

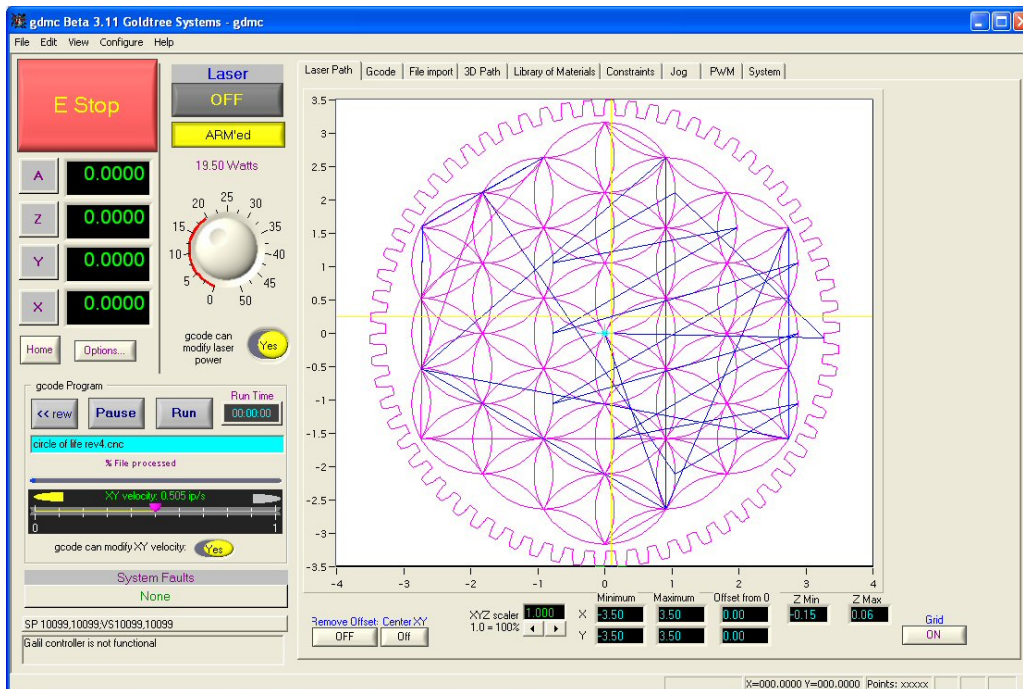
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1 Introduction

Please Note: This document is in a preliminary revision state!

The purpose of this document will be to provide the kind of help information that you would find in a typical Windows help file. Until such time a help file is added to the gdmc program this file will be the “living and breathing” replacement.

gdmc is a application that blossomed form the need to have a Galil (www.galilmc.com) 18XX motion controller do something useful with a 100 watt CO2 laser. In its early stages of its design it only provided simple jogging capabilities for manual motion control and to test the Galil servos and laser system. G code to DMC commanding was added to provide the ability to do CNC types of work. I used VisualMill™ (www.mecsoft.com) to generate the gcode using dxf drawings from TurboCAD and Rhino.



Current Status and issues:

1. gdmc is in an evaluation beta phase of development. This means the current version is having its “usefulness” ascertained before taking it to the next level. The developments of many new and necessary features (see Planned Enhancements section) are pending based upon feedback from other users. The biggest obstacle in gdmc’s path is the dxf file importing process.
2. the Kadmos dxf file importer display goes blank when any layer is turned off.
3. The sorting of dxf objects to speed up XY movement efficiencies is still under development so sorting objects when using the home brew method can take a long time ...but it might be worth the wait depending on the nature of the dxf file.
4. The raster processor is under development and not ready for testing yet.

The latest version can be obtained from: www.goldtreesystems.com/testing.htm.

2 Features

- Communicates with the Galil “bus-based” (i.e. 1700, 1800, etc.) controllers.
- gcode to DMC command interpreter.
- **DXF** file import to gcode .
- Embroidery (Tajima- **DST** etc) file import to gcode
- Safety E-STOP control.
- Servo error detection can be configured to generate E-STOP event.
- Laser enable synchronized to the X and the Y axis velocity.

- Password enable for configuration settings.
- Real-time plot of XY cut path.
- Real-time control of laser power.
- Real-time control of XY cutting velocity.
- 3d drawing view of XYZ movements
- Machine homing control and limit-switch error detection.
- Re-settable DROs to establish new machine origins.
- Lath mode, the Y axis moves will be directed to the rotational A-axis.
- Laser enable generation based upon the Z –axis movement to a user settable position.
- User controls to enable or disable any axis.
- Z-axis can be configured for servo or stepper (dir and step pulses) or +/- 10 amplifier output.
- Manual jogging controls with user definable incremental or absolute position movements for each axis.
- Manual jogging controls with user definable absolute vector position movements for XY-axis.
- Machine units per inch and max velocities configuration,
- Pulse width generator (PWM) interface to an intelligent laser power controller.
- M-code to perform operations using the Galil digital I/O and analog inputs.
- RS-232 interface to a intelligent Coherent Diamond CO2 Laser PWM power control

3 Planned Enhancements

1. Drawing job history and configuration list to simplify and streamline the setup of previous processing jobs. (file name, pwm powers, velocities, materials, etc., etc.
2. For new job setups, the ability to selection from a user defined materials library to set pwm powers, velocities, etch/cut depths, passes, etc., etc.
3. TBD dpi raster processing.
4. USB interface to Goldtree Systems intelligent XY galvanometric scanner processor that supports A-axis and Z-axis for rotational and focus control and also the laser enable time and pwm power.
5. Windows print interface. gdmc will run in the background and will behave as though it were a printer.
6. USB drivers to connect to laser USB PWM power controller device.
7. Additional dxf file drawing layers support
8. layer multi-pass support.
9. layer and object processing order precedence user settable
10. TCP/IP Ethernet commendable
11. dxf file merge to process a succession of files

4 Limitations and caveats

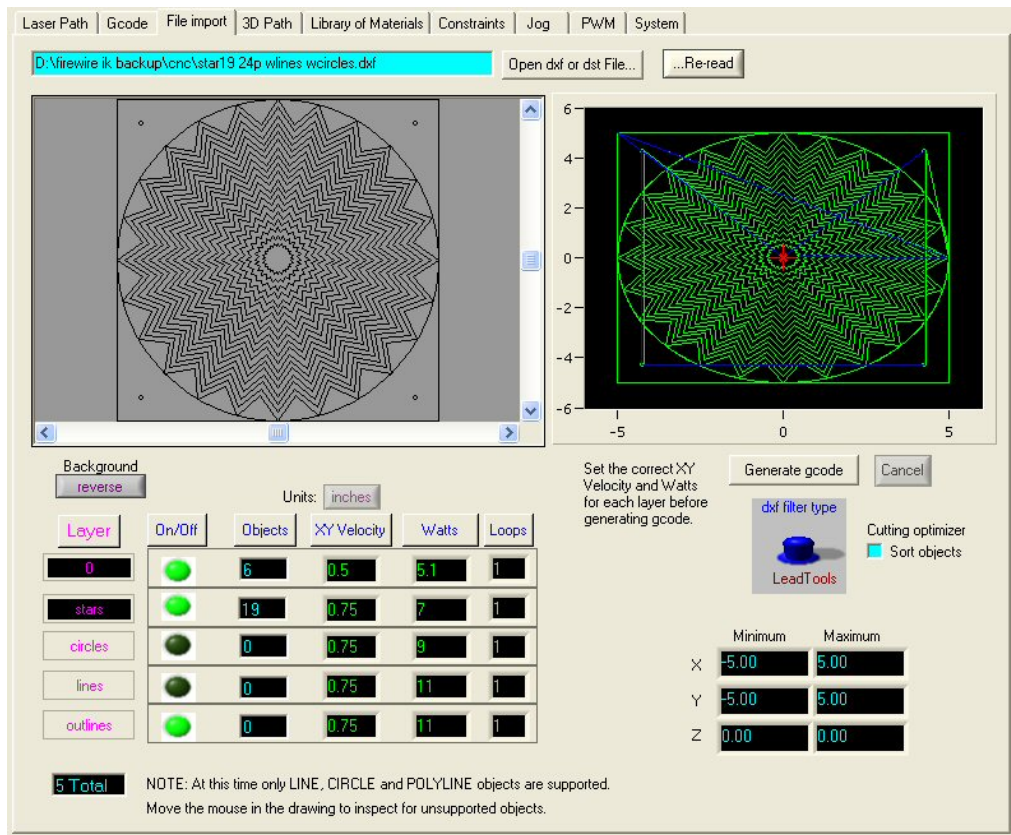
1. This is a evaluation version of gdmc which resorts to processing only 500 lines of gcode after the evaluation period. Contact gmalone@wispertel.net to arrange for an extension demo time period of the license.
2. A RS-232 com port is required to communicate with an intelligent Coherent Inc., Diamond CO2 Laser PWM power control device. Since you don't have one of these clever devices (available from Goldtree Systems) you can simply ignore the error message generated from trying to open a com port. Feel free to contact us if you need a quote for a PWM power control device.
3. This code has only been tested with a Galil DMC 1840 type controller board. It uses the Galil provided windows dll drivers available at:
<http://www.galilmc.com/support/download.html>
4. The first time gdmc communicates with the Galil controller there will be about a 30 second to 1 minute delay where the keyboard and mouse actions will be very sluggish. During this time the Galil controller is being micro-programmed with code to sync XY velocity to laser enable time. This delay anomaly should only happen once!
5. Testing Z and A axis gcode functionality has not been done for a long time!
6. On line help not available yet, is in the process of being written.
7. All arcs and circles are converted to TBD size line segments. The DMC command for circles is not supported yet.
8. Usage of Galil digital I/O and analog inputs are TBD

5 DXF input filter

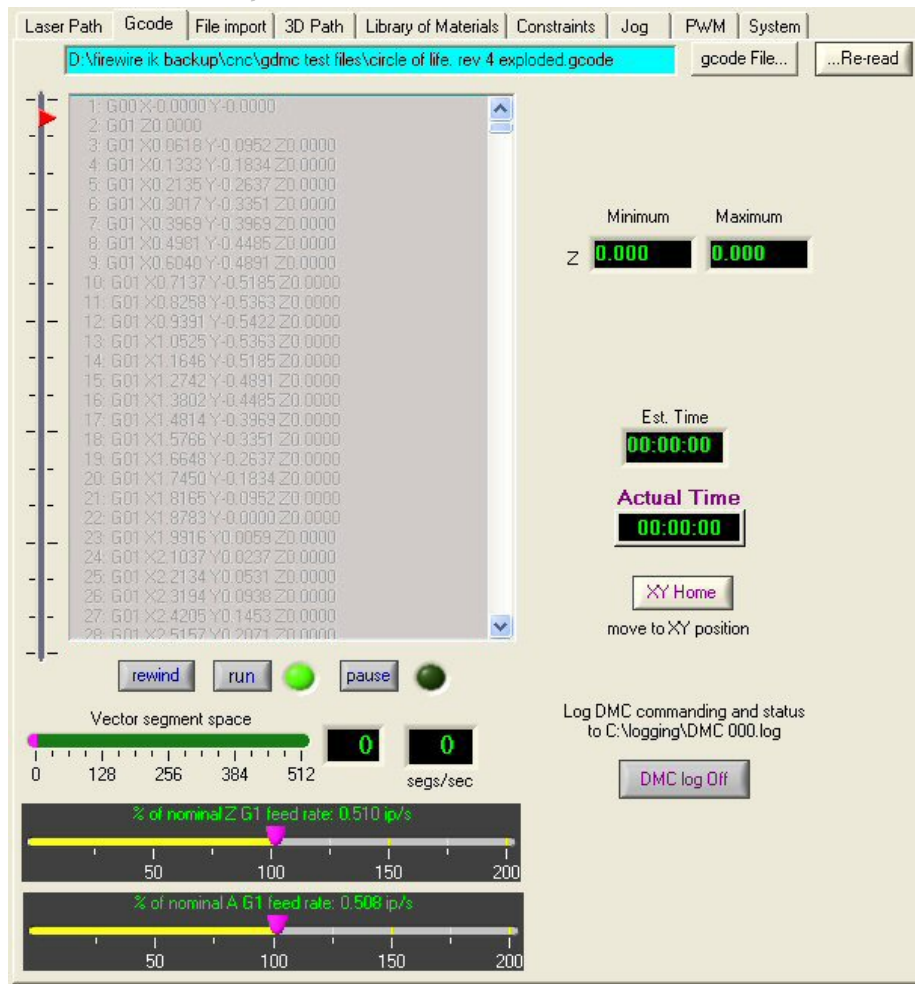
This interface has two methods of parsing a dxf input file. The first uses a third party program from Kadmos. The second is a homebrewed method. It seems to be most compatible with Rhino generated files and files that are saved with the R14 version level. A big advantage of the homebrew version is that objects can be sorted which streamlines the cutting head movement.

Currently only five (5) layers are supported. Once the files is opened and displayed a layer can be turned **ON** or **OFF** and the laser power and cut velocity can be specified. This should be done *before* the **Generate gcode** button is pushed. Kadmos gcode conversion will be save with a file extension of .gcode and the homebrew conversion will be saved with a file extension of .dgcode. I do this to make it easier to study the conversion process. After the conversion process the gcode file will be automatically be read as if the **File...** button was pushed on the Gcode tab display.

Note: it is best dxf file interpretation all arc and circle objects should be exploded into polylines before the dxf file is written by your CAD program and avoid using 3d type fonts.



6 G Code interpreter



6.1 Supported commands

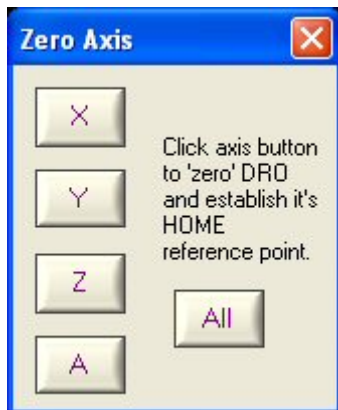
Since gdmc was developed to specifically to perform laser cutting and etching tasks only a limited number of G and M codes are supported.

- G00 line at rapid move speed
- G01 line at feed rate speed
- G02 clockwise arc
- G03 counter-clockwise arc
- G20 select mm
- G21 select inches
- M00 program stop
- M04 laser enable
- M05 laser disable
- M06 air and vacuum on
- M07 air and vacuum off
- Fxx set cutting feed rate

- Pxx set laser power

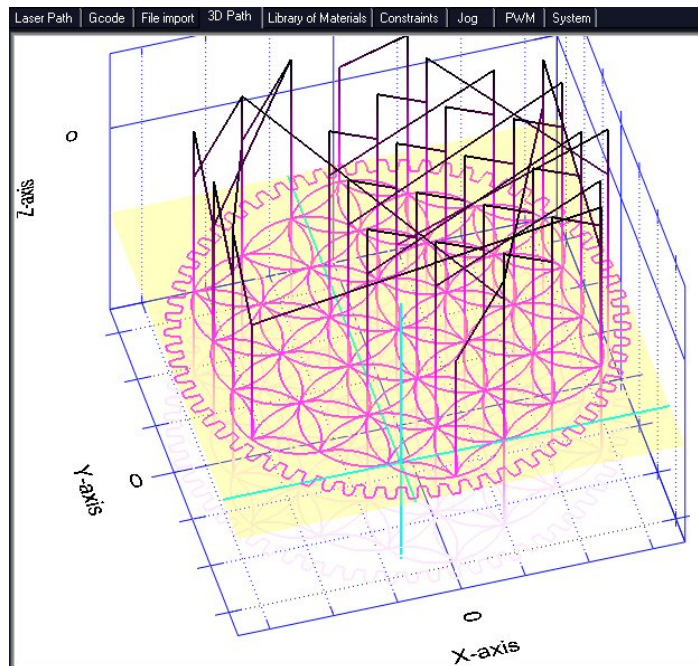
7 Digital Readout (DRO)

Right-clicking a DRO on the main window will activate the following dialog.

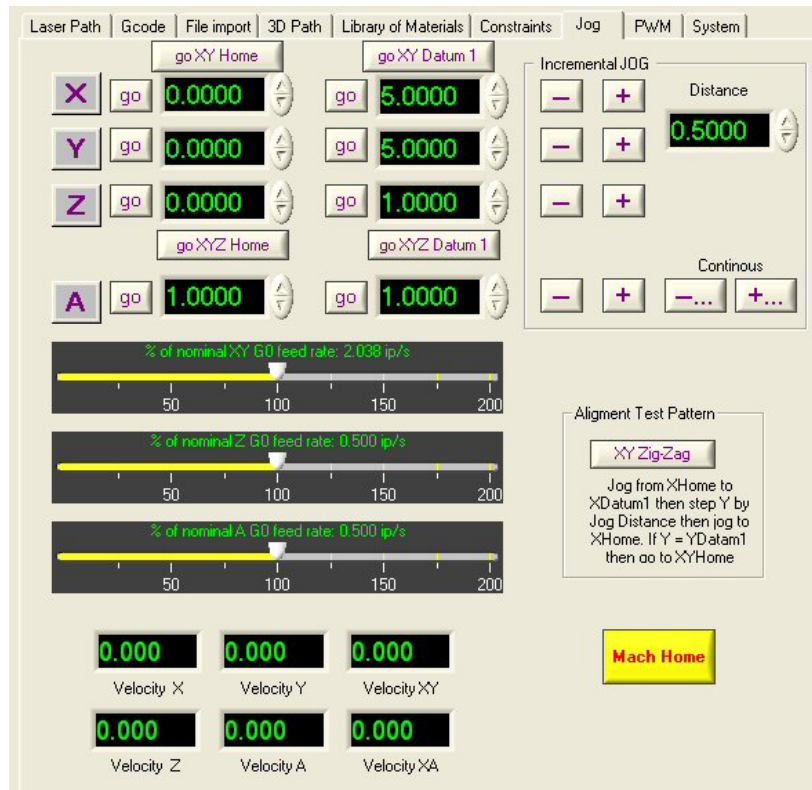


8 3D isometric tool path display

- Uses OpenGL graphics API's.
- Drawing color will changes to show tool path progress.
- User can change view perspective

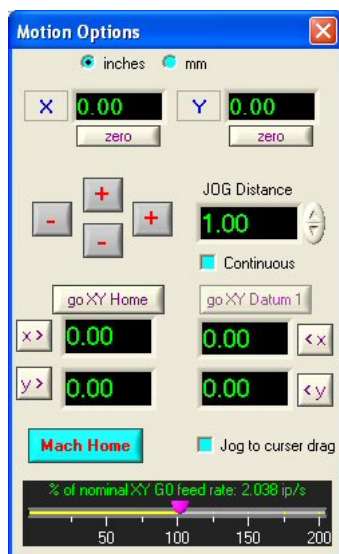


9 Jog Controls



Next to each axis GO command button is a user input control that allows the user to specify a position the axis will move to when the GO button is pressed.

The sliders also set the “rapid” velocity values.



This dialog is available from the front panel “Options...” button.

Note: The motion units, inches or mm, can be set from this dialog and also G20/21 codes.

10 Motor Configuration

The Configure->Motors menu will pop-up the following dialog box

The Motor Config dialog box contains the following settings:

| Parameter | X-axis | Y-axis | Z-axis | A-axis |
|---|---|---------|---------|---------|
| Enable or Disable Servos: | enabled | enabled | enabled | enabled |
| Polarity: | - | + | + | + |
| Encoder counts per inch: | 20000 | 20000 | 20000 | 20000 |
| Linear Acceleration counts: in/sec/sec | 500000 | 500000 | 500000 | 500000 |
| Linear Deceleration counts: in/sec/sec | 500000 | 500000 | 500000 | 500000 |
| Axis length: inches | 32 | 32 | 10 | |
| Vector acceleration counts: in/sec/sec | 500000 | | | |
| Vector deceleration counts: in/sec/sec | 500000 | | | |
| G0 rapid and G1 cutting velocity limits | <div>Maximum XY velocities: Rapids 2.0, Cutting 1.0</div> <div>Z Feed Rate: in/sec: NONIMAL 0.5, MAXIMUM 1.0</div> <div>A Feed Rate: in/sec: NONIMAL 0.5, MAXIMUM 1.0</div> | | | |

Additional settings and notes:

- home command forward direction: CN -1
- Z-axis - must be disabled to set motor type: servo, amp output: servo, Invert polarity: ☐
- Note: all acceleration counts will typically be 10-20 times the encoder counts value.

This is where a servo can be toggled off/on to clear a servo error condition.

10.1 Motors

10.1.1 xyz-axis

Encoder counts per inch. To set: command a axis movement for one (1) inch using the Jog screen. Next, measure the result and divide that into the original steps/inch. The answer will be the correct steps/inch to enter in this field.

- Acceleration counts per inch per inch
- Deceleration counts per inch per inch
- Maximum feed rate in inches per second

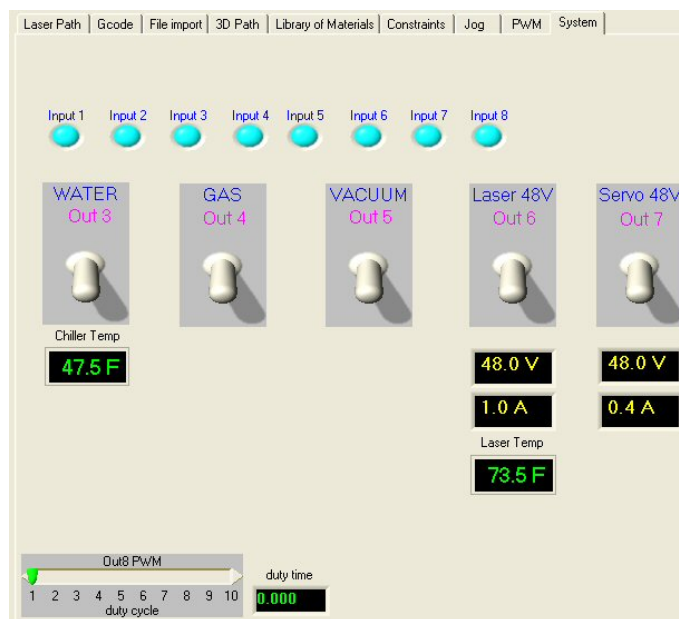
10.1.2 a-axis

- Encoder counts per revolution
- Acceleration counts per radian
- Deceleration counts per radian
- Maximum feed rate in revolutions per second

10.2 Axis length

- xyz movement lengths specified in inches (note: these settings influence the jogging controls)

11 System



11.1 Digital

11.1.1 Inputs

All Inputs are active low.

- Bit-1
- Bit-2
- Bit-3
- Bit-4
- Bit-5
- Bit-6
- Bit-7
- Bit-8

11.1.2 Outputs

- Bit-1 active-high laser enable generated from gcode command
- Bit-2 active-high laser enable generated from X or Y axis velocity detection
- Bit-3 water pump SSR

- Bit-4 gas SSR
- Bit-5 Vacuum SSR
- Bit-6 48V laser power supply SSR
- Bit-7 48V servo power supply SSR
- Bit-8 experimental PWM generator

11.2 Analog

- Ch-0
- Ch-1
- Ch-2
- Ch-3
- Ch-4
- Ch-5
- Ch-6
- Ch-7

12 General

12.1 Persistence

- All user settable values saved and restored from session to session in a file called “gdmc V 3.settings” that is placed in the root (C:) directory.

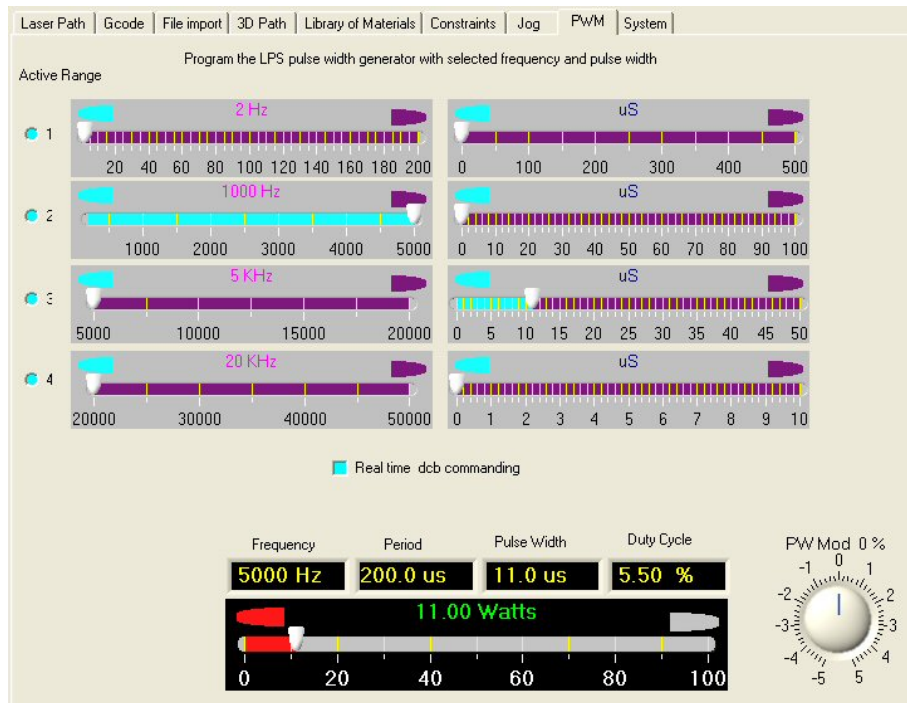
13 Laser Interfaces

This control panel communicates with the intelligent Coherent Diamond CO2 laser control device (**dcb**) to set the power based upon frequency and pulse-width.

Note: The default power calibration assumes a Coherent G-100 laser is deployed and 5 KHz is used for the PRF frequency.

Four frequency ranges are provided to set the PRF frequency from 2 Hz to 50 KHz and four pulse-width ranges are provided to set the PWM from 2 us to 500 us. The **dcb** provides the proper enforcement that a 60% duty-cycle limit is not exceeded for the G-100 laser.

At this time the PW Mod control is de-activated but is intended to allow an external source such as axis velocity, to adjust the laser power.



14 Galvanometric Scanner Interface

This interface will control a 2-axis galvanometric scanner system including all the necessary signals for laser PWM and enable control. As an option a third axis (Z) for focus control and a forth axis (A) for rotational control is available.

14.1 Specifications

14.1.1 USB interface

14.1.2 Digital I/O

14.1.3 Analog I/O

14.1.4 CO2 Laser control

14.1.5 Optical Field Dimensions