

## Connecting a DRO PROS scale to the Z axis of a Sieg SX3

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I have a Sieg SX3 mill. I here describe how I installed the Z-axis scale provided with my DRO PROS 3-axis Milling Machine DRO. I am almost a complete novice to machine tools, and this installation scheme intentionally minimized the need for skills I don't yet have. In particular, when two parts were mated by a machine screw passing through a slot or clearance hole to a tapped hole, I often avoided measurements by

- using a transfer punch through the clearance hole or slot to determine the location of the tapped hole, or
- using the tapped hole and a transfer punch to determine the location of the slot or clearance hole.

None of the fittings I used were made of the castings supplied with the DRO. Those castings had irrelevant holes and slots that would have been difficult to evade, and they were thinned in so many places that they often could not be used for tapped holes in the locations of my choice.

Hardware not otherwise specified is 10-32 socket-head cap screws. At one point, as can be seen in the pictures, I ran out of SHCS and used an ordinary round-head machine screw.

All of my fittings were made of 6061 aluminum, including

- 3" × 3" × 0.25" angle stock  
([http://www.onlinemetals.com/merchant.cfm?pid=1000&step=4&id=62&top\\_cat=60](http://www.onlinemetals.com/merchant.cfm?pid=1000&step=4&id=62&top_cat=60))
- 2" × 2" × 0.125" angle stock  
([http://www.onlinemetals.com/merchant.cfm?pid=987&step=4&id=62&top\\_cat=60](http://www.onlinemetals.com/merchant.cfm?pid=987&step=4&id=62&top_cat=60)), and
- 0.5" × 1" rectangular bar stock  
([http://www.onlinemetals.com/merchant.cfm?pid=1165&step=4&showunits=inches&id=997&top\\_cat=60](http://www.onlinemetals.com/merchant.cfm?pid=1165&step=4&showunits=inches&id=997&top_cat=60)).

Make the **rail that will support the scale body (Part A)** from 0.5" × 1" rectangular bar stock. Mine is 29.25" long, but the exact length is not critical. Drill two clearance holes about 0.5" apart, about 0.5" from the bottom end. Using these holes and a transfer punch, determine the locations of two tapped holes into the Verticality Lead Rail (Sieg part #191), with the forward one just behind the forward Bolt M10x50 (Sieg part #192) of the two that connect the Verticality Lead Rail to the Base (Sieg part #150) on the left side of the mill. The height of the tapped holes should be chosen so that the bottom of Part A can rest on the tiny edge of Base that protrudes below the bottom of the Verticality Lead Rail.

Drill and counterbore another pair of clearance holes about 2" from the upper end of Part A.

Drill and tap (M6/1.0) a hole in Part A about 0.6" from the upper end. Temporarily mount the scale body to Part A using this hole. Using the clearance slot in the other end of the scale body and a transfer punch, determine the location of the tapped hole that will fix the other end of the scale body. Remove the scale body from Part A, and drill and tap the second M6/1.0 mounting hole.

**Part B** is the piece of 3" × 3" × 0.25" angle stock that will support the upper end of Part A; it runs horizontally along the top of the mill, where it is fastened, and then down the side to meet Part A. The width of Part B is not critical; mine is about 1.5" wide.

To fit close to the edge of the top of the mill, the inside radius of Part B (shown as "R" in the Online Metals drawing) must be milled out to a clean right angle. The length of the horizontal portion of Part B is not critical, so you may wish to shorten that leg of Part B if you can't otherwise get an endmill into the inside corner.

Mill two slots lengthwise in the horizontal part of Part B, running most of its length and wide enough to clear an M5 screw. (Don't be distracted by the pictured slots in the **vertical** leg of my Part B; I used a piece of scrap with irrelevant pre-existing slots).

An M5/0.8 SHCS (Sieg part #136) runs down through the top of the Back Cover of the mill (Sieg part #220) near the left front corner, holding it to the Verticality Lead Rail. Replace this screw with a longer one, running it through the forward slot of Part B, the Back Cover, and into the Verticality Lead Rail. Use the other slot and a transfer punch to determine the location of a parallel hole, directly to the rear. Drill the new hole through the Back Cover and into the Verticality Lead Rail, tap (M5/0.8) into the Verticality Lead Rail, and attach Part B with another M5/0.8 SHCS.

Use a level to get Part A as close to vertical as you can, and then use a transfer punch with the upper pair of counterbored holes to determine the locations in Part B of the two tapped holes that will allow Part A to be screwed to Part B. Drill and tap those holes, and screw Part A to Part B.

Attach the scale body to Part A, but don't bother precisely aligning it yet.

**Part C** is the piece of 2" × 2" × 0.125" angle stock that makes the connection to the scale trolley. It runs right-to-left out from its attachment to the furthest-from-the-scale-body surface of the trolley, then forward to connect to Part D. The width of Part C must span the width of the trolley, but it is otherwise not critical.

Drill clearance holes in the right-to-left leg of Part C, sufficient to pass M4 screws, positioned to meet the tapped holes in the trolley, and sufficiently far from Part C's elbow to allow the back-to-front leg to clear the front of the scale, leaving enough room for the thickness of Part D. Mill two slots lengthwise in the back-to-front leg of Part C.

Attach Part C to the trolley with M4/0.7 screws.

**Part D** is made from a piece of 3" × 3" × 0.25" angle stock. It runs forward and then left-to-right, turning the front left corner of the mill column, and it serves as a connector between Part C and Part E. To prepare Part D, the outermost inch or so of its left-to-right leg must be lopped off. The width of Part D is not critical.

Use the slots in Part C to determine the locations of two drilled and tapped holes in the back-to-front leg of Part D. Drill and tap those holes.

**Part E** is made from a piece of 2" × 2" × 0.125" angle stock. It makes the connection to the mill head. It runs left-to-right from its connection to Part D, then forward. To prepare Part E, its forward-running leg must be trimmed by about an inch.

Drill two clearance holes in the forward-running leg of Part E, then use them and a transfer punch to determine the locations on the Side Support Plate II (Sieg part #198) of holes that will need to be drilled and tapped. Drill and tap those holes. Mill two slots lengthwise in the left-to-right leg of Part E.

Attach Part E to Side Support Plate II. Use the slots in Part E to determine the locations of two drilled and tapped holes in the left-to-right leg of Part D. Drill and tap those holes.

Attach Part D to Parts C and E. Adjust to taste.