Michael Brombeiss
Santa Monica, CA 90404
https://brombeiss.com/

Precision Matthews Mill PM-25MV – Setup and Upgrades

Stand

- Basis: US General 30” 5 Drawer Toolbox
- Reinforced Bottom and Top
- Bolted against Wall with metal mounting angles
- Four height adjustable rests
- Four retractable casters
- Leveled with precision machinist’s level

Power, Air, Light

- 110V Power supply to power outlet next to Mill
- High pressure air connector next to Mill stand
- Airline and Nozzle attached to right side of Lathe Stand
- LED light strip above Lathe

X-Axis Power feed

- Installed X-Axis power feed to left side of milling table
- Attached rubber covers on top of Power feed (tool tray)

X-Axis Limit Switch

- The X-Axis Limit switch (part of the x-Axis power feed package) gets in contact with the Y-Axis hand wheel and limits the Y-Axis movement
- Replaced the original plastic limit switch cover with a custom-made aluminum cover which allows the limit switch to be mounted higher, providing clearance to the hand wheel and extending the maximum forward travel along the Y-Axis

Z-Axis Power Feed

- The PM-25 comes with a manual crank to move the headstock (Z-Axis up and down)
- Built a power feed for the Z-Axis containing of the following main components
    - 12V electric motor geared down to 150rpm
    - Base Plate to hold electrical 12V motor, mounted on top of Z-Axis column
    - 2-piece clutch to connect 8mm motor shaft to Z-Axis lead screw
    - Control board to hold up/down switch and green “power on” LED
    - 110VAC to 12V DC 10-Amp power adapter
    - Harnesses for 110V and 12V
    - 3D printed cover for up/down switch to protect/hide cables
- The electric motor has an attached gearbox with tooth wheels (no worm drive) to allow the Z-Axis movement with the manual crank wheel. (A worm drive would block reversed torque from the lead screw to the motor)
- The 12V electric motor connects through a 2-piece clutch to the Z-Axis lead screw.
- The top part of the clutch is attached to the 8mm drive shaft of the motor and hold in place by a set screw.

- To allow tightening the bottom part of the clutch to the lead screw, the upper end of the to clutch features flat surfaces for a 22mm wrench
- The bottom part of the clutch is screwed on top of the Z-Axis lead screw and secured against rotation on the lead screw by a set screw
- A 110V AC to 12V DC 10 Amp power adapter provides 12V power for the motor
- The temporary up-down switch alternates the turning direction of the motor by switching the +/- poles to the motor and is attached to the top of the head stock (next to PM label)
- A green indicator light signals if the Z-Axis power feed is active (has 12V DC)
- The speed of Z-Axis movement is similar to normal to fast manual cranking, the difference in speed between up and down is insignificant

Spindle Stop with steady and rotating Indicator Holder

- The PM-25 is not equipped with a spindle stop which requires “three hands” for tool changing (one for turning the drawbar, one for holding the spindle stop wrench and one for preventing the tool to drop out of the spindle)
- Built a spindle lock system containing the following main components
    - Base plate mounted to spindle housing
    - Locking pin housing
    - Spindle ring for Locking
    - Locking pin
    - Safety switch
    - Spindle Ring for rotating Indicator Holder
- The locking pin slides in the locking pin housing into one of six holes in the spindle ring which is attached to the spindle.
- Before the switch can be moved into locked position, a (thump operated) safety switch needs to be pressed to move out of a groove in the locking pin, cutting the power to the spindle motor.
- When the locking pin is moved back to its unlocked position, the safety switch automatically moves back into the groove in the locking pin, reestablishing power to the motor
- For power cut-off the cables to the originally installed chip guard safety switch were utilized
- The spindle ring is attached to the spindle with 3 set screws.
- The drawbar momentum is captured by two straights at the bottom of the spindle ring which connect to the cut outs on the spindle used for the spindles top wrench
- The spindle-stop baseplate features two 3/8” holes (front and back) and knuckle screws to hold an indicator holder
- A separate spindle ring clamps on the spindle and features a 3/8” hole to hold an indicator holder

Michael Brombeiss
Santa Monica, CA 90404
https://brombeiss.com/

Quill Stop

- Built a quill stop to limit quill travel to a preset distance, e.g. to achieve get the same drill depth for several holes without the need to watch the depth DRO.
- The quill stop is attached to the left side of the head stock and has the following components:
  - Quill Stop holder (attached to Headstock)
  - Threated rod
  - Push-Lock nut
  - Connecting plate
- The lower end of the threated rod is attached to the connecting plate, which is attached to the base plate of the Spindle Stop assembly.
- When the quill moves, the threated rod moves simultaneously.
- The Push-lock mechanism of the Push-lock nut allows for a quick, sliding positioning of the nut by Disengaging the threat of the rod and the nut.
  If the push-lock button is released, the Push lock nut behaves like a regular nut.
- The desires quill travel is set by sliding (when push button is pressed) or turning the Push-lock against the travel stop (part of the quill stop holder).

X-, Y- Z-Axis and Quill lock screws and Y-Axis (Hand-) protector

- The lock screws for the X-(2), Y-(2), Z-Axis (2) and Quill (1) are either oversized and collide with other parts (Y-Axis), or are hard to reach (X- and Z-Axis)
- Replaced all lock screws with round, spring-loaded, knurled aluminum pieces and extended 8mm rods.
- The length of the Z-Axis and Quill rods is long enough for the handles to be on the right side of the motor control box. The length of the rods for the X-Axis needs to be at least 3 inch long to clear the power feed end stops.
- When turning the Y-Axis lock screws underneath the table, the hand usually gets in contact with and dirty from the oiled ways and lead screw.
- Fabricated a protector made from sheet metal which attaches to the two lock screw holes and is hold in place by the lock screw springs

Z-Axis Way Protector

- The Bottom of the Z-Axis way protector attaches to the Z-Colum with a steel angle and two 5mm head screws.
- The head screw gets in contact with the DRO at minimum Y.
- I slotted the two (vertical) mounting holes of the bottom steel angle and replace the (horizontal) head screws with flat head screws to get clearance for the DRO.

Z-Axis Way Protector

- The Bottom of the Z-Axis way protector steel angle gets in contact with the back side of the vise at minimum Y.
- I drilled two now mounting holes in the z-column, approx. 1 inch above the existing holes. This avoids contact between the steel angle and vise and give approx. 2” of additional Y-travel.

Collet Set Screw (Spindle)

- The original 5mm Spindle Collet Set screw head a bit of a lose fit and I was concerned that it might change its position due to vibrations etc.
- Fabricated new flat head screw (5mm diameter, 2.5mm long with tapered end to fit collet slot) which can be tightened to Quill

Draw Bar

- The top of the draw bar features a 10mm square to tighten/loosen the drawbar
- I slid a 7/16 12-point socket for ½ drive on top of drawbar and fixed it with Loctite 603 (potential to replace 7/16 12-Point Socket with 3/8 8-point Socket – tbd)
- Draw bar can now be operated with ½" drive ratchet

Draw Bar Tool Rest

- Resting place for Draw bar tool (1/2" Ratchet) on top of motor housing
- Resting place for Spindle Stop Wrench between headstock and motor control unit

Chip guard safety switch

- The original, rotating chip guard is attached to the headstock and equipped with a safety switch which deactivates the motor when the guard is in open position.
- Rotating chip guard removed
- Safety switch removed and cables directly connected to each other (permanent connection)

Chip Guard holder

- Magnetic holder for chip guard, mounted to left side of headstock housing Chip guard rest
- Rubber cushioned rest for chip guard (when not in use) on to of motor control box

Table Protector

- Table protector to the left and right of vice made of 3/16 ich composite material

Vice handle

- The vice comes with a folding "one-arm" handle
- To allow for faster cranking I bought a "speed crank" from Edge technologies
- The six-point hole of this speed crank were too small for the hex end of the vice lead screw
- Enlarged the six-point holes to fit the hex end of the vice lead screw

Vice T-keys

- The mill vice comes with two milled slots (16mm wide) at the underside for vice keys. This key can fit
- into the table slots (12mm wide) and align the vice with the table.
- Machined two vice keys. Unfortunately, the milled slots on the vice are not precisely aligned,
- difference between left and right slot was 16 thousand (0.4mm) in Y-axis.
- Adjusted the left vice key accordingly

Michael Brombeiss
Santa Monica, CA 90404
https://brombeiss.com/

Rotary Table Center

- The Vertec 6” rotary table has a (tapered) MT2 center.
- To get a cylindrical center to which makes it easier to center workpieces on the rotary table
- I machined an MT2 insert with a 1/2 inch hole on top, flush with the surface of the rotary table.
- In order to be able to remove the center without removing the rotary table from the mill I created a “lifter” which pulls out the center with a M5 screw

Rotary Table T-Nut Extensions

- In order to increase the holding capacity of the rotary table I built four T-Nut extensions which
- allow to mount M10 studs outside the table.
- To get clearance between the table and the base when rotating with the extensions installed
- I milled off the base accordingly.

Rotary Table mounting

- The mounting holes/slots of the rotary table have different heights, requiring different T-Nut studs.
- I milled of the top off the holes slots to allow for equal length studs.

Spindle Center Plane for alignment of Rotary Table

- Built a spindle center plane to align workpieces on the rotary table
- The center plane fits in a ¾” R8 collar

ProStop

- The ProStop from Edge Technologies is designed for larger machines and its T-Nut does not
- fit the table slots of the PM-25.
- Machined Aluminum Bushing to hold 8mm Bolt (replacing the original 12mm bolt).
- Machined new T-nut for 8mm Bolt and PM-25 table slots

Collet and Drill Chuck holder

- Fabricated holder for R8 collets and Drill Chuck, mounted to wall on left side of head stock

Clamping Kit

- Mounted Clamping kit to left side of Mill stand

Headstock Shelve cut-out

- At max Z-Axis travel the top of the Motor case gets in contact with the overhead board (Shelf)
- To allow for service etc. the middle section of the overhead board can be removed
- To allow for max. Z-Axis travel, a small section of the overhead board can be removed

Vacuum Cleaner

- Attached “ready-to-go” vacuum cleaner to right side of Mill stand

Michael Brombeiss
Santa Monica, CA 90404
https://brombeiss.com/

Work light

- LED work light on flexible Gooseneck and adjustable brightness mounted to Y-Axis DRO scale (moving
- with cross slide)

MQL – Micro Quantity Lubrication System

- Designed and built a MQL for cooling and lubricating milling operations
- Fluid container: PENTAIR PENTEK 158110 Slim Line Water filter housing
- Air Pressure Regulator: NANU 3/8" NPT Compressed Air Regulator
- Mixing Body: BACHIN Mist Coolant Lubrication System with two separate needle valves for air and fluid
- Cutting Fluid: TRIM SC520/1
- Hoses: Air: 8mm Vinyl; Fluid: 4mm Vinyl
- Air goes through a cut-off valve, enters the pressure regulator and is then split in two ways:
  - 1: Air is routed through 8mm hose to air needle valve in mixing body.
    Exiting the needle valve the air enters the nozzle between the outer metal nozzle tube and the inner fluid hose
  - 2: Air pressurizes the fluid container and pushes liquid through 4mm hose to mixing body.
    The fluid exits the needle valve in a small diameter hose routed through all the way to the end of the nozzle
- Machined inside lid of the fluid container to allow for routing of the exit tube
- Machined a brass coupling to connect the hose inside the fluid container to the 4mm vinyl hose to the mixing body
- 3D printed a holder for the mixing body which includes
- a mounting place for a 3/8" pin for attachment to an adjustable indicator holder.
- The indicator holder can be attached to the spindle stop base plate so that the MQL nozzle
- always stays at the same place relative to the cutting tool
- a clamp to secure the 4mm and 8mm hoses to prevent for