own light source.

LCD is an integral part of electronic equipments. An LCD display offers a lower cost, and is more readable outdoors or in high-ambient light conditions. The viewing angle for most LCD is less than 50 degree.

MTBF - Mean Time Between Failures

The calculated MTBF is using MIL-HDBK-217E (one of regulations).

MTTR - Mean Time To Repair

The calculated MTTR is using calculate the man-power in the field for troubleshooting.

Operating Temperature

(IEC 68-2-1 Ad and IEC 68-2-2 Bd) Operating temperature specifications are 0°C to 50°C (32°F to 122°F) for most industrial workstations and 0”C to 55°C (32°F to 131°F) for some units. Compare this to office-grade equipment, which may only be rated from 15°C to 35°C (59°F to 95°F).

Optical Isolation

Like RS-232 ports, both RS-422 and RS-485 ports are susceptible to damage from electrical transients and the differences in ground potential between connected devices. A relatively expensive solution, called "optical isolation", is necessary for a true industrial workstation. With this solution, the only connection between the workstation and external equipment is a light beam inside an optical coupler. Most PLCs rely on optical isolation for protection

Parallel Port

Refer to ECP/EPP/SPP for detail.

PCB – Printed Circuit Board

N/A

PCMCIA - Personal Computer Memory Card International Association

- PCMCIA is an organization which sets the technical standards according which all related devices are designed. PCMCIA cards are rapidly replacing floppy diskettes as the storage medium of choice for computer users. They are small, compact, have a large capacity and offer a flexible range of options for both storage of data and implementation of devices.

- PCMCIA cards come in 3 thickness (all of them have the same length and width dimension) : Type I cards are 3.3 mm thick, Type II cards are 5 mm thick, and Type III cards are 10.5 mm thick.

- Type I cards: Memory cards for storing data. These include two main types - SRAM memory cards and flash memory cards.
- Type II cards: I/O cards including modem cards, fax/modem cards, Ethernet LAN cards, and solid-state ATA hard disk drive cards.
- Type III cards: ATA hard disk drive cards with rotating media.
- The Card Master series of products supports some or all of these card types depending on the model.

PID - Proportional, Integral, Derivative

A PID controller or PID loop constantly reads and manipulates an output condition so that a process variable is maintained at a set point.

The PID algorithm combines P-value proportional to the error value, I-value a time integral (accumulation of past errors), and D-value a time derivative (rate of change) of the error value. The P, I, and D factors may vary depending on the process being controlled.

PID control has the advantage of being able to respond to rapidly changing errors before they get too large and yet send out control values that will not cause the process to overreact.

Pulse Modulation

The modulation of pulsed signals, where the duration of the pulse is proportional to some characteristic of the modulating signal, for example, its amplitude. Several common forms of pulse modulation are pulse amplitude modulation (PAM) and pulse width modulation (PWM).

PPI - Pulse Per Inch

Stands for **d**ots **p**er **i**nch. DPI specifies the resolution of an output device, such as a computer screen or a printer, or an input device, such as a scanner. Web page resolution ranges from 72-86 dots per inch. Print resolution usually runs from 300-600 dots per inch on a Laser Printer and 125-200 dots per inch for photographic images on a print brochure.

PS/2 Type

Bi-directional parallel port

PWM – Pulse Width Modulation

One kind of pulse modulation, which provides different percentage of duty cycle to control the servomotor. For example, 90% duty cycle

$$90\% = \frac{T_{Hight\_Cycle}}{T_{Hight\_Cycle} + T_{Low\_Cycle}} = \frac{90}{90+10}$$

Quadrature signal

Refer to **A/B phase signal**

Radiated Electromagnetic Energy

(IEC 801-3 Level 3) The radiated electromagnetic (ER) test, commonly referred to as "RF susceptibility", determines whether a system is susceptible to continuous wave radiated electromagnetic energy from 27 to 500 MHz. Sources of interference include walkie-talkies, broadcast stations, and local transient equipment such as arc welders and induction heaters.

RF – Radio Frequency

N/A

RFI - Radio Frequency Interference

Generally, radiated EMI in the frequency range 10Khz to 3000Ghz, when an antenna is involved.

RS-232

RS-232 a low-cost and reliable standard for low speed, point-to-point communications at distances up to 50 feet (15 meters). The biggest drawback to RS-232 communications is that plant floor environments often generate electrical noise and transients, which can cause errors in transmission and damage to the interface components.

Sensor

Device that converts a physical parameter such as temperature, pressure, flow, strain, or position into an electrical signal - sometimes used synonymously with transducer - a true sensor contains signal conditioning so its output is more easily measured.

Serial Port

Refer to RS-232

Shielding

An extra layer of conductive material surrounding a wire to prevent external electrical signals from interfering with the signal on the wire.

SIMM - Single in line Memory Module

A DRAM memory module used on PC system.

SPP - Standard Parallel Port

PS/2 type bi-directional parallel port

SRAM - Static Random Access Memory

SRAM were operating at around 100 nanoseconds. SRAM consists of memory chips that require power to hold their data. SRAM chips are faster than DRAM chips and don't need to be continuously refreshed like DRAM chips.

Stepping Motor

Electro-mechanical device that rotates (or moves) proportional to pulses it receives from a stepper motor controller - DAC system sometimes contain stepper motor controllers - used for positioning equipment.

Thermistor

Temperature transducer changes resistance proportional to its temperature. Its advantages are high output, fast response time, and two-wire ohms measurement. Its disadvantages are non-linear, limited temperature range, fragile, current source required, and self-heating.

TTL –Transducer Transistor Logic

A typical medium-speed digital technology. Nominal TTL logic levels are 0 and 5 V.

USB –Universal Serial Bus

USB is a collection of USB devices. The software and hardware allow them to connect the capabilities provided by functions to the host. The USB is the answer to connectivity for the PC architecture. It is a fast, bi-direction, isochroous, low-cost, dynamically attachable serial interface that is consistent with the requirements of the PC platform of today and tomorrow. The following criteria were applied in defining the architecture for the USB:

- Ease of use for PC peripheral expansion
- Low-cost solution that supports transfer rates up to 12 Mbytes
- Full support for the real-time data for voice, audio, and compressed video
- Protocol flexibility for mixed-mode isochronously data transfers and asynchronous messaging
- Integration in commodity device technology
- Comprehend various PC configuration and form factors
- Provide a standard interface capable of quick diffusion into product
- Enable new classes of devices that augment the PC‘s capability

Vector Graphic

A graphic image drawn in shapes and lines, called paths. Images created in Illustrator and Freehand (graphic design software) are vector graphics. They are usually exported to be bitmap images.

EMC - Electromagnetic Compatibility

- The ability to use equipment without having it disrupt, or be disrupted by other equipment in the vicinity, is called EMC.

- The purpose of EMC is to provide the technology and guidelines to attain peaceful coexistence (compatibility) when dealing with EMI issues.

- The goal in EMC is to minimize, divert, or eliminate one of three elements (a source that generate the noise; a receiving device that is affected by the noise; and a coupling channel between the source and receptor) necessary for a noise problem.

EMI - Electromagnetic Interference

- The Federal Communications Commission (FCC) and other agencies specify acceptable levels of "emitted" EMI to prevent electronic equipment from interfering with other equipment or communications in general.

- EMI is defined as a disturbance or malfunction of equipment or system caused by the operation of other equipments or systems, or by the forces of nature.

- Any switching process is a potential source of EMI. Factors that influence EMI generation at the chip level include clock frequency, waveforms, duty cycle, and the nature of specific chip used.

- Two of the main solutions to radiated interference - whether electrical, magnetic, or conducted - are shielding and filtering.

High-frequency Transients

(IEC 801-4 Level 4) The electrical fast transient/burst test evaluates industrial process control and measurement systems for repetitive fast transient (bursts) on supply, signal, or control lines. Transients can enter the system through power mains or signal and communication lines. They can be one of the most troublesome and damaging types of susceptibility to industrial digital devices.

The "power line test" delivers transient pulses with a 4 KV amplitude with a 5 ns rise time, first in positive and then negative polarities, at the rate of 2.5 KHz in bursts which are 15 ms long with bursts approximately 300 ms apart.

The "I/O transient test" simulates the effects of transient noise coupled into input/output cables. In this test, a 3-foot (1 meter) capacitive clamp is attached to an I/O cable as close as possible to the system. The transient noise is identical to the test described in the power line test except that the amplitude is 2 KV.

The "lightening test" (IEEE 587) verifies the system 's immunity to high-energy transients and high-energy AC power line surges from large inductive sources, such as motors. In this test, a generator delivers a 100 KHz "ring wave", or oscillatory wave, to the system through the AC power line while the system is performing diagnostics. The amplitude parameters are 6KV for high impedance loads. These parameters represent 10 joules of energy.

Humidity Storage and Operation Test

(IEC 68-2-14 Na) Humidity can cause corrosion and affect the dielectric strength of insulating materials. In hard disk drives, humidity can cause read and write errors and damage the media.

The test requires the system to be placed in an environmental chamber where the temperature and humidity are increased to 50°C (122°F) 95% relative humidity (RH) at the rate of 10°C (18°F) 10% RH per hour (non-condensing). The system soaks in this environment for five days and is then energized for two hours. The unit is then examined for any mechanical degradation.

Mechanical Shock

(IEC 68-2-27 Ea) Workstation performs both operating and non-operating mechanical shock tests. The workstation is attached to the test system and three shocks are applied to each of the six surfaces for a total of 18 shocks per test. The shock pulse is half sine wave. After completing the shock test, the workstation is disassembled and checked for any sign of fatigue.

Operating Vibration Test

(IEC 68-2-6 Fc) A system is panel-mounted to a test fixture and subjected to a resonance search performed at 0.5g from 5 to 500 Hz in all three mutually perpendicular axes as a control test. Then the assembly is subjected to sine vibration from 5 to 500 Hz at a logarithmic sweep rate of octave per minute. These tests proceed for two hours per axis while the system performs functional diagnostics.

On completing this six-hour endurance test, the system is subjected to the resonance search again and checked for any change in resonant characteristics, which would indicate that mechanical degradation of the system has occurred.

Packaged Drop Test

(National Safe Transit Committee, Project 1A) The packaged drop test drops a system packed for shipment ten times: Once on each of the six surfaces, once on a corner, One on each of the three edges which extend from the “dropped corner”. The height of the drop varies from 29.5“ (75cm) for a 10 lb. (4.5Kg.) package (severity level A) to a drop of 11.8” (30cm) for a 53 to 198 lb. (24 to 90 Kg.) package (severity level D).

RVT – Reliability Verification Test

This is a GCC unique production test, which includes below items, before running a new product into production.

- EMC
- EMI
- Operating Vibration
- Package Drop Test
- Shock Test
- Vibration Test

Shock Test

Exposure to the regular shocks caused by stamping and punch presses, or the typical abuse of equipment and materials being moved near a control enclosure, can cause a "non-industrial" system to operate intermittently or to fail.

Storage Temperature

(IEC 68-2-1 Ab and IEC 68-2-2 Bb) Storage temperature ratings fall between -40°C and 70°C (-40°F and 158°F) to ensure that extreme temperature encountered during transportation do not warp or crack workstation materials due to expansion, contraction, or stress.

Temperature Cycle Test

(IEC 68-2-14 Nb) System needs to pass through cycles of rapid temperature changes to test circuit timing and capacitance. The system places in an environmental chamber and cycles through the temperature from the minimum to the maximum at 1°C (1.8°F) per minute for system without a hard disk drive or 10°C (18°F) per hour for system with a hard disk drive. The proto type system must pass five temperature change cycles.

Temperature Shock Test

(IEC 68-2-14 Na) Temperature shock tests simulate the changes that a system can undergo during shipment. A system at laboratory temperature, approximately 23°C (73°F), is placed in a -40°C (-40°F) environmental chamber for two hours and then returned to the laboratory temperature for two hours. System is subjected to five cycles at -40°C (-40°F) and five cycles at 70°C (158°F).

Thermal Evaluation

A thermal evaluation of any hardware system is particularly crucial where low-voltage digital semiconductor devices are used. Digital devices are specified to operate at 70°C (158°F) maximum operating free-air temperature.

Vibration Test

Vibration sensitivity is determined by several factors: strength, mass, and the distance between mountings points.

In almost every industry, machines (such as fork lifts, presses, and railroad equipment) are in constant motion. These vibrations have a cumulative effect on system, which result in random, as well as permanent, failure.

Version Notice:

V1.0A

First Release of the Venus Maintenance Manual without any modification or add-in.

V1.0B

The part diagrams are revised with better rendered graphics.