Automation and Robotics

CNC LATHE SYSTEM (LIGHT DUTY) MODEL 5300

GENERAL DESCRIPTION

The CNC Lathe System (Light Duty), Model 5300, provides training in computer-aided design (CAD) and computer-aided manufacturing (CAM) with a microprocessor-driven CNC Lathe (Light Duty). The system allows students to practice computer numerical controlled (CNC) code programming and editing, learn to operate lathe components, controls, and tools, set a programmed reference zero, follow the steps necessary to turn a specified part, and apply the machine code language to current lathe technology.

The CNC lathe consists of a horizontal lathe constructed with a machined steel bed, head-stock, and tailstock. It can machine pieces of soft materials such as plastics and waxes, as well as harder materials such as aluminum and brass. Pieces can be turned into a variety of cylindrical bumps, grooves, and hollows. Stock is mounted onto the lathe using a 3-jaw chuck that centers the stock and holds it in place. Two lead screws, each driven by a stepper motor, are used to move the cross slide that carries the cutting tool along the Z-axis (right and left) and X-axis (in and out). The speed of each stepper motor can be programmed separately for feed rates up to 356 mm/min (14 in/min). A 160-W (0.21-hp) motor rotates the spindle and chuck, and thus the stock, at speeds programmable up to 2800 r/min.

A computer (not included) is used to create part programs with G and M machine codes or their conversational code equivalents. The created programs are uploaded to the lathe's on-board microprocessor, which stores and executes them. Since the CNC Lathe connects

(732) 938-2000 / 800-LAB-VOLT, FAX: (732) 774-8573, E-MAIL: us@labvolt.com
(418) 849-1000 / 800-LAB-VOLT, FAX: (418) 849-1666, E-MAIL: ca@labvolt.com
INTERNET: http://www.labvolt.com

directly to the serial or Ethernet port of a computer, or directly to a network, no additional interface card is required. The computer is free to be used for any additional applications, since it is not dedicated to the control of the lathe.

The CNC Lathe is designed for use with the included Lab-Volt CNC Lathe Software, Model 5560. This Windows®-based software permits creation of G and M code part programs for download to the CNC Lathe. It features CAD/CAM design and tool path emulation, which allow students to create a drawing of a part, set up the tool paths and cut steps, and create a part program to simulate tool motion onscreen in order to verify NC code and the finished part prior to the actual cutting. Canned cycles can be programmed. The software can import NC part programs created with other CAM programs that support the G and M codes.

The CNC Lathe features a control panel that permits the lathe to be operated manually. This panel includes a multiple-line LCD display, an easy-to-use membrane keypad, an error indicator/pause button, and a key-released emergency stop push-button. The lathe parameters, including the spindle speed, the feed rate, the reference point, and the X and Z axes coordinates of the cutting tool are adjusted by accessing different menus. During the turning, the control panel displays the X and Z axes coordinates of the cutting tool, the feed rate, and the spindle speed.

The CNC Lathe is designed for maximum safety. A safety door provides protection during machining. Magnetic interlocks located on this door stop the spindle and the axes if the door is opened during machining. Limit switches prevent the bed from over-traveling and the cutting tool from crashing into the chuck. Pressing the emergency stop push-button on the control panel cuts off the power to the spindle motor and stops the axes.

The CNC Lathe supports low-voltage communications with robotic units. For this purpose, the CNC Lathe features a 15-pin TTL/IO port providing four 5-V digital input and four 5-V digital output lines for TTL communication to an automation work cell. The CNC Lathe also features a 5-pin solenoid driver port providing connections for up to four auxiliary devices. The TTL/IO and solenoid driver ports are M code supported through the CNC Lathe Software, Model 5560.

The CNC Lathe comes with the accessories, software, and cables required for its operation. These include, a carbide insert cutting tool, a set of six cutting tools (types AR4, AL4, BR4, BL4, C4, and E4), several pieces of machinable Delrin®, a serial cable, a cross-over Ethernet cable, and a copy of the CNC Lathe Software for a single user.

Also included are two user guides. One user guide directs students in hands-on experiences with equipment designed to prepare them for the automated manufacturing environment. A user guide for the CNC Lathe Software, Model 5560, is also included. It provides documentation describing the features of the CNC Lathe Software.

To enhance or expand the capabilities of the system, an assortment of machining tools and stock materials of different sizes are offered as options.

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Lathe Features

- On-board microprocessor
- Full manual control mode
- Feed rate override
- Spindle speed override

Safety Features

- Fully enclosed bed and work area
- Key-released emergency stop push-button
- Error indicator/pause button
- Switches monitored by the machine for:
  - safety door open
  - tool post too close to the chuck
  - over-travel protection on each axis
- Ability to restart programs from stopping point after operator aborts or safety interruption has been corrected.

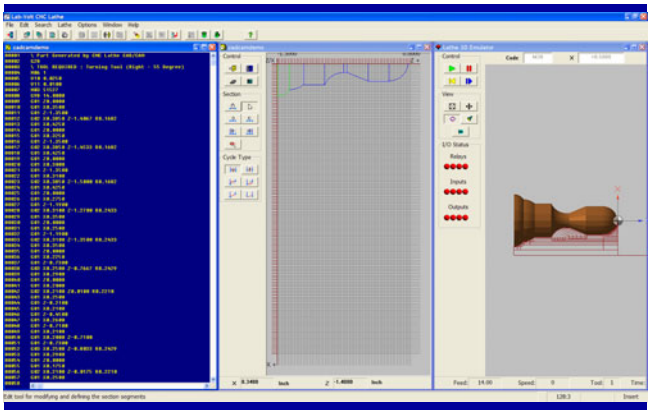
Control Panel Feature

- Main power LED indicator
- 20-character by four-line LCD display
- 12-key membrane keypad
- Manual mode controls for:
  - X and Z axes coordinates
  - units used (millimeters or inches)
  - feed rate
  - spindle speed
  - TTL I/O and solenoid outputs

  During execution, display of
  - X and Z axes coordinates
  - feed rate
  - spindle speed
  - current G and M codes
  - TTL I/O and solenoid output status
  - tool change

CNC LATHE SOFTWARE

This Windows®-based software runs under Windows® XP and Vista. It features a parametric-based graphical tool editor, a 3D (three-dimensional) Tool Path Emulator, and an easy-to-use graphical interface. The software can import NC part programs created with other CAM programs that support the G and M codes.



Features

- Provides G- and M-code programming
- Pull-down menus and icons
- Editor printout of part program
- Part program error checking using a syntax parser
- Fast syntax verification with line highlighting to speed part program debugging
- Full 3D Tool Path Emulator including:
  - Path and Tool trace view
  - Radius or Diameter view
  - Part rotation and camera positioning for better emulation viewing
  - Zoom in/zoom out capability
  - Interface with the tool table to provide an accurate tool simulation
  - Active display of X and Z axes coordinates
  - Display of current tool
  - Display of current G and M codes
  - Display of current feed rate and spindle speed
  - Simulation of current solenoid and I/O port activity
  - Real-time estimation of machining time
  - Editor line highlighting while emulating part program to track progress
- Parametric, graphical view tool editor with support for 20 tools
- Full G and M code help with graphical display and example code
- Simple CAD-CAM graphical development of part programs, including:
  - CAD editor to provide a simple yet powerful design for ease of use
  - Standard turning cycles that can be graphically created
  - Integrated materials database that provides speed, feed, and rough/finish cut settings
  - CAM export utilizing tool table and materials for part program parameters
- Serial and Ethernet download support for the Lab-Volt Automation CNC lathes

TABLE OF CONTENTS OF THE USER GUIDES

CNC Lathe, User Guide 39546-E0

- **Section 1 – Overview and Installation**
  - Functional description
  - Front panel
  - Back panel connectors
  - Control panel
- **Section 2 – Tools and Accessories**
  - Cutting tools
  - Tool posts
  - Mounting a cutting tool in a tool post
  - Tool vertical alignment
  - Tool post alignment
  - Mounting a cut-off tool
  - Cutting precision
  - Installing a four-jaw chuck
- **Section 3 – Using the Lathe Interface**
  - The lathe firmware
  - Feed rate
  - Spindle speed
- **Section 4 – Turning Stock**
  - Loading the stock
  - Setting the PRZ
  - Connecting the lathe to a computer or to an Ethernet network
  - Downloading a program
  - Executing a part program
- **Section 5 – Tutorial Exercise**
  - Tutorial
- **Section 6 – Maintenance**
  - Routine maintenance
  - Updating the firmware

CNC Lathe Software, User Guide 36188-E0

- **Section 1 – Overview of the CNC Lathe Software**
  - The Main Screen
  - The Toolbar
  - The Menu Bar
- **Section 2 – Menus**
  - The File Menu
  - The Edit Menu
  - The Search Menu
  - The Lathe Menu
  - The Options Menu
  - The Window menu
  - The Help menu
- **Section 3 – The Part Program Editors**
  - The Line Editor
  - The CAD/CAM Editor
  - The Block Editor
- **Section 4 – Tutorial Exercices**
  - Creating a simple G and M code part program with the Line Editor
  - Emulating and downloading a G and M code part program
  - Creating, editing, and exporting a simple CAD/CAM drawing with the CAD/CAM Editor
  - Creating, editing, and exporting a simple block part program with the Block Editor

LIST OF EQUIPMENT

CNC Lathe System (Light Duty), Model 5300-20

QTY	DESCRIPTION	ORDERING NUMBER[1]
1	CNC Lathe (Light Duty)	5300-B0
1	CNC Lathe Software for one user	5560-00
1	Black/White Delrin® Turning Stock Package	5304-00
1	CNC Lathe Software, User Guide	36188-E0
1	CNC Lathe, User Guide	39546-E0

[1] The ordering numbers shown apply to the English 120-V version. Other versions are available. Refer to the Ordering Numbers section.

OPTIONAL EQUIPMENT

DESCRIPTION	ORDERING NUMBER[2]
Black/White Delrin® Turning Stock Package	5304-00
Black Delrin® Turning Stock Package	5305-00
White Delrin® Turning Stock Package	5306-00
Aluminum Turning Stock Package	5307-00
Brass Turning Stock Package	5308-00
Turning Tool Set	5322-00
Basic Turning Kit	5323-00
Aluminum Turning Stock Package	5357-00
CNC Lathe Software	5560-00
Carbide Tool Set	32913-00
Parting-off Tool and Holder	96862-00

SPECIFICATIONS

Model 5300-B – CNC Lathe (Light Duty)		**120 V – 60 Hz**	**220 V – 50 Hz**	**240 V – 50 Hz**
Power Requirement	Current	3 A	1.5 A	1.5 A
Lathe	Swing Over Bed	90 mm (3.5 in)		
	Center Height	101.6 mm (4 in)		
	Distance Between Centers	200 mm (8 in)		
	Swing Over Cross Slide	48 mm (1.9 in)		
	X-Axis Travel	47.8 mm (1.88in)		
	Z-Axis Travel	105.4 mm (4.15in)		
	Resolution	±0.00318 mm (±0.000125 in)		
Headstock	Spindle Bore	10 mm (0.405 in)		
	Spindle Taper	Morse No. 1		
Tailstock	Tailstock Taper	Morse No. 0		
	Sleeve Stroke	38.1 mm (1.5 in)		
Main Spindle Drive	Programmable Speed Range	0-2800 r/min		
	Motor	160 W (0.21 hp), overload protected		
Feed Motors	Type	Stepper		
	Resolution	400 steps/r		
	Rapid Traverse Speed	356 mm/min (14 in/min)		
Accessories included in Model 5300-B				
Carbide Insert Tool with Tool Post		35° right-hand insert		
Carbide Tool Set with Tool Post	Types	AR4, AL4, BR4, BL4, C4 and E4		
Null Modem Serial Cable	Length	3.05 m (10 ft)		
	Connectors	DB9 female/female		
TTL/IO Cable	Length	3.05 m (10 ft)		
	Connectors	DB15 male/male		
Ethernet Crossover Cable	Length	2.13 m (7 ft)		
	Connectors	RJ45 male/male		
Set of Tools	Content	hex keys, cleaning brush, digital caliper and tool bag		

[2] The ordering numbers shown apply to the English 120-V version. Other versions are available. Refer to the Ordering Numbers section.

SPECIFICATIONS (cont'd)

Accessories included in Model 5300-B (cont'd)		
Fuses	Current Rating	1.0 A
	Voltage Rating	250 V
Physical Characteristics	Dimensions (H x W x D)	750 x 864 x 597 mm (29.5 x 34 x 23.5 in)
	Net Weight	68 kg (150 lb)
Model 5304 – Black/White Delrin® Turning Stock Package		
Quantity		50 white and 50 black
Dimensions		19 mm (0.75 in) diameter, 76.2 mm (3 in) long
Model 5305 – Black Delrin® Turning Stock Package		
Quantity		100
Dimensions		19 mm (0.75 in) diameter, 76.2 mm (3 in) long
Model 5306 – White Delrin® Turning Stock Package		
Quantity		100
Dimensions		19 mm (0.75 in) diameter, 76.2 mm (3 in) long
Model 5307 – Aluminum Turning Stock Package		
Quantity		100
Dimensions		19 mm (0.75 in) diameter, 50.8 mm (2 in) long
Model 5308 – Brass Turning Stock Package		
Quantity		25
Dimensions		12.7 mm (0.5 in) diameter, 76.2 mm (3 in) long
Model 5322 – Turning Tool Set		
Indexable Carbide Tool Set	Types	TAR, TAL, TBR, TBL, and TE with 9.53 mm (0.375 in) shank
Carbide Inserts		ten, C-2 grade, 6.35 mm (0.25 in) inscribed circle
Two-Position Tool Post		mounts one 7.94 mm (0.3125 in) tool and one 9.53 mm (0.375 in) tool
Model 5323 – Basic Turning Kit		
High-Speed Steel Cutting Tool Set		three-piece set including a right-hand tool, a left-hand tool, and a boring tool, all 6.35 mm (0.25 in) square type
Parting-Off Tool and Holder		see Model 96862
Cutting Tool with Tool Post		6.35 mm (0.25 in) shank, high speed steel
Model 5357 – Aluminum Turning Stock Package		
Quantity		100
Dimensions		12.7 mm (0.5 in) diameter, 63.5 mm (2.5 in) long
Model 5560 – CNC Lathe Software		
Licenses	Number of Users	1, 5, 10, 15, 20, 25, 30 or 35
Computer Requirements (minimum)	Type	Pentium II, 400 MHz
	Operating system	Windows® 98/ME, NT 4.0/2000 or Vista
	RAM	32 MB
	Graphic Card	3D
Model 32913 – Carbide Tool Set		
	Types	AR4, AL4, BR4, BL4, C4 and E4
Model 96862 – Parting-off Tool and Holder		
Holder	Type	for parting-off blade
Parting-off Blade	Material	high speed steel (HSS)

ORDERING NUMBERS

120 V – 60 Hz			220 V – 50 Hz			240 V – 50 Hz
ENGLISH	**FRENCH**	**SPANISH**	**ENGLISH**	**FRENCH**	**SPANISH**	**ENGLISH**
5300-20	TBE[3]	TBE	5300-25	TBE	TBE	5300-2A
5300-B0	TBE	TBE	5300-B5	TBE	TBE	5300-BA
5304-00	5304-00	5304-00	5304-00	5304-00	5304-00	5304-00
5305-00	5305-00	5305-00	5305-00	5305-00	5305-00	5305-00
5306-00	5306-00	5306-00	5306-00	5306-00	5306-00	5306-00
5307-00	5307-00	5307-00	5307-00	5307-00	5307-00	5307-00
5308-00	5308-00	5308-00	5308-00	5308-00	5308-00	5308-00
5322-00	5322-00	5322-00	5322-00	5322-00	5322-00	5322-00
5323-00	5323-00	5323-00	5323-00	5323-00	5323-00	5323-00
5357-00	5357-00	5357-00	5357-00	5357-00	5357-00	5357-00
32913-00	32913-00	32913-00	32913-00	32913-00	32913-00	32913-00
96862-00	96862-00	96862-00	96862-00	96862-00	96862-00	96862-00
36188-E0	TBE	36188-E2	36188-E0	TBE	36188-E2	36188-E0
39546-E0	TBE	TBE	39546-E0	TBE	TBE	39546-E0

Table 1. Equipment Ordering Numbers (Domestic and International Markets).

NUMBER OF USERS	120 V – 60 Hz			220 V – 50 Hz			240 V – 50 Hz
	ENGLISH	**FRENCH**	**SPANISH**	**ENGLISH**	**FRENCH**	**SPANISH**	**ENGLISH**
1	5560-00	TBE	5560-02	5560-00	TBE	5560-02	5560-00
5	5560-A0	TBE	5560-A2	5560-A0	TBE	5560-A2	5560-A0
10	5560-B0	TBE	5560-B2	5560-B0	TBE	5560-B2	5560-B0
15	5560-C0	TBE	5560-C2	5560-C0	TBE	5560-C2	5560-C0
20	5560-D0	TBE	5560-D2	5560-D0	TBE	5560-D2	5560-D0
25	5560-E0	TBE	5560-E2	5560-E0	TBE	5560-E2	5560-E0
30	5560-F0	TBE	5560-F2	5560-F0	TBE	5560-F2	5560-F0
35	5560-G0	TBE	5560-G2	5560-G0	TBE	5560-G2	5560-G0

Table 2. Software Ordering Numbers

[3] TBE = To be established

Reflecting Lab-Volt's commitment to high quality standards in product, design, development, production, installation, and service, our manufacturing and distribution facility has received the ISO 9001 certification.

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