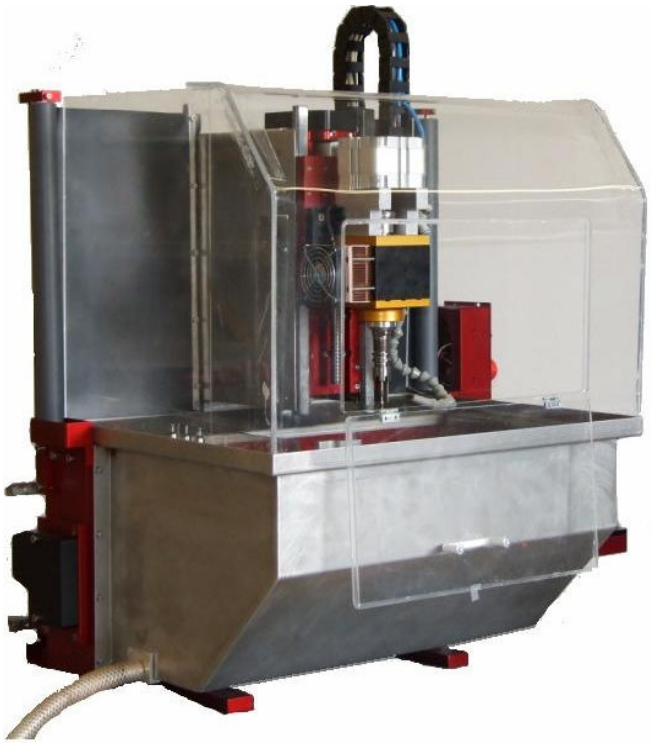
WL-400 Milling Machine

Operator's Manual



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Introduction

This manual covers the safety, usage and maintenance of the tabletops CNC milling machines manufactured and sold by Levil Technology Corp.

Those who operate the machine should read and understand the rest of this manual in order to operate the machine efficiently, maintain a safe environment for themselves and others around, to avoid serious injury to oneself and damage/ loss of life of the machine.

Safety

There are a number of safety facts the operator must know before operating the machine. Therefore the operator must read and understand every safety precaution needed in order to safely operate the machine.

Before approaching the machine, proper dress wear should be worn at all times such as safety glasses, toe steel boots, long pants and a shirt. Loose dress wear such as ties should be removed and shirts should be tucked in because they could get caught by a moving part and cause serious injury. Long hair has to be kept away from face and should be restrained by a hair tie and jewelry should be removed.

Before operating the machine, make sure there are no loose cables or components if visible. If a loose cable or component is detected, turn the main power off and disconnect the 110v cable from the machine before attempting to put the cable or component back to its designated position. If the operator is doubtful even for a second of where the cable or component should go, leave the machine alone and contact Levil support at techsupport@levil.com addressing the issue.

Do not turn switches on/off with wet hands.

When operating the machine, keep hands and any part of your body away from moving parts while the machine is working because it could get caught and result in serious injury.

If this is a wet machine, it could cause the floor around it to be wet and slippery. Make sure to keep the floor dry and clean.

Do not attempt to do jobs that go beyond the capabilities of the machine. This machine was designed to perform small jobs.

The operator should be knowledgeable about the material characteristics he is going to use before attempting to work with it.

The emergency button location should be well known so that it can be pushed easily during an emergency.

Specifications

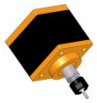
General Specifications	Measurements	
	English	Metric
Size	3.3' L x 2.6' W x 3' H	1m x 0.8m x 0.895m
Footprint	20" x 28"	510 x 710 mm
Machine Weight	200 lbs	91 Kg
Shipping Dimensions	36" x 36" x 26"	914 x 914 x 914 mm
Work Capacities	Plastics, Woods, metals including steel	
Maximum Weight on Table	180 lbs	81 kg
Table		
Table Size	16" x 10"	400 x 250 mm
Slots on Table, Qty.	5/16" 10 Slots	8 mm
Table Travel X Axis	14"	350 mm
Strusion	7075 Anodized Aluminum	
Spindle		
Motor HP Rating	2 HP	2 HP
Drive System	Direct Driven	Direct Driven
Minimum Speed	100 RPM	100 RPM
Maximum Speed	18,000 RPM	18,000 RPM
Quill Diameter	0.787"	20 mm
Spindle Bearings	Angular contact ceramic bearings	Angular contact ceramic bearings
Spindle to Column	Not applicable	Not applicable
Spindle Taper	ER-16	ER-16
Axis		
Guideways (X, Y, Z Axis)	0.6" Hiwin Linear guides	15 mm Hiwin Linear guides
Travel X Axis	16.5"	421 mm
Travel Y Axis	8.5"	217 mm
Travel Z Axis	8"	200 mm
Ball Screws	Rolled Ball Screws w/ Backlash Adjustable Nuts	Rolled Ball Screws w/ Backlash Adjustable Nuts
Ball Screw Size (X, Y, Z Axis)	5/8"	16 mm
Ball Screw Pitch	0.197"	5 mm
Rapid Traverse Speed	400 in/min	10 m/min
Max Feed Rate	236 in/min	6 m/min
Resolution (X,Y Z Axis)	0.00003"	0.0007 mm
Precision (X,Y,Z Axis)	0.0004"	0.01 mm
Repeatability (X,Y,Z Axis)	0.0002"	0.005 mm
Power		
Power Requirement	110 Volts AC	110 Volts AC
Phase	Single	Single
Current	15 Amps	15 Amps
Servo Motors (X,Y Z Axis)		
Power	100 Watts, 36 V	100 Watts, 36 V
Servo Type	DC Brush-type servo	DC Brush-type servo
Feedback	Close Loop	Close Loop
Encoder	4000 counts/rev Encoder with differential output and index pulse.	4000 counts/rev Encoder with differential output and index pulse.
Torque	55 oz/inch	0.37 Nm
Gear reduction	1.5	1.5

Accessories

These are the basic accessories your machine comes with when you buy the machine.

1	Oil can
1	Collet nut
1	Collet nut wrench
1	Set of ER-16 collets
1	Hexwrench set for 3, 4 and 5 mm
1	Set of open end wrenches
1	Power cable
1	USB cable
1	Netbook computer
4	Tool holder
4	T-slot nut

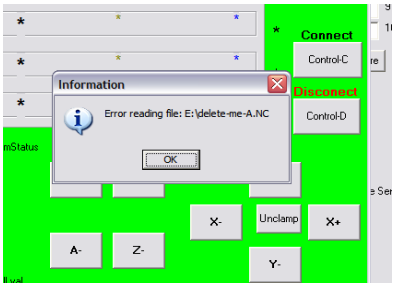
Software Navigation

Open the software ***LEVIL 11-MC***  that appears on your desktop.

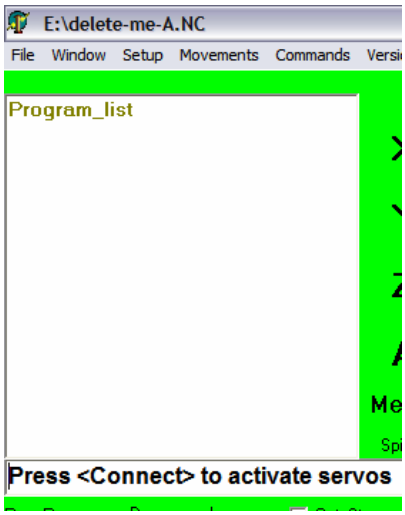
If not installed, refer to Word document ***INSTALL MANUAL*** under the file ***LEVIL 5*** which is located in ***MY DOCUMENTS*** in your computer.

After opening ***LEVIL 11-MC*** two windows should pop up. One window should have a green background (**MAIN SCREEN**) and the second window is grey and has offsets (**OFFSETS WINDOW**).

If a third, small window shows up that reads “error reading file” just click ok and ignore it.

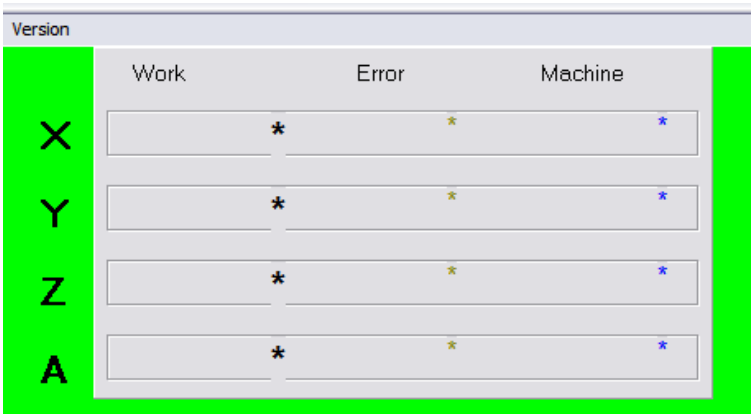


The **MAIN SCREEN** is the main screen you will use to operate the machine. On the top right corner there is a blank square called ***PROGRAM LIST***, this is where you will write or inport the G-code to feed to the machine.



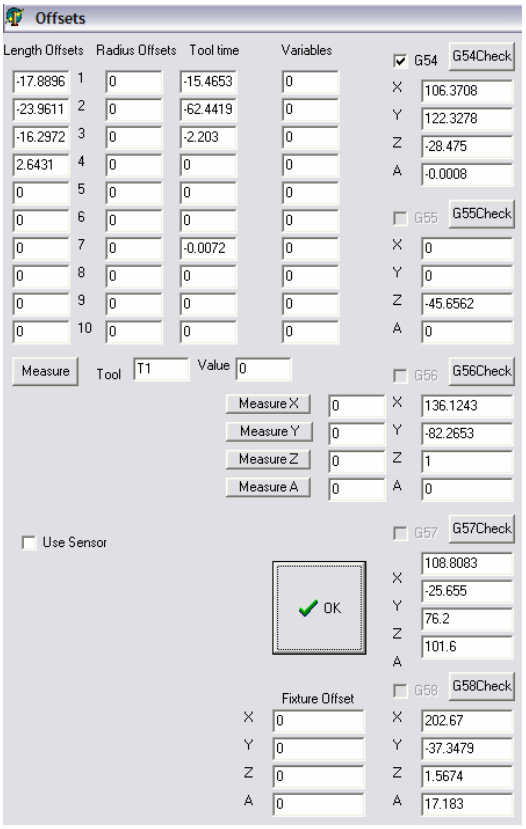
You can write the code manually in here, or load the file generated by a CAD program by clicking on File/ Open.

On the center of the ***MAIN SCREEN***, there is a square which reads ***Work***, ***Error*** and ***Machine*** and 4 asterisks under each.



This is where the position (***X, Y, Z, A axis***) of the machine will appear once the machine is connected.

The second window, ***OFFSETS***, that appeared when we first opened the software, contains all the offsets for the machine.



Make sure to learn all the buttons and their specific tasks so you don't have any trouble while operating the machine.

The rest of the taskbar buttons are complementary functions to enhance the operation of the machine.

In the taskbar, under **WINDOW** you will find the following:

- **TEST** Test the connection of the servo-motors, and axis
- **GRAPHICS X, Y, Z** Projects a drawing of the G-code in file
- **ISOMETRIC GRAPH** Projects an isometric drawing of the G-code in file
- **RUN MDI**
- **DIGITIZE** Reverse engineer a part using this function

Under **SETUP** you will find the following:

- **OFFSETS** Shows the offsets of the machine

- **PARAMETERS** Shows the parameter of the machine (Password Protected)

Machine Start Up

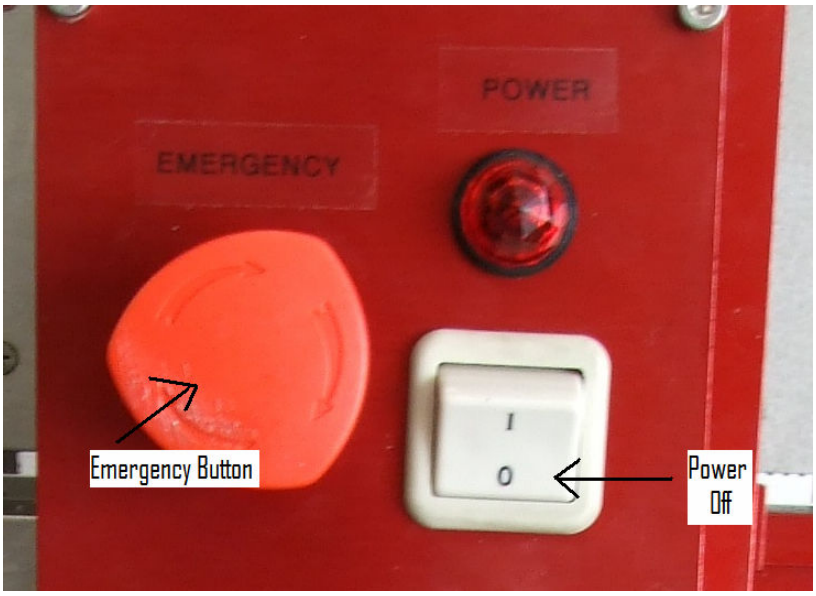
Turn on Procedure

1. **Push** the emergency button (Big red button)
2. Make sure the **Power Switch** is on the off position
3. Plug in the **USB wire** from the computer to the machine
4. Plug in the **Power cable** from the wall outlet to the machine
5. Have the **Levil 11-MC** software closed
6. Turn the **Power Switch** to the on position
7. Open the **Levil 11-MC** software
8. Move each axis' ball screw by hand and look at the position of the machine in the software to check that numbers are changing in the specific axis that you are moving.
9. Release the emergency button (turn clockwise until it releases)
10. Click **Connect** in the upper right hand side of the software (Green background turns blue)
11. Click the **-X** button and make sure the machine moves on that direction, then click the **+X** button and make sure the machine moves in the opposite direction
12. Repeat the last two steps for every axis
13. Click the **Home Act** box in lower center part of the software and make sure it is checked marked
14. Click the **+Z** button and wait until the rectangle in the left reads **Home End**.
15. Click the **-Y** button and wait for the **Home End**
16. Click the **-X** button and wait for the **Home End**

These are all the steps you need to take the first time you turn on the machine, to make sure all axes are working properly.

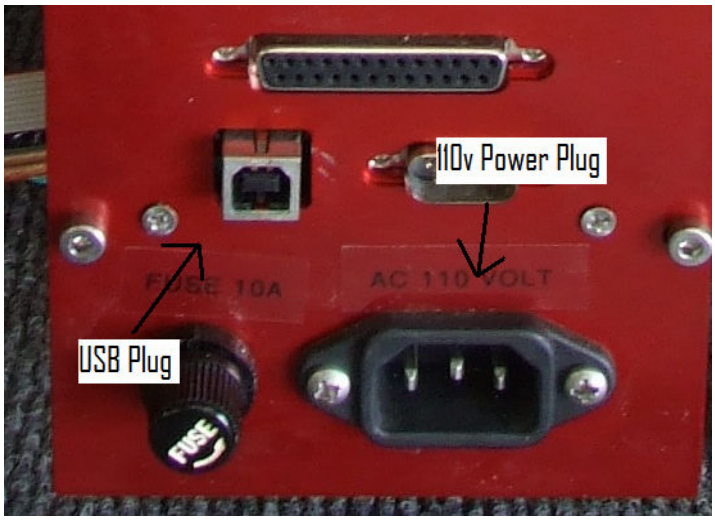
The following pages describe in detail what each step does.

PUSH the red mushroom button (Emergency Button) on the machine. It disconnects the power from the servo motors to avoid runaways since the control board has not been initialized. Also make sure the ***Power Button*** (white button) is on the **OFF** position.



Plug the USB wire from the machine to the computer, only use short wires.

Plug the machine to the 110volt wall outlet. **DO NOT** turn ON the machine yet.



With the computer on, switch the ***Power Button*** to the **ON** position (Red Emergency button still pushed in).

Run the **Levil 10-MC** program (Make sure the machine is on before you open the Levil 11-MC software or else it will not connect to the machine).

NOTE: Make sure you are running only **ONE** program of **Levil 11-MC**; otherwise there will be conflicts if more than one is running. Believe me, it happens frequently.

You should see the ***MAIN SCREEN*** opening with the ***OFFSET*** screen behind. If everything is in order, the X, Y and Z axis should appear with position numbers shown.

Move one axis by rotating a ball screw by hand, there should be numbers changing on that axis under ***Machine***. If so, rotate the Red Emergency mushroom button clockwise to give power to the servos. Do not attempt to touch the ball screws after the servos are connected (Red button is pulled). This could result in an injury

Click the **CONNECT** button on the Machine Status window on the ***MAIN SCREEN***; the green background should turn blue. If this happens, the machine is now on and ready to work.

Click the **X-** button located on the lower right corner to make sure the machine moves. Now click the ***X+*** button and make sure the machine moves in the opposite direction. Feel free to do the same with the ***Y, Z axis***. If you hit end of travel as you move, the machine will automatically disconnect the power to the servos. Click **CONNECT** to recover and move that axis in the opposite direction.

Last step to finish the start sequence is the home positioning. To do this, click the ***HOME*** box to check mark it.

Hit one axis (X,Y, Z or A) and wait until it reaches home. Make sure the position number under ***MACHINE*** reads ***.000*** and the bar in the middle-left under the **PROGRAM LIST** box reads ***END HOME***. If you hit the wrong direction, the machine will crash and disconnect. If this happens, simply reconnect the machine and repeat the process hitting the opposite direction. Repeat this step for the other axes. Make sure to remember which direction the ***HOME ACT*** is for each axis.

Zero of a Part

In order for the machine to know where to start cutting a work-piece, we have to tell it where it is. Let's call the point where the work-piece starts, the Zero point. This machine has 5 Zero points that we can use. G54 is the first Zero point, followed by G55, G56, G57, G58.

Since the Zero point tells the machine where to start cutting, you will write whichever Zero point you choose to use at the beginning of the code.

For Example

N10 G54 Here, I chose to use G54 coordinates to start working on the part

X0 Y0 Z0

X10 Y15

X30 Y45

Z10

M30

I can choose whichever Zero point I want, as long as I set the Zero point where it's supposed to be.

Under Levil 5 in **My documents**, there is a notepad file called **Zero Test 1**. Open it and take a look at it. G56 is the Zero point I chose so now we have to set the coordinate somewhere in the machine.

Now, take the machine to its home position if you have not done so already. You should choose a reference tool that you will use always when locating the zero of your part. Once you have installed your reference tool, manually take the machine to the center where it will not crash to anything on its sides when it starts moving. Once there, go to the offsets window.

On the top right side of the window you will see a box that reads G56 and its corresponding coordinates under it for each axis. If you click the box, a checkmark will appear. This tells us the machine is using G56 for coordinates.

Now go to the middle of the window where there are 4 boxes that read measure X, measure Y, measure Z, and measure A. Make sure that each square has a 0 written next to them. Now click on the measure X button, and look at the Main Screen, under

work, it should read X 0. Repeat the same for the Y and Z axes (and the A if you have one) Once all the axes read 0, the G56 coordinate is set.

Click Run Program and watch as the machine performs its task from the point we chose. You can slow down the machine by lowering the cutting feed and the rapid feed to your convenience.

Once the machine is done, manually take it to another point of your choice and run the code again and watch it come back to the Zero point to start the code again.

No matter where the machine is, it will always go back to its Zero point before starting the code.

The following will explain how to define the Zero point of a part.

Manually take the X-axis, the Y-axis and the Z-axis to where you want your work piece's Zero point to be. Normally is at a corner of the work piece, like the following picture demonstrates.

This is a practical but inaccurate way to measure the Zero point of the work-piece, because it is an eye approximation. The error is big compared to what some measuring tools out in the market can eliminate. For precise cutting, this method is not recommended, but since this is a beginner's course, it will do just fine.

Make sure that wherever you decide your zero to be, there will be enough room on the work piece to create whatever you want to make. In other words, the machine will not move past the sides of the work piece.

When you are getting close to the work piece to measure the Zeros, make sure to move in small amounts (manual step reduced to 0.1 or less) and really slow until the bit touches the part, because it could break and damage the work piece.

Once you reach the Zero point, click the measure X, Y and Z to set the Zero.

Also, if you look under **G54 Check**, the numbers should match those under **Machine** in the main screen when the machine is centered on the Zero point.

If you choose to use G55 or G56 or any of the other ones, just make sure that the check mark is next to the G coordinate you wish to use before doing each axis measure.

Tool Length Offset

To set a tool offset, you will need to define a Zero point to offset the different lengths from. For example, if you define the Zero point with a tool that is 25 mm long, the offset of another tool that is 20 mm long would be -5 mm.

To set these offsets, choose a reference tool, a tool that will always be the one to base the offsets off of. For this case let's say tool #1 is our reference tool.

The steps are:

1. Put tool #1 in the spindle
2. Define the Zero point in the Z-axis for tool #1 in your desired G coordinate (pick a smooth surface that will most likely never move such as the top of the vise, or a sensor)
3. Once you reach the desired position go to the offsets window and in the center there is a box that reads tool and value
4. Make sure that they both read T1 and 0
5. Click measure
6. In the top left corner, under lengths offsets, box #1 should say 0
7. Switch to tool #2
8. Repeat steps 4, 5 and 6 but switch the T1 to T2
9. When you click measure, check that the value under lengths offsets box #2 matches the number in the Main Screen under Work in the Z-axis
10. Switch to tool 3 and repeat the same steps as for tool #2
11. Repeat the steps until all your tools have an offset

Maintenance

These machines are easy to maintain since the linear guide ways are not covered, and the ball screws are self-cleaning, but also long periods of exposure can make them dusty.

The dust particles can easily enter the ball bearings inside the guide blocks and damage them. Make sure to grease the linear guide ways monthly if the machine will be used daily, or if it will not be used for some time, make sure to grease the guide ways and cover the machine until it will be used again.

Also the cars have small insertions on the sides where you can use an oil gun to insert some oil inside the ball bearings.

For the ball bearing screws, add a coat of oil all over the screw. Make sure to move that axis back and forth so the self-cleaning part of the screw absorbs all the oil and keeps cleaning the screw.

The coolant should be aerated constantly to keep it from decomposing. If coolant becomes decomposed, change it right away since it can damage the machine.

If you have any questions, please contact us via phone at 407-542-3971 or via email at techsupport@levil.com