



Link  Motion™
by Solustan, Inc.

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User's Manual

SOFTWARE LICENSE AGREEMENT

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7. LinkMotion driver software is protected with a software protection key. The protection key is tied to your specific PC computer using appropriate Microsoft Operating System. If the technology was not available to transfer the license to another PC, **you will be required to buy another license at a full price** of the software in case of a PC failure beyond normal repair. **It is very important to safeguard the PC with the license.**

8. LinkMotion driver software you purchased can also protected with optionally available hardware ID (dongle) key. If the ID key fails for some reason, you could return it for replacement. As long as Solustan can identify the key to be the one issued by us, **we will replace it for a fee.** On the other hand, if you lose the key, you will be required to buy another license at a full price of the software. **It is very important to safeguard the ID key.**

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LinkMotion Detail Installation and Setup Instructions

Computer Requirements:

Windows XP with Service Pak 2 or higher and Microsoft .NET 2.0 Framework installed, Parallel Port, Processor speed of at least 800 Mhz, Minimum RAM memory 1 GB or more preferred, 60 MB of Hard drive free space, Screen resolution of at least 800 x 600, CD-ROM drive is not required, if the driver software was down-loaded from the web site. CD-ROM drive is necessary, if the software was received on a CD.

Use keyboard and mouse with PS2 connection only. Do not use Keyboard and mouse with USB connection.

Microsoft .NET 2.0 Framework is available for a free download from the following site:
Microsoft.com>Downloads & Trials>Download Center>.NET Framework Version 2.0 or Higher.

LinkMotion version 2.6 or older required I.D. Key and the I.D. key driver. I.D. Key may be provided as an option and user will need to load the I.D. key driver and we can send instructions separately. Do not worry about loading the driver for the key if you did not receive any hardware I.D. key.

Installation required for LinkMotion VC for Co2 Laser:

Part 1 - Driver for the USB I.D.key (Dongle) is necessary to install only if you purchased hardware key option.

Part 2 - Second part is installation of LinkMotion VC for Co2 Laser driver software.

Part 3 - Software License Code procedure is necessary to follow if you already purchased LinkMotion driver software without the hardware key.

Part 1 – Hardware key (dongle) Driver:

This is necessary to install only if you purchased this optional item. If you had a demo version of our software that was installed on the same computer please make sure to uninstall that version and then continue this procedure. Your CD should start installing this part first.

Keep the ID key handy **but do not plug it in yet**. First you will be asked if you would like to install software for the I.D. Key. Click on the **Yes** button if you are installing for the first time. You can click on the no button if you are only reinstalling LinkMotion to by pass this procedure. Follow the on-screen instructions. Choose full installation when you see that option on the screen and after you agree to standard software license procedure and it should finish driver installation for the hardware key. It will install **Sentinal Protection Installer 7.4.0**. **Please get in touch with us if you need more help.**

Part 2 - Installation Procedure for LinkMotion VC driver version 2.7 or higher:

Note that you must have administrative privileges on the computer in order to install LinkMotion. Most of the installation process is self-explanatory with following screens. You can stop the installation at any time by clicking "Cancel".

If you have received the driver software on a CD then follow steps from (1A). If you have downloaded from the web then go to step (1B). Go to step (2) if you already installed the driver for the hardware key (dongle).

(1A) Insert the LinkMotion installation CD into your CD-ROM drive. If the Auto-run feature is enabled, Windows will start the Installation automatically. If the Auto-run feature is not enabled, browse the CD drive in Windows explorer and double-click on the "Launcher.exe" and installation will begin.
or

(1B) After downloading, unzip the files and save them by creating a folder name LinkMotion. Now double click on the file name Launcher.exe and installation will begin.

(2) Click on the Next Button.



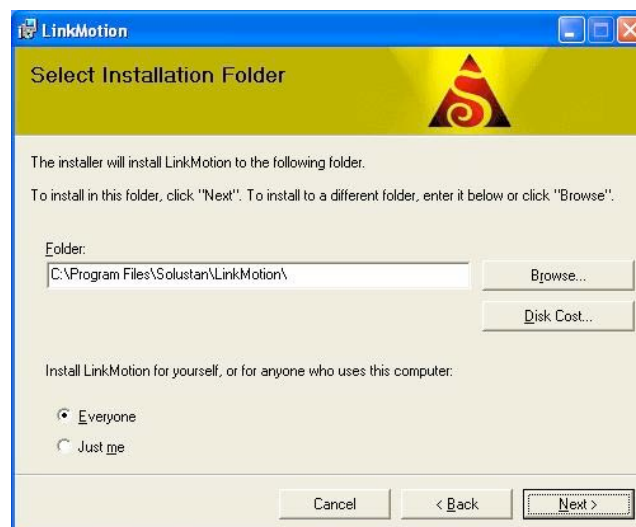
(3) Click on the **Next Button**.



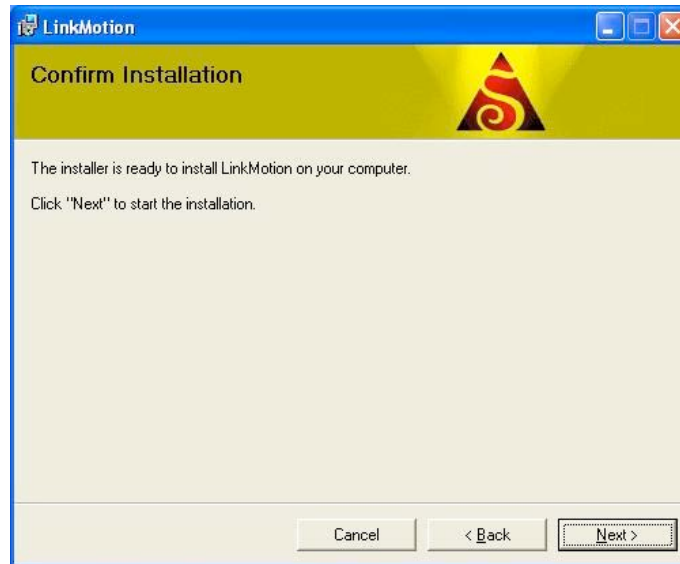
(4) When you get to the License Agreement dialog (see above), **you must read the agreement. If you agree, go ahead and click the radio button, "I Agree" for the installation process to continue. Then Click on the Next Button.**



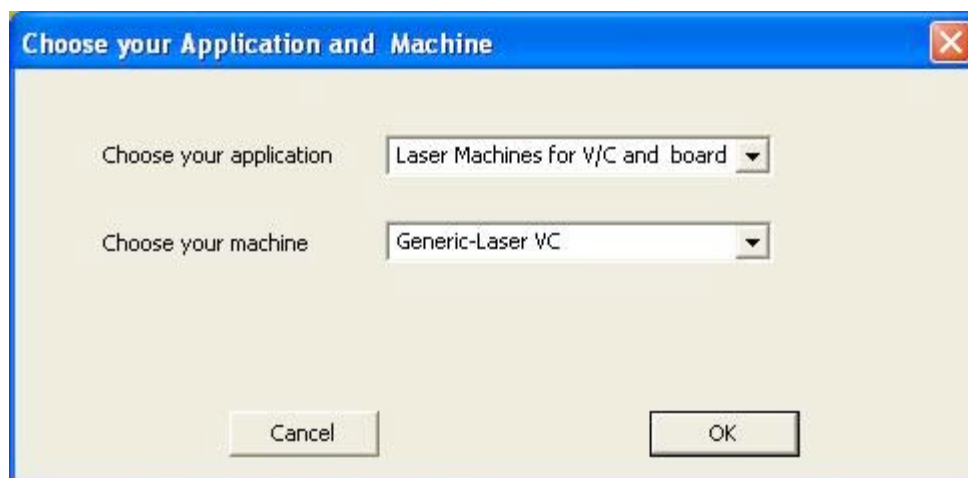
(5) After you have read and agreed to the License Agreement, you will be asked to specify the installation folder. In most cases you can leave this at the default value. You will also be asked to specify who will be able to run LinkMotion on this computer. In most cases you should specify **"Everyone"** and then **Click on Next button.**



(6) Click on the Next button once again.



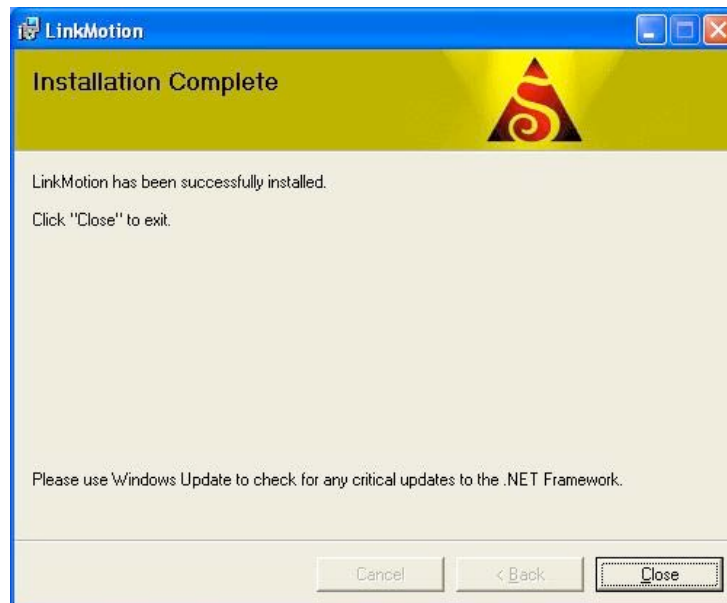
(7) Later during the installation you will see **Choose your application and Choose your machine** for installation. Application name is **Laser machines for V/C and board** and machine is **Generic-Laser VC**. Name of the machine is shown as an example and if you click on the scrolling arrow on the right you should see many more machines listed. If you do not see the name of your machine then it is easy for us to include once we have proper information from you with specifications of your machine.



(8) During installation, if a dialog pops up warning you that you are installing an untested driver, **click on "continue anyway"**. This warning will be removed in a future release.



(9) Click on "Close" when the installation is complete.

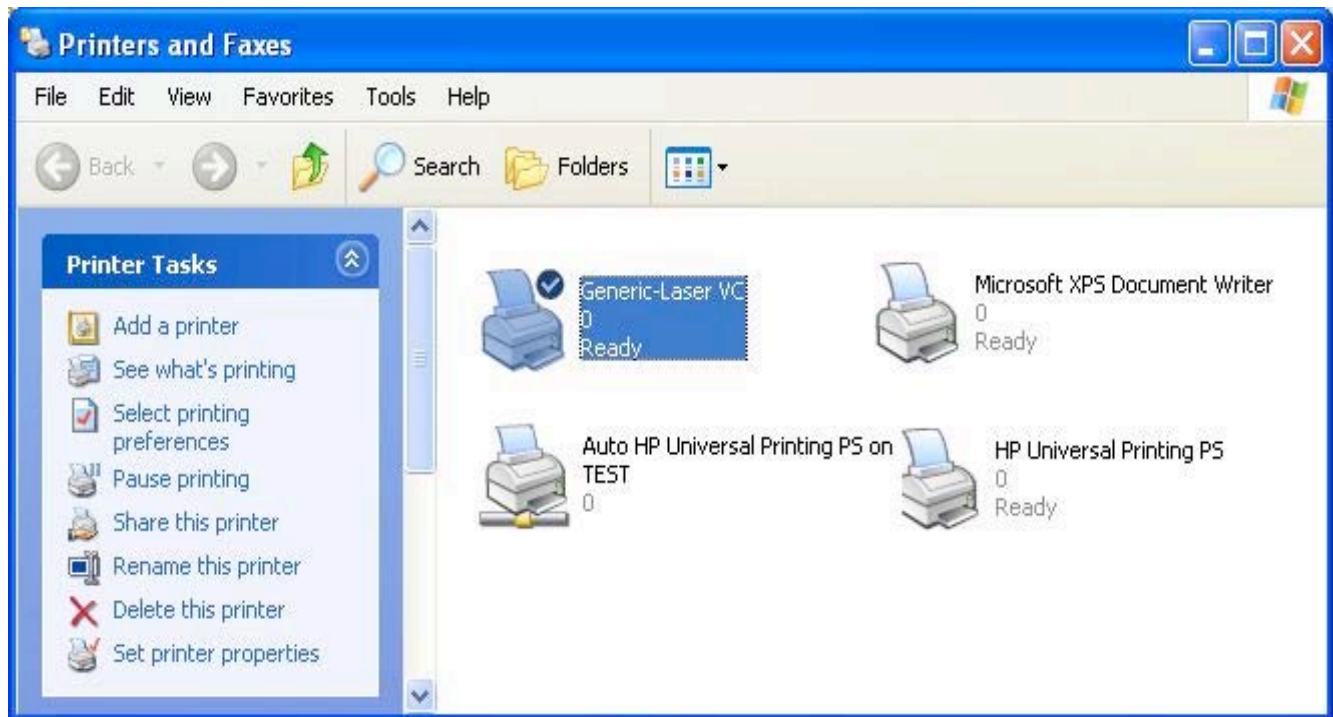


Icon shown above should show up in system tray at the bottom right.



(10) Setting up the Default Printer:

You want the LinkMotion printer to be your default printer. Go to the Start button and open the "Control Panel>Printers and Faxes" menu and find the **printer driver with Generic-Laser VC** name as shown in the picture below. **Right click on this printer and select "Set as Default Printer"**.



Installation procedure is complete.

Now refer to **Using LinkMotion** and the design application you are using and how that works with **LinkMotion and Popular Applications**. Document names are as following:

LinkMotion and Corel Draw

LinkMotion and Illustrator

LinkMotion and Auto Cad and More

Uninstalling LinkMotion:

Please make sure of the following before you uninstall:

Your specific machine related settings are saved as **LinkMotion.ini** file. This file can be **saved** from **General Options Menu** and simply click on the **Save button** and give whatever name you prefer. You can also navigate where in your hard drive you want to save it. Different users can save under different names. Similarly you can **Load** that file back after another installation of LinkMotion by going to the General Options menu and clicking on the **Load button**. Navigate to the file from your computer where you saved it earlier. Restore Default button allows you to load default installed INI file that is supplied with LinkMotion. **It is very important to exit LinkMotion applet and Re-launch the applet when you make any changes for it to be effective.**

Uninstall LinkMotion Procedure:

Make sure the LinkMotion applet is closed. Open the **Start menu** and select the **Control Panel**. Double-click on **Add or Remove Programs**. Look for LinkMotion entry in the list and click on that. Select **"Remove"** and answer **"Yes"** when it asks you if you really want to remove LinkMotion.

LinkMotion.INI file (configuration file) does not get deleted with uninstall procedure. If you want to delete your existing INI file following is the procedure:
In the hard drive Find folder name **Document and Settings> Folder with users (your own name) name> Folder name Application Data> Folder name Total Graphics Network> Folder name LinkMotion> LinkMotion.INI**. Delete this file.

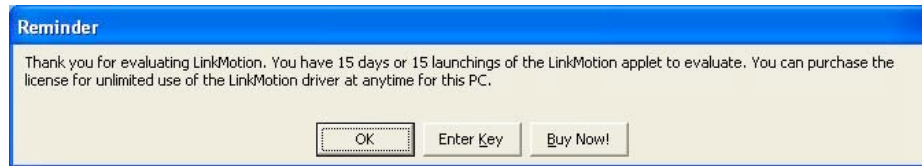
Re-Launch LinkMotion:

It is extremely important to Re-Launch LinkMotion if you replace or change LinkMotion.INI file for it to be effective.

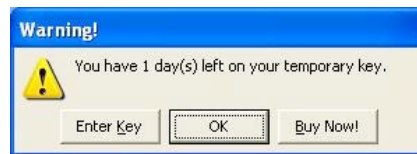
Exit the LinkMotion (icon) applet by right mouse click from the systems tray at the bottom right. LinkMotion icon should go away from the systems tray.
Now launch it back again by following and selecting the path Windows Start button>Program Files>Solustan>LinkMotion by the arrow of your mouse.
LinkMotion icon should appear again in the systems tray at the bottom right.

Part 3 – Software License Key Procedure:

We welcome you for trying out our LinkMotion driver software. You will see the following message on the screen when LinkMotion is launched from the systems tray every time when you are using the program as demo. This procedure is not needed for the customers who purchased optional hardware key.



If you did not purchase within 15 days or 15 launchings you will see a last reminder as seen in the following picture. It will be best to purchase at this point.



Once the trial period of LinkMotion expires, you will see the following message.



Click on the Enter key button, whenever you decide to purchase.



Once purchased LinkMotion, you need to provide us the proper information for **Hardware fingerprint, Name of your Business and valid email for Business**. Fill out this information in each respective boxes, save it and email it to us at support@solustan.com. We recommend for you to use copy and paste method so there are no errors. Solustan is not responsible for any incorrect Hardware fingerprint code you provide. Please double check this information before you send it to us. Software license working with Hardware fingerprint and matching code provided by Solustan, Inc. is intended to work only on the computer with the proper hardware fingerprint.

After you send us this information we will send you the customized Key Code. This key code is long text containing numeric numbers as well as alphabet letters. **We highly recommend that you simply copy and paste** this by bringing back the same **Enter Key screen**. Click OK and you are ready to use your LinkMotion driver software.

Hardware fingerprint:

Business Name:

Valid email for Business:

Key Code:

LinkMotion Virtual Controller and CO2 Laser:

Important Laser Warning:

Solustan is the provider of control software for your laser power based equipment. Extreme caution shall be applied in the use of the machines. Proper safety equipment shall be installed and properly tested to make sure that in case of a failure either in the functioning of the Solustan provided software or other software or the computer hardware associated with the software, proper and safe shut down of the laser power takes place automatically.

This is simply a guide line and not an all-encompassing document for safety and precaution. It is the responsibility of the laser system integrator to make sure that all the safety requirements are met to meet the letter of the law and additional considerations for human safety.

Machine use and Safety:

Buyer acknowledges that the seller does not know of the specific application of said equipment by the buyer, therefore, it is the buyer's (user's) responsibility to provide proper safety devices and equipment to safeguard the operator from harm for any particular use, operation, or set up, and to adequately safeguard the machine or machines to conform to all federal, state and local government safety standards and all industry safety standards, including, without limitation, the 1970 Occupational Health and Safety Act, as amended ("OSHA") and ANSI Z136.1-2001 Safe Use of Laser Standard.

Indemnification:

Buyer agrees to indemnify, hold harmless and defend Seller from and against any and all claims, liabilities or lawsuits involving injury or accident occasioned by Buyer's use of said equipment. This agreement includes but is not limited to the duty to indemnify, hold harmless and defend seller in any of the following: (1) Claim involving or alleging improper or negligent maintenance, reconstruction, repair, alteration, or modifications of the equipment by the buyer, its agents or employees; (2) Claims involving allegations of failure, negligent or otherwise, by the buyer, its agents or employees, to follow Seller's instructions, warnings or recommendations, or to equip said equipment with safety devices as required by federal, state or local government statutes, rules or regulations (including "OSHA" and ANSI Z136.1-2001 Safe Use of Lasers Standard), or as is customary in the trade.

Safety:

Tests carried out have proved the safety and reliability of the laser when used properly. The operator should nevertheless be aware of all the necessary safety rules in order to avoid any risk of damage to persons or the equipment itself.

Laser Radiation:

The Solustan software employed to work with any laser system is an OEM system (original Equipment manufacturer), which means that it has been designed and developed as an individual component to be integrated into more complex systems. As an OEM component, it has not been fitted with all the safety systems that complete a laser system. Specialized technicians will need to connect up the machine with all the interlocks, safety indicators and protection devices.

Laser radiation is an electromagnetic emission with a micrometric wavelength found in far infrared (CO₂ Laser), near infrared (Nd:Yag, Nd:YV04 Laser), visible (He:Ne or Argon Laser), and ultraviolet (ecchymmer lasers).

It should be considered non ionogenic Radiation. In many laser machines, the emission of a crystal bar is excited by “optical pumping” generated by powerful Laser Diode. The continuous bouncing of Photons between a front and a rear mirror sets up a positive reaction and so their numbers increase by the instant, until the required concentration is achieved to produce a collimated beam emitted from the semi-reflective front mirror. The radiation (which we can imagine to be a “Beam of invisible light”) is then Focused by means of Lenses on a point where the intensity becomes so great that it can react with different materials to cause an alteration by thermal effect.

Even though the radiation of many of such Laser machines may be invisible, because it is near the threshold of vision, the Eye receives it virtually integrally without even any papillary reflex! If we take into account that this is generally very intense, it follows that it can be extremely damaging or lethal to the eyesight.

Note:

Looking directly at a laser beam can cause irreversible damage to the eyesight.

To avoid permanent personal injury, certain precautions must be followed. All persons who may be exposed to dangerous levels of laser radiation, must know when the laser is active, in which case they must wear protective glasses.

The laser integrated in the Yag system, because of its high power, causes laser light to be reflected from flat surfaces. This reflected light is potentially dangerous to the eyes and skin. Electromagnetic emission with micrometric wavelength comes within the far infrared range and is therefore invisible, it is therefore not obvious where these reflected beams are directed.

Note:

Protection from reflected light beams is essential, because these can be of sufficient intensity to cause permanent damage to the eyes and to the skin.

In addition to the potential damage to eyes, invisible laser emission can burn clothes and other flammable materials such as organic solvents (alcohol, acetone) or benzines.

Note:

Every laser system is designed as a particular class system. The system integrator shall understand and document the appropriate class of the device, label it properly and explain the importance of safety to the user organization personnel. Class IV covers all lasers which are hazardous, not just because of direct or reflected radiation, but also because of diffused radiation! These laser sources can be particularly dangerous to the skin and represent a fire hazard for flammable materials.

The LinkMotion driver comes with a small application that resides in the System Tray. The System Tray is the lower right bar of the Windows screen. **Double click on the LinkMotion icon** to bring up the application. Based on the selection, the Control Pad will show up in English, Spanish, or symbols. Control Pad can be designed easily into any of the languages of the world.

Your computer should have Windows XP operating system with Service Pak 2 (SP 2) installed, one parallel port (on original mother board) and one USB 2.0 connection. Also you should install Microsoft .NET Framework Version 2.0. This is available from Microsoft's web site for you to download freely:

Microsoft.com>Downloads & Trials>Download Center>.NET Framework Version 2.0
Do not use Keyboard or mouse connected with USB connection. Use PS2 connections.

Install LinkMotion following the instruction that you received with your LinkMotion CD. First part of the installation is for LinkMotion I.D. Key driver and the second part will be the LinkMotion driver application. Make sure to select proper application and your machine name during the last part of the LinkMotion installation.

Warning for use of Control Pad:

Please avoid using the mouse after you have sent the job for the output. Once the job is done, your mouse should be available for use. Use the 'Zero' or the 'Space Bar' key on your keypad to Pause. You will see a message box asking you if you want to Continue or Quit the job. (Some times this message box is in the back of your Control pad and you can bring it to the front simply by clicking on the system tray's active LinkMotion application.) At this point you can go to LinkMotion and change the speed or depth in the materials menu, click apply and then click Yes to continue the job or No to stop the job completely. Keep in mind that if it is in the 'Move Mode' between the shapes or letters, it may not pause. **Raster mode for Laser application in Virtual controller mode does not support Resume function after Pause. When jogging the machine do not press three keys together, it may cause undesirable results. Some times pressing two keys together for both X and Y movements can cause machine to continue moving in one direction even if you are no longer pressing the key. Pressing the same key again or the opposite direction key should stop this unnecessary movements. Do not use the arrow keys elsewhere on the keyboard in place of the Control Pad keys.**

Important:

Zero or thinnest line width and No fill are the most important things to remember when you are designing a file to send to a machine for the vector output. It is not necessary to create jobs with the thinnest line widths and not necessary to unfill shapes before sending the jobs for processing in case of raster output.

Control Pad:



The Control Pad is operated using the numeric keypad, the right side of the extended PC keyboard. **Click on the Apply button after any changes** you make on any of the Tabs (Menus). Changes are effective only when you click on these buttons.

Home (Limit) switches (Green or red lights) show up at the top of the Control Pad for each axis. If switches are present and properly configured, it will show **green** color when not tripped. We protect you from driving into the end of an axis where you may have tripped the Home switch already. Move the table in any one of the axis until the switch is tripped, the green color will change to **red**. Once the switch has Settings for the switches are in the Origin Setup menu. Laser machines may not have motorized Z axis. User can uncheck Zaxis for home switch setting.

Reset Counter – Basic function of this is to **Reset Counter to 0 value** for each X, Y and Z axis positions. If you move the tool any where on the table, the X, Y and Z the counter will display the actual position of the tool. If you then click on the **Reset Counter** it will make all the display values to 0, 0, 0. Machines without the Home switches or selecting a new starting position on any machines are some of the useful functions of **Reset Counter** button.

Move To 0,0 – Clicking on this button will make your machine **move your X and Y position to 0, 0 location if the counters show values other than 0, 0**. This is a useful function for resetting back to the start position for the machines without the Home switches.

Clicking on the Solustan logo will take you to Solustan web site, if the computer is online and connected to Internet.

All the blue colored keys are designed to move X, Y, and Z axis with respective direction. Following are the keys for each axis X left (4), X Right (6), Y Up (8), Y Down (2), Z Up (-), Z Down (+) and Move Fast (5).

Move Fast Key (5) is pressed along with X or Y key movement to make it move faster. For faster movement you also need to have faster speed in the Move section of the materials menu. Move value is responsible for two functions. One function is **fast jog speed** and second function is **tool up speed** when it lifts up between the shape while doing a job.

Z Ref key (*) is not useful for Laser application.

HOME key (7) will move the machine to its Home position, if the machine is equipped with home switches. Machines may have home switches in X and Y axis or all the three axis.

I/O Keys (1), (3), (. or Del) and (9) are available for I/O 1, I/O 2, I/O 3 and I/O4 controls. These could be used to control Z axis movement in case Z axis is not motorized but it is solenoid and is controlled by air valve, for example. Can also be used for lubrication of tools, vacuum control, laser control, red diode, air, water etc. Each click of the keys can toggle the I/O position. User can set to make the action momentary or toggle by way of settings in the LinkMotion .INI file. Details are described after the symbol Control Pad.

Spindle Control for CNC type application or Air Control for Laser type application - Key (9) I/O 4 is used to control spindle motor or air in case of laser application. Each click of the keys will toggle the I/O position.

I/O keys to be either momentary or toggle keys find the following lines in LinkMotion.INI file and in the area of your machine name selection:

```
Key1Toggle=0  
Key3Toggle=0  
Key9Toggle=0  
KeyDeleteToggle=0
```

These lines control the toggle or no toggle nature of the four I/O keys on the Control Pad. The four keys correspond to keys 1, 3, 9, and Del. Any key with a declared value of zero is a momentary key while a declared value of 1 becomes a toggle key.

The big 0 (zero) or Space bar key is available to stop processing of the job anytime. When job is being processed it is very important to remember not to touch the mouse and the rest of the keyboard.

Num Lock and \ keys are available only when machine is in motion.

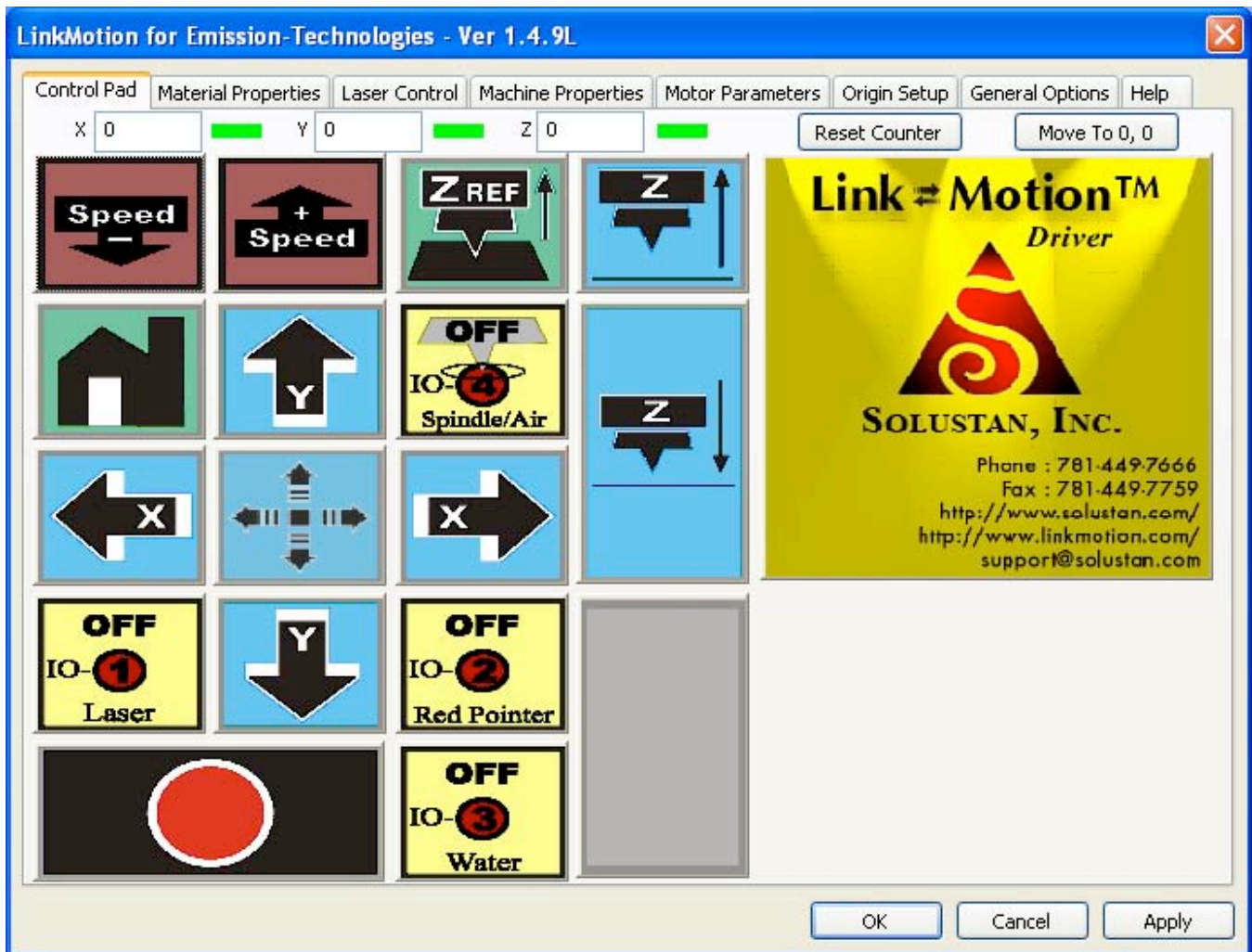
These keys can **decrease or increase** the speed of the X, Y movements of the machine. Do not keep this key pressed for long time. Simply press and release gently **each click of the key** will decrease or increase the speed according to the settings in the LinkMotion.INI file. **OnTheFlySpeedChange=4** is a default value in the INI file. This number works in percentage value of the original speed specified in the **Job feed rate of the Materials menu**. When the machine is in motion user can **decrease the speed by pressing Num Lock Key**. Similarly user can **increase the speed by pressing the / Key**. For safety reasons **increasing the speed will never go above the speed declared in the Job Feedrate of the Material Properties**. Once the job is done the speed again goes back to what is declared in the Job Feedrate of the Material Properties.

Control Pad in the Spanish language:



Go into **General Options** menu. Look at **Control Pad Labels**. Arrow to the right will show you the choices you have. Here select the **Spanish** Control pad and click on **Apply** button. Now you will see the **Spanish control pad**.

Control Pad with Symbols:



Go into General Options menu. Look at Control Pad Labels. Arrow to the right will show you the choices you have. Here select the Symbol Control pad and click on Apply button. Now you will see the Symbol control pad.

Above shown Control Pad will be available when Laser application is loaded. Four I/O's are available as shown in the picture for the Virtual Controller mode.

I/O 1(Pin14 of parallel Port) is for Laser Power
I/O 2 (Pin1 of parallel Port) is for Red Pointer(Diode)
I/O 3 (Pin17 of parallel Port) is for cooling water control
I/O 4 (Pin16 of parallel Port) is for positive air pressure

All four I/O keys can behave as momentary contacts (Click and hold down to change the status. Let go of the key and the status is back to original) or toggle contacts (Click once to change the state. Click again to change it back to original state). The settings are done in the INI file as shown below:

LinkMotion.INI file can be found as follows:

In the hard drive Find folder name **Document and Settings> Folder with user's(your own or business name) name> Folder name - Application Data> Folder name - Solustan> Folder name - LinkMotion> File name - LinkMotion.INI**

Open LinkMotion.INI file by double clicking on the file. It is a text file. You will see all the different machine names at the beginning. Specific machine related controls are further down in the file. Find the specific settings for your machine and you can make changes there. Remember to save the file after you make changes.

Also, remember to ReLaunch LinkMotion for your changes to take effect.

(1) I/O keys to be either momentary or toggle keys find the following lines:

Key1Toggle=0
Key3Toggle=0
Key9Toggle=0
KeyDeleteToggle=0

These lines control the toggle or no toggle nature of the four I/O keys on the Control Pad. The four keys correspond to keys 1, 3, 9, and Del. Any key with a declared value of zero is a momentary key while a declared value of 1 becomes a toggle key.

(2) Increase or decrease the Job Feed on the fly

Num Lock and \ (back slash) keys are available only when the machine is processing a job. These keys can decrease or increase the speed of the machine (movement of the X, Y axis). Do not keep this key pressed for long time. Simply press and release gently every time and it will decrease or increase the speed according to the settings in the LinkMotion.INI file.

OnTheFlySpeedChange=4 is a default value in the INI file. Even if you do not find any declared value, it will automatically increase or decrease the speed by 4 percent upon clicking the Speed+ or Speed- keys. If you want values other than 4, declare the value of your choice in the INI file. This number works in percentage value of the original speed specified in the Job Feed Rate of the Materials menu.

(3) Tickle pulse enable or disable

Tickle Pulse for Laser is set at a fixed 1 Micro second in our LinkMotion code.

Enable Tickle=1 will allow LinkMotion to generate the tickle pulse.
Enable Tickle=0 will not allow LinkMotion to generate the tickle pulse.

(4) Fine tuning of laser power output

LaserPowerPercent=5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

User will select a percentage of power for a specific color in the LinkMotion user interface. LinkMotion will check the laser power percent area of the INI file to find the necessary pulse width that it will need to generate to achieve the requested power point.

Here is how to enter values in the LaserPowerPercent. 20 values need to be generated and entered. There should be a space between two values. Let us assume that the laser power source is rated at 100 watts. Also, let us assume that the selected frequency for the CO2 operation is 5 KHz. This makes every pulse to be 200 microseconds.

Attach a pulse generator to the input of the CO2 laser power source. Set it up for pulses of 200 microseconds and start with zero on time of the pulse. Set the power meter to monitor the power output. Increase the on time of the pulse (keeping the frequency of 5 KHz constant) until you note the power output to be 5 percent of the rated value of the source, 5 watts in our case. Note the on time of the pulse. Let us assume that the on time of the pulse was 10 microseconds to generate 5 watts of power. 10 microseconds of a possible on time of 200 microseconds is 5 percent. Enter the value 5 in the first location. Your CO2 tube may not be linear for generating the output power.

The values in each of the locations shall be only an integer (a whole number). Should **NOT** have a decimal point.

If the user decides to specify a power level of 18 percent, LinkMotion will interpolate the values in the locations for 15 and 20 to arrive at a value for 18 and will generate a on time pulse width of that value.

Usually, the output of the power from laser power sources decline based on the usage of the machine. It is a good idea to re-tune the system periodically. This will assure proper output power from the laser source.

(5) Laser power output level as a function of the feed rate

This important feature is designed into the LinkMotion driver. User selects power output level as well as the feed rate. LinkMotion will make sure that the output power will be proper when the machine is running at the feedrate. If the machine needs to slow down because it needs to make a sharp turn or it needs to move on a curve or it needs to work with many small characters, LinkMotion will change the on time pulse widths to make sure that the power output corresponds and is properly reduced to match with the slower speeds of the machine. This built-in feature will avoid burning of the corners. The energy output will be consistent with the X, Y speeds of the machine.

(6) Logic levels of the I/O's

Microsoft Windows sets all the active lines of the parallel port as logic High when the PC and the Windows are launched. To comply with that, LinkMotion uses Logic Low to activate any of the I/O's. We set up a line in the INI file called,

Control Port Default=4 (This makes logic High) or

Control Port Default=11 (This makes logic Low)

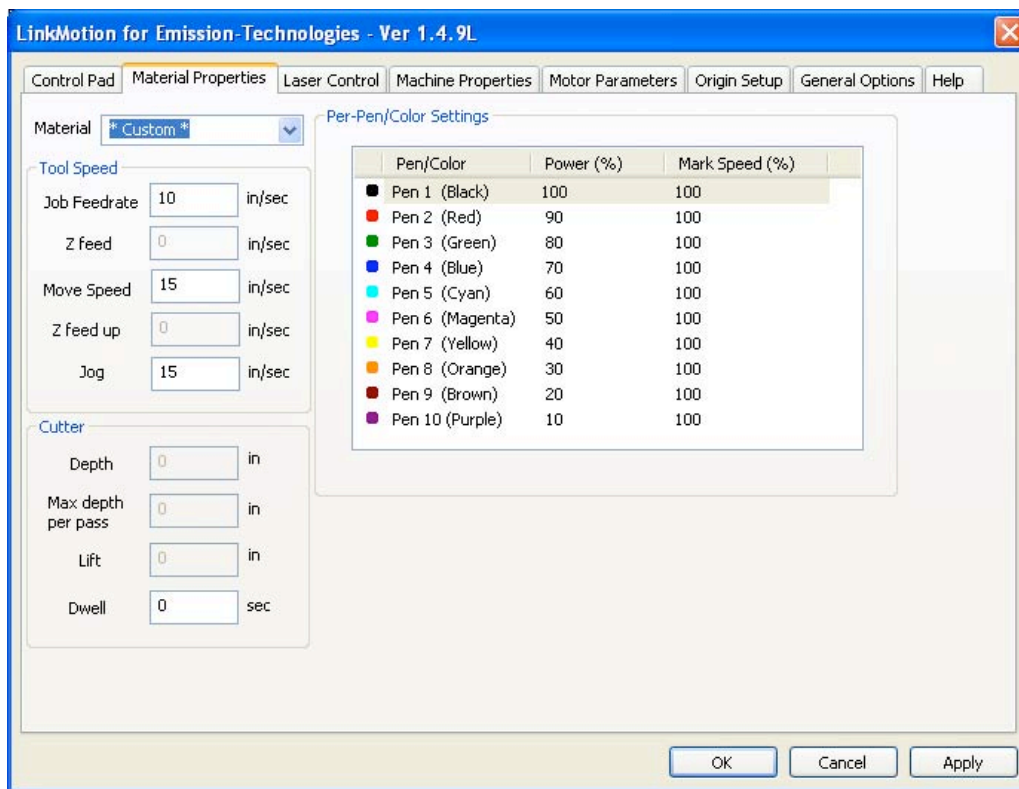
If you need to invert any of the I/O lines, you could do that by declaring different values for the above setting. Following values will give you the following results:

| Control Port Default= | 1 | 2 | <u>4</u> | 7 | 8 | 11 | 15 |
|------------------------------|----------|----------|-----------------|----------|----------|-----------|-----------|
| I/O1 (Pin14) | L | H | <u>H</u> | L | H | L | L |
| I/O2 (Pin1) | H | L | <u>H</u> | L | H | L | L |
| I/O3 (Pin17) | H | H | <u>H</u> | H | L | L | L |
| I/O4 (Pin16) | L | L | <u>H</u> | H | L | L | H |

(7) Safety, Limit, and Emergency controls

Pin 15 on the parallel port is available for connecting safety, limit, and emergency switches. **We will expect Logic 0 on pin 15 for the machine to operate normally. When we see logic 1 on pin 15, the job will be aborted or will not start.** Once job is aborted, it cannot be recovered. It has to be restarted. We feel Logic 1 is failsafe and requires active response from the safety apparatus for it to work properly.

Material Properties:



Material:

Different material selection and the flexibility of different speed settings are available here. You can again add more materials by going into the LinkMotion.INI file and create your own list in the material section. Color selection in your design application will effect the output **power and the mark speed** as you see in the above chart. Make these selections ahead of time and simply click on the **Apply button** and they become effective.

The values can be inches per second or millimeters per second or centimeters per second. General Options menu allows you to make your selection for this measure of units.

Per-Pen/Color Settings:

Following are the color/pen values for the LinkMotion printer driver. RGB values are given in percent.

| Pen number | Color | R | G | B |
|------------|-------|-----|-----|-----|
| ----- | ----- | --- | --- | --- |
| 1 | Black | 0 | 0 | 0 |
| 2 | Red | 255 | 0 | 0 |
| 3 | Green | 0 | 255 | 0 |

| | | | | |
|----|---------|-----|-----|-----|
| 4 | Blue | 0 | 0 | 255 |
| 5 | Cyan | 0 | 255 | 255 |
| 6 | Magenta | 255 | 0 | 255 |
| 7 | Yellow | 255 | 255 | 0 |
| 8 | Orange | 255 | 128 | 0 |
| 9 | Brown | 128 | 0 | 0 |
| 10 | Purple | 128 | 0 | 128 |

If you did not create a color palette with the above RGB values, our understanding of the way GDI handles this is that GDI will convert the object's color to an RGB value using whatever color correction model is in effect, then will do a least-squares fit to the 10-color palette (whichever of the 10 colors is closest to the color of the object on a least-squares bases will be the color that is sent to the printer driver). It is best if you can create your own palette in the job design program of your choice with the above selected colors to get the best results.

Tool Speed:

Job feed rate is the speed when the job is being lasered. Bringing your arrow on the number that shows Mark Speed (100%) for each color and Double clicking on the number should open a box that will allow you to change this number. If your job federate in tool speed is 2in/sec and you make the red pen to give output at 50% then job should run at 1in/sec.

Jog speed is when the user is jogging the machine with the help of Control Pad.

Move speed has two functions, it is the speed when the tool is retracted and the **machine is moving to the next shape** after finishing the previous one and it is also used for **fast jogging** (holding down fast key while keeping the directional key pressed).

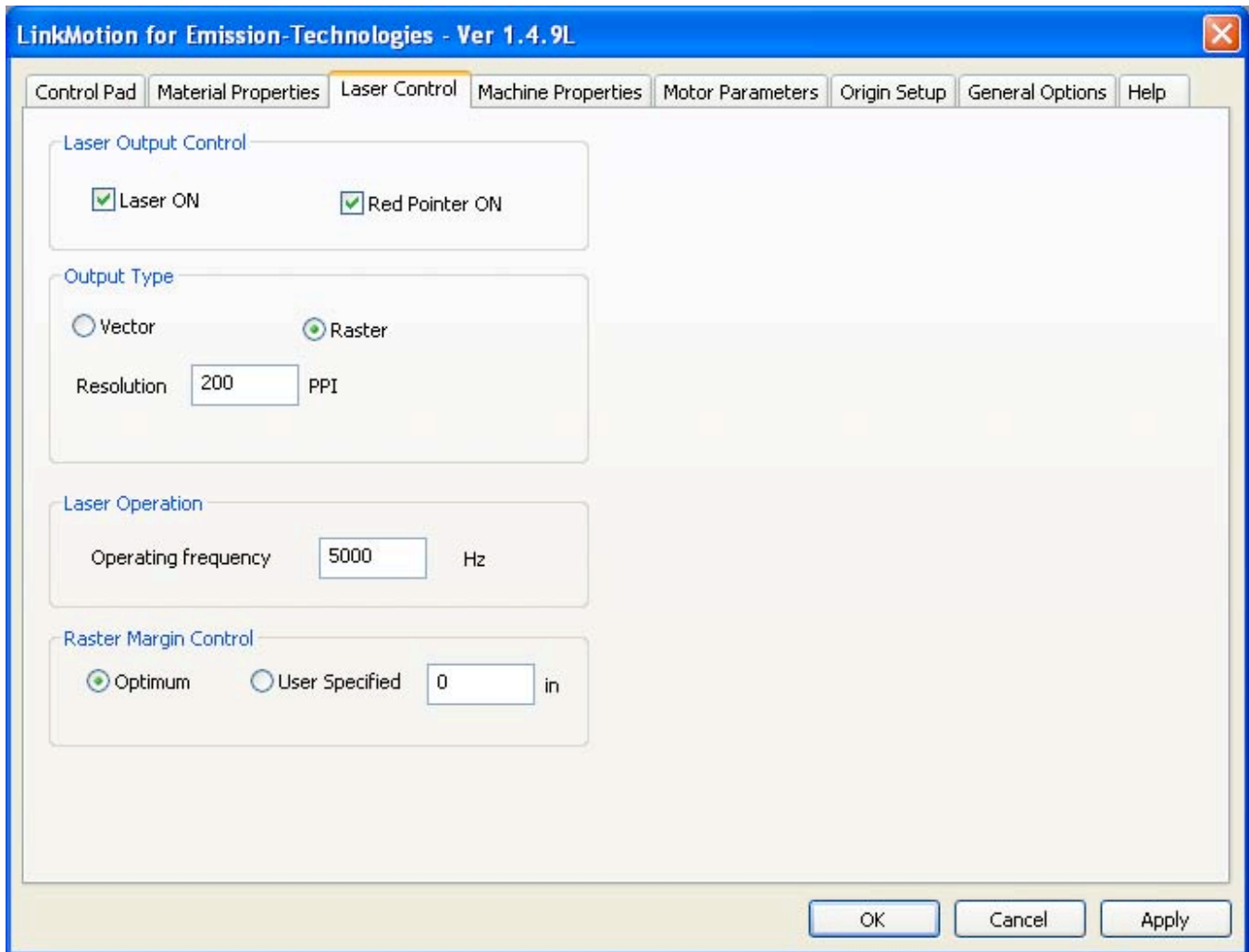
User can set up separate speeds for **Z feed up** and **Z feed down**.

Cutter:

Depth, Maximum depth per pass and lift are not used for LinkMotion VC for Laser application.

Dwell is the amount of time in seconds and fraction of seconds before laser will turn on before making X, Y move and after finishing the shape to cut or engrave the material.

Laser Control:



When Laser On button is checked the job will output with the laser power on. Laser on or off can be checked by checking this button and then selecting the Control Pad and press the I/O 1 and laser should be on. Red Pointer On is also effective in the same manner.

Selection of **Vector or Raster** mode is checked depending on you design. Raster mode requires for you to select the proper PPI (pulses per inch) resolution. Remember to understand different speed settings for Raster work and Vector work. **Vector will require slower speed and raster can be driven at a higher speed settings.** Speed will depend on the motors of your machine.

Raster margin controls are also given if you prefer different than optimum.

Color based controls work differently in vector and raster mode. It is more effective in vector mode. Please understand it and use it properly.

Vector and Raster modes:

The raster and vector modes are equally important in the laser machines. It is these two modes that make laser machines very versatile for different operations.

It is important to note that there is no external controller electronics and support for the system operation. The only brain in the whole system is your PC/Windows computer. LinkMotion saves the complete file and sends it to the machine via a parallel port. LinkMotion controls all the timing of the step motors, coordination of the axis, and laser on and off with proper modulation for fine power control. Usually, the vector files are small describing the paths the machine needs to travel.

However, the raster work is different. It is very important to do **error diffusion dithering for raster jobs**. The files are bigger describing every pixel, its position and whether the laser power is on or off for that pixel. It is important to know that the PC should be equipped with lots of RAM memory. First of all, Windows requires lots of memory. Secondly, your application is going to require some memory. You need additional RAM memory to store the raster job in the memory. LinkMotion lays out complete job before starting the laser operation. Normally, it takes a little bit of time to create a map of the job. If the operation runs out of memory, Windows automatically uses space on the hard disk in lieu of memory. This is going to be very slow operation and a few seconds required to prepare a job may turn into minutes.

Resume capability after Pause is not available in Raster mode for CO2 Virtual Controller mode of LinkMotion driver.

The other issue is the size of the working area. Generally, you will declare a full working area in the LinkMotion for your machine. Also, you will work with the same size in your application. This will allow you to position the job in exact location on your working area of the machine. However, LinkMotion does not know where the job is when it ends. To be faithful, it will rasterize the complete document size on the screen of your application. Here is what you want to do to be able to work efficiently:

- 1 Plan on 1 GB RAM memory and if you can afford it, go for 2 GB RAM. Memory is cheap compared to your time.
- 2 If your table size is very large, e.g. 48 inch X 48 inch and you are working with a raster area of 12 X 6 inches. You position the material close to the starting position of the machine. Define the size of the working area in LinkMotion to be a bit bigger than the material size, say 14 X 8 inches. Reload **LinkMotion and your design application** for it to get the latest information of the new size of the table. Create an area of 14 X 8 on your job design screen to match with the new table size. Position the job exactly where the material is on the table in reference to the starting point.
It will be quick to create the raster job and it will take less memory to save the job and it will take less over all time to process the job.
- 3 When you import a raster job in Corel with BMP or JPG files **Corel seems to fill the background space with white color. You need to select the objects and select None for Fill**. This is important for LinkMotion to send the file without using lots of memory as white fill consumes tons of memory in calculations.

Machine properties:

The screenshot shows the 'LinkMotion for MicroSmart 1212 - Ver 1.4.0' window with the 'Machine Properties' tab selected. The window contains several configuration sections:

- Control Pad:** Includes checkboxes for 'Enable Output 1', 'Enable Output 2', and 'Z axis is Solenoid (Not Motorized)'. The 'Z axis is Solenoid' checkbox is currently unchecked.
- Enable Spindle:** A checked checkbox.
- Spindle Delay:** A text box containing the value '1' followed by 'Sec'.
- Axis Movement:** Checkboxes for 'X moves up and down', 'Y moves up and down', and 'Z moves up and down'. 'Z moves up and down' is checked.
- Reverse Direction:** Checkboxes for 'Reverse X direction', 'Reverse Y direction', and 'Reverse Z direction'. 'Reverse Y direction' and 'Reverse Z direction' are checked.
- Cylindrical Axis support:** Includes 'Enable Cylindrical Support' (unchecked), 'No Limit Switch' (checked), and 'Reverse Direction' (unchecked). Below this is a 'Cylindrical Axis:' section with radio buttons for 'X Axis' and 'Y Axis'; 'Y Axis' is selected.
- Maximum Travel:** Text boxes for 'X axis' (12 in), 'Y axis' (11.9 in), and 'Z axis' (2 in). Below these is the text 'Table size 12.00 x 11.90 in'.
- Linear Travel per revolution:** Text boxes for 'X axis' (0.5 in), 'Y axis' (0.5 in), and 'Z axis' (0.25 in).
- Motor Gear Ratio:** A text box containing the value '50'.
- Job Piece Diameter:** A text box containing the value '1.5915' followed by 'in'.

At the bottom right of the window are three buttons: 'OK', 'Cancel', and 'Apply'.

Enable output 1, 2, 3 and Spindle/Air:

If **Enable I/O control 1** is checked, it will turn the I/O **ON** while cutting/engraving a shape during a job and turn itself **OFF** at the end of completing the shape. The I/O will stay **OFF** during the traverse/Move motion to the beginning of the next shape. You can test the operation of the I/O by either clicking on the **Key 1** button with a mouse or depressing the key on the Control Pad.

If **Enable I/O control 2** is checked, it will turn the I/O **ON** while cutting/engraving a shape during a job and turn itself **OFF** at the end of completing the shape. The I/O will stay **OFF** during the traverse/Move motion to the beginning of the next shape. You can test the operation of the I/O by either clicking on the **Key 3** button with a mouse or depressing the key on the Control Pad.

Z axis can be selected as solenoid or air controlled. It may be attached to I/O 1 or I/O 2.

If **Enable I/O control 3** is checked, it will turn on and off with the job execution. You can check by clicking **Key Del (.)** on the Control Pad.

If **Enable I/O control 4 (Spindle)** is checked, it will turn on and off with the job execution. You can check by clicking **Key 9** on the Control Pad. The value of delay can be entered in **seconds and fraction of seconds in the Spindle Delay area**. This delay value will allow the spindle motor to reach its speed before the tool plunges into the material.

Logic levels of the I/O's

Microsoft Windows sets all the active lines of the parallel port as logic High when the PC and the Windows are launched. To comply with that, LinkMotion uses Logic Low to activate any of the I/O's. We set up a line in the INI file called,

Control Port Default=4 (This makes logic High) or

Control Port Default=11 (This makes logic Low)

If you need to invert any of the I/O lines, you could do that by declaring different values for the above setting. Following values will give you the following results:

| Control Port Default= | 1 | 2 | <u>4</u> | 7 | 8 | 11 | 15 |
|------------------------------|----------|----------|-----------------|----------|----------|-----------|-----------|
| I/O1 (Pin14) | L | H | <u>H</u> | L | H | L | L |
| I/O2 (Pin1) | H | L | <u>H</u> | L | H | L | L |
| I/O3 (Pin17) | H | H | <u>H</u> | H | L | L | L |
| I/O4 (Pin16) | L | L | <u>H</u> | H | L | L | H |

Safety, Limit, and Emergency controls

Pin 15 on the parallel port is available for connecting safety, limit, and emergency switches. **We will expect Logic 0 on pin 15 for the machine to operate normally. When we see logic 1 on pin 15, the job will be aborted or will not start.** Once job is aborted, it cannot be recovered. It has to be restarted. We feel Logic 1 is failsafe and requires active response from the safety apparatus for it to work properly.

Reverse X, Y, or Z direction:

Directions for X, Y and Z can be set properly here by checking or un-checking the direction button. If the axis movements are opposite to the intended directions, the direction or directions can be reversed without changing the wiring.

Machine Travel (Table size) for X and Y and Maximum Z travel:

The **maximum travel distances of the machine in X, Y and Z axis is shown here which is also known as the table size of your machine**. The maximum travel numbers should match the Design applications you are using like Corel Draw or Auto Cad for the job to appear in the expected place on the machine.

Linear travel per revolution for X, Y, and Z:

Linear travel per revolution (lead screw pitch) is shown here and you can change this if necessary. There are unknowns in a system from time to time. These are the pitch of the screw (2 turns per inch, 5 turns per inch, etc.), full step angle of a step motor (200 full steps for 360 degree turn, etc.), and micro stepping of the driver. If you know any two of the three, **the third one can be determined using nudge feature of the Control Pad.** Typically, most of the Control Pad is activated using physical keys of the keyboard and using them with fingers. The nudge feature is activated using a single click of the mouse on the appropriate key on the screen. Nudge a distance by declaring the distance in the General Options. Next, measure the actual distance moved by the machine. Make the necessary correction of the value for the unknown parameter until you get the desired distance by nudging.

Machine setup Test:

There is one simple test you can do using the **nudge** value in the **General Options** tab. Default nudge value is 1inch when you install LinkMotion. User can change this nudge value (0.25 or 0.5 inches) for Z axis if your machine is designed to travel very small distance overall.

Now when you bring up the control pad and bring the arrow of your mouse on the x axis right movement arrow and click with the left mouse button and X Axis of your machine should move 1inch to the right. If it does not move 1 inch then your values declared as explained above is not correct and you need to get the proper values.

Using that nudge value you can do this test for all of the three axis to determine if your settings are proper in **Linear Travel per revolution of Machine Properties** as well as **Microstep per full step in Motor parameters.**

Following two values are important for getting proper size output.

(1) Linear Travel per revolution in Machine Properties

The pitch of the screw in all three axis determines the linear movement of the axis per single rotation of the step motor.

(2) Microstep per full step in Motor Parameters

Amplifier Drivers used for the motors of your machine determine this value.

Cylindrical Axis:

Cylindrical axis choices will be offered if the machine is equipped with it. **It is very important to quit and Re-launch LinkMotion applet after you make this selection.** Maximum Travel size of the table in X or Y will change when you Enable Cylindrical Axis Support. You do not need to enter this new size in Maximum Travel area in LinkMotion applet. However, it is very important to remember the dimensions and create that Table size in your design applications like Corel or Cad. Selecting X or Y whichever is the cylindrical axis for your machine. **Motor Gear Ratio and Job Piece Diameter** is entered for your job in the bottom section.

Motor Parameters:

The screenshot shows the 'Motor Parameters' tab in the 'LinkMotion for MicroSmart 1212 - Ver 1.4.0' application. The interface includes a menu bar with 'Control Pad', 'Material Properties', 'Machine Properties', 'Motor Parameters' (selected), 'Origin Setup', 'General Options', and 'Help'. The main area contains four groups of input fields:

- Full Steps per Revolution:**
 - X axis: 200
 - Y axis: 200
 - Z axis: 200
- Toolhead Maximum Acceleration:**
 - X axis: 50.00 in/sec^2
 - Y axis: 47.00 in/sec^2
 - Z axis: 27.00 in/sec^2
- Microsteps per Full Step:**
 - X axis: 10
 - Y axis: 10
 - Z axis: 8
- Maximum Motor RPM:**
 - X axis: 1500
 - Y axis: 1500
 - Z axis: 1500

At the bottom right, there are three buttons: 'OK', 'Cancel', and 'Apply'.

Full steps per revolution:

Above values are determined by the motor manufacturer. Enter **Full steps per revolution** values for each axis depending upon the motor and the lead screw size specifications.

Toolhead Maximum Acceleration:

Declare **Toolhead Maximum Acceleration** values for the motors in each of the axis in in/sec^2. You may need to adjust this numbers to get proper acceleration constants for smooth motion. Check with your machine manufacturer for the correct numbers required for the machine. In absence of that, you should start with a number between 25 and 100 as a safe starting point.

Microsteps per every full Step:

Set the **Microsteps per every full Step** for your system for each of the axis. This is necessary only if you are using step motors in your system. This number is derived from the Amplifier driver used for your motors. In case of servo motors, you need to make sure that the multiplication of numbers in this

area as well as in the number of full steps per revolution of the motor in the Motor parameters match your encoder number for the feedback. Generally, it would be a good idea to declare number 1 as the number in microsteps per every full step and the encoder resolution number in the number of full steps per revolution in the motor parameters location.

Maximum Motor RPM:

Maximum Motor RPM number should be selected by the specifications given by your motor manufacturer.

Machine setup Test:

There is one simple test you can do using the **nudge** value in the **General Options** tab. Default nudge value is 1inch when you install LinkMotion. User can change this nudge value (0.25 or 0.5 inches) for Z axis if your machine is designed to travel very small distance overall.

Now when you bring up the control pad and bring the arrow of your mouse on the x axis right movement arrow and click with the left mouse button and X Axis of your machine should move 1inch to the right. If it does not move 1 inch then your values declared as explained above is not correct and you need to get the proper values.

Using that nudge value you can do this test for all of the three axis to determine if your settings are proper in **Linear Travel per revolution of Machine Properties** as well as **Microstep per full step in Motor parameters**.

Following two values are important for getting proper size output.

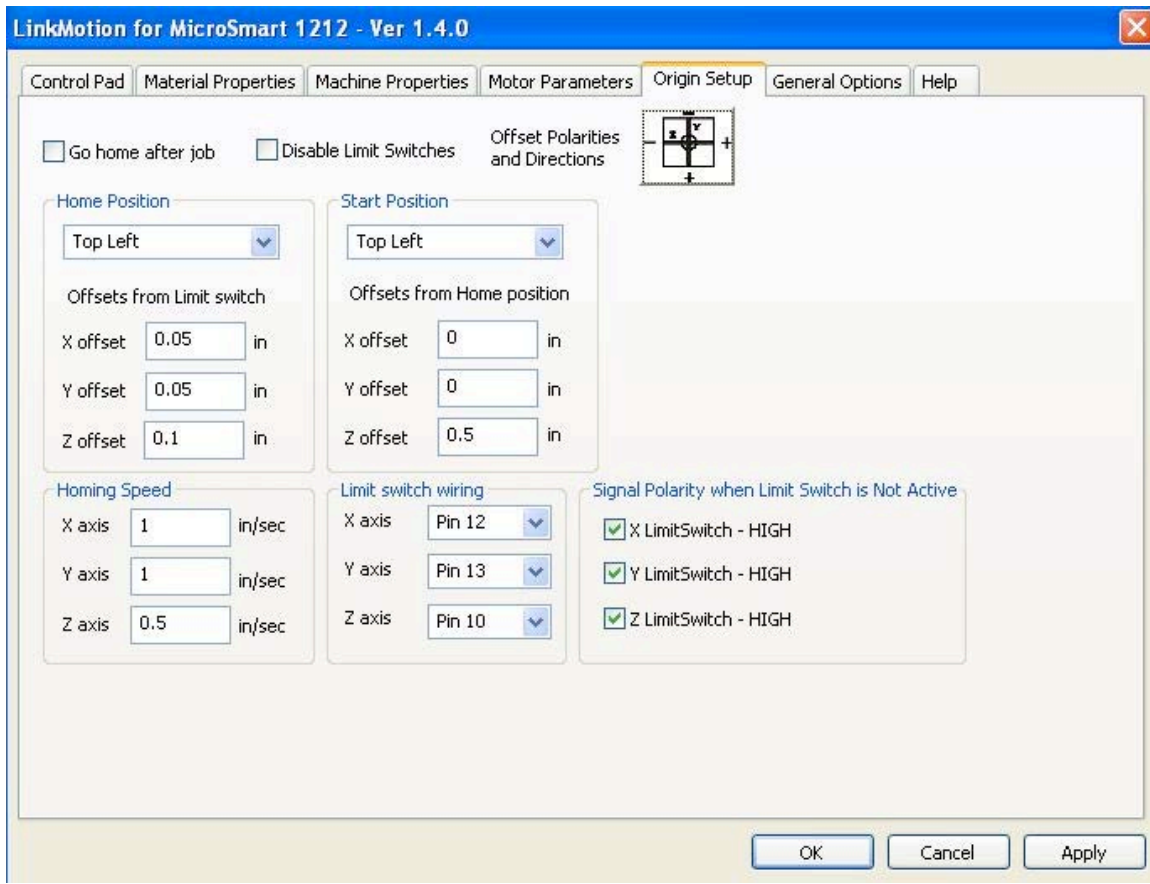
(1) Linear Travel per revolution in Machine Properties

The pitch of the screw in all three axis determines the linear movement of the axis per single rotation of the step motor.

(2) Microstep per full step in Motor Parameters

Amplifier Drivers used for the motors of your machine determine this value.

Origin Setup:



Go Home After Job:

If you have not checked this box then after finishing the job the tool will travel up on Z axis and stop at the position where it finished the last shape. It does not move the X and Y position. It does not go to the start position. Checking this box **makes your tool go back to the starting position (parking position) for X, Y and Z axis.** Most of the time parking positions are 0, 0 for X and Y. If you have the need to sense the Home switches again then you need to make sure your surfacing value in the Z axis (Origin Setup and Z offset value in Start Position) is proper and then click on the Home key on the control pad and that will place you tool in the Home position. If you need to change the surfacing value then you need to surface the tool again and then go home.

Disable Home (Limit) Switch:

Checking this box disables the home switches. Un checking the box activates the limit switches. If **limit switches** are present, **pin numbers** need to be assigned in **home switch wiring** section where the switches are connected to the computer. It is also important to declare the logic level of the switch in normal conditions high or low.

Home Switch Position:

This is the parking position of the tool of your machine. **Bottom Left and Top Left** are the choices. Top Right and Bottom Right are not available at present.

It is important to understand the setting of the origin for the machine. If the machine has home switches, it will have a defined **Home position**. It should be selected. The offsets from the limit switch sensing serve two purposes:

- A. It is advisable to get off the switch once sensed. The **offset value** will allow the machine to move back by the declared distance after reaching the switch.
- B. The offset values can be adjusted to get to a specific position such as the very corner of the table where the user may want to start every job.
- C. This position shall be recalibrated every six months or anytime the sensor is replaced.

Homing Speed:

The **Homing speed** for finding and going Home is different than the jogging or move speed. LinkMotion forces the machine to go Home twice when asked to go Home. **The Home key is key 7 on the Control Pad**. The first time the machine travels at a higher speed. Once reaching Home the first time, the machine travels back into the working area of the table and hunts for Home again at a slower speed. This will allow the table to get to the exact Home position every time.

Start Position:

Bottom Center, Bottom Left, Bottom Right, Center, Top Center, Top Left and Top Right are the choices.

If your Home Position and Start Positions are the same following are the selection necessary: **Top left and Bottom left are the only two home positions supported at this point if your machine has the home switches.**

| Home Position Selection | Start Position Selection |
|--------------------------------|---------------------------------|
| Bottom Left | Bottom Left |
| Top Left | Top Left |

Job start position can be different than the Home position. Job start position may be,

- Where the jig is positioned (Home Position)
- **Center of a machine in case of a vise type machine** with offset values in X and Y where both jaws move
- **Top center of a machine** with offset value in X only in case of a machine where only bottom jaw moves

In above situations and others, it is necessary to select **Start Position** and declare offset values for X and Y appropriately.

If you suspect that there is a problem with one or more limit switches and it is hindering your production, check the **Disable home (limit) switch box at the top**. This will allow the operation of the machine while the limit switches are being investigated.

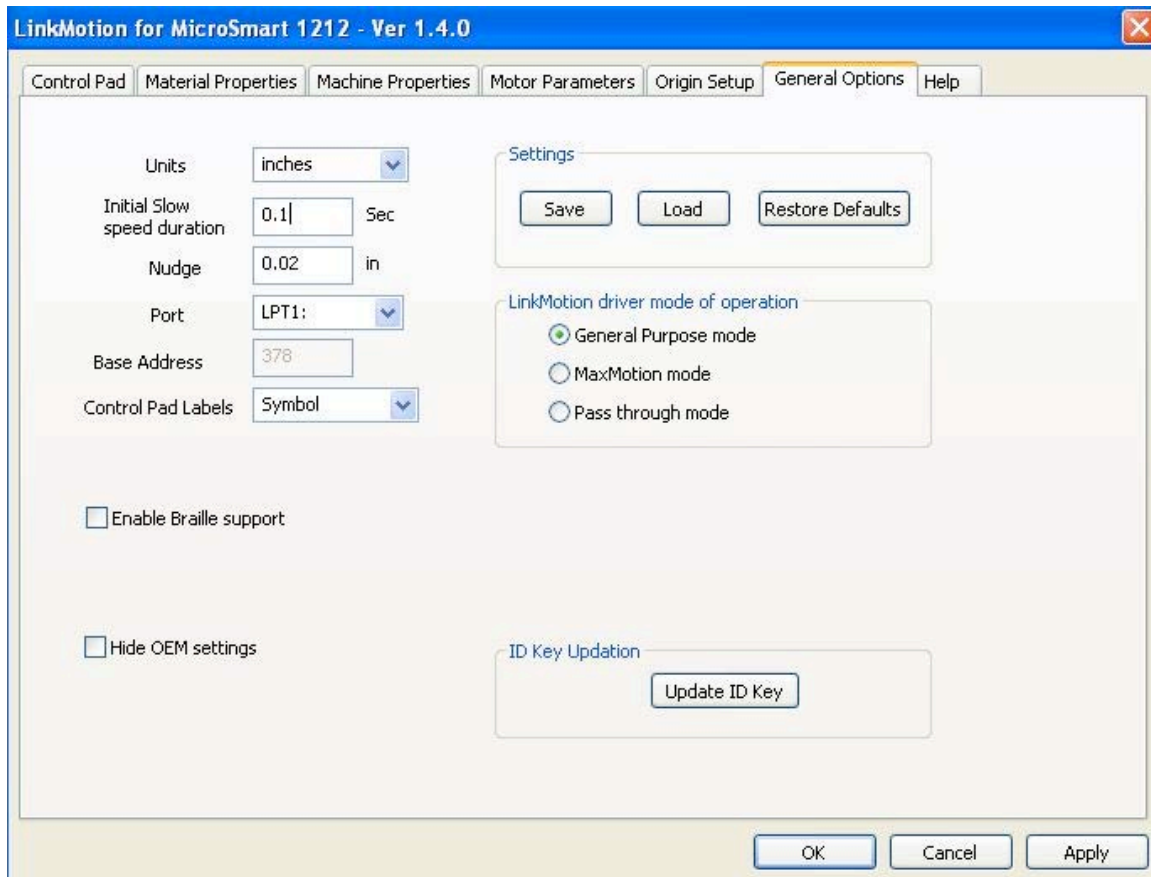
Home Switches:

Home Switches for each axis can be selected individually by selecting the pin numbers. This depends on how your machine is built and wiring is connected. Some machines have home switches for all three axis and some have for X and Y but not for Z axis. Make proper selection for your machine.

Home Switch Polarity selection is available for **Normally High or Low** and it depends on how the wiring is done for your home switches. LinkMotion will sense those switches and show you **green lights on the control pad** (next to X, Y and Z movement boxes) when we sense proper switches. If you do not know how your machine is wired then try selecting one after another and when the lights are green you have made the proper selection.

Select **Not Present** when machine you are using does not have home switches.

General Options:



Units:

There are just a few things in the General Options screen. **Units of choice can be selected from inch, mm, or cm.**

LinkMotion is designed to provide a **slow speed move** for a declared amount of time, when jogging. After that, the tool will move at the declared speed of jogging in materials property screen. This allows the user to position the tool or the laser red indicator diode at a precise position quickly.

Nudge:

The **Nudge** will allow the axis to move a fix distance when any axis is moved with a **single mouse click** on the keys that move the X, Y and Z axis when Control Pad tab is open or selected.

Using nudge you can do the basic testing for your machines settings in following manner:

Set up the Nudge to be 1" and Apply and save. Go to Control Pad.

Bring the arrow of your mouse on the X-Right arrow.

Click the left mouse button and watch and measure the machines movement in X direction.

If it moved 1” to the right then your settings are proper. If it moved less or more distance than 1” you need to change **linear travel per revolution** in **Machine properties** as well as check your **Microsteps per full steps (dependent upon drivers used for the motors)** declared in the **Motor Parameters**.

Port:

Port: LinkMotion will send the jobs to the **selected port**. If it is used for Virtual Controller applications where machine is connected to parallel port. You can specify the port's **Base address**.

Control Pad Labels:

Control Pad Labels: Arrow to the right will show you the choices you have. Here select the **English, or Spanish or Symbol** and click on the **Apply button**. Now you should see the control pad you have selected.

Enable Braille support:

Enable Braille support is an **optional feature** and it is designed to drill dots. This is used for creating Braille signs. **Adot is the font** we provide when Optional Braille support is purchased. Selecting this option makes your tool travel to the **begin point of each shape** and go down to create a mark or a hole and go back up and go to the begin point of the next shape.

OEM Settings:

Hide OEM setting is for OEM customers only and it hides some of the control pad settings as requested. It is controlled by a line User Type=0 or 1 in the LinkMotion.INI file. One value enables OEM settings and Zero value displays all settings. Checking the button in the General Options menu will hide some of the settings and user needs to change the value back to Zero in the LinkMotion.INI file manually to bring back those hidden settings.

Save Settings:

Save:

Once the machine is properly configured and is working well, it is advisable to Save the settings on the hard disk drive. This is saved as LinkMotion.INI file.

LinkMotion.INI file is located on your hard drive C:\ Document and Settings> Folder with computer users name> Folder name Application Data> Folder name Solustan> Folder name LinkMotion> LinkMotion.INI.

Click on the **Save** button and it will ask you to give a file name. Make sure to remember the file name, and where you are saving it. You can navigate on your hard drive where you want to save. You can also rename the file with what ever is easy for you to remember. Mostly our customers rename the file with their machine name.

Load:

In case the LinkMotion needs to be loaded again from the CD supplied by Solustan, or you need to

load upgraded version the user will be able to reload all the settings with your .INI file without wasting any time. For loading the settings back select **Load** button and navigate to the saved .INI file and click on **Apply and OK**. Now click on the right mouse button when you are on the LinkMotion applet and exit the program. Go to the start button and launch back LinkMotion. You should see all your saved settings here now.

Restore Defaults:

Clicking on this button will load **default LinkMotion.INI** file that we supply with the LinkMotion driver.

It is very important to exit Link applet and Re-launch the applet when you change and select another INI file for it to be effective.

LinkMotion driver mode of operation:

General purpose mode – **This is loaded by default. This mode is used when you use Corel, AutoCAD type of design softwares and use LinkMotion to send files to your machine.** Only MaxMotion users do not need to use this mode.

Other modes are not available in LinkMotion VC for Co2 Laser application.

Instructions for I.D. key Upgrade: (Needed only for hardware key option when upgrade available)

This is used only if you have hardware key.

This is required only when you need to upgrade the features offered or upgrade to use with the new version of LinkMotion or upgrade the number of executions for the I.D. Key.

To upgrade your I.D. key you will receive a code as a text file from us.

Note pad or Word pad type of utility should open this code.

Simply highlight the code with a cursor. Right mouse click and select **Copy**.

Now launch **LinkMotion** Icon. Click on the **General Options** menu. Click on the button **Update I.D. Key**. A dialog box will open. Right mouse click inside the **Authorization Code** box. Select **Paste**. Click **OK**. Click on **OK** in General Options menu.

Now right mouse click on the **LinkMotion** icon and select **Exit**.

Go to the Start button. Select All Programs. Select Solustan folder and select LinkMotion application. Now you will see a LinkMotion Icon on the bottom right again. You are all set to work with your updated I.D. Key.

Description of the Parallel Port configuration for machine control:

It is amazing what parallel port (AKA Printer port) allows us to achieve in the world of motion control.

Pins 2, 3, 4, 5, 6 and 7 are used for the three step motors for the three axis.

Pins 1, 14, 16, and 17 are output lines. Microsoft Windows prefer to set all the bits on the parallel port to logic high when Windows is invoked. To be compatible and to avoid any surprise turning on of the I/O lines, we recommend that the logic be setup to invoke the I/O's when you receive logic low from the parallel port.

It is always a good Idea and a good practice to turn on the PC first and your driver module after the Windows is loaded. In the same manner, It is always a good Idea to turn off the PC last when you switch off the system.

The procedure will be that the X and Y motors will move to a position. The speed of the move will be determined by the pre-selected speed in the software. The customer will also pre-select the number of micro steps required.

Pins 10, 12 and 13 along with one of the ground lines (18 through 25) will be used for the Home switches, if necessary.

It is important to note that the gates on the parallel ports may not be able to source 4 mA to 5 mA and may not be able to sink much more current. Some of the newer parallel port boards may use lower power circuits (instead of 5 V TTL, it may be a 3.3 VDC level). Some parallel ports may be able to drive the gates of the step motor drivers. Others may not be able to. Additionally, if you plan to use solid state relays to control I/O's, the relays may require more current. For all these reasons, it is advisable to use a breakout board that may have a couple of high current drivers IC's to Interface to the parallel port (you need two of such IC's and may cost around 25 cents each) to do the trick. We build simple breakout boards and make them available to simplify the system builder's job.

It is important to note that the Home switch feed back shall be TTL levels only, if you use our breakout board. This means that the high output level shall not exceed 5 VDC or it may damage your parallel port card.

Standard configuration of Parallel Port of a PC for LinkMotion Multi-Axis Virtual Controller

Parallel port on the back of a PC has a 25 pin female connector. Most computers may have only one parallel port. However, a PC can be configured with as many as 3 parallel ports. You can use any one of them to connect to the XYZ table. Following is the pin configuration:

| DB-25 pins | Signals |
|-------------------|--|
| 1 | I/O (2) output switch (I/O signal, turns on and off with the job) |
| 2 | X - Step |
| 3 | X - Direction |
| 4 | Y - Step |
| 5 | Y - Direction |
| 6 | Z - Step |
| 7 | Z - Direction |
| 8 | Switching between cylindrical and flat axis (new breakout board) |
| 9 | Reverse 24 VDC spindle motor direction (new breakout board) |
| 10 | Home switch Input to parallel port- Z axis |
| 11 | Future use |
| 12 | Home switch Input to parallel port - X axis |
| 13 | Home switch Input to parallel port - Y axis |
| 14 | I/O (1) output switch (I/O signal, turns on and off with the job) |
| 15 | Emergency switch Input to parallel port |
| 16 | I/O 4, Spindle motor enable (Programmable delay available before plunging) |
| 17 | I/O 3 output switch |
| 18 - 25 | Ground lines |

This is a standard configuration. Custom configurations are available.

Application Compatibility with LinkMotion:

Go to www.solustan.com/support and download instructions for the appropriate design application you might be using. Some applications have their own limitations and mostly it is listed in the document. We are adding information as we test with respective applications.

Solustan tests the primary function of accepting hair lines (vector lines) from the third party application software to make the vector moves on the machine using LinkMotion driver. Solustan may test additional functions. However, it is not a detailed testing. The developer and marketer of the third party software make changes to their applications quite often. It is the responsibility of the user to make sure that the necessary functions are available while making the choice of off-the-shelf application software.

Solustan's liability is limited to the purchase price of the LinkMotion driver software.

1. Corel Draw version 9, 10, 11, 12, 3X
2. Corel Paint Shop Pro (Raster Only)
3. Adobe Illustrator
4. EngraveLab / SignLab version 6.0 and higher
5. FlexiExpert
6. FreeHand MX
7. Gerber ArtPath and Composer
8. Vinyl Express
9. Xenetech
10. AutoCAD version 2000 and higher
11. DesignCad
12. DolphinCAD specially designed version for LinkMotion
13. Instant Engineer 14
14. Rhino 4.0 Beta
15. IntelliCAD (AcceliCAD)
16. BarTender (Raster only)
17. Microsoft Word (Raster only)
18. PhotoShop (Raster only)
19. MaxMotion

Frequently Asked Questions:

Section I - Microsoft Windows configuration and computer related questions:

1. What is the minimum configuration required for the PC?

Windows XP operating system with Service Pak 2 or higher and Microsoft .NET 2.0 or higher Framework installed and Parallel Port (Printer port)

Processor speed of at least 800 Mhz, minimum RAM memory 1 GB or higher preferred.

60 MB of Hard drive free space, Screen resolution of at least 800 x 600.

Service Pak and .NET 2.0 Framework are (free) downloadable from Microsoft's website.

CD-ROM drive is not required, if the driver software was down loaded from the web site.

CD-ROM drive is necessary, if the software was received on a CD.

2. How to check if I have installed Service Pak2 or higher on my computer?

Go to the **Start** button. Select **Control Panel**. Select **System**. Now in **General** menu it should show if **Service Pak 2** is installed. Also you can install and uninstall by windows standard Add/Remove program procedure. Make sure you install LinkMotion after you install windows operating system related update first.

3. How to check if I have installed .NET Framework 2.0 or higher on my computer?

Go to the Start button. Select Control Panel. Select Add/Remove programs. Here you should see if you have installed the .NET Framework 2.0 of Microsoft. This is required to work with our new version of LinkMotion.

4. How can I check the processor speed and RAM memory on my PC?

Go to the **Start button** on the System Tray on the bottom left and **select Control Panel**. Select **System** from the Control panel. Here you should see information for the version of your operating system and **under Computer** you should see the **processor speed and the RAM memory** installed on your computer.

5. How to see hidden folders in windows?

Go to the **Start button**. Select **Control Panel**. Select **Tools Menu** and select **Folder option**. Click on the **View menu**. You should see a folder called **Hidden files and folders**. Here **select the button for Show hidden files and folders**. Click on the **Apply button**. Now you will see all the folders. This is useful to see the configuration file name **LinkMotion.INI** for **LinkMotion driver** application

Section II - LinkMotion Driver:

1. Do I need to access LinkMotion driver software once loaded?

Generally, you simply deal with your job design software and your machine. We do provide an accompanied settings application. This application can be invoked from its icon in the System Tray area. This application will allow you to choose a few settings by going to different tabs (menu) like Material Properties, Machine parameters, Origin setup and Motion Control Boards. Make proper selection, click on the apply button and then start the design application.

2. How do I know if my LinkMotion is installed properly?

When you launch LinkMotion applet does it show the title “**LinkMotion for Generic-Laser VC – Ver. X.XX**” (version that you have). If this is not proper you may have installed for the wrong machine. You need to **uninstall and re-install LinkMotion again** by windows standard uninstall procedure.

If you had a trial version you need to purchase the full working version.

3. How to see the file for my LinkMotion related configuration settings?

This file is named **LinkMotion.INI**.

Go to your C:\ > Documents and Settings > Folder with computer User’s name (how ever you have set up your computer) > Application Data > Total Graphics Network > LinkMotion > LinkMotion.INI.

This file has all your machine related settings. You can save this file under different name as well as reload this file from where you might have saved this file.

4. LinkMotion is installed but the lights on Control Pad are red, Why?

There are also three lights on the Control Pad of LinkMotion next to the X, Y and Z axis counter on top area. These lights are for home(limit) switches of your machine. Check if you see all three lights to be green. Home switches are available by using normally open or normally close mode. Origin setup of LinkMotion has the selection available for both the modes. You can try reversing this mode click on the Apply button and see if home switches lights changed from red to green. You can temporarily disable them by checking the check mark for disable home switches under Origin Setup of LinkMotion. Please refer to the help section or PDF manual for more detail explanation.

5. I want to design in millimeters and not inches. How do I change?

Simply go to the **General Options tab** and change from **inches to mm** by clicking on the scroll down arrow and then **click on the Apply button**. Similarly you can change to cm also. It is that easy.

6. I am sending file for printing and nothing is happening. What am I doing wrong?

This situation may occur due to any of the following:

(A) There are three lights on the Control Pad of LinkMotion next to the X, Y and Z axis counter on top area. These lights are for home(limit) switches of your machine. Check if you see all three lights to be green. You can temporarily disable them by checking the check mark for disable home switches under Origin Setup of LinkMotion. If any of the lights are red the job will not go out. Please refer to the help section or PDF file manual for more detail explanation.

(B) Check if you have given the Print command from your design application.

(C) Check the print queue for any extraneous documents and remove them.

(D) Check the job feed rates and other settings to make sure that they are all correct.

(E) Printer driver installed for your machine may not have been selected as **DEFAULT DRIVER**. Please check in **Control Panel>Printers and Faxes>Your Machine Driver** (this should be selected as default driver).

(F) You might have selected **thick outline or filled object** in your design. **White fill is also not proper to send the job to a machine. Use only Hairline for any job you design with graphics or text. If you sent the file for print by mistake with thick line or the filled object go to the print spooler and make sure you delete the file properly before sending the new corrected file.**

(G) If **Service Pak 2** was not installed on your **Windows XP operating system** you may see the problem of LinkMotion not sending anything to the machine. You need to **uninstall the LinkMotion** and then **install the Service Pak 2** and **re-install the LinkMotion driver**.

(H) Make sure to design the job within the size of plotting area available with your machine table size.

7. Suggestions for the breakout board you need to use and wiring the cable properly for CO2 Virtual Controller laser application.

LinkMotion generates PWM commands based on the frequency you asked for on I/O 1 on pin 14. Parallel ports are usually designed to output TTL 5 VDC or 3.3 VDC signals. You can gate this line for pin 14. If your laser needs 5 VDC on pin 14 as long as your breakout board can switch fast enough with the PWM pulses at the frequency you desire, you should be OK. Most CO2 laser units we come across work between 2K and 20K frequency.

If your laser needs 5 VDC on pin 14 in a PWM frequency form do not supply 12 VDC or any other higher voltage. It will be a mismatch. However, you may want to check with the manufacturer of the laser unit. 12 VDC may actually cause problems with the laser circuit. We do not recommend you connecting anything else than the required voltage level specified by the manufacturer in the specification. You are likely to damage the internal electronics of laser unit.

Most SSR's trigger on TTL logic Hi (greater than 2.4 VDC per TTL specification). If not, most logic boards will have chips receiving the signals from parallel ports and will shape the signals for the SSR's etc.

8. Can I preset or change the values for the speeds of operation for different materials? Where and How?

Launch LinkMotion from Systems Tray. Go to Material Properties. Set values for **Job Feed Rate** of operation for different materials. Click Apply and then send the file again to the machine. Read more details in the HELP tab under the chapter **Using LinkMotion or PDF manual**.

9. I have setup and customized LinkMotion for my needs. Now, you sent me information for new version of LinkMotion. How can I preserve my settings while upgrading to a new version?

It is very easy. Remember to first save your older configuration file and then uninstall. Follow the uninstall instruction (from the end of the document) from installation instructions. Now install the new version and bring back your older configuration file from General Options tab by Load button. Re-Launch LinkMotion driver one time and then work with your new version.

10. How do I Pause a job?

Space Bar or **Zero Key** on your accounting key pad of your Key board will pause the job any time. After a job is paused you get a message if you want to continue or quit. Make your selection. If you select continue then it will finish the rest of the job. If you select not to continue it will ask you if you wish to go back to 0, 0 position or you wish to stay at the position where you are. Make your selection and work accordingly. Resume after pause is supported and works actively only in Vector mode. **Resume after pause is not supported in raster mode.** Please make sure raster job is well prepared before sending for the final production.

11. LinkMotion Virtual Controller application working with Parallel Port is not moving any of the axis. Why?

First important thing to check is all of your cable connections. Make sure nothing is loose. Parallel port cable connections on both ends one on the computer side and the second on the Amplifier module side should be tight and properly connected. Second cable to check is the machine cable. Check all the connections for each axis on the machine side as well as the second side connecting to the Amplifier module.

Second important thing is to check the selection of the Port in LinkMotion's General Option setup menu. First figure out the exact port address you have in your computer for the parallel port.

Generally speaking, if you have a LPT port with 378, 278, or 3BC addresses, you would select LPT1, 2, or 3 to take care of things. If the PC was organized with a unique address for the LPT, you may want to follow the following method to declare the address of the port in LinkMotion and LinkMotion should go

and look for the unique address to send the information:

Go to the Start button. Select My Computer with the right mouse click.
Select Manage. On the left side select Device Manager.
Double click on the Ports on the right side. Double click on the Printer Ports.
Go to the Resources menu. Here you will see the Settings range for your port.
For example: 0378-037F or ECE0-ECE7. Write down the first four digits of this setting. For example:0378 or ECE0.

Next, go to LinkMotion. Click on the tab - General Options.
Go to Port and select custom.
Enter the new address as base address.
Now you have directed LinkMotion to send commands to that address.

12. When I press any key for X, Y or Z axis from the Control Pad the machine keeps moving in that direction and I cannot stop it. Why?

You might be **using keyboard with USB connection**. You need to use **keyboard with PS2 connection** for all LinkMotion virtual controller applications working with parallel port.

Section III - LinkMotion and Design Applications:

1. My machine moves properly with Control Pad of LinkMotion but when I send the job I have a problem. Why?

You need to make sure that your page size in the design application is same as the machine (table) size declared in the machine properties of LinkMotion. Printer driver selection from your application should be for Linkmotion driver installed for your machine. Shapes you design should have either **hair line, thinnest line or zero width line** selected for vector output. **Shapes cannot be filled for vector output.**

Raster files may take a long time to prepare and if you do not have enough memory it may fail. Please understand raster work well, prepare proper file, read our guide lines from the PDF manual and then send it.

Please refer to the most recent document **on help section** or PDF manuals.

2. Can you tell me briefly the settings I should make sure of in Corel Draw! version 11 or 12 to make Corel and LinkMotion compatible with each other?

Yes, we suggest that you take a look at the HELP section and read the chapter on LinkMotion and popular applications. We have listed a number of settings and suggestions.

Also check help menu or LM&USB and LM&Popular applications.

3. How can I change starting positions of a job?

Starting position is controlled by your design application as well as what you have **selected in Start Position under Origin Setup of LinkMotion. Please read and understand functions of both applications from their help section before using it.**

4. Why is my job being cut goes back and forth all over the machine?

Most design applications generally will output jobs in the order that it was designed. If you wish to see a different order then you need to use sorting available from the Design Application. Please check your design application functions. **LinkMotion and specific Design Application** document has more detail explanation.

5. How can I design a job in different colors or layers?

These functions are available from the design Applications. Please check the document of your design application or the document name **LinkMotion with popular applications.**

6. How can I duplicate my design to cut several times?

These functions are available from the design Applications. Please check the document of your design application or the document name **LinkMotion with popular applications**.

7. Can I cut the same job again since it was not cut all the way (depth) properly?

User should always do preliminary testing for proper depth and then send the job for production. Following conditions will allow you to cut the job again.

Check the box under **Origin setup** for **Return to 0,0 after job**. This allows your tool to be parked back in the same position as before.

Make sure to make changes in the **depth** selection of **Material Properties**, Click on the **Apply button** for it to be effective.

Now you can select the object or the shapes that did not cut properly and send it again to the machine. Make sure to look at the preview before you create the file for proper location of the output.

8. Can I cut any part of the job again without sending a complete job again?

Yes, Follow the same procedure as in answer no. 5 from above.

9. Can I use any design applications to save my job?

Yes, you can use other applications as long as the design application is capable of sending a vector output file. Design application should allow you to design shapes with thinnest line or hairline or zero line width and no fill. Word processing type applications are not capable of sending the vector output. Please check with your supplier for more information. We document the one we do testing with.

10. What can I do to get more help?

Support is freely available by email – support@solustan.com