The Precision Matthews Mill, for those trained on the Rong Fu Mill

If you've taken the Manual Mill class using the Rong Fu Mill, then all you need to do now to use the new Precision Matthews mill is read this document or watch a forthcoming video. They will briefly cover the key differences between the Precision Matthews mill and the Rong Fu mill you were trained on. (Henceforth, these may be referred to by their initials, PM and RF.)

For the most part, you'll find operating the Precision Matthews mill to be a natural extension of using the Rong Fu mill. It's more rigid and more powerful with a larger table, but using it is conceptually the same. Like the Rong Fu, the PM machine holds tools using an R8 collet, so they can share the same set of tools.

Like the Rong Fu, we will keep the Precision Matthew's table covered when not in use.

To use the mill, you'll need to power the ancillary features by turning on this power strip, attached to the mill on the left front of the main body. This will provide power to the three auto-feed motors, the DRO (location readout), a spindle light, and a coolant pump which will be installed later.

(The motor itself has no master switch and is always ready to turn on.)

A key difference is that the PM is a knee mill, while the Rong Fu is a shoulder mill. On the Rong Fu, precision in the z-axis comes from the quill. On the PM, the quill has less precise markings, with no thousandths reading. Precision in Z comes from raising and lowering the entire table.

The Z-axis handle is larger than the others because you need more torque to lift the table rather than just sliding it. The handle has two parts, held lightly apart with a spring; this is so that the auto feed doesn't spin this huge handle around. To raise and lower the table manually, align the handle tabs and push the handle in. You will have to keep a light pressure on the handle to stay engaged while turning it. If you have trouble getting it to engage, you're likely pushing it slightly off of straight.

Here you have the usual thousandths of an inch precision, using either the analog position dial or more likely the DRO.

The DRO's basic functions are nearly identical to the Rong Fu's; it just has a three axis readout rather than two. If the DRO doesn't seem to be acknowledging a keypress, try hitting the Clear (C) button and trying again.

(Like the Rong Fu's DRO, it has a some neat advanced functions that I've never bothered to learn. Look it up online if you want to learn more.)

The Rong Fu has an auto feed along X; the Precision Matthews has auto feeds along X, Y, and Z. These all work *exactly* like the X-feed on the Rong Fu: move the lever to start moving (I've labeled the directions), turn the knob to adjust the speed, which can go all the way to zero, or hold the button for rapid movement. (These also have an on-off switch, which should be left on. The rapid button is lit up when power is on.)

Just like the Rong Fu's feed, these have auto-stops at both ends. However, unlike the Rong Fu, these aren't the hard limit stops for the table travel. You can go a bit further using the manual handles, but this should generally be avoided. Care should thus be taken using manual feed near the table limits.

In particular, do not raise the table beyond the upper Z feed auto-stop point – doing so can bend the channel guiding the stop! (It's a bit flimsy; we'll likely upgrade it soon.) This stop is set such that there is no possibility of bringing the spindle into contact with the table. (This of course won't prevent you from running the spindle into your piece, running your tool into the table, etc.). But this means that you may not be able to reach your piece if you are milling close to the table. Again, do not raise the table higher than this point; instead, unlock and lower the quill to bring your tool to the piece.

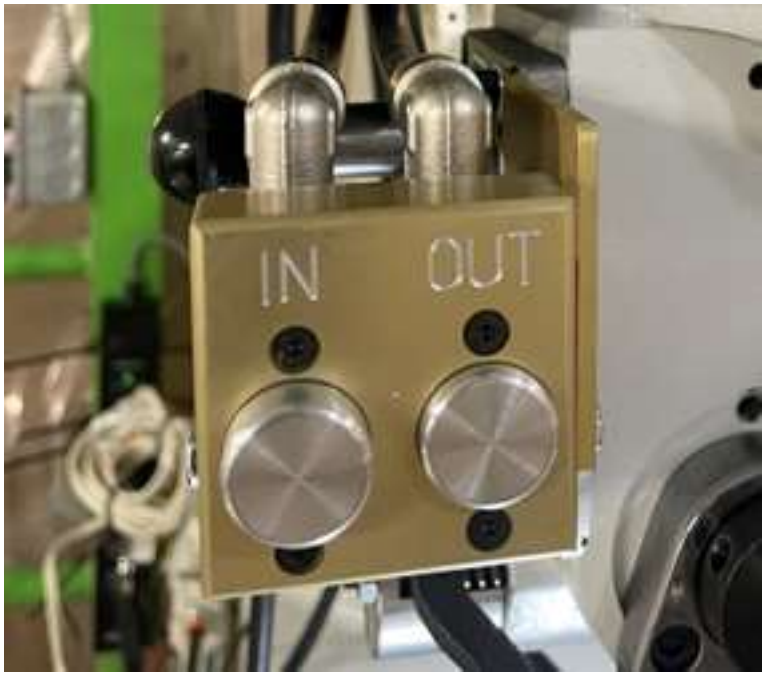
The recommended procedure if you are working near the table at the top of the table's range: raise the table using the Z auto-feed until the auto-stop triggers. Then lower the quill down so the tool is clearly below the deepest depth it needs to reach. Then lock the quill and lower the table. Make all Z adjustments using the table from then on.

You can raise and lower the quill just like a drill press, with this handle. Like a drill press, and unlike the Rong Fu, it has a spring which will retract it whenever it isn't locked. Generally, you'll use this only for drilling. You will want to keep it locked in a single position for milling operations, because moving it invalidates the Z values shown in the DRO.

The set of mechanisms shown below is a quill auto-feed. It is an advanced feature which we are not covering here. Use of it is not allowed without further instruction. It's mainly useful if you have a huge number of repeated holes to drill. Contact Ethan Moore, the mill class teacher, directly for further instruction if you feel you might need to use this.

Tool Changer:

There is a spindle brake on the upper left of the head; raise or lower it slightly to engage. But you probably won't use this often. If the PM had a manual collet like the Rong Fu, you'd use it to keep the spindle in place while you tightened the collet. But that's unnecessary because the PM has a pneumatic automatic tool changer.



To use it, you do have to make sure the quill is fully up and locked. Insert the collet with the tool in it, aligning the slot on the collet so it travels most of the way in. Then you hold down the IN button until the tool is in place, which will take less than a second. Don’t continue to hold the button down beyond that point. To remove the collet, just press the OUT button until the collet is free. This will take slightly longer. The whole system is simple and fast.

If you start to install a tool with the quill not fully up or not locked, things may move and get wonky. If so, just stop, raise and lock the quill, and try again.

For some tools, you could possibly put your finger between the tool and the collet. I don’t know what would happen if you then pushed the IN button. I don’t intend to find out, and I recommend you don’t either. Just hold everything from underneath.

The tool changer requires shop air to operate. There is no manual alternative if you don’t have air. The regulator pressure is set at 90 psi and should not be adjusted.

Running the Mill:

To start the mill, simply turn the power knob to run the spindle forward (FWD) or in reverse (REV).

One important oddity: the spin directions shown only apply to high gear. If the mill is switched into low gear (as described below), the directions are inverted; in that case, you have to turn the knob to REV to run the spindle forward.

There is no master power switch to enable; the mill motor is always ready to go. There is also currently no emergency stop (though I plan to add one).

Motor Speed:

The Rong Fu mill only has six discrete speeds. The Precision Matthews has two discrete ranges of speeds; within each range, you can adjust the spindle speed continuously.

For our uses, we will almost always want to be in the HI gear range, as shown.

You can only change the gear setting when the motor is stopped.

To switch to the LO gear range, push the lever inward slightly, then turn the lever back. Release the inward force and continue turning the lever back until a clear detent is reached.

Rember that spindle directions are reversed when using the lower gear range.

To return to HI gear, do the same thing in reverse.

Any lever location between the two detents is neutral, which is useful if want the spindle to move freely. (On the Rong Fu, you can turn the spindle while it is in gear; you cannot do so here.)

If you have difficulty getting the lever into gear from neutral, you may need to turn the spindle slightly to help the gears engage.

Within each gear range, you can select from a continuous range of speeds, 70 - 500 rpm in low gear and 600 - 4200 rpm in high gear. Few of our applications call for spindle speeds less than 600 rpm, which is why the machine will most often be used in high gear.

You can adjust the speed setting by turning the wheel on the upper right side of the head.

It is very important that you only change this setting when the motor is running!

You can read the speed setting through the window appropriate for the current gear setting. In this picture, the spindle will turn at about 800 rpm (because the machine is in high gear, as usual).

The Precision Matthews is much more rigid and powerful than the Rong Fu, so you can use speeds about 1.5 to 2 times as fast as what you would use on the Rong Fu. There will be a chart of suggested speeds on the machine. These are just guidelines which I will likely update over time.

(A side note regarding the Rong Fu: the speeds I've taught for cutting aluminum have perhaps been a bit conservative; I've posted an updated recommended speed chart for it as well.)

General Considerations:

It will be tempting to use the baffle for the front Y-axis ways to set things on. Resist this temptation. Set nothing there, not even briefly! (We will likely add a nearby work surface soon.)

There are many cables and pipes running around the machine's table. These cannot be managed more tightly, as they must be free to move as needed to match the table's large range of motion. Try to be aware of their movements and ensure that they don't catch on or get caught between other parts as the table moves.

The Rong Fu has one adjustment, the head tilt, that should not be changed without permission from the metal shop area lead. The PM is bigger in this category as well, with four prohibited adjustments: the head tilt, head nod, turret ram, and turret rotation. These all require permission because the machine has to be re-trammed afterward. Thus, you'd have to have a really unusual need to receive this approval.

Shutdown:
When you are done, clean the machine and return all tools to their proper location.

It is usually best to leave the table somewhere in the middle of its horizontal ranges (X and Y). The table will usually be left high, but do not leave it up against its upper Z stop. Make sure the quill is locked in its top position.

Cover the table with the cloth and turn the power strip off. You do not need to do anything to shut down main power or the compressed air line.

Key Points to Remember:

I've covered the differences between the machines quite thoroughly, but if you are getting lost in details, remember mainly these things:

- Only change the spindle speed using the wheel when the motor is running.
- Be careful when raising the table near the upper motion stop.
- Precision Z movements are made by moving the table, not the quill.
- The quill has to be fully raised and locked to use the automatic tool changer.
- Appropriate tool speeds are about 1.5-2 times the speeds you'd use on the Rong Fu.