

WARNING

Due to the dangers involved in operating machinery of any type and especially those controlled by computers, CNC ZEUS is not liable for any experimental or other machine building that **you** are attempting.

Also, no claim is made as to the ability of this software or any of its functions to suit any purpose.

The objective of this project is to create a PC based dedicated CNC control with the abilities of industrial machinery controls while using minimal external hardware.

Any 150mhz or better Pentium class computer will achieve satisfactory performance and will most likely outperform the hardware, unfortunately due to demands placed on the PC hardware, CNC ZEUS will NOT run under Windows, it is designed to run under Dos 3.x or higher, and preferably with expanded memory support to facilitate large programs. (Up to 1.6 million program lines or about a 60-megabyte file)

INSTALLATION

Under DOS, simply copy all files to a directory called ZEUS, or any you prefer, and run ZDEMO.EXE, (ZEUS.EXE for purchased version).

ZEUS will run with a default configuration and create the file "TOOL.CFG" that will save the new configuration data for your machine as you change it.

SETUP

Pressing F5 key takes you to setup screen.

This is where all control parameters are set and also how you EXIT the program.

Since you are building a machine (we assume) you probably already know what most of the setup screens settings do. I'll list a few anyway.

PARAMETERS

FILE DIRECTORY PATH: sets the directory where you'd retrieve your program files. This can also be changed in the file menu screen with Ctrl+C.

DEFAULT FILE EXT: the default file extension you want placed on files when no extension is given. (Blank if none desired)

EXT-FEED CONTROL: enables external Rapid and Feed-rate override controls if connected.

PULSE GENERATOR: enables external manual pulse generator if connected.

MAX FEED RATE: sets the maximum feed and rapid limit. (inches per minute)

ACCELERATION IPS: sets acceleration in inches per second.

G0 ACC/DECEL. ONLY: when set to ON, causes acceleration and deceleration to apply to G0 or rapid moves only, (off for G1, G2, G3) this can greatly improve performance if your drive motors are capable.

FEED +/- INCREMENT: when your feed rate in JOG or AUTO or SINGLE, is too slow, pressing + will increase the feed in steps of this settings size.

Aprox dist to stop: is informational and merely displays how far it will take to stop from rapid at the given acceleration rate.

X/Y STEPS PER UNIT: sets the number of steps per unit (inch) on the X and Y-axis. Both X and Y must be the same for circular movement on the G17 XY plane.

Z STEPS PER UNIT: sets the number of steps per unit (inch) on the Z-axis. The Z-axis can have different steps than the XY axis, but if the Z-axis steps are different than the XY steps then no circular can take place between the XZ G18 or YZ G19 planes.

A STEPS PER UNIT: set the number of steps per unit (inch) or (degrees) on the A axis.

PULSE GEN IRQ: this is the interrupt the external pulse generator uses if enabled. Usually 5 for port 278 or 7 for 378 but some printer ports can be set different.

X AXIS BACKLASH: backlash compensation for X-axis in machine steps.

Y AXIS BACKLASH: backlash compensation for Y-axis in machine steps.

Z AXIS BACKLASH: backlash compensation for Z-axis in machine steps.

A AXIS BACKLASH: backlash compensation for A-axis in machine steps.

Backlash is applied anytime axis reverses direction, even in midst of an arc.

X/Y/Z LIMIT: if axis over travel limit switches are connected, then this can be set to ON to enable over travel limits on XYZ axis. Also allows machine to home to limits when on.

A AXIS LIMIT: enables over travel for A axis limit if connected.

Emg Stop/HLD: enables ES/hold pin.

STEP TRANSITION

X AXIS: sets the step clocking transition from low to high or high to low. This must be set to match the connected driver hardware or problems can result.

Y AXIS: same as X AXIS

Z AXIS: same as X AXIS

A AXIS: same as X AXIS

PORT SETUP

PORT: can be set to 378h, 278h, 3BCh, but is usually set to 378h for the primary printer port (1).

X STEP: sets the selected port pin to be the step pulse for the X-axis.

X DIR: set the selected port pin to be the direction signal for the X-axis.

Y STEP: sets the selected port pin to be the step pulse for the Y-axis.

Y DIR: set the selected port pin to be the direction signal for the Y-axis.

Z STEP: sets the selected port pin to be the step pulse for the Z-axis.

ZX DIR: set the selected port pin to be the direction signal for the Z-axis.

A STEP: sets the selected port pin to be the step pulse for the A-axis.

A DIR: set the selected port pin to be the direction signal for the A-axis.

X LIMIT: sets the selected port pin to be the input for the X-axis limit switch.

Y LIMIT: sets the selected port pin to be the input for the Y-axis limit switch.

Z LIMIT: sets the selected port pin to be the input for the Z-axis limit switch.

A LIMIT: sets the selected port pin to be the input for the A-axis limit switch.

(Limit switches are wired normally closed (shorted to ground) and go open when limit is hit.)

SPINDLE FWD: sets port pin to be used for spindle forward drive signal.

SPINDLE REV: sets port pin to be used for spindle reverse drive signal.

COOLANT1: sets port pin to be used for coolant on signal.

PORT: can be set to 378h, 278h, 3BCh, but is usually set to 278h for the secondary printer port (2).

FEED O/RIDE: port pins used for external feed override input.

RPD O/RIDE: port pins used for external rapid override input.

AXIS SLCT: port pins used for axis select on manual pulse generator.

INCR SLCT: port pins used for step increment on manual pulse generator.

PULSE A/B: port pins used for AB step input from manual pulse generator.

PULSE IRQ: port input for manual pulse generator step interrupt.

AUX1: gear change outputs for transmission shifting.

AUX2: gear change outputs for transmission shifting

AUX3: gear change outputs for transmission shifting

AUX4: gear change outputs for transmission shifting

SCREEN COLORS:

Sets palette and colors for all windows, borders, background, etc.

(Pressing “D” while in color settings will reset all colors back to default)

SETTINGS

AXIS SETTINGS:

X AXIS MIRROR: sets X-axis mirror ON or OFF.

Y AXIS MIRROR: sets Y-axis mirror ON or OFF.

SCALE X/Y AXIS: sets scale for both X and Y-axis.

SCALE Z AXIS: sets scale for Z-axis.

SCALE A AXIS: sets scale for A-axis.

Note: if Z-axis scale is set different than X/Y scale then errors will result during circular interpolation if in plane G18 XZ or G19 YZ.

ON-SCREEN HELP: sets key help in main screen ON or OFF.

MACHINE HOME:

HOME FEEDRATE IPM: sets the homing feed rate to the limit switch.

LIMIT RETURN RATIO: sets the return off from limit when homing to a divisor of the home feed rate. (30 ipm home with 1/30 return = $30/30 = 1$ ipm)

LIMIT CLEAR DIST: sets the distance in machine steps to continue after leaving the limit when homing.

X HOME DIRECTION: home to limits in either + or – direction.

Y HOME DIRECTION: home to limits in either + or – direction.

Z HOME DIRECTION: home to limits in either + or – direction.

CANNED CYCLE:

G83/73 R-STOP: in G83 peck drill cycle, this sets the distance in machine steps to stop short when rapid traversing back into the hole.

SPDL REV DELAY: time in milliseconds to delay so the forward spindle relay can disengage before engaging the reverse relay and vice versa.

(Assures both relays are never closed at the same time, since this could be one of those bad things)

G84/74 REV DLY: time in milliseconds to wait for spindle to reverse while tapping before axis movement continues.

HANDLE STEPS / MACHINE STEPS

Since AB pulse generators actually generate 4 state changes between indents, this setting selects how many state changes are required to make how many machine steps in each of the modes X1, X10 and X100.

Example

On a machine with 5000 steps per unit, $1/5000 = .0002$

Smallest machine step is then .0002

So 2 indents = 8 state changes and this would be right for 1 step which = .0002

Using this logic, you would then set

X1 = 8 HAND = 1 STEPS = 2 indents = .0002

X10 = 4 HAND = 5 STEPS = 1 indent = .001

X100=4 HAND =50 STEPS = 1 indent = .010

GS2 DRIVE

Note: The GS2 series controller must be properly configured prior to setting the CNC ZEUS control settings.

After proper motor setup, per the GS2 ac drive controller manual, and motor functions correctly from the ac drives front panel then, make the following changes per the GS2 drives instruction manual.

- 1: set protocol switches to communicate in ASCII mode.
- 2: set baud rate to 38400 (if cabling permits)
- 3: set target frequency control to "communication port"
- 4: match the following settings to those settings on the GS2 ac drive unit.

COM SETTINGS

ENABLE DRIVE: set to on if a GS2 series ac drive controller is installed for spindle drive, otherwise this must be set to off for proper operation of spindle relay output pins. (See port setup).

COM PORT: sets the serial port to be used for GS2 series as drive controller.

BAUD RATE: selects the communication speed for GS2 series ac drive controller. (This must match the setting on the drive unit, 9600 baud is drive default and 38400 is preferable)

DRIVE LIMITS

BASE FREQUENCY: normally 60hz.

MOTOR RPM AT BASE FREQUENCY: set same as GS2 drive unit.

MAX FREQUENCY: set same as GS2 drive unit.

MIN FREQUENCY: set same as GS2 drive unit.

MAX SPINDLE OVR%: sets the maximum percent of spindle RPM increase.

MIN SPINDLE OVR%: sets the minimum percent of spindle RPM decrease.

SPINDLE INC/DEC: sets the step in percent the spindle will increase or decrease when spindle rpm override is effective.

GEAR CHANGES

If electronic gear shifting is possible, then setup of gear changes as below other-wise set number of gear changes to (1) and set ratio to formula below.

NUMBER OF GEAR CHANGES: sets the number of possible gear ratios.

GEAR RATIO: set the ratio per the formula for each gear change.

(Spindle RPM / motor RPM) = ratio.

Example: 250 RPM / 1725 RPM = 0.1449

The RPM display on the (F5) setup page requires an optical sensor attached to the spindle and interrupted only once per revolution.

Input is through the A axis limit switch input which is normally not used.