# **Provel** C5
# Carver
# User's Guide

61610

# Introduction

The Provel C5 is a fully automated 3 axis CNC servo carving machine designed to quickly and accurately produce models for socket forming.  The C5 is constructed of stainless steel and features a 4 line LCD for machine status, a 9 key control panel for user inputs, a serial I/O port, automatic calibration, and an illuminated carving area.  Foam blanks up to 12 inches in diameter and 36 inches in length can be carved, including AFO blanks.  The C5 serial port receives carving files from Provel Carve software for carving.  The C5 monitors door position, cutter position, servo motor load, and drive speed. Cutter operation can only occur when the door is closed.

# Software

The Provel C5 Carver is compatible with any software that supports the AOP file format.  Use the included Provel Carve software for sending files to the carver and specifying carve parameters.  Use AOP Viewer (a free download) for viewing and analyzing shape files from the Provel D2 Digitizer or any other  AOP file source.  The C5, Provel Carve, and AOP Viewer can be used with any AOP compatible software.

# Precautions

Never remove access panels or attempt to service the carver without disconnecting electrical power.  Read the entire user's guide carefully before using the carver.
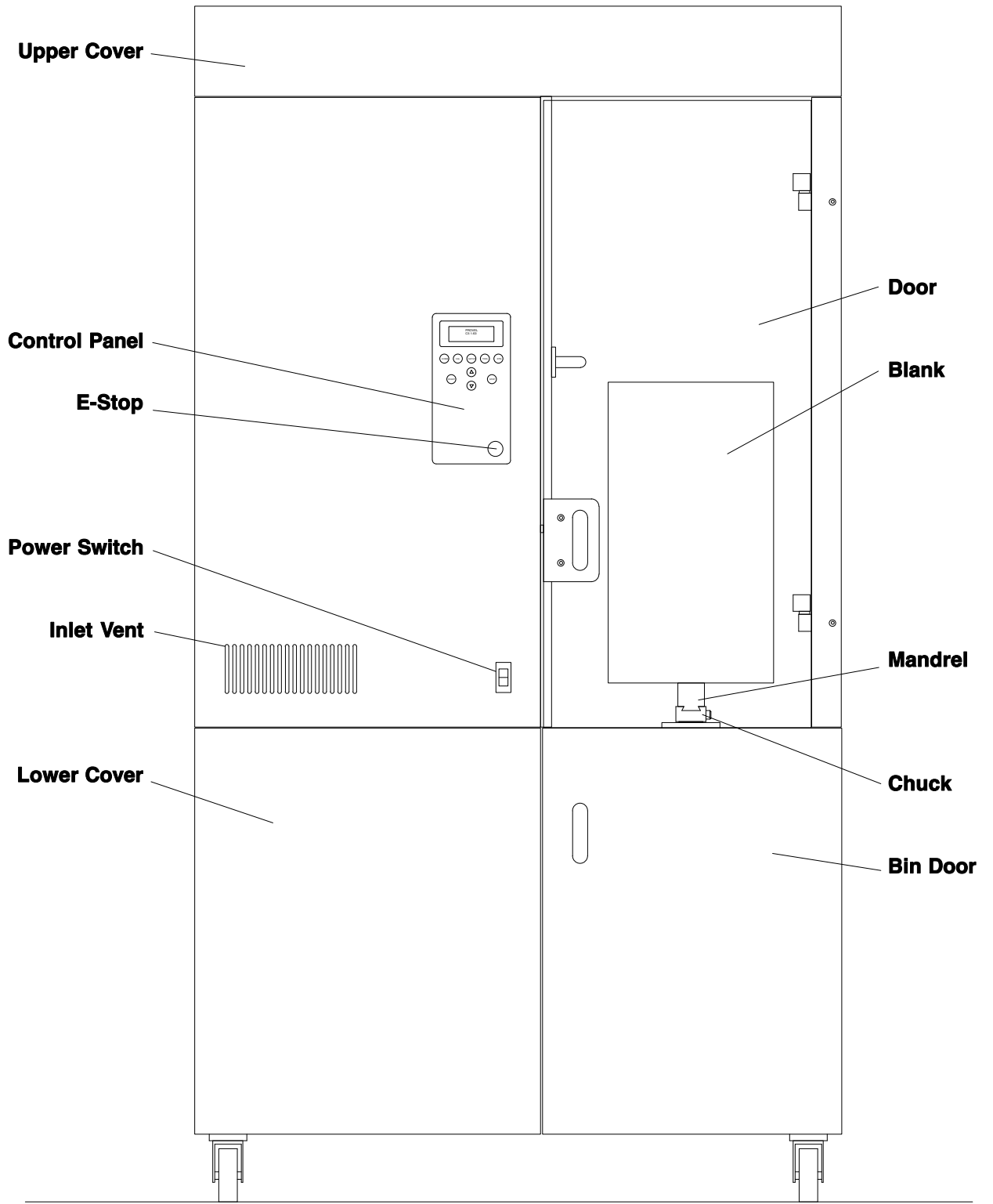
# Cleaning

Detergent based spray cleaners can be used to clean exterior surfaces.
The acrylic door can be cleaned with a clean, soft cloth and a solution of detergent in water.  Do not use solvents or abrasive cleansers.

# Maintenance

Never remove any access panel without disconnecting power.  The lead screws and guide shafts must be kept clean and well lubricated with WD 40 or a similar spray lubricant.  **Never operate the carver with dry lead screws.**  Do not allow lubricant to puddle on top of ball screw bearings.  Vacuum the bellows periodically to remove chips that can increase the stacked height of the bellows and restrict full travel.  Clean exhaust filter and intake filter as needed using vacuum cleaner or simply rinsing in water.  Filter must be dry before replacing.  Plaster carving will require frequent filter cleaning to maintain air flow.

# C5 Carver

**Upper Cover**

**Door**

**Blank**

**Control Panel**

**E-Stop**

**Power Switch**

**Inlet Vent**

**Mandrel**

**Chuck**

**Lower Cover**

**Bin Door**

# Operation

## Operation Summary

Turn power on.  The carver will automatically home and calibrate if the door is closed.
Load blank, close door.
Configure file in Provel Carve.
Send file to carver.
Press start.
Remove pattern.

## Manual Motion

Press UP or DOWN arrow to move cutter up or down.   The carriage automatically stops at the end of travel limits.  The carriage will not move unless the door is closed.

## Carver Settings

Setup Mode allows selection of cutter speed, display backlight brightness, display contrast, baud rate, and radial offset.

## Blank Loading

Blanks are available in several sizes.  The smallest blank that will accommodate the model to be carved should be selected.  Fully seat the blank on the mandrel before carving.

## Carving

Select starting cutter position, carved height, and transition in Provel Carve.  Press START to begin carving the loaded file.  The cycle will not start if the door is open.  The display will show file name and the axial position of the long axis from the top.  Press STOP to pause carving and turn the spindle off.  Press START to resume. Press HOME to exit carving.  Pressing the E-STOP during automatic operation will cancel the carving cycle and require starting over.

## Changing Cutters

If your carver is equipped with a full length flexible cover mandrel, always remove it before changing cutters. Press TOOL.  Spindle will move to tool change position and wait.  Loosen the set screws on the spindle and change the cutter.  Make surre to tighten the set screws before closing the door.  The C5 will automatically calibrate after the door is closed.

## Control Panel

PROVEL
C5 1.71

Provel C5

HOME    CAL    SETUP    TOOL    ENTER

△

START                    STOP

▽

E STOP
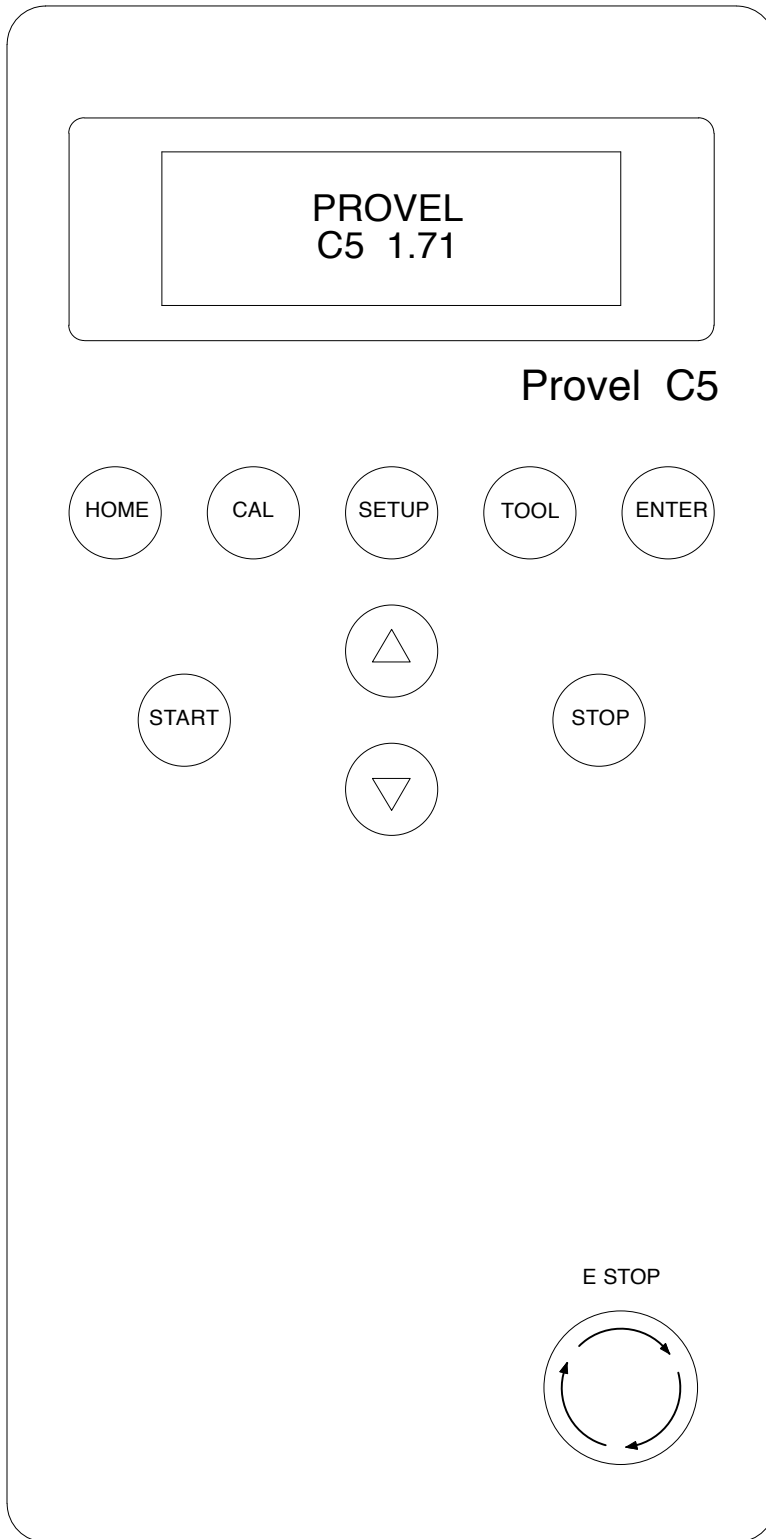
HOME :  Carriage home.

CAL :  Calibrate cutter.

SETUP :  Enter setup mode,
        advance thru setup screens.

TOOL :  Move spindle out for
        cutter change.

ENTER :  Accept entry, next screen.

START :  Start or resume carving
         loaded file.

△ :   Move cutter up.

▽ :  Move cutter down.

STOP :  Stop carver, spindle off.

E-STOP :  Twist to release.

```
┌─────────────────────────────────┐
│                                 │
│   ┌───────────────────────┐     │
│   │  Acme, J Socket        │     │
│   │  SOCKET XX.X x X.X in   │     │
│   │  READY    3000 RPM      │     │
│   │  AXIAL  XXX MM          │     │
│   └───────────────────────┘     │
│                                 │
└─────────────────────────────────┘
```

**File Loaded**
Displays up to 20 character file name, carver status, and spindle speed. Axial is long axis position from top.

```
┌─────────────────────────────────┐
│                                 │
│   ┌───────────────────────┐     │
│   │  Acme, J Socket 1.00   │     │
│   │  SOCKET XX.X x X.X in   │     │
│   │  CARVED    3000 RPM     │     │
│   │  AXIAL  XXX MM          │     │
│   └───────────────────────┘     │
│                                 │
└─────────────────────────────────┘
```

**Finished Carving**
Carver will automatically return to home parking position.

```
┌─────────────────────────────────┐
│                                 │
│   ┌───────────────────────┐     │
│   │    SELECT SPEED        │     │
│   │    5000 RPM  (↑)        │     │
│   │  > 3000 RPM  (↓)        │     │
│   │                        │     │
│   └───────────────────────┘     │
│                                 │
└─────────────────────────────────┘
```

**Setup**
Press SETUP to enter setup mode and advance thru setup screens: Cutter Speed, Display Backlight, Display Contrast, Baud Rate, Radial Offset.

**Select Speed**
Use Up, Down Arrow keys to make selection.
Press ENTER to exit.

```
┌──────────────────────────────────┐
│   ┌──────────────────────────┐   │
│   │ SELECT SPEED             │   │
│   │ SELECT BAUD              │   │
│   │ SELECT CONTRAST          │   │
│   │ TEST MODE                │   │
│   └──────────────────────────┘   │
└──────────────────────────────────┘
```

**Setup Mode**
Select Tool:  Specify cutter
Select Baud:  Set baud rate
Select Contrast:  Set display contrast
Test Mode:  Enter Test Mode

```
┌──────────────────────────────────┐
│   ┌──────────────────────────┐   │
│   │      0123456789ABCDEF    │   │
│   │  1  0000000000000000     │   │
│   │                          │   │
│   └──────────────────────────┘   │
└──────────────────────────────────┘
```

**Test Mode**
Displays status of limit and home switches or other diagnostic information.

```
┌──────────────────────────────────┐
│   ┌──────────────────────────┐   │
│   │ SERVO FAULT              │   │
│   │ POSITION ERROR           │   │
│   │                          │   │
│   └──────────────────────────┘   │
└──────────────────────────────────┘
```

**Fault**
Displays servo, amp, motion processor, spindle motor controller, enclosure  temperature faults.

# Status Messages

| | |
|---|---|
| *****STOPPED***** | Carver operation stopped due to fault. |
| E-STOP PRESSED | E-Stop must be released to proceed. |
| PRESS E-STOP | E-Stop must be pressed and released to clear fault. |
| STOP PRESSED | Stop must be released for carriage motion. |
| DOOR OPEN | Door must be closed for carriage motion. |
| SPINDLE DRIVE FAULT | Cutter motor drive fault. |
| LOGIC ERROR | Program error. |
| TIMEOUT | Carriage failed to reach target. |
| NO RESPONSE | Commnication fault. |
| AMP ERROR | Servo Amplifier fault. |
| POSITION ERROR | Servo not moving to required position. |
| NNN, NNN, NNN | Error for Chuck, Short, and Long axes. |
| MOTOR OVER TEMP | Servo motor over temperature limit. |
| COMMAND ERROR | Motion processor error. |

# Troubleshooting

### Unable to Load File
Check baud rate in Provel Carve and Carver Setup. 38400 is preferred. Confirm that correct port has been selected on computer.

### Carved Pattern Over or Undersize
Press SETUP. Repeat until Radial Offset displayed. Use Up, Down arrow keys to enter radial under or oversize in millimeters.

### Will not Calibrate
Make sure the bellows are clean. Compacted chips in the folds will increase the folded height of the bellows and can prevent full travel of the long axis required for calibration.

### Long or Short Axis Will Not Move
The ball screw on both the long axis and the short axis must be kept lubricated. The ball nuts can jam if not lubricated. A light coat of WD-40 is sufficient. Remove any lubrication that settles to the lower bearing on the long axis ball screw.
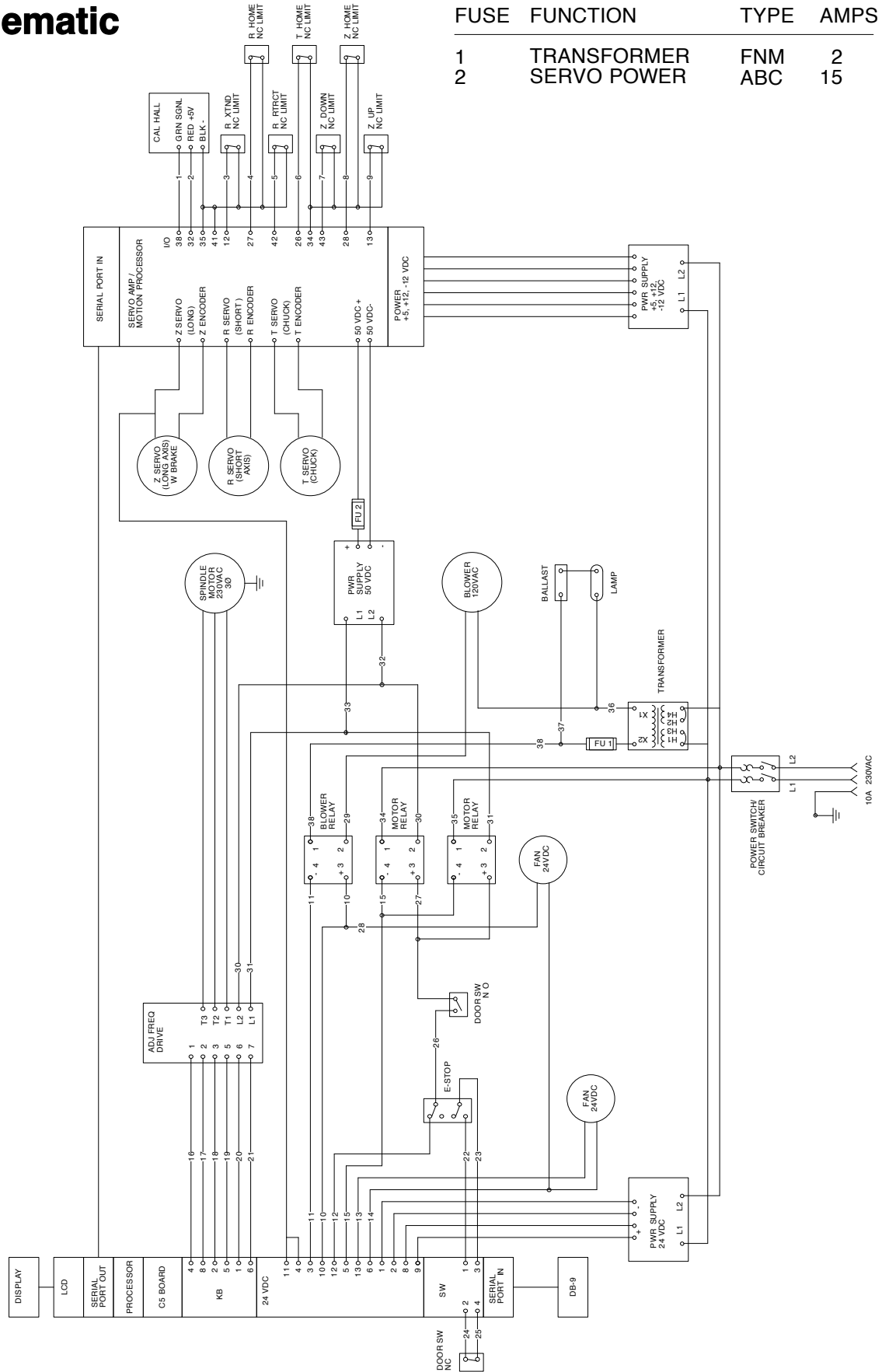
# Specifications

| | |
|---|---|
| Overall Size | 61 x 109 x 202 cm (24 x 43 x 79.5 in) |
| Weight | 205 kg (450 lbs) |
| Power | 220 VAC 5A, 50/60 Hz |
| Capacity | 30 cm diameter x 86 cm  (12 in diameter x 34 in)<br>3.25 inch over center travel possible with long cutter |
| Spindle Speed | 3,000 RPM |
| Standard Cutter | 18mm diameter x 8.5" long, ball nose |
| Optional Cutter | 18mm diameter x 12" long, ball nose |
| Spindle Bore | 16mm |
| Waste Bin | 18 x 18 x 24", 30 gallon capacity |
| Cable | 9 pin d-sub |
| Interface | RS-232 serial |
| Controls | Home, Calibrate, Setup, Tool, Return, Start,<br>Up, Down, Stop |
| Display | 20 character x 4 line back lit LCD |
| Limit Switches | 2 Long Axis, 2 Short Axis |
| Home Switches | Long Axis, Short Axis, Chuck |
| Auto Calibration | Hall effect switch |
| Blower | Carving chamber exhaust |
| Fans | 2, equipment chamber |
| Filters | 2, carving chamber exhaust,<br>equipment chamber inlet |
| Fuses | Servo Transformer:  ABC 15A 250V<br>Blower Transformer:  FNM-2 |

## Provel Inc

# Schematic

| FUSE | FUNCTION | TYPE | AMPS |
|------|----------|------|------|
| 1 | TRANSFORMER | FNM | 2 |
| 2 | SERVO POWER | ABC | 15 |

CAL HALL
GRN SGNL —1
RED +5V —2
BLK - 

R HOME NC LIMIT
T HOME NC LIMIT
Z HOME NC LIMIT

R XTND NC LIMIT —3
R RTRCT NC LIMIT —4
R DOWN NC LIMIT —5 —6
Z DOWN NC LIMIT —7 —8
Z UP NC LIMIT —9

SERIAL PORT IN

SERVO AMP / MOTION PROCESSOR

I/O 38 32 35 41 12 27 42 26 34 43 28 13

Z SERVO (LONG)
Z ENCODER
R SERVO (SHORT)
R ENCODER
T SERVO (CHUCK)
T ENCODER
50 VDC +
50 VDC -
POWER +5, +12, -12 VDC

PWR SUPPLY +5, +12, -12 VDC
L1 L2

Z SERVO (LONG AXIS) W BRAKE
R SERVO (SHORT AXIS)
T SERVO (CHUCK)

SPINDLE MOTOR 230VAC 3Ø

FU 2

PWR SUPPLY 50 VDC
L1 L2

BLOWER 120VAC

BALLAST
LAMP

TRANSFORMER
X1 H4 H2
X2 H1 H3
36
38 —37
FU 1

POWER SWITCH/ CIRCUIT BREAKER
L1 L2
10A 230VAC

—33
—32

BLOWER RELAY
- 4 1
+ 3 2
—38 —29
—11 —10

MOTOR RELAY
- 4 1
+ 3 2
—34 —30
—15 —27

MOTOR RELAY
- 4 1
+ 3 2
—35 —31

FAN 24VDC

—28

DOOR SW N O
—26

E-STOP

FAN 24VDC

—22 —23

ADJ FREQ DRIVE
T3 T2 T1 L2 L1
—16 —17 —18 —19 —20 —21
—30 —31

—11 —10 —12 —15 —13 —14

DISPLAY
LCD
SERIAL PORT OUT
PROCESSOR
C5 BOARD
KB
4 8 2 1 6
24 VDC
11 4 3 10 12 5 6 1 2 8 9

SW
SERIAL PORT IN
DB-9
—24 —25
3

PWR SUPPLY 24 VDC
L1 L2

DOOR SW NC

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